TABLE OF CONTENTS OF SPECIAL PROVISIONS

Note: This Table of Contents has been prepared for the convenience of those using this contract with the sole express purpose of locating quickly the information contained herein; and no claims shall arise due to omissions, additions, deletions, etc., as this Table of Contents shall not be considered part of the contract.

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AUGUST 29, 2018

FEDERAL AID PROJECT NO. 1063(1043)
STATE PROJECT NO. 63-703

RELOCATION OF I-91 NB INTERCHANGE 29 AND WIDENING OF I-91 NB AND ROUTE 5/15 NB TO I-84

City of Hartford & Town of East Hartford
Federal Aid Project No. 1063(143)

&

FEDERAL AID PROJECT NO. 0912(136)
STATE PROJECT NO. 159-191

RESURFACING, BRIDGE AND SAFETY IMPROVEMENTS ON I-91

City of Hartford & Town of Wethersfield
Federal Aid Project No. 0912(136)

The State of Connecticut, Department of Transportation, Standard Specifications for Roads, Bridges, Facilities and Incidental Construction, Form 817, 2016, as revised by the Supplemental Specifications dated January 2018 (otherwise referred to collectively as "ConnDOT Form 817") is hereby made part of this contract, as modified by the Special Provisions contained herein. Form 817 is available at the following DOT website link http://www.ct.gov/dot/cwp/view.asp?a=3609&q=430362. The current edition of the State of Connecticut Department of Transportation's "Construction Contract Bidding and Award Manual" ("Manual"), is hereby made part of this contract. If the provisions of this Manual conflict with provisions of other Department documents (not including statutes or regulations), the provisions of the Manual will govern. The Manual is available at the following DOT website link http://www.ct.gov/dot/cwp/view.asp?a=2288&q=259258. The Special Provisions relate in particular to the RELOCATION OF I-91 NB INTERCHANGE 29 AND WIDENING OF I-91 NB AND ROUTE 5/15 NB TO I-84 in the City of Hartford & Town of East Hartford & RESURFACING, BRIDGE AND SAFETY IMPROVEMENTS ON I-91 in the City of Hartford & Town of Wethersfield.

COMBINED PROJECTS

There will be but one Contract for Federal Aid Project No. 1063(1043) (State Project No. 63-703) and Federal Aid Project No. 0912(136) (State Project No. 159-191). The two projects will be considered as a single contract in all respects.

CONTRACT TIME AND LIQUIDATED DAMAGES

In order to minimize the hazard, cost and inconvenience to the traveling public and pollution of the environment, it is necessary to limit the time of construction work, which interferes with traffic as specified in Article 1.08.04 of the Special Provisions.

There will be three assessments for liquidated damages and they will be addressed in the following manner:

1. For this contract, an assessment per day for liquidated damages, at a rate of Twenty Three Thousand Dollars ($23,000.00) per day shall be applied to each calendar day the work runs in excess of the One Thousand One Hundred Fifty Two (1152) allowed calendar days for the contract.

2. For this contract, an assessment per hour for liquidated damages shall be applied to each hour, or any portion thereof, in which the Contractor interferes with normal traffic operations during the restricted hours given in Article 1.08.04 of the Special Provisions. The liquidated damages shall be as shown in the following tables entitled "Liquidated Damages Per Hour" for each hour, or any portion thereof, in which the Contractor interferes with normal traffic operations during the restricted hours.

3. For this contract, assessments related to IMS Equipment Installations shall be applied as listed below.

For the purpose of administering this contract, normal traffic operations are considered interfered with when:

1. Any portion of the travel lanes or shoulders is occupied by any personnel, equipment, materials, or supplies including signs.

2. The transition between the planes of pavement surfaces is at a rate of one inch in less than fifteen feet longitudinally.

LIQUIDATED DAMAGES PER HOUR

Route I-91 Northbound

4 Lane Section (MP 34.12 – 35.51)				
If Working Periods Extends Into	A.M. 1 Lane Closure	A.M. 2 Lane Closure	A.M. 3 Lane Closure	P.M. 1 Lane Closure
1st Hour of Restrictive Period	$ 500	$ 500	$ 25,000	$ 500
2nd Hour of Restrictive Period	$ 8,000	$ 35,000	$ 100,000	$ 1,000
3rd Hour or any Subsequent Hour of Restrictive Period	$ 4,000	$ 60,000	$ 100,000	$ 1,000

Route I-91 Southbound

3 Lane Section (MP 33.05 – 36.53)		
If Working Periods Extends Into	A.M. 1 Lane Closure	A.M. 2 Lane Closure
1st Hour of Restrictive Period	$ 500	$ 35,000
2nd Hour of Restrictive Period	$ 35,000	$ 100,000
3rd Hour or any Subsequent Hour of Restrictive Period	$ 50,000	$ 100,000

The above liquidated damages apply to those hours shown on the Limitation of Operations charts designated with a "3"or "E" for 3-lane sections and "4" or "E" for 4-lane sections.

For each hour shown on the Limitation of Operations charts designated with an "E", liquidated damages of $500 per hour shall apply if all available shoulder widths are not available to traffic.

Liquidated damages in the amount of $500 shall apply for each hour that the Contractor interferes with existing traffic operations on any ramps during the non-allowable hours.

LIQUIDATED DAMAGES PER HOUR

Route I-91 Northbound

3 Lane Section (MP 35.51 – MP 36.99)			
If Working Periods Extends Into	A.M. 1 Lane Closure	A.M. 2 Lane Closure	P.M. 1 Lane Closure
1st Hour of Restrictive Period	$ 500	$ 20,000	$ 8,000
2nd Hour of Restrictive Period	$ 25,000	$ 100,000	$ 30,000
3rd Hour or any Subsequent Hour of Restrictive Period	$ 35,000	$ 100,000	$ 40,000

Route I-91 Southbound

4 Lane Section (MP 36.53 – 37.68)					
If Working Periods Extends Into	A.M. 1 Lane Closure	A.M. 2 Lane Closure	A.M. 3 Lane Closure	P.M. 1 Lane Closure	P.M. 2 Lane Closure
1st Hour of Restrictive Period	$ 500	$ 500	$ 15,000	$ 500	$ 4,000
2nd Hour of Restrictive Period	$ 500	$ 10,000	$ 70,000	$ 500	$ 20,000
3rd Hour or any Subsequent Hour of Restrictive Period	$ 500	$ 15,000	$ 100,000	$ 500	$ 45,000

The above liquidated damages apply to those hours shown on the Limitation of Operations charts designated with a "3"or "E" for 3-lane sections and "4" or "E" for 4-lane sections.

For each hour shown on the Limitation of Operations charts designated with an "E", liquidated damages of $500 per hour shall apply if all available shoulder widths are not available to traffic.

Liquidated damages in the amount of $500 shall apply for each hour that the Contractor interferes with existing traffic operations on any ramps during the non-allowable hours.

LIQUIDATED DAMAGES PER HOUR

Route I-91 Northbound

5 Lane Section (MP 36.99 – MP 37.10)							
If Working Periods Extends Into	A.M. 1 Lane Closure	A.M. 2 Lane Closure	A.M. 3 Lane Closure	A.M. 4 Lane Closure	P.M. 1 Lane Closure	P.M. 2 Lane Closure	P.M. 3 Lane Closure
1st Hour of Restrictive Period	$ 500	$ 500	$ 500	$ 10,000	$ 500	$ 500	$ 5,000
2nd Hour of Restrictive Period	$ 500	$ 500	$ 15,000	$ 70,000	$ 500	$ 500	$ 15,000
3rd Hour or any Subsequent Hour of Restrictive Period	$ 500	$ 500	$ 30,000	$ 100,000	$ 500	$ 500	$ 25,000

The above liquidated damages apply to those hours shown on the Limitation of Operations charts designated with a "5" or "E" for 5-lane sections.

For each hour shown on the Limitation of Operations charts designated with an "E", liquidated damages of $500 per hour shall apply if all available shoulder widths are not available to traffic.

Liquidated damages in the amount of $500 shall apply for each hour that the Contractor interferes with existing traffic operations on any ramps during the non-allowable hours.

LIQUIDATED DAMAGES PER HOUR

Route 15 Northbound

2 Lane Section (MP 77.94 – 80.64)		
If Working Periods Extends Into	A.M. 1 Lane Closure	P.M. 1 Lane Closure
1st Hour of Restrictive Period	$ 500	$ 500
2nd Hour of Restrictive Period	$ 15,000	$ 2,000
3rd Hour or any Subsequent Hour of Restrictive Period	$ 30,000	$ 2,000

Route 15 Southbound

2 Lane Section (MP 77.94 – 80.18)		
If Working Periods Extends Into	A.M. 1 Lane Closure	P.M. 1 Lane Closure
1st Hour of Restrictive Period	$ 500	$ 500
2nd Hour of Restrictive Period	$ 1,000	$ 6,000
3rd Hour or any Subsequent Hour of Restrictive Period	$ 500	$ 15,000

The above liquidated damages apply to those hours shown on the Limitation of Operations charts designated with a "2"or "E" for 2-lane sections.

For each hour shown on the Limitation of Operations charts designated with an "E", liquidated damages of $500 per hour shall apply if all available shoulder widths are not available to traffic.

Liquidated damages in the amount of $500 shall apply for each hour that the Contractor interferes with existing traffic operations on any ramps during the non-allowable hours.

LIQUIDATED DAMAGES PER HOUR

Route 15 Northbound

2 Lane Section (MP 80.64 – 83.53)		
If Working Periods Extends Into	A.M. 1 Lane Closure	P.M. 1 Lane Closure
1st Hour of Restrictive Period	$ 500	$ 6,000
2nd Hour of Restrictive Period	$ 500	$ 25,000
3rd Hour or any Subsequent Hour of Restrictive Period	$ 500	$ 45,000

Route 15 Southbound

2 Lane Section (MP 81.45 – 83.53)		
If Working Periods Extends Into	A.M. 1 Lane Closure	P.M. 1 Lane Closure
1st Hour of Restrictive Period	$ 500	$ 2,000
2nd Hour of Restrictive Period	$ 500	$ 25,000
3rd Hour or any Subsequent Hour of Restrictive Period	$ 500	$ 35,000

The above liquidated damages apply to those hours shown on the Limitation of Operations charts designated with a "2"or "E" for 2-lane sections.

For each hour shown on the Limitation of Operations charts designated with an "E", liquidated damages of $500 per hour shall apply if all available shoulder widths are not available to traffic.

Liquidated damages in the amount of $500 shall apply for each hour that the Contractor interferes with existing traffic operations on any ramps during the non-allowable hours.

LIQUIDATED DAMAGES PER HOUR

Route 2 Eastbound

3 Lane Section (MP 0.93 – MP 1.49)			
If Working Periods Extends Into	A.M. 1 Lane Closure	A.M. 2 Lane Closure	P.M. 1 Lane Closure
1st Hour of Restrictive Period	$ 500	$ 500	$ 500
2nd Hour of Restrictive Period	$ 500	$ 2,000	$ 9,000
3rd Hour or any Subsequent Hour of Restrictive Period	$ 500	$ 7,000	$ 15,000

Route 2 Eastbound

2 Lane Section (MP 1.49 – 5.31)	
If Working Periods Extends Into	A.M. 1 Lane Closure
1st Hour of Restrictive Period	$ 500
2nd Hour of Restrictive Period	$ 3,000
3rd Hour or any Subsequent Hour of Restrictive Period	$ 9,000

The above liquidated damages apply to those hours shown on the Limitation of Operations charts designated with a "3"or "E" for 3-lane sections and "2" or "E" for 2-lane sections.

For each hour shown on the Limitation of Operations charts designated with an "E", liquidated damages of $500 per hour shall apply if all available shoulder widths are not available to traffic.

Liquidated damages in the amount of $500 shall apply for each hour that the Contractor interferes with existing traffic operations on any ramps during the non-allowable hours.

LIQUIDATED DAMAGES PER HOUR

Route 2 Westbound

3 Lane Section (MP 0.92 – MP 1.85)			
If Working Periods Extends Into	A.M. 1 Lane Closure	A.M. 2 Lane Closure	P.M. 1 Lane Closure
1st Hour of Restrictive Period	$ 500	$ 10,000	$ 500
2nd Hour of Restrictive Period	$ 2,000	$ 50,000	$ 500
3rd Hour or any Subsequent Hour of Restrictive Period	$ 2,000	$ 90,000	$ 500

The above liquidated damages apply to those hours shown on the Limitation of Operations charts designated with a "3"or "E" for 3-lane sections.

For each hour shown on the Limitation of Operations charts designated with an "E", liquidated damages of $500 per hour shall apply if all available shoulder widths are not available to traffic.

Liquidated damages in the amount of $500 shall apply for each hour that the Contractor interferes with existing traffic operations on any ramps during the non-allowable hours.

IMS Equipment Installations

IMS Trunkline Fiber Optic Cable Rte. 15, I-91 & I-84

For this Contract, an assessment for liquidated damages, at a rate of Twenty Thousand Dollars ($20,000) per day shall be applied to each full calendar day that the Incident Management System (IMS) equipment are not operational due to damage caused by the Contractors work operations to the Trunkline Fiber Optic Cable within the project limits. The Trunkline Fiber Optic Cable is defined as the 96 Fiber Optic Cable installed on Rte. 15 (To NOC), 60 Fiber Optic Cable (I-91S), 156 Fiber Optic Cable (Charter Oak Bridge), 168 Fiber Optic Cable (I-91S), and 60 Fiber Optic Cable (I-84E).

Equipment Operations/VMS Operations

For this Contract, an assessment for liquidated damages, at a rate of Two Thousand Dollars ($2,000) per day per CCTV or VMS Site, shall be applied to each full calendar day that the Incident Management System (IMS) equipment are not operational. The IMS equipment included in this Contract are the following:

- Existing CCTV Camera Sites
- Permanent CCTV Camera Sites
- Existing VMS Sites
- Permanent VMS Sites

Response Time

For this Contract, an assessment for liquidated damages, at a rate of One Thousand Dollars ($1,000) per day shall be applied for repairs that are not commenced within 8 hours after notification to each CCTV Cameras, Traffic Flow Monitor, and/or Variable Message Sign (VMS) Site failure.

NOTICE TO CONTRACTOR - PRE–BID CONFERENCE

All prospective bidders are hereby informed that a pre-bid meeting is scheduled for:

Tuesday October 9, 2018 at 10:30 am

Conference Room A & B

Connecticut Department of Transportation

2800 Berlin Turnpike, Newington, CT 06111

Attendance at the pre-bid meeting is not mandatory. The meeting will provide an overview of the project.

Bidders are advised that no questions will be entertained at the pre-bid meeting. All questions must be presented through the CTDOT Pre-Bid Questions and Answers Website.

All attendees of the pre-bid meeting will be required to register. Registration will be from 10:00 a.m. to 10:30 a.m. prior to the pre-bid meeting. Advance registration can be completed by forwarding the company name, contact person and anticipated number of attendees to DOTContracts@ct.gov. Advance registration will be accepted up to 3:00 p.m. the day prior to the pre-bid meeting.

NOTICE TO CONTRACTOR - PRE-BID QUESTIONS AND ANSWERS

Questions pertaining to DOT advertised construction projects must be presented through the CTDOT Pre-Bid Q and A Website. The Department cannot guarantee that all questions will be answered prior to the bid date. **PLEASE NOTE - at 9:00 am Monday (i.e. typical Wednesday Bid Opening) the project(s) being bid will be closed for questions, at which time questions can no longer be submitted through the Q and A Website.**

Answers may be provided by the Department up to 12:00 noon, the day before the bid. At this time, the Q and A for those projects will be considered final, unless otherwise stated and/or the bid is postponed to a future date and time to allow for further questions and answers to be posted.

If a question needs to be asked the day before the bid date, please contact the Contracts Unit staff and email your question to dotcontracts@ct.gov immediately.

Contractors must identify their company name, contact person, contact email address and phone number when asking a question. The email address and phone number will not be made public.

The questions and answers (if any) located on the Q and A Website are hereby made part of the bid/contract solicitation documents (located on the State Contracting Portal), and resulting contract for the subject project(s). It is the bidder's responsibility to monitor, review, and become familiar with the questions and answers, as with all bid requirements and contract documents, prior to bidding. By signing the bid proposal and resulting contract, the bidder acknowledges receipt of, and agrees to the incorporation of the final list of Q and A, into the contract document.

Contractors will not be permitted to file a future claim based on lack of receipt, or knowledge of the questions and answers associated with a project. All bidding requirements and project information, including but not limited to contract plans, specifications, addenda, Q and A, Notice to Contractors, etc., are made public on the State Contracting Portal and/or the CTDOT website.

NOTICE TO CONTRACTOR - CONTRACT DURATION

The Contractor is hereby notified that this is not to be considered an ordinary project by any means and that due to the inconvenience to the traveling public that it causes, extra manpower, equipment and work shifts may be required to complete the work in accordance within the specified contract time.

NOTICE TO CONTRACTOR - COORDINATION WITH MAINTENANCE

The Contractor is hereby advised that coordination with the local CTDOT Maintenance garage is required. This project requires construction activities during the winter months that may require lane closures along I-91, Route 15 and other roadways within the contract limits. Highway sanding and plowing activities by CTDOT Maintenance forces will require the removal of the lane closures by the Contractor. The Engineer will notify the Contractor indicating when a maintenance activity will take place and when the lane closures are required to be removed. Removal of lane closures and any resulting loss of construction time will be deemed weather related and therefore are not the basis for a time extension per Section 1.08.08. Also, this is not a basis for additional compensation.

Similarly, the Contractor is required to coordinate with the City of Hartford Public Works Department and the Town of East Hartford Public Works Department for sanding and plowing of local City streets. Removal of lane closures and any resulting loss of construction time on local City streets will be deemed weather related and therefore are not the basis for a time extension per Section 1.08.08. Also, this is not a basis for additional compensation.

NOTICE TO CONTRACTOR - SITE NUMBER DESIGNATIONS

For the purposes of this contract, the following site designations shall apply:

BRIDGES

Site No. 1: Bridge No. 02555 – Interstate 91 over Service Road (Hartford)

Site No. 2: Bridge No. 03244 – Interstate 91 & TR826 SB over Drainage (Hartford)

Site No. 3: Bridge No. 00813 – Interstate 91 over U.S. Route 5 and 15 (Hartford)

Site No. 4: Bridge No. 03613 – Interstate 91 & TR 827over Drainage (Hartford)

Site No. 5: Bridge No. 03614 – TR 828 and TR 15-161 over Drainage (Hartford)

Site No. 6: Bridge No. 01466 – Interstate 91 over I-91 TR 827(Hartford)

Site No. 7: Bridge No. 00480 – Interstate 91 over Airport Road (Hartford)

Site No. 8: Bridge No. 06654 – Airport Road culvert (Hartford)

Site No. 9: Bridge No. 05922 – Interstate 91 NB over Route 15 NB & SB (Hartford)

Site No. 10: Bridge No. 06947 – I-91 NB Ramp (Relocated Exit 29) (Hartford)

Site No. 11: Bridge Nos. 06000A & 06000B – U.S. Route 15 NB & SB over I-91 NB, Route 2, CT River, and Railroad (Hartford)

Site No. 12: Bridge No. 06000C – I-91 NB Exit 29 Ramp over Railroad and Reserve Road (Hartford)

Site No. 13: N/A

Site No. 14: Bridge No. 06043A & 06043B – U.S. Route 15 NB & SB over Main Street (East Hartford)

Site No. 15: Bridge No. 05796 – U.S. Route 15 over Silver Lane (East Hartford)

RETAINING WALLS

Site No. 1: Wall W103A
Site No. 2: Wall W103B
Site No. 3: Wall W104A
Site No. 4: Wall W104B
Site No. 5: Wall W105
Site No. 6: Wall W106
Site No. 7: Wall W107

NOTICE TO CONTRACTOR - CONSTRUCTION CONTRACTOR DIGITAL SUBMISSIONS

Upon execution of the Contract, the Contractor acknowledges and agrees that contractual submittals for this Project shall be submitted and handled through a system of paperless electronic means as outlined in the special provision for Section 1.05 herein.

Shop drawings, working drawings, and product data shall be created, digitally signed and delivered by the Contractor in accordance with the Department's Contractor Digital Submission Manual (CDSM). Other deliverables that are required by other special provisions shall be similarly submitted.

Access credentials will be provided to the Contractor by the Department.

The Department will provide the Contractor with a list of email addresses that are to be used for each submittal type.

The Department shall not be held responsible for delays, lack of processing or response to submittals that do not follow the specified guidelines in the CDSM.

NOTICE TO CONTRACTOR - ELECTRONIC ENGINEERING DATA (EED)

The EED is an assembly of engineering data files that were used to produce the Contract plans.

Electronic Engineering Data (EED) is provided for information purposes only. In case of conflict between the EED and the Contract plans and specifications, the contract plans and specifications shall govern. The EED has been reviewed by the Department for quality control purposes, but it is the Contractor's responsibility to build the Project per the contract plans and specifications.

The EED is being provided to the Engineer for GPS/RTS inspection. The Contractor may use the EED to assist in bidding, layout and Automated Machine Control/Guidance.

The EED includes geospatially-correct 2D CAD files and may include horizontal and vertical alignment data files, 3D surface model files (break-line features and triangles) and a preference file. The data is being provided in two formats:

- Native Format
  - Bentley MicroStation CAD files (dgn)
  - Bentley SS2 InRoads Alignment Files (alg)
  - Bentley SS2 InRoads Digital Terrain Models (dtm)jk
  - Bentley SS2 InRoads Preference File (xin)
- Converted Format (for use in GPS/RTS Site equipment)
  - AutoCAD CAD files (dxf)
  - Alignment files (xml)
  - Surface Models (xml)

For a complete list of EED files, see the EED file manifest (PDF) located in the EED_XXXX-XXXX.zip file which is posted with the contract PS&E's on the State Contracting portal.

NOTICE TO CONTRACTOR - BUCKEYE PIPE LINE

The Contractor is hereby notified there are two known locations where Buckeye Pipe Line (Buckeye) facilities are present within the project limits. The approximate locations are as follows:

- I-91 NB, Sta. 103+50+/-
- US 5/RTE 15 NB, Sta. 210+10 +/-

The Contractor shall contact Buckeye a minimum of 2 weeks in advance of working within their right of way. Work shall be defined as but not limited to grading, filling, excavation, staging of equipment or materials, heavy vehicle or equipment access and any activity which has a potential to impact the pipeline facility.

Contact: Mr. David Jones
Project Manager
Buckeye Pipe Line Company, L.P.
9999 Hamilton Boulevard, Five TEK Park
Breinigsville, PA 18031
(610) 904-4409
dajones@buckeye.com

NOTICE TO CONTRACTOR - COAST GUARD

The Contractor shall notify the Coast Guard at least 90 days in advance of initiating work on the Charter Oak Bridge in order to adhere to the US Coast Guard Bridge Administration General Construction Requirements attached to this notice. Subsequently the information listed in the following pages must be supplied as required.

U.S. Coast Guard Bridge Administration

GENERAL CONSTRUCTION REQUIREMENTS

1. All bridge closures, or bridge operating schedule changes, must be requested in writing, 90 days in advance, from the First Coast Guard District Bridge Branch Office. No channel restrictions, or vertical clearance reductions may be made without written approval from the above office.

2. Waterway closures or safety zones must also be requested a **minimum** of 90 days in advance. Please contact: USCG Sector Long Island Sound, 120 Woodward Ave., New Haven, CT 06512-3628. Ph: (203) 468-4596.

3. All submissions to the Coast Guard for review and approval must first be approved by the *owner of the bridge or their authorized agent*. All submission of plans, scope of work, and schedules of operation must be sent to the First Coast Guard District, Bridge Branch Office.

4. At least 30 days prior to commencement of any work**,** we must have for our review, a copy of the construction plans, contractor' schedule, preferably depicted in a time line graphic format, and the contractor's daily hours of operation. The construction plan package must show the following: **(1)** a plan of the entire waterway area in the vicinity of the project. **(2)** The location of work barges and any anchor lines during working and off-hours. **(3)** In addition, a drawing must be included, if applicable, depicting any scaffolding or containment used indicating the location and the total vertical or horizontal channel reduction. All vertical clearance reductions below low steel or concrete under the bridge as a result of the use of scaffolding must be clearly detailed on the drawings shown in total feet. **(4)** Emergency 24 hour telephone numbers for all responsible individuals for this project must be submitted to this office before any phase of construction begins in case of an emergency situation during off-hours.

5. Scaffolding used under ANY span of the bridge must be lighted with constant burning red lights every 50 feet and on all corners. The placement of scaffolding must not interfere with the ability of a moveable bridge to open for vessel traffic. Moveable bridges must continue to operate according to their normal schedule unless special drawbridge operation regulation changes have been requested. Warning signs must be posted on both sides of the bridge, visible for a 1-mile range, to warn mariners of the vertical clearance reduction. The signs shall face upstream and downstream so as to draw the mariner's attention to the fact that the clearance has been reduced.

6. All barges placed in the waterway must be lighted with constant burning white lights on all four corners of the barge. The contractor is required to comply with all provisions of the Navigation Rules International-Inland**,** regarding the use of work barges or floating equipment in the waterway. Copies are available from the U.S. Government Bookstore, 710 N Capitol Street NW, Washington, DC, 20403, (202) 512-0132, or www.navcen.uscg.gov .

7. Placement of construction barges in the navigable channel shall be done so as to provide a minimum horizontal clearance reduction. Only one navigation channel of a swing bridge may be blocked by work equipment at anytime. Barges must be moved out of the navigable channel after working hours unless approved in writing by this office.

8. Barges held in place by anchor lines must be marked by anchor buoys, which should be lighted.

9. An as built survey must be taken upon completion of this project, approved by a professional engineer or land surveyor verifying the bridge clearances.

10. The on-scene contractor must have a VHF-FM marine radio set to the bridge communication channels 16/13 or the designated channel for the bridge. Additional marine radios monitoring the above channels must also be maintained at the main control of any floating equipment or barges on station.

11. Preventive measures must be taken to prevent any hot work, debris, or construction material from entering the waterway. This includes sandblasting material, paint, and any concrete work by-products. Welding and burning must cease upon approach of a vessel and shall not start again until the vessel has passed the bridge.

12. The project manager must contact the Coast Guard Sector Long Island Sound via marine radio before commencement of any and after completion of any Hot Work. A cell phone back-up may be used to contact the above Coast Guard Unit at (203) 468-4401.

13. If permanent bridge navigational lighting cannot be maintained operational during any phase of this project, temporary battery/power lights must be installed at the same locations. These temporary lights must be visible for a distance of **2,000 yards on 90% of the nights of the year**. Generally, a lamp of **(50 candela)** will meet these requirements. Plans for temporary lighting shall be submitted to this office for written approval. Deviations from the approved **temporary lighting shall be permitted only upon written authorization from this office.**

14. **All newly constructed bridge piers, or those in the process of demolition, must be lighted with either red or white flashing (60 flashes per minute) lights. All cofferdams used during construction must also be lighted with red or white flashing (60 flashes per minute) on all four corners.**

15. Bridge protective fenders shall not be constructed or rebuilt with any metal surfaces on the rubbing face of the fender system. All bolts, spikes, or other metal fastening devices must be countersunk. Metal splicing plates, if used, shall be mounted on back of outer wales.

16. All piles including those previously damaged or broken that are not being used in the new or repaired fender shall be extracted rather than cut off at the mud line. Upon completion of all fender repairs a bottom sweep is required to determine if any piles or debris are present in the waterway. A wire-drag sweep or side-scan sonar is the preferred method.

17. During the progress of work should any debris or equipment enter the waterway and become a hazard to navigation, immediate notice shall be given to the Coast Guard and the object removed as soon as possible. Until removal can be effected, the obstruction shall be properly marked.

18. Spillage of oil and hazardous substances is specifically prohibited by the **Clean Water Act**, as amended. Approved spill containment equipment and absorbent material must be located at the project site in the event of a spill into the waterway or the shoreline. The Coast Guard must be notified immediately at (800) 424-8802.

19. The bridge owner is responsible to ensure that channel depths are not affected by this work. Any material, machinery or equipment lost, dumped, thrown into, or otherwise entering the waterway must be removed immediately. If immediate removal is impractical and the object entering the waterway could possibly obstruct or hazard navigation, the object must be marked immediately to protect navigation and the Coast Guard shall be notified as soon as possible. Upon request of the Coast Guard or Corps of Engineers, the bridge owner/contractor shall provide the necessary equipment and personnel to determine the presence of any suspected obstructions in the waterway.

20. The bridge owner/contractor shall provide any and all necessary equipment and personnel to determine the presence of any "suspected" obstructions in the waterway at any time either during or following the completion of bridge construction or demolition operations.

21. Upon project completion, the bridge owner shall provide the Coast Guard with a written certification by a registered professional engineer that the waterway depths have not been impaired as a result of any construction or demolition operations and that the waterway has been cleared of any and all construction debris or remnants from the existing or previous bridge construction or demolition.

22. This approval may be revoked and/or civil penalties imposed for failure to ensure that the above listed stipulations are adhered to or if work is determined to hazard or impair navigation.

Date 09/02/16

NOTICE TO CONTRACTOR - EQUIPMENT WORKING PAD

The Contractor shall be aware of the poor soils conditions and wet conditions due to shallow groundwater is the area of Bridge No. 06947 (Site No. 10), Bridge Nos. 06000A&B (Site No. 11), and Bridge No. 06000C (Site No. 12) as noted in the project geotechnical report. The alluvium and portions of the fill have low strength and are highly susceptible to disturbance from construction equipment and vibrations. The contractor shall anticipate that a temporary working pad will be necessary to support installation equipment. Working pads could potentially include multiple layers of geogrids, stabilization fabric, crushed stone, well-graded sand and gravel aggregate, or other materials, and the working pad may need to be on the order of three feet thick. The contractor shall be responsible for design of an appropriate working pad capable of supporting his proposed installation equipment.

This work will not be tracked for payment and shall be considered incidental to construction. Work shall conform to guidelines of the ConnDOT Form 817.

NOTICE TO CONTRACTOR - FAA RESTRICTIONS

The Contractor is alerted that the Federal Aviation Administration (FAA) regulates all regions of the air space 200 feet above ground level as well as some regions at lower elevations within the construction project limits due to the proximity of the Hartford-Brainard Airport. The FAA vertical air space regulatory threshold varies within the project limits and is based upon a proximity relationship to the Hartford-Brainard Airport.

The Contractor is therefore required to file a Notice of Proposed Construction or Alteration to the FAA in accordance with the requirements of Federal Aviation Regulation Part 77- Objects Affecting Navigable Airspace for the use of cranes affecting or that may affect navigable air space. Form 7460-1 must be filed with the FAA at least 30 days prior to the subject crane use within the FAA regulatory airspace. The required form (7460-1) must be filed electronically through the FAA website located at "https://oeaaa.faa.gov".

No crane which extends into regulated air space shall be used without FAA determination of "No Objection" or "Conditional Determination". There shall be no separate compensation for costs associated with compliance with any FAA determination in regard to the use of regulated navigable air space.

The Contractor shall notify the airport manager of the Hartford-Brainard Airport of all scheduled crane operations that require aerial obstruction lighting. The Contractor shall provide copies all FAA Form 7460-1 filings to the Engineer and the airport manager at the time of submission and shall provide copies of all FAA response determinations to same upon receipt and in all cases before subject crane use. The airport manager can be reached at telephone number 860-566-7037. Mailing address is:

Hartford-Brainard Airport
Airport Administrative Building
239 Maxim Road
Hartford, CT 06114

More information, if needed regarding the "Filing of Notice", may be obtained by phone through the FAA Express Processing Center at 817-222-5520.

NOTICE TO CONTRACTOR - FIRE SUPPRESSION SYSTEM

There is an existing fire suppression system on the Charter Oak Bridge. The Contractor is hereby notified that no activity that will impact the existing system shall be allowed without providing thirty (30) days of notice to the City of Hartford Engineering Department and Fire Chief and the Town of East Hartford Engineering Department and Fire Chief. Notification shall include a construction calendar showing the initial date the system will be impacted along with a schedule as to when the system will fully operational. When the system is deemed to be fully operational by the Contractor he shall notify the same parties and schedule a site visit for the field testing of the system. The system shall not be deemed fully operational until such time that the City of Hartford and Town of East Hartford Fire Chiefs have certified that the system is fully functional.

NOTICE TO CONTRACTOR - SPECIAL EVENTS

The Contractor shall be made aware that several special events occur at Rentschler Field in East Hartford throughout the year that may impact local traffic. The Contractor shall coordinate with the Town of East Hartford for all traffic shifts and lane closures on Silver Lane and Main Street 30 days prior to implementing them to determine if an event is scheduled during the same timeframe. The contractor shall make every effort to avoid overlap in schedules. If overlap is unavoidable, the Contractor shall notify the Engineer immediately.

The Travelers Championship golf tournament occurs for one week during the summer months in Cromwell at the TPC River Highlands. The Contractor shall coordinate with the TPC River Highlands to determine the schedule each year and coordinate his activities to limit disruption to the traveling public. Specifically no lane closures will be allowed during the week of the tournament on I-91 and access to Exit 23 West Street shall be maintained at all times.

The park located at Charter Oak Landing acts as a port for private cruise lines. Several weekends a year cruises will draw hundreds of vehicles to the park located off of Reserve Road. The Contractor shall coordinate with the City of Hartford and Riverfront Recapture to obtain schedules and limit lane closures to provide access to the park at all times during these events.

NOTICE TO CONTRACTOR - VERIFICATION OF PLAN DIMENSIONS AND FIELD MEASUREMENTS

The Contractor is responsible for verifying all dimensions before any work is begun. Dimensions of the existing structures shown on the plans are for general reference only; they are not guaranteed. The Contractor shall take all field measurements necessary to assure proper fit of the finished work and shall assume full responsibility for their accuracy. When shop drawings and/or working drawings based on field measurements are submitted for approval and/or review, the field measurements shall also be submitted for reference by the reviewer.

In the field, the Contractor shall examine and verify all existing and given conditions and dimensions with those shown on the plans. If field conditions and dimensions differ from those shown on the plans, the Contractor shall use the field conditions and dimensions and make the appropriate changes to those shown on the plans as approved by the Engineer. All field conditions and dimensions shall be so noted on the drawings submitted for approval.

There shall be no claim made against the Department by the Contractor for work pertaining to modifications required by any difference between actual field conditions and those shown by the details and dimensions on the contract plans. The Contractor will be paid at the unit price bid for the actual quantities of materials used or for the work performed, as indicated by the various items in the contract.

NOTICE TO CONTRACTOR - VIBRATORY ROLLERS

There are several underground utilities on Airport Road that will have as little as 12" of cover due to the lowering of the profile and several beneath Reserve Road and Main Street that may have minimal cover. The Contractor is hereby notified that the use of vibratory rollers will not be allowed on Airport Road, Reserve Road and Main Street.

The Contractor is restricted from using vibratory rollers for roadway construction within 75' of the Market Industrial Spur Track crossing of Reserve Road due to the presence of sensitive underground railroad facilities.

NOTICE TO CONTRACTOR - WATER METER PIT

The Contractor is hereby notified that there is an existing water meter pit located at STA 3005+93 Reserve Road, 62' RT that is depicted as a water manhole on the existing survey. The Contractor shall not set any heavy construction equipment, materials or vehicles on top of this structure. There is also an existing above ground cabinet adjacent to the meter pit that shall not be impacted. If the Contractor needs to be located adjacent to either structure, MDC shall be notified within 14 days prior to performing any work that could impact the structures.

NOTICE TO CONTRACTOR - FEDERAL WAGE DETERMINATIONS (Davis Bacon Act)

The following Federal Wage Determinations are applicable to this Federal- Aid contract and are hereby incorporated by reference. During the bid advertisement period, it is the bidder's responsibility to obtain the latest Federal wage rates from the US Department of Labor website, as may be revised 10 days prior to bid opening. Any revisions posted 10 days prior to the bid opening shall be the wage determinations assigned to this contract.

Check Applicable WD# (DOT Use Only)	WD#	Construction Type	Counties
	CT1	Highway	Fairfield, Litchfield, Middlesex, New Haven, Tolland, Windham
	CT2	Highway	New London
X	CT3	Highway	Hartford
	CT5	Heavy Dredging (Hopper Dredging)	Fairfield, Middlesex, New Haven, New London
	CT6	Heavy Dredging	Statewide
	CT13	Heavy	Fairfield
	CT14	Heavy	Hartford
	CT15	Heavy	Middlesex, Tolland
	CT16	Heavy	New Haven
	CT17	Heavy	New London
	CT26	Heavy	Litchfield, Windham
	CT18	Building	Litchfield
	CT19	Building	Windham
	CT20	Building	Fairfield
	CT21	Building	Hartford
	CT22	Building	Middlesex
	CT23	Building	New Haven
	CT24	Building	New London
	CT25	Building	Tolland
	CT4	Residential	Litchfield, Windham
	CT7	Residential	Fairfield
	CT8	Residential	Hartford
	CT9	Residential	Middlesex
	CT10	Residential	New Haven
	CT11	Residential	New London
	CT12	Residential	Tolland

The Federal wage rates (Davis-Bacon Act) applicable to this Contract shall be the Federal wage rates that are current on the US Department of Labor website (http://www.wdol.gov/dba.aspx) as may be revised 10 days prior to bid opening. The Department will no longer physically include revised Federal wage rates in the bid documents or as part of addenda documents. These applicable Federal wage rates will be incorporated in the final contract document executed by both parties.

If a conflict exists between the Federal and State wage rates, the higher rate shall govern.

To obtain the latest Federal wage rates, go to the US Department of Labor website (link above). Under Davis-Bacon Act, choose "Selecting DBA WDs" and follow the instruction to search the latest wage rates for the State, County and Construction Type.

NOTICE TO CONTRACTOR - ALL-INCLUSIVE DRAINAGE

ADDED SECTIONS:

2.86 – DRAINAGE TRENCH EXCAVATION

ROCK IN DRAINAGE TRENCH EXCAVATION

5.86 – CATCH BASINS, MANHOLES AND DROP INLETS

6.86 – DRAINAGE PIPES

DRAINAGE PIPE ENDS

This Contract contains the above-noted Special Provisions for all-inclusive drainage, developed to replace the following Sections in their entireties:

- Section 5.07 – *Catch Basins, Manholes and Drop Inlets*
- Section 6.51 – *Culverts*
- Section 6.52 – *Culvert Ends*

The Section 5.86 and 6.86 items include excavation and bedding material in the drainage structure, pipe and pipe end unit prices.

Section 2.05 *Trench Excavation* may be included for miscellaneous trenching, where necessary, but will not be used with all-inclusive drainage items.

Other Standard Specifications, Supplemental Specifications or Special Provisions may contain references to Articles or Subarticles from previous versions of Sections 5.07, 6.51 and 6.52 which are no longer valid.

The following Standard Specifications Sections or Supplements contain references to Articles or Subarticles from Section 2.05 which shall remain in effect:

- Section 2.06 – *Ditch Excavation*
- Section 5.06 – *Retaining Walls, Endwalls and Steps*
- Section 7.51 – *Underdrains and Outlets*
- Section 10.01 – *Trenching and Backfilling*

'Rock in Drainage Trench Excavation' is now defined in Section 2.86. 'Rock in Trench Excavation' will remain in Section 2.05 and may be used with trenching not associated with all-inclusive drainage items.

Any references to Articles beginning with "5.07," "6.51," or "6.52" shall refer to the pertinent topic or materials in the new Special Provisions contained herein.

NOTICE TO CONTRACTOR - CLEANING OF CATCH BASINS, PIPES AND OUTLETS

All existing and proposed drainage structures and drainage pipes (including outlets) within the project limits shall be routinely inspected and cleaned throughout the project duration and at post construction.

The cleaning of drainage structures or drainage pipes in non-regulated areas must be reported under the Department of Transportation's (Department) MS4 Permit requirements. In addition, the cleaning of outfalls or areas within the Department's right-of-way which is located in a regulated area must be reported under the Department's General Maintenance Permit.

Prior to the commencement of any work associated with the cleaning of catch basins, pipes and outlets, the Contractor and Inspector shall meet with the District Drainage Engineer for the purpose of reviewing the requirements and restrictions specified in the MS4 Permit and General Maintenance Permit and report all activities at each location and establish reporting protocols to the District Drainage Engineer that will be adhered to during construction.

NOTICE TO CONTRACTOR - DRAINAGE SYSTEMS

The design and installation of Hydrodynamic Separator No. 1, US 5 / RTE 15 NB, Sta 400+00, 60L, includes a Junction Chamber. The Junction Chamber will contain the diversion structure for the separator. The design and installation of the Junction Box must incorporate both the Junction Chamber specification and the diversion structure portion of the Hydrodynamic Separator specification. Payment for the junction box/diversion structure shall be made under Item 0586850.01 Hydrodynamic Separator (Site No. 1). Payment for diversion structures for Hydrodynamic Separator No. 2, RTE 15 NB Sta 250+80, 140L and Hydrodynamic Separator No. 3, RTE 15 NB, Sta 255+60, 67R shall include the diversion structure, the manhole that incorporates the diversion structure, and the return manhole from the hydrodynamic separator to the main drainage system if required.

The Contractor shall confirm the size, location and material of the existing drainage system outleting at I-91 NB Exit 27, Sta 19+75, 59R. This shall be performed through test pits, pipe video, dye testing and/or smoke testing. The Contractor shall notify the Engineer prior to the commencement of any work associated with the investigation of the drainage system. Differences found in the plan set shall be reported to the Engineer. Payment for this work shall be made through Items 0202452 Test Pit, 0653002 Clean Drainage System, and 0653102A Video and Dye Test Drainage System as required.

NOTICE TO CONTRACTOR - MINIMUM CONCRETE COMPRESSIVE STRENGTH

The concrete strength or allowable design stress specified in the General Notes is for design purposes only. The minimum compressive strength of concrete in constructed components shall comply with the requirements of Section 6.01 Concrete for Structures.

NOTICE TO CONTRACTOR - CAS CERTIFICATION FOR ABRASIVE BLAST CLEANING AND COATING WORK

This Contract requires abrasive blast cleaning and coating work be done with at least one (1) Coating Application Specialist per four (4) craft-workers. Coating Application Specialist (CAS) certification is available through the Society for Protective Coatings (SSPC). The CAS program is based on the requirements of SSPC ACS-1/NACE 13, a standard published jointly in 2008 by SSPC and NACE International (National Association of Corrosion Engineers). ACS-1 defines training and experience requirements that tradespersons must have in order to qualify to be assessed for certification. CAS QP-1 implementation requires that the CAS Level II certified applicator be on the job during abrasive blast cleaning and painting operations.

The firm proposed to perform abrasive field blast cleaning and coating on this Project must meet the requirements outlined in the special provisions under "Contractor - Subcontractor Qualifications."

When applicable, the shop painting firm proposed to perform abrasive blast cleaning and shop painting on this Project must meet the requirements outlined in the special provisions under "Qualifications of Shop Painting Firm."

NOTICE TO CONTRACTOR - ARCHITECTURAL AND INDUSTRIAL MAINTENANCE COATINGS

This Contract includes the application of materials subject to the Volatile Organic Compounds (VOC) content limits stated in the Regulations of Connecticut State Agencies (RCSA) Sections 22a-174-41 and -41a. All architectural and industrial maintenance (AIM) coatings and applications of such coatings must comply with these regulations.

The Contractor shall submit a Material Safety Data Sheet/Safety Data Sheet or Product Technical Data Sheet developed by the manufacturer of each material that may be subject to the Regulations. The submittal must verify both the type of AIM and its VOC Content. VOC content shall be determined based on the formulation data supplied by the materials manufacturer.

The Contractor may only use AIM coatings that contain VOCs below the respective coating category Phase II limits specified in Table 1 if either:

a) the coating was manufactured on or after May 1, 2018, **or**
b) the coating is being applied after April 30, 2021.

The Contractor may use AIM coatings that contain VOCs exceeding the respective coating category Phase II limits specified in Table 1 only if all of the following four conditions are met:

a) the coating is being applied on or before April 30, 2021,
b) the coating contains VOCs below the applicable Phase I limits specified in Table 1,
c) the coating was manufactured prior to May 1, 2018, **and**
d) the coating container(s) are dated (or date coded) as such.

For any coating that is not categorized within Table 1, the Contractor shall classify the coating as follows and apply corresponding limits in Table 1.

- Registers gloss <15 on an 85-degree meter or <5 on a 60-degree meter) – Flat Coating,
- Registers gloss of ≥15 on an 85-degree meter and ≥5on a 60-degree meter) - Nonflat Coating,
- Registers gloss of ≥70 on a 60-degree meter - Nonflat-High Gloss Coating.

The Contractor must close all containers of coating and solvent when not in use.

Coating container labels must display the date the coating was manufactured, the manufacturer's recommendation regarding thinning with solvent, and the coating's VOC content in grams per liter (g/L) of coating. Certain coating categories as noted in Table 1 have additional labeling requirements.

The Contractor may add additional solvent to a coating only if such addition does not cause the coating to exceed the applicable VOC limit specified Table 1. The Contractor must adhere to type(s) of solvent and maximum amount of solvent recommended by coating manufacturer. VOC content of a thinned coating shall be the VOC content as listed by the manufacturer after thinning in accordance with its recommendation.

TABLE 1		
Coating Category	**Phase I**	**Phase II**
	manufactured prior to May 1, 2018 VOC content limit (g/L)	**manufactured on or after May 1, 2018 VOC content limit (g/L)**
Aluminum roof coating	---[1]	450
Antenna coating	530	---[1]
Antifouling coating	400	---[1]
Basement specialty coating	---[1]	400
Bituminous roof coating	300	270
Bituminous roof primer	350	350
Bond breaker	350	350
Calcimine recoater	475	475
Clear wood coating - Clear brushing lacquer[2]	680	275
Clear wood coating - Lacquer[2,3]	550	275
Clear wood coating - Sanding sealer[2,4]	350	275
Clear wood coating - Varnish[2]	350	275
Concrete curing compound	350	350
Concrete or masonry sealer/ Waterproofing concrete or masonry sealer	400	100
Concrete surface retarder	780	780
Conjugated oil varnish	---[1]	450
Conversion varnish	725	725
Driveway sealer	---[1]	50
Dry fog coating	400	150
Faux finishing coating[2]	350	350
Fire resistive coating	350	350
Fire retardant coating - Clear	650	---[1]
Fire retardant coating - Opaque	350	---[1]
Flat coating	100	50
Floor coating	250	100
Flow coating	420	---[1]
Form-release compound	250	250
Graphic arts coating (sign paint)	500	500
High temperature coating	420	420
Impacted immersion coating	780	780
Industrial maintenance coating[2]	340	250
Industrial maintenance coating	340	250
Low solids coating	120	120
Magnesite cement coating	450	450
Mastic texture coating	300	100
Metallic pigmented coating	500	500

TABLE 1		
Coating Category	**Phase I**	**Phase II**
	manufactured prior to May 1, 2018 VOC content limit (g/L)	**manufactured on or after May 1, 2018 VOC content limit (g/L)**
Multi-color coating	250	250
Nonflat coating	150	100
Nonflat high gloss coating[2]	250	150
Nuclear coating	450	450
Pre-treatment wash primer	420	420
Primer, sealer and undercoater	200	100
Quick-dry enamel	250	---[1]
Quick-dry primer, sealer and undercoater	200	---[1]
Reactive penetrating carbonate stone sealer[2]	---[1]	500
Reactive penetrating sealer[2]	---[1]	350
Recycled coating	250	250
Roof coating	250	250
Rust preventive coating[2]	400	250
Shellac Clear	730	730
Shellac Opaque	550	550
Specialty primer, sealer and undercoater[2]	350	100
Stain	250	250
Stone consolidant[2]	---[1]	450
Swimming pool coating	340	340
Thermoplastic rubber coating and mastic	550	550
Traffic marking coating	150	100
Traffic marking coating	150	100
Tub and tile refinish	---[1]	420
Waterproofing membrane	---[1]	250
Waterproofing sealer	250	---[1]
Wood coating[2]	---[1]	275
Wood preservative	350	350
Zinc-rich primer[2]	---[1]	340

1 Classify as follows and apply corresponding limits in Table 1.

- Registers gloss <15 on an 85-degree meter or <5 on a 60-degree meter) – Flat Coating,
- Registers gloss of ≥15 on an 85-degree meter and ≥5on a 60-degree meter) – Nonflat Coating
- Registers gloss of ≥70 on a 60-degree meter – Nonflat-High Gloss Coating

2 Container must be appropriately labeled. See RCSA 22a-174-41a

3 "Clear Wood Coating – Lacquer" includes lacquer sanding sealer

4 "Clear Wood Coating - Sanding Sealer" does not include lacquer sanding sealer

-END-

NOTICE TO CONTRACTOR - STEEL ERECTION

This Contract requires Specifications for Erection of Steel should be amended as follows:

The erection of the structural steel girders for Bridge Nos. 06000A and 06947 is considered to be complex bridge construction. The Contractor shall take special precautions during the development of erection plans and working drawings and during the construction of the bridges. The erection methods and erection plans shall be developed by a Specialty Erection Engineer (SEE). The SEE shall have a minimum of 5 projects demonstrating experience with the development of erection plans for long-span curved steel structures within the last 10 years. The resume of the SEE shall be submitted to the Engineer for approval prior to the development of erection plans.

Construction of Bridge 06000A:

The construction of Bridge 06000A requires the following special attention items:

1. The girders have been designed and the camber tables developed for the conditions noted on the plans, however historical experience with long-span curved steel girders has produced deflections that can differ from design calculations. Therefore, the erection plans shall include provisions to control deflections during deck casting. Temporary shoring towers may be used to limit excessive deflections in the girders (should they occur). Other means to control deflections may also be employed. The SEE shall develop a design that can ensure the proper fit-up of cross frames and produce acceptable deck grades. The design shall be included in the erection plans working drawings.
2. The stability of the girders during deck casting has been checked by the designer, however additional cautionary measures shall be employed to ensure the safety of the workers and the traveling public. Additional temporary bracing is shown for Spans 4 and 5 to prevent lateral torsional bucking of the two girder system. The temporary shoring towers shall also be used in all spans to provide additional resistance to lateral torsional buckling of the girder system during deck casting. The SEE shall design the towers to aide in stability of the system during deck casting. The design shall be included in the erection plans working drawings.

Geometry Control Plans:

The SEE shall develop a geometry control plans for the erection of the girders on Bridge Nos. 0600A and 06947. These plans shall be included in the erection plan working drawings. These plans shall identify the means of controlling geometry during erection to ensure that the girders are in the proper position prior to deck casting. The geometry control plans shall account for deflections due to curvature and skew so that the girders will be in the proper position during erection to achieve the specified final position of the girders. The Contractor shall allow for 45-day review time upon receipt of complete submittal.

NOTICE TO CONTRACTOR - USE OF STATE POLICE OFFICERS

The Department will reimburse services of State Police Officers as a direct payment to the Department of Emergency Services and Public Protection. Payment for State Police Officers utilized by the Contractor for its convenience, not approved by the Engineer, is the responsibility of the Contractor. No separate payment item for State Police Officers is included in this contract.

Any costs associated with coordination and scheduling of State Police Officers will be included under the cost of Item No. 0971001A – Maintenance and Protection of Traffic.

NOTICE TO CONTRACTOR - PROCUREMENT OF MATERIALS

Upon award, the Contractor shall coordinate with the District prior to proceeding with shop drawings, working drawings, procurement of materials, and all other submittals required to complete the work in accordance with the contract documents.

NOTICE TO CONTRACTOR - PROPRIETARY ITEMS

The Contractor is hereby notified that the following items shall be furnished by the specific manufacturer:

Item	Description	Manufacturer
0520420A	Prefabricated Expansion Joint (Movement Capacity 7")	Watson Bowman Acme Corp.
0520456A	Prefabricated Expansion Joint System	Watson Bowman Acme Corp.
0916111A	Noise Barrier Wall (Structure)	Acousta Crete Faddis Concrete Products
0916123A	Noise Barrier Wall-Transparent (Structure)	Acrylite Soundstop CT GSCC NBS Armtec
0916126A	Noise Barrier Wall	Acousta Crete Faddis Concrete Products
1113059A	Traffic Flow Monitor	EIS Electronic Integrated Systems
1108704A	Optical Video/ Data Transmitter	Multidyne, Inc.
1112210A	Camera Assembly	American Dynamics, Inc.
1112216A	Camera Lowering Device Assembly Type A	MG2
1112286A	360 Degree Camera Assembly	GRIDSMART Technologies
1112289A	360 Degree Closed Loop System Video Detection Processor	GRIDSMART Technologies
1113604A	Optical Fiber Cable, Single Mode, Loose Buffer Tube Cable, 6 Fiber	Corning, Inc.
1113620A	Optical Fiber Cable, Single Mode, Loose Buffer Tube Cable, 60 Fiber	Corning, Inc.
1113621A	Optical Fiber Cable, Single Mode, Loose Buffer Tube Cable, 72 Fiber	Corning, Inc.

NOTICE TO CONTRACTOR - SALVAGED MATERIAL

The following items shall be salvaged from the project during the rehabilitation:

1. Metal Bridge Rail Protective Fence (Bridge 06000C)
2. Drainage items used for temporary drainage but not required for permanent.
3. Traffic Flow Monitor (TFM) and TFM Pole

The Contractor shall load, transport, and unload the material. The material shall be stacked and stored according to the directions of the Materials Storage Manager. The condition of the material is to be determined by the State Inspector responsible for this project. Strict adherence to proper stores documentation, Directive 19 - "Transfer of Salvage Material from Project to Stores", is mandatory. Any material not meeting this criterion will be refused.

Items shall be delivered in good condition. The Engineer shall inspect and will designate the units to be salvaged. For the protective fencing, the Contractor shall disassemble the system (panels and posts) without damaging the material and deliver them on a rack body or flatbed truck for unloading by DOT equipment. The posts and hardware should be gathered together and cutting should be avoided where possible.

Deliver Salvaged Materials to the following address:

For Protective Fence
Hartford Bridge Maintenance
49 Jennings Road
Hartford, CT 06120
Contact: John Riddick
Phone: (860) 213-1079

For Temporary Drainage Structures
Glastonbury Maintenance Garage
235 Oak Street
Glastonbury, CT 06033
Contact: Ken Rulnick
Phone: 860-633-1159

For Traffic Flow Monitor (TFM) and TFM Pole
Rocky Hill Maintenance Garage
1107 Cromwell Avenue
Rocky Hill, CT 06067
Contact: Special Services Manager
Phone: 860-258-4516

A minimum of 2 days' notice shall be provided prior to delivery.

All materials that the Resident Engineer deems unsuitable for salvage shall remain the property of the Contractor.

NOTICE TO CONTRACTOR - Federal Rail Safety Regulations (49 C.F.R. Part 219) Concerning Alcohol and Drug Testing

On October 16, 2008, the United States Congress enacted the Rail Safety Improvement Act of 2008 (RSIA). RSIA directs the Federal Railroad Administration (FRA) to promulgate new safety regulations related to railroad safety. The purpose of this NTC is to notify you of certain requirements recently promulgated by the FRA that may be applicable to work you are currently performing, or may in the future perform, for the Connecticut Department of Transportation (Department).

On June 10, 2016, the FRA published a final rule expanding the scope of its drug and alcohol testing regulations (FRA Regulations) to provide that "[e]ach railroad must ensure that a regulated employee is subject to being selected for random testing... whenever the employee performs regulated service on the railroad's behalf." 49 C.F.R. § 219.601. A "regulated employee" includes a contractor to a railroad or any individual who is performing activities for a railroad and includes those contractors, consultants or individuals who are deemed "maintenance-of-way" employees under 49 C.F.R. Part 219 (See 49 C.F.R. §219.5).

The term maintenance-of-way (MOW) employee, as used in 49 C.F.R. Part 219, is defined in 49 C.F.R. § 214.7 as "any employee…of a contractor to a railroad, whose duties include inspection, construction, maintenance or repair of railroad track, bridges, roadway, signal and communications systems, electric traction systems, roadway facilities or roadway maintenance machinery on or near track or with the potential of fouling a track, and flagmen and watchmen/lookouts." (collectively, MOW Activities).

The final rule, which is effective **June 12, 2017,** requires contractors and consultants employing MOW employees to submit a Part 219 Compliance Plan to FRA **prior** to the effective date. Please consult the following link to the model drug and alcohol plan prepared by the FRA for guidance.

https://www.fra.dot.gov/eLib/details/L02814

The final rule mandates, among other things, the establishment of a random testing pool to ensure a testing rate of 50% of MOW employees for drugs and 25% of MOW employees for alcohol on an annual basis. For more information related to the requirements, please refer to:

http://www.ecfr.gov/cgi-bin/text-idx?rgn=div5&node=49:4.1.1.1.14

Every contractor or consultant that is performing MOW Activities must comply with its obligations under 49 C.F.R. Part 219 to ensure that all MOW employees are being randomly tested for drugs and alcohol. Failure of a contractor or consultant to timely comply with the FRA Regulations may subject that firm to civil penalties. In addition, MetroNorth Railroad (MNR) has stated that contractors or consultants who do not comply with the FRA regulations will not be able to work on MNR property.

The Department strongly urges all contractors and consultants to consult with their attorneys and/or to conduct their own independent due diligence regarding the requirements imposed by the new FRA Regulations to determine what steps are necessary to assure compliance. The information provided herein is advisory in nature and is offered without warranty of any kind. The Department does not accept any responsibility or liability for the accuracy, content, completeness, legality, or reliability of the information contained herein.

Any questions regarding the FRA Regulations concerning drug and alcohol testing should be directed to: Mr. Gerald Powers, Drug and Alcohol Program Manager, Office of Safety Enforcement, Federal Railroad Administration, 1200 New Jersey Avenue SE, Mail Stop 25, Washington, DC 20590 or via telephone (202) 493-6313.

NOTICE TO CONTRACTOR - WORK ON RAILROAD PROPERTY

The Contractor is hereby notified that all railroad specifications contained elsewhere herein shall be made a part of this contract, and that the Contractor shall be bound to comply with all requirements of such specifications with the following exception: Connecticut Southern Railroad (CSO) is a subsidy of Genesee & Wyoming, Inc. (G&W) and their specifications include some provisions that the Department has determined are not applicable for this project given the State's or City's ownership of the track and associated property.

The requirements and conditions set forth in the subject specifications shall be binding on the Contractor just as any other specification would be.

The Contractor is herein notified of the following railroad related special provisions that are part of this contract:

- NTC – Federal Rail Safety Regulations (49 C.F.R. Part 219) Concerning Alcohol and Drug Testing

- Article 1.05.06 – Cooperation with Utilities (Including Railroads)

- G&W General Special Provision: This specification provides general requirements for the Contractor to work on the property upon which the railroad operates. The cost of complying with the specification shall be included in the general cost of the work. The following section has been determined by the Department to not be applicable for this project: Temporary Crossings. A temporary crossing at a location and with a general layout acceptable to the Railroad is detailed in the contract plans. If the Contractor proposes an alternative temporary crossing in layout or location, the Contractor shall be required to submit a request for approval for such alternative from the Engineer and the Railroad.

- G&W Construction Submittal Criteria: This specification provides requirements for Contractor submissions to the Railroad. The cost of complying with the specification shall be included in the general cost of the work. The following revisions or deletions have been determined by the Department to be applicable for this project: Article I - DEFINITIONS F. Engineer – The Railroad's definition of Engineer does not replace the Department's definition of Engineer, and all references to Engineer within the G&W specification is clarified to refer to the Railroad's Engineer; and Article VIII. TEMPORARY GRADE CROSSINGS A – replace the paragraph with the following "If at any time the Agency or its Contractor desires a temporary crossing of the Railroad's tracks other than a temporary crossing detailed in the Contract plans, he shall make a request for a temporary crossing from the Railroad. If approved, the Contractor shall pay all installation, maintenance, removal, protection and associated costs."

- G&W Temporary Shoring Special Provision: This specification provides requirements for Contractor design and construction of temporary shoring for excavation adjacent to track

where the Railroad operates. The cost of complying with the specification shall be included in the general cost of the work. The following revisions or deletions have been determined by the Department to be applicable for this project: Article 1.01 DESCRIPTION OF WORK D.2 – replace the sentence with the following "The Contractor must comply with all Railroad requirements when working on Railroad Right-of-Way."; Article 1.03 SUBMITTALS D.6 – replace the sentence with the following "Proposed horizontal construction clearances. The minimum allowable is 10 feet measured at a right angle from centerline of track."; Part 2 – MATERIALS J. – replace "12'<S<18'" with "10'<S<18'" in Table 1 Deflection Criteria; and Part 3 – EXECUTION B. – replace the first sentence with the following "No excavation shall be permitted closer than 10'-0" measured at a right angle from the centerline of track to the trackside of shoring system."

- G&W Special Provision for Track Monitoring: This specification provides requirements for Contractor monitoring of the railroad track, railroad embankment and temporary shoring during construction. The cost of complying with the specification shall be included in the general cost of the work. The following revisions or deletions have been determined by the Department to be applicable for this project: Article 3.02 DATA COLLECTION AND REPORTING C.3 TABLE 1 – replace temporary shoring monitoring horizontal threshold and limiting values to 0.25-in. and 0.375-in. respectively.

- Cost of Railroad Protection: The Contractor will be reimbursed for the cost of Railroad Protection necessary to complete the work shown in the contract in accordance with the item "RAILROAD PROTECTION".

- Compliance with Federal Rail Safety Regulations (49 C.F.R. Part 214): The Contractor's employees, and the employees of all subcontractors, who will be entering the jobsite within Railroad territory and before coming within twenty-five (25) feet of the centerline of track, must first attend and complete a railroad safety training class acceptable to the Railroad and satisfying the requirements of the current Federal Regulations – 49 CFR Part 214. A training program acceptable to the Railroad is available online at the website www.rrtrainers.com, "G&W Roadway Worker Protection Training for Railroad Contractors". Alternative training programs may be available and are subject to the approval of the Engineer and the Railroad. The Contractor is responsible for ensuring that all employees on the jobsite have the required training and have an Identification card, sticker or badge issued by the training organization. Training is valid for one calendar year. The Contractor's employees and the employees of all subcontractors entering the Railroad territory shall complete any sign in process employed by the Railroad to monitor and control access to Railroad territory. No additional compensation will be allowed to the Contractor for employee's time for attending these training classes. Refer to the special provisions and to Article 1.05.06 entitled "Cooperation with Utilities (Including Railroads)."

Authority of the Railroad Engineer

The Connecticut Southern Railroad (CSO or the Railroad) is a subsidy of Genesee & Wyoming, Inc. (G&W or GWI).A representative of the Railroad shall have final authority in all matters affecting the safe maintenance of Railroad operations and Railroad property, and approval shall be obtained by the Agency or its Contractor for methods of construction to avoid interference with Railroad operations and Railroad property and all other matters contemplated by the Agreement and these Special Provisions.

The Agency and its Contractor shall:

1. Cooperate at all times with the local officials of the Railroad or its representative.
2. Use all reasonable care and diligence in the work in order to avoid accidents, damage or unnecessary delay to, or interference with the trains and other property of the Railroad.
3. Conduct its work in a manner satisfactory to the Chief Engineer of the Railroad or his authorized representative, to perform its work in such manner and at such time as not to unnecessarily interfere with the movements of trains or Railroad traffic, and to hold its work open to inspection of Railroad inspectors.
4. Avoid unnecessary use of Railroad property without written permission of the Railroad and to leave the Railroad roadbed and property in a condition acceptable to the Chief Engineer of the Railroad. No storage of materials and/or loose equipment will remain on the ROW.
5. Pay the Railroad or owning company for any changes, requested for his convenience, to Railroad property, facilities, wire, fiber optic and/or pipe lines other than shown on the plans for the project.
6. Comply with the attached Genesee & Wyoming Contractor Safety Rules.

Methods and procedures for performing work on property of **The Connecticut Southern Railroad Company** must be approved by:

Dave Cuthbertson
AVP, Engineering
Northeast Region Railroads
75 Hammond Street
Worcester, MA 01610-1729
(508) 755-4000
david.cuthbertson@gwrr.com

Public Projects Contacts:

Debra-Ann Bocash
Regional Coordinator of Engineering
2 Federal St., Suite 201
St. Albans, VT 05478
(802) 527-3444
deb.bocash@gwrr.com

Nick Torello, PE*
Public Project Manager
Patrick Engineering, Inc.
(617) 583-9409
ntorello@patrickco.com
*General Engineering Consultant

Project Information

State Project: CT DOT #63-703
Hartford & East Hartford, Hartford County, Connecticut
Relocation of I-91NB Interchange 29 and Widening of I-91NB and Route
Connecticut Southern Railroad
CSO: Regional Market Spur / Wethersfield Subdivision
RPN: 16CSOR09R

Train Movements

The **estimated** number of trains (not including specials) operating through the project area is:

Total Trains:
2 trains per 24 hour period at **10** mph.

Insurance Requirements

Contractors completing new installations or working on or around any of the Railroad's properties are required to carry insurance of the following kinds and amounts:

1) Public Liability or Commercial General Liability Insurance ("CGL"), including Contractual Liability Coverage and CG 24 17 "Contractual Liability – Railroads" endorsement, covering all liabilities assumed by the Contractor under this Agreement, without exception or restriction of any kind, with a combined single limit of not less than Two Million Dollars ($2,000,000) for Bodily Injury and/or Property Damage Liability per occurrence, and an aggregate limit of not less than Six Million Dollars ($6,000,000) per annual policy period. Such insurance policy shall be endorsed to provide a Waiver of Subrogation in favor of the Railroad and its affiliates and shall name the Railroad and affiliates as Additional Insured. An umbrella policy may be utilized to satisfy the required limits of liability under this section, but must "follow form" and afford no less coverage than the primary policy.

2) Commercial Automobile Insurance for all owned, non-owned and hired vehicles with a combined single limit of not less than One Million Dollars ($1,000,000) for Bodily Injury and/or Property Damage Liability per occurrence. Such insurance policy shall be endorsed to provide a Waiver of Subrogation in favor of the Railroad and its affiliates and shall name the Railroad and its affiliates as Additional Insured.

3) Statutory Workers' Compensation and Employers' Liability Insurance for its employees (if any) with minimum limits of not less than One Million Dollars ($1,000,000) for Bodily Injury by Accident, Each Accident; One Million Dollars ($1,000,000) for Bodily Injury by Disease, Policy Limit; One Million Dollars ($1,000,000) for Bodily Injury by Disease, Each Employee. Such insurance policy shall be endorsed to provide a Waiver of Subrogation in favor of the Railroad and its affiliates.

4) **Prior to construction within 50' of the railroad tracks,** Contractor shall purchase Railroad Protective Liability Insurance naming the Railroad as the named insured with

limits of Two Million Dollars ($2,000,000) each occurrence and Six Million Dollars ($6,000,000) aggregate limit. The policy shall be issued on a standard ISO form CG 00 35 12 03 or, if available, obtain such coverage from the Railroad.

If you have questions or require additional information on how to obtain Railroad Protective Liability Insurance coverage through the Railroad, please contact:

Donna Killingsworth, MBA
Real Estate Manager
Genesee & Wyoming Railroad Services, Inc.
13901 Sutton Park Dr., S.,
Suite 160
Jacksonville, FL 32224
(904) 900-6286
donna.killingsworth@gwrr.com

Accessing Railroad Property

Any entry or construction activities on railroad right of way must be coordinated with the Railroad in writing through the Notice of Starting Work process. Notifications shall be sent to the Public Project Contacts and the AVP, Engineering listed above.

Notice of Starting Work

Agency or its Contractor shall not commence any work on Railroad Property or rights-of-way until it has complied with the following conditions:

1. Notify the Railroad in writing of the date that it intends to commence Work on the Project. Such notice must be received by the Railroad at least ten (10) business days in advance of the date the Agency or its Contractor proposes to begin Work on Railroad property. The notice must include the Project Information provided above. If flagging service is required, such notice shall be submitted at least thirty (30) business days in advance of the date scheduled to commence the Work.

2. Obtain authorization from the Railroad to begin Work on the right-of-way, such authorization to include an outline of specific conditions with which it must comply.

Submittal Timing

Review of design submittals by the Railroad will require a minimum of four (4) weeks. To avoid impacting the construction schedule, the Contractor must schedule submittals well in advance. Partial, incomplete or inadequate designs will be rejected, thus delaying the approval. Drawings and calculations must be signed and stamped by a Registered Professional Engineer familiar with Railway loadings and who is licensed in the state where the shoring system is intended for use. Drawings accompanying the shoring plans shall be submitted in 11” x 17” or 8½” x 11” sized paper format.

Flagging Protection/Inspection Service

The Railroad has sole authority to determine the need for flagging required to protect its operations and property. In general, flagging protection will be required during the work shift that coincides with anticipated train movements, when the Agency or Contractor or their equipment are, or are likely to be, working within fifty (50) feet of live track or other track clearances specified by the Railroad, or over tracks, or when work being performed adjacent to operating tracks may present hazards to train operation, or when equipment does or may infringe upon such limits.

If the Railroad provides flagging or other services, the Contractor shall not be relieved of any responsibilities or liabilities as set forth in any document authorizing the work. No work is allowed within 50 feet of track centerline when a train passes the work site and all personnel must clear the area within 25 feet of track centerline and secure all equipment when trains are present.

If it is necessary for the Railroad to advertise a flagging job for bid, it may take up to 90-days to obtain this service, and the Railroad shall not be liable for the cost of delays attributable to obtaining such service.

The Railroad shall have the right to assign an individual to the site of the Project to perform inspection service whenever, in the opinion of the Railroad Representative, such inspection may be necessary. Agency shall reimburse the Railroad for the costs incurred by the Railroad for such inspection service. Inspection service shall not relieve Agency or Contractor from liability for its Work.

The Contractor will not be permitted to operate any of his own equipment on Railroad tracks except under an acceptable arrangement with the Railroad. Such equipment and the operation of such equipment, or equipment rented from the Railroad, shall be arranged for by the Contractor with the Railroad and the cost for its use, including protection of Railroad traffic, shall be borne by the Contractor.

The Contractor shall notify the following named individual for the Railroad at least 30 days, or as directed by the authorized representative of the Railroad, in advance of starting any work which might require protection:

Ryan Siperek
Director of Engineering
Connecticut Southern Railroad
rsiperek@gwrr.com

The Contractor shall notify the Railroad at least 5 working days in advance of suspending or ceasing operations that require a flagger.

Clearance Requirements

The Contractor shall maintain a clearance envelope in accordance with AREMA clearance diagrams for fixed obstructions. (See attached clearance diagram and specification). The resultant clearance envelope is to be verified by the Railroad personnel or its representative prior to commencement of work.

Temporary Crossings

If at any time the Agency or its Contractor desires a temporary crossing of the Railroad's tracks, he shall make a request for a temporary crossing from the Railroad. If approved, he shall arrange with the Railroad, execute its regular form of private grade crossing agreement covering the crossing desired, paying all construction, maintenance, removal, protection and other costs.

Clean- up

Agency or Contractor, upon completion of the Project, shall remove from the Railroad's Property any temporary grade crossings, any temporary erosion control measures used to control drainage, all machinery, equipment, surplus materials, falsework, rubbish, or temporary buildings belonging to Agency or Contractor. Agency or Contractor, upon completion of the Project, shall leave the Railroad Property in neat condition, satisfactory to the Railroad Representative.

GENESEE & WYOMING
CONSTRUCTION
SUBMISSION CRITERIA

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INTRODUCTION

The intent of this document is to guide outside agencies and their Contractors when performing work on, over, or with potential to impact Railroad property and/or Right-of-Way (ROW). Work plans shall be submitted for review to the designated Railroad Engineering Representative for all work which presents the potential to affect Railroad property or operations; this document shall serve as a guide in preparing these work plans. All work shall be performed in a manner that does not adversely impact Railroad operations or safety; as such, the requirements of this document shall be strictly adhered to, in addition to all other applicable standards associated with the construction. Applicable standards include, but are not limited to, Railroad Standards and Special Provisions, Railroad Insurance Requirements, Railroad Pipeline Occupancy Criteria, as well as the governing local, county, state and federal requirements. It shall be noted that this document and all other Railroad standards are subject to change without notice, and future revisions will be made available upon request.

I. DEFINITIONS

A. Agency– The project sponsor (i.e., State DOT, Local Agencies, Private Developer, etc.)

B. AREMA– American Railway Engineering and Maintenance-of-Way Association – the North American railroad industry standards group. The use of this term shall be in specific reference to the AREMA Manual for Railway Engineering.

C. Construction Submission– The Agency or its representative shall submit plans, supporting calculations, and detailed means and methods procedures for the specific proposed activity. All plans, specifications, and supporting calculations shall be signed/sealed by a Professional Engineer as defined below.

D. Controlled Demolition– Removal of an existing structure or subcomponents in a manner that positively prevents any debris or material from falling, impacting, or otherwise affecting Railroad employees, equipment or property. Provisions shall be made to ensure that there is

no impairment of railroad operations or the Railroad's ability to access railroad property at all times.

E. Contractor – The Agency's representative retained to perform the project work.

F. Engineer– Railroad Engineering Representative or a GEC authorized to act on the behalf of the Railroad.

G. Flagger– A qualified Railroad employee with the sole responsibility to direct or restrict movement of trains, at or through a specific location, to provide protection for workers.

H. GEC– General Engineering Consultant who has been authorized to act on the behalf of Railroad.

I. Horizontal Clearance– Distance measured perpendicularly from centerline of any track to the nearest obstruction at any elevation between TOR and the maximum vertical clearance of the track.

J. Professional Engineer– An engineer who is licensed in State or Commonwealth in which the project is to occur. All plans, specifications, and supporting calculations shall be prepared by the Licensed Professional Engineer and shall bear his/her seal and signature.

K. Potential to Foul– Work having the possibility of impacting Railroad property or operations; defined as one or more of the following:

1. Any activity where access onto Railroad property is required.
2. Any activity where work is being performed on Railroad ROW.
3. Any excavation work adjacent to the tracks or facilities, within the Theoretical Railroad Live Load Influence Zone, or where the active earth pressure zone extends within the Railroad property limits.
4. The use of any equipment where, if tipped and laid flat about its center pin within the angle of proposed use, can encroach within twenty five feet (25'-0") of the nearest track centerline. This is based upon the proposed location of the equipment during use, proposed swing angles and is a function of the equipment boom length. Note that hoisting equipment with the potential to foul as defined in Sections I.K.4 and I.K.5 must satisfy the 150% factor of safety requirement for lifting capacities.
5. Any work where the scatter of debris, or other materials has the potential to encroach within twenty five feet (25'-0") of the nearest track centerline.
6. Any work where significant vibration forces may be induced upon the track structure or existing structures located under, over, or adjacent to the track structure.
7. Any other work which poses the potential to disrupt rail operations, threaten the safety of railroad employees, or otherwise negatively impact railroad property, as determined by the Railroad.

L. ROW– Right of Way; Refers to Railroad Right-of-Way as well as all Railroad property and facilities. This includes all aerial space within the property limits, and any underground facilities regardless of ownership.

M. Submission Review Period- a minimum of thirty (30) days in advance of start of work. Up to thirty (30) days will be required for the initial review response. Up to an additional thirty (30) days may be required to review any/all subsequent submissions or resubmission. Partial, incomplete or inadequate designs will be rejected, thus delaying the approval

N. Theoretical Railroad Live Load Influence Zone– A 1½ horizontal to 1 vertical theoretical slope line starting 18 inches (1'-6") below top of tie elevation and twelve feet (12'-0") from the centerline of the nearest track.

O. TOR– Top of Rail. This is the base point for clearance measurements. It refers to the crown (top) of the steel rail; the point where train wheels bear on the steel rails.

P. Track Structure– All load bearing elements which support the train. This includes, but is not limited to, the rail, ties, appurtenances, ballast, sub-ballast, embankment, retaining walls, and bridge structures.

Q. Vertical Clearance– Distance measured from TOR to the lowest obstruction within six feet (6'-0") of the track centerline, in either direction.

II. GENERAL SUBMISSION REQUIREMENTS

A. A construction work plan is required to be submitted by the Agency or its Contractor, for review and acceptance, prior to accessing or performing any work with Potential to Foul.

B. The Agency or its representative shall submit plans, specifications, supporting calculations, and detailed means and methods procedures for the specific proposed work activity.

C. Construction submissions shall include all information relevant to the work activity, and shall clearly and concisely explain the nature of the work, how it is being performed, and what measures are being taken to ensure that railroad property and operations are continuously maintained.

D. All construction plans shall include a map of the work site, depicting the Railroad tracks, the Railroad right of way, proposed means of access, proposed locations for equipment and material staging (dimensioned from nearest track centerline), as well as all other relevant project information. An elevation drawing may also be necessary in order to depict clearances or other components of the work.

E. The Railroad will not provide pricing to individual contractors involved in bidding projects. Bidding contractors shall request information from the agency and not the Railroad.

F. The Contractor shall install a geotextile fabric ballast protection system to prevent construction or demolition debris and fines from fouling ballast. The geotextile ballast protection system shall be installed and maintained by the Contractor to the satisfaction of the Engineer.

G. The Engineer shall be kept aware of the construction schedule. The Contractor shall provide timely communication to the Engineer when scheduling the work such that the Engineer may be present during the work. The Contractor's schedule shall not dictate the work plan review schedule, and flagging shall not be scheduled prior to receipt of an accepted work plan.

H. At any time during construction activities, the Engineer may require revisions to the previously approved procedures to address weather, site conditions or other circumstances that may create a potential hazard to rail operations or Railroad facilities. Such revisions may require immediate interruption or termination of ongoing activities until such time the issue is resolved to the Engineer's satisfaction. The Railroad and its GEC shall not be responsible for any additional costs or time claims associated with such revisions.

I. Blasting will not be permitted to demolish a structure over or within The Railroad right-of-way. When blasting off of Railroad property but with Potential to Foul, vibration monitoring,

track settlement surveying, and/or other protective measures may be required as determined by the Engineer.

1. Blasting is not permitted adjacent to Railroad right-of-way without written approval from the Engineer.
2. Mechanical and chemical means of rock removal must be explored before blasting is considered. If written permission for the use of explosives is granted, the Agency or Contractor must submit a work plan satisfying the following requirements:
    a. Blasting shall be done with light charges under the direct supervision of a responsible officer or employee of the Agency or Contractor.
    b. Electronic detonating fuses shall not be used because of the possibility of premature explosions resulting from operation of two-way train radios.
    c. No blasting shall be done without the presence of an authorized representative of the Railroad. Advance notice to the Engineer is required to arrange for the presence of an authorized Railroad representative and any flagging that the Railroad may require.
    d. Agency or Contractor must have at the project site adequate equipment, labor and materials, and allow sufficient time, to clean up debris resulting from the blasting and correct any misalignment of tracks or other damage to Railroad property resulting from the blasting. Any corrective measures required must be performed as directed by the Engineer at the Agency's or Contractor's expense without any delay to trains. If Agency's or Contractor's actions result in the delay of any trains including passenger trains, the Agency or Contractor shall bear the entire cost thereof.
    e. The Agency or Contractor may not store explosives on Railroad property.
    f. At any time during blasting activities, the Engineer may require revisions to the previously approved procedures to address weather, site conditions or other circumstances that may create a potential hazard to rail operations or Railroad facilities. Such revisions may require immediate interruption or termination of ongoing activities until such time the issue is resolved to the Engineer's satisfaction. The Railroad and its GEC shall not be responsible for any additional costs or time claims associated with such revisions.

III. HOISTING OPERATIONS

A. All proposed hoisting operations with Potential to Foul shall be submitted in accordance with the following:
    1. A plan view drawing shall depict the work site, the track(s), the proposed location(s) of the lifting equipment, as well as the proposed locations for picking, any intermediate staging, and setting the load(s). All locations shall be dimensioned from centerline of the nearest track. Crane locations shall also be dimensioned from a stationary point at the work site for field confirmation.
    2. Computations showing the anticipated weight of all picks. Computations shall be made based upon the field-verified plans of the existing structure. Pick weights shall account for the weight of concrete rubble or other materials attached to the component being removed; this includes the weight of subsequent rigging devices/components. Rigging components shall be sized for the subsequent pick weight.

3. All lifting equipment, rigging devices, and other load bearing elements shall have a rated (safe lifting) capacity that is greater than or equal to 150% of the load it is carrying, as a factor of safety. Supporting calculations shall be furnished to verify the minimum capacity requirement is maintained for the duration of the hoisting operation.
4. Dynamic hoisting operations are prohibited when carrying a load with the Potential to Foul. Cranes or other lifting equipment shall remain stationary during lifting. (i.e., no moving picks).
5. For lifting equipment, the manufacturer's capacity charts, including crane, counterweight, maximum boom angle, and boom nomenclature is to be submitted.
6. A schematic rigging diagram must be provided to clearly call out each rigging component from crane hook to the material being hoisted. Copies of catalog or information sheets shall be provided to verify rigging weights and capacities.
7. For built-up rigging devices, the contractor shall submit the following:
    a. Details of the device, calling out material types, sizes, connections and other properties.
    b. Load test certification documents and/or design computations bearing the seal and signature of a Professional Engineer. Load test shall be performed in the configuration of its intended use as part of the subject demolition procedure.
    c. Copies of the latest inspection reports of the rigging device. The device shall be inspected within one (1) calendar year of the proposed date for use.
8. A detail shall be provided showing the crane outrigger setup, including dimensions from adjacent slopes or facilities. The detail shall indicate requirements for bearing surface preparation, including material requirements and compaction efforts. As a minimum, outriggers and/or tracks shall bear on mats, positioned on level material with adequate bearing capacity.
9. A complete written narrative that describes the sequence of events, indicating the order of lifts and any repositioning or re-hitching of the crane(s).

IV. DEMOLITION PROCEDURE

A. The Agency or its Contractor shall submit a detailed procedure for a controlled demolition of any structure on, over, or adjacent to the ROW. The controlled demolition procedure must be approved by the Engineer prior to beginning work on the project.

B. Existing Condition of structure being demolished:
    1. The Contractor shall submit as-built plans for the structure(s) being demolished.
    2. If as-built plans are unavailable, the Contractor shall perform an investigation of the structure, including any foundations, substructures, etc. The field measurements are to be made under the supervision of the Professional Engineer submitting the demolition procedure. Findings shall be submitted as part of the demolition means and methods submittal for review by the Engineer.
    3. Any proposed method for temporary stabilization of the structure during the demolition shall be based on the existing plans or investigative findings, and submitted as part of the demolition means and methods for review by the Engineer.

C. Demolition work plans shall include a schematic plan depicting the proposed locations of the following, at various stages of the demolition:

1. All cranes and equipment, calling out the operating radii.
2. All proposed access and staging locations with all dimensions referenced from the center line of the nearest track.
3. Proposed locations for stockpiling material or locations for truck loading.
4. The location, with relevant dimensions, of all tracks, other railroad facilities; wires, poles, adjacent structures, or buried utilities that could be affected, showing that the proposed lifts are clear of these obstructions.
5. Note that no crane or equipment may be set on the rails or track structure and no material may be dropped on Railroad property.

D. Demolition submittal shall also include the following information:

1. All hoisting details, as dictated by Section III of this document.
2. A time schedule for each of the various stages must be shown as well as a schedule for the entire lifting procedure. The proposed time frames for all critical subtasks (i.e., torch/saw cutting various portions of the superstructure or substructure, dismantling splices, installing temporary bracing, etc.) shall be furnished so that the potential impact(s) to Railroad operations may be assessed and eliminated or minimized.
3. The names and experience of the key Contractor personnel involved in the operation shall be included in the Contractor's means and methods submission.
4. Design and supporting calculations shall be prepared, signed, and sealed by the Professional Engineer for items including the temporary support of components or intermediate stages shall be submitted for review. A guardrail will be required to be installed for tracks in the proximity of temporary bents or shoring towers, when located within twelve feet (12'-0") from the centerline of the track. The guardrail will e installed by the Agency or its contractor.

E. Girders or girder systems shall be stable at all times during demolition. Temporary bracing shall be provided at the piers, abutments, or other locations to resist overturning and/or buckling of the member(s). The agency shall submit a design and details of the proposed temporary bracing system, for review by the Engineer. Lateral wind forces for the temporary conditions shall be considered in accordance with AREMA, Chapter 8, Section 28.6.2. The minimum lateral wind pressure shall be fifteen pounds per square foot (15 psf).

F. Existing, obsolete, bridge piers shall be removed to a minimum of three feet (3'-0") below the finished grade, final ditch line invert, or as directed by the Engineer.

G. A minimum quantity of twenty five (25) tons of Railroad approved granite track ballast may be required to be furnished and stockpiled on site by the Contractor, or as directed by the Engineer.

H. The use of acetylene gas is prohibited for use on or over Railroad property. Torch cutting shall be performed utilizing other materials such as propane.

I. The Railroad's tracks, signals, structures, and other facilities shall be protected from damage during demolition of existing structure or replacement of deck slab.

J. Demolition Debris Shield

1. On-track or ground-level debris shields (such as crane mats) are prohibited for use by the Railroad.
2. Demolition Debris Shield shall be installed prior to the demolition of the bridge deck or other relevant portions of the structure. The demolition debris shield shall be erected from the underside of the bridge over the track area to catch all falling debris. The debris shield shall not be the primary means of debris containment.
    a. The demolition debris shield design and supporting calculations, all signed/sealed by a Professional Engineer, shall be submitted for review and acceptance.
    b. The demolition debris shield shall have a minimum design load of 50 pounds per square foot (50 psf) plus the weight of the equipment, debris, personnel, and all other loads.
    c. The Contractor shall verify the maximum particle size and quantity of the demolition debris generated during the procedure does not exceed the shield design loads. Shield design shall account for loads induced by particle impact; however the demolition procedure shall be such that impact forces are minimized. The debris shield shall not be the primary means of debris containment.
    d. The Contractor shall include installation/removal means and methods for the demolition debris shield as part of the proposed Controlled Demolition procedure submission.
    e. The demolition debris shield shall provide twenty three feet (23’-0”) minimum vertical clearance, or maintain the existing vertical clearance if the existing clearance is less than twenty three feet (23’-0”).
    f. Horizontal clearance to the centerline of the track should not be reduced unless approved by the Engineer.
    g. The Contractor shall clean the demolition debris shield daily or more frequently as dictated either by the approved design parameters or as directed by the Engineer.

K. Vertical Demolition Debris Shield
    1. This type of shield may be required for substructure removals in close proximity to the track and other facilities, as determined by the Engineer.
    2. The Agency or its Contractor shall submit detailed plans with detailed calculations, prepared, signed, and sealed by a Professional Engineer, of the protection shield.

V. ERECTION PROCEDURE

A. The Agency or its Contractor shall submit a detailed procedure for erection of a structure with Potential to Foul. The erection procedure must be approved by the Engineer prior to beginning work on the project.

B. Erection work plans shall include a schematic plan depicting the following, at all stages of the construction:
    1. All proposed locations of all cranes and equipment, calling out the operating radii.
    2. All proposed access and staging locations with all dimensions referenced from the center line of the nearest track.
    3. All proposed locations for stockpiling material or locations for truck loading.

4. The location, with relevant dimensions, of all tracks, other railroad facilities; wires, poles, adjacent structures, or buried utilities that could be affected, showing that the proposed lifts are clear of these obstructions.

C. No crane or equipment may be set on the rails or track structure and no material may be dropped on Railroad property.

D. For erection of a structure over the tracks, the following information shall be submitted for review and acceptance by the Engineer, at least thirty (30) days prior to erection:

1. As-built beam seat elevations – field surveyed upon completion of pier/abutment construction.
2. Current Top of Rail (TOR) elevations – field measured at the time of as-built elevation collection.
3. Computations verifying the anticipated minimum vertical clearance in the final condition which accounts for all deflection and camber, based upon the current TOR and as-built beam seat elevations. The anticipated minimum vertical clearance shall be greater than or equal to that which is indicated by the approved plans. Vertical clearance (see definitions) is measured from TOR to the lowest point on the overhead structure at any point within six feet (6'-0") from centerline of the track. Calculations shall be signed and sealed by a Professional Engineer.

E. Girders or girder systems shall be stable at all times during erection. No crane may unhook prior to stabilizing the beam or girder.

1. Lateral wind forces for the temporary conditions shall be considered in accordance with AREMA, Chapter 8, Section 28.6.2. The minimum lateral wind pressure shall be fifteen pounds per square foot (15 psf).
2. Temporary bracing shall be provided at the piers, abutments, or other locations to resist overturning and/or buckling of the member(s). The agency shall submit a design and details of the proposed temporary bracing system, for review by the Engineer.
3. Temporary bracing shall not be removed until sufficient lateral bracing or diaphragm members have been installed to establish a stable condition. Supporting calculations, furnished by the Professional Engineer, shall confirm the stable condition.

F. Erection procedure submissions shall also include the following information:

1. All hoisting details, as dictated by Section III of this document.
2. A time schedule for each of the various stages must be shown as well as a schedule for the entire lifting procedure. The proposed time frames for all critical subtasks (i.e., performing aerial splices, installing temporary bracing, installation of diaphragm members, etc.) shall be furnished so that the potential impact(s) to Railroad operations may be assessed and eliminated or minimized.
3. The names and experience of the key Contractor personnel involved in the operation shall be included in the Contractor's means and methods submission.
4. A guardrail will be required to be installed for track in the proximity of temporary bents or shoring towers, when located within twelve feet (12'-0") from the centerline of the track. The guardrail will be installed by the Agency or its Contractor.

5. Design and supporting calculations prepared by the Professional Engineer for items including the temporary support of components or intermediate stages shall be submitted for review.

VI. TEMPORARY EXCAVATION AND SHORING

A. The Agency or its Contractor shall submit a detailed design and procedure for the installation of a sheeting/shoring system adjacent to the tracks. Shoring protection shall be provided when excavating with Potential to Foul, or as otherwise determined by the Railroad. Shoring shall be provided in accordance with the AREMA, except as noted below.

B. Shoring may not be required if all of the following conditions are satisfied:

1. The excavation does not encroach within the Theoretical Live Load Influence Zone. Please refer to Figure 1.
2. The track structure is situated on level ground, or in a cut section, and on stable soil.
3. The excavation does not adversely impact the stability of a Railroad facility (i.e. signal bungalow, drainage facility, undergrade bridge, building, etc), or the stability of any structure on, over, or adjacent to Railroad property with Potential to Foul.
4. Shoring is not required by any governing federal, state, local or other construction code.

C. Shoring is required when excavating the toe of an embankment. Excavation of any embankment which supports an active Railroad track structure without shoring will not be permitted.

D. Trench boxes are not an acceptable means of shoring. Trench boxes are prohibited for use on Railroad property or within the Theoretical Railroad Live Load Influence Zone.

E. Shoring shall be a cofferdam-type, which completely encloses the excavation. However, where justified by site or work conditions, partial cofferdams with open sides away from the track may be permissible, as determined by the Engineer.

F. Cofferdams shall be constructed using interlocking steel sheet piles, or when approved by the Engineer, steel soldier piles with timber lagging. Wales and struts shall be included when dictated by the design.

G. The use of tiebacks can be permissible for temporary shoring systems, when conditions warrant. Tiebacks shall have a minimum clear cover of 6’-0”, measured from the bottom of the rail. Upon completion of the work, tiebacks shall be grouted, cut off, and remain in place.

H. All shoring systems on, or adjacent to Railroad right-of-way, shall be equipped with railings or other fall protection, compliant with the governing federal, state or local requirements. Area around pits shall be graded to eliminate all potential tripping hazards.

I. Interlocking steel sheet piles shall be used for shoring systems qualifying one or more of the following conditions:

1. Within 18’-0” of the nearest track centerline
2. Within the live load influence zone
3. Within slopes supporting the track structure
4. As otherwise deemed necessary by the Engineer.

J. Sheet piles qualifying for one or more of the requirements listed in Section VI.I (above) of this document shall not be removed. Sheet piles shall be left in place and cut off a minimum of 3'-0" below the finished grade, the ditch line invert, or as otherwise directed by the Engineer. The ground shall be backfilled and compacted immediately after sheet pile is cut off.

K. The following design considerations shall be considered when preparing the shoring design package:

1. Shoring shall be designed to resist a vertical live load surcharge of 1,880 lbs. per square foot, in addition to active earth pressure. The surcharge shall be assumed to act on a continuous strip, eight feet six inches (8'-6") wide. Lateral pressures due to surcharge shall be computed using the strip load formula shown in AREMA Manual for Railway Engineering, Chapter 8, Part 20.
2. Allowable stresses in materials shall be in accordance with AREMA Chapter 7, 8, and 15.3.
3. A minimum horizontal clearance of ten feet (10'-0") from centerline of the track to face of nearest point of shoring shall be maintained, provided a twelve foot (12'-0") roadbed is maintained with a temporary walkway and handrail system per OSHA requirements.
4. For temporary shoring systems with Potential to Foul, piles shall be plumb under full dead load. Maximum horizontal movement of the shoring system, under full live load, shall be as follows:
    a. Three-eighths of an inch (3/8") for walls within eighteen feet (18'-0") of track centerline (Measured from centerline of the nearest track to the nearest point of the supporting structure).
    b. One half inch (1/2") for walls located greater than eighteen feet (18'-0") from track centerline.

L. Shoring work plans shall be submitted in accordance with Section II of this document, as well as the following additional requirements:

1. The work plan shall include detailed drawings of the shoring systems calling out the sizes of all structural members, details of all connections. Both plan and elevation drawings shall be provided, calling out dimensions from the face of shoring relative to the nearest track centerline. The elevation drawing shall also show the height of shoring, and track elevation in relation to bottom of excavation.
2. Full design calculations for the shoring system shall be furnished.
3. A procedure for cutting off the sheet pile, backfilling and restoring the embankment

VII. TRACK MONITORING

A. When work being performed has the potential to disrupt the track structure, a work plan must be submitted detailing a track monitoring program which will serve to monitor and detect both horizontal and vertical movement of the Railroad track and roadbed.

B. The program shall specify the survey locations, the distance between the location points, and frequency of monitoring before, during, and after construction. The Railroad reserves to the right to modify the survey locations and monitoring frequency as necessary during the project.

C. The survey data shall be collected in accordance with the approved frequency and immediately furnished to the Engineer for analysis.

D. If any movement has occurred as determined by the Engineer, the Railroad will be immediately notified. The Railroad, at its sole discretion, shall have the right to immediately require all contractor operations to be ceased, have the excavated area immediately backfilled and/or determine what corrective action is required. Any corrective action required by the Railroad or performed by the Railroad including the monitoring of corrective action of the contractor will be at the Agency's or Contractor's expense.

VIII. TEMPORARY GRADE CROSSINGS

A. If at any time the Agency or its Contractor desires a temporary crossing of the Railroad's tracks, he shall make a request for a temporary crossing from the Railroad. If approved, the Contractor shall arrange with the Railroad, execute its regular form of private grade crossing agreement covering the crossing desired, and pay all installation, maintenance, removal, protection and associated costs.

B. If approved, the Agency or its Contractor shall submit a detailed plan and procedure for installation, maintenance, and removal of a temporary grade crossing. The plan must be approved by the Engineer prior to beginning work on the project.

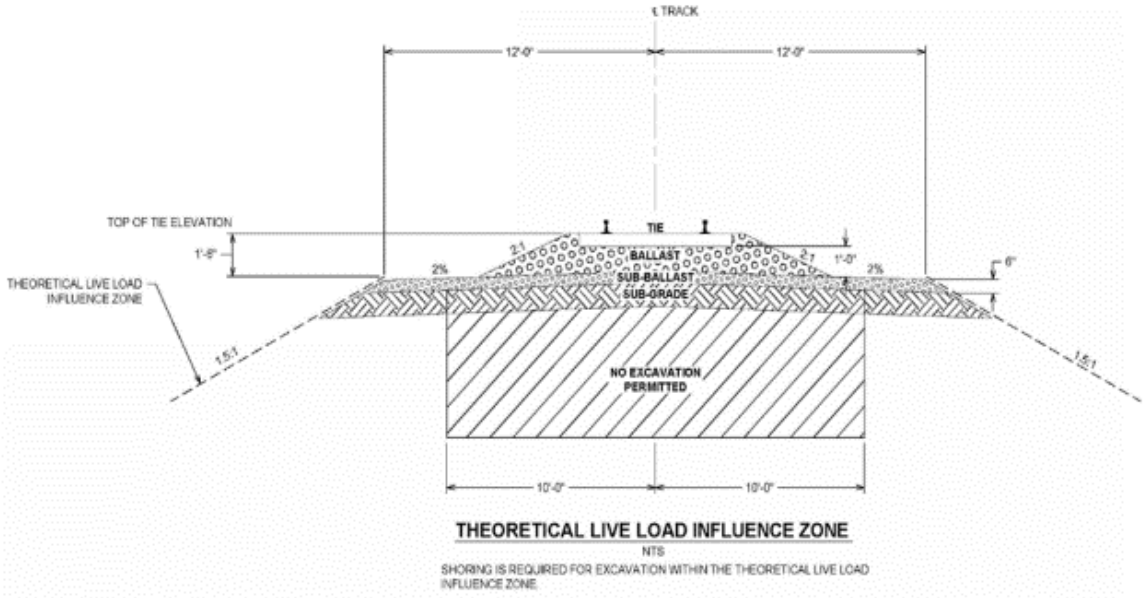
C. Temporary Crossing - Full Depth Timber

1. General
   a. The crossing must be full-depth timber. A timber and gravel crossing will not be permitted.
   b. The proposed crossing areas will be inspected before installation and after removal by the Contractor and a Railroad representative. This shall include determining gage using a gage manufactured for such purpose.
   c. Contractor will be responsible for maintenance and cleaning of the timber crossing for the duration of the project. This work shall occur under the direction of the Railroad's Engineer or his representative and at the sole cost of the Contractor.
   d. Following completion of the work, the contractor shall remove the temporary crossings and restore the site to preconstruction conditions as approved by the Railroad and at the sole cost of the Contractor.
   e. Movement of tracked vehicles across the crossing will require additional protection of the rail. The Railroad will determine the need for additional protection.
   f. The Contractor will take extra care when working in the area of existing utilities within the ROW.
2. Material & Installation
   a. The Contractor is to install a layer of geotextile filter fabric underneath the timber crossing members to aid in keeping the ballast clean and free of deleterious materials.
   b. Crossing timbers to be oak or mixed hardwoods and treated per AWPA Manual C-6, and will conform to AREMA Manual Chapter 30. All timbers shall be free from any defects that might impair their strength or durability as crossing timbers, such as decay, large splits, large shakes, slanting grain or large numerous holes or knots.
   c. The crossing timbers shall be a minimum of 8-ft long and be notched as required for existing tie plates and spikes. They shall be secured at a minimum of three (3) locations into suitable crossties in pre-drilled holes and countersunk. (Note: 10-ft long crossing timbers require a minimum of four (4) spikes).
   d. The ends of the crossing timbers shall be centered on cross ties. The timber screws shall be installed no less than 2-in from the end of the tie.

e. Timber screws shall be 5/8"⌀ x 12", washer head timber drive screw spikes.
f. The top of the crossing timber shall be flush or no more than ½" above the top of existing rail.
g. Screw holes in ties shall be plugged with approved tie plugs upon removal of timber screws.
h. Thermite welds or rail joints shall be located outside of the crossings.

3. Road Approach/Anti-Tracking Pad
   a. The contractor shall furnish, install, maintain and remove a stone road approach/antitracking pad on geotextile filter fabric for each of the grade crossings to protect the existing track shoulders and side slopes.
   b. The pad should be installed to intersect the railroad at or nearly right angles.
   c. The width of the pad shall be equal to or greater than the width of the crossing.
   d. The length of the pad shall be 15ft minimum from nearest rail.
   e. Stone for the pad shall be 6" minus (2" minimum) coarse aggregate material resistant to tracking.
   f. The geotextile filter fabric shall cover the full width and length of the approach area and be covered with the aggregate to a minimum depth of 8-in. It shall be uniformly graded to provide the entry and exit path for all construction equipment.
   g. The pad shall be maintained to provide safe access to the crossing and sufficient protection to the existing track shoulders and side slope.
   h. The aggregate shall be replenished or replaced as necessary or as instructed by the RR representative.
   i. All areas affected by the approach pad shall be restored to the original contours upon removal.
4. Gate & Lock
   a. The contractor shall furnish, install, maintain and remove a cable gate and railroad lock to prevent usage of the crossing when railroad flagging personnel are not present.
   b. The gate and lock will be installed at the entrance to each approach to the temporary crossing – 2 per crossing.
   c. The cable needs to be covered with orange plastic pipe.
   d. Location of cable gate shall be identified on the submitted plan.
5. Whistleposts
   a. The contractor shall furnish two (2) whistlepost signs in accordance with G&W Engineering Specification ES1016.0 – Whistle Post Sign for Railroad installation.

Figure 1: Theoretical Live Load Influence Zone



THEORETICAL LIVE LOAD INFLUENCE ZONE

NTS

SHORING IS REQUIRED FOR EXCAVATION WITHIN THE THEORETICAL LIVE LOAD INFLUENCE ZONE.

NOTES:

1. THEORETICAL LIVE LOAD INFLUENCE ZONE IS A 1 ½ HORIZONTAL TO 1 VERTICAL THEORETICAL SLOPE LINE STARTING 1'-6" BELOW TOP OF TIE ELEVATION AND 12'-0" FROM THE CENTERLINE OF THE NEAREST TRACK.
2. REFER TO CONSTRUCTION SUBMISSION CRITERIA FOR ADDITIONAL REQUIREMENTS.
3. SHORING SHALL BE DESIGNED TO RESIST A VERTICAL LIVE LOAD SURCHARGE OF 1,680 LBS. PER SQUARE FOOT, IN ADDITION TO ACTIVE EARTH PRESSURE. THE SURCHARGE SHALL BE ASSUMED TO ACT ON A CONTINUOUS STRIP, 8'-6" WIDE. LATERAL PRESSURES DUE TO SURCHARGE SHALL BE COMPUTED USING THE STRIP LOAD FORMULA SHOWN IN AREMA MANUAL FOR RAILWAY ENGINEERING, CHAPTER 8, PART 20.

PART 1 - GENERAL

The requirements in this special provision for temporary shoring shall be followed for all locations of work adjacent to track where the Railroad operates, regardless of track ownership.

1.01 DESCRIPTION OF WORK

A. Safe rail operations shall be required for the duration of the project. All personnel, railroad tracks and property shall be protected at all times.

1. Design, install, maintain and remove temporary shoring systems in a manner to prevent local and global instability conditions that will adversely affected the Railroad assets.
2. The Contractor is responsible for planning and executing all procedures necessary to construct, maintain and remove the temporary shoring system in a safe and controlled manner
3. The Contractor is required to meet minimum safety standards as defined by the Railroad.
4. All temporary shoring systems that support or impact the Railroad's tracks or operations shall be designed and constructed to provide safe and adequate rigidity.

B. All excavations that may result in track settlement, are within Railroad ROW or within the Theoretical Live Load Influence Zones shall be governed by Railroad requirements, performed in accordance with the AREMA Manual of Recommended Practice, Federal, State and Local laws and shall be subject to review and approval by the Railroad.

C. Temporary shoring is required for all excavations within the Theoretical Live Load Influence Zone.

1. All shoring to be placed within the Theoretical Live Load Influence Zone shall be designed for Cooper E-80 live load in addition to OSHA standard loads and must be placed prior to the start of excavation.
2. All excavations shall be in compliance with applicable OSHA regulations and shall be shored where there is any danger to tracks, structures or personnel regardless of depth.

D. The Contractor must not begin construction of any component of the shoring system affecting the Railroad right-of-way until written Railroad approval has been received.

1. To expedite the review process of the temporary shoring submittals by the Contractors are required to adhere to the project specifications, AREMA, Railroad and requirements of this special provision as outlined in the section 1.03 SUBMITTALS.
2. The Contractor must obtain a valid right of entry permit from the Railroad and comply with all Railroad requirements when working on Railroad Right-of-Way.
3. The Railroad requirements, construction submittal review times and review criteria should be discussed at the pre-construction meeting.
4. The Railroad will not be responsible for cost associated with any utility, signal, or communication line relocation or adjustments.

E. Contractor Responsibilities

1. The Contractor shall be solely responsible for the design, construction and performance of the temporary shoring system.
2. The Contractor's work shall in no way impede the train operations of the Railroad and must be coordinated with the local Railroad operating department.
3. The Contractor shall develop a work plan that enables the track(s) to remain open to train traffic at all times.
4. All removed soils will become the responsibility of the Contractor and shall be disposed of outside the Railroad Right-of-Way according to the applicable Federal, State and Local regulations.
5. The Contractor is responsible to protect the Railroad ballast and subballast from contamination.
6. The Contractor must monitor the excavation, temporary shoring system and adjacent track(s) throughout the duration of the shoring installation, excavation, construction, removal and backfill.
7. Any damage to Railroad property such as track, signal equipment or structure could result in a train derailment. All damage must be reported immediately to the Railroad representative in charge of the project and to the Railroad Road Master.

1.02 REFERENCES

A. ASTM: Specifications of the American Society for Testing and Materials.

B. AREMA: American Railway Engineering and Maintenance-of-Way Association

1.03 SUBMITTALS

A. Plans and calculations shall be submitted, signed and stamped by a Registered Professional Engineer familiar with Railroad loadings and who is licensed in the state where the shoring system is intended for use.

B. Information shall be assembled concerning right-of-way boundary, clearances, proposed grades of tracks and roads, and all other factors that may influence the controlling dimensions of the proposed shoring system.

C. The shoring plans must completely identify the site constraints and the shoring system. Sufficient information shall be shown on the plans in the form of profiles, cross sections and topographical maps to determine general design and structural requirements. Field survey information of critical or key dimensions shall be referenced to the centerline of track(s) and top of rail elevations. Existing and proposed grades and alignment of tracks and roads shall be indicated together with a record of controlling elevation of water surfaces or ground water. Show the location of existing/proposed utilities and construction history of the area which might hamper proper installation temporary shoring.

D. Shoring design plans and calculations shall be in English units and shall show:

1. Railroad right-of-way and North arrow.
2. Position of all Railroad tracks and identify each track as mainline, siding, spur, etc.

3. Spacing between all existing tracks.
4. Location of all access roadways, drainage ditches and direction of flow.
5. Footprint of proposed structure, proposed shoring system and any existing structures if applicable.
6. Proposed horizontal construction clearances. The minimum allowable is 12 feet measured at a right angle from centerline of track.
7. Location of existing and proposed utilities.
8. Drawings must be signed and stamped by a Licensed Professional Engineer, registered in the state where the work will be performed.
9. Railroad and other "CALL BEFORE YOU DIG" numbers.
10. Detailed view of shoring along with controlling elevations and dimensions.

E. Typical section and elevation shall show:

1. Top of rail elevations for all tracks.
2. Offset from the face of shoring system to the centerline of all tracks at all changes in horizontal alignment.
3. All structural components, controlling elevations and dimensions of shoring system.
4. All drainage ditches and controlling dimensions.
5. All slopes, existing structures and other facilities which may surcharge the shoring system.
6. Location of all existing and proposed utilities.
7. Total depth of shoring system.

F. General criteria:

1. Design loads based on the AREMA manual and Cooper E80 loading.
2. Pressure due to embankment surcharges.
3. ASTM designation and yield strength for each material.
4. Maximum allowable bending stress for structural steel is 0.55Fy.
5. Temporary overstress allowances are not acceptable.
6. In situ soil classification.
7. Backfill soil classification.
8. Internal angle of friction and unit weight of the soil.
9. Active and passive soil coefficients.
10. Fill within 100 feet of bridge ends or 20 feet outside culverts shall be placed and compacted to a minimum of 100% of maximum dry density tested per Modified Proctor ASTM D1557.
11. Slopes without shoring shall not be steeper than 2 horizontal to 1 vertical
12. Dredge line elevation.
13. Shoring calculations for deflection meeting Railroad requirements.

G. Miscellaneous:

1. Procedure outlining the installation and removal of the temporary shoring system.
2. General notes specifying material requirements, design data, details, dimensions, cross-sections, sequence of construction etc.
3. A description of the tieback installation including drilling, grouting, stressing information and testing procedures, anchor capacity, type of tendon, anchorage

hardware, minimum unbonded lengths, minimum anchor lengths, angle of installation, tieback locations and spacing.

4. All details for construction of drainage facilities associated with the shoring system shall be clearly indicated.
5. Details and descriptions of all shoring system members and connection details.
6. Settlement and displacement calculations.
7. Handrail and protective fence details along the excavation.

H. Geotechnical Information shall include:

1. Elevation and location of soil boring in reference to the track(s) centerline and top of rail elevations.
2. Classification of all soils encountered.
3. Internal angle of soil friction.
4. Dry and wet unit weights of soil.
5. Active and passive soil coefficients, pressure diagram for multiple soil strata.
6. Bearing capacity and unconfined compression strength of soil.
7. Backfill and compaction recommendations.
8. Optimum moisture content of fill material.
9. Maximum density of fill material.
10. Minimum recommended factor of safety.
11. Water table elevation on both sides of the shoring system.
12. Dewatering wells and proposed flownets or zones of influence.
13. In seismic areas, evaluation of liquefaction potential of various soil strata.

I. All design criteria, temporary and permanent loading must be clearly stated in the design calculations. Temporary loads include, but are not limited to: construction equipment, construction materials and lower water levels adjoining the bulkhead causing unbalanced hydrostatic pressure. Permanent loads include, but are not limited to: future grading and paving, Railroads or highways, structures, material storage piles, snow and earthquake.

J. The drainage pattern of the site during construction should be analyzed and adequate drainage provisions shall be incorporated into the temporary shoring system design. Consideration shall be given to groundwater as well as surface drainage.

K. Structural design calculations:

1. List all assumptions used to design the temporary shoring system.
2. Determine E80 live load lateral pressure using the Boussinesq strip load equation.
3. Computerized calculations and programs must clearly indicate the input and output data. List all equations used in determining the output.
4. Example calculations with values must be provided to support computerized output and match the calculated computer result.
5. Provide a simple free body diagram showing all controlling dimensions and applied loads on the temporary shoring system.
6. Calculated lateral deflections of the shoring and effects to the rail system must be included. Include the elastic deflection of the wall as well as the deflection due to the passive deflection of the resisting soil mass.
7. Documents and manufacturer's recommendations which support the design assumptions must be included with the calculations.

L. Review of design submittals by the Railroad will require a minimum of four (4) weeks. To avoid impacting the construction schedule, the Contractor must schedule submittals well in advance. Partial, incomplete or inadequate designs will be rejected, thus delaying the approval. Drawings and calculations must be signed and stamped by a Registered Professional Engineer familiar with Railway loadings and who is licensed in the state where the shoring system is intended for use. Drawings accompanying the shoring plans shall be submitted in 11" x 17" or 8½" x 11" sized paper format.

1.04 QUALITY ASSURANCE

A. Contractor

1. The Contractor must review the temporary shoring plans to ensure that the proposed method of construction is compatible with the existing site and soil conditions.
2. The Contractor's work plan must be developed to allow train traffic to remain in service. Removal of the shoring system must also be addressed.
3. The Contractor is responsible for providing an approved test method to verify the capacity of anchored or tieback systems. The manufacturer's recommendations for testing must be satisfied. Systems which support the Railroad embankment will be considered high risk in determining the percentage of elements to be proof tested.

B. Applicant or Agency

1. The applicant or Agency must review and approve the submittal for compliance with the project specifications, AREMA Manual and this special provision before forwarding the submittal to the Railroad.
2. The Engineer shall evaluate the quality of materials furnished and work performed.

C. Railroad

All design submittals shall be forwarded to the Railroad following Contactor and Agency approval. The Railroad will review or have an outside consultant review said submittals.

PART 2 - MATERIALS

A. Structures and structural members shall be designed to have the design strengths at all sections at least equal to the required strengths calculated for the loads and forces in such combinations as stipulated in AREMA Chapter 8 Part 2.

B. Design of sheet pile temporary shoring shall follow recommended practice for the design of Flexible Sheet Pile Bulkheads (AREMA Chapter 8 Part 20)

C. The AREMA allowable stresses on materials are as follows:

1. Structural Steel: 0.55Fy for Compression in extreme fiber. (Ch.15 Table 1-11)
2. Structural Steel: 0.35Fy for Shear. (Ch.15 Table 1-11)
3. Sheet Pile Sections: 2/3 of yield strength for steel. (8.20.5.7)
4. Concrete: 1/3 of Compressive strength. (8.20.5.7)
5. Anchor Rods: 1/2 of yield strength for steel. (8.20.5.7)

D. AISC allowances for increasing allowable stress due to temporary loading conditions are not acceptable.

E. Gravity type temporary shoring systems must also be analyzed for overturning, sliding and global stability.

F. Secondhand material is not acceptable unless the Engineer of Record submits a full inspection report which verifies the material properties and condition of the secondhand material. The report must be signed and sealed by the Engineer of Record.

G. Slurry type materials are not acceptable as fill for soldier piles in drilled holes. Concrete and flowable backfill may prevent removal of the shoring system. Use compacted peagravel material.

H. Type of backfill.

1. The backfill shall be investigated and classified with reference to the soil types described in AREMA Table 8-5-1.
2. Types 4 and 5 backfill shall be used only with the permission of the Engineer. In all cases the wall design shall be based on the type of backfill used.

I. All timber members shall be Douglas Fir grade 2 or better.

J. Calculated deflections of temporary shoring system should not exceed the criteria outlined in Table 1 Deflection Criteria.

Table 1 Deflection Criteria	
Horizontal distance from shoring to track C/L measured at a right angle from track	Maximum horizontal movement of shoring system
12’ < S ≤ 18’	3/8”
18’ < S ≤ 24’	1/2”

PART 3 - EXECUTION

A. Emergency Railroad phone numbers are to be obtained from the Railroad representative in charge of the project prior to the start of any work and shall be posted at the job site.

B. No excavation shall be permitted closer than 12’-0” measured at a right angle from the centerline of track to the trackside of shoring system. If existing conditions preclude the installation of shoring at the required minimum distance, the shifting of tracks or temporary removal of tracks shall be investigated prior to any approval. All costs associated with track shifting or traffic interruption shall be at Contractor’s expense.

C. Provide sufficient space for construction of the required ditches parallel to the standard roadbed section. Maintain capacity of ditches depending upon the flow and terrain.

D. Any excavation, holes or trenches on the Railroad property shall be covered, guarded and/or protected. Handrails, fence, or other barrier methods must meet OSHA and FRA

requirements. Temporary lighting may also be required by the Railroad to identify tripping hazards to train crewmen and other Railroad personnel.

E. The most stringent project specifications of the Public Utilities Commission Orders, Department of Industrial Safety, OSHA, FRA, AREMA, GWRR or other governmental agencies shall be used.

F. All components of the shoring system are to be removed when the shoring is no longer needed. All voids must be filled and drainage facilities restored.

G. Subsurface Exploration. (AREMA 8.5.2.2)

1. Sufficient borings shall be made along the length of the proposed temporary shoring to determine, with a reasonable degree of certainty, the subsurface conditions. Irregularities found during the initial soil boring program may dictate that additional borings be taken.
2. The subsurface investigation shall be made in accordance with the provisions of AREMA Chapter 8 Part 22, Geotechnical Subsurface Investigation.
3. Deviations from anticipated subsurface conditions encountered during excavations will be reported to the Engineer of Record as soon as practical.

H. Compaction.

1. The backfill shall preferably be placed in loose layers not to exceed 8 inches in thickness. Each layer shall be compacted before placing the next, but over compaction shall be avoided.
2. It is required that backfill be compacted to no less than 95% of maximum dry density at a moisture content within 2% of optimum and tested using Modified Proctor ASTM D1557.
3. Fill within 100 feet of bridge ends or 20 feet outside culverts shall be placed and compacted to not less than 100% of maximum dry density.
4. No dumping of backfill material shall be permitted in such a way that the successive layers slope downward toward the wall. The layers shall be horizontal or shall slope downward away from the structure and tracks.

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

1. The Contractor shall develop a Track Monitoring Program for monitoring of the railroad track, railroad embankment and temporary shoring installed within the Theoretical Live Load Influence Zone of the Railroad.

2. The purpose of the Track Monitoring Program include but are not limited to providing:

3. Preconstruction baseline data for comparison with construction and post-construction data.

4. Monitor track and embankment during and after construction, to determine whether they have been adversely affected by construction activities.

5. A forewarning of unforeseen conditions that may require remedial or precautionary measures.

6. The Railroad and Railroad Representative are not responsible for the safety of the Work based on Contractor instrumentation data collection and reporting.

1.02 CONTRACTOR RESPONSIBILITIES

A. Develop a Track Monitoring Program for monitoring the track, railroad embankment and temporary shoring installed within the Theoretical Live load Influence Zone of the Railroad.

B. Furnish all instrumentation.

C. Install, monitor, and report data collected from all track monitoring instrumentation.

1. Protect from damage and maintain instruments installed by the Contractor. Repair or replace damaged instruments in a timely manner.

2. Interpret instrumentation data and implement remedial and precautionary measures based on results of instrumentation monitoring.

3. The Contractor shall immediately implement a Contingency Plan if Threshold Values specified in section 3.03.C Table 1 of this special provision, are exceeded. The proposed plan shall include, but not be limited to, additional bracing, segmented and/or slotted excavation, temporary berms, backfilling the excavation, bracing slabs and/or other measures. The Contractor shall demonstrate that the proposed measures can be implemented immediately to prevent damage to Railroad.

1.03 QUALIFICATIONS OF CONTRACTOR'S INSTRUMENMTATION PERSONNEL

A. Development and implementation of a track monitoring program requires highly specialized personnel. The Contractor's personnel responsible for furnishing installing,

maintaining, monitoring, reporting, and interpreting data of instrumentation required, shall include and have the following qualifications:

1. Track Monitoring Instrumentation Specialist with a minimum of a Bachelor of Science Degree in civil engineering and who has five years prior experience in installation and monitoring of the types of instruments to be installed. A comparably qualified engineering geologist is also acceptable as the Instrumentation Specialist. The Instrumentation Specialist shall:

    a. Prepare detailed step by step procedures for implementing the Contractor's Track Monitoring Program.
    b. Be on site and supervise at least the first installation of each type of instrument.
    c. Supervise the interpretation of all instrumentation data.

2. Superintendent who will be in responsible charge during implementation of the Track Monitoring Program. The Superintendent shall have prior field experience in excavation adjacent to sensitive structures, temporary shoring systems, installation and monitoring of the types of instrumentation installed. The Superintendent shall:

    a. Be on site and supervise all instrument installations following installations supervised by the Instrumentation Specialist.
    b. Supervise data collection and reporting in cooperation with the Instrumentation Specialist

3. The person in responsible charge of survey data collection shall be a Registered Land Surveyor in the state the Work is to take place. The field survey party chief shall have experience in survey measurements of the types and accuracies specified herein.

B. The Contractor's instrumentation personnel including the Instrumentation Specialist, Superintendent, Registered Land Surveyor, field survey party chief and all other field or office personnel responsible for scope of the Track Monitoring Program may be subject to review by the Railroad.

1.04 MONITORING INSTRUMENTATION

A. Instrumentation shall be installed to monitor the horizontal and vertical deformation of existing structures, ground, and temporary shoring systems installed Within the Theoretical Live Load Influence Zone.

A. Qualified instrumentation personnel, under the supervision of the Instrumentation Specialist, Superintendent, and or Surveyor shall install the following instrumentation.

1. Track monitoring instrumentation

2. Embankment monitoring instrumentation

3. Temporary shoring monitoring instrumentation

4. The Contractor may obtain additional data from the instrumentation and/or furnish, install and monitor, and determine the need for additional instrumentation as necessary to monitor construction performance and safety aspects of the Work.

Furnishing, installing and monitoring of additional instrumentation shall be at the Contractor's discretion.

1.05 REFERENCES

A. ASTM: Specifications of the American Society for Testing and Materials.

1.06 SUBMITTALS

A. Review of design submittals by the Railroad will require a minimum of four (4) weeks. To avoid impacting the construction schedule, the Contractor must schedule submittals well in advance. Partial, incomplete or inadequate designs will be rejected, thus delaying the approval. Drawings and calculations must be signed and stamped by a Registered Professional Engineer familiar with Railway loadings and who is licensed in the state where the shoring system is intended for use. Drawings accompanying the shoring plans shall be submitted in 11" x 17" or 8½" x 11" sized paper format.

B. The Contractor shall submit for review by the Railroad the following information:

1. A Track Monitoring Program to be implemented on the project based means and methods of excavation and temporary shoring to be used within the Theoretical Live Load Influence Zone of the Railroad.

2. Product information indicating the instrumentation sizes, material types, specifications, installation procedures, and locations.

3. Personnel Qualifications for Instrumentation Specialist and Superintendent.

B. As-built data and monitoring data of all Contractor installed instrumentation.

C. Contingency Plan

1. The Contractor shall submit a Contingency Plan, in the event that the Threshold Values specified in section 3.03.C Table 1, are exceeded.

2. Emergency contact numbers and notification procedures shall be included in the plan.

D. Contractor submittals shall be acceptable to the Railroad prior to undertaking the Work. The Contractor shall obtain an acceptable submittal and shall forward submittals in advance considering that re-submittals may be required.

1.07 QUALITY ASSURANCE

A. The Contractor shall monitor, record, and plot the instrumentation data.

B. The Contractor shall install all instrumentation to the satisfaction of the Railroad. The Contractor shall immediately repair or replace any Contractor installed instrumentation, which fails, for whatever reason, to perform its intended function.

PART 2 - MATERIALS

2.01 Instrumentation may be of an optical survey type with readings taken using an optical survey instrument to observe levels of rail-mounted, ground-mounted and shoring mounted targets.

2.02 Instrumentation may alternatively involve an electronic track monitoring system using rail mounted sensors that transmit via radio signals to a nearby base station.

2.03 The proposed monitoring system must minimize the risk of railway operations as well as track surveyors. It must be possible to collect monitoring data remote from the track. Viewing of survey targets must be from a position away from the track and the position must allow the survey measurements to be taken without the need for Railroad Protection.

A. Track monitoring instrumentation must be securely fixed to the rail, but must not interfere with the passage of trains. Drilling of rail is not permitted. No target may protrude above the height of the plane of the top of rails and must not be susceptible to vibration of passing trains.

B. Embankment monitoring instrumentation shall be used to monitor vertical deformation of the ground adjacent to excavations within the Theoretical Live Load Influence Zone of the Railroad. Ground surface monitoring points shall consist of a ¼-inch diameter masonry nail driven into wooden stake, or a 3-foot long, ¾-inch diameter steel rod at locations.

C. The maximum spacing of temporary shoring instrumentation shall be 10 feet.

2.04 At least 3 survey control points must be established for collection of survey information of monitoring instrumentation. The location of each survey control point must not be affected by settlement due to construction works or traffic.

PART 3 - EXECUTION

3.01 GENERAL REQUIREMENTS

A. The Contractor shall establish a Track Monitoring Program as described above prior to excavation activity within the Theoretical Live Load Influence Zone.

B. Prior to installation of any instrumentation, the Contractor shall evaluate field conditions and select proposed locations for the instrumentation. The Contractor shall submit the proposed locations of instrumentation to the Railroad for review.

C. The Contractor shall notify the Railroad at least 72 hours prior to installing the first instrument.

D. The Contractor shall install, monitor, and interpret data from instrumentation in addition to that specified herein, that the Contractor deems necessary to ensure performance of the work in accordance with the specifications.

E. The Contractor shall exercise caution during the progress of Work and shall prevent damage to all track monitoring instrumentation.

INSTALLATION

A. Monitoring instrumentation shall be installed in accordance with approved Contractor's Track Monitoring Program. Following completion of installation, the as-built location of survey dependent monitoring instrumentation shall be determined to an accuracy of 0.03 ft. in horizontal position and to an accuracy of 0.01 ft. in elevation.

B. The Contractor's instrumentation personnel shall consider field conditions, obstructions and the Contractor's means and methods when determining field locations of instruments. Final location of instrumentation that deviate from the Track Monitoring Program shall be subject to review and acceptance by the Railroad.

3.02 DATA COLLECTION AND REPORTING

A. The Contractor will monitor the instrumentation on a schedule based on the location and extent of construction activities. Data collected by the Contractor shall be emailed to the Railroad a maximum of 24 hours after collection in report form. At a minimum, the report must include:

1. Project Title

2. Date of report

3. Instrument data presented in tabular form showing all previous readings of the instrument.

4. Plot of readings versus time.

B. The Contractor shall collect data from the instrumentation in accordance with the following schedule:

1. Obtain a minimum of three initial readings over a period of 2 weeks prior to excavation to establish baseline readings.

2. Obtain daily readings, or at a frequency approved by the Railroad, when excavation activities are within 25 feet of the monitoring point or if threshold limits are reached.

3. Reading must be taken during construction and during a 2 week period thereafter.

C. Threshold and Limiting Values

1. If Threshold Values of instrumentation readings are reached, the Railroad and Contractor shall jointly assess necessity of altering methods, rate, or sequence of excavation and temporary shoring within the Theoretical Live load Influence Zone.

2. If Limiting Values of instrumentation readings are reached, Railroad can order the Contractor to cease construction operations, make site and affected properties secure, and take necessary and agreed upon measures to mitigate movements and to assure the safety of the Work and the public.

3. The project threshold and limiting values are specified in Table 1 below. Immediately inform the Railroad verbally, and in writing within 24-hours, when the threshold and limiting levels are reached.

TABLE 1

INSTRUMENTATION TYPE	INSTRUMENT CRITERIA	
	THRESHOLD	LIMITING
Track Monitoring	0.25-in.	0.5-in.
Ground Monitoring	0.5-in.	1.0-in.
Temporary Shoring Monitoring	Vertical: 0.25-in. Horizontal: 0.75-in.	Vertical: 0.5-in. Horizontal: 1.0-in.

E. Each week the Contractor shall submit to the Railroad a description of the work performed during that week including:

1. A summary of excavation support system construction activities. This summary shall include any sheet pile driving activities and other activities associated with construction of excavation support systems.

2. A summary of excavation and filling activities. This summary shall include a general description of where excavation has occurred during the week.

3. A description of any events which may have affected instrumentation readings. Include a description of any remedial or precautionary measures that were implemented during the week in response to monitoring instrumentation or other data, including when they were implemented and for what reason. Include a description of any future remedial or precautionary measures that are planned in response to existing monitoring instrumentation or other data.

NOTICE TO CONTRACTOR - INSTALLATION OF FIBER OPTIC CABLE IN EXISTING MULTIDUCT CONDUIT

The work under this contract includes the installation of new fiber optic cable within exiting multiduct conduit. Prior to the installation of the new fiber optic cable, the Contractor shall be responsible for verifying the condition of the existing multiduct conduit and spare innerduct in which the fiber optic cable will be installed. In accordance with the requirements of the respective items for Optical Fiber Cable, Single Mode, Loose Buffer Tube Cable, the Contractor shall submit a testing procedure to the Engineer for approval. The intention of this testing procedure is to verify the integrity of the existing multiduct conduit system prior to installation of the fiber optic cable.

In the event that a blockage is identified as part of the conduit testing and verification process, the Contractor shall alert the Engineer. At the Engineer's direction, the Contractor shall clean the obstructed section of the existing conduit. The work associated with clearing sections of obstructed multiduct conduit will be paid on an hourly basis in accordance with the requirements of Item 1008907A – Cleaning Existing Conduit.

If the conduit is found to be damaged to any extent that the cleaning process will not clear the obstruction, the Engineer will determine whether the conduit is to be repaired or replaced. When directed by the Engineer to repair the damaged or impassable section of multiduct conduit or innerduct, the Contractor shall perform the repairs in accordance with the requirements of Item 1008910A –Multiduct Conduit Repair.

When it is determined by the Engineer to replace entire damaged sections of existing multiduct conduit, the work involved in the replacement of the conduit will be paid separately under the appropriate contract item(s) for RMC Multiduct Conduit, Trenching and Backfilling, and any applicable restoration items.

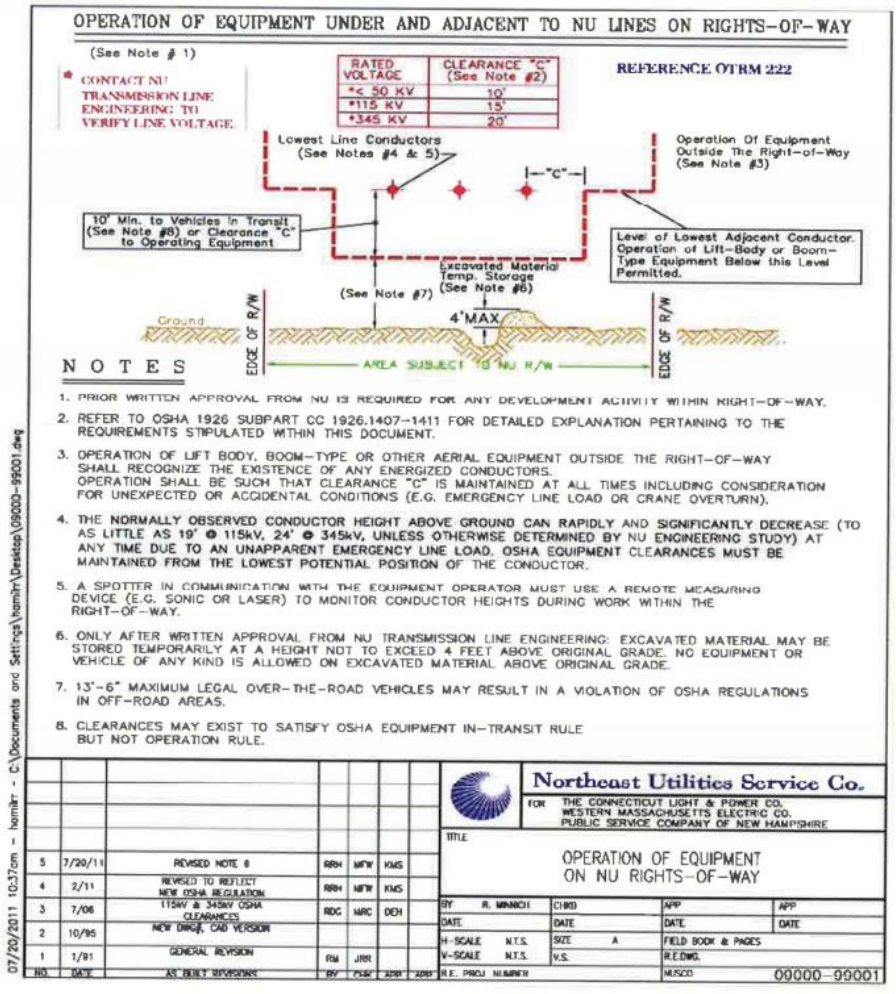
NOTICE TO CONTRACTOR - OVERHEAD TRANSMISSION LINES

The Contractor is hereby notified that operations over, under and adjacent to overhead transmission lines shall meet the requirements shown on the following Attachment 1.

Northeast Utilities

Northeast Utilities
Overhead Transmission Standards

Attachment 1



Operation of Equipment on NU Rights-of-Way			
Northeast Utilities Approved by: KMS (CT/MA), JJJ (NH)	**Construction**	**OTRM 222** **Page 4 of 4**	**Rev.3** **01/24/2012**

NOTICE TO CONTRACTOR - PROTECTION OF EXISTING UTILITIES

Existing utilities shall be maintained during construction except as specifically stated herein and/or noted on the plans and as coordinated with the utilities. The Contractor shall verify the location of underground, structure mounted and overhead utilities. Construction work within the vicinity of utilities shall be performed in accordance with current safety regulations.

The Contractor shall notify "Call Before You Dig", telephone 1-800-922-4455 for the location of public utility, in accordance with Section 16-345 of the Regulations of the Department of Utility Control.

Representatives of the various utility companies shall be provided access to the work, by the Contractor.

Contractors are cautioned that it is their responsibility to verify locations, conditions, and field dimensions of all existing features, as actual conditions may differ from the information shown on the plans or contained elsewhere in the specifications.

The Contractor shall notify the Engineer prior to the start of work and shall be responsible for all coordination with the Department. The Contractor shall allow the Engineer complete access to the work.

The Contractor shall be liable for all damages or claims received or sustained by any persons, corporations or property in consequence of damage to the existing utilities, their appurtenances, or other facilities caused directly or indirectly by the operations of the Contractor.

Any damage to any existing private and public utility, as a result of the Contractors operations, shall be repaired to the Utilities and Engineer's satisfaction at no cost to the State or the Utilities, including all materials, labor, etc., required to complete the repairs.

The Contractor's attention is directed to the requirements of Section 1.07.13 – "Contractor's Responsibilities for Adjacent Property and Services".

Prior to opening an excavation, effort shall be made to determine whether underground installations, i.e., water, sanitary, gas, electric ducts, communication ducts, etc., will be encountered and, if so, where such underground installations are located. When the excavation approaches the estimated location of such an installation, the exact location shall be determined by careful probing or hand digging, and when it is uncovered, proper supports shall be provided for the existing installation. Utility companies shall be contacted and advised of proposed work prior to the start of actual excavation, as noted above.

NOTICE TO CONTRACTOR - UTILITY GENERATED SCHEDULE

The attached project specific utility work schedules were provided to the Connecticut Department of Transportation (Department) by the utility companies regarding their identified work on this project.

The utility scheduling information is provided to assist the Contractor in scheduling its activities. However, the Department does not ensure its accuracy and Section 1.05.06 of the Standard Specifications still is in force.

The utility scheduling information shall be incorporated into the Contractor's pre-award schedule in accordance with the Department's Bidding and Award Manual and Section 1.05.08 of the Contract.

After award, the Contractor shall conduct a utility coordination meeting or meetings to obtain contemporaneous scheduling information from the utilities prior to submitting its baseline schedule to the Department in accordance with the Project Coordinator for the Contract.

The Contractor shall incorporate the contemporaneous utility scheduling information into its baseline schedule submittal. The baseline schedule shall include Contractor predecessor and successor activities to the utility work in such detail as acceptable to the Engineer.

UTILITY WORK SCHEDULE Rev 3/2015

CTDOT Project Number:	63-703	Town:	EAST HARTFORD
Project Description:	RELOCATION OF I-91 NB INTERCHANGE 29 RT 15 NB (MAIN ST)		
CTDOT Utilities Engineer:	GREG CHHABRA		
Phone:	860-594-3262	Email:	greg.chhabra@ct.gov

Utility Company:	FRONTIER COMMUNICATIONS		
Prepared By:	MARC SWEENEY	Date Prepared:	11/17/2017
Phone:	860-725-4226	Email:	marc.w.sweeney@ftr.com

Scope of Work

The following is a description of all utility work planned to be completed in conjunction with the CTDOT project. The narrative describes all work to be carried out by the utility or its contractor, including temporary and permanent work required by the project as well as any additional utility infrastructure work the utility intends on performing within the project limits during the construction of the project.

This project will require Frontier Communications to remove abandon service loops to facilitate pole relocation by Eversource. In the area of 500 Nain St, commuter lot.

Special Considerations and Constraints

The following describes the limiting factors that must be planned for in the scheduling and performance of the utility work. For example, restrictions on cut-overs, outages, limitations on customer service interruptions (e.g. nights, weekends, holidays), seasonal and environmental shutdown periods, long lead material procurements, etc..

PLEASE NOTE THAT ANY TIME FRAME GIVEN AS A START TIME OR DURATION OF WORK CAN BE AFFECTED BY MANY FACTORS INCLUDING, BUT NOT LIMITED TO, MAKE READY WORK, OTHER UTILITIES, PERMIT APPLICATIONS, CHANGES IN SCOPE, INCLEMENT WEATHER, HOLIDAYS AND EMERGENCY SITUATIONS.

UTILITY WORK SCHEDULE Rev 3/2015

CTDOT Project Number:	63-703		
Utility Company:	FROMTIER COMMUNICATIONS		
Prepared By:	MARC SWEENEY	Total Working Days:	1

Schedule

The following schedule identifies each major activity of utility work in sequential order to be performed by the utility or its contractor. The location of each activity of work is identified by the baseline stationing on the CTDOT plans. All activities identify the predecessor activity which must be completed before a utility work activity may progress. The duration provided is the number of working days required to complete the utility work activity based on historical information and production rates.

Location (Station to Station)	Description of Utility Work Activity	Predecessor Activity	Duration (working days)
MAIN ST	REMOVE SERVICE LOOPS	NONE	1

UTILITY WORK SCHEDULE Rev 3/2015

CTDOT Project Number:	63-703	Town:	HARTFORD
Project Description:	RELOCATION OF I-91 NB INTERCHANGE 29 (AIRPORT RD)		
CTDOT Utilities Engineer:	GREG CHHABRA		
Phone:	860-594-3262	Email:	greg.chhabra@ct.gov

Utility Company:	FRONTIER COMMUNICATIONS		
Prepared By:	M SWEENEY/S BARRETT	Date Prepared:	REV: 6/29/2018
Phone:	860-725-4226	Email:	marc.w.sweeney@ftr.com

Scope of Work

The following is a description of all utility work planned to be completed in conjunction with the CTDOT project. The narrative describes all work to be carried out by the utility or its contractor, including temporary and permanent work required by the project as well as any additional utility infrastructure work the utility intends on performing within the project limits during the construction of the project.

This project will require Frontier Communications to replace a 96F cable from MH2230 Airport Rd to MH 2124 Brainard Rd. This work is required due to P390 being moved behind guard rail. Replace through strand and down guy at P390. Poles to be replaced by Eversource. Airport Rd, near the I-91 overpass. CONDUIT WORK: This project will require Frontier Communications to place 15' of new 4" conduit (2) from old pole 391 to new pole 391. Pole to be replaced by Eversource. Airport Rd, near the I-91 overpass. Reset manhole covers on Airport Rd & Reserve Rd.

Special Considerations and Constraints

The following describes the limiting factors that must be planned for in the scheduling and performance of the utility work. For example, restrictions on cut-overs, outages, limitations on customer service interruptions (e.g. nights, weekends, holidays), seasonal and environmental shutdown periods, long lead material procurements, etc..

PLEASE NOTE THAT ANY TIME FRAME GIVEN AS A START TIME OR DURATION OF WORK CAN BE AFFECTED BY MANY FACTORS INCLUDING, BUT NOT LIMITED TO, MAKE READY WORK, OTHER UTILITIES, PERMIT APPLICATIONS, CHANGES IN SCOPE, INCLEMENT WEATHER, HOLIDAYS AND EMERGENCY SITUATIONS.

UTILITY WORK SCHEDULE Rev 3/2015

CTDOT Project Number: 63-703

Utility Company: FROMTIER COMMUNICATIONS

Prepared By: MARC SWEENEY Total Working Days: 13

Schedule

The following schedule identifies each major activity of utility work in sequential order to be performed by the utility or its contractor. The location of each activity of work is identified by the baseline stationing on the CTDOT plans. All activities identify the predecessor activity which must be completed before a utility work activity may progress. The duration provided is the number of working days required to complete the utility work activity based on historical information and production rates.

Location (Station to Station)	Description of Utility Work Activity	Predecessor Activity	Duration (working days)
47+75	SHIFT 576 FIBER CABLE LATERAL TO NEW P391	POLE PLACED BY EVERSOURCE & OTHER UTILITIES SHIFTED, NEW CONDUIT	1
		PLACED TO NEW POLE	
46+00	REPLACE THROUGH STRAND & DOWN GUY TO NEW P390 PLACED BY EVERSOURCE	POLE PLACED BY EVERSOURCE & OTHER UTILITIES SHIFTED	1
42+50 TO	PLACE NEW 96 FIBER CABLE	POLE PLACED BY EVERSOURCE & OTHER UTILITIES SHIFTED, NEW CONDUIT	3
BRAINARD RD		PLACED TO NEW POLE	
46+00	REPLACE THROUGH STRAND & DOWN GUY TO NEW P390 PLACED BY EVERSOURCE	POLE PLACED BY EVERSOURCE & OTHER UTILITIES SHIFTED	1
42+50 TO	SPLICE NEW 96 FIBER CABLE	NEW CABLE PLACED	5
BRAINARD RD			
42+50 TO	REMOVE OLD 96 FIBER CABLE	NEW 96F SPLICES	2
BRAINARD RD			

UTILITY WORK SCHEDULE Rev 3/2015

CTDOT Project Number: 63-703

Utility Company: FRONTIER COMMUNICATIONS

Prepared By: STEVE BARRETT Total Working Days: 2.5

Schedule

The following schedule identifies each major activity of utility work in sequential order to be performed by the utility or its contractor. The location of each activity of work is identified by the baseline stationing on the CTDOT plans. All activities identify the predecessor activity which must be completed before a utility work activity may progress. The duration provided is the number of working days required to complete the utility work activity based on historical information and production rates.

Location (Station to Station)	Description of Utility Work Activity	Predecessor Activity	Duration (working days)
47+75	PLACE 15 OF 2-4" PLASTIC CONDUIT FROM OLD LOCATION TO NEW LOCATION OF P391	POLE PLACED BY EVERSOURCE & OTHER UTILITIES SHIFTED	1
45+75	RESET ONE (1) FRAME & COVER TO NEW GRADE	WILL NEED FINAL GRADE FROM CONTRACTOR	0.5
3004+90	RESET ONE (1) FRAME & COVER TO NEW GRADE	WILL NEED FINAL GRADE FROM CONTRACTOR	0.5
3006+90	RESET ONE (1) FRAME & COVER TO NEW GRADE	WILL NEED FINAL GRADE FROM CONTRACTOR	0.5

rev. 5/20/2013	UTILITY WORK SCHEDULE		
CTDOT Project Number:	63-703	Town:	Hartford / East Hartford
Project Description:	Relocation of I-91 Interchange 29 and Widening of I-91 NB and Route 15		
CTDOT Utilities Engineer:	Greg Chhabra		
Phone: (860) 594-3268		Email:	Greg.Chhabra@ct.gov
Utility Company:	Metropolitan District		
Prepared By:	Rich Norris	Date Prepared:	1/12/2018
Phone: (860) 278-7850 x3450		Email:	rnorris@themdc.com

Scope of Work

The following is a description of all utility work planned to be completed in conjunction with the CTDOT project. The narrative describes all work to be carried out by the utility or its contractor, including temporary and permanent work required by the project as well as any additional utility infrastructure work the utility intends on performing within the project limits during the construction of the project.

MDC forces to install 10" and 16" valves on Main Street East Hartford each side of Route 15 bridge for isolation of water mains during placement of crane mats. Remove and replace water blow off gate boxes.

Special Considerations and Constraints

The following describes the limiting factors that must be planned for in the scheduling and performance of the utility work. For example, restrictions on cut-overs, outages, limitations on customer service interruptions (e.g. nights, weekends, holidays), seasonal and environmental shutdown periods, long lead material procurements, etc..

Proposed valves to be installed and blow off gate boxes to be removed prior to Contractor installation of crane mats at Route 15 bridge over Main Street, East Hartford

UTILITY WORK SCHEDULE

CTDOT Project Number:	63-703		
Utility Company:	Metropolitan District		
Prepared By:	Rich Norris	Total Calendar Days:	13

Schedule

The following schedule identifies each major activity of utility work in sequential order to be performed by the utility or its contractor. The location of each activity of work is identified by the baseline stationing on the CTDOT plans. All activities identify the predecessor activity which must be completed before a utility work activity may progress. The duration provided is the number of calendar days required to complete the utility work activity based on historical information and production rates.

Location (Station to Station)	Description of Utility Work Activity	Predecessor Activity	Duration (calendar days)
	Install 16" Valve		2
	Install 16" Valve		2
	Install 10" Valve		2
	Install 16" Valve		2
	Install 16" Valve		2
	Install 10" Valve		2
	Remove and Replace Blow Off Gate Boxes		1

UTILITY WORK SCHEDULE Rev 3/2015

CTDOT Project Number:	63-703	Town:	EAST HARTFORD
Project Description:	CHARTER OAK BRIDGE		
CTDOT Utilities Engineer:	GREG CHHABRA		
Phone:	(860)594-3268	Email:	greg.chhabra@ct.gov
Utility Company:	CROWN CASTLE FIBER		
Prepared By:	TERENCE J SHEA	Date Prepared:	12/27/2017
Phone:	(203)649-3905	Email:	tshea@lightower.com

Scope of Work

The following is a description of all utility work planned to be completed in conjunction with the CTDOT project. The narrative describes all work to be carried out by the utility or its contractor, including temporary and permanent work required by the project as well as any additional utility infrastructure work the utility intends on performing within the project limits during the construction of th project.

Crown Castle Fiber's work will consist of extending 2-4" conduits to relocated pole #6083 Main St, East Hartford. Two fiber optic cables will need to be replaced from splice points outside the limits of construction. Existing cables will be removed upon completion of cut overs.

Special Considerations and Constraints

The following describes the limiting factors that must be planned for in the scheduling and performance of the utility work. For example, restrictions on cut-overs, outages, limitations on customer service interruptions (e.g. nights, weekends, holidays), seasonal and environmental shutdown periods, long lead material procurements, etc..

PLEASE NOTE THAT ANY TIME FRAME GIVEN AS A START TIME OR DURATION OF WORK CAN BE AFFECTED BY MANY FACTORS INCLUDING, BUT NOT LIMITED TO, MAKE READY WORK, OTHER UTILITIES, PERMIT APPLICATIONS, CHANGES IN SCOPE, INCLEMENT WEATHER, HOLIDAYS AND EMERGENCY SITUATIONS.

UTILITY WORK SCHEDULE Rev 3/2015

CTDOT Project Number: 63-703

Utility Company: CROWN CASTLE FIBER

Prepared By: TERENCE J SHEA Total Working Days: 19

Schedule

The following schedule identifies each major activity of utility work in sequential order to be performed by the utility or its contractor. The location of each activity of work is identified by the baseline stationing on the CTDOT plans. All activities identify the predecessor activity which must be completed before a utility work activity may progress. The duration provided is the number o working days required to complete the utility work activity based on historical information and production rates.

Location (Station to Station)	Description of Utility Work Activity	Predecessor Activity	Duration (working days)
P6083 MAIN ST	EXTEND SPARE 4" CONDUIT TO RELOCATED POLE	POLE SET BY EVERSOURCE	2
LIMITS	PLACE NEW FIBER CABLES	NEW CONDUIT EXTENDED	8
LIMITS	CUTOVER CABLES	CABLES PLACED	4
LIMITS	REMOVE EXISTING CABLES.	NEW CABLES CUTOVER	4
LIMITS	EXTEND PREVIOUSLY OCCUPIED 4" CONDUIT TO RELOCATED POLE	EXISTING CABLES REMOVED	1

UTILITY WORK SCHEDULE Rev 3/2015

CTDOT Project Number:	63-703	Town:	Hartford
Project Description:	Widening of I-91 NB & S.R. 5/15...Reserve Rd. in vicinity of Ch. Oak Bridge		
CTDOT Utilities Engineer:	Meredith Andrews		
Phone: 860-594-3224		Email:	Meredith.Andrews@ct.gov

Utility Company:	Eversource Energy		
Prepared By:	Steve Wells	Date Prepared:	12/13/2017
Phone: 860-280-2417		Email:	steven.wells@eversource.com

Scope of Work

The following is a description of all utility work planned to be completed in conjunction with the CTDOT project. The narrative describes all work to be carried out by the utility or its contractor, including temporary and permanent work required by the project as well as any additional utility infrastructure work the utility intends on performing within the project limits during the construction of the project.

In order to accommodate CDOT's proposed widening of I-91 NB Interchange 29 and SR 5/15 from Wethersfield to East Hartford, Eversource Energy, will be required to relocate 23kv, electrical distribution facilites at 3 separate locations: 1). Reserve Rd. Hartford, 2). Airport Rd. Hartford, and 3.) Main St. East Hartford.

This UWS is for proposed Eversource work on the property of 100 Reserve Rd. Hartford, in the vicinity of the Charter Oak Bridge. An existing 20 duct bank containing 6- 23kv circuits, 1 idle circuit and 1 neutral is in the way of a proposed pier extension for the Ch. Oak Bridge.

Eversource's Proposed Work: Eversource's excavating contractor, Charter Oak Utility Constructors to install (3) manholes and a duct bank connecting them. The duct bank will be composed of 16-5" & 1-2" concrete encased conduits, extending from existing Eversource Manhole 4867 approx. 6' SSE to new manhole 2528, located approx. @ Sta 928 +36.2 Offset 233.3' L. From MH-2528, the duct line will extend SSE approx. 238' to new MH-2527 located at approx. 929+10, Offset 20' L. Then, from MH-2527 the duct bank will extend approx. 238' South to new MH-2526, located @ 427 +16.8, Offset 188.2' R. which is approx. 50' ESE of existing Eversource Manhole 4868. Following that, Eversource will install cable for 6-23kv circuits and 1 neutral conductor from MH-4867 thru new MH-2528 and MH-2527 to new MH-2526. The 6 cables will be installed and spliced in the intermediate manholes awaiting planned circuit outages to perform cutover splicing in in MH-2526 and MH-4867. When all 6 cutovers are complete cable will be removed between MH-4887. MH-2528, MH-4588, and MH-2526. When CDOT's contractor excavates for the Ch. Oak Bridge pier extension, Charter Oak Constr. will cut and seal the ends of the EL duct bank in conflict with the proposed pier.

Special Considerations and Constraints

The following describes the limiting factors that must be planned for in the scheduling and performance of the utility work. For example, restrictions on cut-overs, outages, limitations on customer service interruptions (e.g. nights, weekends, holidays), seasonal and environmental shutdown periods, long lead material procurements, etc..

Eversource has an easement for the 100 Reserve Rd. property, owned by MIRA. Eversource & CDOT have been made aware that the soil throughout the property is contaminated. Some areas have approx 4' of clean fill above the contam. soil while other areas have clean material to a depth of 2' or less above an orange barrier which separates clean from contam. soil. Eversource's contractor will remove the clean top soil and set it aside, to be used for back fill. The orange barrier will be repaired/replaced during backfilling. Most of the soil removed below the depth of the orange barrier will be displaced by the new manhole and conduit. Eversource needs to hire a subcontractor to create a Health & Safety Plan, HASP, prior to any construction for the safe excavation, stock piling, sampling and disposal of contaminated soil.

UTILITY WORK SCHEDULE Rev 3/2015

CTDOT Project Number: 63-703 Reserve Rd.

Utility Company: Eversource Energy

Prepared By: Steve Wells Total Working Days: 92

Schedule

The following schedule identifies each major activity of utility work in sequential order to be performed by the utility or its contractor. The location of each activity of work is identified by the baseline stationing on the CTDOT plans. All activities identify the predecessor activity which must be completed before a utility work activity may progress. The duration provided is the number of working days required to complete the utility work activity based on historical information and production rates.

Location (Station to Station)	Description of Utility Work Activity	Predecessor Activity	Duration (working days)
928+36.2 233.3' L to	Eversource's Contractor, Weston & Sampson to perform pre-characterization of soil, submit work	Notification to proceed from State.	22
427+16.8 188.2' R	plan to DEEP & property owner along w/ Health & Safety Plan. Establish stock pile loc. for excav. soil.		
928+36.2 233.3' L	Eversource's Contractor, Ch. Oak Constr., to fabricate MH-2528 around existing duct bank holding live...	Approval of work plan and HASP by DEEP & Property Owner, MIRA.	10
	circuits. Install (1)-2"+(16) 5" ducts to MH-2527. (230'). Relocate 2" water service if necessary.		
929+10 5.0' L	Ch. Oak Constr. to instl. precast MH-2527 & (1)-2" + (16) 5" ducts to MH-2526...approx. 230'	Concurrent w/ other excavation.	12
427+16.8 188.2' R	Ch. Oak Constr., to fabricate MH-2526 around exist. duct bank holding live circuits. Restore area of excav.	Concurrent w/ other excavation.	12
928+36.2 233.3' L to	Install (1) 4/0 cu neutral & (6) 25kv, 500 cu primary cables from MH-4857 to MH-2528 to MH-2527 to ...	Completion of all manhole and duct bank construction.	31
929+10 5.0' L to	MH-2526 & splice cables in MH-2527. When all preliminary cable work is complete, cutover splicing...		
427+16.8 188.2' R	take place in MH-4857 & MH-2526.		
928+36.2 233.3' L to	Remove (1) neutral & (7) primary cables from MH-4867 to MH-2528 to MH-4868 to MH-2526	Energizing of the 6 circuits installed in new manholes & ducts.	5
427+16.8 188.2' R			

UTILITY WORK SCHEDULE Rev 3/2015

CTDOT Project Number:	63-703	Town:	Hartford
Project Description:	Improvements on I-91 North to Route 15 NB & I-84 EB. Airport Rd, HTFD		
CTDOT Utilities Engineer:	Meredith Andrews		
Phone:	860-594-3224	Email:	Meredith.Andrews@ct.gov

Utility Company:	Eversource Energy		
Prepared By:	Xu Lin	Date Prepared:	10/17/2017
Phone:	860-280-2256	Email:	xu.lin@eversource.com

Scope of Work

The following is a description of all utility work planned to be completed in conjunction with the CTDOT project. The narrative describes all work to be carried out by the utility or its contractor, including temporary and permanent work required by the project as well as any additional utility infrastructure work the utility intends on performing within the project limits during the construction of the project.

This estimate is for proposed Eversource work on Airport Rd, Hartford
Pole 391 Station 47+75, Replace pole 391 - shift facilities
Pole 390 Station 46+30 , Relocate pole 390 – Shift facilities
Pole 390-S Station 46+50 , Relocate pole 390-S – Shift facilities
Pole 9585 Station 45+00, Remove pole 9585 during bridge construction, reinstall pole 9585 after bridge construction.
Pole 386 Station 42+30 , Relocate pole 386 – Shift facilities
Manhole# 1718 Station 43+50, install 275' cable from MH# 1718 to pole 386. Reset MH cover.

Special Considerations and Constraints

The following describes the limiting factors that must be planned for in the scheduling and performance of the utility work. For example, restrictions on cut-overs, outages, limitations on customer service interruptions (e.g. nights, weekends, holidays), seasonal and environmental shutdown periods, long lead material procurements, etc..

Require city of Hartford permission to remove existing street light on pole 9585.

UTILITY WORK SCHEDULE Rev 3/2015

CTDOT Project Number:	63-703		
Utility Company:	Eversource Energy		
Prepared By:	Xu Lin	Total Working Days:	9

Schedule

The following schedule identifies each major activity of utility work in sequential order to be performed by the utility or its contractor. The location of each activity of work is identified by the baseline stationing on the CTDOT plans. All activities identify the predecessor activity which must be completed before a utility work activity may progress. The duration provided is the number of working days required to complete the utility work activity based on historical information and production rates.

Location (Station to Station)	Description of Utility Work Activity	Predecessor Activity	Duration (working days)
P# 391 Sta. 47+75	Relocate pole 391 – Shift facilities		1
P# 390 Sta. 46+30	Relocate pole 390 – Shift facilities		1
P# 390-S Sta. 46+50	Relocate pole 390-S – Shift facilities		1
P# 9585 Sta. 45+00	Temporary removal of pole 9585 during bridge construction. Reinstall pole after construction	City of Hartford grant permission to remove existing street light on the pole	2
P# 386 Sta. 42+30	Relocate pole 386 – Shift facilities		2
MH# 1718 Sta. 43+50	install 275' cable from MH# 1718 to pole 386	Install new pole 386	2

UTILITY WORK SCHEDULE Rev 3/2015

CTDOT Project Number:	63-703	Town:	East Hartford
Project Description:	Improvements on I-91 North to Route 15 NB & I-84 EB. Main St, E. HTFD		
CTDOT Utilities Engineer:	Meredith Andrews		
Phone:	860-594-3224	Email:	Meredith.Andrews@ct.gov

Utility Company:	Eversource Energy		
Prepared By:	Xu Lin	Date Prepared:	10/17/2017
Phone:	860-280-2256	Email:	xu.lin@eversource.com

Scope of Work

The following is a description of all utility work planned to be completed in conjunction with the CTDOT project. The narrative describes all work to be carried out by the utility or its contractor, including temporary and permanent work required by the project as well as any additional utility infrastructure work the utility intends on performing within the project limits during the construction of the project.

This estimate is for proposed Eversource work near 500 Main St. East Hartford
Loc.1 P# 6083 Station 75+33 , Relocate pole 6083 – Shift facilities
Loc.2 P# 6084 Station 76+50 , Relocate pole 6084 – Shift facilities
Loc.3 P# 4023 Station 88+80, Install tree guy for pole #4023

Special Considerations and Constraints

The following describes the limiting factors that must be planned for in the scheduling and performance of the utility work. For example, restrictions on cut-overs, outages, limitations on customer service interruptions (e.g. nights, weekends, holidays), seasonal and environmental shutdown periods, long lead material procurements, etc..

CDOT contractor shall install PVC conduit from pole 6084 to meter pedastal according to Eversource Standards.
CDOT contractor will provide minimum 3" slip joint for meter pedastal conduit
CDOT contractor will provide 90 degree steel conduit to pole 6084

UTILITY WORK SCHEDULE Rev 3/2015

CTDOT Project Number: 63-703

Utility Company: Eversource Energy

Prepared By: Xu Lin Total Working Days: 5

Schedule

The following schedule identifies each major activity of utility work in sequential order to be performed by the utility or its contractor. The location of each activity of work is identified by the baseline stationing on the CTDOT plans. All activities identify the predecessor activity which must be completed before a utility work activity may progress. The duration provided is the number of working days required to complete the utility work activity based on historical information and production rates.

Location (Station to Station)	Description of Utility Work Activity	Predecessor Activity	Duration (working days)
P# 6083 Sta. 75+33	Relocate pole 6083 – Shift facilities		2
P# 6084 Sta. 76+50	Relocate pole 6084 – Shift facilities		2
P# 4023, Sta. 88+80	Install tree guy for pole #4023		1

UTILITY WORK SCHEDULE Rev 3/2015

CTDOT Project Number:	63-703	Town:	Hartford
Project Description:	Relocate Fiber Optic Cable For Pole Relocation		
CTDOT Utilities Engineer:	Greg Chhabra		
Phone:		Email:	
Utility Company:	Comcast Cable		
Prepared By:	Gary Meek	Date Prepared:	3/13/2018
Phone:	203-721-0727	Email:	Gary_Meek@Cable.Comcast.Com

Scope of Work

The following is a description of all utility work planned to be completed in conjunction with the CTDOT project. The narrative describes all work to be carried out by the utility or its contractor, including temporary and permanent work required by the project as well as any additional utility infrastructure work the utility intends on performing within the project limits during the construction of th project.

Comcast will need to delash approx 2436' of fiber optic cable for the relocation of Eversource pole 390 and 391 located on Airport RD. Comcast will be installing an U/G vault and split duct to route fober optic cable from the old pole 390 to the new pole 390 location. Comcast will shift the existing fiber optic cable from the old pole 391 location to the new pole 391 location. Comcast will need to relash 2436' of fiber after new U/G is in place and the aerial cable has been shifted.

Special Considerations and Constraints

The following describes the limiting factors that must be planned for in the scheduling and performance of the utility work. For example, restrictions on cut-overs, outages, limitations on customer service interruptions (e.g. nights, weekends, holidays), seasonal and environmental shutdown periods, long lead material procurements, etc..

UTILITY WORK SCHEDULE Rev 3/2015

CTDOT Project Number: 63-703

Utility Company: Comcast Cable

Prepared By: Gary Meek Total Working Days: 2

Schedule

The following schedule identifies each major activity of utility work in sequential order to be performed by the utility or its contractor. The location of each activity of work is identified by the baseline stationing on the CTDOT plans. All activities identify the predecessor activity which must be completed before a utility work activity may progress. The duration provided is the number o working days required to complete the utility work activity based on historical information and production rates.

Location (Station to Station)	Description of Utility Work Activity	Predecessor Activity	Duration (working days)
4006+00 - 45+00	Re-Route Comcast U/G fiber optic cable for Eversource pole relocation at the corner of Airport		2

NOTICE TO CONTRACTOR - UTILITY SPECIFICATIONS

The contractor is hereby notified that all utility specifications contained elsewhere herein shall be made a part of this contract, and that the contractor shall be bound to comply with all requirements of such specifications. The requirements and conditions set forth in the subject specifications shall be binding on the contractor just as any other specification would be.

NOTICE TO CONTRACTOR - TRAFFIC SIGNALS

The Contractor is hereby notified that certain conditions pertaining to the installation of new signals and maintenance of traffic signal operations are required when relevant, as part of this contract.

Qualified/Unqualified Workers

U.S. Department of Labor
Occupational Safety & Health Administration (OSHA) www.osha.gov

Part Number	**1910**
Part Title	**Occupational Safety & Health Administration**
Subpart	**S**
Subpart Title	**Electrical**
Standard Number	**1910.333**
Title	**Selection and use of work practices**

The contractor will be held liable for all damage to existing equipment resulting from his or his subcontractor's actions. A credit will be deducted from monies due the Contractor for all maintenance calls responded to by Department of Transportation personnel.

Completion of this project will require Contractor employees to be near overhead utility lines. All workers and their activities when near utility lines shall comply with the above OSHA regulations. In general, unqualified workers are not allowed within 10 feet of overhead, energized lines. It is the Contractor's responsibility to ensure that workers in this area are qualified in accordance with OSHA regulations.

NOTICE TO CONTRACTOR - 30-DAY SYSTEM OPERATIONAL TEST

Upon successful completion of the installation and testing of the VMS and other items within this contract and as approved by the Engineer, a 30-day system operational test shall commence.

The Contractor shall not be permitted to start the 30-day system operational test until all manufacturers' equipment warranties, spare parts and as-built drawings have been received by the Engineer for all equipment listed in the item numbers below in this special provision.

During the course of this test, each item listed below must function in accordance with the specifications for the duration of the test. Each item listed below must be tested concurrently. The contractor shall refer to each item for additional testing, if required.

If a malfunction occurs within the stated time frame, then the Contractor shall make all necessary repairs to the system and re-establish proper operation. Upon approval of the Engineer, the 30-day system operational test will begin as new. The system must operate a full thirty (30) consecutive days without a malfunction before the system will be accepted by the Engineer. The Contractor shall coordinate the 30-day System Operational Test with other pertinent items in this specification and contract.

The Contractor shall maintain and submit to the Engineer a log of recording each 30-day system operational test until all items have successfully completed the 30-day test. The log shall contain a record of all 30-day system operational test start date, reported and recorded failures and repairs to remedy failures of any of the items, re-start dates, and 30-day system operational test completion dates. The log shall contain a list all of the sites on the plans. The Contractor shall submit to the Engineer a weekly status of the log to the Engineer for approval until all of the sites have successfully completed the test. The Contractor shall report to the Engineer each 30-day system operational test successful completion on the day the test is completed. The Contractor shall maintain the log on a daily basis. The Contractor shall provide a copy of the log at the Engineer's request at any time to clarify or resolve any issues with the 30-day system operational test. The Contractor shall submit to the Engineer a proposed log format prior to start of any 30-day system operational test for review and approval by the Engineer.

The Contractor shall be responsible for coordination of the 30-day system operational test with the Newington Operations Staff. The Contractor shall notify Mr. Robert Kennedy @ 860-594-3458 when each system is to begin a 30-day system operational test. The Contractor shall make available a telephone number to the Engineer and the Bridgeport Operations Staff for reporting failures. The Contractor shall be responsible for notifying Bridgeport Operations when a restart and successful completion of each VMS is made.

The Bridgeport Operations Staff will report to the Contractor when the system experiences a failure. The Contractor is responsible for reporting any or all failures to the Engineer.

Upon successful completion of the 30-day System Operational Test and approval by the Engineer, the system shall be supported by Item #1112250A – Equipment Operations until the successful completion of the entire construction project or as directed by the Engineer.

The Contractor shall coordinate the 30-day System Operational Test with other pertinent items in this contract and other ConnDOT contracts (If required). The 30-day System Operational Test will not be accepted until all As-Built drawings for IMS equipment installations have been submitted by the Contractor and accepted by the Engineer.

NOTICE TO CONTRACTOR - ACCESS TO PRIVATE PROPERTY

The Contractor shall maintain access to all private property adjacent to and within the contract limits unless otherwise specifically noted within these contract documents. Refer to special provision NTC-Right of Way Restrictions for additional information. The Contractor is responsible for coordinating through the District with the property owners for the scheduling of work and access. Of particular note are the following properties:

Materials Innovation and Recycling Authority (MIRA) Property, Reserve Road, Hartford

Access to and from the facility shall be maintained at all times. As shown on the contract plans and property map prepared for this project, an easement will be obtained on a portion of this property for the purpose of staging equipment, tools and materials. Access along the existing MIRA facility driveway (Gate 20) within this construction easement shall be maintained at all times except for the following allowable driveway closures:

Stage 2 Construction: 4 month maximum driveway closure
Stage 4 Construction: 6 month maximum driveway closure

Every effort shall be made to minimize the driveway closure durations. The work requiring the driveway closures shall be coordinated to include consecutive days thereby minimizing the number of individual closures needed during each stage. The Contractor shall provide 30 day notice to the Owner prior to initiating each driveway closure.

Contact: Christopher R. Shepard, P.E.
Environmental Compliance Manager
Materials Innovation and Recycling Authority
200 Corporate Place, Suite 202
Rocky Hill, CT 06067
Tel: 860-757-7706
cshepard@ctmira.org

The MIRA driveway (Gate 20) is the emergency access point for local emergency response agencies (i.e. fire, police and ambulance) responding to incidents at the Power Block Facility and South Meadow Station Jet Turbine Facility. The Contractor shall notify these agencies and attend meetings (as required) prior to closing the driveway.

Metropolitan District Commission (MDC) Property, Brainard Road, Hartford

As shown on the contract plans and property maps prepared for this project, easements will be obtained through the MDC property adjacent to I-91 NB Exit 27 construction, from Brainard Road, to facilitate access to the State's right of ways, construction easement and work area. The Contractor shall coordinate with the MDC 30 days prior to accessing the property and at no time shall interfere with the on-going construction of the MDC Tunnel Project in progress on the property.

Contact:

Andrew Perham
Construction Manager
The Metropolitan District
555 Main Street
Hartford, CT 06103
Tel: 860-278-7850 Ext. 3449
aperham@themdc.com

Existing Billboards

There are existing billboards on the MDC property and MIRA Properties listed above. The Contractor shall allow sufficient access to these billboards at all times including room for equipment for the billboard company to work on the overhead billboards.

Contact: Richard Bourne
Operations Manager
Outfront
355 Washington Avenue
North Haven, CT 06473
Tel: 203-985-0430
Richard.bourne@OUTFRONTmedia.com

Charter Oak Landing and Access Driveway

As shown on the contract plans and property map prepared for this project, an easement will be obtained along the driveway and portion of the parking area for the purpose of accessing the State's right of way and work area above. Access shall be maintained at all times along the Charter Oak Landing driveway. Contractor work activities shall at no time prevent access or use of the boat launch, dock or parking areas unless otherwise approved and/or shown on the property maps. The City of Hartford must have access at all times to the levee (including river side), Park River conduit outlet and all other various components of the drainage and flood protection system. The Contractor shall coordinate with Riverfront Recapture and the City of Hartford Department of Public Works 30 days prior to accessing the property.

Contacts: Marc Nicol
Director of Planning & Park Development
Riverfront Recapture
50 Columbus Boulevard, 1st Floor,
Hartford, CT 06106
Tel: 860-713-3131 Ext. 334
mnicol@riverfront.org

City of Hartford
Department of Public Works
50 Jennings Road
Hartford, CT 06120
860 757-9900

South Meadow Pump Station and Clark Dike Access Road

As shown on the contract plans and property map prepared for this project, an easement will be obtained for the purpose of accessing the State's right of ways and work area. .Access shall be maintained at all times along the road which provides access to the South Meadow Pump Station and levee from the MDC property off of Brainard Road, through the vehicular tunnel under I-91. The Contractor shall coordinate with the City of Hartford Department of Public Works 30 days prior to accessing the property.

Contacts: City of Hartford
Department of Public Works
50 Jennings Road
Hartford, CT 06120
860 757-9900

The City of Hartford currently maintains grassed areas within the project's access and construction easements. The Contractor shall coordinate with the Department of Public Works periodically to avoid maintenance conflicts in these areas.

The Contractor shall submit with the initial construction schedule the anticipated dates and durations for the MIRA driveway closure, access along Charter Oak Landing driveway and displacement of parking spaces within the defined easement; and use of the access roads within the MDC property (Brainard Rd.).

NOTICE TO CONTRACTOR - MIRA PROPERTY ENVIRONMENTAL LAND USE RESTRICTION (ELUR)

Environmental investigations and remedial actions have taken place in accordance with the Connecticut Remediation Standard Regulations at the Materials Innovation and Recycling Authority (MIRA)-owned South Meadows Mid-Connecticut Facility (Gate 20 Reserve Road, Hartford, Connecticut), a portion of which is located within the Project Limits. As an integral part of the remedial actions, the portion of the MIRA property that falls within the Project Limits is subject to an Environmental Land Use Restriction (ELUR) to be protective of human exposure to pollutants and hazards to the environment by preventing activities that would inadvertently disturb protective site features installed at the site. Specifically, the ELUR imposes a "do not disturb" restriction for soils that are rendered environmentally inaccessible by either two feet of clean fill and three inches of asphalt or four feet of clean fill overlying impacted soils or by use of an engineered control.

The only means by which the areas subject to the ELUR can be disturbed is to obtain a temporary release from the ELUR and manage soils in accordance with a Soil Management Plan (SMP). Prior to work in this area, the Engineer shall submit a request to Connecticut Department of Energy and Environmental Protection (CTDEEP) to obtain a temporary release from the ELUR. A copy of the release shall be provided to the Contractor. Pertinent elements of the SMP for the portions of the MIRA site that fall within the Project Limits are included in the environmental specifications as appropriate.

Within the portion of the Project Limits that overlap the MIRA property, arsenic, lead, extractable total petroleum hydrocarbons (ETPH), and PAHs are present in soil at concentrations in excess of the Industrial/Commercial Direct Exposure Criteria (I/C DEC). Asbestos-containing materials (ACM) are also present in the soils within this area, east of the existing I-91 NB Exit 29 ramp. The polluted soil has been rendered inaccessible by one of three means:

1) Located more than four feet beneath the ground surface;

2) More than two feet below a paved surface comprised of a minimum of three inches of bituminous concrete, which two feet may include the depth of any material used as sub-base for the pavement; or

3) Addressed as part of a CT DEEP-approved engineered control.

The engineered control under and to the north of the current Charter Oak Bridge was designed to eliminate exposure pathways to ETPH and PAH-impacted soils which will remain in place. The engineered control varied within three distinct portions of this area and consisted of the following:

- Placement of an orange geotextile warning layer covered by 2-feet of suitable clean backfill material over an area which extends from just north of the Gate 20 access road, northwest under the Charter Oak Bridge and extending west until approximately 80 feet east of the Charter Oak Landing access road (approximately 86,000 square feet).

- Placement of HDPE pavers filled/covered with 4-inches of topsoil along the southeastern edge of the Charter Oak Landing access road (approximately 18,300 square feet).
- Placement of an orange geotextile warning layer at an excavated depth of two feet below grade and placement of excavated material over the geotextile layer in the area northwest of the Charter Oak Landing access road (approximately 16,800 square feet).

Large trees that line the park access road, as well as larger trees to the south and east of the access road were not disturbed as part of the construction of the engineered control. Tree wells were placed around the mature trees to allow for the landscaping to remain intact.

The Specifications which shall be reviewed by the Contractor include, but are not limited to, the following:

- Item No. 0101050A – ELUR Soil Management and Restoration

NOTICE TO CONTRACTOR - RIGHTS OF WAY RESTRICTIONS

The Contractor is hereby advised that at the time of advertising for bids not all the property may be acquired by the State, certain residences and/or business establishments had not been vacated, and asbestos removal by others from buildings to be disposed of had not been completed. A complete listing of the affected properties and the anticipated dates that they will become available is hereinafter provided. The Contractor is further advised that limitations, as enumerated herein below, are imposed which may interfere with the physical construction of the project. Following are statements which will set forth the restrictions on the right of entrance to property and conditions governing construction of the project.

1) The Contractor shall not occupy properties that are unacquired, perform any work thereon, or inhibit access thereto until the properties have been acquired and right of possession has been obtained. If the Contractor is allowed to proceed with the physical construction of the project, no action will be taken that will result in unnecessary inconvenience such as the discontinuance of utilities, the prevention of ingress and egress to the property, or will result in disproportionate injury or any action coercive in nature to occupants of residences (businesses, farms, or non-profit organization) who have not yet moved from the right-of-way.

2) It should be anticipated that each of the properties listed herein may be considered to have an effect upon construction operations.

3) The Contractor shall be aware that extensions of time will be granted, if necessary, for delays in construction operations caused by properties being unacquired beyond the estimated time period.

The following is a complete listing of properties which have not been acquired as of September 19, 2018 with the anticipated dates such properties will be acquired.

- **City of Hartford** – Project 63-703, Serial No. 1, sheet 1 of 3, (*anticipated by April 1, 2019*)
- **City of Hartford** – Project 63-703, Serial No. 1, sheet 2 of 3, (*anticipated by April 1, 2019*)
- **City of Hartford** – Project 63-703, Serial No. 1, sheet 3 of 3, (*anticipated by April 1, 2019*)
- **MIRA** – Project 63-703, Serial No. 2, sheet 1 of 1, (*anticipated by April 1, 2019*)
- **MDC (2 maps)** – Project 63-703, Serial No. 3, sheets 1 of 2, (*anticipated by April 1, 2019*)
- **MDC (2 maps)** – Project 63-703, Serial No. 3, sheets 2 of 2, (*anticipated by April 1, 2019*)

NOTICE TO CONTRACTOR - GENERAL PERMIT FOR STORMWATER DISCHARGE

This notice is provided to summarize the requirements of the Connecticut Department of Environmental Protection's General Permit for the Discharge of Stormwater and Dewatering Wastewaters associated with Construction Activities (Permit) issued on August 21, 2013. When construction activities will result in the disturbance of a total of 1 acre or more of land regardless of phasing, the Connecticut Department of Transportation (Department) will incorporate a Stormwater Registration (Registration) and Stormwater Pollution Control Plan (SWPCP) as part of the Contract documents in order to insure compliance with all conditions of this Permit. The Permit's 'Construction activities' means activities including but not limited to clearing and grubbing, grading, excavation, and dewatering.

The Registration and SWPCP addresses pollution caused by soil erosion and sedimentation during construction as well as the long term post-maintenance use of the facility after construction is completed. The Contractor and all subcontractors will be required to sign a certified statement to comply with all applicable conditions of the Registration and SWPCP. There will be no additional payment for the Contractor to sign the certification statement and no additional payment for the Contractor to comply with the conditions of the Registration and SWPCP.

The District Engineer is responsible to sign the Registration and will be the permittee for all Department construction projects. For all local town/municipal projects, the District Engineer is not responsible to sign the Registration as the local town or municipality will be the signed permittee.

If the Contractor requires a modification to the SWPCP, it shall be in accordance with the 2002 Connecticut Guidelines for Soil Erosion and Sediment Control and the 2004 Connecticut Stormwater Quality Manual or as revised or amended. The Department shall approve or reject the modification to the SWPCP and notify the Contractor in writing as to any revisions or additional information required for approval within 30 days of the date of the Contractor's submission. No damage for delays will be granted to the Contractor based on time taken by the Department to review the Contractor's proposal, or to apply for or secure the Permit amendment, modification or revision as per Section 1.10 - Environmental Compliance, of the Standard Specifications for Roads, Bridges, and Incidental Construction Form 817 and any Supplements thereto. At no time shall the Contractor proceed with the proposed Permit amendment, modification, or revision unless the Engineer approves, in writing, the Contractor's request.

At a minimum, the Contractor along with qualified personnel (provided by the permittee) shall inspect the site for non stabilized areas, structural control measures, and locations where vehicles enter or exit the site at least once every seven calendar days and within twenty four hours of the end of a storm that is 0.1 inches or greater. If a potential source of pollution is identified, pollution preventive measures shall be implemented within twenty four hours and the SWPCP must be amended within three calendar days.
In order for the Contractor to meet the requirements set forth in the SWPCP, the Contractor shall comply with additional erosion and sedimentation control provisions included in the project.

Erosion and Sedimentation Control Provisions:

Unless specifically outlined in the Contract Plans and/or SWPCP, the Contractor is not allowed to disturb more than two (2) acres of erodible material per discharge point at any one time regardless of phasing. If the Contractor elects to deviate from the Contract Plans and/or SWPCP to disturb more than two (2) acres of erodible material per discharge point at any one time regardless of phasing, the Contractor must provide a sequenced staging plan outlining the proposed disturbed activities. In all cases, the Contractor must meet the following conditions:

- *If the area of disturbance is maintained less than two (2) acres per discharge point*, the Contractor may disturb additional areas if and only if the previously disturbed areas are temporarily or permanently stabilized using acceptable measures such as the standard controls which are provided in the SWPCP or as shown on the Contract Plans.

- *If the construction activities create an area of disturbance to be at least two (2) acres per discharge point but no more than five (5) acres per discharge point*, the Contactor must submit to the Engineer a revised SWPCP for review and approval. The SWPCP must include locations of the temporary sedimentation trap/temporary sedimentation basin per discharge point with a capacity to contain 134 cubic yards per acre of material. The Contractor shall design and construct the temporary sedimentation trap/temporary sedimentation basin in accordance with the 2002 Connecticut Guidelines for Soil and Sediment Control. The Contractor shall provide an inspection and maintenance plan for the temporary sedimentation trap/temporary sedimentation basin as part of the amended SWPCP.

- *If the area of disturbance has a potential to reach more than five (5) acres per discharge point*, the Contactor must submit to the Engineer a revised SWPCP for review and approval. The SWPCP must include locations of the engineered sedimentation basin per discharge point with a capacity to contain 134 cubic yards per acre of material. The Contractor shall design and construct the engineered sedimentation basin in accordance with the 2004 Connecticut Stormwater Quality Manual. The Contractor shall provide an inspection and maintenance plan for the engineered sedimentation basin as part of the amended SWPCP.

The permittee shall amend the SWPCP whenever there is a change in Contactors or subcontractors at the site, or a change in design, construction, operation, or maintenance at the site which has the potential for the discharge of pollutants. In all cases as described above, the amended SWPCP shall adhere to and comply with Section 1.10 - Environmental Compliance, of the Standard Specifications for Roads, Bridges and Incidental Construction Form 817 and any Supplements thereto. No additional payment will be made for any Permit amendment, modification, or revision which alters the Contract Plans, SWPCP, and/or estimated quantities as a result of the Department's approval of the modifications to the Contract by the Contractor. Changes or variations to the Contract Plans and/or SWPCP by the Contractor shall not result in any additional cost to the State.

NOTICE TO CONTRACTOR - DUST CONTROL

The Contractor is responsible for controlling air pollution at all times during work of this contract, 24 hours a day, 7 days per week, including non-working hours, weekends and holidays, in conformance with the items "Sweeping for Dust Control", "Calcium Chloride for Dust Control", and "Water for Dust Control".

The Contractor shall comply with all State and Federal regulations pertaining to dust control. Particular attention shall be made to the Regulations of Connecticut State Agencies Section 22a-174-18a,b "Control of Particulate Emissions".

The contractor shall submit a dust control plan to the Engineer within 30 days after the Award of the Contract. The dust control plan shall include contact information for the responsible individual(s) from the contractor (24-hour availability) who have authority to implement necessary controls. The plan should detail dust control procedures for anticipated activities that may typically generate dust (ex. Jack hammering, saw-cutting pavement, haul roads, material storage sites, etc.).

The cost for the dust control submittal associated with this "Dust Control" notice shall be included in the general cost of the contract. Payment for the application of dust control items included in the Contract ("Sweeping for Dust Control", "Calcium Chloride for Dust Control", and "Water for Dust Control") will be under those respective items.

NOTICE TO CONTRACTOR - ENCAPSULATED SOLID WASTE DISPOSAL AREA

The Contractor shall be aware that an encapsulated Solid Waste Disposal Area is located within the Project limits as shown on Project Plans. The Solid Waste Disposal Area was capped under CTDOT Project 63-434.

According to previous environmental investigations, the encapsulated material consists of solid waste with sand, silt, and clay impacted with low levels of polynuclear aromatic compounds (PAHs), total petroleum hydrocarbons (TPH), polychlorinated biphenyls (PCBs), and metals at concentrations below the Connecticut Department of Energy and Environmental Protection (CTDEEP) Remediation Standard Regulations. An as-built drawing, dated September 2, 1993, showing the extent of the Solid Waste Disposal Area is available for review.

Prior to work in this area, the Engineer shall apply for and obtain an Authorization for the Disruption of a Solid Waste Disposal Area. A copy of the authorization shall be provided to the Contractor.

The Contractor shall provide for "Liner System Modifications" at locations where the flexible membrane liner (FML) is encountered during catch basin, drainage pipe, and lighting foundation installations adjacent to the encapsulated Solid Waste Disposal Area.

The Specifications which shall be reviewed by the Contractor include, but are not limited to, the following:

- Item No. 0007020A – Liner System Modifications

NOTICE TO CONTRACTOR - ENVIRONMENTAL INVESTIGATIONS

Environmental site investigations were conducted that included the sampling and laboratory analysis of soil and groundwater collected from various locations and depths within the Project limits. Results of the environmental investigations indicated the following within the Project limits:

- Leachable lead at concentrations exceeding the EPA Hazardous Regulatory Level of 5 milligrams per liter (mg/L) in soil.

- Semi-volatile organic compounds (SVOCs), extractable total petroleum hydrocarbons (ETPH), polychlorinated biphenyls (PCBs), pesticides, total arsenic, chromium and lead, and leachable cadmium and lead at concentrations exceeding the CTDEEP Remediation Standard Regulations (RSR) numeric criteria in soil. In addition, PCBs were documented to exist at concentrations above 1 part per million (ppm) in soil.

- Groundwater has been impacted with dibenzo(a,h)anthracene and dissolved lead at levels that prevent discharge without prior treatment in accordance with a CTDEEP discharge permit.

Based on the findings of the environmental investigation, ten (10) Areas of Environmental Concern (AOECs), two (2) Hazardous Area of Environmental Concern (HAOEC), and one (1) Groundwater Area of Environmental Concern (GWAOEC) exist within the Project limits. The Contractor is hereby notified that Controlled Material (soil and groundwater) within the AOECs, HAOECs, and GWAOEC will require special management and/or disposal procedures.

All suitable Controlled Material excavated from the AOEC may be reused in the AOEC from which it was excavated or another AOEC with similar contaminants, as determined by the Engineer. Controlled Material excavated from the AOEC that is to be reused may be temporarily stockpiled adjacent to the excavation for immediate reuse. Controlled Material excavated from an AOEC that is to be reused at a later date must be transported to and properly stockpiled, at the direction of the Engineer, at another location approved by the Engineer. Only the volume of soil that is reasonably estimated to be reused within the Project limits may be stockpiled in this way. Material excavated from within the HAOECs cannot be directly reused within the HAOECs and must be transported directly to the Waste Stockpile Area (WSA) and placed within a designated storage bin for waste characterization.

Controlled Material from the AOEC that cannot be reused must be transported to the WSA and placed within a designated storage bin for waste characterization.

In addition, one (1) Site-Wide soil “Low Level” Area of Environmental Concern (LLAOEC) exist within the Project limits, where regulated compounds were detected at concentrations below the RSR numeric criteria. The presence of regulated compounds in soil within the

LLAOEC will not require material handling measures beyond those required for normal construction operations. Soil excavated within the LLAOEC may be reused within the Project limits at a location with a similar groundwater classification, with certain restrictions, as described below. Excess or unsuitable soil excavated from the LLAOEC that cannot be reused within the Project limits must be transported to the WSA and placed within a designated storage bin for waste characterization.

Controlled Material reused within the Project limits shall be reused in accordance with the following conditions: (1) such soil is deemed to be structurally suitable for use as fill by the Engineer, (2) such soil is not placed below the water table, and 3) such soil is not placed in an area subject to erosion. Soil within the AOECs shall be reused on-site prior to the use of other soil and/or fill minimizing the quantity of soil requiring off-site disposal.

Contractor Take Note: There are two WSAs shown on the Project plans, one located in a commuter lot in Hartford (WSA 1) and the other located in Wethersfield (WSA 2). WSA 2 is designated as the primary WSA. WSA 1 is secondary and will only be constructed and utilized if deemed necessary by the Engineer.

The WSAs are to be used exclusively for temporary stockpiling of excavated materials from within the AOECs and HAOECs for determination of disposal classification. No other material shall be stored within the WSAs. Excavated materials from the HAOEC shall be loaded into lined dump trucks and transported directly to the WSA for waste characterization and disposal.

The CTDEEP groundwater classification beneath majority of the Project limits is GB. A portion of the Project in the vicinity of the entrance ramp to Route 5 and 15 Southbound via Silver Lane in East Hartford, CT is located in a GA classified area. Groundwater was encountered during the environmental investigation at depths ranging from 5 to 18 feet below existing grade.

Contractor Take Note: Groundwater encountered within GWAOEC 1 will require containment and treatment prior to discharge or off-site disposal at a treatment facility in accordance with Item No. 0204213A – Handling Contaminated Groundwater.

Railroad ties may be encountered within the Project limits. Such railroad ties shall be loaded and transported for disposal to any processing facility on the DEEP Construction & Demolition Material Processing Facilities list permitted to accept creosote-treated wood. An alternate facility can be used; however, the Contractor must provide the Engineer a copy of the operating permit indicating the facility can accept creosote-treated wood.

The Contractor will be required to implement appropriate health and safety measures for all construction activities to be performed within the AOECs and HAOECs. These measures shall include, but are not limited to, air monitoring, engineering controls, personal protective equipment, decontamination, and personnel training. WORKER HEALTH AND SAFETY PROTOCOLS WHICH ADDRESS POTENTIAL AND/OR ACTUAL RISK OF EXPOSURE TO SITE SPECIFIC HAZARDS ARE SOLELY THE RESPONSIBILITY OF THE CONTRACTOR.

The Specifications which shall be reviewed by the Contractor include, but are not limited to, the following:

- Item No. 0101000A – Environmental Health and Safety
- Item No. 0101109A – Hazardous Materials Excavation
- Item No. 0101117A – Controlled Material Handling
- Item No. 0101126A – Disposal of Hazardous Waste
- Item No. 0101128A – Securing, Construction and Dismantling of a Waste Stockpile and Treatment Area
- Item No. 0101130A – Environmental Work – Solidification
- Item No. 0202315A – Disposal of Controlled Materials
- Item No. 0020413A – Handling of Contaminated Groundwater

An environmental consultant will be onsite to oversee excavation activities within the AOECs, HAOECs, and GWAOEC, collect soil and groundwater samples (if necessary), and observe site conditions for the State.

Information pertaining to the results of the environmental investigation can be found in the document listed below and shall be available for review electronically. The results contained in the environmental investigation reports listed below show levels of various contaminants that the Contractor may encounter during construction. Actual levels found during construction may vary and such variations will not be considered a change in condition provided the material can still be disposed as non-hazardous at one or more of the disposal facilities listed in Item No. 0202315A - Disposal of Controlled Materials or as hazardous at one or more of the disposal facilities listed in Item No. 0101126A – Disposal of Hazardous Waste.

- Task 210 Subsurface Site Investigation Report, Relocation of I-91 NB Interchange 29 and Widening of I-91 NB, Hartford, Connecticut, BL Companies, March 2017.

NOTICE TO CONTRACTOR - HAZARDOUS MATERIALS INVESTIGATIONS

Limited hazardous materials site investigations have been conducted at Bridge Nos. 00480, 00813, 01456, 01457, 01459, 01460, 01466, 05796, 05922, 6000A, 6000B, 6000C, 06043A, 06043B & 06289; Culvert Nos. 02555, 03244, 03613, 03614, 06654; Sign Nos. 21460, 21510, 21349, 21002, 21004, "Hartford City Line" Sign & "Exit 27-Hartford Regional Market" Sign in Hartford, East Hartford & Wethersfield, Connecticut. The scope of inspections were limited to the representative components projected for impact.

Results of the survey identified lead paint to be present on the structural steel/metal/railing bridge components of Bridge Nos. 00480, 00813, 01466 and the painted metal support surfaces of Sign Nos. 21460 & 21510. No detectable amounts of lead in paint were identified on the concrete abutments/piers/walls or structural metal surfaces of Bridge Nos. 05922, 6000A, 6000B, 6000C & 06289; Sign Nos. 21002, 21004 "Hartford City Line" Sign & "Exit 27-Hartford Regional Market" Sign. Bridge Nos. 06043A & 06043B were constructed entirely of unpainted concrete. All concrete/metal surfaces of Bridge No. 05922 were not painted. All bridge railing systems were not painted except for Bridge Nos. 00480, 00813 & 01466. Culvert Nos. 02555, 03244, 03613, 03614, 06654 & Sign Nos. 21349, "Hartford City Line" Sign & "Exit 27-Hartford Regional Market" Sign were not painted.

Results obtained from TCLP waste stream sampling and analysis for leachable lead from the paint on the structural steel/metal bridge components at Bridge Nos. 00480, 00813 & 01466 characterized the paint waste streams as CTDEEP/RCRA hazardous waste. Results obtained from TCLP waste stream sampling and analysis for leachable lead from the paint on the metal support components of Sign Nos. 21460 & 21510 characterized those paint waste streams as non-hazardous, non-RCRA waste. Also, since no detectable amounts of lead in paint were identified on the structural metal components of Bridge Nos. 05922, 6000A, 6000B, 6000C & 06289 any paint waste debris generated would be non-hazardous, non-RCRA waste.

****Note: Detectable levels of lead were also identified on the structural steel/metal bridge components at Bridge Nos. 01456, 01457, 01459 & 01460, however they are not projected to be impacted by the bridge rehabilitation project. Should lead painted metal bridge components at these bridges be required to be impacted during construction, work shall cease immediately until the Engineer can determine the extent of any lead paint impact and implement proper procedures. Further, any paint waste generated from the structural steel/metal bridge components at the bridges would be characterized as RCRA/CTDEEP hazardous waste.**

All steel and metal generated from work tasks (painted or not) shall be segregated and recycled as scrap metal at a scrap metal recycling facility. The recycling of scrap metal (regardless of lead paint concentration) is exempt from USEPA RCRA and CTDEEP Hazardous Waste Regulation.

Silver/grey and white caulks around the base supports of the railing systems at Bridge Nos. 00480, 00813 & 01466 were sampled and found to contain asbestos. Also, hard grey/tan caulking where abutment meets main bridge at Bridge No. 01459 and presumed caulking on the storm drains in the concrete deck of Bridge No. 01460 were identified/presumed to contain asbestos. Light grey caulking at the abutments of Bridge No. 01456 was also identified as ACM, however is not projected to be impacted by the rehabilitations. Other various caulks, tar pipe coatings, expansion joint materials, cloth/paper bearing pads, seam sealants, drain pipes and vapor barriers were sampled and found to contain no detectable levels of asbestos.

Bird/pigeon guano accumulations were observed in accessible areas of Bridge Nos. 00480, 01459, 01460, 05796, 05922, 6000A, 6000B, 06043A, 06043B & 06289. No bird/pigeon guano accumulations were observed in the accessible areas of Bridge Nos. 01456, 01457, 6000C, 00813 & 01466 or in any of the accessible areas of the culverts and signs.

Universal Waste/Connecticut Regulated Waste in the forms of fluorescent/mercury vapor/halogen bulbs with ballasts were observed at multiple bridge locations and will be impacted by the rehabilitation work.

Evidence of homeless activity was observed at Bridge Nos. 6000A & 6000B.

The Contractor is hereby notified that these hazardous materials requiring special management or disposal procedures will be encountered during various construction activities conducted within the project limits. The Contractor will be required to implement appropriate health and safety measures for all construction activities impacting these materials. These measures shall include, but are not limited to, air monitoring, engineering controls, personal protective equipment and decontamination, equipment decontamination and personnel training. WORKER HEALTH AND SAFETY PROTOCOLS WHICH ADDRESS POTENTIAL AND/OR ACTUAL RISK OF EXPOSURE TO SITE SPECIFIC HAZARDS ARE SOLELY THE RESPONSIBILITY OF THE CONTRACTOR.
The Department, as Generator, will provide an authorized representative to sign all manifests and waste profile documentation required by disposal facilities for disposal of hazardous materials.

The Sections which shall be reviewed by the Contractor include, but are not limited to, the following:

- Item No. 0020801A – Asbestos Abatement
- Item No. 0020765A- Guano Abatement
- Item No. 0020905A – Lead Compliance for Abrasive Blast Cleaning & Miscellaneous Tasks
- Item No. 0603222A – Disposal of Lead Debris from Abrasive Blast Cleaning
- Item No. 0101143A- Handling and Disposal of Regulated Items

The Contractor is alerted to the fact that a Department environmental consultant may be on site for abatement and related activities, to collect environmental samples (if necessary), and to observe site conditions for the State.

Information pertaining to the results of the limited hazardous materials investigation discussed can be found in the document listed below. These documents shall be available for review electronically.

- HazMat Inspection Letter, Bridge Nos. 00480, 00813, 01466, 05796, 05922, 6000A, 6000B, 6000C; Culvert Nos. 02555, 03244, 03613, 03614, 06654 and Sign Nos. 21460, 21510, 21349, 21002, 21004, "Hartford City Line" I91 NB & "Hartford Regional MKT" I91 NB, Hartford, East Hartford, CT, November 1, 2017.

- HazMat Inspection Letter, Bridge Nos. 01456, 01457, 01459, 01460 & 06289, Wethersfield, CT, April 16, 2018.

NOTICE TO CONTRACTOR - INSTALLATION QUALIFICATIONS

All management, construction, installation, and inspection services shall be performed by individuals who have performed the same job function on at least two previously completed construction and installation communication projects of comparable size and complexity.

Approval of ITS Equipment Installer:

Each Contractor or Subcontractor performing the work involved with the installation of Intelligent Transportation System (ITS) equipment related to the Incident Management System shall provide references and resumes of staff that shall meet the following requirements:

Satisfactory completion of at least three (3) projects in the last five (5) years that includes the installation of each of the ITS equipment identified below.

- 4" (100 mm) Multiduct Conduit
- Pullboxes
- Camera Lowering Devices
- Camera Assemblies
- Traffic Management System Cabinets (TMSC)
- Traffic Flow Monitors (TFM) and TFM Poles
- Variable Message Signs (VMS) and VMS Controller Cabinets

The Contractor shall provide a list of each ITS project which the Contractor has performed, including a description of each project, the location of each project, inclusive dates of when the work was performed on each project, and a contact reference for each project listed.

This document shall be submitted to ConnDOT for review and approval before any Incident Management System project work may proceed.

Approval of Traffic Structure Foundations Installer:

The Contractor or Subcontractors performing the work to install large drilled shaft or spread footing "Traffic Structure Foundations" including Traffic Control Foundation – Span Pole Type "D" shall provide references and resumes of staff that shall meet the following requirements:

All management, construction, installation of traffic structure foundations shall be performed by individuals who have performed the same job function on at least two previously completed construction and installation projects of comparable size and

complexity. Each previously completed project shall have included the installation of at least four (4) drilled shaft foundations for overhead sign support foundations. The Contractor shall submit a list of available equipment that will be used for the installation of the traffic structure foundations proposed in the project. The resumes of staff shall include, but not be limited to, the equipment operator(s) and supervisor who will be responsible for conducting the work. The resume of staff and list of available equipment shall demonstrate the ability to perform the installation of drilled shaft foundations and rock socket foundations to the depths identified on the plans and as demonstrated by the soil boring information.

Approval of Fiber-Optic Cable Installation, Splicing and Testing:

Each Contractor or Subcontractor performing the work involved with installing, splicing and testing of cable and electronic communication systems and installing detection and video systems, shall provide references and resumes of staff that shall meet the following requirements:

Satisfactory completion of at least three (3) fiber-optic based communication projects in the last three (3) years. Experience shall be in related fiber optic systems for installers involving single-mode cables in excess of 6 miles (9.7 kilometers).

The Contractor shall provide a list of each fiber-optic based communications project and/or intelligent transportation system project which the Contractor has performed, including a description of each project, the location of each project, inclusive dates of when the work was performed on each project, and a contact reference for each project listed. Each of the referenced projects shall include completing a minimum of three (3), multifiber, single-mode, optical fiber cable fusion splices, and installation of at least 25 optical connectors on single-mode optical fibers. As a minimum, the contact reference shall include an individual's name, training certificates (including updated licenses), title, and current telephone number.

<u>This document shall be submitted to ConnDOT for review and approval before any Incident Management System project work may proceed.</u>

Approval of ITS Systems Integrator:

The Prime Contractor or qualified proposed ITS Systems Integrator Subcontractor performing the work described in these Special Provisions which are involved with supplying, installing, configuring and testing of electronic communication systems and video systems for the Incident Management System and newly installed video and data transport system, shall provide a printed document (nine copies) that contains the proposed ITS Systems Integrator's experience in the areas noted below, as well as references and resumes for staff proposed to perform the project work. The document should clearly indicate how the proposed ITS Systems Integrator meets the following requirements:

- Experience involving at least seven (7) ITS system integration projects with overall system responsibility and accountability, each employing at least 8 camera sites used for highway transportation purposes. A minimum of 7 years experience in ITS system integration.

- Design and installation of at least 200 point-to-point optical digital video links used for highway transportation purposes.

- A minimum of two (2) projects using video matrix switchers with a minimum size of 240 inputs and 64 outputs of analog video used for highway transportation purposes.

- Installation of video compression equipment involving at least ten sites, comprising video compression algorithms including but not limited to: H.264, MPEG1, MPEG2, MPEG4, and MJPEG used for highway transportation purposes.

- Experience using various applicable test equipment including: Fiber Optic Spectrum Analyzer, OTDR, BERT, Protocol Analyzer, and Oscilloscope.

- Installation of a minimum of 40 digital video encoder and decoder devices.

- Ability to respond within 2 hours travel by car to Central Office located at ConnDOT, 2800 Berlin Turnpike, Newington CT.

- Provision of 24x7x365 maintenance available with technicians fully trained in ITS related equipment.

- Demonstrate a general working knowledge of specifications RS-170 and RS-250C.

- Demonstrate a general working knowledge of communications protocols utilized in the CCTV industry.

- Demonstrate a general working knowledge of physical communications interfaces such as RS-232, RS-422, and RS-485.

- Demonstrate extensive working knowledge of Ethernet physical topologies TCP/IP routing schemes, rapid spanning tree, link aggregation protocols, VLAN configurations, and Quality of Service configuration and setup.

The document for the ITS Equipment Installer, Traffic Structure Foundations Installer, Fiber-Optic Cable Installation, Splicing and Testing Qualifications, and ITS Systems Integrator shall be submitted for approval within ten (10) days of the Contract Award to:

Mr. John F. Korte
Connecticut Department of Transportation
Bureau of Engineering and Highway Operations
2800 Berlin Turnpike P.O. Box 317456
Newington, Connecticut 06131-7546

These requirements shall apply to the following contract item installations:

- Optical Fiber Cable, Single Mode, Loose Buffered Tube Cable, 6-Fiber, 72-Fiber and 144-Fiber
- Fiber Optic Cable Splice Enclosures
- Equipment Operations
- Traffic Management System Cabinets
- Video equipment, including cameras and mountings
- Optical Video/Data Transmitter and Receiver
- 10/100 Base – TX Ethernet Switch
- Terminal Server
- Port Sharing Device
- Ethernet Switch
- Ethernet Media Converter
- Media Converter
- Wireless Router
- MPEG 4 Video Encoder and Decoder
- Traffic Flow Monitor
- Motorist Variable Message Signs

The Contractor shall not start work on the Incident Management System until the Contractor receives approval from the Department.

The Incident Management System shall be maintained in normal working operation at all times.

In the event that the Contractor needs to remove an Incident Management System device from service, the Contractor shall notify Mr. Robert Kennedy at the Newington Operations Center (830) 594-3458 at least ten (10) working days prior to any scheduled work operation. An Incident Management System device shall consist of CCTV cameras, camera cabinets, mini-hub cabinets, Traffic Flow Monitors, Variable Message Signs, Highway Advisory Radio site equipment and fiber optic cable including any associated fiber optic communications plant equipment.

All Project related scheduled work that will require the downtime of the Incident Management System, such as the splicing of the fiber optic trunkline cable, shall be performed on a non-holiday weekend as specified in Section 1.08 Prosecution and Progress - Incident Management System and as approved by Mr. Robert Kennedy, Newington Operations Center. The scheduled work performed on the approved non-holiday weekend shall be completed in a fifteen (15) hour work window. The Contractor shall identify the work that will be performed during this work window as well as a list of the approved staff to be performing work on the Incident Management System. Any deviation in the fifteen (15) hour work window must be approved by the Newington Operations Center staff.

Prior to the scheduled start of work on the Incident Management System, the Contractor shall contact the Newington Operations Center to determine if there are any on-going incidents on the highway system. The Incident Management System will not be removed from service until any on-going incidents on the highway system are cleared and approval is granted by the Newington Operations Center staff.

All Contractor personnel involved in the placing, splice preparation and splicing of fiber optic cable shall meet or exceed the above referenced installation qualifications and shall be approved by the Department. Under no circumstance will unqualified, unapproved Contractor personnel be allowed to work on the Incident Management System.

NOTICE TO CONTRACTOR - EXISTING IMS

The existing Variable Message Signs (VMS) were constructed under Project No. 171-277 and equipment was updated under Project 171-375. The existing CCTV Cameras and Fiber Optic Cable was installed in Project No. 63-548. Copies of these existing project plans will be provided to the Contractor upon request.

The Contractor is hereby notified that there is a 96 & 60 fiber optic trunkline cable installed in a 4" multiduct conduit along I-91 NB requiring removal and relocation between approx. Sta. 310+00 and approx. Sta. 327+25. This fiber optic cable trunkline connects the DOT Newington Operations Center to all of the IMS infrastructure installed on I-91, I-84, I-291, I-691 and Route 2 in the Greater Hartford and Waterbury areas. The maintenance and protection of this fiber optic trunkline cable and IMS Splice Cabinet is critical to the operation of the Incident Management System and shall remain operational at all times.

The Contractor is hereby notified that existing conditions depicted on the plans (IMS) were developed from existing sources, such as Highway Reconstruction Projects. The available information was then digitized and field checked for discrepancies. These plans are in no way meant to construe accurate survey of actual conditions.

The Contractor is herein made aware of existing Incident Management System (IMS) conduit and appurtenances located on Bridge No. 1459 parapet, Bridge No. 1460 parapet, Bridge No. 0813 parapet, Bridge No. 1466 parapet, Bridge No. 0480 parapet and along I-91 SB in the vicinity of the project area. The Contractor shall also be made aware of existing IMS conduit and appurtenances located along US 5/Route 15 NB and I-91 NB in the vicinity of the project area, including those near proposed pier construction for the widening of Bridge No. 0813 and Bridge No. 6000A, located on Bridge No. 6043A parapet, and those buried under and in the vicinity of various ramps and approach roadways within the project area.

The Contractor is responsible for verifying existing conditions depicted on the plans or contained elsewhere in the specification, any changes found shall be immediately reported to the Engineer.
The Contractor will be responsible for locating, verifying the location of and protecting all IMS below and above the ground. Prior to the start of construction, the Contractor shall contact "Call Before You Dig" and all utility companies within the towns within the project area. The Contractor shall also contact Robert Kennedy (860-594-3458) of ConnDOT Highway Operations at to mark out IMS conduit and appurtenances.

In areas adjacent to existing incident management system equipment, the Contractor is required to hand excavate. Any damage caused to the IMS conduit/equipment will be the responsibility of the Contractor and will be replaced by the Contractor at the Contractor's expense, as directed by the Engineer. Mark out of the IMS will not relieve the Contractor of responsibility for repair of damage caused by the Contractor or the Contractor's sub-contractors.

The Contractor is further advised to perform a field review of the entire project area in relation to the location of the proposed conduit to identify actual field conditions.

The Contractor is hereby notified that some of the details provided in the IMS sheets may not apply. These details are meant as typicals, and the Contractor may need to modify or develop new details where required.

NOTICE TO CONTRACTOR - REGIONAL TRANSPORTATION MANAGEMENT PLAN

In addition to the project-specific Transportation Management Plan (TMP), there is also a Regional Transportation Management Plan. Due to the preponderance of state and local construction contracts commencing between the spring of 2018 and fall of 2019, a Regional Transportation Management Plan has been prepared with the intent to coordinate traffic impacts across all active projects in the Greater Hartford area. The Regional TMP ensures that lane shifts or closures on I-91 and Route 15, periodic ramp closures, and the local road detours associated with this project and other projects in close proximity are well-coordinated with other ongoing state and municipal projects along the I-84, I-91, Route 2 and Route 15 corridors as well as on major state and local streets.

Be aware that the ongoing Regional TMP coordination efforts may require adjustment to the planned timing of specific maintenance and protection of traffic activities (lane closures and ramp closings) on this project.

NOTICE TO CONTRACTOR - SMART WORK ZONE ITEMS

The Contractor is hereby notified that the Portable Work Zone Management System (PWZMS) items have been changed to Smart Work Zone (SWZ) items. The Contractor should read the special provisions carefully as many requirements have been changed including but not limited to item numbers, new item numbers, method of measurement and basis of payment.

NOTICE TO CONTRACTOR - GLOBAL POSITIONING SYSTEM (GPS) COORDINATES FOR SIGNS

The Contractor shall obtain and provide to the Engineer sign installation data, including Global Positioning System (GPS) latitude and longitude coordinates, for all new State owned and maintained signs. The Engineer shall forward the sign data to the Division of Traffic Engineering for upload into the Highway Sign Inventory and Maintenance Management Program (SIMS). Sign data submissions or questions relating to SIMS or GPS shall be sent to DOT-signInventory@ct.gov Refer to the special provision for Section 12.00 General Clauses For Highway Signing.

SECTION 1.02 - PROPOSAL REQUIREMENTS AND CONDITIONS

Article 1.02.04 – Examination of Plans, Specifications, Special Provisions and Site of Work:

Replace the third sentence of the last paragraph with:

The Department cannot ensure a response to inquiries received later than ten (10) days prior to the original scheduled opening of the related bid.

SECTION 1.03 - AWARD AND EXECUTION OF CONTRACT

Article 1.03.07—Insurance is supplemented as follows:

Add the following paragraphs after the second paragraph:

"...In addition, the Contractor is required to file certificates of insurance with the Connecticut Southern Railroad Company at least 30 days prior to commencing any work within the Railroad right-of-way. Certificates are to be sent to:

Donna Killingsworth,
MBA Real Estate Manager
Genesee & Wyoming Railroad Services, Inc.
13901 Sutton Park Dr., S.,
Suite 160
Jacksonville, FL 32224
(904) 900-6286
donna.killingsworth@gwrr.com

"The Contractor is warned that entrance to the railroad property will not be allowed by the Railroad Company if there are outstanding charges remaining against the Contractor for Railroad Services rendered on prior projects. No request for an extension of time will be considered as a result of any delay to the Contractor's operations caused by the Contractor's indebtedness to the railroad. It is agreed that providing of any conductors, flagmen, or other employees shall not relieve the Contractor from liability or payment for any damages previously caused by its operations."

"If any insurance specified within this Article shall be provided on a claims-made basis, then in addition to coverage requirements, such policy shall provide that:

1) The policy retroactive date must coincide with or precede the Contractor's start of work (including subsequent policies purchased as renewals or replacements),
2) The Contractor shall maintain insurance for at least 2 years following Project completion, If insurance is terminated for any reason, the Contractor agrees to purchase an extended reporting provision of at least 2 years to report claims arising from Work performed in connection with this Contract, and,
3) The policy must allow for reporting of circumstances or incidents that might give rise to future claims."

"The Contractor shall assume any and all deductibles in the described insurance policies contained herein. Except as otherwise indicated in the detailed coverage paragraphs below, self-insured retentions and policy deductibles shall not exceed $100,000, unless such increased deductible or retention is approved by the State and the Connecticut Southern Railroad Company."

Revise the numbered paragraphs as follows:

1. Worker's Compensation Insurance:

In the second paragraph, replace the first sentence "Employer's Liability...amounts not less than $100,000 per accident...$100,000 per employee..." *with the following:*

Employer's Liability insurance shall be provided in amounts not less than $2,000,000 which limit may be met by a combination of primary and excess insurance meeting the statutory limits of the laws of the state in which the work is performed, whichever is greater."

2. Commercial General Liability Insurance:

Add the following to end of the first paragraph:

"Contractual Liability, Products and Completed Operations, Broad Form Property Damage and Independent Contractors coverages shall have all railroad exclusions deleted. The "named as an additional insured" shall be as noted in Subarticle 15. Any Umbrella/Excess Policy used to meet the minimum Contract requirements must follow form of the underlying policy and be extended to "drop down" to become primary in the event the primary policy is exhausted."

Replace the "Limits of Coverage" chart with the following:

Contract Amount ($)	Minimum Single Occurrence Limit ($)	Minimum Annual Aggregate Limit ($)
0-10,000,000	3,000,000	3,000,000
>10,000,000	4,000,000	8,000,000

4. Owner's and Contractor's Protective Liability Insurance for and in the Name of The State:

Replace the "Limits of Coverage" chart with the following:

Contract Amount ($)	Minimum Single Occurrence Limit ($)	Minimum Annual Aggregate Limit ($)
0-50,000,000	3,000,000	3,000,000
>50,000,000	4,000,000	4,000,000

10. Umbrella Liability Insurance:

Following every occurrence of "...the State of Connecticut..." *add* "and the Railroad..."

12. Copies of Policies:

Following every occurrence of "...the State..." *add* "and the Railroad..."

15. State Named as Additional Insured:

Change the last sentence of the only paragraph as follows:

"Each policy shall waive right of recovery (waiver of subrogation) against the State of Connecticut or the Railroad and the described insurance shall be primary coverage."

After the only paragraph, add the following:

"For coverage provided under this Article, Subarticle 5 - Railroad Protective Liability Insurance, as amended herein, the names of the "Additional Insured" shall be as indicated below:

Connecticut Southern Railroad Company
State of Connecticut, Its Agents and Assigns

16. Termination or Change of Insurance:

Following every occurrence of"...the Department..." *add* "and the Railroad..."

19. Property Owners Named as Additional Insured: The following property owners must be named as additional insured parties for the Commercial General Liability insurance required by this Article and the Special Provisions to the Contract, and any Umbrella Liability Insurance, as applicable, obtained in accordance with this Article:

Materials Innovation and Recycling Authority

Each policy shall waive right of recovery (waiver of subrogation against the property owners).

SECTION 1.03 - AWARD AND EXECUTION OF CONTRACT

Article 1.03.08 - Notice to Proceed and Commencement of Work:

Change the first paragraph to read as follows:

> "The Contractor shall commence and proceed with the Contract work on the date specified in a written notice to proceed issued by the Engineer to the Contractor. The date specified will be no later than 45 calendar days after the date of the execution of the Contract by the Department".

SECTION 1.05 - CONTROL OF THE WORK

Replace Article 1.05.02 *with the following:*

1.05.02—Contractor Submittals, Working Drawings, Shop Drawings, Product Data, Submittal Preparation and Processing - Review Timeframes, Department's Action:

1. Contractor Submittals: The plans provided by the Department show the details necessary to give a comprehensive idea of the construction contemplated under the Contract. The plans will generally show the location, character, dimensions, and details necessary to complete the Project. If the plans do not show complete details, they will show the necessary dimensions and details, which when used along with the other Contract documents, will enable the Contractor to prepare working drawings, shop drawings or product data necessary to complete the Project.

The Contractor shall prepare submittals as Portable Document Format (PDF) files. The Contractor is also required to acquire, maintain access and use the Department's document management system for delivery of submittals. The format, digital signing requirements, delivery processes and document tracking procedures shall be performed in accordance with this specification and the Contractor's Digital Submission Manual (CDSM).

The submittals shall be sent to the Department's reviewer(s), sufficiently in advance of the work detailed, to allow for their review in accordance with the review periods as specified herein (including any necessary revisions, resubmittal, and final review), and acquisition of materials, without causing a delay of the Project.

2. Working Drawings: When required by the Contract or when ordered to do so by the Engineer, the Contractor shall prepare and submit the working drawings, signed, sealed and dated by a qualified Professional Engineer licensed to practice in the State of Connecticut, for review. The drawings shall be delivered sufficiently in advance of the work detailed, to allow for their review in accordance with the review periods specified herein (including any necessary revisions, resubmittal, and final review).

There will be no direct payment for furnishing any working drawings, procedures or supporting calculations, but the cost thereof shall be considered as included in the general cost of the work.

a. Working Drawings for Permanent Construction: The Contractor shall supply to the Assistant District Engineer a certificate of insurance in accordance with 1.03.07 at the time that the working drawings for the Project are submitted.

The Contractor's designer, who prepares the working drawings, shall secure and maintain at no direct cost to the State a Professional Liability Insurance Policy for errors and omissions in the minimum amount of $2,000,000 per error or omission. The Contractor's designer may elect to obtain a policy containing a maximum $250,000 deductible clause, but if the Contractor's designer should obtain a policy containing such a clause, they shall be liable to the extent of at

least the deductible amount. The Contractor's designer shall obtain the appropriate and proper endorsement of its Professional Liability Policy to cover the indemnification clause in this Contract, as the same relates to negligent acts, errors or omissions in the Project work performed by them. The Contractor's designer shall continue this liability insurance coverage for a period of

(i) 3 years from the date of acceptance of the work by the Engineer, as evidenced by a State of Connecticut, Department of Transportation form entitled "Certificate of Acceptance of Work," issued to the Contractor; or

(ii) 3 years after the termination of the Contract, whichever is earlier, subject to the continued commercial availability of such insurance.

b. Working Drawings for Temporary Construction: The Contractor shall submit drawings, calculations, procedures and other supporting data to the Assistant District Engineer.

3. Shop Drawings: When required by the Contract, or when ordered to do so by the Engineer, the Contractor shall prepare and deliver shop drawings to the Designer for review. Review timeframes and submission locations are as specified herein.

There will be no direct payment for furnishing any shop drawings, but the cost thereof shall be considered as included in the general cost of the work.

4. Product Data: When required by the Contract, or when ordered to do so by the Engineer, the Contractor shall prepare and deliver product data.

The Contractor shall submit the product data in a single submittal for each element or group of elements of construction.

The Contractor shall mark each copy of the product data submittal to show applicable choices and options. Where product data includes information on several products that are not required, copies shall be marked to indicate the applicable information. Product data shall include the following information and confirmation of conformance with the Contract to the extent applicable: manufacturer's printed recommendations, compliance with recognized trade association standards, compliance with recognized testing agency standards, application of testing agency labels and seals, notation of coordination requirements, Contract item number, and any other information required by the individual Contract provisions.

There will be no direct payment for furnishing any product data, but the cost thereof shall be considered as included in the general cost of the work.

5. Submittal Preparation and Processing – Review Timeframes: The Contractor shall allow 30 calendar days for submittal review by the Department, from the date receipt is acknowledged by the Department's reviewer. For any submittals marked with "Revise and Resubmit" or "Rejected," the Department is allowed an additional 20 calendar days for review of any resubmissions.

An extension of Contract time will not be authorized due to the Contractor's failure to transmit submittals sufficiently in advance of the work to permit processing.

The furnishing of shop drawings, working drawings or product data, or any comments or suggestions by the Designer or Engineer concerning shop drawings, working drawings or product data, shall not relieve the Contractor of any of its responsibility for claims by the State or by third parties, as per 1.07.10.

The furnishing of the shop drawings, working drawings and product data shall not serve to relieve the Contractor of any part of its responsibility for the safety or the successful completion of the Project construction.

6. Department's Action: The Designer or Engineer will review each submittal, mark each with a self-explanatory action stamp, and return the stamped submittal promptly to the Contractor. The Contractor shall not proceed with the part of the Project covered by the submittal until the submittal is marked "No Exceptions Noted" or "Exceptions as Noted" by the Designer or Engineer. The Contractor shall retain sole responsibility for compliance with all Contract requirements. The stamp will be marked as follows to indicate the action taken:

a. If submittals are marked "No Exceptions Noted," the Designer or Engineer has not observed any statement or feature that appears to deviate from the Contract requirements. This disposition is contingent on being able to execute any manufacturer's written warranty in compliance with the Contract provisions.
b. If submittals are marked "Exceptions as Noted" the considerations or changes noted by the Department's Action are necessary for the submittal to comply with Contract requirements. The Contractor shall review the required changes and inform the Designer or Engineer if they feel the changes violate a provision of the Contract or would lessen the warranty coverage.
c. If submittals are marked "Revise and Resubmit," the Contractor shall revise the submittals to address the deficiencies or provide additional information as noted by the Designer or Engineer. The Contractor shall allow an additional review period as specified in 1.05.02-5.
d. If submittals are marked "Rejected," the Contractor shall prepare and submit a new submittal in accordance with the Designer's or Engineer's notations. The resubmissions require an additional review and determination by the Designer or Engineer. The Contractor shall allow an additional review period as specified in 1.05.02-5.

SECTION 1.05 - CONTROL OF THE WORK

Replace Article 1.05.02 *with the following:*

1.05.02—Contractor Submittals, Working Drawings, Shop Drawings, Product Data, Submittal Preparation and Processing - Review Timeframes, Department's Action:

1. Contractor Submittals: The plans provided by the Department show the details necessary to give a comprehensive idea of the construction contemplated under the Contract. The plans will generally show the location, character, dimensions, and details necessary to complete the Project. If the plans do not show complete details, they will show the necessary dimensions and details, which when used along with the other Contract documents, will enable the Contractor to prepare working drawings, shop drawings or product data necessary to complete the Project.

The Contractor shall prepare submittals as Portable Document Format (PDF) files. The Contractor is also required to acquire, maintain access and use the Department's document management system for delivery of submittals. The format, digital signing requirements, delivery processes and document tracking procedures shall be performed in accordance with this specification and the Contractor's Digital Submission Manual (CDSM).

The submittals shall be sent to the Department's reviewer(s), sufficiently in advance of the work detailed, to allow for their review in accordance with the review periods as specified herein (including any necessary revisions, resubmittal, and final review), and acquisition of materials, without causing a delay of the Project.

2. Working Drawings: When required by the Contract or when ordered to do so by the Engineer, the Contractor shall prepare and submit the working drawings, signed, sealed and dated by a qualified Professional Engineer licensed to practice in the State of Connecticut, for review. The drawings shall be delivered sufficiently in advance of the work detailed, to allow for their review in accordance with the review periods specified herein (including any necessary revisions, resubmittal, and final review).

There will be no direct payment for furnishing any working drawings, procedures or supporting calculations, but the cost thereof shall be considered as included in the general cost of the work.

a. Working Drawings for Permanent Construction: The Contractor shall supply to the Assistant District Engineer a certificate of insurance in accordance with 1.03.07 at the time that the working drawings for the Project are submitted.

The Contractor's designer, who prepares the working drawings, shall secure and maintain at no direct cost to the State a Professional Liability Insurance Policy for errors and omissions in the minimum amount of $2,000,000 per error or omission. The Contractor's designer may elect to obtain a policy containing a maximum $250,000 deductible clause, but if the Contractor's designer should obtain a policy containing such a clause, they shall be liable to the extent of at

least the deductible amount. The Contractor's designer shall obtain the appropriate and proper endorsement of its Professional Liability Policy to cover the indemnification clause in this Contract, as the same relates to negligent acts, errors or omissions in the Project work performed by them. The Contractor's designer shall continue this liability insurance coverage for a period of

(i) 3 years from the date of acceptance of the work by the Engineer, as evidenced by a State of Connecticut, Department of Transportation form entitled "Certificate of Acceptance of Work," issued to the Contractor; or

(ii) 3 years after the termination of the Contract, whichever is earlier, subject to the continued commercial availability of such insurance.

b. Working Drawings for Temporary Construction: The Contractor shall submit drawings, calculations, procedures and other supporting data to the Assistant District Engineer.

3. Shop Drawings: When required by the Contract, or when ordered to do so by the Engineer, the Contractor shall prepare and deliver shop drawings to the Designer for review. Review timeframes and submission locations are as specified herein.

There will be no direct payment for furnishing any shop drawings, but the cost thereof shall be considered as included in the general cost of the work.

4. Product Data: When required by the Contract, or when ordered to do so by the Engineer, the Contractor shall prepare and deliver product data.

The Contractor shall submit the product data in a single submittal for each element or group of elements of construction.

The Contractor shall mark each copy of the product data submittal to show applicable choices and options. Where product data includes information on several products that are not required, copies shall be marked to indicate the applicable information. Product data shall include the following information and confirmation of conformance with the Contract to the extent applicable: manufacturer's printed recommendations, compliance with recognized trade association standards, compliance with recognized testing agency standards, application of testing agency labels and seals, notation of coordination requirements, Contract item number, and any other information required by the individual Contract provisions.

There will be no direct payment for furnishing any product data, but the cost thereof shall be considered as included in the general cost of the work.

5. Submittal Preparation and Processing – Review Timeframes: The Contractor shall allow 30 calendar days for submittal review by the Department, from the date receipt is acknowledged by the Department's reviewer. For any submittals marked with "Revise and Resubmit" or "Rejected," the Department is allowed an additional 20 calendar days for review of any resubmissions.

An extension of Contract time will not be authorized due to the Contractor's failure to transmit submittals sufficiently in advance of the work to permit processing.

The furnishing of shop drawings, working drawings or product data, or any comments or suggestions by the Designer or Engineer concerning shop drawings, working drawings or product data, shall not relieve the Contractor of any of its responsibility for claims by the State or by third parties, as per 1.07.10.

The furnishing of the shop drawings, working drawings and product data shall not serve to relieve the Contractor of any part of its responsibility for the safety or the successful completion of the Project construction.

6. Department's Action: The Designer or Engineer will review each submittal, mark each with a self-explanatory action stamp, and return the stamped submittal promptly to the Contractor. The Contractor shall not proceed with the part of the Project covered by the submittal until the submittal is marked "No Exceptions Noted" or "Exceptions as Noted" by the Designer or Engineer. The Contractor shall retain sole responsibility for compliance with all Contract requirements. The stamp will be marked as follows to indicate the action taken:

a. If submittals are marked "No Exceptions Noted," the Designer or Engineer has not observed any statement or feature that appears to deviate from the Contract requirements. This disposition is contingent on being able to execute any manufacturer's written warranty in compliance with the Contract provisions.
b. If submittals are marked "Exceptions as Noted" the considerations or changes noted by the Department's Action are necessary for the submittal to comply with Contract requirements. The Contractor shall review the required changes and inform the Designer or Engineer if they feel the changes violate a provision of the Contract or would lessen the warranty coverage.
c. If submittals are marked "Revise and Resubmit," the Contractor shall revise the submittals to address the deficiencies or provide additional information as noted by the Designer or Engineer. The Contractor shall allow an additional review period as specified in 1.05.02-5.
d. If submittals are marked "Rejected," the Contractor shall prepare and submit a new submittal in accordance with the Designer's or Engineer's notations. The resubmissions require an additional review and determination by the Designer or Engineer. The Contractor shall allow an additional review period as specified in 1.05.02-5.

Article 1.05.06 — Cooperation with Utilities (Including Railroads) – *is supplemented as follows:*

Add the following after the last paragraph:

Special Requirements Regarding Work in Connecticut Southern (CSO) Railroad territory:

The project site includes a section in the Reserve Road area of Hartford where the Market Industrial Spur is located. This single track railroad is an active freight line with typical service including 2 trains every weekday. The track and the property it traverses are the property of the

State or City of Hartford with rail operations by CSO under contract with the State. The track is maintained as an exempt line with maximum speed of 10 mph.

Work in the vicinity of the railroad must be performed in conformance with special requirements associated with railroads in general and more specifically the CSO. These special requirements address but are not limited to authority, definitions, regulatory requirements, traffic regulation and coordination of the Contractor's work schedule with the operation of train service, construction equipment and safety requirements for working near the railroad, and provisions for storage of materials and equipment and worker safety rules.

The Contractor shall comply with the general requirements of the CSO elsewhere included in these special provisions except for certain clauses or requirements that the Department has determined are not applicable for this project given the State's or City's ownership of the track and associated property – see NTC – WORK ON RAILROAD PROPERTY.

In addition, the Contractor shall install delineation fencing along the Market Industrial Spur in areas where the Contractor operates or parks equipment or vehicles. This fencing shall be offset a minimum of 10' from the track centerline and shall serve as a visual barrier reducing the risk of operation or parking of Contractor equipment within the railroad's restricted zone.

The fencing fabric shall be high visibility green high-density Polyethylene or Polypropylene material and shall be a minimum of four feet in height. Opening sizes shall be a minimum of 1" x 1" and a maximum of 2" x 4". The fabric shall have a temperature service range of -40 to 200 degrees F.

Posts for the barrier fence shall be made of wooden stakes with the minimum dimensions of 1 inch x 2 inches and a minimum length of 5 feet.

The post material and spacing shall be as necessary to ensure the installation is rigid, plumb and does not deflect laterally more than 2 inches under wind loading including from passing trains. A tension wire shall run through the top of the fence and be secured to the end posts to increase rigidity. The Contractor may propose alternate temporary fence materials to the Engineer for approval.

The fence is to be maintained in position and any damage to posts or fence shall be repaired or replaced by the Contractor. The cost of furnishing, installing, maintaining and removing the required fence shall be included in the general cost of the work.

SECTION 1.06 - CONTROL OF MATERIALS

Add the following:

General:

The Special Provisions contain the description of various items which must be submitted to the Engineer by the Contractor for review and approval. These items are in addition to other requirements described in the Specifications. Unless otherwise noted, the Contractor shall provide all required submissions as detailed in Section 1.05 – Control of the Work, and elsewhere in these specifications.

The State will complete its review of the material within thirty (30) calendar days from the date of receipt of the submission. The State shall advise the Contractor, in writing, as to the acceptability of the material submitted. The State may determine that the item is approved, in which case no further submittal is required by the Contractor, or the item may be partially or totally rejected in which case the Contractor shall be required to modify or clarify the submittal as required by the State and resubmit the item within fifteen (15) days. At this time, the review and approval cycle described above shall begin again. Approval by the Engineer of equipment and materials lists, catalogue cuts, and/or shop drawings shall not relieve the Contractor of any of his responsibility under the Contract for the successful completion of the work in conformity with the requirements of the Special Provisions.

Article 1.06.01 - Source of Supply and Quality is amended as follows:

Delete the last paragraph and replace with the following:

For the following items the Contractor shall submit in an electronic portable document format (.pdf) a complete description of the item, complete set(s) of shop drawings, catalog cuts, data sheets and other descriptive literature which completely illustrates such items presented for formal approval.

Approval of the Shop Drawings and catalog cuts shall not change the requirements for a Certified Test Report, Materials Certificate and Certificate of Compliance as may be called for.

The packaged set submitted in an electronic portable document format (.pdf) shall be in an individual file with appropriate bookmarks for each item. The electronic files for shop drawings shall be created on ANSI A (8 ½" x 11"; 216 mm x 279mm; letter) sheets or on 22 inch by 34 inch standard plan sheets. Shop drawings and data sheets shall be required for, but not limited to the following:

<u>Incident Management System:</u>

- Surface Mounted Conduit and Appurtenances
- Pullbox, pullbox covers

- Conduit, supports, brackets, hangers, clamps and any hardware involved with the supports and including complete fabrication details.
- Field fastener details including chemical and mechanical anchors
- Hand holes and covers
- Variable Message Signs (VMS)
- VMS supports
- Overhead Cantilever Sign Support
- Ground Mounted (2-Post) Sign Supports
- VMS Cabinets
- VMS Controllers
- VMS support foundations
- Fiber Optic Modems
- Camera Assembly. Schematics of the wiring between the camera and the equipment cabinet shall also be provided.
- Camera power supply
- Camera Video Cables, Data Cables, Power Cables and Connectors
- Remote Processing Unit (RPU), RPU Tower and Cabinet
- Ethernet Media Converter
- Terminal (Port) Server
- Port Sharing Device
- Traffic Flow Monitor
- Sensor Wire and Communication Cable
- Cast Iron Handhole Cover
- Cast Iron Junction Box
- Traffic Management System Mini Hub Cabinets
- Traffic Management System Cabinets
- Transformers
- Auxiliary Termination Cabinets
- Steel CCTV Poles
- Camera Lowering Device Assembly Type B
- Meter Sockets
- Conductors
- Outdoor Fiber Optic Splice Enclosures
- Fiber Optic Cable
- Fiber Patch Cords
- Fiber Optic Connectors
- Optical Fiber Termination Patch Panels
- Optical Video/Data Transmitter
- Ethernet Switch
- 10/100 Base-TX Ethernet Switch
- Multi-Channel Multiplexer/Demultiplexer
- MPEG 4 Video Encoder and Decoder
- Media Converter
- Wireless Router
- Rack Mount Optical Video/Data Receiver

- Ring Ethernet Equipment
- Ethernet Switch Equipment
- Controller Interface Communications Unit (CICU)
- Central Communications Equipment (CCE)
- Cat 6 Cable
- RG-U59 Coax Cable
- RG-U59 Coax Cable Connectors
- High Density Patch Panels
- RJ 45 and RJ 48 Connectors

Required catalog cuts for all items listed above shall be submitted in one package at the same time. All approvals or disapprovals and comments will be returned in one package.

Please forward to:

Mr. John F. Korte
Connecticut Department of Transportation
Highway Operations Section
2800 Berlin Turnpike
Newington, Connecticut 06131-7546

Mr. Donald L. Ward
Connecticut Department of Transportation
District 1 Construction
1107 Cromwell Avenue
Rocky Hill, CT 06067

Article 1.06.01 - Source of Supply and Quality:

Add the following:

Smart Work Zone Items:

For the following Smart Work Zone items the Contractor shall submit a complete description of the item consisting of the latest manufacturer shop drawing(s) which completely illustrates the material presented for formal approval. The submitted shop drawing(s) shall clearly call-out all material and operational properties for the item specific to the project. Such approval shall not change the requirements for a certified test report and materials certificate as may be called for.

Smart Work Zone Queue Trailer/Sensor (SQT)
Smart Work Zone Variable Message Sign/Queue Sensor Trailer (SVMQ)
Smart Work Zone Mobile Video Camera/Queue Sensor Trailer (SVQS)

Required product data sheets for all items listed above shall be submitted in one package at the same time. Please note: the list of items above is a "general" list of items. Certain items listed may or may not be present in a specific project. Please consult the Detailed Estimate sheet for project specific items.

Illumination:

For the following materials the Contractor shall submit a complete description of the item consisting of the latest manufacturer shop drawing(s) which completely illustrates the material presented for formal approval. The submitted shop drawing(s) shall clearly call-out all material and operational properties for the item specific to the project. Such approval shall not change the requirements for a certified test report and materials certificate as may be called for.

Light Standards
Foundations
Conductors
Luminaires
Conduit
Fuses and Fuse Holders
Service Items
Handholes
Junction Boxes
Temporary Illumination Unit
Spare Parts
Navigation Lights and Pendant Brackets
Transformer

Required catalog cuts for all items listed above shall be submitted in one package at the same time. All approvals or disapprovals and comments will be returned in one package. Please note: the list of items above is a "general" list of items. Certain items listed may or may not be present in a specific project. Please consult the Detailed Estimate sheet for project specific items.

The packaged set submitted in an electronic portable document format (.pdf) shall be in an individual file with appropriate bookmarks for each item. The electronic files for shop drawings shall be created on ANSI A (8 ½" x 11"; 216 mm x 279mm; letter) sheets.

Please send the pdf documents via email to:

jon.andrews@ct.gov

Traffic Monitoring Station Items

For the following traffic monitoring station items the Contractor shall submit a complete description of the item, together with shop drawings, cuts and other descriptive literature which completely illustrates such items presented for formal approval. Such approval shall not change the requirements for a Certified Test Report and Materials Certificate as may be called for.

Conduit
Conductors
Pole
Camera Assembly
Closed Loop System Video Detection Processor
Camera Cable
Vehicle Detection Monitor
Circuit Breaker
Traffic Controller Cabinet Items
Foundation (Precast)

Required catalog cuts for all items listed above shall be submitted in one package at the same time. All approvals or disapprovals and comments will be returned in one package.

The packaged set submitted in an electronic portable document format (.pdf) shall be in an individual file with appropriate bookmarks for each item. The electronic files for catalog cuts and/or shop drawings for all **traffic monitoring station items** shall be created on ANSI A (8 ½" x 11"; 216 mm x 279 mm; letter) sheets.

Please send the pdf documents via e-mail to:

bradley.overturf@ct.gov

Article 1.06.05 - Shipping Materials: *Add the following:*

All vehicles transporting materials on highways and bridges in the State shall comply with all the vehicle regulations of the Connecticut General Statutes and regulations of Connecticut State Agencies as they apply to vehicle length, width, height and weight.

Any vehicle, either loaded or unloaded, will not be allowed to travel across any bridge or on any highway when such vehicle exceeds the legal limits or posted limits of such bridge or highway without a permit. The owner of the vehicle must apply to the Department for a permit for such travel, as provided in the statutes.

The General Statutes include the following limitations:

Vehicle Width (Section 14-262(a)(1)) - The width of a vehicle and combination vehicle and trailer, including its load, is limited to 8.5 ft. (2,590 mm), without a permit.

Vehicle Length (Section 14-262(c)) - The length of the semitrailer portion of a tractor-trailer unit, including its load, is limited to 50 ft. (14,630 mm), without a permit.

Vehicle Height (Section 14-264) - The height of a vehicle, with its load, is limited to 13.5 ft. (4110 mm), without a permit.

Vehicle Weight (Section 14-267a(b)(7)) - The gross vehicle weight (weight of vehicle including its load) is limited to 80,000 lbs. (36,280 kg) on 5 axles for vehicles with a 50 ft. (15 540 mm) wheelbase, without a permit.

Axle Weights of Vehicles (Section 14-267a) – For the above five axle vehicle, weight on a single axle may not exceed 22,400 lbs. (10,160 kg) or in the case of axles spaced less than 6 ft. (1,828 mm) apart, 18,000 lbs. (8,160 kg).

On Department projects, in accordance with the Commissioner's policy, any member or component, either temporary or permanent, that measures 120 ft. (36,570 mm) or less and weighs no greater than 120,000 lbs. (54,430 kg), is transportable via an authorized permit route established by the Department provided the individual axle weights on the vehicle and trailer transporting the member or component do not exceed 20,000 lbs. (9,070 kg).

Members and components, shown in the contract documents, that exceed the above length and weight limits have been reviewed by the Department's Oversize and Overweight Permits Section and are transportable via an authorized permit route established by the Department provided the individual axle weights on the vehicle and trailer transporting the member or component do not exceed 20,000 lbs. (9,070 kg).

All permits to transport materials are subject to shipping times established by the Department's Oversize and Overweight Permits Section.

Applications for permits, required to transport materials, shall be submitted a minimum of two weeks prior to their required use, to the Department's Oversize and Overweight Permits Sections.

Article 1.06.07 - Certified Test Reports and Materials Certificate

Incident Management System (IMS) Items:

1) For the materials in the following Incident Management System items, a Materials Certificate will be required confirming their conformance to the requirements set forth in these plans or specifications or both.

    - Structural Steel (Poles and Sign Supports)
    - Structural Tubing
    - Galvanizing (certifying compliance with ASTM)
    - Zinc Rich Primer
    - Neoprene Gasket
    - Polyurethane Sealant
    - Grounding Rods
    - Copper Wire
    - Rigid Metal Conduit

- Anchor Bolts
- Handholes
- Pull Box
- Pull Box Cover
- Lowering Device Assembly
- Fiber Optic Cable
- Fiber Optic Cable Connectors
- Concrete Communications Shelter

2) For the materials in the following Incident Management System items, a Certified Test Report will be required confirming their conformance to the requirements set forth in these plans or specifications or both.

    - Anchor Bolt and Hardware
    - Structural Steel (Poles and Sign Supports)
    - Structural Tubing
    - Welds
    - Conduit
    - Fiber Optic Cable
    - Fiber Optic Cable Connectors
    - Conductors
    - Service Cabinet
    - Transformer
    - VMS Cables
    - Camera Cables
    - Structural Steel (Poles)

3) The Contractor shall submit to the Engineer all Warranties and guarantees prior to final acceptance.

Traffic Monitoring Station Items:

1) For the materials in the following items, a Certified Test Report will be required confirming their conformance to the requirements set forth in these plans or specifications or both. Should the consignee noted on a Certified Test Report be other than the Prime Contractor, then Materials Certificates shall be required to identify the shipment.

    - Conductors
    - Pole
    - Anchor Bolts

2) For the materials in the following items, a Materials Certificate will be required confirming their conformance to the requirements set forth in these plans or specifications or both.

    - Conduit

- Conductors
- Pole
- Anchor Bolts
- Camera Assembly
- Closed Loop System Video Detection Processor
- Camera Cable
- Vehicle Detection Monitor

Illumination Items:

1) For the materials in the following items, a Certified Test Report will be required confirming their conformance to the requirements set forth in these plans or specifications or both. Should the consignee noted on a Certified Test Report be other than the Prime Contractor, then Materials Certificates shall be required to identify the shipment.

- Light Standards
- Conductors
- Anchor Bolts
- Conduit

2) For materials in the following items, a Materials Certificate will be required confirming their conformance to the requirements set forth in these plans or specifications or both.

- Light Standards
- Conductors
- Luminaires
- Conduit
- Anchor Bolts
- Service Items
- Navigation Lights

SECTION 1.07 - LEGAL RELATIONS AND RESPONSIBILITIES

Delete Article 1.07.07 in its entirety and replace it with the following:

1.07.07—Safety and Public Convenience: The Contractor shall conduct the Project work at all times in such a manner as to ensure the least possible obstruction to traffic. In a manner acceptable to the Engineer, the Contractor shall provide for the convenience and interests of the general public; the traveling public; parties residing along or adjacent to the highway or Project Site; and parties owning, occupying or using property adjacent to the Project Site, such as commuters, workers, tenants, lessors and operating agencies.

Notwithstanding any other Contract provision, the Contractor shall not close to normal pedestrian or vehicular traffic any section of road, access drive, parking lot, sidewalk, station platform, railroad track, bus stop, runway, taxiway, occupied space within a Site, or occupied space within a building, except with the written permission of the Engineer.

All equipment, materials, equipment or material storage areas, and work areas must be placed, located, and used in ways that do not create a hazard to people or property, especially in areas open to public pedestrian or vehicular traffic. All equipment and materials shall be placed or stored in such a way and in such locations as will not create a hazard to the traveling public or reduce sight lines. In an area unprotected by barriers or other means, equipment and materials must not be stored within 30 feet of any traveled way.

The Contractor must always erect barriers and warning signs between any of its work or storage areas and any area open to public, pedestrian, or vehicular traffic. Such barriers and signs must comply with all laws and regulations, including any applicable codes.

The Contractor must arrange for temporary lighting, snow and ice removal, security against vandalism and theft, and protection against excessive precipitation runoff within its Project work and storage areas, and within other areas specifically designated in the Contract.

In addition to meeting the requirements of Section 9.71, the Contractor shall take all precautions necessary and reasonable for the protection of all persons, including, but not limited to, employees of the Contractor or the Department, and for the protection of property, until the Engineer notifies the Contractor in writing that the Project or the pertinent portion of the Project has been completed to the Engineer's satisfaction.

The Contractor shall comply with the safety provisions of applicable laws, including building and construction codes and the latest edition of the CFR. The Contractor must make available for reference in its field office, throughout the duration of the Project, a copy of the latest edition and all supplements of the CFR pertaining to OSHA.

The Contractor shall make available to the Contractor's employees, subcontractors, the Engineer, and the public, all information pursuant to OSHA 29 CFR Part 1926.59 and The

Hazard Communication Standard 29 CFR 1910.1200, and shall also maintain a file on each job site containing all MSDS for products in use at the Project. These MSDS shall be made available to the Engineer upon request.

The Contractor shall observe all rules and regulations of the Federal, State, and local health officials. Attention is directed to Federal, State, and local laws, rules, and regulations concerning construction safety and health standards. The Contractor shall not require any worker to work in surroundings or under conditions that are unsanitary, hazardous, or dangerous to the worker's health or safety.

Safety Plan: Before starting work on the Project, the Contractor shall submit to the Engineer a written Safety and Health Plan (hereinafter referred to as the "Plan"). The Plan shall meet or exceed the minimum requirements of this Subsection and any applicable State or Federal regulations.

The Plan shall apply to any work under the Contract whether such work is performed, by way of example and not limitation, by the Contractor's forces, subcontractors, suppliers, or fabricators.

The Plan shall be prepared by the Contractor and submitted to the Engineer for review before the actual start of work on the Project. Within ten (10) calendar days of receipt, the Engineer will determine whether or not the Plan meets the requirements of this Specification. If the Plan does not meet the requirements of this Specification, it will be returned for revision. Work on the Project may not proceed until the Engineer has accepted the Plan. Nothing herein shall be construed, however, to relieve the Contractor from responsibility for the prosecution of the Project.

The Plan shall conform to the following general format:

1. **General Introduction**.
   a. **Description.** The general introduction of the Plan shall include a statement by the Contractor describing its commitment to maintain a safe work environment for its employees, Department representatives, and the public. Implementation procedures and company policies relative to safety shall be summarized or referenced in the Plan.
      i. The Plan shall include the names, addresses, and telephone numbers of the Contractor's Project Manager, Project superintendent and/or its designee for safety oversight, all competent persons, and the traffic control coordinator. Any changes to the safety management and oversight for the Project shall be promptly communicated to all concerned.
      ii. The Plan shall provide guidelines for protecting all personnel from hazards associated with Project operations and activities.
      iii. The Plan shall establish the policies and procedures that are necessary for the Project to be in compliance with the requirements of OSHA and other State and Federal regulatory agencies with jurisdiction, rules, regulations, standards, or guidelines in effect at the time the work is in progress.

b. Responsibility, Identification of Personnel, and Certifications. The Contractor is solely responsible for creating, implementing, and monitoring the Plan.

i. The Contractor shall identify and designate on-site supervisory level personnel who shall be responsible for implementing and monitoring the Plan at all times throughout the duration of the Project and shall have authority to take prompt corrective measures to eliminate hazards including the ability to stop work activities.

ii. Documentation of training provided to the on-site supervisory level personnel shall be included as part of the Plan.

iii. For any work activities wherein the Contractor has identified a competent person as defined by OSHA, that person shall be capable of identifying existing and predictable hazards and have the authority to take prompt corrective measures to eliminate the hazards, including the ability to stop work activities.

iv. Documentation of the qualifications of such competent persons identified, including any certifications received, shall be included as part of the Plan.

v. The Contractor shall further identify the qualified safety professional responsible for developing the Plan and shall provide that person's qualifications for developing the Plan which shall include, but not be limited to, education, training, certifications, and experience in developing this type of Plan.

vi. The Plan shall contain a certification executed by the qualified safety professional that developed the Plan, stating that the Plan complies with OSHA and other applicable State and Federal regulatory agencies with jurisdiction, rules, regulations, standards, or guidelines in effect at the time the work is in progress.

2. Elements of the Plan. The Plan shall address, but not be limited to, the following elements:

a. Management Safety Policy and Implementation Statement.

i. The Plan shall describe in detail the means by which the Contractor shall implement and monitor the Plan. Implementation and monitoring shall also mean that the Plan shall be a document with provision for change to update the Plan with new information on a yearly basis at a minimum and shall include new practices or procedures, changing site and environmental conditions, or other situations that could adversely affect site personnel. The Plan shall provide guidelines for protecting all personnel from hazards associated with Project operations and activities.

b. Emergency Telephone Numbers.

c. Personnel Responsibilities.

i. Management responsibilities

ii. Responsibilities of Supervisor(s)

iii. Site safety officer(s) responsibilities

iv. Employee responsibilities

v. Competent person(s) as defined by OSHA responsibilities

d. Training.

i. Regulatory

ii. Documentation

iii. Site hazard assessment -Daily employee awareness of site operations

e. Safety Rules.

i. General safety rules
ii. Personal protective equipment
iii. Housekeeping

f. Safety Checklists.

i. Project safety-planning checklist
ii. Emergency plans and procedures checklist
iii. Documentation checklist
iv. Protective materials and equipment checklist

g. Traffic Control Coordinator Inspections.

i. Responsible person
ii. Frequency
iii. Documentation of actions taken

h. Record Keeping.

i. OSHA 200 log

i. Reporting.

i. Accident(s)
ii. On site
iii. Legal notice requirement
iv. Public liability
v. Property damage
vi. Department of Labor
vii. Hazard Communications

j. Additional Procedures for Project Specific Situations as Applicable.

i. Compressed gas cylinders
ii. Confined spaces
iii. Cranes
iv. Crystalline silica (stone, masonry, concrete, and brick dust)
v. Electrical
vi. Equipment operators
vii. Fall protection
viii. Hand and power tools
ix. Hearing conservation
x. Highway safety
xi. Lead health and safety plan
xii. Lock out/tag out
xiii. Materials handling, storage, use, and disposal
xiv. Areas of environmental concern
xv. Night work
xvi. Personal protective equipment
xvii. Project entry and exit
xviii. Respiratory protection
xix. Sanitation
xx. Signs, signals, and barricades

xxi. Subcontractors
xxii. Trenching

3. **Appendix for Environmental Health and Safety Plan (HASP).** If environmental hazards are identified in the Contract, an Environmental HASP shall be included in an appendix to the Plan, or in a separate document. References to any Environmental HASP shall be included within the Plan, where appropriate.

The Plan shall be kept on the site and shall apply and be available to all workers and all other authorized persons entering the work site. Copies of all updates to the Plan shall be promptly supplied to the Engineer.

If at any time during the Project the Engineer determines that the Contractor is not complying with the requirements of this provision or the updated Plan, the Contractor shall correct such deficiencies immediately. Failure to remediate such deficiencies may result in suspension of the Contractor's operations until the deficiencies have been corrected. Suspensions ordered due to safety deficiencies will not be considered compensable or excusable delays.

The Contractor is responsible for implementation of the Plan. Pursuant to Article 1.07.10, the Contractor shall indemnify, and save harmless the State from any and all liability related to the Plan in proportion to the extent that the Contractor is held liable for same by an arbiter of competent jurisdiction.

The Contractor shall allow onto the Project site any inspector of OSHA or other legally responsible agency involved in safety and health administration upon presentation of proper credentials, without delay and without the presentation of an inspection warrant.

SECTION 1.07 - LEGAL RELATIONS AND RESPONSIBILITIES

Article 1.07.10 - Contractor's Duty to Indemnify the State against Claims for Injury or Damage:

Add the following after the only paragraph:

"It is further understood and agreed by the parties hereto, that the Contractor shall not use the defense of Sovereign Immunity in the adjustment of claims or in the defense of any suit, including any suit between the State and the Contractor, unless requested to do so by the State."

SECTION 1.07 - LEGAL RELATIONS AND RESPONSIBILITIES

Article 1.07.11 Opening of Section of project to Traffic or Occupancy:

Add the following sentence to the last paragraph:

"In cases in which guiderail is damaged by the traveling public, repair or replacement will be reimbursable as contained elsewhere herein."

SECTION 1.07 - LEGAL RELATIONS AND RESPONSIBILITIES

Article 1.07.13 - Contractor's Responsibility for Adjacent Property, Facilities and Services is supplemented as follows:

The following company and representative shall be contacted by the Contractor to coordinate the protection of their utilities on this project 30 days prior to the start of any work on this project involving their utilities:

Mr. Augusto Grazuna
District 1 Electrical Supervisor
Department of Transportation
Hartford, Connecticut
(860) 566-3156/3157

Mr. David Jones
Project Manager
Buckeye Pipe Line Company, L.P.
9999 Hamilton Boulevard, Five TEK Park
Breinigsville, PA 18031
(610) 904-4409
dajones@buckeye.com

Ms. Lynne DeLucia
Manager - Engineering & Construction
Frontier Communication of Connecticut
1441 North Colony Road
Meriden, CT 06450-4101
(203) 238-5000
Lynne.m.delucia@ftr.com

Mr. Jim Bitzas
Sr. Manager of Western New England
Comcast of Connecticut, Inc.
1110 East Mountain Road
Westfield, MA 01085
(413) 562-9923
jim_bitzas@cable.comcast.com

Mr. Thomas Woronik
Supervisor - Construction Engineering
Eversource Energy – Electric Distribution
22 East High Street
East Hampton, CT 06424
(860) 267-3891
Thomas.Woronik@eversource.com

Mr. Richard Norris, P.E.
Project Engineer/Utility Liaison
The Metropolitan District
555 Main Street, P.O. Box 800
Hartford, CT 06142-0800
(860) 278-7850
rnorris@themdc.com

Mr. Mike Weaver
Project Manager, OSP Relocations
Level 3 Communications, LLC
1025 Eldorado Boulevard
Broomfield, CO 80021
(919) 710-8891
mike.weaver@level3.com

Mr. Eric Clark
Manager Fiber Construction
Crown Castle Fiber
1781 Highland Avenue, Suite 102
Cheshire, CT 06410
(203) 649-3904
Eric.Clark@crowncastle.com

Mr. Jonathan Gould
Gas Engineer
Connecticut Natural Gas Corporation,
Engineering Department
76 Meadow Street, 2nd Floor
East Hartford, CT 06108
(860) 727-3044
jgould@ctgcorp.com

Mr. Daniel J. Garstka
Senior Engineer – Transmission Siting
Eversource Energy – Electric Division
56 Prospect Street
Hartford, CT 06103
(860) 728-4533
daniel.garstka@eversource.com

Please provide the electrical service request number provided by the power company. This is a Work Request (WR) Number provided by Eversource (formerly Northeast Utilities [CL&P]). For State-owned traffic signals in CL&P territory, contact the Department's Traffic Electrical Unit to obtain the WR Number.

SECTION 1.08 - PROSECUTION AND PROGRESS

Article 1.08.03 – Prosecution of Work - Add the following:

The Contractor shall notify the Traffic Signal Lab at Telephone (860) 258-0346 or (860) 258-0349 forty-five (45) days prior to starting work on computer controlled signalized intersections only. This notice will initiate work to be completed by others. The Contractor shall be responsible for any timely updates that need to be reported to this Unit for the successful coordination of work by others.

The Contractor shall notify the project engineer on construction projects, or the district permit agent on permit jobs, when all traffic signal work is completed. This will include all work at signalized intersections including loop replacements, adjusting existing traffic signals or any relocation work including handholes. The project engineer or district permit agent will notify the Division of Traffic Engineering to coordinate a field inspection of all work. Refer to Section 10.00 – General Clauses for Highway Illumination and Traffic Signal Projects, Article 10.00.10 and corresponding special provision.

UTILITY RELOCATIONS

The following utility relocations will be necessary to accommodate full Contractor access for the construction of the I-91 NB Interchange 29 and Route 5/15 work from Wethersfield to East Hartford. After award, the Contractor shall be responsible for coordination and scheduling with the utility companies to ensure the relocation work is performed prior to proceeding with the Contract.

Comcast

Airport Road (Hartford) -- Comcast will disconnect approximately 2450 LF of fiber optic cable for the relocation of Eversource Pole No. 390 and install an underground vault and split duct to route fiber optic cable to the relocated location for Pole No. 390. Comcast will reconnect 2450 LF of fiber after the new underground duct and vault is in place.

Eversource

Reserve Road (Hartford) -- An existing 20 conduit distribution duct bank will be relocated in the vicinity of the Charter Oak Bridge Pier 3 to clear an area required for the construction of the pier substructure. This will consist of 3 manholes and approximately 500’ of duct bank.

Airport Road (Hartford) – Eversource will relocate Poles 386, 390, 390-S, 391 and 9585 and shift all utilities. The poles will be relocated to facilitate staging and reconstruction operations. Eversource will also install approximately 275 LF of cable from MH No. 1718 to Pole 386. Pole 9585 and a new pole 11173 will be installed after Airport Road construction is completed. Service to an existing IMS cabinet will need to be relocated to accommodate relocation of Pole 386.

Main Street (East Hartford) – Eversource will relocate two poles, 6083 and 6084 and shift facilities to facilitate widening of Bridge No. 06043. Service to an existing illumination meter cabinet will need to be relocated to accommodate relocation of Pole 6084.

Light Tower (Castle Crown)

Main Street (East Hartford) – Light Tower will extend an existing underground conduit to Eversource relocated pole 6083.

Metropolitan District Commission (MDC)

Main Street (East Hartford) – There are water mains running in the north south direction along Main Street that will not be directly impacted by reconstruction of Bridge No. 06043, however there will be shoring towers installed on the pavement surface directly above at least one of these lines. MDC will be performing valve installation and potential shutoff services to avoid potential impacts. The Contractor shall be responsible for installing a monitoring system and coordinating with MDC.

Other Aerial Utilities

Each of the pole relocations on Airport Road and Main Street will include facility relocations by other utility companies who lease the Eversource poles. These facilities will be relocated as part of the pole relocations.

PROJECT NO. 63-703 STAGE CONSTRUCTION RESTRICTIONS

- The staging plans identify a suggested sequence of operations. Modifications to the suggested staging sequence shall be proposed to the Engineer for prior approval for the purpose of maintaining safety, efficiency and operational capacity of all facilities. Changes to staging that initiate work in an area, leaving the area unfinished for long periods of time then completing the work later will not be allowed. Work, once started, should be progressed to completion in a timely manner as directed by the Engineer.
- Maintain the existing number of lanes as required in the Limitations of Operations.
- Utility (overhead and underground) relocations and detailed above will be advanced as in accordance with the staging plans and prior to the stage in which construction is to occur in the respective area.
- Noise barrier walls shall be installed as soon as possible to help mitigate noise. Where possible, the new walls shall be constructed prior to removing the existing walls. When this is not possible, the Contractor shall include the removal of existing noise barrier and the installation of new noise barrier in the project schedule for review.
- Reserve Road at-grade track crossing shall be installed in Stage 1A.
- The profile of the roadways under Bridge Nos. 00813, 01466 and 00480 shall be lowered prior to constructing the superstructure to maintain minimum vertical clearances.
- Steel strengthening improvements for Bridges 06000A/B shall commence in Stage 1A and proceed to completion.
- Maintain continuous and uninterrupted service for all IMS and Illumination facilities in accordance with the specifications.
- The construction staging shown on the plans depict simultaneous work in both Hartford and East Hartford. However, work in East Hartford may begin at an earlier stage than shown in the plans, with approval of the Engineer. The Contractor may be required to make slight modifications to lane layouts and traffic shifts on the Charter Oak Bridge to ensure smooth traffic flow between the work on each side of the river.
- The establishment and opening of four (4) lanes to traffic on Route 15 Northbound on the Charter Oak Bridge shall not occur until all work in East Hartford is complete. The new lane and all lanes of Route 15 Northbound in East Hartford shall be complete, accepted, and functional (in service).
- There is no winter shutdown for this project. The Contractor shall coordinate all lane closures to ensure snow removal maintenance operations can proceed unimpeded by construction activities. The Contractor shall also coordinate all traffic shifts to ensure and maintain adequate delineation of pavement markings and pavement conditions.

Temporary Ramp and Roadway Closures

Prior to the commencement of any roadway closures, the Contractor must notify and coordinate with the appropriate Local and/or State emergency response agencies and provide them with the detour routes and temporary traffic patterns. Stage construction plans have been developed for the entire project with the goal of identifying the sequence of how the project can be constructed while maintaining the existing number of travel lanes throughout construction phase. This goal was achieved in all but three (3) locations I-91NB at Exit 28 (to ROUTE 5/15SB), ROUTE 5/15SB at

Exit 87 (to I-91 SB only) and Route 5 Entrance Ramp to ROUTE 15NB at Interchange 90, which will require closure.

DETOUR (DTR)-01 – Closure at Exit 28 (91NB to Route 5/15SB) - Currently under Bridge No. 00813, there are four travel lanes, 2 lanes for Route 5/15 NB, 1 lane for 5/15 SB and 1 lane from the Exit 28 Ramp. To stage the lowering of Route 5/15 under Bridge No. 00813, the entrance ramp lane from Exit 28 onto Route 5/15 SB requires closure. The closure of this connection allows the Contractor enough work area to lower Route 5/15 in four Stages, while maintaining the existing number of travel lanes on Route 5/15. The volume of traffic on this ramp is low and will result in minimal inconvenience.

The detour route for this closure is 91NB to Exit 29, Route 5/15 (Charter Oak Bridge) to Exit 90, Route 2 WB, to East River Drive, Right onto ROUTE 5/15SB..

Exit 87 (Route 5/15 SB to I-91 SB only) – This exit ramp provides connections to both the Brainard Road and a secondary connection from Route 5/15 SB to I-91 SB. While the connection from Route 5/15 SB to Brainard Road will remain open at all times, the connection to I-91 SB will be closed during Stages 1A through 1D for the lowering of the ramp under Bridge No. 01466. The closure of the secondary connection to I-91 SB can be expected **only after the completion of the shoulder modifications on Exit 86 (expected completion within 2 or 3 off-peak periods)**. Exit 86 serves as the main connection from Route 5/15 SB to I-91 SB.

DTR-02 – Main Street (Route 5) On-Ramp to Route 15 NB/I-84 EB – This entrance ramp closure is required during Stage 2. The preferred detour route for traffic north of the on-ramp is Main Street northbound, Silver Lane eastbound, and Roberts Street to the I-84 EB on-ramp. The expected duration of this ramp closure is between April 2020 and November 2020. The preferred detour route for traffic south of the on-ramp is Main Street southbound, Willow Street westbound, Route 2 WB using Exit 4 to East River Drive, Silver Lane eastbound, and Roberts Street to the I-84 EB on-ramp.

DTR-03 – Route 15 SB Exit 90 (East River Drive) Off-Ramp – This exit-ramp closure is required during Stage 1B and expected to be completed in 3 weeks during off-peak periods. The preferred detour route is Route 5/15 SB to I-91 SB using Exit 86, to Great Meadow Road using Exit 26, to Route 5/15 NB via I-91 NB Exit 29, to Route 2 WB via Route 5/15 NB Exit 90, to East River Drive via Route 2 WB Exit 4.

DTR-04 – East River Drive On-Ramp to Route 5/15 SB – This entrance-ramp closure is required during Stage 1B and expected to be completed in 3 weeks during off-peak periods. The preferred detour route is East River Drive eastbound to Silver Lane eastbound, to the Route 5/15 SB on-ramp.

DTR-05 – Reserve Road – The Reserve Road closure is required to replace the existing at-grade rail crossing. This work will expected to be started in April 2019 and be completed in July 2019 and will proceed as specified in Article 1.08.04, Limitations of Operations. The preferred detour

route for traffic using Reserve Road southbound is Wawarme Avenue westbound, Locust Street southbound, Airport Road eastbound, and Maxim Road northbound to Reserve Road northbound. The preferred detour route for traffic using Reserve Road northbound is Reserve Road southbound, Maxim Road southbound, Airport Road westbound, Locust Street northbound to Wawarme Avenue eastbound.

DTR-06 – Main Street Northbound – This roadway closure is required during off-peak periods. The expected duration of these periodic closures is approximately 15 days. The preferred detour route is the Route 5/15 NB on-ramp to Silver Lane, via the Route 15 NB Off-Ramp at Exit 91.

DTR-07 – Main Street Southbound – This roadway closure is required during off-peak periods. The expected duration of these periodic closures is approximately 15 days. The preferred detour route is East River Drive westbound to Route 2 EB, to Willow Street eastbound via Route 2 EB Exit 5, to Main Street northbound.

DTR-08 – Silver Lane Westbound – This roadway closure is required during off-peak periods. The expected duration of these periodic closures is approximately 5 days. The preferred detour route is Roberts Street to the I-84 WB on-ramp, to Governor Street eastbound via I-84 WB Exit 56, to Main Street southbound.

DTR-09 – Silver Lane Eastbound – This roadway closure is required during off-peak periods. The expected duration of these periodic closures is approximately 5 days. The preferred detour route is Main Street northbound to Pitkin Street, to I-84 EB, to Roberts Street via I-84 EB Exit 58.

DTR-11 – Route 15 SB Exit 86 (to I-91 SB) Off-Ramp – This off-ramp closure is required early in Stage 1A and expected to be completed in 2 or 3 days during off-peak periods. The preferred detour route is Route 5/15 SB to I-91 SB using Exit 87.

DTR-12 – Route 15 NB Exit 87 (to Brainard Road) Off-Ramp – This off-ramp closure is required during off-peak periods in Stages 1A, 1B and 1D. The preferred detour route is Route 5/15 NB to Exit 90 to East River Road (via Route 2 WB) to Route 15 SB to Exit 87.

DTR-13 – Route 15 SB to Route 15 SB Exit 86 (to I-91 SB) – This off-ramp closure is required during off-peak periods for the placement of girders (Bridge No. 06947) in Stage 3. The preferred detour route is Route 5/15 SB to Exit 86 to 91SB to Exit 26 (Great Meadow Road) to 91NB to Exit 28 to Route 15 SB.

OTHER CLOSURES

Materials Innovation and Recycling Authority (MIRA) Driveway, Reserve Road, Hartford

The existing driveway on the MIRA property which provides access through the facilities Gate 20 is within a construction easement obtained for the project. Access along this driveway shall be maintained at all times except for the following allowable driveway closures:

Stage 2 Construction: 4 month maximum driveway closure
Stage 4 Construction: 6 month maximum driveway closure

The driveway closures are anticipated for the staging of equipment (i.e. cranes) and work overhead during removal of the existing Exit 29 ramp structure and widening of the Charter Oak Bridge. Every effort shall be made to minimize the driveway closure durations. The work requiring the driveway closures shall be coordinated to include consecutive days thereby minimizing the number of individual closures needed during each stage. The Contractor shall provide 30 day notice to the Owner prior to initiating the driveway closures. See other special provisions related to property access and rights of way for additional information.

The MIRA driveway (Gate 20) is the emergency access point for local emergency response agencies (i.e. fire, police and ambulance) responding to incidents at the Power Block Facility and South Meadow Station Jet Turbine Facility. The Contractor shall notify these agencies and attend meetings (as required) prior to closing the driveway.

FINAL STAGE MILL AND OVERLAY

After all work is complete and the traffic control devices have been removed, the Contractor shall mill and pave a final course of pavement; install final joint on Bridge Nos. 00813, 01466 and 00480; place permanent pavement markings on I-91, SR 5/15 and ramps in accordance with the Signing and Pavement Marking Plans. This operation shall not be performed until traffic can be permanently placed in its final locations.

PROJECT NO. 159-191 STAGE CONSTRUCTION RESTRICTIONS

- The staging plans identify a suggested sequence of operations. Modifications to the suggested staging sequence shall be proposed to the Engineer for prior approval for the purpose of maintaining safety, efficiency and operational capacity of all facilities.
- Maintain the existing number of lanes as required in the Limitations of Operations.
- Noise barrier walls shall be installed immediately when walls and highway work permit to mitigate noise.
- Work zones with Temporary Precast Concrete Barrier Curb shall be limited to one mile continuous maximum sections in each direction unless approved by the Engineer.
- The intent of this project is to commence and complete the repairs and improvements to the pavement structure, bridge decks, storm drainage, median barrier and roadside safety within the first two full construction seasons to restore the highway and ramps to full serviceability.
- Stage number designations do not correlate to stage numbers from Project 63-703.
- Work on interchange ramps may occur independent of the staging of work on I-91 unless the work and detour conflicts with other work or detours.
- There is no winter shutdown for this project. The Contractor shall coordinate all lane closures to ensure snow removal maintenance operations can proceed unimpeded by construction activities. The Contractor shall also coordinate all traffic shifts to ensure and maintain adequate delineation of pavement markings and pavement conditions.

Temporary Ramp and Roadway Closures

DTR-01 – I-91 NB Exit 26 On-Ramp – This on-ramp closure is required during overnight work. The preferred detour route is Great Meadow Road westbound to I-91 SB, to Route 3 NB via I-91 SB Exit 25N, to the left exit to I-91 NB.

DTR-02 – I-91 SB Exit 26 Off-Ramp – This off-ramp closure is required during overnight work. The preferred detour route is I-91 SB to Route 3 NB via I-91 SB Exit 25N, to the left exit to I-91 NB, to the exit to Great Meadow Road.

DTR-03 – I-91 SB Exit 26 On-Ramp – This on-ramp closure is required during overnight work. The preferred detour route is Great Meadow Road westbound to Marsh Street southbound, to Main Street southbound, to Wells Road westbound, to the I-91 SB on-ramp at Exit 24 via Route 99 southbound (Silas Deane Highway).

DTR-04 – I-91 SB Exit 27 Off-Ramp – This off-ramp closure is required during overnight work. The preferred detour route is I-91 SB to Route 3 NB via I-91 SB Exit 25N, to the left exits to I- 91 NB, to I-91 NB, to Brainard Road via I-91 NB Exit 27, to Airport Road.

DTR-05 – I-91 NB Exits 25 and 26 Off-Ramp – This off-ramp closure is required during overnight work. The preferred detour route is I-91 NB, to Brainard Road via I-91 NB Exit 27, to I-91 SB via Airport Road and the cheater ramp, to I-91 SB Exit 25N to Route 3 NB.

DTR-06 – Route 3 SB to I-91 NB Off-Ramp – This off-ramp closure is required during overnight work. The preferred detour route is I-91 SB via Route 3 SB, I-91 SB Exit 24 to Route 99 southbound (Silas Deane Highway), to I-91 NB via Route 99 southbound (Silas Deane Highway), to Great Meadow Road via I-91 NB Exit 26.

DTR-07 – Route 3 SB to I-91 SB Off-Ramp – This off-ramp closure is required during overnight work. The preferred detour route is Route 3 SB (Maple Street), to I-91 SB on-ramp at Exit 24 via Route 99 southbound (Silas Deane Highway).

DTR-08 – Route 3 NB/SB Off-Ramp to Great Meadow Road – This off-ramp closure is required during overnight work. The preferred detour route is I-91 NB, to Brainard Road via I-91 NB Exit 27, to Brainard Road, to Airport Road to the entrance ramp to I-91 SB to Exit 26.

DTR-09 – Route 15 NB Exit 86 Off-Ramp to I-91 SB – This off-ramp closure is required during overnight work. The preferred detour route is RTE 15 NB Exit 87, to Brainard Road, to Airport Road to the entrance ramp to I-91 SB.

DTR-10 – I-91 SB Exit 25S Off-Ramp – This off-ramp closure is required during overnight work. The preferred detour route is I-91 SB Exit 24, to Route 99 northbound (Silas Deane Highway).

DTR-11 – I-91 SB Exit 25N Off-Ramp to Route 3 NB – This off-ramp closure is required during overnight work. The preferred detour route is I-91 SB Exit 24 to Route 99 southbound (Silas Deane Highway), to I-91 NB via Route 99 southbound (Silas Deane Highway), to Route 3 NB via I-91 NB Exit 25.

I-91 Final Mill and Overlay

After all work is complete and the temporary traffic control devices have been removed, the Contractor shall pave the final pavement course and place final pavement markings on I-91 in Wethersfield in accordance with the Signing and Pavement Marking Plans. Following the median construction on I-91 in Hartford (Project 63-703), the Contractor shall perform final mill and overlay operations on I-91 SB within the project limits in Hartford. In conjunction with this work, the Contractor will replace temporary bridge joints with permanent bridge joints on Bridge Nos. 00480, 01466 and 00813. This operation shall not be performed until traffic can be indefinitely placed in their final locations.

Article 1.08.04 - Limitation of Operations - Add the following:

In order to provide for traffic operations as outlined in the Special Provision "Maintenance and Protection of Traffic," the Contractor will not be permitted to perform any work, which will interfere with the described traffic operations on all project roadways as follows:

Route I-91/US Route 5/Route 15/Route 2

On the following State observed Legal Holidays:

New Year's Day
Good Friday,
Easter*
Memorial Day
Independence Day
Labor Day
Columbus Day
Thanksgiving Day**
Christmas Day

The following restrictions also apply:

On the day before and the day after any of the above Legal Holidays.

On the Friday, Saturday, and Sunday immediately preceding any of the above Holidays celebrated on a Monday.

On the Saturday, Sunday, and Monday immediately following any of the above Holidays celebrated on a Friday.

On the Thursday through Sunday during the Travelers Championship Golf Tournament.

In East Hartford, on the day of any event at Rentschler Field.

* From 6:00 a.m. the Thursday before the Holiday to 8:00 p.m. the Monday after the Holiday.

** From 6:00 a.m. the Wednesday before the Holiday to 8:00 p.m. the Monday after the Holiday.

During all other times

The Contractor shall maintain and protect traffic as shown on the accompanying "Limitation of Operations" charts, which dictate the minimum number of lanes that must remain open for each day of the week. The Contractor shall refer to the Notice to Contractor – Special Events and coordinate with the Engineer in advance of all events to ensure disruptions to the traveling public are mitigated or eliminated.

The Contractor will be allowed to halt traffic on Route I-91, US 5/Route 15 and Route 2 for a period not to exceed 15 minutes to perform necessary work for the erection and installation of overhead sign supports and signs, structural steel for Bridge No. 06947, Bridge No. 00813, Bridge No. 06000A and 06000B and for the removal of the existing bridge superstructure, as approved by the Engineer, between 12:01 a.m. and 5:00 a.m. on all non-Holiday days.

Ramps and Turning Roadways

Monday through Friday between 6:00 a.m. and 9:00 a.m. & between 3:00 p.m. and 6:00 p.m.

Airport Road (Hartford) and Main Street (East Hartford)

Monday through Friday between 6:00 a.m. and 7:00 p.m.
Saturday and Sunday between 10:00 a.m. and 6:00 p.m.

All Other Roadways

Monday through Friday between 6:00 a.m. and 9:00 a.m. & between 3:00 p.m. and 6:00 p.m.
Saturday and Sunday between 10:00 a.m. and 6:00 p.m.

Additional Lane Closure Restrictions

It is anticipated that work on adjacent projects will be ongoing simultaneously with this project. The Contractor shall be aware of those projects and anticipate that coordination will be required to maintain proper traffic flow at all times on all project roadways, in a manner consistent with these specifications and acceptable to the Engineer.

The Contractor will not be allowed to perform any work that will interfere with traffic operations on a roadway when traffic operations are being restricted on that same roadway, unless there is at least a one mile clear area length where the entire roadway is open to traffic or the closures have been coordinated and are acceptable to the Engineer. The one mile clear area length shall be measured from the end of the first work area to the beginning of the signing pattern for the next work area.

Weekend Lane Closures

The Contractor shall be permitted to close one lane on I-91 for a total of four (4) weekends between the hours of 9:00 p.m. on Friday to 6:00 a.m. on Monday for the purpose of performing contract operations. During these 4 weekend periods all 3's called out on the I-91 Limitation of Operations Charts as the minimum number of lanes to remain open shall be replaced by 2's, however in no case is the Contractor permitted to close the highway to traffic. The Contractor shall always keep at least one lane of traffic through these weekend lane closures.

The Contractor shall propose weekend closures at least thirty-two (32) days in advance of the scheduled closure for review and approval. The proposal shall consist of a plan that details public relations strategy; highway operations and advance messaging; incorporation of Smart Work Zone applications; proposed detours, alternate routes and traffic control plans; nature of the work, including

equipment and labor resources; specific locations of construction activity and length of the work zone; and specific proposed hours of operation.

Weekend Reserve Road Closure

The Contractor shall be permitted to close Reserve Road to all vehicular traffic for the replacement of the Market Industrial Spur railroad crossing. This single closure is to be scheduled during Stage 1A Phase 3 and is limited to the period from Monday through Thursday between 6:00 pm and 6:00 am. Traffic shall be detoured in accordance with the Reserve Road detour plan. The Contractor shall coordinate the closure weekend with the Engineer, City of Hartford and Railroad providing a minimum of 4 weeks' notice of the planned closure. The closure shall not be scheduled for any weekend with any significant events scheduled for the park at Charter Oak Landing.

INCIDENT MANAGEMENT SYSTEM

The Contractor will not be allowed to perform any work that will disrupt the normal operation of the Incident Management System (IMS) as follows:

On Monday through Friday from 5:00 a.m. to 9:00 p.m.

On Saturday and Sunday.

On the day before or after any of the Legal Holidays listed below:

New Years Day
Good Friday
Memorial Day
Independence Day
Labor Day
Thanksgiving Day
Christmas Day

On the Saturday, Sunday and Monday following Thanksgiving Day.

On the Friday, Saturday and Sunday immediately preceding any of the above Legal holidays celebrated on a Monday.

On the Saturday, Sunday and Monday immediately following any of the above Legal holidays celebrated on a Friday.

Route: Interstate 91 NB Location: Wethersfield/Hartford – Great Meadow Road On-Ramp to Exit 27 Off-Ramp Number of Through Lanes: 4							
Hour Beginning	Mon	Tue	Wed	Thu	Fri	Sat	Sun
Mid	1	1	1	1	1	1	1
1 AM	1	1	1	1	1	1	1
2 AM	1	1	1	1	1	1	1
3 AM	1	1	1	1	1	1	1
4 AM	1	1	1	1	1	1	1
5 AM	2	2	2	2	2	1	1
6 AM	E	E	E	E	E	1	1
7 AM	E	E	E	E	E	2	1
8 AM	E	E	E	E	E	2	2
9 AM	3	3	3	3	3	3	2
10 AM	3	3	3	3	3	3	3
11 AM	3	3	3	3	3	3	3
Noon	3	3	3	3	3	3	3
1 PM	3	3	3	3	E	3	3
2 PM	3	3	3	3	E	3	3
3 PM	E	E	E	E	E	3	3
4 PM	E	E	E	E	E	3	3
5 PM	E	E	E	E	E	3	3
6 PM	3	3	3	3	3	3	3
7 PM	3	3	3	3	3	3	3
8 PM	2	2	2	2	3	2	2
9 PM	2	2	2	2	2	2	2
10 PM	2	1	1	1	2	2	2
11 PM	1	1	1	1	2	2	2

On Holidays and within Holiday Periods, all Hours shall be 'E.'

'E' = maintain existing traffic operations = all available travel lanes, including exit only lanes, climbing lanes and all available shoulder widths shall be open to traffic during this period. During stage construction the existing number of lanes of traffic will be considered to be the number of lanes shown on the Maintenance and Protection of Traffic plans contained in the contract documents

Route: Interstate 91 NB Location: Hartford – Exit 27 Off-Ramp to Route 15 NB On-Ramp Merge Number of Through Lanes: 3							
Hour Beginning	Mon	Tue	Wed	Thu	Fri	Sat	Sun
Mid	1	1	1	1	1	1	1
1 AM	1	1	1	1	1	1	1
2 AM	1	1	1	1	1	1	1
3 AM	1	1	1	1	1	1	1
4 AM	1	1	1	1	1	1	1
5 AM	1	1	1	1	1	1	1
6 AM	E	E	E	E	E	1	1
7 AM	E	E	E	E	E	2	1
8 AM	E	E	E	E	E	2	2
9 AM	3	3	3	3	3	3	2
10 AM	3	3	3	3	3	3	3
11 AM	3	3	3	3	3	3	3
Noon	3	3	3	3	3	3	3
1 PM	3	3	3	3	3	3	3
2 PM	3	3	3	3	3	3	3
3 PM	E	E	E	E	E	3	3
4 PM	E	E	E	E	E	3	3
5 PM	E	E	E	E	E	3	3
6 PM	3	3	3	3	3	3	3
7 PM	2	2	2	2	3	2	2
8 PM	2	2	2	2	2	2	2
9 PM	2	2	2	2	2	2	2
10 PM	1	1	1	2	2	2	2
11 PM	1	1	1	1	1	1	1

On Holidays and within Holiday Periods, all Hours shall be 'E.'

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Route: Interstate 91 NB Location: Hartford – After Route 15 NB On-Ramp Merge Number of Through Lanes: 5							
Hour Beginning	Mon	Tue	Wed	Thu	Fri	Sat	Sun
Mid	1	1	1	1	1	1	1
1 AM	1	1	1	1	1	1	1
2 AM	1	1	1	1	1	1	1
3 AM	1	1	1	1	1	1	1
4 AM	1	1	1	1	1	1	1
5 AM	1	1	1	1	1	1	1
6 AM	E	E	E	E	E	1	1
7 AM	E	E	E	E	E	2	1
8 AM	E	E	E	E	E	2	2
9 AM	3	3	3	3	3	3	2
10 AM	3	3	3	3	3	3	3
11 AM	3	3	3	3	3	3	3
Noon	3	3	3	3	3	3	3
1 PM	3	3	3	3	3	3	3
2 PM	3	3	3	3	3	3	3
3 PM	E	E	E	E	E	3	3
4 PM	E	E	E	E	E	3	3
5 PM	E	E	E	E	E	3	3
6 PM	3	3	3	3	3	3	3
7 PM	2	2	2	2	3	2	2
8 PM	2	2	2	2	2	2	2
9 PM	2	2	2	2	2	2	2
10 PM	1	1	1	2	2	2	2
11 PM	1	1	1	1	1	1	1

On Holidays and within Holiday Periods, all Hours shall be 'E.'

'E' = maintain existing traffic operations = all available travel lanes, including exit only lanes, climbing lanes and all available shoulder widths shall be open to traffic during this period. During stage construction the existing number of lanes of traffic will be considered to be the number of lanes shown on the Maintenance and Protection of Traffic plans contained in the contract documents.

Route: Interstate 91 SB Location: Wethersfield/Hartford – Between Elm Street Overpass and Exit 27 Off-Ramp Number of Through Lanes: 3							
Hour Beginning	Mon	Tue	Wed	Thu	Fri	Sat	Sun
Mid	1	1	1	1	1	1	1
1 AM	1	1	1	1	1	1	1
2 AM	1	1	1	1	1	1	1
3 AM	1	1	1	1	1	1	1
4 AM	1	1	1	1	1	1	1
5 AM	2	2	2	2	2	1	1
6 AM	E	E	E	E	E	1	1
7 AM	E	E	E	E	E	2	1
8 AM	E	E	E	E	E	2	2
9 AM	3	3	3	3	3	3	2
10 AM	3	3	3	3	3	3	3
11 AM	3	3	3	3	3	3	3
Noon	3	3	3	3	3	3	3
1 PM	3	3	3	3	E	3	3
2 PM	3	3	3	3	E	3	3
3 PM	E	E	E	E	E	3	3
4 PM	E	E	E	E	E	3	3
5 PM	E	E	E	E	E	3	3
6 PM	3	3	3	3	3	3	3
7 PM	2	2	2	2	3	3	3
8 PM	2	2	2	2	3	3	3
9 PM	2	2	2	2	2	2	2
10 PM	1	1	1	2	2	2	2
11 PM	1	1	1	1	1	1	1

On Holidays and within Holiday Periods, all Hours shall be 'E.'

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Route: Interstate 91 SB Location: Hartford – Between Exit 27 Off-Ramp and On-Ramp from Whitehead Hwy Number of Through Lanes: 4							
Hour Beginning	Mon	Tue	Wed	Thu	Fri	Sat	Sun
Mid	1	1	1	1	1	1	1
1 AM	1	1	1	1	1	1	1
2 AM	1	1	1	1	1	1	1
3 AM	1	1	1	1	1	1	1
4 AM	1	1	1	1	1	1	1
5 AM	1	1	1	1	1	1	1
6 AM	E	E	E	E	E	1	1
7 AM	E	E	E	E	E	2	1
8 AM	E	E	E	E	E	2	2
9 AM	3	3	3	3	3	3	2
10 AM	3	3	3	3	3	3	2
11 AM	3	3	3	3	3	3	3
Noon	3	3	3	3	3	3	3
1 PM	3	3	3	3	3	3	3
2 PM	3	3	3	3	3	3	3
3 PM	E	E	E	E	E	3	3
4 PM	E	E	E	E	E	3	3
5 PM	E	E	E	E	E	3	3
6 PM	3	3	3	3	3	3	3
7 PM	2	2	2	2	2	2	2
8 PM	2	2	2	2	2	2	2
9 PM	2	2	2	2	2	2	2
10 PM	1	1	1	1	2	2	1
11 PM	1	1	1	1	1	1	1

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Route: Route 15 NB Location: Wethersfield/Hartford – Between End of Berlin Turnpike and Exit 87 Off-Ramp Number of Through Lanes: 2							
Hour Beginning	Mon	Tue	Wed	Thu	Fri	Sat	Sun
Mid	1	1	1	1	1	1	1
1 AM	1	1	1	1	1	1	1
2 AM	1	1	1	1	1	1	1
3 AM	1	1	1	1	1	1	1
4 AM	1	1	1	1	1	1	1
5 AM	1	1	1	1	1	1	1
6 AM	E	E	E	E	E	1	1
7 AM	E	E	E	E	E	1	1
8 AM	E	E	E	E	E	1	1
9 AM	2	2	2	2	2	1	1
10 AM	1	1	1	1	1	1	1
11 AM	1	1	1	1	1	1	1
Noon	1	1	1	1	2	2	1
1 PM	1	1	1	1	2	2	1
2 PM	1	1	2	2	2	2	1
3 PM	E	E	E	E	E	1	1
4 PM	E	E	E	E	E	1	1
5 PM	E	E	E	E	E	1	1
6 PM	2	2	2	2	2	1	1
7 PM	1	1	1	1	1	1	1
8 PM	1	1	1	1	1	1	1
9 PM	1	1	1	1	1	1	1
10 PM	1	1	1	1	1	1	1
11 PM	1	1	1	1	1	1	1

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Route: Route 15 NB Location: Hartford/East Hartford – Between Exit 87 Off-Ramp and I-84 Merge Number of Through Lanes: 2							
Hour Beginning	Mon	Tue	Wed	Thu	Fri	Sat	Sun
Mid	1	1	1	1	1	1	1
1 AM	1	1	1	1	1	1	1
2 AM	1	1	1	1	1	1	1
3 AM	1	1	1	1	1	1	1
4 AM	1	1	1	1	1	1	1
5 AM	1	1	1	1	1	1	1
6 AM	E	E	E	E	E	1	1
7 AM	E	E	E	E	E	1	1
8 AM	E	E	E	E	E	1	1
9 AM	2	2	2	2	2	2	1
10 AM	2	2	2	2	2	2	1
11 AM	2	2	2	2	2	2	2
Noon	2	2	2	2	2	2	2
1 PM	2	2	2	2	2	2	2
2 PM	2	2	2	2	2	2	2
3 PM	E	E	E	E	E	2	2
4 PM	E	E	E	E	E	2	2
5 PM	E	E	E	E	E	2	2
6 PM	2	2	2	2	2	2	2
7 PM	2	2	2	2	2	2	1
8 PM	1	1	2	2	2	2	1
9 PM	1	1	1	1	1	1	1
10 PM	1	1	1	1	1	1	1
11 PM	1	1	1	1	1	1	1

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Route: Route 15 SB Location: Wethersfield/Hartford – Between End of Berlin Turnpike and On-Ramp from 91SB/Airport Rd. Number of Through Lanes: 2							
Hour Beginning	Mon	Tue	Wed	Thu	Fri	Sat	Sun
Mid	1	1	1	1	1	1	1
1 AM	1	1	1	1	1	1	1
2 AM	1	1	1	1	1	1	1
3 AM	1	1	1	1	1	1	1
4 AM	1	1	1	1	1	1	1
5 AM	1	1	1	1	1	1	1
6 AM	E	E	E	E	E	1	1
7 AM	E	E	E	E	E	1	1
8 AM	E	E	E	E	E	1	1
9 AM	1	1	1	1	1	1	1
10 AM	1	1	1	1	1	1	1
11 AM	1	1	1	1	1	1	1
Noon	1	1	1	1	1	1	1
1 PM	1	1	1	1	2	2	1
2 PM	1	1	1	1	2	2	1
3 PM	E	E	E	E	E	1	1
4 PM	E	E	E	E	E	1	1
5 PM	E	E	E	E	E	1	1
6 PM	2	2	2	2	2	1	1
7 PM	1	1	1	1	1	1	1
8 PM	1	1	1	1	1	1	1
9 PM	1	1	1	1	1	1	1
10 PM	1	1	1	1	1	1	1
11 PM	1	1	1	1	1	1	1

On Holidays and within Holiday Periods, all Hours shall be 'E.'

'E' = maintain existing traffic operations = all available travel lanes, including exit only lanes, climbing lanes and all available shoulder widths shall be open to traffic during this period. During stage construction the existing number of lanes of traffic will be considered to be the number of lanes shown on the Maintenance and Protection of Traffic plans contained in the contract documents.

Route: Route 15 SB Location: Hartford – Between On-Ramp from 91SB/Airport Rd. and Exit 87 Off-Ramp Number of Through Lanes: 1							
Hour Beginning	Mon	Tue	Wed	Thu	Fri	Sat	Sun
Mid	1	1	1	1	1	1	1
1 AM	1	1	1	1	1	1	1
2 AM	1	1	1	1	1	1	1
3 AM	1	1	1	1	1	1	1
4 AM	1	1	1	1	1	1	1
5 AM	1	1	1	1	1	1	1
6 AM	E	E	E	E	E	1	1
7 AM	E	E	E	E	E	1	1
8 AM	E	E	E	E	E	1	1
9 AM	1	1	1	1	1	1	1
10 AM	1	1	1	1	1	1	1
11 AM	1	1	1	1	1	1	1
Noon	1	1	1	1	1	1	1
1 PM	1	1	1	1	1	1	1
2 PM	1	1	1	1	1	1	1
3 PM	E	E	E	E	E	1	1
4 PM	E	E	E	E	E	1	1
5 PM	E	E	E	E	E	1	1
6 PM	1	1	1	1	1	1	1
7 PM	1	1	1	1	1	1	1
8 PM	1	1	1	1	1	1	1
9 PM	1	1	1	1	1	1	1
10 PM	1	1	1	1	1	1	1
11 PM	1	1	1	1	1	1	1

On Holidays and within Holiday Periods, all Hours shall be 'E.'

'E' = maintain existing traffic operations = all available travel lanes, including exit only lanes, climbing lanes and all available shoulder widths shall be open to traffic during this period. During stage construction the existing number of lanes of traffic will be considered to be the number of lanes shown on the Maintenance and Protection of Traffic plans contained in the contract documents.

Route: Route 15 SB Location: Hartford/East Hartford – Between Exit 87 Off-Ramp and On-Ramp from I-84WB Number of Through Lanes: 2							
Hour Beginning	Mon	Tue	Wed	Thu	Fri	Sat	Sun
Mid	1	1	1	1	1	1	1
1 AM	1	1	1	1	1	1	1
2 AM	1	1	1	1	1	1	1
3 AM	1	1	1	1	1	1	1
4 AM	1	1	1	1	1	1	1
5 AM	1	1	1	1	1	1	1
6 AM	E	E	E	E	E	1	1
7 AM	E	E	E	E	E	1	1
8 AM	E	E	E	E	E	1	1
9 AM	2	2	2	2	2	2	1
10 AM	2	2	2	2	2	2	1
11 AM	2	2	2	2	2	2	2
Noon	2	2	2	2	2	2	2
1 PM	2	2	2	2	2	2	2
2 PM	2	2	2	2	2	2	2
3 PM	E	E	E	E	E	2	2
4 PM	E	E	E	E	E	2	2
5 PM	E	E	E	E	E	2	2
6 PM	2	2	2	2	2	2	2
7 PM	2	2	2	2	2	2	1
8 PM	1	1	1	2	2	1	1
9 PM	1	1	1	1	1	1	1
10 PM	1	1	1	1	1	1	1
11 PM	1	1	1	1	1	1	1

On Holidays and within Holiday Periods, all Hours shall be 'E.'

'E' = maintain existing traffic operations = all available travel lanes, including exit only lanes, climbing lanes and all available shoulder widths shall be open to traffic during this period. During stage construction the existing number of lanes of traffic will be considered to be the number of lanes shown on the Maintenance and Protection of Traffic plans contained in the contract documents.

Route: Route 2 EB Location: East Hartford – East of Charter Oak Bridge Overpass (MP 1.49 - 5.31) Number of Through Lanes: 2							
Hour Beginning	Mon	Tue	Wed	Thu	Fri	Sat	Sun
Mid	1	1	1	1	1	1	1
1 AM	1	1	1	1	1	1	1
2 AM	1	1	1	1	1	1	1
3 AM	1	1	1	1	1	1	1
4 AM	1	1	1	1	1	1	1
5 AM	1	1	1	1	1	1	1
6 AM	2	2	2	2	2	1	1
7 AM	2	2	2	2	2	1	1
8 AM	2	2	2	2	2	2	2
9 AM	2	2	2	2	2	2	2
10 AM	2	2	2	2	2	E	2
11 AM	2	2	2	2	2	E	2
Noon	2	2	2	2	2	E	2
1 PM	2	2	2	2	E	E	2
2 PM	2	2	2	2	E	E	2
3 PM	E	E	E	E	E	E	2
4 PM	E	E	E	E	E	E	2
5 PM	E	E	E	E	E	E	2
6 PM	2	2	E	E	E	E	2
7 PM	1	1	1	1	2	2	2
8 PM	1	1	1	1	2	2	2
9 PM	1	1	1	1	1	1	1
10 PM	1	1	1	1	1	1	1
11 PM	1	1	1	1	1	1	1

On Holidays and within Holiday Periods, all Hours shall be 'E.'

'E' = maintain existing traffic operations = all available travel lanes, including exit only lanes, climbing lanes and all available shoulder widths shall be open to traffic during this period. During stage construction the existing number of lanes of traffic will be considered to be the number of lanes shown on the Maintenance and Protection of Traffic plans contained in the contract documents.

Route: Route 2 EB Location: East Hartford – West of Charter Oak Bridge Overpass (MP 0.93 - 1.49) Number of Through Lanes: 3							
Hour Beginning	Mon	Tue	Wed	Thu	Fri	Sat	Sun
Mid	1	1	1	1	1	1	1
1 AM	1	1	1	1	1	1	1
2 AM	1	1	1	1	1	1	1
3 AM	1	1	1	1	1	1	1
4 AM	1	1	1	1	1	1	1
5 AM	1	1	1	1	1	1	1
6 AM	2	2	2	2	2	1	1
7 AM	2	2	2	2	2	1	1
8 AM	2	2	2	2	2	2	2
9 AM	2	2	2	2	2	2	2
10 AM	2	2	2	2	2	3	2
11 AM	2	2	2	2	2	3	2
Noon	2	2	2	2	2	3	2
1 PM	2	2	2	2	3	3	2
2 PM	2	2	2	2	3	3	2
3 PM	3	3	3	3	E	3	2
4 PM	3	3	3	3	E	3	2
5 PM	3	3	3	3	E	3	2
6 PM	2	2	3	3	E	3	2
7 PM	1	1	1	1	2	2	2
8 PM	1	1	1	1	2	2	2
9 PM	1	1	1	1	1	1	1
10 PM	1	1	1	1	1	1	1
11 PM	1	1	1	1	1	1	1

On Holidays and within Holiday Periods, all Hours shall be 'E.'

'E' = maintain existing traffic operations = all available travel lanes, including exit only lanes, climbing lanes and all available shoulder widths shall be open to traffic during this period. During stage construction the existing number of lanes of traffic will be considered to be the number of lanes shown on the Maintenance and Protection of Traffic plans contained in the contract documents.

Route: Route 2 WB Location: East Hartford – At Charter Oak Bridge Overpass (MP 0.92 - 1.85) Number of Through Lanes: 3							
Hour Beginning	Mon	Tue	Wed	Thu	Fri	Sat	Sun
Mid	1	1	1	1	1	1	1
1 AM	1	1	1	1	1	1	1
2 AM	1	1	1	1	1	1	1
3 AM	1	1	1	1	1	1	1
4 AM	1	1	1	1	1	1	1
5 AM	1	1	1	1	1	1	1
6 AM	E	E	E	E	E	1	1
7 AM	E	E	E	E	E	2	1
8 AM	3	3	3	3	3	2	1
9 AM	2	2	2	2	2	2	2
10 AM	2	2	2	2	2	2	2
11 AM	2	2	2	2	2	2	2
Noon	2	2	2	2	2	2	2
1 PM	2	2	2	2	2	2	2
2 PM	2	2	2	2	2	2	2
3 PM	3	3	3	3	3	2	2
4 PM	3	3	3	3	3	2	2
5 PM	2	2	2	2	3	2	3
6 PM	2	2	2	2	2	2	3
7 PM	2	2	2	2	2	2	2
8 PM	1	1	1	1	1	2	2
9 PM	1	1	1	1	1	2	1
10 PM	1	1	1	1	1	2	1
11 PM	1	1	1	1	1	2	1

On Holidays and within Holiday Periods, all Hours shall be 'E.'

'E' = maintain existing traffic operations = all available travel lanes, including exit only lanes, climbing lanes and all available shoulder widths shall be open to traffic during this period. During stage construction the existing number of lanes of traffic will be considered to be the number of lanes shown on the Maintenance and Protection of Traffic plans contained in the contract documents.

Article 1.08.07 - Determination of Contract Time:

Delete the second, third and fourth paragraphs and replace them with the following:

When the contract time is on a calendar day basis, it shall be the number of consecutive calendar days stated in the contract, INCLUDING the time period from December 1 through March 31 of each year. The contract time will begin on the effective date of the Engineer's order to commence work, and it will be computed on a consecutive day basis, including all Saturdays, Sundays, Holidays, and non-work days.

1.08.08 - Extension of Time:

Delete the sixth paragraph, "If an approved extension of Contract time…. the following April 1".

Article 1.08.09 - Failure to Complete Work on Time:

Delete the second paragraph, "If the last day...the project is substantially completed" *and replace it with* "Liquidated damages as specified in the Contract shall be assessed against the Contractor per calendar day from that day until the date on which the project is substantially completed.".

SECTION 1.10 - ENVIRONMENTAL COMPLIANCE

Article 1.10.03 Water Pollution Control:

Add the following after Required Best Management Practices Number 13.

14. The Contractor is hereby notified that the Bald Eagle *(Haliaeetus leucocephalus) may* be present at or near the project site during the construction period. Bald Eagles are currently listed as a state threatened species as well as protected under both the Federal Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act. These laws prohibit disturbing the birds while they are roosting, feeding, or nesting. There is the potential that Bald Eagles may roost in some of the trees within or adjacent to the project area, or forage in the river / waterbody near the project area. Roosting activity would include perching in the trees, either temporarily or for over-night periods. New construction work may present an increased risk of disturbance when the birds are roosting or feeding nearby. To protect eagles during the non-breeding months (Aug. – Jan.), machinery and equipment shall maintain a minimum of 600 feet from areas of high eagle usage, most importantly, winter roosting sites. The cutting of large trees must be reviewed and approved by a biologist from the Department of Transportation's Office of Environmental Planning (OEP) before any clearing and grubbing activities commence.

Though Bald Eagles are not known to nest within the project site presently, this information must be confirmed throughout the project duration. In order to protect this species, if a nest is observed and confirmed within 600 feet of the project area, the proposed construction activities shall be completed during non-nesting season months (Aug. – Jan.) within 600 feet of the nest. If there is no confirmed nest within 600 feet of the project area work may commence at any time.

Known areas (approximates) of winter roost sites and confirmed nest information will be provided by the OEP, as exact locations are not given in order to further protect the species.

Personnel working on, or involved in the project, shall be apprised of the presence of Bald Eagles within the vicinity of the project limits. Photographs of the Bald Eagles and the laws protecting them will be provided by OEP in the form of species ID sheets. These ID sheets shall be posted in the Contractor and DOT field offices for the duration of the project.

15. The peregrine falcon (*Falco peregrinus*) is a State threatened species and Connecticut's largest falcon, measuring up to 20 inches. Adults are slate gray above and pale underneath with fine bars and spots of black; they have long pointed wings with a narrow tail. Young falcons have the same composition but are darker underneath and browner all over. Peregrine falcons have adapted to life in urban settings. In Connecticut, they sometimes utilize bridges for nesting and brood rearing purposes. Peregrines will actively and aggressively defend the nest. The peregrine will attack anyone or anything that comes within the area of its nest. The peregrine falcon nesting season occurs between the months of April and July. For this reason, special conditions regarding the timing of work on the structures, and immediate area that have nesting falcons must be adhered to.

In order to protect this specie and project personnel, any construction and/or inspection activities which are within 500 feet of an identified nest shall not be permitted during nesting season (between April 1st and July 31st.) Any change in construction sequencing or timing affecting work within 500 feet of a known nest shall not be permitted.

The Contractor shall, through the Engineer, at least 10 days prior to the commencement of any construction activities, arrange for a CT DOT Environmental Inspector from the Office of Environmental Planning (OEP) or their authorized delegate to be available to meet and identify the nest location as well as discuss proper protocol for maintaining environmental commitments made to the protection of this species and habitat.

This species is protected by State laws which prohibit killing, harming, taking, or keeping them in your possession. Workers shall be notified of the existence of peregrine falcons in the area and be apprised of the laws protecting them. Photographs of, and the laws protecting, peregrine falcons shall be posted in the Contractor's and DOT field offices (species ID sheets will be provided by OEP). Any observations of this species are to be immediately reported to the Department.

SECTION 2.86 - DRAINAGE TRENCH EXCAVATION, ROCK IN DRAINAGE TRENCH EXCAVATION

2.86.01—Description
2.86.03—Construction Methods
2.86.04—Method of Measurement
2.86.05—Basis of Payment

2.86.01—Description: Drainage trench excavation consists of the excavation necessary for the proper installation of drainage structures, pipes, pipe ends and any other incidental drainage items.

It shall include earth and rock excavation, removal of existing pipes, dewatering, backfill, and disposal of materials; to the trench limits described herein, to the dimensions shown on the plans, or as directed by the Engineer.

Classifications:

(1) Drainage Trench Excavation will include only the excavation necessary for the construction of the drainage items and the removals specified above.

(2) Rock in Drainage Trench Excavation, insofar as it applies to drainage trench excavation, shall be defined as **1/2 cubic yard or more** in volume of the following obstructions removed from the limits of the drainage trench:

(a) rock in definite ledge formation
(b) boulders, or portions of boulders
(c) cement masonry structures
(d) concrete or reinforced concrete structures
(e) reinforced concrete pipe
(f) subsurface concrete pavement or concrete base

The removal shall be as indicated or directed from within the limits defined in 2.86.03 for drainage trench excavation.

2.86.03—Construction Methods:

(1) Drainage Trench Excavation Limits:

Horizontal Limits: Trench widths for pipes, pipe ends, pipe-arches, and drainage structures shall be as follows:

(a) 2 feet greater than the nominal inside diameter of circular pipe or nominal inside span of elliptical pipe or pipe-arch for such diameters or spans of less than 30 inches
(b) 3 feet greater than the nominal inside diameter of circular pipe or the nominal inside span of elliptical pipe or pipe-arch for such diameters or spans that are 30 inches or greater
(c) 4 feet greater than the nominal inside diameter or nominal horizontal inside span for pipe-arches fabricated from structural plates
(d) 2 feet beyond the neat lines of all exterior or foundation walls of drainage structures

Vertical Limits: Trench depths shall extend vertically as follows:

(a) From the bottom of the trench to the bottom of the roadway excavation, or in areas away from roadway excavation, to the top of existing ground surface.

(b) Where drainage pipe is to be laid in a fill area, the embankment shall be placed and compacted to a minimum elevation 12 inches above the top of the proposed pipe, whereupon the drainage trench excavation shall be performed and the pipe installed.

(2) Drainage Trench Excavation: Drainage trench excavation shall be made in conformity with the requirements of the plans, or as directed by the Engineer. The Contractor shall furnish and employ such shores, braces, pumps, or ancillary equipment as needed for the proper protection of property, proper completion of the work, as well as safety of the public and employees of both the Contractor and the Department. All bracing and shoring shall be removed when no longer required for the construction or safety of the work. When required, the Contractor shall provide or have on the Site at all times any OSHA certification for equipment to be used, per 1.07.07. For support of trenches greater than 10 feet in depth, working drawings shall be submitted, in accordance with 1.05.02. The Contractor shall control erosion and sedimentation at trench locations and ensure that pumped water from the drainage excavation is discharged in accordance with the requirements of 1.10.

Where a firm foundation is not encountered at the grades established due to unsuitable material, such as soft, spongy, or unstable soil, the unsuitable material shall be removed and replaced with approved backfill, thoroughly compacted in lifts not to exceed 6 inches, for the full trench width. The Engineer shall be notified prior to removal of the unsuitable material in order to determine the depth of removal necessary.

After the excavation is complete, the Contractor shall notify the Engineer and no drainage structure or material shall be placed in the excavated area until the Engineer has approved the depth of excavation and the character of the foundation material.

(3) Rock in Drainage Trench Excavation:

(a) Rock in Drainage Trench Excavation - Ledge: When rock in definite ledge form is encountered, the Contractor shall excavate a minimum of 12 inches below the bottom of the proposed pipe or drainage structure; and this depth shall be filled with bedding material (as specified in M.08.03-1) below the proposed pipe; or granular fill (as specified in M.02.01) below the proposed drainage structure, which shall be thoroughly compacted in lifts not to exceed 6 inches.

(b) Rock in Drainage Trench Excavation - Boulders: When boulders are encountered, the Contractor shall remove them from the trench and if backfill is required, the void shall be filled with bedding material, surplus excavated material (as specified in 2.02.03-8) or granular fill which shall be thoroughly compacted in lifts not to exceed 6 inches.

(c) Rock in Drainage Trench Excavation –Structures: When cement masonry, concrete or reinforced concrete structures are encountered within the drainage trench limits, the Contractor shall remove the structure in its entirety or as directed by the Engineer, and if backfill is required, the void shall be filled with bedding material, surplus excavated material or granular fill which shall be thoroughly compacted in lifts not to exceed 6 inches.

(4) Backfill: Suitable material excavated from the drainage trench shall be used as backfill material prior to consideration of using any other source of backfill. Backfill material used shall be of a quality satisfactory to the Engineer and shall be free from large or frozen lumps, wood and other extraneous material. Rock fill or stones larger than 5 inches shall not be placed within 1 foot of the drainage structure or pipe. The grading shall be

completed to the lines shown on the plans, or as ordered, by refilling to the required elevation with approved material, placed in layers not to exceed 6 inches in depth after compaction, which shall be thoroughly compacted with equipment approved by the Engineer.

All surplus or unsuitable material shall be removed and disposed of as directed. Should additional material be required for backfilling, it may be obtained from the Project surplus excavation in accordance with 2.02.03-8 or from borrow pits, gravel pits, or elsewhere as directed by the Engineer.

2.86.04—Method of Measurement:

Drainage Trench Excavation: Drainage trench excavation will not be measured for payment.

If granular fill or borrow is required to replace unsuitable material it will be measured for payment as directed by the Engineer.

Rock in Drainage Trench Excavation: If any material meeting the definition of Rock in Drainage Trench Excavation is encountered, the Contractor shall strip it of sufficient overlying material to allow for proper measurement and shall then notify the Engineer that the rock surface is ready for measurement. If the Contractor fails to give such notice, the Engineer will presume that the measurements taken at the time the Engineer first saw the material in question will give the true quantity of excavation.

Rock in Drainage Trench Excavation will be measured according to the classification provided in 2.86.01 and within the drainage trench excavation limits provided in 2.86.03.

For the removal of underground obstructions, as classified in 2.86.01-2, the measurement shall be the actual volume of rock removed (1/2 cubic yard or more) as approved by the Engineer.

Rock in Drainage Trench Excavation will not be measured for payment in fills.

Bedding Material or other suitable fill, as specified in 2.86.03(3), used to fill voids after rock is excavated will not be measured for payment.

2.86.05—Basis of Payment:

Drainage Trench Excavation: There will be no direct payment for drainage trench excavation required for the installation of drainage pipes, pipe ends, catch basins, drop inlets, manholes, and other drainage structures, or any other incidental drainage work including materials, tools, equipment and labor necessary to complete the drainage trench excavation in conformity with the plans or as directed by the Engineer.

There will be no direct payment for backfill or disposal of surplus material necessary for the satisfactory completion of this work.

There will be no direct payment made for shoring, bracing, dewatering, or for material or equipment necessary for the satisfactory completion of the work.

Where called for on the plans to install temporary earth retaining systems for the support of existing facilities, pavement, utilities, or for other constraints, payment will be made in accordance with such items in the Contract.

If granular fill or borrow is used to replace unsuitable material, payment will be made at the respective Contract unit prices, or in the absence of such items in the Contract, as Extra Work in accordance with 1.04.05.

Rock in Drainage Trench Excavation: When rock, conforming to the description in 2.86.01 is encountered within the limits of drainage trench excavation, its removal will be classified and

paid for at the Contract unit price per cubic yard for "Rock in Drainage Trench Excavation 0' – 10' Deep," or "Rock in Drainage Trench Excavation 0' – 20' Deep," as the case may be.

Those portions of drainage trench excavation classified and paid for as "Rock in Drainage Trench Excavation" of the various depths will be the actual volumes of rock excavated within the limits for drainage trench excavation, at the applicable bottom depth price.

Where no item or items for "Rock in Drainage Trench Excavation" at the applicable depth appear in the proposal and rock is encountered in drainage trench excavation, its removal will be paid for as Extra Work in accordance with 1.04.05.

When excavation is necessary in fill, no such excavation will be paid for as "Rock in Drainage Trench Excavation."

When excavation is necessary for any purpose other than drainage-related items, no such excavation will be paid under this item.

Bedding material or any other suitable material used to fill voids vacated by excavated rock will not be paid for but shall be included in the unit price per cubic yard for "Rock in Drainage Trench Excavation."

Pay Item	Pay Unit
Rock in Drainage Trench Excavation 0' - 10' Deep	c.y.
Rock in Drainage Trench Excavation 0' - 20' Deep	c.y.

SECTION 4.06 - BITUMINOUS CONCRETE

Section 4.06 is being deleted in its entirety and replaced with the following:

4.06.01—Description
4.06.02—Materials
4.06.03—Construction Methods
4.06.04—Method of Measurement
4.06.05—Basis of Payment

4.06.01—Description: Work under this section shall include the production, delivery, placement, and compaction of an uniform textured, non-segregated, smooth bituminous concrete pavement to the grade and cross section shown on the plans.

The terms listed below as used in this specification are defined as:

Bituminous Concrete: A composite material consisting of prescribed amounts of asphalt binder, and aggregates. Asphalt binder may also contain additives engineered to modify specific properties and/or behavior of the composite material. References to bituminous concrete apply to all of its forms, such as those identified as hot-mix asphalt (HMA),or polymer-modified asphalt (PMA).

Bituminous Concrete Plant (Plant): A structure where aggregates and asphalt binder are combined in a controlled fashion into a bituminous concrete mixture suitable for forming pavements and other paved surfaces.

Course: A continuous layer (a lift or multiple lifts) of the same bituminous concrete mixture placed as part of the pavement structure.

Density Lot: The total tonnage of all bituminous concrete placed in a single lift and as defined in Article 4.06.03.

Disintegration: Erosion or fragmentation of the pavement surface which can be described as polishing, weathering-oxidizing, scaling, spalling, raveling, or formation of potholes.

Dispute Resolution: A procedure used to resolve conflicts between the Engineer and the Contractor's test results that may affect payment.

Hot Mix Asphalt (HMA): A bituminous concrete mixture typically produced at 325°F.

Job Mix Formula (JMF): A recommended aggregate gradation and asphalt binder content to achieve the required mixture properties.

Lift: An application of a bituminous concrete mixture placed and compacted to a specified thickness in a single paver pass.

Percent Within Limits (PWL): The percentage of the lot falling between the Upper Specification Limit (USL) and the Lower Specification Limit (LSL).

Polymer-Modified Asphalt (PMA): A bituminous concrete mixture containing a polymer modified asphalt binder and using a qualified warm mix technology.

Production Lot: The total tonnage of a bituminous concrete mixture from a single source that may receive an adjustment.

Production Sub Lot: Portion of the production lot typically represented by a single sample.

Quality Assurance (QA): All those planned and systematic actions necessary to provide ConnDOT the confidence that a Contractor will perform the work as specified in the Contract.

Quality Control (QC): The sum total of activities performed by the vendor (Producer, Manufacturer, and Contractor) to ensure that a product meets contract specification requirements.

Superpave: A bituminous concrete mix design used in mixtures designated as "S*" Where "S" indicates Superpave and * indicates the sieve related to the nominal maximum aggregate size of the mix.

Segregation: A non-uniform distribution of a bituminous concrete mixture in terms of gradation, temperature, or volumetric properties.

Warm Mix Asphalt (WMA) Technology: A qualified additive or technology that may be used to produce a bituminous concrete at reduced temperatures and/or increase workability of the mixture.

4.06.02—Materials: All materials shall conform to the requirements of Section M.04.

1. Materials Supply: The bituminous concrete mixture must be from one source of supply and originate from one Plant unless authorized by the Engineer.

2. Recycled Materials: Reclaimed Asphalt Pavement (RAP), Crushed Recycled Container Glass (CRCG), Recycled Asphalt Shingles (RAS), or crumb rubber (CR) from recycled tires may be incorporated in bituminous concrete mixtures in accordance with Project Specifications.

4.06.03—Construction Methods:

1. Material Documentation: All vendors producing bituminous concrete must have Plants with automated vehicle-weighing scales, storage scales, and material feeds capable of producing a delivery ticket containing the information below.

a. "State of Connecticut" printed on ticket.
b. Name of producer, identification of Plant, and specific storage silo if used.
c. Date and time.
d. Mixture Designation; Mix type and level Curb mixtures for machine-placed curbing must state "curb mix only".
e. If WMA Technology is used, the additive name and dosage rate or water injection rate must be listed.
f. Net weight of mixture loaded into the vehicle (When RAP and/or RAS is used the moisture content shall be excluded from mixture net weight).
g. Gross weight (equal to the net weight plus the tare weight or the loaded scale weight).
h. Tare weight of vehicle (Daily scale weight of the empty vehicle).
i. Project number, purchase order number, name of Contractor (if Contractor other than Producer).
j. Vehicle number - unique means of identification vehicle.
k. For Batch Plants, individual aggregate, recycled materials, and virgin asphalt max/target/min weights when silos are not used.
l. For every mixture designation the running daily total delivered and sequential load number.

The net weight of mixture loaded into the vehicle must be equal to the cumulative measured weights of its components.

The Contractor must notify the Engineer immediately if, during production, there is a malfunction of the weight recording system in the automated Plant. Manually written tickets containing all required information will be allowed for no more than one hour.

The State reserves the right to have an inspector present to monitor batching and /or weighing operations.

2. Transportation of Mixture: The mixture shall be transported in vehicles that are clean of all foreign material, excessive coating or cleaning agents, and, that have no gaps through which mixture might spill. Any material spilled during the loading or transportation process shall be quantified by re-weighing the vehicle. The Contractor shall load vehicles uniformly so that segregation is minimized. Loaded vehicles shall be tightly covered with waterproof covers acceptable to the Engineer. Mesh covers are prohibited. The cover must minimize air infiltration. Vehicles found not to be in conformance shall not be loaded.

Vehicles with loads of bituminous concrete being delivered to State projects must not exceed the statutory or permitted load limits referred to as gross vehicle weight (GVW). The Contractor shall furnish a list and allowable weights of all vehicles transporting mixture.
The State reserves the right to check the gross and tare weight of any vehicle. If the gross or tare weight varies from that shown on the delivery ticket by more than 0.4 percent, the Engineer will recalculate the net weight. The Contractor shall correct the discrepancy to the satisfaction of the Engineer.

If a vehicle delivers mixture to the project and the delivery ticket indicates that the vehicle is overweight, the load may not be rejected but a "Measured Weight Adjustment" will be taken in accordance with Article 4.06.04.

Vehicle body coating and cleaning agents must not have a deleterious effect on the mixture. The use of solvents or fuel oil, in any concentration, is prohibited for the coating of vehicle bodies.

For each delivery, the Engineer shall be provided a clear, legible copy of the delivery ticket.

3. Paving Equipment: The Contractor shall have the necessary paving and compaction equipment at the project site to perform the work. All equipment shall be in good working order and any equipment that is worn, defective or inadequate for performance of the work shall be repaired or replaced by the Contractor to the satisfaction of the Engineer. During the paving operation, the use of solvents or fuel oil, in any concentration, is prohibited as a release agent or cleaner on any paving equipment (i.e., rollers, pavers, transfer devices, etc.).

Refueling or cleaning of equipment is prohibited in any location on the project where fuel or solvents might come in contact with paved areas or areas to be paved. Solvents used in cleaning mechanical equipment or hand tools shall be stored off of areas paved or to be paved.

Pavers: Each paver shall have a receiving hopper with sufficient capacity to provide for a uniform spreading operation and a distribution system that places the mix uniformly, without segregation. The paver shall be equipped with and use a vibratory screed system with heaters or burners. The screed system shall be capable of producing a finished surface of the required evenness and texture without tearing, shoving, or gouging the mixture. Pavers with extendible screed units as part of the system shall have auger extensions and tunnel extenders as necessary. Automatic screed controls for grade and slope shall be used at all times unless otherwise authorized by the Engineer. The controls shall automatically adjust the screed to compensate for irregularities in the preceding course or existing base. The controls shall maintain the proper transverse slope and be readily adjustable, and shall operate from a fixed or moving reference such as a grade wire or floating beam.

Rollers: All rollers shall be self-propelled and designed for compaction of bituminous concrete. Rollers types shall include steel-wheeled, pneumatic or a combination thereof. Rollers that operate in a dynamic mode shall have drums that use a vibratory or oscillatory system or combination of. Vibratory rollers shall be equipped with indicators for amplitude, frequency and speed settings/readouts to measure the impacts per foot during the compaction process. Oscillatory rollers shall be equipped with frequency indicators. Rollers can operate in the dynamic mode using the oscillatory system on concrete structures such as bridges and catch basins if at the lowest frequency setting.

Pneumatic tire rollers shall be equipped with wide-tread compaction tires capable of exerting an average contact pressure from 60 to 90 pounds per square inch uniformly over the surface, The Contractor shall furnish documentation to the Engineer regarding tire size; pressure and loading

to confirm that the proper contact pressure is being developed and that the loading and contact pressure is uniform for all wheels.

Lighting: For paving operations, which will be performed during hours of darkness, the paving equipment shall be equipped with lighting fixtures as described below, or with an approved equal. Lighting shall minimize glare to passing traffic. The lighting options and minimum number of fixtures are listed in Tables 4.06-1 and 4.06-2:

TABLE 4.06-1: Minimum Paver Lighting

Option	Fixture Configuration	Fixture Quantity	Requirement
1	Type A	3	Mount over screed area
	Type B (narrow) or Type C (spot)	2	Aim to auger and guideline
	Type B (wide) or Type C (flood)	2	Aim 25 feet behind paving machine
2	Type D Balloon	2	Mount over screed area

TABLE 4.06-2: Minimum Roller Lighting

Option	Fixture Configuration*	Fixture Quantity	Requirement
1	Type B (wide)	2	Aim 50 feet in front of and behind roller
	Type B (narrow)	2	Aim 100 feet in front of and behind roller
2	Type C (flood)	2	Aim 50 feet in front of and behind roller
	Type C (spot)	2	Aim 100 feet in front of and behind roller
3	Type D Balloon	1	Mount above the roller

*All fixtures shall be mounted above the roller.

Type A: Fluorescent fixture shall be heavy-duty industrial type. Each fixture shall have a minimum output of 8,000 lumens. The fixtures shall be mounted horizontally, and be designed for continuous row installation.

Type B: Each floodlight fixture shall have a minimum output of 18,000 lumens.

Type C: Each fixture shall have a minimum output of 19,000 lumens.

Type D: Balloon light: Each balloon light fixture shall have a minimum output of 50,000 lumens, and emit light equally in all directions.

Material Transfer Vehicle (MTV): A MTV shall be used when placing a bituminous concrete surface course as indicated in the contract documents.

The MTV must be a vehicle specifically designed for the purpose of delivering the bituminous concrete mixture from the delivery vehicle to the paver. The MTV must continuously remix the bituminous concrete mixture throughout the placement process.

The use of a MTV will be subject to the requirements stated in Article 1.07.05- Load Restrictions. The Engineer may limit the use of the vehicle if it is determined that the use of the MTV may damage highway components, utilities, or bridges. The Contractor shall submit to the Engineer at time of pre-construction the following information:

- The make and model of the MTV.
- The individual axle weights and axle spacing for each piece of paving equipment (haul vehicle, MTV and paver).
- A working drawing showing the axle spacing in combination with all pieces of equipment that will comprise the paving echelon.

4. Test Section: The Engineer may require the Contractor to place a test section whenever the requirements of this specification or Section M.04 are not met.

The Contractor shall submit the quantity of mixture to be placed and the location of the test section for review and approval by the Engineer. The same equipment used in the construction of a passing test section shall be used throughout production.

If a test section fails to meet specifications, the Contractor shall stop production, make necessary adjustments to the job mix formula, Plant operations, or procedures for placement and compaction. The Contractor shall construct test sections, as allowed by the Engineer, until all the required specifications are met. All test sections shall also be subject to removal as set forth in Article 1.06.04.

5. Transitions for Roadway Surface: Transitions shall be formed at any point on the roadway where the pavement surface deviates, vertically, from the uniform longitudinal profile as specified on the plans. Whether formed by milling or by bituminous concrete mixture, all transition lengths shall conform to the criteria below unless otherwise specified.

Permanent Transitions: Defined as any gradual change in pavement elevation that remains as a permanent part of the work.

A transition shall be constructed no closer than 75 feet from either side of a bridge expansion joint or parapet. All permanent transitions, leading and trailing, shall meet the following length requirements:

a) Posted speed limit is greater than 35 MPH: 30 feet per inch of elevation change.
b) Posted speed limit is 35 MPH or less: 15 feet per inch of elevation change.

In areas where it is impractical to use the above described permanent transition lengths the use of a shorter permanent transition length may be permitted when approved by the Engineer.

Temporary Transitions: A temporary transition is defined as a transition that does not remain a permanent part of the work. All temporary transitions shall meet the following length requirements:

a) Posted speed limit is greater than 50 MPH
   (1) Leading Transitions = 15 feet per inch of vertical change (thickness)
   (2) Trailing Transitions = 6 feet per inch of vertical change (thickness)
b) Posted speed limit is 40, 45, or 50 MPH
   (1) Leading and Trailing = 4 feet per inch of vertical change (thickness)
c) Posted speed limit is 35 MPH or less
   (1) Leading and Trailing = 3 feet per inch of vertical change (thickness)

Note: Any temporary transition to be in-place over the winter shutdown period or during extended periods of inactivity (more than 14 calendar days) shall conform to the greater than 50 MPH requirements shown above.

6. Spreading and Finishing of Mixture: Prior to the placement of the mixture, the underlying base course shall be brought to the plan grade and cross section within the allowable tolerance.

Immediately before placing a bituminous concrete lift, a uniform coating of tack coat shall be applied to all existing underlying pavement surfaces and on the exposed surface of a wedge joint. Such surfaces shall be clean and dry. Sweeping or other means acceptable to the Engineer shall be used.

The mixture shall not be placed whenever the surface is wet or frozen.

The Engineer may verify the mixture temperature by means of a probe or infrared type of thermometer. The Engineer may reject the load based on readings from a probe type thermometer and the specify temperature in the quality control plan (QCP) for placement.

Tack Coat Application: The tack coat shall be applied by a pressurized spray system that results in uniform overlapping coverage at an application rate of 0.03 to 0.05 gallons per square yard for a non-milled surface and an application rate of 0.05 to 0.07 gallons per square yard for a milled surface. For areas where both milled and un-milled surfaces occur, the tack coat shall be an application rate of 0.03 to 0.05 gallons per square yard. The Engineer must approve the equipment and the method of measurement prior to use. The material for tack coat shall not be heated in excess of 160°F and shall not be further diluted.

Tack coat shall be allowed sufficient time to break prior to any paving equipment or haul vehicles driving on it.

The Contractor may request to omit the tack coat application between bituminous concrete layers that have not been exposed to traffic and are placed during the same work shift. Requests to omit tack coat application on the exposed surface of a wedge joint will not be considered.

Placement: The mixture shall be placed and compacted to provide a smooth, dense surface with a uniform texture and no segregation at the specified thickness and dimensions indicated in the plans and specifications.

When unforeseen weather conditions prevent further placement of the mixture, the Engineer is not obligated to accept or place the bituminous concrete mixture that is in transit from the Plant.

In advance of paving, traffic control requirements shall be set up, maintained throughout placement, and shall not be removed until all associated work including density testing is completed.

The Contractor shall inspect the newly placed pavement for defects in the mixture or placement before rolling is started. Any deviation from standard crown or section shall be immediately remedied by placing additional mixture or removing surplus mixture. Such defects shall be corrected to the satisfaction of the Engineer.

Where it is impractical due to physical limitations to operate the paving equipment, the Engineer may permit the use of other methods or equipment. Where hand spreading is permitted, the mixture shall be placed by means of suitable shovels and other tools, and in a uniformly loose layer at a thickness that will result in a completed pavement meeting the designed grade and elevation.

Placement Tolerances: Each lift of bituminous concrete placed at a specified thickness shall meet the following requirements for thickness and area. Any pavement exceeding these limits shall be subject to an adjustment or removal. Lift tolerances will not relieve the Contractor from meeting the final designed grade. Lifts of specified non-uniform thickness, i.e. wedge or shim course, shall not be subject to thickness and area adjustments.

a) Thickness- Where the average thickness of the lift exceeds that shown on the plans beyond the tolerances shown in Table 4.06-3, the Engineer will calculate the thickness adjustment in accordance with Article 4.06.04.

TABLE 4.06-3: Thickness Tolerances

Mixture Designation	Lift Tolerance
S1	+/- ⅜ inch
S0.25, S0.375, S0.5	+/- ¼ inch

Where the thickness of the lift of mixture is less than that shown on the plans beyond the tolerances shown in Table 4.06-3, the Contractor, with the approval of the Engineer, shall take corrective action in accordance with this specification.

b) Area- Where the width of the lift exceeds that shown on the plans by more than the specified thickness, the Engineer will calculate the area adjustment in accordance with Article 4.06.04.

c) Delivered Weight of Mixture - When the delivery ticket shows that the vehicle exceeds the allowable gross weight for the vehicle type, the Engineer will calculate the weight adjustment in accordance with Article 4.06.04.

Transverse Joints: All transverse joints shall be formed by saw-cutting to expose the full thickness of the lift. Tack coat shall be applied to the sawn face immediately prior to additional mixture being placed.

Compaction: The Contractor shall compact the mixture to meet the density requirements as stated in Article 4.06.03 and eliminate all roller marks without displacement, shoving, cracking, or aggregate breakage.

When placing a lift with a specified thickness less than one and one-half (1 ½) inches, or a wedge course, the Contractor shall provide a minimum rolling pattern as determined by the development of a compaction curve. The procedure to be used shall be documented in the Contractor's QCP for placement and demonstrated on the first day of placement.

The use of the vibratory system on concrete structures is prohibited. When approved by the Engineer, the Contractor may operate a roller using an oscillatory system at the lowest frequency setting.

If the Engineer determines that the use of compaction equipment in the dynamic mode may damage highway components, utilities, or adjacent property, the Contractor shall provide alternate compaction equipment. The Engineer may allow the Contractor to operate rollers in the dynamic mode using the oscillatory system at the lowest frequency setting.

Rollers operating in the dynamic mode shall be shut off when changing directions.

These allowances will not relieve the Contractor from meeting pavement compaction requirements.

Surface Requirements:
Each lift of the surface course shall not vary more than ¼ inch from a Contractor-supplied 10 foot straightedge. For all other lifts, the tolerance shall be ⅜ inch. Such tolerance will apply to all paved areas.

Any surface that exhibits these characteristics or exceeds these tolerances shall be corrected by the Contractor at its own expense.

7. Longitudinal Joint Construction Methods: The Contractor shall use Method I- Notched Wedge Joint (see Figure 4.06-1) when constructing longitudinal joints where lift thicknesses are between 1½ and 3 inches. S1.0 mixtures shall be excluded from using Method I. Method II Butt Joint (see Figure 4.06-2) shall be used for lifts less than 1½ inches or greater than or equal to 3 inches. During placement of multiple lifts, the longitudinal joint shall be constructed in such a

manner that it is located at least 6 inches from the joint in the lift immediately below. The joint in the final lift shall be at the centerline or at lane lines. Each longitudinal joint shall maintain a consistent offset from the centerline of the roadway along its entire length. The difference in elevation between the two faces of any completed longitudinal joint shall not exceed ¼ inch in any location.

Method I - Notched Wedge Joint:

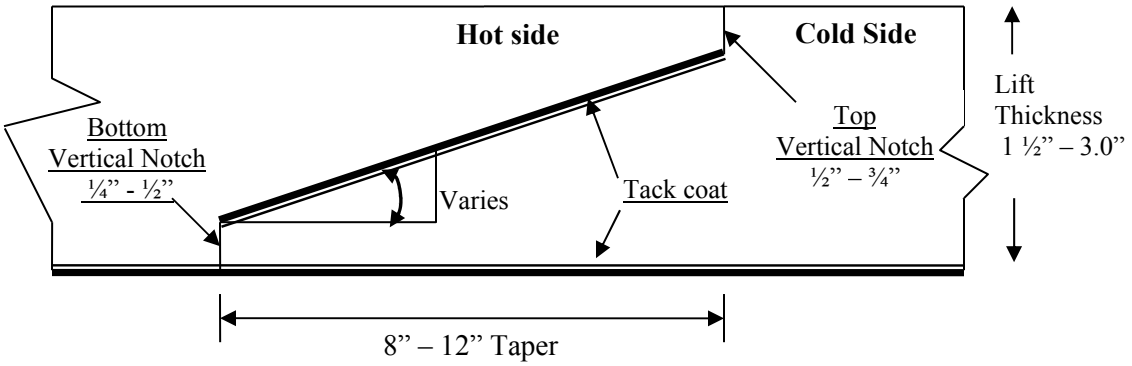

FIGURE 4.06-1: Notched Wedge Joint

A notched wedge joint shall be constructed as shown in Figure 4.06-1 using a device that is attached to the paver screed and is capable of independently adjusting the top and bottom vertical notches. The device shall have an integrated vibratory system.

The taper portion of the wedge joint must be placed over the longitudinal joint in the lift immediately below. The top vertical notch must be located at the centerline or lane line in the final lift. The requirement for paving full width "curb to curb" as described in Method II may be waived if addressed in the QC plan and approved by the Engineer.

The taper portion of the wedge joint shall be evenly compacted using equipment other than the paver or notch wedge joint device.

The taper portion of the wedge joint shall not be exposed to traffic for more than 5 calendar days.

Any exposed wedge joint must be located to allow for the free draining of water from the road surface.

The Engineer reserves the right to define the paving limits when using a wedge joint that will be exposed to traffic.

If Method I, Notched Wedge Joint cannot be used on lifts between 1.5 and 3 inches, Method III Butt Joint may be substituted according to the requirements below for "Method III – Butt Joint with Hot Pour Rubberized Asphalt Treatment."

Method II - Butt Joint:

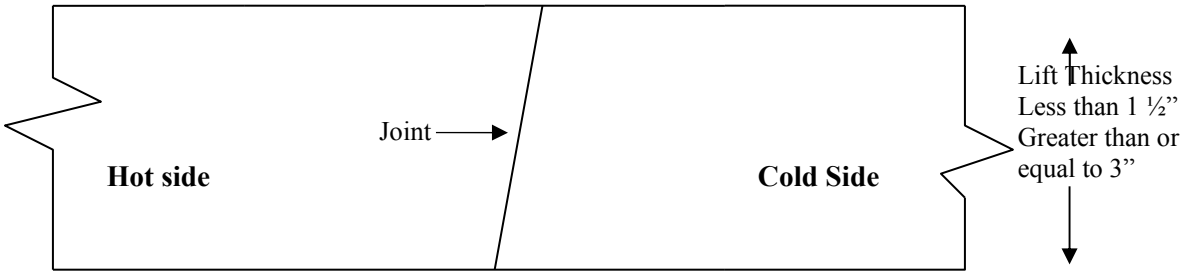

FIGURE 4.06-2: Butt Joint

When adjoining passes are placed, the Contractor shall utilize equipment that creates a near vertical edge (refer to Figure 4.06-2). The completing pass (hot side) shall have sufficient mixture so that the compacted thickness is not less than the previous pass (cold side). The end gate on the paver should be set so there is an overlap onto the cold side of the joint.

The Contractor shall not allow any butt joint to be incomplete at the end of a work shift unless otherwise allowed by the Engineer. When using this method, the Contractor is not allowed to leave a vertical edge exposed at the end of a work shift and must complete paving of the roadway full width "curb to curb."

Method III- Butt Joint with Hot Poured Rubberized Asphalt Treatment: If Method I Wedge Joint cannot be used due to physical constraints in certain limited locations; the contractor may submit a request in writing for approval by the Engineer, to utilize Method III Butt Joint as a substitution in those locations. There shall be no additional measurement or payment made when the Method III Butt Joint is substituted for the Method I Notched Wedge Joint. When required by the contract or approved by the Engineer, Method III (see Figure 4.06-3) shall be used.

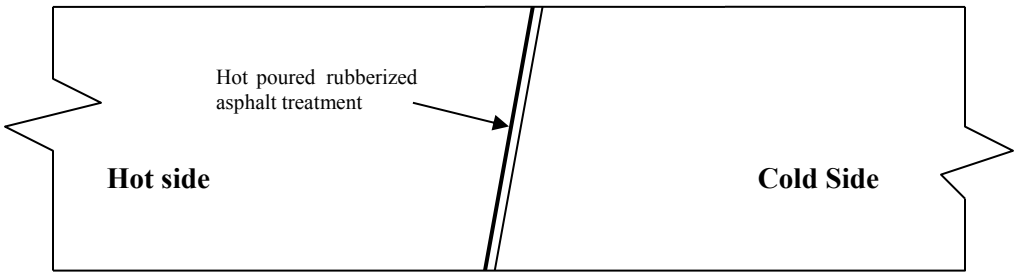

FIGURE 4.06-3: Butt Joint with Hot Poured Rubberized Asphalt Treatment

All of the requirements of Method II must be met with Method III. In addition, the longitudinal vertical edge must be treated with a rubberized joint seal material meeting the requirements of ASTM D 6690, Type 2. The joint sealant shall be placed on the face of the "cold side" of the butt joint as shown above prior to placing the "hot side" of the butt joint. The joint seal material shall be applied in accordance with the manufacturer's recommendation so as to provide a uniform coverage and avoid excess bleeding onto the newly placed pavement.

8. Contractor Quality Control (QC) Requirements: The Contractor shall be responsible for maintaining adequate quality control procedures throughout the production and placement operations. Therefore, the Contractor must ensure that the materials, mixture and work provided by Subcontractors, Suppliers and Producers also meet contract specification requirements.

This effort must be documented in Quality Control Plans and address the actions, inspection, or sampling and testing necessary to keep the production and placement operations in control, to determine when an operation has gone out of control and to respond to correct the situation in a timely fashion.

The Standard QCP for production shall consist of the quality control program specific to the production facility.

There are three components to the QCP for placement: a Standard QCP, a Project Summary Sheet that details project specific information, and if applicable a separate Extended Season Paving Plan as required in Section 9 "Temperature and Seasonal Requirements".

The Standard QCP for both production and placement shall be submitted to the Department for approval each calendar year and.at a minimum of 30 days prior to production or placement.

Production or placement shall not occur until all QCP components have been approved by the Engineer.

Each QCP shall include the name and qualifications of a Quality Control Manager (QCM). The QCM shall be responsible for the administration of the QCP, and any modifications that may become necessary. The QCM shall have the ability to direct all Contractor personnel on the project during paving operations. All Contractor sampling, inspection and test reports shall be reviewed and signed by the QCM prior to submittal to the Engineer. The QCPs shall also include the name and qualifications of any outside testing laboratory performing any QC functions on behalf of the Contractor.

Approval of the QCP does not relieve the Contractor of its responsibility to comply with the project specifications. The Contractor may modify the QCPs as work progresses and must document the changes in writing prior to resuming operations. These changes include but are not limited to changes in quality control procedures or personnel. The Department reserves the right to deny significant changes to the QCPs.

QCP for Production: Refer to Section M.04.03-1.

QCP for Placement: The Standard QCP, Project Summary Sheet, and Extended Season Paving Plan shall conform to the format provided by the Engineer. The format is available at http://www.ct.gov/dot/lib/dot/documents/dconstruction/pat/qcp_outline_hma_placement.pdf.

The Contractor shall perform all quality control sampling and testing, provide inspection, and exercise management control to ensure that placement conforms to the requirements as outlined in its QCP during all phases of the work. The Contractor shall document these activities for each day of placement.

The Contractor shall submit complete field density testing and inspection records to the Engineer within 48 hours in a manner acceptable to the Engineer.

The Contractor may obtain one (1) mat core and one (1) joint core per day for process control, provided this process is detailed in the QCP. The results of these process control cores shall not be used to dispute the Department determinations from the acceptance cores. The Contractor shall submit the location of each process control core to the Engineer for approval prior to taking the core. The core holes shall be filled to the same requirements described in sub-article 4.06.03-10.

9. Temperature and Seasonal Requirements: Paving, including placement of temporary pavements, shall be divided into two seasons, "In-Season" and "Extended-Season". In-Season paving occurs from May 1 – October 14, and Extended Season paving occurs from October 15-April 30. The following requirements shall apply unless otherwise authorized or directed by the Engineer:

- Mixtures shall not be placed when the air or sub base temperature is less than 40°F regardless of the season.
- Should paving operations be scheduled during the Extended Season, the Contractor must submit an Extended Season Paving Plan for the project that addresses minimum delivered mix temperature considering WMA, PMA or other additives, maximum paver speed, enhanced rolling patterns and the method to balance mixture delivery and placement operations. Paving during Extended Season shall not commence until the Engineer has approved the plan.

10. Obtaining Bituminous Concrete Cores: This Section describes the methodology and sampling frequency the Contractor shall use to obtain pavement cores.

Coring shall be performed on each lift specified to a thickness of one and one-half (1 ½) inches or more within 5 days of placement. The Contractor shall extract cores (4 or 6 inch diameter for S0.25, S0.375 and S0.5 mixtures 6 inch diameter for S1.0 mixtures) from locations determined

by the Engineer. The Engineer must witness the extraction, labeling of cores and filling of the core holes.

A density lot will be complete when the full designed paving width and length of the lot has been placed and shall include all longitudinal joints between the curb lines. HMA S1 mixes are excluded from the longitudinal joint density requirements.

A standard density lot is the quantity of material placed within the defined area exclusive of any structures. A combo density lot is the quantity of material placed within the defined area inclusive of structures less than or equal to 500 feet long. A bridge density lot is the quantity of material placed on a structure larger than 500 feet in length.

Prior to paving, the type and number of lot (s) shall be determined by the Engineer. The number of cores per lot shall be determined in accordance to Tables 4.06-4, 4.06-5A and 4.06-5B. Noncontiguous areas such as highway ramps may be combined to create one lot. Combined areas should be set up to target a 2000 ton lot size. The longitudinal locations of mat cores within a lot containing multiple paving passes will be determined using the total distance covered by the paver. The locations of the joint cores will be determined using the total length of longitudinal joints within the lot.

Sampling is in accordance with the following tables:

TABLE 4.06-4: Bridge Density Lot(s)

Length of Each Structure (Feet)	No. of Mat Cores	No. of Joint Cores
≤ 500’	See Table 4.06-5(A or B)	See Table 4.06-5(A or B)
501’ – 1500’	3	3
1501’ – 2500’	4	4
2501’ and greater	5	5

All material placed on structures less than or equal to 500 feet in length shall be included as part of a standard lot as follows:

TABLE 4.06-5A: Standard and Combo Density Lot(s) ≥ 500 Tons

Lot Type	No. of Mat Cores		No. of Joint Cores		Target Lot Size (Tons)
Standard Lot / Without Bridge (s)	4		4		2000
Combo Lot / Lot With Bridge(s)[1]	4 plus	1 per structure (≤ 300’)	4 plus	1 per structure (≤ 300’)	2000
		2 per structure (301’ – 500’)		2 per structure (301’ – 500’)	

TABLE 4.06-5B: Standard and Combo Density Lot < 500 Tons

Lot Type	No. of Mat Cores		No. of Joint Cores	
Standard Lot / Without Bridge (s)	3		3	
Combo Lot / Lot With Bridge(s)[(1)]	2 plus	1 per structure	2 plus	1 per structure

Note:
[(1)] If a combo lot mat or joint core location randomly falls on a structure, the core is to be obtained on the structure in addition to the core(s) required on the structure.

After the lift has been compacted and cooled, the Contractor shall cut cores to a depth equal to or greater than the lift thickness and remove them without damaging the lift(s) to be tested. Any core that is damaged or obviously defective while being obtained will be replaced with a new core from a location within 2 feet measured in a longitudinal direction.

A mat core shall not be located any closer than one foot from the edge of a paver pass. If a random number locates a core less than one foot from any edge, the location will be adjusted by the Engineer so that the outer edge of the core is one foot from the edge of the paver pass.

Method I, Notched Wedge Joint cores shall be taken so that the center of the core is 5 inches from the visible joint on the hot mat side (Figure 4.06-5).

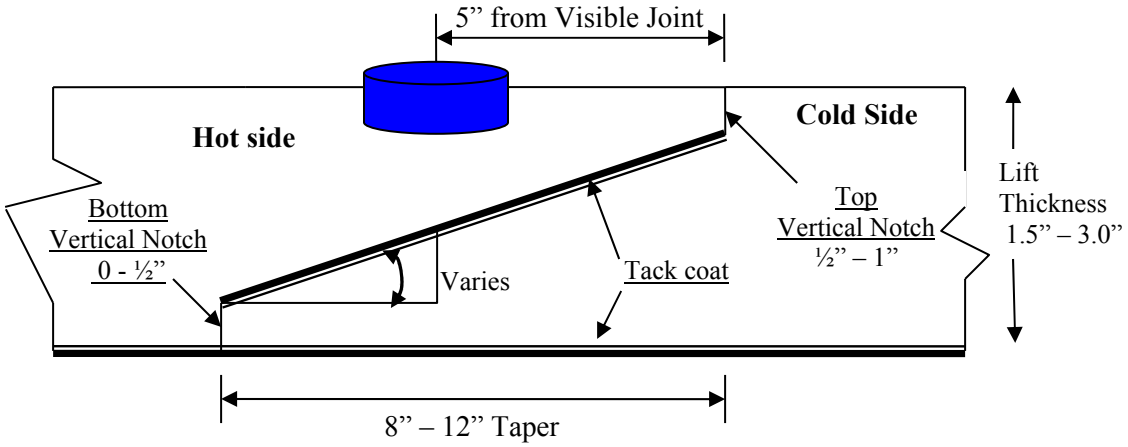

FIGURE 4.06-5: Notched Wedge Joint Cores

When Method II or Method III Butt Joint is utilized, cores shall be taken from the hot side so the edge of the core is within 1 inch of the longitudinal joint.

The cores shall be labeled by the Contractor with the project number, date placed, lot number and sub-lot number. The core’s label shall, include “M” for a mat core and “J” for a joint core. A mat core from the second lot and first sub-lot shall be labeled “M2 – 1” (Figure 4.06-4). The Engineer shall fill out a MAT-109 to accompany the cores. The Contractor shall deliver the

cores and MAT-109 to the Department's Central Lab. The Contractor shall use a container approved by the Engineer. The container shall have a lid capable of being locked shut and tamper proof. The Contractor shall use foam, bubble wrap, or another suitable material to prevent the cores from being damaged during handling and transportation. Once the cores and MAT-109 are in the container the Engineer will secure the lid using a security seal. The security seal's identification number must be documented on the MAT-109. Central Lab personnel will break the security seal and take possession of the cores.

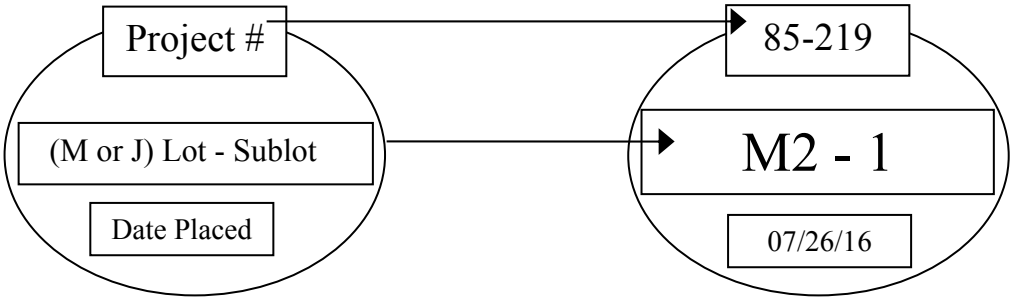

FIGURE 4.06-4: Labeling of Cores

Each core hole shall be filled within four hours upon core extraction. Prior to being filled, the hole shall be prepared by removing any free water and applying tack coat using a brush or other means to uniformly cover the cut surface. The core hole shall be filled using a bituminous concrete mixture at a minimum temperature of 240ºF containing the same or smaller nominal maximum aggregate size and compacted with a hand compactor or other mechanical means to the maximum compaction possible. The bituminous concrete shall be compacted to ⅛ inch above the finished pavement.

11. Acceptance Sampling and Testing: Sampling and testing shall be performed at a frequency not less than the minimum frequency specified in Section M.04 and sub-article 4.06.03-10.

Sampling shall be performed in accordance with ASTM D 3665, or a statistically based procedure of stratified random sampling approved by the Engineer.

Plant Material Acceptance: The Contractor shall provide the required sampling and testing during all phases of the work in accordance with Section M.04. The Department will verify the Contractor's acceptance test results. Should any test results exceed the specified tolerances in the Department's current QA Program for Materials, the Contractor test results for a subject lot or sub lot may be replaced with the Department's results for the purpose of calculating adjustments. The verification procedure is included in the Department's current QA Program for Materials.

Density Acceptance: The Engineer will perform all acceptance testing in accordance with AASHTO T 331. The density of each core will be determined using the daily production's

average maximum theoretical specific gravity (Gmm) established during the testing of the parent material at the Plant. When there was no testing of the parent material or any Gmm exceeds the specified tolerances in the Department's current QA Program for Materials, the Engineer will determine the maximum theoretical density value to be used for density calculations.

12. Density Dispute Resolution Process: The Contractor and Engineer will work in partnership to avoid potential conflicts and to resolve any differences that may arise during quality control or acceptance testing for density. Both parties will review their sampling and testing procedures and results and share their findings. If the Contractor disputes the Engineer's test results, the Contractor must submit in writing a request to initiate the Dispute Resolution Process within 7 calendar days of the notification of the test results. No request for dispute resolution will be allowed unless the Contractor provides quality control results within the timeframe described in sub-article 4.06.03-9 supporting its position. No request for Dispute Resolution will be allowed for a Density Lot in which any core was not taken within the required 5 calendar days of placement. Should the dispute not be resolved through evaluation of existing testing data or procedures, the Engineer may authorize the Contractor to obtain a new set of core samples per disputed lot. The core samples must be extracted no later than 14 calendar days from the date of Engineer's authorization.

The number and location (mat, joint, or structure) of the cores taken for dispute resolution must reflect the number and location of the original cores. The location of each core shall be randomly located within the respective original sub lot. All such cores shall be extracted and the core hole filled using the procedure outlined in Article 4.06.03. The dispute resolution results shall be added to the original results and averaged for determining the final in-place density value.

13. Corrective Work Procedure:
If pavement placed by the Contractor does not meet the specifications, and the Engineer requires its replacement or correction, the Contractor shall:

a) Propose a corrective procedure to the Engineer for review and approval prior to any corrective work commencing. The proposal shall include:
   - Limits of pavement to be replaced or corrected, indicating stationing or other landmarks that are readily distinguishable.
   - Proposed work schedule.
   - Construction method and sequence of operations.
   - Methods of maintenance and protection of traffic.
   - Material sources.
   - Names and telephone numbers of supervising personnel.

b) Any corrective courses placed as the final wearing surface shall match the specified lift thickness after compaction.

14. Protection of the Work: The Contractor shall protect all sections of the newly finished pavement from damage that may occur as a result of the Contractor's operations for the duration of the Project.

15. Cut Bituminous Concrete Pavement: Work under this item shall consist of making a straight-line cut in the pavement to the lines delineated on the plans or as directed by the Engineer. The cut shall provide a straight, clean, vertical face with no cracking, tearing or breakage along the cut edge.

4.06.04—Method of Measurement:

1. HMA S* or PMA S*: The quantity of bituminous concrete measured for payment will be determined by the documented net weight in tons accepted by the Engineer in accordance with this specification and Section M.04.

2. Adjustments: Adjustments may be applied to bituminous concrete quantities and will be measured for payment using the following formulas:

Yield Factor for Adjustment Calculation = 0.0575 Tons/SY/inch

Actual Area = [(Measured Length (ft)) x (Avg. of width measurements (ft))]

Actual Thickness (t) = Total tons delivered / [Actual Area (SY) x 0.0575 Tons/SY/inch]

a) Area: If the average width exceeds the allowable tolerance, an adjustment will be made using the following formula. The tolerance for width is equal to the specified thickness (in.) of the lift being placed.

Tons Adjusted for Area (T_A) = [(L x W_{adj})/9] x (t) x 0.0575 Tons/SY/inch = (-) Tons

Where: L = Length (ft)
(t) = Actual thickness (inches)
W_{adj} = (Designed width (ft) + tolerance /12) - Measured Width)

b) Thickness: If the actual average thickness is less than the allowable tolerance, the Contractor shall submit a repair procedure to the Engineer for approval. If the actual thickness exceeds the allowable tolerance, an adjustment will be made using the following formula:
Tons Adjusted for Thickness (T_T) = A x t_{adj} x 0.0575 = (-) Tons

Where: A = Area = {[L x (Designed width + tolerance (lift thickness)/12)] / 9}
t_{adj} = Adjusted thickness = [(Dt + tolerance) - Actual thickness]
Dt = Designed thickness (inches)

c) Weight: If the quantity of bituminous concrete representing the mixture delivered to the project is in excess of the allowable gross vehicle weight (GVW) for each vehicle, an adjustment will be made using the following formula:

Tons Adjusted for Weight (T_W) = GVW – DGW= (-) Tons

Where: DGW = Delivered gross weight as shown on the delivery ticket or measured on a certified scale.

d) Mixture Adjustment: The quantity of bituminous concrete representing the production lot at the Plant will be adjusted as follow:

i. Non-PWL Production Lot (less than 3500 tons):
The adjustment values in Table 4.06-6 and 4.06-7 shall be calculated for each sub lot based on the Air Void (AV) and Asphalt Binder Content (PB) test results for that sub lot. The total adjustment for each day's production (lot) will be computed using tables and the following formulas:

Tons Adjusted for Superpave Design (T_{SD}) = $[(AdjAV_t + AdjPB_t) / 100]$ X Tons

Percent Adjustment for Air Voids = $AdjAV_t = [AdjAV_1 + AdjAV_2 + AdjAV_i + \ldots + AdjAV_n)] /n$

Where: $AdjAV_t$ = Total percent air void adjustment value for the lot
$AdjAV_i$ = Adjustment value from Table 4.06-7 resulting from each sub lot or the average of the adjustment values resulting from multiple tests within a sub lot, as approved by the Engineer.
n = number of sub lots based on Table M.04.03-2

TABLE 4.06-6: Adjustment Values for Air Voids

Adjustment Value ($AdjAV_i$) (%)	S0.25, S0.375, S0.5, S1 Air Voids (AV)
+2.5	3.8 - 4.2
+3.125*(AV-3)	3.0 - 3.7
-3.125*(AV-5)	4.3 – 5.0
20*(AV-3)	2.3 – 2.9
-20*(AV-5)	5.1 – 5.7
-20.0	$\leq$ 2.2 or $\geq$ 5.8

Percent Adjustment for Asphalt Binder = $AdjPB_t = [(AdjPB_1 + AdjPB_2 + AdjPB_i + \ldots + AdjPB_n)] / n$

Where: $AdjPB_t$= Total percent asphalt binder adjustment value for the lot
$AdjPB_i$ = Adjustment value from Table 4.06-7 resulting from each sub lot
n = number of binder tests in a production lot

TABLE 4.06-7: Adjustment Values for Binder Content

Adjustment Value ($AdjAV_i$) (%)	S0.25, S0.375, S0.5, S1 Pb
0.0	JMF Pb ± 0.3
- 10.0	≤ JMF Pb - 0.4 or ≥ JMF Pb + 0.4

ii. PWL Production Lot (3500 tons or more):
For each lot, the adjustment values shall be calculated based on PWL for AV, VMA and PB test results. The lot will be considered as being normally distributed and all applicable equations in AASHTO R9 and AASHTO R42 Appendix X4 will apply.

Only one test result will be considered for each sub lot. The specification limits are listed in Section M.04.

For AV, PB and voids in mineral aggregate (VMA), the individual material quality characteristic adjustment (Adj) will be calculated as follow:

For PWL between 50 and 90%: $Adj(AV_t \text{ or } PB_t \text{ or } VMA_t) = (55 + 0.5\ PWL) - 100$
For PWL at and above 90%: $Adj(AV_t \text{ or } PB_t \text{ or } VMA_t) = (77.5 + 0.25\ PWL) - 100$

Where:
$AdjAV_t$ = Total percent AV adjustment value for the lot
$AdjPB_t$ = Total percent PB adjustment value for the lot
$AdjVMA_t$ = Total percent VMA adjustment value for the lot

Lots with PWL less than 50% in any of the three individual material quality characteristics will be evaluated under 1.06.04.

The total adjustment for each production lot will be computed using the following formula:

Tons Adjusted for Superpave Design (T_{SD}) = $[(0.5AdjAV_t + 0.25AdjPB_t + 0.25\ AdjVMA_t) / 100]$ X Tons

iii. Partial Lots:
Lots with less than 4 sublots will be combined with the prior lot. If there is no prior lot with equivalent material or if the last test result of the prior lot is over 30 calendar days old, the adjustment will be calculated as indicated in 4.06.04-2.d.i.
Lots with 4 or more sublots will be calculated as indicated in 4.06.04-2.d.ii.

e) Density Adjustment: The quantity of bituminous concrete measured for payment in a lift of pavement specified to be 1½ inches or greater may be adjusted for density. Separate density adjustments will be made for each lot and will not be combined to establish one density adjustment. The final lot quantity shall be the difference between the total payable tons for the project and the sum of the previous lots. If either the Mat or Joint adjustment value is "remove and replace", the density lot shall be removed and replaced (curb to curb).

No positive adjustment will be applied to a Density Lot in which any core was not taken within the required 5 calendar days of placement.

Tons Adjusted for Density (T_D) = [{(PA_M x .50) + (PA_J x .50)} / 100] X Density Lot Tons

Where: T_D = Total tons adjusted for density for each lot
PA_M = Mat density percent adjustment from Table 4.06-9
PA_J = Joint density percent adjustment from Table 4.06-10

TABLE 4.06-9: Adjustment Values for Pavement Mat density

Average Core Result Percent Mat Density	Percent Adjustment (Bridge and Non-Bridge) (1)(2)
97.1 - 100	-1.667*(ACRPD-98.5)
94.5 – 97.0	+2.5
93.5 – 94.4	+2.5*(ACRPD-93.5)
92.0 – 93.4	0
90.0 – 91.9	-5*(92-ACRPD)
88.0 – 89.9	-10*(91-ACRPD)
87.0 – 87.9	-30
86.9 or less	Remove and Replace (curb to curb)

TABLE 4.06-10: Adjustment Values for Pavement Joint Density

Average Core Result Percent Joint Density	Percent Adjustment (Bridge and Non-Bridge) [(1)(2)]
97.1 – 100	-1.667*(ACRPD-98.5)
93.5 – 97.0	+2.5
92.0 – 93.4	+1.667*(ACRPD-92)
91.0 – 91.9	0
89.0 – 90.9	-7.5*(91-ACRPD)
88.0 – 88.9	-15*(90-ACRPD)
87.0 – 87.9	-30
86.9 or less	Remove and Replace (curb to curb)

[(1)] ACRPD = Average Core Result Percent Density
[(2)] All Percent Adjustments to be rounded to the second decimal place. For example, 1.667 is to be rounded to 1.67.

3. Transitions for Roadway Surface: The installation of permanent transitions shall be measured under the appropriate item used in the formation of the transition.

The quantity of material used for the installation of temporary transitions shall be measured for payment under the appropriate item used in the formation of the transition. The installation and removal of a bond breaker, and the removal and disposal of any temporary transition formed by milling or with bituminous concrete pavement is not measured for payment.

4. Cut Bituminous Concrete Pavement: The quantity of bituminous concrete pavement cut will be measured in accordance with Article 2.02.04.

5. Material for Tack Coat: The quantity of tack coat will be measured for payment by the number of gallons furnished and applied on the Project and approved by the Engineer. No tack coat material shall be included that is placed in excess of the tolerance described in Article 4.06.03.

a. Container Method- Material furnished in a container will be measured to the nearest ½ gallon. The volume will be determined by either measuring the volume in the original container by a method approved by the Engineer or using a separate graduated container capable of measuring the volume to the nearest ½ gallon. The container in which the material is furnished must include the description of material, including lot number or batch number and manufacturer or product source.

b. Vehicle Method-
i. Measured by Weight: The number of gallons furnished will be determined by weighing the material on calibrated scales furnished by the Contractor. To convert weight to gallons, one of the following formulas will be used:

$$\text{Tack Coat (gallons at 60°F)} = \frac{\text{Measured Weight (pounds)}}{\text{Weight per gallon at 60°F}}$$

$$\text{Tack Coat (gallons at 60°F)} = \frac{0.996 \times \text{Measured Weight (pounds)}}{\text{Weight per gallon at 77°F}}$$

ii. Measured by automated metering system on the delivery vehicle:

Tack Coat (gallons at 60°F) = Factor (from Table 4.06-11) multiplied by the measured gallons.

TABLE 4.06-11: Factor to Convert Volume of Tack Coat to 60°F

Tack Coat Application Temperature (°F)	Factor	Tack Coat Application Temperature (°F)	Factor
75	0.996	120	0.985
80	0.995	125	0.984
85	0.994	130	0.983
90	0.993	135	0.982
95	0.991	140	0.980
100	0.990	145	0.979
105	0.989	150	0.978
110	0.988	155	0.977
115	0.986	160	0.976

6. Material Transfer Vehicle (MTV): The furnishing and use of a MTV will be measured separately for payment based on the actual number of surface course tons delivered to a paver using the MTV.

4.06.05—Basis of Payment:

1. HMA S* or PMA S*: The furnishing and placing of bituminous concrete will be paid for at the Contract unit price per ton for "HMA S*" or "PMA S*".

- All costs associated with providing illumination of the work area are included in the general cost of the work.
- All costs associated with cleaning the surface to be paved, including mechanical sweeping, are included in the general cost of the work. All costs associated with constructing longitudinal joints are included in the general cost of the work.

- All costs associated with obtaining cores for acceptance testing and dispute resolution are included in the general cost of the work.

2. Bituminous Concrete Adjustment Costs: The adjustment will be calculated using the formulas shown below if all of the measured adjustments in Article 4.06.04 are not equal to zero. A positive or negative adjustment will be applied to monies due the Contractor.

Production Lot: $[T_T + T_A + T_W + T_{SD}]$ x Unit Price = Est. (P)

Density Lot: T_D x Unit Price = Est. (D)

Where: Unit Price = Contract unit price per ton per type of mixture

T_* = Total tons of each adjustment calculated in Article 4.06.04

Est. ( ) = Pay Unit represented in dollars representing incentive or disincentive.

The Bituminous Concrete Adjustment Cost item if included in the bid proposal or estimate is not to be altered by the Contractor.

3. Transitions for Roadway Surface: The installation of permanent transitions shall be paid under the appropriate item used in the formation of the transition. The quantity of material used for the installation of temporary transitions shall be paid under the appropriate pay item used in the formation of the transition. The installation and removal of a bond breaker, and the removal and disposal of any temporary transition formed by milling or with bituminous concrete pavement is included in the general cost of the work.

4. The cutting of bituminous concrete pavement will be paid in accordance with Article 2.02.05.

5. Material for tack coat will be paid for at the Contract unit price per gallon at 60°F for "Material for Tack Coat".

6. The Material Transfer Vehicle (MTV) will be paid at the Contract unit price per ton for a "Material Transfer Vehicle".

Pay Item*	Pay Unit*
HMA S*	ton
PMA S*	ton
Bituminous Concrete Adjustment Cost	est.
Material for Tack Coat	gal.
Material Transfer Vehicle	ton

*For contracts administered by the State of Connecticut, Department of Administrative Services, the pay items and pay units are as shown in contract award price schedule.

SECTION 5.86 - CATCH BASINS, MANHOLES AND DROP INLETS

5.86.01—Description
5.86.02—Materials
5.86.03—Construction Methods
5.86.04—Method of Measurement
5.86.05—Basis of Payment

5.86.01—Description: The work under this Section shall consist of furnishing, preparing, and installing catch basins, manholes and drop inlets (and also the removal, abandonment, alteration, reconstruction, or conversion of such existing structures) in conformity with the lines, grades, dimensions and details shown on the plans.

This Section shall also include resetting or replacing catch basin tops as well as manhole frames and covers.

5.86.02—Materials: The materials for this work shall meet the following requirements:

Drainage structures shall meet the requirements of M.08.02 and shall utilize concrete with a 28-day minimum compressive strength of 4000 psi.

Galvanizing shall meet the requirements of M.06.03.

Mortar shall meet the requirements of M.11.04.

Butyl rubber joint seal shall meet the requirements of ASTM C990.

Granular fill, if necessary, shall meet the requirements of M.02.01.

Protective compound material shall be a type appearing on the Department's Qualified Products List and be acceptable to the Engineer, as specified in M.03.09.

5.86.03—Construction Methods: Drainage trench excavation, including rock in drainage trench excavation and backfilling, shall be performed in accordance with 2.86.03 and the requirements of the plans.

Where a drainage structure is to be installed below the surface, a drainage trench shall be excavated to the required depth, the bottom of which shall be graded to the elevation of the bottom of the proposed drainage structure or to ensure a uniform foundation for the structure.

Where a firm foundation is not encountered at the grades established due to unsuitable material, such as soft, spongy, or unstable soil, the unsuitable material shall be removed and replaced with approved granular fill, thoroughly compacted in lifts not to exceed 6 inches. The Engineer shall be notified prior to removal of the unsuitable material in order to determine the depth of removal necessary.

When rock, as defined in 2.86.01-2, is encountered, work shall be performed in accordance with 2.86.03 and the requirements of the plans.

When a drainage structure outside of proposed drainage trench limits is to be removed, it shall be completely removed and all pipes shall be removed or plugged with cement masonry.

When a drainage structure is to be abandoned, the structure shall be removed to a depth 2 feet below the subgrade or as directed by the Engineer. The floor of the structure shall be broken and all pipes shall be plugged with cement masonry.

Drainage structures shall be constructed in accordance with the plans and the requirements contained herein for the character of the work involved. The provisions of 6.02.03 pertaining to bar reinforcement shall apply except that shop drawings need not be submitted for approval unless called for in the plans, Contract or directed by the Engineer. Welding shall be performed in accordance with the applicable sections of the AWS Structural Welding Code, D1.1.

When it becomes necessary to increase the horizontal dimensions of manholes, catch basins and drop inlets to sizes greater than those shown on the plans in order to provide for multiple pipe installations, large pipes or for other reasons, the Contractor shall construct such manholes, catch basins and drop inlets to modified dimensions as directed by the Engineer.

The surfaces of the tops of all catch basins, and drop inlets shall be given a coat of protective compound material, at the manufacturer's recommended application rate, immediately upon completion of the concrete curing period.

All masonry units shall be laid in full mortar beds.

Metal fittings for catch basins, manholes or drop inlets shall be set in full mortar beds or otherwise secured as shown on the plans.

All inlet and outlet pipes shall be set flush with the inside face of the wall of the drainage structure as shown on the plans. The pipes shall extend through the walls for a sufficient distance beyond the outside surface to allow for satisfactory connections, and the concrete or masonry shall be constructed around them neatly to prevent leakage along their outer surfaces.

When constructing a new drainage structure within a run of existing pipe, the section of existing pipe disturbed by the construction shall be replaced with new pipe of identical type and size extending from the drainage structure to the nearest joint of the existing pipe in accordance with 6.86.03 or as directed by the Engineer.

Backfilling shall be performed in accordance with 2.86.03.

Frames, covers and tops which are to be reset shall be removed from their present beds, the walls or sides shall be rebuilt to conform to the requirements of the new construction and the frames, covers and tops shall be reset as shown on the plans or as directed by the Engineer.

Where temporary structures are called for on the plans but are to be removed in later stages, they shall be salvaged as listed on the Notice to Contractor – Salvage.

5.86.04—Method of Measurement:

Drainage Trench Excavation: In accordance with 2.86.04, excavation for drainage trench will not be measured for payment but shall be included in the Contract unit price for the type of structure being installed.

Rock in Drainage Trench Excavation: Rock in Drainage Trench Excavation will be measured in accordance with the drainage trench excavation limits described in 2.86.03.

Manholes, Catch Basins and Drop Inlets will be measured as separate units.

Resetting of Manholes, Catch Basins and Drop Inlets will be measured as separate units.

Replacement of frames, covers, and tops will be measured as a unit for catch basin top or manhole frame and cover.

Conversion of drainage structures as specified on the plans, or as directed by the Engineer, including structure reconstruction will be measured for payment as a unit.

Removal or abandonment of drainage structures outside of drainage trench excavation limits, as defined in 2.86.03, will be measured as separate units.

There will be no measurement or direct payment for the application of the protective compound material, the cost of this work shall be considered as included in the general cost of the work.

Measurement for payment for work and materials involved with installing pipes to connect new drainage structures into a run of existing pipe will be as provided for under the applicable Contract items in accordance with 6.86.04.

There will be no measurement or direct payment for plugging existing pipes with cement masonry, the cost of this work will be considered as included in the general cost of the work.

Temporary structures to be removed shall be salvaged. Salvage will not be measured for payment but should be included in the cost of the items.

5.86.05—Basis of Payment:

Drainage Trench Excavation for the installation of proposed structures described herein will be paid for under the respective drainage Contract item(s) for which the excavation is being performed, in accordance with the provisions of 2.86.05.

Rock in Drainage Trench Excavation will be paid for in accordance with the provisions of 2.86.05.

Manholes and Catch Basins will be paid for at the Contract unit price for each "Manhole," or "Catch Basin," of the type specified, at "0' to 10' Deep" or "0' to 20' Deep," complete in place, which price shall include all excavation, backfill, materials, equipment, tools and labor incidental thereto.

Drop Inlets will be paid for at the Contract unit price for each "Drop Inlet," of the type specified, complete in place, which price shall include all excavation, backfill, materials, equipment, tools and labor incidental thereto.

Manholes, Catch Basins and Drop Inlets constructed to modified dimensions as directed by the Engineer, will be paid for as follows:

Where the interior floor area has to be increased to accommodate existing field conditions, as measured horizontally at the top of the base of the completed structure, and does not exceed 125% of the interior floor area as shown on the plans for that structure, then the structure shall be paid for at the Contract unit price for each "Manhole," "Catch Basin," or "Drop Inlet" of the type specified. Where the floor area is greater than 125%, the increase in the unit price for the individual structure shall be in direct proportion to the increase of the completed structure interior floor area as compared to the interior floor area as shown on the plans for that structure. Such increased unit price shall include all excavation, materials, equipment, tools, and labor incidental to the completion of the structure.

Reset Units will be paid for at the Contract unit price each for "Reset Manhole," "Reset Catch Basin," or "Reset Drop Inlet," of the type specified, respectively, complete in place, which price shall include excavation, cutting of pavement, removal and replacement of pavement structure, and all materials, equipment, tools and labor incidental thereto, except when the work requires reconstruction greater than 3 feet, measured vertically, then the entire cost of resetting the unit will be paid for as Extra Work in accordance with the provisions of 1.04.05.

Frames, Covers, and Tops when required in connection with reset units, will be paid for at the Contract unit price each for such "Manhole Frame and Cover" or "(Type) Catch Basin Top," complete in place, including all incidental expense; or when no price exists, the furnishing and placing of such material will be paid for as Extra Work in accordance with the provisions of 1.04.05.

When the catch basin top has a stone or granite curb in its design, the curb or inlet shall be included in the cost of the "(Type) Catch Basin Top."

Conversion of drainage structures will be paid for at the Contract unit price each for "Convert Catch Basin to (Type) Catch Basin," "Convert Catch Basin to (Type) Manhole," or "Convert Manhole to (Type) Catch Basin," complete in place, which price shall include excavation, cutting of pavement, removal and replacement of pavement, backfill, all alterations to existing structure, all materials including catch basin frame and grate of the type specified, or manhole frame and cover, all equipment, tools and labor incidental thereto.

The maximum change in elevation of frame under these items shall not exceed 3 feet. Greater depth changes, if required, shall be paid for as Extra Work, in accordance with 1.04.05.

Removal or abandonment of drainage structures outside of drainage trench excavation limits as defined in 2.86.03 will be paid for at the Contract unit price each for "Remove Drainage Structure – 0' to 10' Deep," "Remove Drainage Structure – 0' to 20' Deep," or "Abandon Drainage Structure," which price shall include excavation, cutting of pavement, removal and replacement of pavement, backfill, and all equipment, tools and labor incidental thereto.

When temporary structures are to be removed and salvaged, the cost of salvage, storage and transport shall not be measured for payment and should be included in the cost of the item.

Pay Item	Pay Unit
(Type) Catch Basin – 0' to 10' Deep	ea.
(Type) Catch Basin – 0' to 20' Deep	ea.
Manhole (Size) – 0' to 10' Deep	ea.
Manhole (Size) – 0' to 20' Deep	ea.
(Type) Drop Inlet	ea.
Reset Catch Basin	ea.
Reset Manhole	ea.
Reset Drop Inlet	ea.
Convert Catch Basin to (Type) Catch Basin	ea.
Convert Catch Basin to (Type) Manhole	ea.
Convert Manhole to (Type) Catch Basin	ea.
Manhole Frame and Cover	ea.
(Type) Catch Basin Top	ea.
Remove Drainage Structure – 0' to 10' Deep	ea.
Remove Drainage Structure – 0' to 20' Deep	ea.
Abandon Drainage Structure	ea.

SECTION 6.03 - STRUCTURAL STEEL

Section 6.03 *is amended as follows:*

6.03.03—Construction Methods: *Revise* Subarticle **4(f)** "**High Strength Bolted Connections**" *as follows:*

Replace the first paragraph and Table A: "Minimum Bolt Tension in kips" *with the following:*

" The assembly of structural connections using high-strength bolts shall be installed so as to develop the minimum required bolt tension specified in Table A. The Manufacturer's certified test report; including the rotational capacity test results must accompany the fastener assemblies. Fastener Assemblies delivered without the certified reports will be rejected.

Table A: Minimum Bolt Tension in kips*

Bolt Diameter (Inches)	ASTM F3125 Grade A325	ASTM F3125 Grade A490
5/8	19	24
3/4	28	35
7/8	39	49
1	51	64
1 1/8	64	80
1 1/4	81	102
1 3/8	97	121
1 1/2	118	148

*Equal to 70% of specified minimum tensile strength of bolts (as specified in ASTM Specifications for tests of full-size F3125 Grade A 325 and F3125 Grade A 490 bolts with UNC threads, loaded in axial tension) rounded to the nearest kip.

Revise the last sentence of the sixteenth paragraph, "**Rotational-Capacity Tests**" *as follows:*

" When performed in the field, the procedure shall meet the requirements of ASTM F3125 Annex A2."

In Table C, insert the word "**Grade**" *in the third row before every occurrence of* "**A325**" and "**A490**."

SECTION 6.86 - DRAINAGE PIPES, DRAINAGE PIPE ENDS

6.86.01—Description
6.86.02—Materials
6.86.03—Construction Methods
6.86.04—Method of Measurement
6.86.05—Basis of Payment

6.86.01—Description: This work shall consist of furnishing, preparing and installing drainage pipes of the size and type specified, bedding material, joint sealant, rubber gaskets, clamps, collars, grout, grout collars, drainage trench excavation, backfilling or satisfactory disposal of all materials, the removal of which is necessary for the proper completion of the work, connecting proposed drainage systems to existing systems, plugging or abandoning existing pipes and removal of existing pipe within trench limits, as shown on the plans or as directed by the Engineer.

This Section shall also include removal of drainage pipes outside of drainage trench excavation limits, as defined in 2.86.03-1.

6.86.02—Materials: The materials for this work shall meet the following requirements:

Drainage Pipe, Drainage Pipe Ends, Sealers, Gaskets and connection hardware shall meet the requirements of M.08.01.

Bedding Material shall meet the requirements of M.08.03-1.

Granular Fill, if necessary, shall meet the requirements of M.02.01.

Brick Masonry shall meet the requirements of M.11.03 and Mortar shall meet the requirements of M.11.04.

Concrete used for Concrete Pipe Connections shall be Class "F" Concrete meeting the requirements of M.03.

6.86.03—Construction Methods:

(1) Drainage Trench Excavation: Drainage trench excavation and backfilling shall be performed in accordance with 2.86.03 and the requirements of the plans.

Where drainage pipe is to be laid below the surface, a drainage trench shall be excavated to the required depth, the bottom of which shall be graded to the elevation of the bottom of the bedding material.

Where drainage pipe is to be laid in a fill area, the embankment shall be placed and compacted to a minimum elevation 12 inches above the top of the proposed pipe, whereupon the drainage trench excavation shall be performed and the pipe installed.

(2) Rock in Drainage Trench Excavation: When rock, as defined in 2.86.01-2, is encountered, work shall be performed in accordance with 2.86.03 and the requirements of the plans.

(3) Drainage Pipe Installation: New or re-laid drainage pipes shall be installed on 4 inches of bedding material (12 inches if over rock in ledge formation), the details as shown on the plans, or as directed by the Engineer. Prior to placement of the drainage pipe, in accordance with the plans, bedding material shall be pre-shaped to 10% of the total height

of the pipe in order to keep the pipe in the center of the trench. Following placement of the drainage pipe, bedding material backfill shall be placed in accordance with the following table:

Internal Pipe Diameter	**Required Bedding Material Backfill**
< 48 inches*	25% of total height of the pipe
≥ 48 inches*	12 inches above the top of the pipe
*Includes pipe arch of equivalent internal horizontal span See Standard Drawing	

The placement of the drainage pipe shall start at the downstream end and progress upstream or as shown on the plans, or as directed by the Engineer. All drainage pipes shall be carefully laid in the center of the drainage trench, true to the lines and grades given. Bell ends shall face upgrade and all joints shall be tight.

Joints in concrete pipe shall be sealed with cold-applied bituminous sealer, preformed plastic gaskets or flexible, watertight, rubber-type gaskets. Portland cement mortar shall not be used for sealing pipe joints except with permission of the Engineer.

When cold-applied bituminous sealer is used, the bell and spigot ends shall be wiped clean and dry before applying the bituminous sealer to the pipe ends. Before the drainage pipes are placed in contact with each other, the spigot or tongue end shall be completely covered with bituminous sealer; then the pipe shall be laid to line and grade so the inside surface of all abutting pipes are flush. Additional bituminous sealer shall be applied to the joint after the connection has been made to ensure a water tight connection.

Where the end of an existing drainage pipe is not compatible with the end of a proposed concrete pipe, the Contractor shall align the inner diameters of the pipes being connected, butt the pipe ends together, and construct a cast-in-place concrete pipe connection, as shown in the plans. Incompatible bell/spigot or tongue/groove ends shall be cut off as required to ensure the interior drainage pipe walls are aligned to provide a smooth transition between the pipes.

Metal pipe and pipe arches shall be carefully joined and firmly clamped together by approved connecting bands, which shall be properly bolted in place before any backfill is placed.

Newly installed drainage pipe which is not in true alignment, or which shows any settlement or distortion, shall be reinstalled in accordance with 1.05.03.

When drainage pipe outside of proposed drainage trench limits is to be removed, it shall be removed to the limits shown on the plans and all remaining pipes shall be plugged with cement masonry.

Where shown on the plans or directed by the Engineer, the Contractor shall plug abandoned existing pipes with cement masonry.

Temporary drainage installed but removed in later stages shall be salvaged as listed in the Notice to Contractor – Salvage.

(4) Drainage Pipe End Installation: Reinforced concrete drainage pipe ends shall be placed on a prepared bed of the existing ground and accurately aligned as shown on the plans. The joints shall be sealed as specified in 6.86.03-3 and backfill shall be placed around both sides of the unit simultaneously to the elevation shown on the plans.

Metal drainage pipe ends shall be placed on a prepared bed of the existing ground and accurately aligned as shown on the plans. After the attachment of the drainage pipe end, backfill shall be placed around both sides of the unit up to the elevation shown on the plans, exercising caution to avoid displacement or deformation of the unit.

6.86.04—Method of Measurement: This work will be measured as follows:

Drainage Trench Excavation, in accordance with 2.86.04, will not be measured for payment.

Rock in Drainage Trench Excavation will be measured in accordance with 2.86.04.

Bedding Material will not be measured for payment.

New and Re-laid Pipes and Pipe Arches will be measured for payment by the actual number of linear feet of pipe or pipe arch of the various sizes and types, completed and accepted and measured in place along the invert. Coupling bands and fittings for pipes and pipe arches will not be measured for payment.

Reinforced Concrete Drainage Pipe Ends and Metal Drainage Pipe Ends will be measured for payment as separate units.

Corrugated Metal Pipe Elbows (of the Size and Type specified) will be measured for payment by the actual number of linear feet of pipe elbows completed and accepted, based on 6 linear feet per elbow, as shown on the plans. Coupling bands for elbows will not be measured for payment.

Concrete Pipe Connection will be measured for payment by the number of each concrete pipe connection constructed at locations where proposed concrete pipes tie into an existing pipe with an incompatible end, completed and accepted by the Engineer.

Removal of drainage pipe outside of drainage trench excavation limits, as defined in 2.86.03, will be measured for payment by the actual number of linear feet of drainage pipe removed.

There will be no measurement for plugging existing pipes with cement masonry.

Temporary drainage pipe that has been installed and later removed in subsequent stages shall be salvage. Salvage shall not be measured for payment but shall be included in the cost of the items.

6.86.05—Basis of Payment:

Drainage Trench Excavation for the installation of drainage pipes will not be paid separately but shall be included in the Contract unit price for the respective drainage pipe or pipe end item(s), in accordance with the provisions of 2.86.05.

Rock in Drainage Trench Excavation will be paid for in accordance with the provisions of 2.86.05.

Bedding Material necessary for the installation of drainage items described herein will be included in the Contract unit price for the respective drainage pipe or pipe end item(s). Bedding material required to fill voids when rock in drainage trench is encountered will not be measured

for payment but shall be included in the Contract unit price for "Rock in Drainage Trench Excavation," in accordance with 2.86.05.

New Pipes and Pipe Arches will be paid for at the Contract unit price per linear foot for "(Size and Type) Pipe (Thickness) – 0' to 10' Deep," "(Size and Type) Pipe (Thickness) – 0' to 20' Deep," "(Size) Pipe Arch (Thickness) – 0' to 10' Deep" or "(Size) Pipe Arch (Thickness) – 0' to 20' Deep" complete in place, including materials, drainage trench excavation, bedding material, equipment, tools, and labor incidental thereto.

Relaid Pipes and Pipe Arches will be paid for at the Contract unit price per linear foot for "Relaid Pipe (Size and Type) – 0' to 10' Deep," "Re-laid Pipe (Size and Type) – 0' to 20' Deep," "Relaid Pipe Arch (Size and Type) – 0' to 10' Deep," or "Relaid Pipe Arch (Size and Type) – 0' to 20' Deep," complete in place, including all materials, drainage trench excavation, bedding material, equipment, tools, and labor incidental thereto.

Reinforced Concrete Drainage Pipe Ends and Metal Drainage Pipe Ends will be paid for at the Contract unit price for each drainage pipe end of the Size and Type specified, complete in place, including all excavation, materials, attachment systems, equipment, tools and labor incidental thereto.

Corrugated Metal Pipe Elbows will be paid for at the Contract unit price per linear foot for "(Size and Type) Corrugated Metal Pipe Elbow" including all materials, drainage trench excavation, bedding material, equipment, tools, and labor incidental thereto.

Concrete Pipe Connection will be paid for at the Contract unit price each for "Concrete Pipe Connection" complete in place, including all materials, equipment, tools and labor incidental thereto.

Removal of drainage pipes of all types and sizes, outside of drainage trench excavation limits, as defined in 2.86.03-1, will be paid for at the Contract unit price per linear foot for "Remove Existing Pipe – 0' to 10' Deep," or "Remove Existing Pipe – 0' to 20' Deep," which price shall include excavation, temporary trench protection, backfill, and all equipment, tools and labor incidental thereto.

There will be no direct payment for the plugging of existing drainage pipes or salvage, storage and transport of temporary pipe installed and removed, but the cost thereof shall be included in the respective drainage Contract item(s).

Pay Item	Pay Unit
(Size and Type) Pipe (Thickness) – 0' to 10' Deep	l.f.
(Size and Type) Pipe (Thickness) – 0' to 20' Deep	l.f.
(Size and Type) Pipe Arch (Thickness) – 0' to 10' Deep	l.f.
(Size and Type) Pipe Arch (Thickness) – 0' to 20' Deep	l.f.
Relaid (Size and Type) Pipe– 0' to 10' Deep	l.f.
Relaid (Size and Type) Pipe– 0' to 20' Deep	l.f.
(Size and Type) Relaid Pipe Arch – 0' to 10' Deep	l.f.
(Size and Type) Relaid Pipe Arch – 0' to 20' Deep	l.f.
(Size) Reinforced Concrete Drainage Pipe End	ea.
(Size) Metal Drainage Pipe End	ea.
(Size and Type) Corrugated Metal Pipe Elbow	l.f.
Concrete Pipe Connection	ea.
Remove Existing Pipe – 0' to 10' Deep	l.f.
Remove Existing Pipe – 0' to 20' Deep	l.f.

SECTION 9.75 - MOBILIZATION AND PROJECT CLOSEOUT

Article 9.75.04 – Method of Measurement

Revise Subarticle 9.75.04 (4) as follows:

4. When Project 159-191 is complete, as described in Prosecution and Progress, 85% of the lump sum price of this item or 8.5% of the total original Contract price, whichever is less, minus any previous payments made to the Contractor for this item, will be certified for payment.

SECTION 10.00 - GENERAL CLAUSES FOR HIGHWAY ILLUMINATION AND TRAFFIC SIGNAL PROJECTS

Article 10.00.03 – Plans:
In the first paragraph, replace the 2nd and 3rd sentences with the following:

> The Contractor shall digitally mark in red any changes on the plan(s) using a pdf program.
>
> The Contractor shall submit the digital pdf file(s) to DOT.TrafficElectrical@ct.gov prior to requesting the Functional Inspection.

In the first paragraph, last sentence, in item no. 1, replace "Four (4)" with "Five (5)" [paper prints of schematics and wiring diagrams…].

Article 10.00.10 Section 3. Functional Inspection, first paragraph after the 2nd sentence: Add the following:

The Contractor shall have a bucket truck with crew on site during the Functional Inspection to make any necessary aerial signal adjustments as directed by the Engineer.

Article 10.00.12 - Negotiations with utility company: Add the following:

The Contractor shall give notice to utility companies a minimum of 30 days prior to required work or services to the utility company. Refer to Section 1.07 – Legal Relations and Responsibilities for the list of utility companies and representatives the contractor shall use.

The Contractor shall perform all work in conformance with Rules and Regulations of Public Utility Regulatory Authority (PURA) concerning Traffic Signals attached to Public Service Company Poles. The Contractor is cautioned that there may be energized wires in the vicinity of the specified installations. In addition to ensuring compliance with NESC and OSHA regulations, the Contractor and/or its Sub-Contractors shall coordinate with the appropriate utility company for securing/protecting the site during the installation of traffic signal mast arms, span poles or illumination poles.

When a span is attached to a utility pole, the Contractor shall ensure the anchor is in line with the proposed traffic signal span wire. More than 5 degree deviation will lower the holding strength and is not allowed. The Contractor shall provide any necessary assistance required by the utility company, and ensure the anchor and guy have been installed and properly tensioned prior to attaching the span wire to the utility pole.

SECTION 12.00 - GENERAL CLAUSES FOR HIGHWAY SIGNING

Description:
Work under this item shall conform to the requirements of Section 12.00 supplemented as follows:

12.00.06 – Data Labels:
For the purpose of developing and maintaining a highway sign inventory and for the purpose of sampling and testing reflective sheeting, the Contractor shall affix a Data Label(s) to the back of each sign face-extruded aluminum sign and each sign face-sheet aluminum sign in the vicinity of the lower left hand corner or quadrant. Data Labels shall be 2 (two) separate 5 (five) inch by 3 (three) inch (125mm by 75mm), non-reflective weatherproof films with black copy on a yellow background having a pressure sensitive adhesive backing.

A "Fabrication" Data Label is to include information about the sign fabricator, date of fabrication and the sheeting manufacturer - type. An "Installation" Data Label is to include The State Project Number or Maintenance Permit Number that installed the sign and date of installation.

The cost of the data labels coded and in place on the sign shall be included in the unit cost of the respective sign material. Payment for the respective quantities of each sign face-extruded aluminum sign and each sign face-sheet aluminum sign may be withheld until all Data Label(s) have been installed to the satisfaction of the Engineer.

The Data Label designs, with additional notes relative to design requirements are attached herewith.

DATA LABELS

NON REFLECTIVE, WEATHERPROOF FILM
BLACK COPY, YELLOW BACKGROUND

CONN DOT
SIGN FACE DATA LABEL

Fabricator: (Insert NAME or State)
Sheeting Manufacturer - Type
(Insert NAME - TYPE)

Date Fabricated - Month / Year

J	F	M	A	M	J	J	A	S	O	N	D
12	13	14	15	16	17	18	19	20	21	22	23

CONN DOT
SIGN FACE DATA LABEL

Installed By:
Project No.: (Insert 000-0000 or State)
Permit No.: (Insert D_-000000)

Date Installed - Month / Year

J	F	M	A	M	J	J	A	S	O	N	D
12	13	14	15	16	17	18	19	20	21	22	23

Data Labels To Be 5 Inch By 3 Inch Each (125mm x 75mm) With Face Designs As Shown Above.

All Copy Ink Must Be Durable And Not Fade, Discolor, Or Smudge.

All Variable Legends To Be Included At Label Fabrication.

Only One "Installed By" Permit Or Project Number Should Be Provided.

Sign Fabrication And / Or Installation By State Forces, Insert "State."
The Month And Year Of Fabrication And Installation May Be Punched Or Marked Out

The Back Of The Data Label Must Contain A Pre-coated Pressure-Sensitive Adhesive Covered By A Removable Liner.
At Application, The Liner Must Be removable Without Soaking In Water Or Other Solvents.
The Adhesive Must Form A Durable Bond To Surfaces That Are Smooth, Clean, Corrosion-Free And Weather Resistant.

Completed Data Labels Must Not Discolor, Crack, Craze, Blister, Delaminate, Peel, Chalk, Or Lose Adhesion When Subjected To Temperatures From -30 Degrees to 200 Degrees Fahrenheit.

SECTION M.04 - BITUMINOUS CONCRETE MATERIALS

Section M.04 is being deleted in its entirety and replaced with the following:

M.04.01—Bituminous Concrete Materials and Facilities
M.04.02—Mix Design and Job Mix Formula (JMF)
M.04.03—Production Requirements

M.04.01—Bituminous Concrete Materials and Facilities: Each source of component material, Plant and laboratory used to produce and test bituminous concrete must be qualified on an annual basis by the Engineer. AASHTO or ASTM Standards noted with an (M) have been modified and are detailed in Table M.04.03-6.

Aggregates from multiple sources of supply must not be blended or stored in the same stockpile.

1. Coarse Aggregate:

All coarse aggregate shall meet the requirements listed in Section M.01.

2. Fine Aggregate:

All fine aggregate shall meet the requirements listed in Section M.01

3. Mineral Filler:

Mineral filler shall conform to the requirements of AASHTO M 17.

4. Performance Graded (PG) Asphalt Binder:

a. General:

i. PG asphalt binder shall be uniformly mixed and blended and be free of contaminants such as fuel oils and other solvents. Binder shall be properly heated and stored to prevent damage or separation.

ii. The binder shall meet the requirements of AASHTO M 332 and shall be graded or verified in accordance with AASHTO R 29. The Contractor shall submit a Certified Test Report and bill of lading representing each delivery in accordance with AASHTO R 26(M). The Certified Test Report must also indicate the binder specific gravity at 77ºF; rotational viscosity at 275ºF and 329ºF and the mixing and compaction viscosity-temperature chart for each shipment.

iii. The Contractor shall submit the name(s) of personnel responsible for receipt, inspection, and record keeping of PG binder. Contractor plant personnel shall document specific storage tank(s) where binder will be transferred and stored until used, and provide binder samples to the Engineer upon request. The person(s) shall assure that each shipment is accompanied by a statement certifying that the transport vehicle was inspected before loading and was found acceptable for the material

shipped, and, that the binder is free of contamination from any residual material, along with two (2) copies of the bill of lading.

iv. The blending or combining of PG binders in one storage tank at the Plant from different suppliers, grades, or additive percentages is prohibited.

b. Basis of Approval:

The request for approval of the source of supply shall list the location where the material will be manufactured, and the handling and storage methods, along with necessary certification in accordance with AASHTO R 26(M). Only suppliers/refineries that have an approved "Quality Control Plan for Performance Graded Binders" formatted in accordance with AASHTO R 26(M) may supply PG binders to Department projects.

c. Standard Performance Grade (PG) Binder:

i. Standard PG binder shall be defined as "Neat". Neat PG binders shall be free from modification with: fillers, extenders, reinforcing agents, adhesion promoters, thermoplastic polymers, acid modification and other additives such as re-refined motor oil, and shall indicate such information on each bill of lading and certified test report.

ii. The standard asphalt binder grade shall be PG 64S-22.

d. Modified Performance Grade (PG) Binder:

The modified asphalt binder shall be Performance Grade PG 64E-22 asphalt modified solely with a Styrene-Butadiene-Styrene (SBS) polymer. The polymer modifier shall be added at either the refinery or terminal and delivered to the bituminous concrete production facility as homogenous blend. The stability of the modified binder shall be verified in accordance with ASTM D7173 using the Dynamic Shear Rheometer (DSR). The DSR $G^*/\sin(\delta)$ results from the top and bottom sections of the ASTM D7173 test shall not differ by more than 10%. The results of ASTM D7173 shall be included on the Certified Test Report. The binder shall meet the requirements of AASHTO M 332 (including Appendix X1) and AASHTO R 29.

e. Warm Mix Additive or Technology:

i. The warm mix additive or technology must be listed on the North East Asphalt User Producer Group (NEAUPG) Qualified Warm Mix Asphalt (WMA) Technologies List at the time of bid, which may be accessed online at http://www.neaupg.uconn.edu.

ii. The warm mix additive shall be blended with the asphalt binder in accordance with the manufacturer's recommendations.

iii. The blended binder shall meet the requirements of AASHTO M 332 and shall be graded or verified in accordance with AASHTO R 29 for the specified binder grade. The Contractor shall submit a Certified Test Report showing the results of the testing demonstrating the binder grade. In addition, it must include the grade of the virgin

binder, the brand name of the warm mix additive, the manufacturer's suggested rate for the WMA additive, the water injection rate (when applicable) and the WMA Technology manufacturer's recommended mixing and compaction temperature ranges.

5. Emulsified Asphalts:

a. General:

i. The emulsified asphalt shall meet the requirements of AASHTO M 140 or AASHTO M 208 as applicable.

ii. The emulsified asphalts shall be free of contaminants such as fuel oils and other solvents.

iii. The blending at mixing plants of emulsified asphalts from different suppliers is prohibited.

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b. Basis of Approval

i. The request for approval of the source of supply shall list the location where the material is manufactured, the handling and storage methods, and certifications in accordance with AASHTO PP 71. Only suppliers that have an approved "Quality Control Plan for Emulsified Asphalt" formatted in accordance with AASHTO PP 71 and submit monthly split samples per grade to the Engineer may supply emulsified asphalt to Department projects.

ii. Each shipment of emulsified asphalt delivered to the project site shall be accompanied with the corresponding Certified Test Report listing Saybolt viscosity, residue by evaporation, penetration of residue, and weight per gallon at 77°F and Material Certificate.

iii. Anionic emulsified asphalts shall conform to the requirements of AASHTO M-140. Materials used for tack coat shall not be diluted and meet grade RS-1 or RS-1H. When ambient temperatures are 80˚F and rising, grade SS-1 or SS-lH may be substituted if permitted by the Engineer.

iv. Cationic emulsified asphalt shall conform to the requirements of AASHTO M-208. Materials used for tack coat shall not be diluted and meet grade CRS-1. The settlement and demulsibility test will not be performed unless deemed necessary by the Engineer. When ambient temperatures are 80˚F and rising, grade CSS-1 or CSS-lh may be substituted if permitted by the Engineer.

6. Reclaimed Asphalt Pavement (RAP):

a. General: RAP is a material obtained from the cold milling or removal and processing of bituminous concrete pavement. RAP material shall be crushed to 100% passing the ½ inch sieve and free from contaminants such as joint compound, wood, plastic, and metals.

b. Basis of Approval: The RAP material will be accepted on the basis of one of the following criteria:

i. When the source of all RAP material is from pavements previously constructed on Department projects, the Contractor shall provide a Materials Certificate listing the detailed locations and lengths of those pavements and that the RAP is only from those locations listed.

ii. When the RAP material source or quality is not known, the Contractor shall request for approval to the Engineer at least 30 calendar days prior to the start of the paving operation. The request shall include a Material Certificate and applicable test results stating that the RAP consists of aggregates that meet the specification requirements of sub articles M.04.01-1 through 3, and, that the binder in the RAP is substantially free of solvents, tars and other contaminants. The Contractor is prohibited from using unapproved material on Department projects and shall take necessary action to prevent contamination of approved RAP stockpiles. Stockpiles of unapproved material shall remain separate from all other RAP materials at all times. The request for approval shall include the following:

1. A 50-pound sample of the RAP to be incorporated into the recycled mixture.
2. A 25-pound sample of the extracted aggregate from the RAP.

7. Crushed Recycled Container Glass (CRCG):

a. Requirements: The Contractor may propose to use clean and environmentally-acceptable CRCG in an amount not greater than 5% by weight of total aggregate.

b. Basis of Approval: The Contractor shall submit to the Engineer a request to use CRCG. The request shall state that the CRCG contains no more than 1% by weight of contaminants such as paper, plastic and metal and conform to the following gradation:

CRCG Grading Requirements	
Sieve Size	Percent Passing
3/8-inch	100
No. 4	35-100
No. 200	0.0-10.0

The Contractor shall submit a Materials Certificate to the Engineer stating that the CRCG complies with all the applicable requirements in this specification.

8. Joint Seal Material:

a. Requirements: Joint seal material must meet the requirements of ASTM D 6690 – Type 2. The Contractor shall submit a Material Certificate in accordance with Article 1.06.07 certifying that the joint seal material meets the requirements of this specification.

9. Recycled Asphalt Shingles (RAS)

a. Requirements: RAS shall consist of processed asphalt roofing shingles from post-consumer asphalt shingles or from manufactured shingle waste. The RAS material under consideration for use in bituminous concrete mixtures must be certified as being asbestos free and shall be entirely free of whole, intact nails. The RAS material shall meet the requirements of AASHTO MP 23.

The producer shall test the RAS material to determine the asphalt content and the gradation of the RAS material. The producer shall take necessary action to prevent contamination of RAS stockpiles.

The Contractor shall submit a Materials Certificate to the Engineer stating that the RAS complies with all the applicable requirements in this specification.

10. Plant Requirements:

a. General: The Plant producing bituminous concrete shall comply with AASHTO M 156.

b. Storage Silos: The Contractor may use silos for short-term storage with the approval of the Engineer. A silo must have heated cones and an unheated silo cylinder if it does not contain a separate internal heating system. When multiple silos are filled, the Contractor shall discharge one silo at a time. Simultaneous discharge of multiple silos for the same Project is not permitted.

Type of silo cylinder	Maximum storage time for all classes (hr)	
	HMA	WMA/PMA
Open Surge	4	Mfg Recommendations*
Unheated – Non-insulated	8	Mfg Recommendations*
Unheated – Insulated	18	Mfg Recommendations*
Heated – No inert gas	TBD by the Engineer	

*Not to exceed HMA limits

c. Documentation System: The mixing plant documentation system shall include equipment for accurately proportioning the components of the mixture by weight and in the proper order, controlling the cycle sequence and timing the mixing operations. Recording equipment shall monitor the batching sequence of each component of the

mixture and produce a printed record of these operations on each Plant ticket, as specified herein.

If recycled materials are used, the Plant tickets shall include their dry weight, percentage and daily moisture content.

If a WMA Technology is added at the Plant, the Plant tickets shall include the actual dosage rate.

For drum Plants, the Plant ticket shall be produced at 5 minute intervals and maintained by the vendor for a period of three years after the completion of the project.

For batch Plants, the Plant ticket shall be produced for each batch and maintained by the vendor for a period of three years after the completion of the project. In addition, an asterisk (*) shall be automatically printed next to any individual batch weight(s) exceeding the following tolerances:

Each Aggregate Component	±1.5% of individual or cumulative target weight for each bin
Mineral Filler	±0.5% of the total batch
Bituminous Material	±0.1% of the total batch
Zero Return (Aggregate)	±0.5% of the total batch
Zero Return (Bituminous Material)	±0.1% of the total batch

The entire batching and mixing interlock cut-off circuits shall interrupt and stop the automatic batching operations when an error exceeding the acceptable tolerance occurs in proportioning.

The scales shall not be manually adjusted during the printing process. In addition, the system shall be interlocked to allow printing only when the scale has come to a complete rest. A unique printed character (m) shall automatically be printed on the ticket when the automatic batching sequence is interrupted or switched to auto-manual or full manual during proportioning.

d. Aggregates: Aggregate stockpiles shall be managed to prevent segregation and cross contamination. For drum plants only, the percent moisture content at a minimum prior to production and half way through production shall be determined.

e. Mixture: The dry and wet mix times shall be sufficient to provide a uniform mixture and a minimum particle coating of 95% as determined by AASHTO T 195(M) .

Bituminous concrete mixtures shall contain no more than 0.5% moisture when tested in accordance with AASHTO T 329.

f. RAP: RAP moisture content shall be determined a minimum of twice daily (prior to production and halfway through production).

g. Asphalt Binder: A binder log shall be submitted to the Department's Central Lab on a monthly basis.

h. Warm mix additive: For mechanically foamed WMA, the water injection rate shall be monitored during production and not exceed 2.0% by total weight of binder. For additive added at the Plant, the dosage rate shall be monitored during production.

i. Plant Laboratory: The Contractor shall maintain a laboratory at the production facility to test bituminous concrete mixtures during production. The laboratory shall have a minimum of 300 square feet, have a potable water source and drainage in accordance with the CT Department of Public Health Drinking Water Division, and be equipped with all necessary testing equipment as well as with a PC, printer, and telephone with a dedicated hard-wired phone line. In addition, the PC shall have internet connection and a functioning web browser with unrestricted access to https://ctmail.ct.gov. This equipment shall be maintained in working order at all times and be made available for use by the Engineer.

The laboratory shall be equipped with a heating system capable of maintaining a minimum temperature of 65°F. It shall be clean and free of all materials and equipment not associated with the laboratory. Sufficient light and ventilation must be provided. During summer months, adequate cooling or ventilation must be provided so the indoor air temperature shall not exceed the ambient outdoor temperature.
The laboratory testing apparatus, supplies, and safety equipment shall be capable of performing all tests in their entirety that are referenced in AASHTO R 35and AASHTO M 323. The Contractor shall ensure that the Laboratory is adequately supplied at all times during the course of the project with all necessary testing supplies and equipment.

The Contractor shall maintain a list of laboratory equipment used in the acceptance testing processes including but not limited to, balances, scales, manometer/vacuum gauge, thermometers, gyratory compactor, clearly showing calibration and/or inspection dates, in accordance with AASHTO R 18. The Contractor shall notify the Engineer if any modifications are made to the equipment within the laboratory. The Contractor shall take immediate action to replace, repair, and/or recalibrate any piece of equipment that is out of calibration, malfunctioning, or not in operation.

M.04.02—Mix Design and Job Mix Formula (JMF)

1. Curb Mix:

a. Requirements: The Contractor shall use bituminous concrete that meets the requirements of Table M.04.02-1. RAP may be used in 5% increments by weight up to 30%.

b. Basis of Approval: Annually, an approved JMF based on a mix design for curb mix must be on file with the Engineer prior to use. .
Any change in component source of supply or consensus properties must be approved by the Engineer. A revised JMF shall be submitted prior to use.

TABLE M.04.02 – 1:
Control Points for Curb Mix Mixtures

Notes: (a) Compaction Parameter 50gyration N_{des}. (b) The percent passing the #200 sieve shall not exceed the percentage of bituminous asphalt binder.		
Mix	**Curb Mix**	**Production Tolerances from JMF target**
Grade of PG Binder content %	**PG 64S-22 6.5 - 9.0**	**0.4**
Sieve Size		
# 200	3.0 – 8.0 (b)	2.0
# 50	10 - 30	4
# 30	20 - 40	5
# 8	40 - 70	6
# 4	65 - 87	7
¼"		
3/8 "	95 - 100	8
½ "	100	8
¾"		8
1"		
2"		
Additionally, the fraction of material retained between any two consecutive sieves shall not be less than 4%		
Mixture Temperature		
Binder	325°F maximum	
Aggregate	280-350° F	
Mixtures	265-325° F	
Mixture Properties		
Air Voids (VA) %	0 – 4.0 (a)	

2. Superpave Design Method – S0.25, S0.375, S0.5, and S1

a. Requirements: All designated mixes shall be designed using the Superpave mix design method in accordance with AASHTO R 35. A JMF based on the mix design shall meet the requirements of Tables M.04.02-2 through Table M.04.02-5. Each JMF must be submitted no less than seven (7) days prior to production and must be approved by the Engineer prior to use. All approved JMFs expire at the end of the calendar year.

All aggregate component consensus properties and tensile strength ratio (TSR) specimens shall be tested at an AASHTO Materials Reference Laboratory (AMRL) by NETTCP certified technicians.
All bituminous concrete mixes shall be tested for stripping susceptibility by performing the tensile strength ratio (TSR) test procedure in accordance with AASHTO T 283(M) at a minimum every 36 months. The compacted specimens may be fabricated at the Plant and then tested at an AMRL accredited facility. TSR specimens, and corresponding JMF shall be submitted with each test report.

i. Superpave Mixtures with RAP: RAP may be used with the following conditions:

- RAP amounts up to 15% may be used with no binder grade modification.
- RAP amounts up to 20% may be used provided a new JMF is approved by the Engineer. The JMF submittal shall include the grade of virgin binder added. The JMF shall be accompanied by a blending chart and supporting test results in accordance with AASHTO M 323 Appendix X1, or by testing that shows the combined binder (recovered binder from the RAP, virgin binder at the mix design proportions, warm mix asphalt additive and any other modifier if used) meets the requirements of the specified binder grade.
- Two representative samples of RAP shall be obtained. Each sample shall be split and one split sample shall be tested for binder content in accordance with AASHTO T 164 and the other in accordance AASHTO T 308.
- RAP material shall not be used with any other recycling option.

ii. Superpave Mixtures with RAS: RAS may be used solely in HMA S1 mixtures with the following conditions:

- RAS amounts up to 3% may be used.
- RAS total binder replacement up to 15% may be used with no binder grade modification.
- RAS total binder replacement up to 20% may be used provided a new JMF is approved by the Engineer. The JMF submittal shall include the grade of virgin binder added. The JMF shall be accompanied by a blending chart and supporting test results in accordance to AASHTO M 323 appendix X1 or by testing that shows the combined binder (recovered binder from the RAP, virgin binder at the mix design proportions, warm mix asphalt additive and any other modifier if used) meets the requirements of the specified binder grade.
- Superpave Mixtures with RAS shall meet AASHTO PP 78 design considerations. The RAS asphalt binder availability factor (F) used in AASHTO PP 78 shall be 0.85.

iii. Superpave Mixtures with CRCG: CRCG may be used solely in HMA S1 mixtures. One percent of hydrated lime, or other accepted non-stripping agent, shall be added to all mixtures containing CRCG. CRCG material shall not be used with any other recycling option.

b. Basis of Approval: The following information must be included with the JMF submittal:
- Gradation, consensus properties and specific gravities of the aggregate, RAP or RAS.
- Average asphalt content of the RAP or RAS by AASHTO T 164.
- Source of RAP or RAS, and percentage to be used.
- Warm mix Technology, manufacturer's recommended additive rate and tolerances and manufacturer recommended mixing and compaction temperatures.
- TSR test report and anti-strip manufacturer and recommended dosage rate if applicable.
- Mixing and compaction temperature ranges for the mix with and without the warm-mix technology incorporated.
- JMF ignition oven correction factor by AASHTO T 308.

With each JMF submittal, the following samples shall be submitted to the Division of Materials Testing:
- 4 - one quart cans of PG binder, with corresponding Safety Data Sheet (SDS)
- 1 - 50 lbs bag of RAP
- 2 – 50 lbs bag of plant blended virgin aggregate

A JMF may not be approved if any of the properties of the aggregate components or mix do not meet the verification tolerances as described in the Department's current QA Program for Materials, Acceptance and Assurance Testing Policies and Procedures.

Any material based on a JMF, once approved, shall only be acceptable for use when it is produced by the designated plant, it utilizes the same components, and the production of material continues to meet all criteria as specified herein, and component aggregates are maintained within the tolerances shown in Table M.04.02-2. A new JMF must be submitted to the Engineer for approval whenever a new component source is proposed.

Only one mix with one JMF will be approved for production at any one time. Switching between approved JMF mixes with different component percentages or sources of supply is prohibited.

c. Mix Status: Each facility will have each type of mixture rated based on the results of the previous year's production. Mix Status will be provided to each bituminous concrete producer annually prior to the beginning of the paving season.

The rating criteria are based on compliance with Air Voids and Voids in Mineral Aggregate (VMA) as indicated in Table M.04.03-4 and are calculated as follows:

Criteria A: Percentage of acceptance test results with compliant air voids.

Criteria B: The average of the percentage of acceptance test results with compliant VMA, and percentage of acceptance test results with compliant air voids.

The final rating assigned will be the lower of the rating obtained with Criteria A or B.

Mix status is defined as:

"A" – Approved:
Assigned to each mixture type from a production facility with a current rating of 70% or greater, or to each mixture type completing a successful PPT.

"PPT" – Pre-Production Trial:
Temporarily assigned to each mixture type from a production facility when:

1. there are no compliant acceptance production test results submitted to the Department from the previous year;
2. there is a source change in one or more aggregate components
3. there is a component percentage change of more than 5% by weight;
4. there is a change in RAP percentage;
5. the mixture has a rating of less than 70% from the previous season;
6. a new JMF not previously submitted.

Bituminous concrete mixtures with a "PPT" status cannot be used on Department projects. Testing shall be performed by the Producer with NETTCP certified personnel on material under this status. Test results must confirm that specifications requirements in Table M.04.02-2 and Table M.04.02-5 are met before material can be used. One of the following methods must be used to verify the test results:

Option A: Schedule a day when a Department Inspector can be at the facility to witness testing or,

Option B: When the Contractor or their representative performs testing without being witnessed by an Inspector, the Contractor shall submit the test results and a split sample including 2 gyratory molds, 5,000 grams of boxed bituminous concrete, and 5,000 grams of cooled loose bituminous concrete for verification testing and approval.

Option C: When the Contractor or their representative performs testing without being witnessed by a Department Inspector, the Engineer may verify the mix in the Contractor's laboratory.

Witnessing or verifying by the Department of compliant test results will change the mix's status to an "A".

The differences between the Department's test results and the Contractor's must be within the "C" tolerances included in the Department's QA Program for Materials, Acceptance and Assurance Testing Policies and Procedures in order to be verified.

"U" – Not Approved:

Status assigned to a type of mixture that does not have an approved JMF. . Bituminous concrete mixtures with a "U" status cannot be used on Department projects.

TABLE M.04.02– 2: Superpave Mixture Design Criteria

Notes: (1) For all mixtures using a WMA technology, the mix temperature shall meet PG binder and WMA manufacturer's recommendations.								
	S0.25		**S0.375**		**S0.5**		**S1**	
Sieve	CONTROL POINTS		CONTROL POINTS		CONTROL POINTS		CONTROL POINTS	
inches	Min (%)	Max (%)	Min (%)	Max (%)	Min (%)	Max (%)	Min (%)	Max (%)
2.0	-	-	-	-	-	-	-	-
1.5	-	-	-	-	-	-	100	-
1.0	-	-	-	-	-	-	90	100
3/4	-	-	-	-	100	-	-	90
1/2	100	-	100	-	90	100	-	-
3/8	97	100	90	100	-	90	-	-
#4	75	90	-	75	-	-	-	-
#8	32	67	32	67	28	58	19	45
#16	-	-	-	-	-	-	-	-
#30	-	-	-	-	-	-	-	-
#50	-	-	-	-	-	-	-	-
#100	-	-	-	-	-	-	-	-
#200	2.0	10.0	2.0	10.0	2.0	10.0	1.0	7.0
VMA (%)	16.5 ± 1		16.0 ± 1		15.0 ± 1		13.0 ± 1	
VA (%)	4.0 ± 1		4.0 ± 1		4.0 ± 1		4.0 ± 1	
Gse	JMF value		JMF value		JMF value		JMF value	
Gmm	JMF ± 0.030		JMF ± 0.030		JMF ± 0.030		JMF ± 0.030	
Dust / binder	0.6 – 1.2		0.6 – 1.2		0.6 – 1.2		0.6 – 1.2	
Mix Temp(1)	265 – 325°F		265 – 325°F		265 – 325°F		265 – 325°F	
TSR	≥ 80%		≥ 80%		≥ 80%		≥ 80%	
T-283 Stripping	Minimal, as determined by the Engineer							

TABLE M.04.02–3: Superpave Consensus Properties Requirements for Combined Aggregate

Notes: **(1)** 95/90 denotes that a minimum of 95% of the coarse aggregate, by mass, shall have one fractured face and that a minimum of 90% shall have two fractured faces.. (2) Criteria presented as maximum Percent by mass of flat and elongated particles of materials retained on the #4 sieve, determined at 5:1 ratio.

Traffic Level	Design ESALs (80 kN), Millions	Coarse Aggregate Angularity (1) ASTM D 5821, Minimum %	Fine Aggregate Angularity AASHTO T 304, Method A Minimum %	Flat and Elongated Particles (2) ASTM D 4791, Maximum %	Sand Equivalent AASHTO T 176, Minimum %
1	< 0.3	55/- -	40	10	40
2	0.3 to < 3.0	75/- -	40	10	40
3	≥ 3.0	95/90	45	10	45

TABLE M.04.02– 4: Superpave Traffic Levels and Design Volumetric Properties

Traffic Level	Design ESALs	Number of Gyrations by Superpave Gyratory Compactor			Percent Density of Gmm from HMA/WMA specimen			Voids Filled with Asphalt (VFA) Based on Nominal mix size – inch			
	(million)	Nini	Ndes	Nmax	Nini	Ndes	Nmax	0.25	0.375	0.5	1
1	< 0.3	6	50	75	≤ 91.5	96.0	≤ 98.0	70 - 80	70 - 80	70 - 80	67 - 80
2	0.3 to < 3.0	7	75	115	≤ 90.5	96.0	≤ 98.0	65 - 78	65 - 78	65 - 78	65 - 78
3	≥ 3.0	8	100	160	≤ 90.0	96.0	≤ 98.0	65 – 77	73 - 76	65 - 75	65 - 75

TABLE M.04.02– 5:
Superpave Minimum Binder Content by Mix Type and Level

Mix Type	Level	Binder Content Minimum
S0.25	1	5.70
S0.25	2	5.60
S0.25	3	5.50
S0.375	1	5.70
S0.375	2	5.60
S0.375	3	5.50
S0.5	1	5.10
S0.5	2	5.00
S0.5	3	4.90
S1	1	4.60
S1	2	4.50
S1	3	4.40

M.04.03— Production Requirements:

1. Standard Quality Control Plan (QCP) for Production:

The QCP for production shall describe the organization and procedures which the Contractor shall use to administer quality control. The QCP shall include the procedures used to control the production process, to determine when immediate changes to the processes are needed, and to implement the required changes. The QCP must detail the inspection, sampling and testing protocols to be used, and the frequency for each.

Control Chart(s) shall be developed and maintained for critical aspect(s) of the production process as determined by the Contractor. The control chart(s) shall identify the material property, applicable upper and lower control limits, and be updated with current test data. As a minimum, the following quality characteristics shall be included in the control charts: percent passing #4 sieve, percent passing #200 sieve, binder content, air voids, Gmm and VMA. The control chart(s) shall be used as part of the quality control system to document variability of the bituminous concrete production process. The control chart(s) shall be submitted to the Engineer the first day of each month.

The QCP shall also include the name and qualifications of a Quality Control Manager. The Quality Control Manager shall be responsible for the administration of the QCP, including compliance with the plan and any plan modifications.

The Contractor shall submit complete production testing records to the Engineer within 24 hours in a manner acceptable to the Engineer.

The QCP shall also include the name and qualifications of any outside testing laboratory performing any QC functions on behalf of the Contractor. The QCP must also include a list of sampling & testing methods and frequencies used during production, and the names of all Quality Control personnel and their duties.

Approval of the QCP does not imply any warranty by the Engineer that adherence to the plan will result in production of bituminous concrete that complies with these specifications. The Contractor shall submit any changes to the QCP as work progresses.

2. Acceptance Requirements:

i. General:

Acceptance samples shall be obtained from the hauling vehicles and tested by the Contractor at the Plant.

The Contractor shall submit all acceptance tests results to the Engineer within 24 hours or prior to the next day's production. All acceptance test specimens and supporting documentation must be retained by the Contractor and may be disposed of with the approval of the Engineer. All quality control specimens shall be clearly labeled and separated from the acceptance specimens.

Contractor personnel performing acceptance sampling and testing must be present at the facility prior to, during, and until completion of production, and be certified as a NETTCP HMA Plant Technician or Interim HMA Plant Technician and be in good standing. Production of material for use on State projects must be suspended by the Contractor if such personnel are not present. Technicians found by the Engineer to be non-compliant with NETTCP policies and procedures or Department policies may be removed by the Engineer from participating in the acceptance testing process for Department projects until their actions can be reviewed.

Anytime during production that testing equipment becomes defective or inoperable, production can continue for a maximum of 1 hour. The Contractor shall obtain box sample(s) in accordance with Table M.04.03-2 to satisfy the daily acceptance testing requirement for the quantity shipped to the project. The box sample(s) shall be tested once the equipment issue has been resolved to the satisfaction of the Engineer. Production beyond 1 hour may be considered by the Engineer. Production will not be permitted beyond that day until the subject equipment issue has been resolved.

Verification testing will be performed by the Engineer in accordance with the Department's QA Program for Materials.

Should the Department be unable to verify the Contractor's acceptance test result(s) due to a failure of the Contractor to retain acceptance test specimens or supporting documentation, the Contractor shall review its quality control plan, determine the cause of the nonconformance and

respond in writing within 24 hours to the Engineer describing the corrective action taken. In addition, the Contractor must provide supporting documentation or test results to validate the subject acceptance test result(s). The Engineer may invalidate any adjustments for material corresponding to the subject acceptance test(s). Failure of the Contractor to adequately address quality control issues at a facility may result in suspension of production for Department projects at that facility.

ii. Curb Mix Acceptance Sampling and Testing Procedures:

Curb Mix shall be tested in accordance to Table M.04.03-1 by the Contractor at a frequency of one test per every 250 tons of cumulative production, regardless of the day of production.

TABLE M.04.03 – 1: Curb Mix Acceptance Test Procedures

Protocol	Reference	Description
1	**AASHTO T 30(M)**	Mechanical Analysis of Extracted Aggregate
2	**AASHTO T 168**	Sampling of Bituminous Concrete
3	**AASHTO T 308**	Binder content by Ignition Oven method (adjusted for aggregate correction factor)
4	**AASHTO T 209(M)[(2)]**	Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures
5	**AASHTO T 312[(2)]**	[(1)]Superpave Gyratory molds compacted to N_{des}
6	**AASHTO T 329**	Moisture Content of Hot-Mix Asphalt (HMA) by Oven Method

Notes: **(1)** One set equals two six-inch molds. Molds to be compacted to 50 gyrations
(2) Once per year or when requested by the Engineer

a. Determination of Off-Test Status:
   i. Curb Mix is considered “off test" when the test results indicate that any single value for bitumen content or gradation are not within the tolerances shown in Table M.04.02-1. If the mix is “off test”, the Contractor must take immediate actions to correct the deficiency and a new acceptance sample shall be tested on the same day or the following day of production.

   ii. When multiple silos are located at one site, mixture supplied to one project is considered as coming from one source for the purpose of applying the “off test” status.

   iii. The Engineer may cease supply from the plant when test results from three consecutive samples are not within the JMF tolerances or the test results from two consecutive samples not within the control points indicated in Table M.04.02-1 regardless of production date.

b. JMF revisions

i. If a test indicates that the bitumen content or gradation are outside the tolerances, the Contractor may make a single JMF revision as allowed by the Engineer prior to any additional testing. Consecutive test results outside the requirements of Table M.04.02-1 JMF tolerances may result in rejection of the mixture.

ii. Any modification to the JMF shall not exceed 50% of the JMF tolerances indicated in Table M.04.02-1 for any given component of the mixture without approval of the Engineer. When such an adjustment is made to the bitumen, the corresponding production percentage of bitumen shall be revised accordingly.

iii. Superpave Mix Acceptance:

a. Sampling and Testing Procedures

Production Lot: The Lot will be defined as one of the following types:
- Non-PWL Production Lot for total estimated project quantities per mixture less than 3500 tons: All mixture placed during a single continuous paving operation.
- PWL Production Lot for total estimated project quantities per mixture of 3500 tons or more: Each 3500 tons of mixture produced within 30 calendar days.

Production Sub Lot:
- For Non-PWL: As defined in Table M.04.03 – 2
- For PWL: 500 tons (the last Sub Lot may be less than 500 tons)

Partial Production Lots (For PWL only): A Lot with less than 3500 tons due to:
- completion of the Course
- a Job Mix Formula revision due to changes in:
  - cold feed percentages over 5%
  - target combined gradation over 5%
  - target binder over 0.15%
  - any component specific gravity
- a Lot spanning 30 calendar days

The acceptance sample(s) location(s) shall be selected using stratified – random sampling in accordance with ASTM D 3665 based on:
- the total daily estimated tons of production for non-PWL lots, or
- the total lot size for PWL lots.

One acceptance sample shall be obtained and tested per Sub Lot. The Engineer may direct that additional acceptance samples be obtained. For non-PWL lots, one acceptance test shall always be performed in the last sub-lot based on actual tons of material produced.

For Non-PWL lots, quantities of the same mixture per plant may be combined daily for multiple State projects to determine the number of sub lots.

The payment adjustment will be calculated as described in 4.06.

TABLE M.04.03 – 2:
Superpave Acceptance Testing Frequency per Type/Level/Plant for Non-PWL lots

Daily quantity produced in tons (lot)	Number of Sub Lots/Tests
0 to 150	0, Unless requested by the Engineer
151 to 500	1
501 to 1,000	2
1,001 to 2,000	3
2,001 or greater	1 per 500 tons or portions thereof

The following test procedures shall be used for acceptance:

TABLE M.04.03– 3: Superpave Acceptance Testing Procedures

Protocol	Procedure	Description
1	AASHTO T 168	Sampling of bituminous concrete
2	AASHTO R 47	Reducing samples to testing size
3	AASHTO T 308	Binder content by ignition oven method (adjusted for aggregate correction factor)
4	AASHTO T 30(M)	Gradation of extracted aggregate for bituminous concrete mixture
5	AASHTO T 312	(1)Superpave gyratory molds compacted to N_{des}
6	AASHTO T 166	(2)Bulk specific gravity of bituminous concrete
7	AASHTO R 35	(2)Air voids, VMA
8	AASHTO T 209(M)	Maximum specific gravity of bituminous concrete (average of two tests)
9	AASHTO T 329	Moisture content of bituminous concrete

Notes: **(1)** One set equals two six-inch molds. Molds to be compacted to Nmax for PPTs and to Ndes for production testing. The first sublot of the year will be compacted to N_{max}
(2) Average value of one set of six-inch molds.

If the average ignition oven corrected binder content differs by 0.3% or more from the average of the Plant ticket binder content in five (5) consecutive tests regardless of the production date (moving average), the Contractor shall immediately investigate, determine an assignable cause and correct the issue. When two consecutive moving average differences are 0.3% or more and no assignable cause has been stablished, the Engineer may require a new ignition oven aggregate correction factor to be performed or to adjust the current factor by the average of the differences between the corrected binder content and production Plant ticket for the last five (5) acceptance results.

The test specimen must be placed in an ignition oven for testing in accordance with AASHTO T 308 within thirty minutes of being obtained from the hauling vehicle and the test shall start immediately after.

The Contractor shall perform TSR testing within 30 days after the start of production for all design levels of HMA- and PMA- S0.5 plant-produced mixtures, in accordance with AASHTO T 283(M). The TSR test shall be performed at an AMRL certified laboratory by NETTCP certified technicians. The compacted specimens may be fabricated at the Plant and then tested at an AMRL accredited facility. The test results and specimens shall be submitted to the Engineer for review. Superpave mixtures that require anti-strip additives (either liquid or mineral) shall continue to meet all requirements specified herein for binder and bituminous concrete. The Contractor shall submit the name, manufacturer, percent used, technical datasheet and SDS for the anti-strip additive (if applicable) to the Engineer.

b. Determination of Off-Test Status:

i. Superpave mixes shall be considered *"off test"* when any Control Point Sieve, binder content, VA, VMA, or Gmm value is outside of the limits specified in Table M.04.03-4 or the target binder content at the Plant is below the minimum binder content stated in Table M.04.02-5. Note that further testing of samples or portions of samples not initially tested for this purpose cannot be used to change the status.

ii. Any time the bituminous concrete mixture is considered Off-test:

1. The Contractor shall notify the Engineer when the Plant is *"off test"* for any mix design that is delivered to the project in any production day. When multiple silos are located at one site, mixture supplied to one project is considered as coming from one source for the purpose of applying the *"off test"* determination.

2. The Contractor must take immediate actions to correct the deficiency, minimize *"off test"* production to the project, and obtain an additional Process Control (PC) test after any corrective action to verify production is in conformance to the specifications. A PC test will not be used for acceptance and is solely for the use of the Contractor in its quality control process.

c. Cessation of Supply for Superpave Mixtures in non-PWL lots:

A mixture shall not be used on Department's projects when it is "off test" for:

i. four (4) consecutive tests in any combination of VA, VMA or Gmm, regardless of date of production, or,
ii. two (2) consecutive tests in the Control Point sieves in one production shift.

As a result of cessation of supply, the mix status will be changed to PPT.

d. JMF revisions:

JMF revisions are only permitted prior to or after a production shift. A JMF revision is effective from the time it was submitted and is not retroactive to the previous test(s).

JMF revisions shall be justified by a documented trend of test results.

Revisions to aggregate and RAP specific gravities are only permitted when testing is performed at an AMRL certified laboratory by NETTCP certified technicians.

A JMF revision is required when the Plant target RAP and/or bin percentage deviates by more than 5% and/or the Plant target binder content deviates by more than 0.15% from the active JMF.

TABLE M.04.03– 4: Superpave Mixture Production Requirements

Notes: (1) 300°F minimum after October 15. (2) JMF tolerances shall be defined as the limits for production compliance. (3) For all mixtures with WMA technology, changes to the minimum aggregate temperature will require Engineer's approval. (4) For PMA and mixtures with WMA technology, the mix temperature shall meet manufacturer's recommendations. In addition, for all mixtures with WMA technology, the maximum mix temperature shall not exceed 325°F.(5) 0.4 for PWL lots (6) 1.3 for PWL lots (7) 1.2 for PWL lots

	S0.25		**S0.375**		**S0.5**		**S1**		**Tolerances**
Sieve	CONTROL POINTS		CONTROL POINTS		CONTROL POINTS		CONTROL POINTS		**From JMF Targets** (2)
inches	Min(%)	Max(%)	Min(%)	Max(%)	Min(%)	Max(%)	Min(%)	Max(%)	±Tol
1.5	-	-	-	-	-	-	100	-	
1.0	-	-	-	-	-	-	90	100	
3/4	-	-	-	-	100	-	-	90	
1/2	100	-	100	-	90	100	-	-	
3/8	97	100	90	100	-	90	-	-	
#4	75	90	-	75	-	-	-	-	
#8	32	67	32	67	28	58	19	45	
#16	-	-	-	-	-	-	-	-	
#200	2.0	10.0	2.0	10.0	2.0	10.0	1.0	7.0	
Pb	JMF value		JMF value		JMF value		JMF value		0.3(5)
VMA (%)	16.5		16.0		15.0		13.0		1.0(6)
VA (%)	4.0		4.0		4.0		4.0		1.0(7)
Gmm	JMF value		JMF value		JMF value		JMF value		0.030
Agg. Temp (3)	280 – 350F		280 – 350F		280 – 350F		280 – 350F		
Mix Temp (4)	265 – 325 F (1)		265 – 325 F (1)		265 – 325 F (1)		265 – 325 F (1)		
Prod. TSR	N/A		N/A		≥80%		N/A		
T-283 Stripping	N/A		N/A		Minimal as determined by the Engineer		N/A		

TABLE M.04.03– 5:
Superpave Traffic Levels and Design Volumetric Properties

Traffic Level	Design ESALs (million)	Number of Gyrations by Superpave Gyratory Compactor	
		Nini	Ndes
1	< 0.3	6	50
2	0.3 to < 3.0	7	75
3	≥3.0	8	100

TABLE M.04.03-6:
Modifications to Standard AASHTO and ASTM Test Specifications and Procedures

AASHTO Standard Method of Test	
Reference	**Modification**
T 30	Section 7.2 thru 7.4 Samples are not routinely washed for production testing
T 168	Samples are taken at one point in the pile. Samples from a hauling vehicle are taken from only one point instead of three as specified. Selection of Samples: Sampling is equally important as the testing, and the sampler shall use every precaution to obtain samples that are truly representative of the bituminous mixture. Box Samples: In order to enhance the rate of processing samples taken in the field by construction or maintenance personnel the samples will be tested in the order received and data processed to be determine conformance to material specifications and to prioritize inspections by laboratory personnel.
T 195	Section 4.3 only one truck load of mixture is sampled. Samples are taken from opposite sides of the load.
T 209	Section 7.2 The average of two bowls is used proportionally in order to satisfy minimum mass requirements. 8.3 Omit Pycnometer method.
T 283	When foaming technology is used, the material used for the fabrication of the specimens shall be cooled to room temperature, and then reheated to the manufactures recommended compaction temperature prior to fabrication of the specimens.

AASHTO Standard Recommended Practices	
Reference	**Modification**
R 26	All laboratory technician(s) responsible for testing PG-binders be certified or Interim Qualified by the New England Transportation Technician Certification Program (NETTCP) as a PG Asphalt Binder Lab Technician. All laboratories testing binders for the Department are required to be accredited by the AASHTO Materials Reference Laboratory (AMRL). Sources interested in being approved to supply PG-binders to the Department by use of an "in-line blending system," must record properties of blended material, and additives used. Each source of supply of PG-binder must indicate that the binders contain no additives used to modify or enhance their performance properties. Binders that are manufactured using additives, modifiers, extenders etc., shall disclose the type of additive, percentage and any handling specifications/limitations required. All AASHTO M 320 references shall be replaced with AASHTO M 332. Once a month, one split sample and test results for each asphalt binder grade and each lot shall be submitted by the PG binder supplier to the Department's Central Lab. Material remaining in a certified lot shall be re-certified no later than 30 days after initial certification. Each April and September, the PG binder supplier shall submit test results for two (2) BBR tests at two (2) different temperatures in accordance with AASHTO R 29.

SECTION M.06 - METALS

Section M.06 *is amended as follows:*

M.06.01—Reinforcing Steel:

Delete the entire last paragraph in Subarticle 1 "**Bar Reinforcement"** *that reads:* "Prior to the incorporation… …and type of bar reinforcement."

M.06.02—Structural Steel:

Revise Subarticle 2 "**Anchor Bolts**" *as follows:*

"**(a)** Anchor bolt assemblies shall meet the requirements of ASTM F1554, and the grade shall be as specified on the plans. All components of the bolt assembly shall be galvanized in accordance with ASTM F2329."

Replace Subarticle 3 "**High Strength Bolts**" *with the following:*

" **3. High-Strength Bolts:** High-strength bolts, including suitable nuts and hardened washers, shall meet the following requirements:

(a) High-strength bolts shall meet the requirements of ASTM F3125 Grade A325 or ASTM F3125 Grade A490 as shown on the plans. High-strength bolts used with coated steel shall be mechanically galvanized, unless otherwise specified. High-strength bolts used with uncoated weathering grades of steel shall be Type 3.

Nuts for ASTM F3125 Grade A325 bolts shall meet the requirements of ASTM A563, Grades DH, DH3, C, C3 and D. Where galvanized high-strength bolts are used, the nuts shall be galvanized, heat-treated Grade DH. Where Type 3 high-strength bolts are used, the nuts shall be Grade C3 or DH3.

Nuts for ASTM F3125 Grade A490 bolts shall meet the requirements of ASTM A563, Grade DH. Where Type 3 high-strength bolts are used, the nuts shall be Grade DH3.

All galvanized nuts shall be lubricated with a lubricant containing a visible dye of any color that contrasts with the color of the galvanizing. Black bolts must be oily to the touch when delivered and installed.

Circular flat and square or rectangular beveled, hardened steel washers shall meet the requirements of ASTM F436. Unless otherwise specified, galvanized washers shall be furnished when galvanized high-strength bolts are specified, and washers with atmospheric corrosion resistance and weathering characteristics shall be furnished when Type 3 high-strength bolts are specified.

Compressible-washer-type direct tension indicator washers, used in conjunction with high-strength bolts, shall meet the requirements of ASTM F959. Where galvanized high-strength bolts are used, the washers shall be galvanized in accordance with ASTM B695,

Class 55. Where Type 3 high-strength bolts are used, the washers shall be galvanized in accordance with ASTM B695, Class 55 and coated with epoxy.

(b) Identifying Marks: ASTM F3125 Grade A325 for bolts and the specifications referenced therein for nuts require that bolts and nuts manufactured to the specification be identified by specific markings on the top of the bolt head and on one face of the nut. Markings may be raised or depressed at the manufacturer's option and shall be visible after coating if coating is required. Head markings must identify the grade by the symbol "A325," the manufacturer and the type, if Type 3. Nut markings must identify the grade, the manufacturer and if Type 3, the type. Markings on direct tension indicators must identify the manufacturer and Type "A325." Other washer markings must identify the manufacturer and if Type 3, the type.

ASTM F3125 Grade A490 for bolts and the specifications referenced therein for nuts require that bolts and nuts manufactured to the specifications be identified by specific markings on the top of the bolt head and on one face of the nut. Markings may be raised or depressed at the manufacturer's option and shall be visible after coating if coating is required. Head markings must identify the grade by the symbol "A490," the manufacturer and the type, if Type 3. Nut markings must identify the grade, the manufacturer and if Type 3, the type. Markings on direct tension indicators must identify the manufacturer and Type "A490." Other washer markings must identify the manufacturer and if Type 3, the type.

ASTM F3125 Grade A325 and ASTM F3125 Grade A490 bolt lengths up to 4 times the diameter which are fully threaded but which are not required to be fully threaded by the relevant ASME standard shall be marked with a "T" immediately after the grade designation, for example "A325T." Bolts with any other non-standard dimensions, including thread length, shall be marked with an "S" immediately after the grade designation, for example "A325S." All other markings, if used, such as a private label distributor's mark shall also be separate and distinct.

(c) Dimensions: Bolt and nut dimensions shall meet the requirements for Heavy Hexagon Structural Bolts and for Heavy Semi-Finished Hexagon Nuts given in ASME Standard B18.2.6.

(d) Galvanized Bolts: Galvanized bolts shall meet the requirements of ASTM F3125 Grade A325, Type 1. The bolts shall be hot-dip galvanized in accordance with ASTM F2329, to a thickness of 50 μm or mechanically galvanized in accordance with ASTM B695, Class 55. Bolts, nuts, and washers of any assembly shall be galvanized by the same process. The nuts shall be overtapped to the minimum amount required for the fastener assembly, and shall be lubricated with a lubricant containing a visible dye so a visual check can be made for the lubricant at the time of field installation. Galvanized bolts shall be tension tested after galvanizing. ASTM F3125 Grade A490 bolts shall be uncoated or shall be coated in accordance with either ASTM F1136 Grade 3 or ASTM F2833 Grade 1.

(e) Test Requirements: The maximum hardness of ASTM F3125 Grade A325 bolts shall be 34 HRC. The maximum hardness of ASTM F3125 Grade A490 bolts shall be 38 HRC.

Plain, ungalvanized nuts shall have a minimum hardness of 89 HRB.

Proof load tests, in accordance with the requirements of ASTM F606 Method 1, shall be required for the bolts. Wedge tests of full-size bolts are required in accordance with Section 10.1 of ASTM F3125. Galvanized bolts shall be wedge tested after galvanizing.

Proof load tests of ASTM A563 are required for nuts. Proof load tests for nuts used with galvanized bolts shall be performed after galvanizing, overtapping and lubricating.

Rotational-capacity tests are required and shall be performed on all plain or galvanized (after galvanizing) bolt, nut and washer assemblies by the manufacturer or distributor prior to shipping and by the Contractor at the Site.

The thickness of galvanizing on bolts, nuts and washers shall be measured. On bolts, it shall be measured on the wrench flats or on top of the bolt head, and on nuts it shall be measured on the wrench flats.

(f) Certified Test Reports and Materials Certificates: The Contractor shall submit notarized copies of Certified Test Reports and Materials Certificates in accordance with Article 1.06.07 for fastener assemblies. In addition the Certified Test Reports and Materials Certificates shall include the following:

1. Mill test reports shall indicate the place where the material was melted and manufactured.
2. Test reports for proof load tests, wedge tests, and rotational-capacity tests shall indicate where the tests were performed, date of tests, location of where the components were manufactured and lot numbers.
3. The test report for galvanized components shall indicate the thickness of the galvanizing.

(g) Material Samples: Prior to incorporation into the work, the Contractor shall submit samples of the bolt assemblies to the Engineer for testing in accordance with the latest edition of the "Materials Testing Manual (Chapter 8, Minimum Schedule for Acceptance Testing)." Samples shall be submitted for each diameter, length, material designation, grade, coating and manufacturer of bolt assembly."

M.06.03—Galvanizing:

Replace the entire subarticle with the following:

" **M.06.03—Galvanizing:** Unless otherwise specified on the plans or in the special provisions, the zinc coating on all iron and steel materials, other than wire, shall meet the requirements of ASTM A123, A153 or F2329, whichever shall apply.

When mechanical galvanizing is used it shall meet the requirements of ASTM B695 Class 55."

D.B.E. SUBCONTRACTORS AND MATERIAL SUPPLIERS OR MANUFACTURERS

January 2013

I. ABBREVIATIONS AND DEFINITIONS AS USED IN THIS SPECIAL PROVISION

A. *CTDOT* means the Connecticut Department of Transportation.

B. *USDOT* means the U.S. Department of Transportation, including the Office of the Secretary, the Federal Highway Administration ("FHWA"), the Federal Transit Administration ("FTA"), and the Federal Aviation Administration ("FAA").

C. *Broker* means a party acting as an agent for others in negotiating Contracts, Agreements, purchases, sales, etc., in return for a fee or commission.

D. *Contract, Agreement or Subcontract* means a legally binding relationship obligating a seller to furnish supplies or services (including but not limited to, construction and professional services) and the buyer to pay for them. For the purposes of this provision, a lease for equipment or products is also considered to be a Contract.

E. *Contractor* means a consultant, second party or any other entity under Contract to do business with CTDOT or, as the context may require, with another Contractor.

F. *Disadvantaged Business Enterprise ("DBE")* means a for profit small business concern:

1. That is at least 51 percent owned by one or more individuals who are both socially and economically disadvantaged or, in the case of a corporation, in which 51 percent of the stock is owned by one or more such individuals; and

2. Whose management and daily business operations are controlled by one or more of the socially and economically disadvantaged individuals who own it; and

3. Certified by CTDOT under Title 49 of the Code of Federal Regulations, Part 26, (Title 49 CFR Part 23 of the Code of Federal Regulations for Participation of Disadvantaged Business Enterprise in Airport Concessions)

G. *USDOT-assisted Contract* means any Contract between CTDOT and a Contractor (at any tier) funded in whole or in part with USDOT financial assistance.

H. *Good Faith Efforts ("GFE")* means all necessary and reasonable steps to achieve a DBE goal or other requirement which by their scope, intensity, and appropriateness to the objective, can reasonably be expected to fulfill the program requirement.

I. *Small Business Concern* means, with respect to firms seeking to participate as DBEs in USDOT-assisted Contracts, a small business concern as defined pursuant to Section 3 of the Small Business Act and Small Business Administration ("SBA") regulations implementing it (13 CFR Part 121) that also does not exceed the cap on average annual gross receipts in 49 CFR Part 26, Section 26.65(b).

J. *Socially and Economically Disadvantaged Individual* means any individual who is a citizen (or lawfully admitted permanent resident) of the United States and who is:

1. Any individual who CTDOT finds, on a case-by-case basis, to be a socially and economically disadvantaged individual.

2. Any individuals in the following groups, members of which are rebuttably presumed to be socially and economically disadvantaged:

    - "Black Americans", which includes persons having origins in any of the Black racial groups of Africa;
    - "Hispanic Americans", which includes persons of Mexican, Puerto Rican, Cuban, Dominican, Central or South American, or other Spanish or Portuguese culture or origin, regardless of race;
    - "Native Americans", which includes persons who are American Indians, Eskimos, Aleuts, or Native Hawaiians.
    - "Asian-Pacific Americans", which includes persons whose origins are from Japan, China, Taiwan, Korea, Burma (Myanmar), Vietnam, Laos, Cambodia (Kampuchea), Thailand, Malaysia, Indonesia, the Philippines, Brunei, Samoa, Guam, the U.S. Trust Territories of the Pacific Islands (Republic of Palau), the Commonwealth of the Northern Marianas Islands, Macao, Fiji, Tonga, Kiribati, Juvalu, Nauru, or Federated States of Micronesia;
    - "Subcontinent Asian Americans", which includes persons whose origins are from India, Pakistan, Bangladesh, Bhutan, the Maldives Islands, Nepal or Sri Lanka;
    - Women;
    - Any additional groups whose members are designated as socially and economically disadvantaged by the SBA, at such time as the SBA designation becomes effective.

K. *Commercially Useful Function ("CUF")* means the DBE is responsible for the execution of the work of the contract and is carrying out its responsibilities by actually performing, managing, and supervising the work involved with its own forces and equipment. The DBE must be responsible for procuring, determining quantity, negotiating price, determining quality and paying for all materials (where applicable) associated with their work. The DBE must also perform at least 30% of the total cost of its contract with its own workforce.

II. ADMINISTRATIVE REQUIREMENTS

A. General Requirements

A DBE goal percentage equaling __**13**__ percent (%) of the Contract value has been established for this Contract. This DBE goal percentage will be applied to the final Contract value to ultimately determine the required DBE goal. If additional work is required, DBE firms should be provided the appropriate opportunities to achieve the required DBE goal.

In order to receive credit toward the Contract DBE goal, the firms utilized as DBE subcontractors or suppliers must be certified as DBEs in the type of work to be counted for credit by CTDOT's Office of Contract Compliance prior to the date of the execution of the subcontract. Neither CTDOT nor the State of Connecticut's Unified Certification Program (UCP) makes any representation as to any DBE's

technical or financial ability to perform the work. Prime contractors are solely responsible for performing due diligence in hiring DBE subcontractors.

All DBEs shall perform a CUF for the work that is assigned to them. The Contractor shall monitor and ensure that the DBE is in compliance with this requirement. The Connecticut DBE UPC Directory of certified firms can be found on the CTDOT website http://www.ct.gov/dot. The directory lists certified DBE firms with a description of services that they are certified to perform. Only work identified in this listing may be counted towards the project's DBE goal. A DBE firm may request to have services added at any time by contacting CTDOT's Office of Contract Compliance. No credit shall be counted for any DBE firm found not to be performing a CUF.

Once a Contract is awarded, all DBEs that were listed on the pre-award DBE commitment document must be utilized. The Contractor is obligated to provide the value and items of the work originally established in the pre-award documentation to the DBE firms listed in the pre-award documentation. Any modifications to the pre-award commitment must follow the procedure established in Section II-C.

The Contractor shall designate a liaison officer who will administer the Contractor's DBE program. Upon execution of this Contract, the name of the liaison officer shall be furnished in writing to CTDOT's unit administering the Contract, CTDOT's Office of Contract Compliance and CTDOT's Office of Construction ("OOC"). Contact information for the designated liaison officer shall be furnished no later than the scheduled date for the pre-construction meeting.

The Contractor shall submit a bi-monthly report to the appropriate CTDOT unit administering the Contract. This report shall indicate what work has been performed to date, with the dollars paid and percentage of DBE goal completed.

Verified payments made to DBEs shall be included in this bi-monthly report. A sample form is included on the CTDOT website.

In addition, the report shall include:

1. A projected time frame of when the remaining work is to be completed for each DBE.

2. A statement by the Contractor either confirming that the approved DBEs are on schedule to meet the Contract goal, or that the Contractor is actively pursuing a GFE.

3. If retainage is specified in the Contract specifications, then a statement of certification that the subcontractors' retainage is being released in accordance with 1.08.01 (Revised or supplemented).

Failure by the Contractor to provide the required reports may result in CTDOT withholding an amount equal to one percent (1%) of the monthly estimate until the required documentation is received.

The Contractor shall receive DBE credit when a DBE, or any combination of DBEs, perform work under the Contract in accordance with this specification.

Only work actually performed by and/or services provided by DBEs which are certified for such work and/or services, as verified by CTDOT, can be counted toward the DBE goal. Supplies and equipment a DBE purchases or leases from the Contractor or its affiliate cannot be counted toward the goal.

Monitoring of the CUF will occur by CTDOT throughout the life of the project. If it is unclear that the DBE is performing the work specified in its subcontract with the prime Contractor, further review may be required. If it is determined that the DBE is not performing a CUF, then the work performed by that DBE will not be counted towards the DBE goal percentage.

B. Subcontract Requirements

The Contractor shall submit to CTDOT's OOC all requests for subcontractor approvals on the standard CLA-12 forms provided by CTDOT. The dollar amount and items of work identified on the CLA-12 form must, at minimum, equal the dollar value submitted in the pre-award commitment. CLA-12 forms can be found at http://www.ct.gov/dot/construction under the "Subcontractor Approval" section. All DBE subcontractors must be identified on the CLA-12 form, regardless of whether they are being utilized to meet a Contract goal percentage. A copy of the legal Contract between the Contractor and the DBE subcontractor/supplier, a copy of the Title VI Contractor Assurances and a copy of the Required Contract Provision for Federal Aid Construction Contracts (Form FHWA-1273) (Federal Highway Administration projects only) must be submitted along with a request for subcontractor approval. These attachments cannot be substituted by reference.

If retainage is specified in the Contract specifications, then the subcontract agreement must contain a prompt payment mechanism that acts in accordance with Article 1.08.01 (Revised or supplemented).

If the Contract specifications do not contain a retainage clause, the Contractor shall not include a retainage clause in any subcontract agreement, and in this case, if a Contractor does include a retainage clause, it shall be deemed unenforceable.

In addition, the following documents are to be included with the CLA-12, if applicable:

- An explanation indicating who will purchase material.
- A statement explaining any method or arrangement for utilization of the Contractor's equipment.

The subcontract must show items of work to be performed, unit prices and, if a partial item, the work involved by all parties. If the subcontract items of work or unit prices are modified, the procedure established in Section II-C must be followed.

Should a DBE subcontractor further sublet items of work assigned to it, only lower tier subcontractors who are certified as a DBE firm will be counted toward the DBE goal. If the lower tier subcontractor is a non-DBE firm, the value of the work performed by that firm will not be counted as credit toward the DBE goal.

The use of joint checks between a DBE firm and the Contractor is acceptable, provided that written approval is received from the OOC prior to the issuance of any joint check. Should it become necessary to issue a joint check between the DBE firm and the Contractor to purchase materials, the DBE firm must be responsible for negotiating the cost, determining the quality and quantity, ordering the material and installing (where applicable), and administering the payment to the supplier. The Contractor should not make payment directly to suppliers.

Each subcontract the Contractor signs with a subcontractor must contain the following assurance:

"The subcontractor/supplier/manufacturer shall not discriminate on the basis of race, color, national origin, or sex in the performance of this contract. The contractor shall carry out applicable requirements of 49 CFR Part 26 in the award and administration of DOT-assisted contracts. Failure by the contractor/subcontractor/supplier/manufacturer to carry out these requirements is a material breach of this contract, which may result in the termination of this contract or such other remedy as the recipient deems appropriate."

C. Modification to Pre-Award Commitment

Contractors may not terminate for convenience any DBE subcontractor or supplier that was listed on the pre-award DBE commitment without prior written approval of the OOC. This includes, but is not limited to, instances in which a Contractor seeks to perform work originally designated for a DBE subcontractor with its own forces or those of an affiliate, a non-DBE firm, or with another DBE firm. Prior to approval, the Contractor must demonstrate to the satisfaction of the OOC, that it has good cause, as found in 49CFR Part 26.53 (f)(3), for termination of the DBE firm.

Before transmitting its request for approval to terminate pre-award DBE firms to the OOC, the Contractor must give written notice to the DBE subcontractor and include a copy to the OOC of its notice to terminate and/or substitute, and the reason for the notice.

The Contractor must provide five (5) days for the affected DBE firm to respond. This affords the DBE firm the opportunity to advise the OOC and the Contractor of any reasons why it objects to the termination of its subcontract and why the OOC should not approve the Contractor's action.

Once the Contract is awarded, should there be any amendments or modifications of the approved pre-award DBE submission other than termination of a DBE firm, the Contractor shall follow the procedure below that best meets the criteria associated with the reason for modification:

1. If the change is due to a scope of work revision or non-routine quantity revision by CTDOT, the Contractor must notify CTDOT's OOC in writing or via electronic mail that their DBE participation on the project may be impacted as soon as they are aware of the change. In this case, a release of work from the DBE firm may not be required; however the Contractor must concurrently notify the DBE firm in writing, and copy the OOC for inclusion in the project DBE file. This does not relieve the Contractor of its obligation to meet the Contract specified DBE goal, or of any other responsibility found in this specification.

2. If the change is due to a factor other than a CTDOT directive, a request for approval in writing or via electronic mail of the modification from the OOC must be submitted, along with an explanation of the change(s), prior to the commencement of work. The Contractor must also obtain a letter of release from the originally named DBE indicating their concurrence with the change, and the reason(s) for their inability to perform the work. In the event a release cannot be obtained, the Contractor must document all efforts made to obtain it.

3. In the event a DBE firm that was listed in the pre-award documents is **unable** or **unwilling** to perform the work assigned, the Contractor shall:

- Notify the OOC Division Chief immediately and make efforts to obtain a release of work from the firm.

- Submit documentation that will provide a basis for the change to the OOC for review and approval prior to the implementation of the change.

- Use the DBE Directory to identify and contact firms certified to perform the type of work that was assigned to the unable or unwilling DBE firm. The Contractor should also contact CTDOT's Office of Contract Compliance for assistance in locating additional DBE firms to the extent needed to meet the contract goal.

Should a DBE subcontractor be terminated or fail to complete work on the Contract for any reason, the Contractor must make a GFE to find another DBE subcontractor to substitute for the original DBE. The DBE replacement shall be given every opportunity to perform at least the same amount of work under the Contract as the original DBE subcontractor.

If the Contractor is unable to find a DBE replacement:

- The Contractor should identify other contracting opportunities and solicit DBE firms in an effort to meet the Contract DBE goal requirement, if necessary, and provide documentation to support a GFE. (Refer to GFE in Section III.)

- The Contractor must demonstrate that the originally named DBE, who is unable or unwilling to perform the work assigned, is in default of its subcontract, or identify other issues that affected the DBE firm's ability to perform the assigned work. **The Contractor's ability to negotiate a more advantageous agreement with another subcontractor is not a valid basis for change.**

III. GOOD FAITH EFFORTS

The DBE goal is **NOT** reduced or waived for projects where the Contractor receives a Pre-Award GFE determination from the Office of Contract Compliance prior to the award of the Contract. It remains the responsibility of the Contractor to make a continuing GFE to achieve the specified Contract DBE goal. The Contractor shall pursue every available opportunity to obtain additional DBE firms and document all efforts made in such attempts.

At the completion of all Contract work, the Contractor shall submit a final report to CTDOT`s unit administering the Contract indicating the work done by and the dollars paid to DBEs. Only verified payments made to DBEs performing a CUF will be counted towards the Contract goal.

Goal attainment is based on the total Contract value, which includes all construction orders created during the Contract. If the Contractor does not achieve the specified Contract goal for DBE participation or has not provided the value of work to the DBE firms originally committed to in the pre-award submission, the Contractor shall submit documentation to CTDOT`s unit administering the Contract detailing the GFE made during the performance of the Contract to satisfy the goal.

A GFE should consist of the following, where applicable (CTDOT reserves the right to request additional information):

1. A detailed statement of the efforts made to replace an unable or unwilling DBE firm, and a description of any additional subcontracting opportunities that were identified and offered to DBE firms in order to increase the likelihood of achieving the stated goal.

2. A detailed statement, including documentation of the efforts made to contact and solicit bids from certified DBEs, including the names, addresses, and telephone numbers of each DBE firm contacted; the date of contact and a description of the information provided to each DBE regarding the scope of services and anticipated time schedule of work items proposed to be subcontracted and the response from firms contacted.

3. Provide a detailed explanation for each DBE that submitted a subcontract proposal which the Contractor considered to be unacceptable stating the reason(s) for this conclusion.

4. Provide documentation, if any, to support contacts made with CTDOT requesting assistance in satisfying the specified Contract goal.

5. Provide documentation of all other efforts undertaken by the Contractor to meet the defined goal. Additional documentation of efforts made to obtain DBE firms may include but will not be limited to:
   - Negotiations held in good faith with interested DBE firms, not rejecting them without sound reasons.
   - Written notice provided to a reasonable number of specific DBE firms in sufficient time to allow effective participation.
   - Those portions of work that could be performed by readily available DBE firms.

In instances where the Contractor can adequately document or substantiate its GFE and compliance with other DBE Program requirements, the Contractor will have satisfied the DBE requirement and no administrative remedies will be imposed.

IV. PROJECT COMPLETION

At the completion of all Contract work, the Contractor shall:

1. Submit a final report to CTDOT`s unit administering the Contract indicating the work done by, and the dollars paid to DBEs.

2. Submit verified payments made to all DBE subcontractors for the work that was completed.

3. Submit documentation detailing any changes to the DBE pre-award subcontractors that have not met the original DBE pre-award commitment, including copies of the Department's approvals of those changes.

4. Retain all records for a period of three (3) years following acceptance by CTDOT of the Contract and those records shall be available at reasonable times and places for inspection by authorized representatives of CTDOT and Federal agencies. If any litigation, claim, or audit is started before

the expiration of the three (3) year period, the records shall be retained until all litigation, claims, or audit findings involving the records are resolved.

If the Contractor does not achieve the specified Contract goal for DBE participation in addition to meeting the dollar value committed to the DBE subcontractors identified in the pre-award commitment, the Contractor shall submit documentation to CTDOT`s unit administering the Contract detailing the GFE made during the performance of the Contract to satisfy the goal.

V. SHORTFALLS

A. Failure to meet DBE goals

As specified in (II-A) above, attainment of the Contract DBE goal is based on the final Contract value. The Contractor is expected to achieve the amount of DBE participation originally committed to at the time of award; however, additional efforts must be made to provide opportunities to DBE firms in the event a Contract's original value is increased during the life of the Contract.

The Contractor is expected to utilize the DBE subcontractors originally committed in the DBE pre-award documentation for the work and dollar value that was originally assigned.

If a DBE is terminated or is unable or unwilling to complete its work on a Contract, the Contractor shall make a GFE to replace that DBE with another certified DBE to meet the Contract goal.

The Contractor shall immediately notify the OOC of the DBE's inability or unwillingness to perform, and provide reasonable documentation and make efforts to obtain a release of work from the firm.

If the Contractor is unable to find a DBE replacement, then the Contractor should identify other contracting opportunities and solicit DBE firms in an effort to meet the Contract DBE goal requirement, if necessary, and provide documentation to support a GFE.

When a DBE is unable or unwilling to perform, or is terminated for just cause, the Contractor shall make a GFE to find other DBE opportunities to increase DBE participation to the extent necessary to at least satisfy the Contract goal.

For any DBE pre-award subcontractor that has been released appropriately from the project, no remedy will be assessed, provided that the Contractor has met the criteria described in Section II-C.

B. Administrative Remedies for Non-Compliance:

In cases where the Contractor has failed to meet the Contract specified DBE goal or the DBE pre-award commitment, and where no GFE has been demonstrated, then one or more of the following administrative remedies will be applied:

1. A reduction in Contract payments to the Contractor as determined by CTDOT, not to exceed the shortfall amount of the **DBE goal**. The maximum shortfall will be calculated by multiplying the

Contract DBE goal (adjusted by any applicable GFE) by the final Contract value, and subtracting any verified final payments made to DBE firms by the Contractor.

2. A reduction in Contract payments to the Contractor determined by CTDOT, not to exceed the shortfall amount of the **pre-award commitment**. The maximum shortfall will be calculated by subtracting any verified final payments made by the Contractor to each DBE subcontractor from the amount originally committed to that subcontractor in the pre-award commitment.

3. A reduction in Contract payments to the Contractor determined by CTDOT for any pre-award DBE subcontractor who has not obtained the dollar value of work identified in the DBE pre-award commitment and has not followed the requirements of Section II-C or for any DBE firm submitted for DBE credit that has not performed a CUF.

4. The Contractor being required to submit a written DBE Program Corrective Action Plan to CTDOT for review and approval, which is aimed at ensuring compliance on future projects.

5. The Contractor being required to attend a Non-Responsibility Meeting on the next contract where it is the apparent low bidder.

6. The Contractor being suspended from bidding on contracts for a period not to exceed six (6) months.

VI. CLASSIFICATIONS OTHER THAN SUBCONTRACTORS

A. Material Manufacturers

Credit for DBE manufacturers is 100% of the value of the manufactured product. A manufacturer is a firm that operates or maintains a factory or establishment that produces on the premises the materials or supplies obtained by the Contractor.

If the Contractor elects to utilize a DBE manufacturer to satisfy a portion of, or the entire specified DBE goal, the Contractor must provide the OOC with:

- Subcontractor Approval Form (CLA-12) indicating the firm designation,
- An executed “Affidavit for the Utilization of Material Suppliers or Manufacturers" (sample attached), and
- Substantiation of payments made to the supplier or manufacturer for materials used on the project.

B. Material Suppliers (Dealers)

Credit for DBE dealers/suppliers is limited to 60% of the value of the material to be supplied, provided such material is obtained from an approved DBE dealer/supplier.

In order for a firm to be considered a regular dealer, the firm must own, operate, or maintain a store, warehouse, or other establishment in which the materials, supplies, articles or equipment of the general character described by the specifications and required under the contract are bought, kept in stock, and regularly sold or leased to the public in the usual course of business. At least one of the following criteria

must apply:

- To be a regular dealer, the firm must be an established, regular business that engages, as its principal business and under its own name, in the purchase and sale or lease of the products in question.
- A person may be a regular dealer in such bulk items as petroleum products, steel, cement, gravel, stone, or asphalt without owning, operating or maintaining a place of business if the person both owns and operates distribution equipment for the products. Any supplementing of the regular dealers' own distribution equipment shall be by long term lease agreement, and not on an ad hoc or contract to contract basis.
- Packagers, brokers, manufacturers' representatives, or other persons who arrange or expedite transactions are not regular dealers within the meaning of this paragraph.

If the Contractor elects to utilize a DBE supplier to satisfy a portion or the entire specified DBE goal, the Contractor must provide the OOC with:

- Subcontractor Approval Form (CLA-12) indicating the firm designation,
- An executed "Affidavit for the Utilization of Material Suppliers or Manufacturers" (sample attached), and
- Substantiation of payments made to the supplier or manufacturer for materials used on the project.

C. Brokering

- Brokering of work for DBE firms who have been listed by the Department as certified brokers is allowed. Credit for those firms shall be applied following the procedures in Section VI-D.

- Brokering of work by DBEs who have been approved to perform subcontract work with their own workforce and equipment is not allowed, and is a Contract violation.

- Firms involved in the brokering of work, whether they are DBEs and/or majority firms who engage in willful falsification, distortion or misrepresentation with respect to any facts related to the project shall be referred to the U.S. DOT, Office of the Inspector General for prosecution under Title 18, U.S. Code, Part I, Chapter 47, Section 1020.

D. Non-Manufacturing or Non-Supplier DBE Credit

Contractors may count towards their DBE goals the following expenditures with DBEs that are not manufacturers or suppliers:

- Reasonable fees or commissions charged for providing a bona fide service such as professional, technical, consultant or managerial services and assistance in the procurement of essential personnel, facilities, equipment materials or supplies necessary for the performance of the Contract, provided that the fee or commission is determined by the OOC to be reasonable and consistent with fees customarily allowed for similar services.

- The fees charged only for delivery of materials and supplies required on a job site when the hauler, trucker, or delivery service is a DBE, and not the manufacturer, or regular dealer of the materials and

supplies, and provided that the fees are determined by the OOC to be reasonable and not excessive as compared with fees customarily allowed for similar services.

- The fees or commissions charged for providing bonds or insurance specifically required for the performance of the Contract, provided that the fees or commissions are determined by CTDOT to be reasonable and not excessive as compared with fees customarily allowed for similar services.

E. Trucking

While technically still considered a subcontractor, the rules for counting credit for DBE trucking firms are as follows:

- The DBE must own and operate at least one fully licensed, insured, and operational truck used on the Contract.
- The DBE receives credit for the total value of the transportation services it provides on the Contract using trucks it owns, insures and operates using drivers it employs.
- The DBE may lease trucks from another DBE firm, including an owner-operator who is certified as a DBE. The DBE who leases trucks from another DBE receives credit for the total value of the transportation services the lessee DBE provides on the Contract.
- The DBE may lease trucks from a non-DBE firm; however the DBE may only receive credit for any fees or commissions received for arranging transportation services provided by the non-DBE firms. Additionally, the DBE firm must demonstrate that they are in full control of the trucking operation for which they are seeking credit.

VII. Suspected DBE Fraud

In appropriate cases, CTDOT will bring to the attention of the USDOT any appearance of false, fraudulent, or dishonest conduct in connection with the DBE program, so that USDOT can take the steps, e.g. referral to the Department of Justice for criminal prosecution, referral to USDOT Inspector General, action under suspension and debarment or Program Fraud and Civil Penalties rules provided in 49 CFR Part 31.

January 2013

CONNECTICUT DEPARTMENT OF TRANSPORTATION
(OFFICE OF CONSTRUCTION)
BUREAU OF ENGINEERING AND CONSTRUCTION

This affidavit must be completed by the State Contractor's DBE notarized and attached to the contractor's request to utilize a DBE supplier or manufacturer as a credit towards its DBE contract requirements; failure to do so will result in not receiving credit towards the contract DBE requirement.

State Contract No.

Federal Aid Project No.

Description of Project

I, _____, acting in behalf of _____,
(Name of person signing Affidavit) (DBE person, firm, association or corporation)
of which I am the _____ certify and affirm that _____
(Title of Person) (DBE person, firm, association or corporation)
is a certified Connecticut Department of Transportation DBE. I further certify and affirm that I have read and understand 49 CFR, Sec. 26.55(e)(2), as the same may be revised.

I further certify and affirm that _____ will assume the actual and
(DBE person, firm, association or Corporation)
for the provision of the materials and/or supplies sought by _____ .

If a manufacturer, I operate or maintain a factory or establishment that produces, on the premises, the materials, supplies, articles or equipment required under the contract an of the general character described by the specifications.

If a supplier, I perform a commercially useful function in the supply process. As a regular dealer, I, at a minimum, own and operate the distribution equipment for bulk items. Any supplementing of my distribution equipment shall be by long-term lease agreement, and not on an ad hoc or contract-by-contract basis.

I understand that false statements made herein are punishable by Law (Sec. 53a-157), CGS, as revised).

(Name of Corporation or Firm)

(Signature & Title of Official making the Affidavit)

Subscribed and sworn to before me, this _____ day of _____ 20 _____.

Notary Public (Commissioner of the Superior Court)

My Commission Expires_____

CERTIFICATE OF CORPORATION

I, _____, certify that I am the _____
(Official) (President)
of the Corporation named in the foregoing instrument; that I have been duly authorized to affix the seal of the Corporation to such papers as require the seal; that _____, who signed said instrument on behalf of the Corporation, was then
of said corporation; that said instrument was duly signed for and in behalf of said Corporation by authority of its governing body and is within the scope of its corporation powers.

_____ _____
(Signature of Person Certifying) (Date)

ITEM #0000309A - FURNISH AND INSTALL AVIAN NESTING BOX

Description: Work under this item shall consist of constructing or providing a pre-fabricated avian nesting box as detailed in the plans. Also included shall be the placement and/or mounting of the nesting box as shown on the plans or as directed by the Engineer.

Materials: The material for the nesting box shall be as shown on the plans.

High strength bolts shall conform to ASTM A325, Type 1 as shown on the plans.

Nuts for ASTM A325 bolts shall conform to ASTM A563, grades DH, DH3.

Circular flat and square or rectangular beveled, hardened steel washers shall conform to ASTM F436. Bolts, nuts and washers shall be hot –dip galvanized in accordance with ASTM A153.

All stainless steel fasteners as indicated on the plans shall conform to the requirements of ASTM A193 Class 2 Grade 8. Nuts shall conform to ASTM A194 Grade 8 strain hardened (304) and washers shall conform to ASTM A276 Type 304, annealed.

All mounting brackets such as angles shall conform to the requirements of ASTM A36 or ASTM A709 Grade 36. Angles shall be galvanized in accordance with ASTM A123.

The nesting substrate shall be rounded pea stone only, no broken or crushed stone will be accepted, as it may injure the birds or cause damage to eggs.

Construction Methods: Prior to the construction or purchase of any nesting box the Contractor, through the Engineer, shall contact Christopher Samorajczyk (Christopher.Samorajczyk@ct.gov) of the Office of Environmental Planning (OEP) to set up an on-site coordination meeting. The purpose of such meeting shall be to determine a suitable location for the placement of the nesting box.

Subsequent to the placement determination, the Contractor shall submit either shop drawings (if box is pre-fabricated) or working drawings (if box will be constructed), whichever is appropriate, for review and approval in accordance with Article 1.05.02. The submittal shall be signed and sealed by a Professional Engineer licensed in the State of Connecticut and shall include but not be limited to the following: Construction details or catalog cuts, mounting method and details, anchorage type and details.

Prior to placing the nesting box the Contractor shall drill 15 to 20 evenly spaced holes in the bottom of the box to facilitate drainage. Approximately 4 in. to 6 in. of rounded pea stone gravel shall be placed level inside the box. The gravel shall not be compacted as to interfere with the ability of the box to drain.

Unless specifically waived at the time of the on-site coordination meeting the Contractor shall coordinate through the Engineer, with OEP to coordinate with the CTDEEP Wildlife Division so that their representative may be on-site when the box is mounted in the previously determined location. In the event that a representative cannot be present, the Engineer shall provide OEP and the CTDEEP Wildlife Division with notification acknowledging successful placement of the nesting box, including digital photographs.

Method of Measurement: This item will be measured for payment by the number of avian nesting boxes installed, of the type and size specified, completed and accepted.

Basis of Payment: This item will be paid for at the Contract Unit Price each for "Furnish and Install Avian Nesting Box," complete and in place, which price shall include all materials, tools, equipment, and labor incidental thereto.

Pay Item	Pay Unit
Furnish and Install Avian Nesting Box	Ea.

ITEM #0007020A - LINER SYSTEM MODIFICATIONS

Description:

The Flexible Membrane Liner (FML) associated with the adjacent Solid Waste Disposal Area will be impacted during installation of catch basins, drainage pipe, and lighting foundations, which will require modifications to the liner and anchoring. Under this Item, the Contractor shall locate the existing FML anchor trench within in the Project Limits and modify or anchor the FML to proposed structures adjacent to the encapsulated Solid Waste Disposal Area, located within the Project Limits, in accordance with an Authorization for the Disruption of a Solid Waste Disposal Area.

Materials:

All materials shall conform to the State of Connecticut DOT Standard Specifications for Roads, Bridges, and Incidental Construction Form 817, as supplemented, and to the requirements of the Contract.

Replacement FML: The Contractor shall provide FML of High Density Polyethylene (HDPE) manufactured from virgin polymer material and shall have a nominal thickness of 60 mils as specified. The liner shall be manufactured to be suitable for use in either exposed or buried conditions. The liner shall conform with the following material specifications:

		Requirements (Nominal Thickness [1])		
Property	**Test Method**	**30 Mil**	**40 Mil**	**60 Mil**
Density, g/cc	ASTM D1505	0.94	0.94	0.94
Tensile Properties	ASTM D638 (Type IV at 2 in/min)			
Yield Stress, lb/in		63	84	126
Break Stress, lb/in		114	152	228
Yield Elongation, %		12	12	12
Break Elongation, %		560	560	560
Tear Resistance, lb	ASTM D1004	21	28	42
Puncture Resistance, lb	ASTM D4833	54	72	108
Carbon Black Content, %	ASTM D1603	2-3	2-3	2-3
Carbon Black Dispersion	ASTM D5596	Cat 1-2	Cat 1-2	Cat 1-2
Seam Properties	ASTM D4437 (1-inch-wide at 2 in/min)			
Shear Strength, lb/in		60	80	120
Peel Strength, lb/in		39/FTB [2]	52/FTB [2]	78/FTB [2]

Notes:
1- All values, unless specified otherwise, are minimum average roll values as reported by the specified test methods.
2- Film tear bond (FTB): A failure of one of the bonded sheets by tearing prior to complete separation in the bonded area.

Liner Sealant/Caulk: Sealant shall conform to the following material specifications:

Property	Test Method	Cured Properties
Hardness	ASTM D5261	30
Tensile strength, lb/in^2	ASTM D4632	400
Grab tensile elongation, %	ASTM D4632	450
Tear strength, lb/in	ASTM D4533	45
Peel strength, lb/in	ASTM D4833	40

Metal Battens: The Contractor shall provide batten strips for terminating the liner at structures and shall be 0.25-inch thick by 2 inches wide constructed of stainless steel.

Stainless Steel Expansion Anchor, Batten Nut & Washer: The contractor shall provide fasteners and appurtenances shall be Wedge Anchor, Fully Threaded, 304 Stainless Steel:

1. Thread Size 3/8-16.
2. Overall Length 2 1/4 In.
3. Thread Length 1 1/8 In.
4. Min Embedment 1 1/2 In.
5. Max Work Thickness 3/8 In.
6. Ultimate Tension in 4000 PSI Concrete 2240 Lb.
7. Ultimate Shear in 4000 PSI Concrete 2620 Lb.
8. Meets/Exceeds US Government GSA Specifications FF-S-325 Group II, Type 4. Class I, Includes Nuts and Washers, Package 50.
9. Meets/Exceeds: A-A-1923A Type 4, Agency Compliance: UL.

Hot Shoe (Wedge) Welding: The Contractor shall provide automated welding equipment capable of measuring and controlling both the temperature at the wedge and the welding speed to ensure correct and consistent parameters are maintained during the welding process.

Fillet Extrusion Welding: The Contractor shall provide a field extrusion welder capable of adhering a continuous bead between the panels with a nominal width of one inch. Extrusion welders shall have a fixed preheat nozzle attached to the front of the extrusion welder.

Generator: A 6.5 Kw or larger generator will be used at the work area and electrical extension cords will be used to power the welding equipment. The power source for welding equipment shall be capable of providing constant voltage under a combined-line load.

Final Cover Material: Final cover soil shall meet the definition of "natural soil" pursuant to Section 22a-209-1 of RCSA. Final cover soil shall consist of an 18-inch low permeability soil layer (i.e. minimum of $1x10^{-5}$ cm/sec or 15%-30% fines passing a #200 sieve) overlain by a 6-inch vegetative support layer (i.e. topsoil) and vegetative cover.

References:

ASTM International:

1. D1004 - Initial Tear Resistance of Plastic Film and Sheeting
2. D1505 - Density of Plastics by the Density-Gradient Technique
3. D1603 - Carbon Black Content in Olefin Plastics
4. D4437 - Standard Practice for Non-Destructive Testing (NDT) for Determining the Integrity of Seams Used in Joining Flexible Polymeric Sheet Geomembranes
5. D4533 - Standard Test Method for Trapezoid Tearing Strength of Geotextiles
6. D4632 - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles
7. D4833 - Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products
8. D5261 – Standard Test Method for Measuring Mass per Unit Area of Geotextiles
9. D5596 - Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics
10. D638 - Standard Test Method for Tensile Properties of Plastics
11. D6497 - Mechanical Attachment of Geomembrane to Penetrations or Structures

Submittals:

Contractor shall submit the following in accordance with Form 817 Article 1.20-1.05.02 or in accordance with NOTICE TO CONTRACTOR – SUBMITTALS.

Submit Product Data for all materials to be incorporated in the Liner System Modifications, including, but to HDPE liner, liner sealant, battens, and expansion anchor, nut & washer. Also include:

1. A detailed step by step installation procedure and a list of the specific equipment to be used for the installation. The installation procedure must fully comply with the specifications and address all anticipated field conditions, including the variability that may be encountered with the existing location(s) and area of the FML anchor trench, periods of inclement weather and manufacturer's temperature and humidity restrictions for installation. Include a copy of the manufacturer's temperature/humidity restrictions for placement.
2. A contingency plan for repair of perforations or other damage to the FML that may arise due to installation or other construction activities.

Construction Methods:

A. General

The Contractor shall notify the Engineer at least fifteen (15) days prior to the initiation of construction activities associated with the disruption.

Prior to starting any intrusive work the Contractor shall post and maintain two (2) signs at the Solid Waste Disposal Area alerting drivers and equipment operators that trucks and diesel equipment coming to or used at the project area shall not be left idling for more than three (3) consecutive minutes. Note: The signs shall be visible from a distance of at least 25'. The Contractor shall submit shop drawings to the Engineer for sign approval before ordering. Payment for the signs shall be under the sign face sheet aluminum item in the Contract.

Contractor shall investigate (via test pits or other means) in order to locate the existing FML anchor trench within the Project Limits immediately prior to proceeding with other planned excavation or demolition activities. When the FML is encountered during the course of the work, health and safety provisions shall conform to the appropriate sections of the Contract. Provisions may include implementation of engineering controls, air and personal monitoring, the use of chemical protective clothing (CPC), personal protective equipment (PPE), and decontamination procedures.

FML system repairs shall be constructed in accordance with the Contract as shown on Project plans. The Contractor may request permission from the Engineer to modify the repairs at its own expense. Should the Contractor request such modification and the Engineer approve the change, this will by no means relieve the Contractor of its responsibility for complying with the Authorization for the Disruption of a Solid Waste Disposal Area.

All equipment required as a part of this Item shall be used in a manner acceptable to the Engineer and in accordance with the manufacturer's recommendations.

B. FML Material Storage and Handling

FML material delivered to the site shall be unloaded and stored with minimal handling. It shall be inspected for damage and any damage shall be noted and repaired.

The storage area must be as close as practical to the work area in order to minimize on site handling. The storage area must also be secure to prevent vandalism and theft and must be such that the material is not likely to be damaged by passing vehicles.

FML material shall be handled with equipment that will not cause damage and in accordance with methods approved by the liner manufacturer. The storage area shall be reasonable flat and well drained. The surface shall be free of sharp rocks and other objects that may damage the membrane. All the placed liner shall be adequately ballasted by sandbags to protect it from wind uplift forces. The liner shall be seamed and secured by the end of each workday. No construction

equipment shall be allowed directly on the liner except for light ATVs and generators to power the seaming machines.

The liner shall not be placed during fog and high humidity conditions, precipitation, in the presence of excessive winds, or in temperatures less than 50 degrees Fahrenheit, unless otherwise allowed by the manufacturer's installation instructions and/or warrantee. The liner shall be loosely laid with sufficient slack (about 2 percent) to accommodate thermal expansion and contraction encountered during construction. Each panel shall be laid out and positioned to minimize the number and length of the field seams and to be consistent with accepted installation practice. The methods used to place liner panels shall minimize wrinkles especially along field seams. When necessary, protect the liner to prevent damage when dragging or moving the panels.

C. FML Seaming

The primary method of seaming shall be hot shoe fusion welding. Fillet extrusion welding shall be used for repairs, T-seams, and detail work. Before fusion welding or extrusion welding, all areas that are to become seam interfaces shall be cleaned of dust and dirt.

1. Hot shoe welding—Hot shoe welding shall be accomplished by a double-wedge fusion welder that produces a double track weld. All accessories shall be approved by the liner manufacturer. To produce acceptable seams for the site-specific condition, the welder shall be calibrated at the beginning of each seaming period. Seaming procedures shall be in accordance with liner manufacturer specifications.
2. Fillet extrusion welding—Extrusion welding equipment and accessories shall be approved by liner manufacturer. To produce acceptable seams for the site-specific condition, the extrusion welder shall be calibrated once per day at the beginning of each seaming period. Seaming procedures shall be in accordance with liner manufacturer specifications.
3. Seam overlap—Liner panels shall have a minimum overlap of 4 inches for hot shoe welding and 3 inches for extrusion welding.
4. Seaming equipment and accessories shall meet manufacturer specifications.

D. FML Seam Testing

At a minimum, seams shall be tested under field conditions at the beginning of each seaming period and once in the morning and once in the afternoon. Three specimens shall be tested by a Contractor-supplied tensiometer in shear and peel modes. Test seams shall meet the requirements of Section 2.3 above. Each specimen shall be 1 inch wide with the grip separation rate of 2 inches per minute. All peel tests shall result in film tear bond (FTB) value. The FTB is defined as a failure of one of the bonded sheets before complete separation in the bonded area. The Contractor shall perform all seam testing in the presence of the Engineer. The Contractor shall test any additional seams directed by the Engineer to verify compliance with the specifications.

1. Nondestructive seam testing—Air pressure tests shall be performed on all double-wedge fusion seams. The air pressure test equipment and procedures shall conform to this specification and the liner manufacturer's specifications. Seal both ends of the seam to be tested. Insert the pressure needle into the seam's air channel. Pressurize the air channel through the needle to 25 to 30 pounds per square inch. Monitor any pressure drops for 5 minutes. A loss of pressure in excess of 4 pounds per square inch or a continuous loss of pressure is an indication of a leak. Terminate the test by relieving the pressure from the opposing end of the seam. The pressure shall immediately drop to zero upon opening the opposing end of the seam. If this does not occur, the seam channel shall be checked for obstructions and retested. All defects shall be marked for repair. Vacuum box tests shall be performed on all extrusion welds. The vacuum box equipment and test procedure shall conform to this specification and the liner manufacturer's specifications. Apply soapy water solution to the seam area to be tested. The vacuum box, equipped with a transparent viewing window, shall be centered over the seam area and a vacuum of 3 pounds per square inch shall be drawn. The seam area shall be visually monitored for any soap bubbles for 15 seconds. Seam testing shall continue by overlapping a minimum of 3 inches between each test interval. All defects shall be marked for repair.

2. Destructive seam testing—If required, seam samples shall be cut at no more than one sample per 500 feet of weld for destructive seam testing. All destructive seam samples shall be tested by a tensiometer in shear and peel modes to verify seams meet the requirements of ASTM D4437.

E. FML Repairs

Any damaged or defective FML areas identified upon locating and exposing the existing FML anchor trench within the Project Limits and/or all bad seams identified as a result of testing shall be repaired and tested before the installation is completed.

1. Tears, punctures, material defects—All tears, punctures, and material defects in liner shall be repaired by installing a patch over the defective area. Surfaces of the liner to be patched shall be cleaned to manufacturer’s specification before the repair. To ensure proper bonding of the extrusion weld, edges of the patch material and the adjacent liner shall be properly abraded by a light grinding. This operation shall be done no more than 15 minutes before the welding operation. The abrasion shall remove no more than 10 percent of the material thickness. All patches shall be of the same liner material and extend a minimum of 6 inches beyond the edges of the defect area. All patches shall have rounded corners and shall be extrusion welded to the liner. Alternatively, a bead of extrudate shall be placed over all holes that are less than 0.25 inch in diameter.

2. Seam repair—All failed seams shall be repaired by installing a cap strip over the entire length of failed seam. The cap strip shall be of the same liner material and shall extend the failed seam a minimum of 6 inches in all directions. Alternatively, the seam along the upper flap can be extrusion welded to the liner along the entire length of the failed seam.

F. FML Termination at Drainage Pipe Trench

When the FML is encountered during drainage pipe installation, care shall be taken to avoid damage. The FML material shall be carefully folded back to allow for the drainage pipe installation. Once the drainage pipe installation is complete, the FML material shall be re-anchored within the edge of the drainage pipe trench, as shown on Project plans. The anchor trench shall be constructed by the Contractor to a minimum width of 12 inches and minimum depth of 36 inches.

The edges where the FML is to enter the trench shall be free of irregularities and protrusions to avoid potential damage to the material. Backfilling of the anchor trench should occur when the FML material is at its most contracted state to avoid potential bridging problems. Care must be taken to avoid damaging the FML during backfilling.

G. FML Termination at Catch Basins

When the FML is encountered during catch basin installation, care shall be taken to avoid damage. The FML material shall be carefully folded back to allow for the catch basin installation. Once the catch basin installation is complete, the FML material shall be attached to the catch basins with stainless steel battens, as shown on Project plans and the liner manufacturer's specifications. The battens shall be bolted to structure concrete by epoxy coated bolts on 8-inch intervals to create a leak-free connection under submerged conditions. Bolt spacing shall be increased to 12 inches for connections above the fluid level.

H. Light Foundations

When the FML is encountered during light foundation installation, care shall be taken to avoid damage. The FML material shall be carefully cut and folded back to allow for the light foundation installation. Once the light foundation installation is complete, the FML material shall be attached to the lighting foundation with stainless steel battens, as shown on Project plans and the liner manufacturer's specifications. The battens shall be bolted to structure concrete by epoxy coated bolts on 8-inch intervals to create a leak-free connection under submerged conditions. Bolt spacing shall be increased to 12 inches for connections above the fluid level. If additional FML is required to install the steel batten fixture, additional FML shall be field seamed using extrusion welding.

Method of Measurement:

This work will be measured for payment at the Lump Sum cost for locating, modifying, repairing (as necessary), and anchoring the FML material to proposed structures within the Project Limits.

Basis of Payment:

This work will be paid for at the Contract Lump Sum, which shall include all materials, tools, labor, equipment, and work needed to modify and anchor the FML material to proposed

structures. This price shall also include any exploratory investigation activities for locating the FML material.

Drainage trench excavation shall be paid for under Section 2.86. Furnishing, preparing, and installing catch basins will be paid for under Section 5.86. Payment for light foundation installation activities shall be made under the appropriate Contract items.

Pay Item	Pay Unit
Liner System Modifications	Lump Sum

ITEM #0020765A - GUANO ABATEMENT

Description:

Work under this item shall include the abatement of accumulations of pigeon, bat, bird or other rodent/animal guano and associated work by persons who are knowledgeable, qualified, and trained in the abatement of guano and the subsequent cleaning of the affected environment.

These Specifications govern all work activities that disturb guano. All activities shall be performed in accordance with, but not limited to, the current revision of the OSHA General Duty Clause 29 CFR 1910 Section 5(a)(1), OSHA Respiratory Protection Standard 29 CFR 1910.134, OSHA Construction Standards 29 CFR 1926 and applicable Industry Standards and Guidelines on Guano/Microbial Remediation, such as; ACGIH *Bioaerosols: Assessment and Control*, OSHA SHIB 03-10-10 *A Brief Guide to Mold in the Work Place*, and NIOSH Publication 97-146 *Histoplasmosis: Protecting Workers at Risk.*

The guano abatement work shall include the removal and disposal of all guano accumulations as identified on the Contract Plans and Specifications or as directed by the Engineer.

Deviations from these Specifications require the written approval of the Engineer.

Materials:

All materials shall be delivered to the job site in the original packages, containers, or bundles bearing the name of the manufacturer, the brand name and product technical description.

No damaged or deteriorating materials shall be used. If material becomes contaminated with guano, the material shall be decontaminated or disposed of as guano waste material. The cost to decontaminate and dispose of this material shall be at the expense of the Contractor.

Fire retardant polyethylene sheet shall be in roll size to minimize the frequency of joints, with factory label indicating four (4) or six (6) mil thickness.

Six (6) mil polyethylene disposable bags.

Tape (or equivalent) capable of sealing joints in adjacent polyethylene sheets and for the attachment of polyethylene sheets to finished or unfinished surfaces must be capable of adhering under both dry and wet conditions.

Cleaning detergents, both non-toxic and biodegradable.

Spray equipment must be capable of mixing necessary chemical agents with water, generating sufficient pressure and volume; and equipped with adequate hose length to access all necessary work areas.

Sanders, grinders, wire brushes and needle-gun type removal equipment shall be equipped with a High Efficiency Particulate Air (HEPA) filtered vacuum dust collection system.

Containers for storage, transportation and disposal of guano waste material shall be impermeable and both air and watertight.

Any planking, bracing, shoring, barricades and/or temporary sheet piling, necessary to appropriately perform work activities shall conform to all applicable federal, state and local regulations.

Air filtration devices and vacuum units shall be equipped with HEPA filters.

Construction Methods:

(1) Pre-Abatement Submittals and Notices

(a) Fifteen (15) working days prior to the commencement of guano abatement work, the Contractor shall submit to the Engineer for review and acceptance and/or acknowledgment of the following:

1. Documentation dated within the previous twelve (12) months, certifying that all employees have received hazard communication training and understand the use and limits of respiratory equipment to be used; on an initial and annual basis.

2. Documentation dated within the previous twelve (12) months, from a physician certifying that all employees who may be exposed to airborne guano and mold spores in excess of background level have been provided with an opportunity to be medically monitored to determine whether they are physically capable of working while wearing the respirator required without suffering adverse health affects. Employees shall also be informed of the specific types of respirators they shall be required to wear and the work he/she will be required to perform as well as special workplace conditions such as high temperature, high humidity and chemical contaminants to which he/she may be exposed.

3. Documentation dated within the previous twelve (12) months, of respiratory fit testing for all employees who must don a tight-fitting face piece respirator in order to perform guano abatement activities. This fit testing shall be in accordance with qualitative procedures as detailed in 29 CFR 1910.134.

4. Project time schedule for each phase of work.

5. Name and qualifications of the OSHA Competent Person for the guano abatement activities, shall have a minimum of three years working experience as an environmental abatement site supervisor, shall be capable of identifying existing

guano hazards and shall have the authority to implement corrective measures to eliminate such hazards. The OSHA Competent Person shall be on-site at all times guano abatement is occurring, shall comply with applicable Federal, State and Local regulations which mandate work practices, and shall be capable of performing the work of this contract.

(b) No abatement shall commence until a copy of all required submittals have been received and found acceptable to the Engineer. Those employees added to the Contractor's original list will be allowed to perform work only upon submittal to, and receipt of, all required paperwork by the Engineer.

(2) Guano Abatement Provisions:

(a) General Requirements

The Abatement Contractor/Subcontractor shall have an OSHA Competent Person on site and in control on the job site at all times during abatement work.

All labor, materials, tools, equipment, services, testing, insurance (with specific coverage for work on guano/spores), and incidentals which are necessary or required to perform the work in accordance with applicable governmental regulations, industry standards and codes, and these Specifications shall be provided by the Contractor. The Contractor shall be prepared to work all shifts and weekends throughout the course of this project as directed by the Engineer.

Prior to beginning work, the Contractor shall perform a visual survey of each work area and review conditions at the site for safety reasons. In addition, the Contractor shall instruct all workers in all aspects of personnel protection, work procedures, emergency evacuation procedures and use of equipment including procedures unique to this project.

The Contractor shall:

Shutdown and isolate heating, cooling, and ventilating air systems to prevent contamination and spore dispersal to the other areas of the building.

Shut down and lock out/tag out electrical power, including all receptacles and light fixtures, when feasible. The use or isolation of electrical power will be coordinated with all other ongoing uses of electrical power at the site.

Coordinate all power and fire alarm isolation with the appropriate representatives.

When necessary, provide temporary power and adequate lighting and ensure safe installation of electrical equipment, including ground fault protection and power cables, in compliance with applicable electrical codes and OSHA requirements. The Contractor is responsible for proper connection and installation of electrical wiring.

If sufficient electrical service is unavailable, the Contractor may need to supply electrical power to the site by fuel operated generator(s). Electrical power supply shall be sufficient for all equipment required for this project in operation throughout the duration of the project.

In each interior work area, negative pressure must be continuously maintained until the area achieves satisfactory reoccupancy criteria and is approved by the Project Monitor to be deregulated. If interior work phases cannot be subdivided into manageable work areas that can be completed within one shift, negative air pressure must be maintained twenty-four (24) hours per day and the Contractor shall establish temporary electrical service to the site, rather than utilize generators.

Water service may not be available at the site. Contractor shall supply sufficient water for each shift to operate the decontamination shower units as well as to maintain the work areas adequately wet.

Ladders and/or scaffolds shall be in compliance with OSHA requirements, and of adequate length, strength and sufficient quantity to support the scope of work. Use of ladders/scaffolds shall be in conformance with OSHA 29 CFR 1926 Subpart L and X requirements.

Work performed at heights exceeding six feet (6') shall be performed in accordance with the OSHA Fall Protection Standard 29 CFR 1926 Subpart M including the use of fall arrest systems as applicable.

Any data provided to the Contractor regarding guano accumulations identified throughout the structure(s) is for informational purposes only. Under no circumstances shall this information be the sole means used by the Contractor for determining the presence and location of all guano accumulations. Prior to commencement of work, the **Contractor shall verify all field conditions and quantities affecting performance/completion of the work** as described in these Specifications in accordance with OSHA, USEPA, USDOT, DEP standards. Compliance with the applicable requirements is solely the responsibility of the Contractor.

The Engineer will provide a Project Monitor to oversee the activities of the Contractor. No abatement work shall be performed until the Project Monitor is on-site. Environmental sampling may be conducted as deemed necessary by the Project Monitor.

Warning signs shall be posted at each entrance to the work area which clearly indicates the area has been regulated as a MICROBIAL REMEDIATION WORK AREA – AUTHORIZED PERSONNEL ONLY.

(b) Worker Decontamination Enclosure System

The Contractor shall establish contiguous to the Regulated Work Area, a Worker Decontamination Enclosure System consisting of Equipment Room and Clean Room in series, as detailed below. Access to the Regulated Area shall only be through this enclosure.

Access between rooms in the Worker Decontamination Enclosure System shall be through airlocks. Other effective designs are permissible. The Clean Room and Equipment Room located within the Worker Decontamination Enclosure, shall be contiguously connected with taped airtight edges, thus ensuring the sole source of airflow originates from outside the regulated areas, once a negative pressure differential within Interior Regulated Areas is established.

The Clean Room shall be adequately sized to accommodate workers and shall be equipped with a suitable number of hooks, lockers, shelves, etc., for workers to store personal articles and clothing. Changing areas of the Clean Room shall be suitably screened from areas occupied by the public.

The Equipment Room shall be of sufficient capacity to accommodate the number of workers. The Equipment Room shall be utilized by personnel to remove protective clothing, decontaminate through the use of HEPA vacuums and a wash facility, and clean off sealed waste containers ready for removal from the work area. No worker or other person shall leave a Regulated Area without decontaminating.

(c) Containment of Interior Work Areas

Pre-clean the work areas using HEPA filtered equipment (vacuum) and/or wet methods as appropriate, collecting and properly containing all dust and debris as guano contaminated waste. Vacuum units, of suitable size and capabilities for the project, shall have HEPA filters capable of trapping and retaining at least 99.97 percent of all monodispersed particles of three micrometers in diameter or larger. Do not use methods that raise dust, such as dry sweeping or vacuuming with equipment not equipped with HEPA filters.

After pre-cleaning, movable objects not designated for relocation by others shall be removed from the work areas with the utmost care to prevent damage of any kind and relocated to a temporary storage location coordinated with the Engineer. The Contractor is responsible for protecting all fixed objects that are permanent fixtures or are too large to remove and remain inside the Regulated Area. Fixed objects shall be enclosed with one layer of six (6) mil polyethylene sheeting sealed with tape.

Engineering controls must be implemented to ensure that debris is not dispersed outside of the work area during cleaning/removal process. Such controls involve source containment, limited critical barriers, full poly containment enclosures and/or negative pressure enclosures, based on the size and magnitude of contamination, as directed by the Engineer, and in accordance with Industry Standards and Guidelines.

Critical barriers consisting of a minimum of one (1) layer of six (6) mil polyethylene sheeting, secured at the edges with duct tape, shall be installed to seal off all windows, doorways, skylights, ducts, grilles, diffusers, vents, light fixtures, suspended ceiling tile systems and any other openings between the Regulated Work Areas and the surrounding uncontaminated areas, including the outside of the building. Complete isolation of the work area from adjacent areas

using a minimum of one (1) layer of six (6) mil polyethylene sheeting to create an enclosure and seal with duct tape. HVAC systems within the work area cannot be operating.

HEPA filtered negative air filtration units will be used with the intake in the general work area and exhaust outdoors during removal/cleaning of large or extensive contamination areas, and/or as directed by the Engineer, so as to provide local exhaust ventilation and create a negative pressure enclosure work area. Negative pressure must be maintained continuously in each work area until the area achieves satisfactory verification criteria and is approved by the Engineer for deregulation. A sufficient number of negative air filtration units shall be utilized in each work area to create a negative pressure differential in the range of 0.02 to 0.04 inches of water column between the Regulated Area and surrounding areas, and allow a sufficient flow of air through the area to provide four (4) air changes per hour. Negative air filtration units shall be equipped with four stages of filtration, with the final stage being High Efficiency Particulate Air (HEPA) filtration, and incorporate an automatic warning system to indicate pressure drop or unit failure. Negative pressure shall be measured in each work area by a recording manometer, during the entire project.

Following construction of the containment work area, the containment shall pass a pre-abatement visual inspection by the Competent Person and the Project Monitor prior to commencement of abatement work.

(d) Alternate work area containment requirements for exterior abatement procedures

In lieu of the establishment of a negative pressure enclosure (NPE) system as described above, guano accumulations will be removed from exterior work areas within an outdoor Regulated Area(s). The regulated work areas will be established by the use of appropriately labeled barrier tape and postings, as well as source containment, poly drop cloths and local HEPA exhaust ventilation. A remote personnel decontamination unit will also be required.

(e) Personnel Protection

The Contractor shall utilize all appropriate engineering controls and safety and protective equipment while performing the work in accordance with applicable standards and guidelines.

Abatement workers should have received hazard communication awareness training on safe work practices associated with guano/microbial abatement, and health effects of guano/microbial spore exposure, be medically approved to perform such work and have received fit testing for respirator use.

Abatement workers conducting the cleaning/removal and all personnel entering the work areas will be required to wear personal protective equipment including the following minimum. The Contractors Competent Person shall ultimately make the exposure/hazard assessment judgement on whether upgraded PPE is required.

1. Negative Pressure Respirators equipped with N-95 filter cartridges
2. Disposable coveralls with a hood

3. Eye protection
4. Appropriate gloves

Respiratory protection shall be provided and shall meet the requirements of OSHA as required in 29 CFR 1910.134. A formal respiratory protection program must be implemented in accordance with 29 CFR 1910.134. The Contractor shall provide respirators from among those approved as being acceptable for protection by the National Institute for Occupational Safety and Health (NIOSH) under the provisions of 30 CFR Part ll.

All other necessary personnel protective equipment (i.e. hardhat, work boots, safety glasses, hearing protection, etc.) required to perform the abatement work activities, as deemed necessary by the Competent Person, shall conform to all applicable federal, state and local regulations.

All other qualified and authorized persons entering into a Regulated Area (i.e. Project Monitor, Regulatory Agency Representative) shall adhere to the requirements of personnel protection as stated in this section.

Contractor shall ensure that all workers and authorized persons who enter and leave the work area use a personnel decontamination system.

Contractor shall ensure HEPA filtered local exhaust ventilation is provided in all areas where extensive guano accumulations are to be cleaned/removed to reduce the potential for airborne exposure to spores.

Non-abatement workers shall be kept out of the immediate areas where abatement is ongoing.

(f) Removal and Cleaning Methods

The general cleaning/removal procedures specified herein are to be used as a guideline throughout the project. Deviations from specified methods of removal/cleaning must be approved in writing by the Engineer prior to their implementation.

The following details the extent of each phase of operation designated for this project. Phase areas may be combined or divided at the direction of the Engineer. Proceed through the sequencing of the work phases under the direction of the Engineer.

Bridge Nos. 00480, 01459, 01460, 05796, 05922, 6000A, 6000B, 06043A, 06043B & 06289, in Hartford, Wethersfield & East Hartford, CT

Abutments, Beams, Piers and Ground Cover on Underside of Bridges

Using trained and appropriately protected staff, remove and dispose of all accumulations of guano, feathers, carcasses, etc. as directed by the Engineer. Clean the areas where removal occurs using biodegradable/non-toxic detergent solutions and HEPA vacuuming. Regulated area(s) shall be established at the perimeter of the work area(s), and access shall

be controlled by the Contractor. Utilize dust suppression methods such as misting (not soaking) materials prior to abatement. Poly drop cloths should be used as appropriate to protect objects in direct proximity to the work areas from contamination, and prevent the release of contamination/debris to outside areas. After cleaning the area(s) should be left dry and visibly free from contamination and debris. Utilize damp wiping and HEPA filtered vacuuming techniques for final area cleanup. A remote personnel decontamination unit shall also be utilized. Waste generated from the cleaning process should be removed from the work space in sealed plastic bags to prevent dispersal of spores to non-affected building/work spaces and disposed of as general bulky C&D waste debris. Removal shall be undertaken in accordance with Industry Guidelines. Care should be exercised during guano removal/cleaning to not disturb or release any underlying lead paint which may be present. ***Contractor shall be responsible for the erection and safe maintenance of any and all necessary apparatus/equipment to gain access to the work areas and perform the required abatement.***

Contractor shall wet mist all materials/accumulations/surfaces scheduled for removal/cleaning prior to commencing work to minimize airborne dust/spore generation and use damp methods throughout the removal/cleanup process.

Contaminated materials, accumulations and debris that are to be removed must be removed with as little disturbance as possible.

The Contractor shall promptly place the removed material in disposal containers (six (6) mil polyethylene bags, fiber drums, etc.) as it is removed. Large components removed intact may be wrapped in two (2) layers of six (6) mil polyethylene sheeting secured with tape. As the disposal containers are filled, the Contractor shall promptly seal the containers and clean the containers before removal from the work area. Bags shall be securely sealed to prevent accidental opening and leakage by taping in gooseneck fashion. Materials with sharp-edged components (e.g. nails, screws, metal lath, tin sheeting) which could tear polyethylene bags and sheeting shall be placed in clean drums and sealed with locking ring tops. All waste containers shall be leak-tight, (typically consisting of two layers of 6 mil poly (or bags)). Containers shall be decontaminated by wet cleaning and HEPA vacuuming within the decontamination area prior to exiting the regulated area. On site storage of waste containers shall be as dictated and allowed by the Engineer within the extent of construction operations. On site storage of waste containers in public areas, outside of construction containment areas shall not be allowed.

Following material/accumulation removal, Contractor shall thoroughly clean the work area. Cleaning of surfaces and content items, shall utilize wet/damp wiping coupled with a non-toxic, biodegradable detergent wash. Following cleaning, the areas shall be dried and HEPA vacuumed to remove all associated dirt and debris.

The use of biocides, including chlorine bleach, is not recommended during guano/microbial abatement. Biocides are toxic to humans and may cause damage to underlying building substrates. Any use of biocides, fungicides, disinfectants or encapsulants can be done only with the written approval of the Engineer.

After cleaning, the Competent Person and Project Monitor shall perform a post remediation visual inspection of each work area to ensure remediation is complete, that no dust or debris remains on surfaces in the work areas as the result of removal/cleaning operations and the areas have been dried. All surfaces within the Regulated Work Areas, including but not limited to ledges, beams, and hidden locations shall be inspected for visible residue. Evidence of guano/microbial accumulations/contamination and/or debris identified during this inspection will necessitate further cleaning as heretofore specified. The area shall be re-cleaned at the Contractor's expense, until the standard of cleaning is achieved.

If at any time, the Project Monitor should suspect contamination of areas outside the Regulated Area, the Contractor shall immediately stop all abatement work and take steps to decontaminate these areas and eliminate causes of such contamination.

(g) Quality Assurance/Verification

At a minimum, the affected areas shall be free of visible guano accumulations and debris, free of moldy odors and be left dry.

Surface and airborne types and levels of microbial spores may be tested by the Project Monitor upon completion of the cleaning and sanitizing to assure that the affected areas have been returned to a level equivalent to non-affected/ambient areas. Where samples are collected, acceptable results shall be considered levels less than background (interior non-affected and/or ambient) areas for all microbial genera with similar microbial types and rank order and which do not indicate amplification. Any samples collected shall be analyzed at a laboratory accredited by the AIHA EMPAT program. When sampling is performed, it shall be conducted no less than 1 hour after abatement cleanup work has been completed.

The Engineers on-site Project Monitor will verify compliance with these specifications, conduct post-abatement work area inspections and/or collect post abatement samples, photographs, and/or videos of the cleaned surfaces/work areas as deemed necessary.

If any areas fail inspection/testing, the failed area shall be recleaned by the Contractor and retested at no cost to the Engineer.

(h) Post Abatement Work Area Deregulation

The Contractor shall remove all remaining polyethylene, including critical barriers, and Decontamination Enclosure Systems leaving negative air filtration devices in operation as long as feasible. HEPA vacuum and/or wet wipe any visible residue which is uncovered during this process. All waste generated during this disassembly process shall be discarded as abatement waste.

A final visual inspection of the work area shall be conducted by the Competent Person and the Project Monitor to ensure that all visible accumulations of suspect materials have been removed and that no equipment or materials associated with the abatement project remain.

The Contractor shall restore all work areas and auxiliary areas utilized during work to conditions equal to or better than original. Any damage caused during the performance of the work activity shall be repaired by the Contractor at no additional expense to the Engineer.

(i) Waste Disposal

Waste generated from the removal of guano, while an environmental heath hazard, is not classified as a biological waste or hazardous waste. All waste materials generated during abatement shall be disposed of as bulky C&D waste in accordance with CTDEP Solid Waste Management requirements. Contractor shall supply to the Engineer completed shipping papers for each load of waste transported for disposal, indicating the solid waste landfill name and location and quantity of waste disposed of.

(3) Project Closeout Data:

The Contractors site supervisor shall keep a logbook to document daily site activity. The log book shall document the preparation tasks, schedule, engineering controls utilized, abatement work conducted, daily lists of employees on site, exposure/hazard assessment judgements, negative pressure manometric measurement readings, PPE utilized, waste shipping papers, etc.

The Contractor will submit the original log book and any other related documentation to the Engineer within 30 days of completion of work.

Final payment to the Contractor shall not be approved without submission of the reporting materials.

Method of Measurement:

The quantity of guano abatement shall be the actual number of cubic feet removed for disposal, completed and accepted, within the lines of the work area as shown on the plans or as ordered by the Engineer.

Basis of Payment:

The work will be paid for at the contract unit price per cubic foot for “Guano Abatement”, completed, which price shall include the specialty services of the Guano Removal Contractor including: labor, materials, equipment, insurance, submittals, personal protective equipment, temporary enclosures, apparatus/equipment necessary for work area access, utility costs, incidentals, fees and labor incidental to the removal, transport and disposal of guano, including close out documentation.

Final payment for guano abatement will not be made until all the project closeout data submittals have been completed and provided to the Engineer. Once the completed package has been received in its entirety, the Engineer will make the final payment to the Contractor.

Pay Item	Pay Unit
Guano Abatement	Cubic Foot

ITEM #0020801A - ASBESTOS ABATEMENT

Description:

Work under this item shall include the abatement of asbestos containing materials (ACM) and associated work by persons who are knowledgeable, qualified, trained and licensed in the removal, treatment, handling, and disposal of ACM and the subsequent cleaning of the affected environment. ACM shall include material composed of any type of asbestos in amounts greater than one percent (1%) by weight. The Contractor performing this work shall possess a valid Asbestos Abatement Contractor license issued by the Connecticut Department of Public Health (CTDPH).

These Specifications govern all work activities that disturb asbestos containing materials. All activities shall be performed in accordance with, but not limited to, the current revision of the OSHA General Industry Standard for Asbestos (29 CFR 1926.1001), the OSHA Asbestos in Construction Regulations (29 CFR 1926.1101), the USEPA Asbestos National Emission Standards for Hazardous Air Pollutants (NESHAP) Regulations (40 CFR Part 61 Subpart M), the CTDPH Standards for Asbestos Abatement, Licensure and Training (19a-332a-1 through 16, 20-440-1 through 9 & 20-441), and the CTDEEP Special Waste Disposal Regulations (22a-209-8(i)).

The asbestos abatement work shall include the removal and disposal of all ACM as identified on the Contract Plans and Specifications prior to the planned renovation/demolition project.

Deviations from these Specifications require the written approval of the Engineer.

Materials:

All materials shall be delivered to the job site in the original packages, containers, or bundles bearing the name of the manufacturer, the brand name and product technical description.

No damaged or deteriorating materials shall be used. If material becomes contaminated with asbestos, the material shall be decontaminated or disposed of as asbestos-containing waste material. The cost to decontaminate and dispose of this material shall be at the expense of the Contractor.

Fire retardant polyethylene sheet shall be in roll size to minimize the frequency of joints, with factory label indicating four (4) or six (6) mil thickness.

Six (6) mil polyethylene disposable bags shall have pre-printed OSHA/EPA/DOT labels and shall be transparent.

Tape (or equivalent) capable of sealing joints in adjacent polyethylene sheets and for the attachment of polyethylene sheets to finished or unfinished surfaces must be capable of adhering under both dry and wet conditions.

Surfactant is a chemical wetting agent added to water to improve penetration and shall consist of fifty (50) percent polyoxyethylene ether and fifty (50) percent polyoxyethylene ester, or equivalent. The surfactant shall be mixed with water to provide a concentration one (1) ounce surfactant to five (5) gallons of water, or as directed by the manufacturer.

Spray equipment must be capable of mixing necessary chemical agents with water, generating sufficient pressure and volume; and equipped with adequate hose length to access all necessary work areas.

Drills, saws, sanders, grinders, wire brushes and needle-gun type removal equipment shall be equipped with a High Efficiency Particulate Air (HEPA) filtered vacuum dust collection system.

Containers for storage, transportation and disposal of asbestos containing waste material shall be impermeable and both air and watertight.

Labels and warning signs shall conform to OSHA 29 CFR 1926.1101, USEPA 40 CFR Part 61.152, and USDOT 49 CFR Part 172 as appropriate.

Encapsulant, a material used to chemically entrap asbestos fibers to prevent these fibers from becoming airborne, shall be of the type which has been approved by the Engineer. Use shall be in accordance with manufacturer's printed technical data. The encapsulant shall be clear and must be compatible with new materials being installed, if any.

Any planking, bracing, shoring, barricades and/or temporary sheet piling, necessary to appropriately perform work activities shall conform to all applicable federal, state and local regulations.

Air filtration devices and vacuum units shall be equipped with HEPA filters.

Construction Methods:

(1) Pre-Abatement Submittals and Notices

(a) The scope of work for this project includes the removal of exterior non-friable ACM, which is not defined as "Asbestos Abatement" under the CTDPH Asbestos Abatement Standards (19a-332a-1). Therefore, the Contractor is **not required to submit an Asbestos Abatement Notification to CTDPH, prior to the commencement of work, so long as work practices will not render more than 25 square feet (SF) of the exterior non-friable ACM into a friable state.**

(b) Fifteen (15) working days prior to the commencement of asbestos abatement work, the Contractor shall submit to the Engineer for review and acceptance and/or acknowledgment of the following:

1. Permits and licenses for the removal of asbestos-containing or contaminated materials, including a CTDPH valid asbestos removal contractor's license.

2. Documentation dated within the previous twelve (12) months, certifying that all employees have received USEPA Model Accreditation Plan approved asbestos worker/supervisor training in the proper handling of materials that contain asbestos; understand the health implications and risks involved, including the illnesses possible from exposure to airborne asbestos fibers; understands the use and limits of respiratory equipment to be used; and understands the results of monitoring of airborne quantities of asbestos as related to health and respiratory equipment as indicated in 29 CFR 1926.1101 on an initial and annual basis, and copies of all employees CTDPH asbestos worker and/or supervisor licenses.

3. Documentation from the Contractor, typed on company letterhead and signed by the Contractor, certifying that all employees listed therein have received the following:

    a. medical monitoring within the previous twelve (12) months, as required in 29 CFR 1926.1101;
    b. respirator fit testing within the previous twelve (12) months as detailed in 29 CFR 1910.134 (for all employees who must also don a tight-fitting face piece respirator).

4. Copies of the EPA/State-approved certificates for the proposed asbestos landfill.

(c) No abatement shall commence until a copy of all required submittals have been received and found acceptable to the Engineer. Those employees added to the Contractor's original list will be allowed to perform work only upon submittal to, and receipt of, all required paperwork by the Engineer.

(2) Asbestos Abatement Provisions:

(a) General Requirements

The Abatement Contractor/Subcontractor shall possess a valid State of Connecticut Asbestos Contractor License. Should any portion of the work be subcontracted, the subcontractor must also possess a valid State of Connecticut Asbestos Contractor License. The Asbestos Abatement Site Supervisor employed by the Contractor shall be in control on the job site at all times during asbestos abatement work. All employees of the Contractor who shall perform work (i.e. Asbestos Abatement Site Supervisor, Asbestos Abatement Worker) shall be properly certified/licensed by the State of Connecticut to perform such duties.

All labor, materials, tools, equipment, services, testing, insurance (with specific coverage for work on asbestos), and incidentals which are necessary or required to perform the work in accordance with applicable governmental regulations, industry standards and codes, and these Specifications shall be provided by the Contractor. The Contractor shall be prepared to work all shifts and weekends throughout the course of this project.

Prior to beginning work, the Engineer and Contractor shall perform a visual survey of each work area and review conditions at the site for safety reasons. In addition, the Contractor shall instruct

all workers in all aspects of personnel protection, work procedures, emergency evacuation procedures and use of equipment including procedures unique to this project.

The Contractor shall, when necessary, provide temporary power and adequate lighting and ensure safe installation of electrical equipment, including ground fault protection and power cables, in compliance with applicable electrical codes and OSHA requirements. The Contractor is responsible for proper connection and installation of electrical wiring.

If sufficient electrical service is unavailable, the Contractor may need to supply electrical power to the site by fuel operated generator(s). Electrical power supply shall be sufficient for all equipment required for this project in operation throughout the duration of the project.

Water service may not be available at the site. Contractor shall supply sufficient water for each shift to operate the decontamination shower units as well as to maintain the work areas adequately wet.

Ladders and/or scaffolds shall be in compliance with OSHA requirements, and of adequate length, strength and sufficient quantity to support the scope of work. Use of ladders/scaffolds shall be in conformance with OSHA 29 CFR 1926 Subpart L and X requirements.

Work performed at heights exceeding six feet (6') shall be performed in accordance with the OSHA Fall Protection Standard 29 CFR 1926 Subpart M including the use of fall arrest systems as applicable.

Data provided regarding asbestos sampling conducted throughout the structure(s) is for informational purposes only. Under no circumstances shall this information be the sole means used by the Contractor for determining the presence, location and/or quantity of all asbestos containing materials. The Contractor shall verify all field conditions affecting performance of the work as described in these Specifications in accordance with OSHA, USEPA, USDOT, DEEP standards. Compliance with the applicable requirements is solely the responsibility of the Contractor.

The Engineer will provide a Project Monitor to oversee the activities of the Contractor. No asbestos work shall be performed until the Project Monitor is on-site. Pre-abatement, during abatement and post-abatement air sampling will be conducted as deemed necessary by the Project Monitor. Waste stream testing will be performed, as necessary, by the Project Monitor prior to waste disposal.

(b) Set-Up

Pre-clean the work areas using HEPA filtered equipment (vacuum) and/or wet methods as appropriate, collecting and properly containing all loose debris as asbestos-containing/asbestos contaminated waste. Vacuum units, of suitable size and capabilities for the project, shall have HEPA filters capable of trapping and retaining at least 99.97 percent of all monodispersed particles of three micrometers in diameter or larger. Do not use methods that raise dust, such as dry sweeping or vacuuming with equipment not equipped with HEPA filters.

The Contractor shall establish a remote Worker Decontamination Enclosure System consisting of Equipment Room, Shower Room and Clean Room in series, as detailed below. Access to the Regulated Area shall only be through this enclosure.

Access between rooms in the Worker Decontamination Enclosure System shall be through airlocks. Other effective designs are permissible. The Clean Room, Shower Room and Equipment Room located within the Worker Decontamination Enclosure, shall be contiguously connected with taped airtight edges.

The Clean Room shall be adequately sized to accommodate workers and shall be equipped with a suitable number of hooks, lockers, shelves, etc., for workers to store personal articles and clothing. Changing areas of the Clean Room shall be suitably screened from areas occupied by the public.

The Shower Room shall be of sufficient capacity to accommodate the number of workers. One shower stall shall be provided for each eight (8) workers. Showers shall be equipped with hot and cold or warm running water through the use of electric hot water heaters supplied by the Contractor. No worker or other person shall leave a Regulated Area without showering. Shower water shall be collected and filtered using best available technology and disposed of in an approved sanitary drain. Shower stalls and plumbing shall include sufficient hose length and drain system or an acceptable alternate.

The Contractor shall ensure that no personnel or equipment be permitted to leave the Regulated Area until proper decontamination procedures (including HEPA vacuuming, wet wiping and showering) to remove all asbestos debris have occurred.

Post warning signs meeting the specifications of OSHA 29 CFR 1910.1001 and 29 CFR 1926.1101 at each Regulated Area. In addition, signs shall be posted at all approaches to Regulated Areas so that an employee may read the sign and take the necessary protective steps before entering the area. Additional signs may require posting following construction of workplace enclosure barriers.

Alternate set up requirements for exterior non-friable asbestos abatement procedures

In lieu of the establishment of a negative pressure enclosure (NPE) system as described by CTDPH Sections 19a-332a-5(c), 5(d), 5(e), and 5(h), non-friable ACM will be removed from exterior work areas within an outdoor Regulated Area(s). The regulated work area will be established by the use of appropriately labeled barrier tape and postings in compliance with CTDPH 19a-332a-5(a) as well as OSHA 29 CFR 1926.1101. A remote personnel decontamination unit as specified in Section 19a-332a-6 will be required. This method shall only be utilized provided exposure assessment air sampling data collected during the removal of the exterior non-friable materials indicates that the exposure levels during removal of such materials do not exceed 0.1 asbestos f/cc. Should exposure assessment air sampling data exceed this level, and engineering efforts to reduce the airborne fiber levels not be successful in reducing the levels to less than 0.1 f/cc, removal shall occur within these areas under full containment conditions.

(c) Personnel Protection

The Contractor shall utilize all appropriate engineering controls and safety and protective equipment while performing the work in accordance with OSHA, USEPA, USDOT, CTDEEP and CTDPH regulations.

The Contractor shall provide and require all workers to wear protective clothing in the Regulated Areas where asbestos fiber concentrations may reasonably be expected to exceed the OSHA established Permissible Exposure Limits (PEL) or where asbestos contamination exists. Protective clothing shall include impervious coveralls with elastic wrists and ankles, head covering, gloves and foot coverings.

Respiratory protection shall be provided and shall meet the requirements of OSHA as required in 29 CFR 1910.134, and 29 CFR 1926.1101 as well as the requirements of the CTDPH regulations. A formal respiratory protection program must be implemented in accordance with 29 CFR 1926.1101 and 29 CFR 1910.134. The Contractor shall provide respirators from among those approved as being acceptable for protection by the National Institute for Occupational Safety and Health (NIOSH) under the provisions of 30 CFR Part ll.

All other necessary personnel protective equipment (i.e. hardhat, work boots, safety glasses, hearing protection, etc.) required to perform the asbestos abatement work activities shall conform to all applicable federal, state and local regulations.

All other qualified and authorized persons entering into a Regulated Area (i.e. Project Monitor, Regulatory Agency Representative) shall adhere to the requirements of personnel protection as stated in this section.

(d) Asbestos Abatement Procedures

The Asbestos Abatement Site Supervisor, as the OSHA Competent Person shall be at the site at all times.

The Contractor shall not begin abatement work until authorized by the Project Monitor, following a pre-abatement visual inspection.

All workers and authorized persons shall enter and leave the Regulated Area through the Worker Decontamination Enclosure System, leaving contaminated protective clothing in the Equipment Room for reuse or disposal of as asbestos contaminated waste. No one shall eat, drink, smoke, chew gum or tobacco, or apply cosmetics while in a Regulated Area.

The following details the extent of each phase of operation designated for this project. Phase areas may be combined or divided at the direction of the Engineer. Proceed through the sequencing of the work phases under the direction of the Engineer.

Bridge No. 00480, I-91 over Airport Rd., Hartford, CT

Includes the removal of:

- **White remnant caulking at base of bridge railing supports (C3)**

A regulated area(s) shall be established at the perimeter of the work area(s), and access shall be controlled by the Contractor. A remote personnel decontamination unit shall be utilized. Removal shall be undertaken in accordance with OSHA Class II and USEPA Asbestos NESHAP requirements.

Bridge No. 00813, I-91 over U.S. Routes 5 & 15, Hartford, CT

Includes the removal of:

- **Silver/Grey remnant caulking at base of bridge railing supports (C3)**

A regulated area(s) shall be established at the perimeter of the work area(s), and access shall be controlled by the Contractor. A remote personnel decontamination unit shall be utilized. Removal shall be undertaken in accordance with OSHA Class II and USEPA Asbestos NESHAP requirements.

Bridge No. 01459, I-91 over Great Meadow Road, Wethersfield, CT

Includes the removal of:

- **Hard grey/tan caulking where abutment meets main bridge (southside) (C2)**

A regulated area(s) shall be established at the perimeter of the work area(s), and access shall be controlled by the Contractor. A remote personnel decontamination unit shall be utilized. Removal shall be undertaken in accordance with OSHA Class II and USEPA Asbestos NESHAP requirements.

Bridge No. 01460, I-91 over Wethersfield Cove, Wethersfield, CT

Includes the removal of:

- **Presumed ACM caulking around storm drains in concrete deck of the bridge**

A regulated area(s) shall be established at the perimeter of the work area(s), and access shall be controlled by the Contractor. A remote personnel decontamination unit shall be utilized. Removal shall be undertaken in accordance with OSHA Class II and USEPA Asbestos NESHAP requirements.

Bridge No. 01466, I-91 over I-91 TR 827, Hartford, CT

Includes the removal of:

- **White remnant caulking at base of bridge railing supports (C1)**

A regulated area(s) shall be established at the perimeter of the work area(s), and access shall be controlled by the Contractor. A remote personnel decontamination unit shall be utilized. Removal shall be undertaken in accordance with OSHA Class II and USEPA Asbestos NESHAP requirements.

****Note**: **Light grey caulking at the abutments of Bridge No. 01456 was also identified as ACM, however is not projected to be impacted by the rehabilitations. Should ACM be required to be impacted during construction, work shall cease immediately until the Engineer can determine the extent of any ACM impact and implement proper procedures.**

During removal, the Contractor shall spray asbestos materials with amended water using airless spray equipment capable of providing a "mist" application to reduce the release of airborne fibers. Spray equipment shall be capable of mixing wetting agent with water and capable of generating sufficient pressure and volume. Hose length shall be sufficient to reach all of the Regulated Area. Do not "flood" the area with hose type water supply equipment with the potential to create water releases and/or run-off from the regulated area.

The Contractor shall continue to spray the asbestos materials with amended water, as necessary, throughout removal activities to ensure the asbestos materials remain adequately wet. The asbestos materials shall not be allowed to dry out.

In order to minimize airborne asbestos concentrations inside the Regulated Area, the Contractor shall remove the adequately wetted asbestos in manageable sections. In addition, asbestos materials removed from any elevated level shall be carefully lowered to the floor.

The Contractor shall promptly place the adequately wet asbestos material in disposal containers (six (6) mil polyethylene bags/fiber drum/poly-lined dumpsters, etc.) as it is removed. Large components removed intact may be wrapped in two (2) layers of six (6) mil polyethylene sheeting secured with tape. As the disposal containers are filled, the Contractor shall promptly seal the containers, apply caution labels and clean the containers before transportation from the regulated area. Bags shall be securely sealed to prevent accidental opening and leakage by taping in gooseneck fashion. Small components and asbestos-containing waste with sharp-edged components (e.g. nails, screws, metal lath, tin sheeting) which could tear polyethylene bags and sheeting shall be placed in clean drums and sealed with locking ring tops. All waste containers shall be leak-tight, (typically consisting of two layers of 6 mil poly (or bags)), and shall be properly labeled and placarded with OSHA Danger labels, DOT shipping labels, markings and placards and USEPA NESHAP generators labels. Containers shall be decontaminated by wet cleaning and HEPA vacuuming prior to exiting the regulated area.

If at any time during asbestos removal, the Project Monitor should suspect contamination of areas outside the Regulated Area, the Contractor shall immediately stop all abatement work and

take steps to decontaminate these areas and eliminate causes of such contamination. Unprotected individuals shall be prohibited from entering contaminated areas until air sampling and/or visual inspections determine decontamination.

After completion of abatement work, all surfaces from which asbestos has been removed shall be wet brushed, using a nylon brush, wet wiped and sponged or cleaned by an equivalent method to remove all visible material (wire brushes are not permitted). During this work the surfaces being cleaned shall be kept wet. Cleaning shall also include the use of HEPA filtered vacuum equipment.

The Contractor shall also remove and containerize all visible accumulations of asbestos-containing and/or asbestos-contaminated debris which may have splattered or collected on the polyethylene engineering controls/barriers.

The Contractor shall remove contamination from the exteriors of the scaffolding, ladders, extension cords, hoses and other equipment inside the Regulated Area. Cleaning may be accomplished by brushing, HEPA vacuuming and/or wet cleaning. The Contractor shall wet wipe the Regulated Area using cotton rags or lint free paper towels. Rags and towels shall be disposed of after each use. Workers should avoid the use of dirty rags to insure proper cleaning of surfaces. Waste water shall be filtered using best available technology into leak-proof containers prior to being transported to a sanitary sewer for discharge.

Once the Regulated Area surfaces have dried, the Project Monitor shall perform a thorough post abatement visual inspection utilizing protocols from the ASTM Standard E1368-90 *Standard Practice for Visual Inspection of Asbestos Abatement Projects*. All surfaces within the Regulated Area, including but not limited to ledges, beams, and hidden locations shall be inspected for visible residue. Evidence of asbestos contamination identified during this inspection will necessitate further cleaning as heretofore specified. The area shall be re-cleaned at the Contractor's expense, until the standard of cleaning is achieved.

Once the area has received a satisfactory post-abatement visual inspection, any equipment, tools or materials not required for completion of the work, shall be removed by the Contractor from the Regulated Area.

(e) Air Monitoring Requirements

1. The Contractor shall:

    a. Provide air monitoring equipment including sample filter cassettes of the type and quantity required to properly monitor operations and personnel exposure surveillance throughout the duration of the project.

    b. Conduct personnel exposure assessment air sampling, as necessary, to assure that workers are using appropriate respiratory protection in accordance with OSHA Standard 1926.1101. Documentation of air

sampling results must be recorded at the work site within twenty-four (24) hours and shall be available for review until the job is complete.

2. The Project Monitor, acting as the representative of the Engineer during abatement activities, will:

    a. Collect air samples in accordance with the current revision of the NIOSH 7400 Method of Air Sampling for Airborne Asbestos Fibers while overseeing the activities of the Abatement Contractor. Frequency and duration of the air sampling during abatement will be representative of the actual conditions at the abatement site. The size and configuration of the asbestos project will be a factor in the number of samples required to monitor the abatement activities and shall be determined by the Project Monitor. The following schedule of samples may be collected by the Project Monitor:

        1. Pre-Abatement (Optional)
            a. Background areas
            b. Area(s) adjacent to Work Area(s)
            c. Work Area(s)

        2. During Abatement (Optional)
            a. Within Regulated Area(s)
            b. Area(s) adjacent to Regulated Areas(s) (exterior to critical barriers)
            c. At the Decontamination Enclosure System

Abatement Activity	Pre-Abatement	During Abatement	Post-Abatement
Exterior Friable/Non-Friable	---	PCM	---

If air samples collected outside of the Regulated Area during abatement activities indicate airborne fiber concentrations greater than original background levels, or greater than 0.1 f/cc, as determined by Phase Contrast Microscopy, whichever is larger, an examination of the Regulated Area perimeter shall be conducted and the integrity of barriers shall be restored. Cleanup of surfaces outside the Regulated Area using HEPA vacuum equipment or wet cleaning techniques shall be done prior to resuming abatement activities.

(f) Post Abatement Work Area Deregulation

The Contractor shall remove all remaining polyethylene, including critical barriers, drop-cloths, and Decontamination Enclosure Systems. HEPA vacuum and/or wet wipe any visible residue which is uncovered during this process. All waste generated during this disassembly process shall be discarded as ACM waste.

A final visual inspection of the work area shall be conducted by the Competent Person and the Project Monitor to ensure that all visible accumulations of suspect materials have been removed and that no equipment or materials associated with the abatement project remain.

The Contractor shall restore all work areas and auxiliary areas utilized during work to conditions equal to or better than original. Any damage caused during the performance of the work activity shall be repaired by the Contractor at no additional expense to the Engineer.

(g) Waste Disposal

Unless otherwise specified, all removed materials and debris resulting from execution of this project shall become the responsibility of the Contractor and removed from the premises. Materials not scheduled for reuse shall be removed from the site and disposed of in accordance with all applicable Federal, State and Local requirements.

Waste removal dumpsters and cargo areas of transport vehicles shall be lined with a layer of six (6) mil polyethylene sheeting to prevent contamination from leaking or spilled containers. Floor sheeting shall be installed first, and shall be extended up sidewalls 12-inches. Wall sheeting shall overlap floor sheeting 24-inches and shall be taped into place.

OSHA "Danger" signs must be attached to vehicles used to transport asbestos-containing waste prior to loading ACM waste. The signs must be posted so that they are plainly visible.

Ensure all waste containers (bags, drums, etc.) are properly packed, sealed and labeled with USEPA NESHAP generator labels, OSHA danger labels and DOT shipping labels. For each shipment of ACM waste, the Contractor shall complete an EPA-approved asbestos waste shipment record.

Authorized representatives signing waste shipment records on behalf of the generator must have USDOT Shipper Certification training in accordance with HMR 49 CFR Parts 171-180.

Transport vehicles hauling ACM waste shall have appropriate USDOT placards visible on all four (4) sides of the vehicle.

The Contractor shall dispose of asbestos-containing and/or asbestos contaminated material at an EPA authorized site and must be in compliance with the requirements of the Special Waste Provisions of the Office of Solid Waste Management, Department of Energy & Environmental Protection, State of Connecticut, or other designated agency having jurisdiction over solid waste disposal.

Any asbestos-containing and/or asbestos-contaminated waste materials which also contain other hazardous contaminants shall be disposed of in accordance with the EPA's Resource Conservation and Recovery Act (RCRA), CTDEEP and ConnDOT requirements. Materials may be required to be stored on-site and tested by the Project Monitor to determine proper waste disposal requirements.

(h) Project Closeout Data:

1. Provide the Engineer, within 30 days of completion of asbestos abatement, a compliance package; which shall include, but not be limited to, the following:

    a. Asbestos Abatement Site Supervisor job log;
    b. OSHA personnel air sampling data;
    c. Completed waste shipment records.

The Contractor shall submit the original completed waste shipment records to the Engineer.

Method of Measurement:

No measurement will be made for the work in this Section. The completed work shall be paid as a lump sum.

Basis of Payment:

The lump sum bid price for this item shall include the specialty services of the Asbestos Removal Contractor including: labor, materials, equipment, insurance, permits, notifications, submittals, personal air sampling, personal protection equipment, temporary enclosures, utility costs, incidentals, fees and labor incidental to the removal, transport and disposal of ACM, including close out documentation.

Final payment for asbestos abatement will not be made until all the project closeout data submittals have been completed (including waste shipment record(s) signed by an authorized disposal facility representative) and provided to the Engineer. Once the completed package has been received in its entirety, the Engineer will make the final payment to the Contractor.

Pay Item	Pay Unit
Asbestos Abatement	Lump Sum

ITEM #0020905A - LEAD COMPLIANCE FOR ABRASIVE BLAST CLEANING AND MISCELLANEOUS TASKS

Description: Work under this item shall include the special handling measures and work practices required for abrasive blast cleaning activities and other miscellaneous tasks, principally involved in bridge coating removal/painting and other renovation operations, which impact materials containing or covered by lead paint. Examples of typical miscellaneous exterior tasks includes: work impacting signs, guiderails, minor bridge rehabilitation, catenary structures, canopy structures, spot/localized paint removal, etc. Lead paint includes paint found to contain any detectable amount of lead by Atomic Absorption Spectrophotometry (AAS) or X-Ray Fluorescence (XRF).

All activities shall be performed in accordance with the OSHA Lead in Construction Regulations (29 CFR 1926.62), the USEPA RCRA Hazardous Waste Regulations (40 CFR Parts 260 through 274), the CTDEEP Hazardous Waste Regulations (RCSA 22a-209-1 and 22a-449(c)), and SSPC Guide 6 – Guide for Containing Debris Generated During Paint Removal Operations.

All activities shall be performed by individuals with appropriate levels of OSHA lead awareness and hazard communication training, supervised at all times by the Contractor's Competent Person, and periodically inspected by personnel working for an industrial hygiene firm (IH firm), retained by the Contractor, under the direct supervision of a Certified Industrial Hygienist (CIH). Periodic inspections shall be conducted at least weekly while work impacting lead is occurring, but shall be as frequent as necessary to maintain Contractor compliance with the OSHA Lead Construction Standards. The Contractor's Competent Person shall be on-Site at all times that the work impacting lead is being performed and shall be capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous or dangerous to employees, and has authorization to take prompt corrective measures to eliminate them.

Deviations from these Specifications require the written approval of the Engineer.

This item does not include the work to remove existing paint. Refer to other Contract items for paint removal special provisions.

Materials:

All materials shall be delivered to the Site in the original packages, containers, or bundles bearing the name of the manufacturer, the brand name and product technical description, with MSDS sheets as applicable.

No damaged or deteriorating materials shall be used. If material becomes contaminated with lead, the material shall be decontaminated or disposed of as lead-containing waste material. The cost to decontaminate and dispose of said material shall be at the Contractor's expense.

The following material requirements shall be met, where applicable:
Fire retardant polyethylene sheet shall be in roll size to minimize the frequency of joints, with factory label indicating minimum six (6) mil thickness.

Polyethylene disposable bags shall be minimum six (6) mils thick.

Tape (or equivalent product) capable of sealing joints in adjacent polyethylene sheets and for the attachment of polyethylene sheets to finished or unfinished surfaces must be capable of adhering under both dry and wet conditions.

Cleaning Agents and detergent shall be lead specific, such as TriSodium Phosphate (TSP).

Chemical strippers and chemical neutralizers shall be compatible with the substrate as well as with each other. Such chemical stripper shall contain less than 50% volatile organic compounds (VOCs) by weight in accordance with RCSA 22a-174-40 Table 40-1.

Labels and warning signs shall conform to 29 CFR 1926.62, 40 CFR 260 through 274 and 49 CFR 172 as appropriate.

Air filtration devices and vacuum units shall be equipped with High-Efficiency Particulate Air (HEPA) filters.

Construction Methods:

(1) Pre-Abatement Submittals and Notices

A. Prior to the start of **any** work that will generate hazardous lead waste above conditionally exempt small quantities (greater than 100 kg/month or greater than 1000 kg stored at any time), the Contractor shall obtain from the Engineer, on a contiguous per Site basis, a temporary EPA Hazardous Waste Generators ID number, in accordance with Item #0603222A "Disposal of Lead Debris from Abrasive Blast Cleaning," unless otherwise directed by the Engineer. Temporary EPA ID numbers are good for six (6) months from the date they are issued and can be extended once, for a maximum of six (6) months and shall not be used for longer than one (1) year. The Contractor shall notify the Engineer when an extension is needed.

B. Fifteen (15) working days prior to beginning work that impacts lead paint, the Contractor shall submit four (4) copies of each of the following to the Engineer:

1. A written Site-specific Lead Compliance Work Plan, prepared and stamped by a Certified Industrial Hygienist (CIH) that covers all workers on the Project (Contractor, Subcontractor and CTDOT representatives). The Lead Compliance Work Plan shall be prepared in accordance with 29 CFR 1926.62(e), and shall include: descriptions of each activity impacting lead; procedures for engineering controls, methods of containment, work practices, and administrative controls to be employed; daily on-Site inspections by the Competent Person; periodic on-Site inspections by IH firm personnel (describe frequency and inspection criteria); hazard communication/training; medical surveillance; biological monitoring; exposure assessment; air monitoring; personal protective equipment (PPE); respiratory protection; housekeeping; decontamination; procedures for waste containment, storage, handling and disposal; contents of the job completion close-out report; and all other procedures that may be necessary to comply with 29 CFR 1926.62 and 40 CFR 260 – 274 and minimize employee exposure and prevent the spread of lead contamination outside the Regulated Area, as defined herein.

2. Copies of all employee certificates, dated within the previous twelve (12) months, relating to OSHA lead awareness and hazard communication training and training in the use of lead-safe work practices. SSPC training programs, such as SSPC C-5 Deleading of Industrial Structures may be accepted as meeting these requirements if it can be demonstrated that such training addressed all required OSHA topics.

   This information shall be updated and resubmitted annually, or as information changes, for the duration of lead removal work in order to verify continued compliance.

3. Name and qualifications of Contractor's OSHA Competent Person, as defined under 29 CFR 1926.62, who will be on-Site at all times that the work impacting lead paint is being performed.

4. Name and qualifications of IH firm personnel that will be performing the periodic on-Site inspections. Such personnel shall work under the direct supervision of the same CIH who stamped the Lead Compliance Work Plan and have training within the previous twelve (12) months for OSHA lead awareness and the use of lead-safe work practices or equivalent. Such personnel shall also have a minimum of two (2) years' work experience related to the OSHA Lead in Construction Standard and be capable of recognizing the hazards associated therewith.

5. Documentation from the Contractor, on company letterhead and signed by the Contractor, certifying that all employees listed therein have received the following, and are medically fit to perform the work impacting lead:

   a. medical monitoring within the previous twelve (12) months, as required in 29 CFR 1926.62;

b. biological monitoring within the previous six (6) months, as required in 29 CFR 1926.62;
c. respirator fit testing within the previous twelve (12) months, as required in 29 CFR 1910.134 (for employees who wear a tight-fitting face piece respirator)

This information shall be updated and resubmitted every six (6) months, or as information changes, for the duration of lead removal work in order to verify continued compliance.

6. Name(s) of the proposed non-hazardous, non RCRA lead debris waste disposal facility.

7. Name(s) of the proposed scrap metal recycling facility. The Contractor shall submit to the Engineer all documentation necessary to demonstrate the selected facility is able to accept lead-painted metal.

8. Name(s) of the proposed hazardous waste disposal facility (selected from the Department-approved list provided under Item #0603222A), and copies of each facilities' acceptance criteria and sampling frequency requirements.

9. Copies of the proposed hazardous waste transporters' current USDOT Certificate of Registration for Hazardous Materials Transport, and the proposed transporters' current Hazardous Waste Transporter Permits for the State of Connecticut and the waste destination State.

10. Negative exposure assessments conducted within the previous twelve (12) months documenting that employee exposure to lead for each task is below the OSHA Action Level of 30 $\mu g/m^3$. If a negative exposure assessment has not been conducted, the Contractor shall submit its air monitoring program for the work tasks as part of the Lead Compliance Work Plan. Until a negative exposure assessment is developed for each task impacting lead paint, the Contractor shall ensure that all workers and authorized persons entering the Regulated Area wear protective clothing and respirators in accordance with OSHA 29 CFR 1926.62.

No activity shall commence until all required submittals have been received and found acceptable to the Engineer. Those employees added to the Contractor's original list will be allowed to perform work only upon submittal of acceptable documentation to, and review by, the Engineer.

The Contractor shall provide the Engineer with a minimum of 48 hours' notice in advance of scheduling, changing or canceling work activities.

(2) Lead Abatement Provisions

A. General Requirements:

All employees of the Contractor who perform work impacting lead paint shall be properly trained to perform such duties. In addition, the Contractor shall instruct all workers in all aspects of personnel protection, work procedures, emergency evacuation procedures and use of equipment including procedures unique to this Project.

The Contractor shall provide all labor, materials, tools, equipment, services, testing, and incidentals which are necessary or required to perform the work in accordance with applicable governmental regulations, industry standards and codes, and these Specifications.

Prior to beginning work, the Engineer and Contractor shall perform a visual survey of each work area and review conditions.

As necessary, the Contractor shall:

- Shut down and lock out electrical power, including all receptacles and light fixtures, where feasible. The use or isolation of electrical power will be coordinated with all other ongoing uses of electrical power at the Site.

- Coordinate all power and fire alarm isolation with the appropriate representatives.

If adequate electrical supply is not available at the Site, the Contractor shall supply temporary power. Such temporary power shall be sufficient to provide adequate lighting and power the Contractor's equipment. The Contractor is responsible for proper connection and installation of electrical wiring and shall ensure safe installation of electrical equipment in compliance with applicable electrical codes and OSHA requirements.

If water is not available at the Site for the Contractor's use, the Contractor shall supply sufficient water for each shift to operate the wash facility/decontamination shower units in addition to the water needed at the work area.

The Engineer may provide a Project Monitor to monitor compliance of the Contractor and protect the interests of the Department. In such cases, no activity impacting lead paint shall be performed until the Project Monitor is on-Site. Where no Project Monitor is provided, Contractor shall proceed at the direction of the Engineer. Environmental sampling, including ambient air sampling, TCLP waste stream sampling, and dust wipe sampling, will be conducted by the State as it deems necessary throughout the Project. Any Project Monitor provided by the Engineer is supplementary to the requirement for the Contractor to have periodic inspections performed at a frequency to ensure/document Contractor compliance with the regulations and the requirements of the Contractor's Lead Compliance Work Plan. Air monitoring to comply with the Contractor's obligations under OSHA remains solely the responsibility of the Contractor.

If at any time, procedures for engineering, work practice, administrative controls or other topics are anticipated to deviate from those documented in the submitted and accepted Lead Compliance Work Plan, the Contractor shall submit a modification of its existing plan for review and acceptance by the Engineer prior to implementing the change.

If air samples collected outside of the Regulated Area during activities impacting lead paint indicate airborne lead concentrations greater than original background levels or 30 ug/m^3, whichever is larger, or if at any time visible emissions of lead paint extend out from the Regulated Area, an examination of the Regulated Area shall be conducted and the cause of such emissions corrected. Cleanup of surfaces outside the Regulated Area using HEPA vacuum equipment or wet cleaning techniques shall be done prior to resuming work.

Work outside the initial designated area(s) will not be paid for by the Engineer. The Contractor will be responsible for all costs incurred from these activities including repair of any damage.

B. Regulated Area:
The Contractor shall establish a Regulated Area through the use of appropriate barrier tape or other means to control unauthorized access into the area where activities impacting lead paint are occurring. Warning signs meeting the requirements of 29 CFR 1926.62 shall be posted at all approaches to Regulated Areas. These signs shall read:

DANGER
LEAD WORK AREA
MAY DAMAGE FERTILITY OR THE UNBORN CHILD
CAUSES DAMAGE TO THE CENTRAL NERVOUS SYSTEM
DO NOT EAT, DRINK, OR SMOKE IN THIS AREA

The Contractor shall also implement appropriate engineering controls, such as poly drop cloths, local exhaust ventilation, wet dust suppression methods, etc., as necessary, or where Abrasive Blast Cleaning is to be performed, a full negative pressure enclosure, in accordance with Item #0603XXXA "Class I Containment & Collection of Surface Preparation Debris (Site No. X)," and wet dust suppression methods, etc., as necessary, and as approved by the Engineer, to prevent the spread of lead contamination beyond the Regulated Area in accordance with the Contractor's approved Lead Compliance Work Plan. Should the previously submitted plan prove to be insufficient to contain the contamination, the Contractor shall submit a modified plan for review by the Engineer.

Any air exhausted from the containment enclosure, abrasive-recycling equipment or vacuum equipment shall be passed through a HEPA filtering system. The Contractor is responsible for the design, effectiveness and maintenance of this filtering system. No discharge of debris dust shall be allowed.

C. Wash Facilities:

The Contractor shall provide handwash facilities in compliance with 29 CFR 1926.51(f) and 29 CFR 1926.62 regardless of airborne lead exposure.

If employee exposure to airborne lead exceeds the OSHA Permissible Exposure Limit of 50 micrograms per cubic meter ($\mu g/m^3$), shower rooms must be provided. The Shower Room shall be of sufficient capacity to accommodate the number of workers. One (1) shower stall shall be provided for each eight (8) workers. Showers shall be equipped with hot and cold or warm running water. Shower water shall be collected and filtered using best available technology and disposed of in accordance with all Federal, State and local laws, regulations and ordinances.

D. Personal Protection:

The Contractor shall initially determine if any employee performing construction tasks impacting lead paint may be exposed to lead at or above the OSHA Action Level of 30 $\mu g/m^3$. Assessments shall be based on initial air monitoring results as well as other relevant information. The Contractor may rely on historical air monitoring data obtained within the past twelve (12) months under workplace conditions closely resembling the process, type of material, control methods, work practices and environmental conditions used and prevailing in the Contractors current operations to satisfy the exposure assessment requirements. Monitoring shall continue as specified in the OSHA standard until a negative exposure assessment is developed.

Until a negative exposure assessment is developed for each task impacting lead paint, the Contractor shall ensure that all workers and authorized persons entering the Regulated Area wear protective clothing and respirators in accordance with OSHA 29 CFR 1926.62. Protective clothing shall include impervious coveralls with elastic wrists and ankles, head covering, gloves and foot coverings. Sufficient quantities shall be provided to last throughout the duration of the Project.

Protective clothing provided by the Contractor and used during chemical removal operations shall be impervious to caustic materials. Gloves provided by the Contractor and used during chemical removal shall be of neoprene composition with glove extenders.

Respiratory protective equipment shall be provided and selection shall conform to 42 CFR Part 84, 29 CFR Part 1910.134, and 29 CFR Part 1926.62. A formal respiratory protection program must be implemented in accordance with 29 CFR Part 1926.62 and Part 1910.134.

E. Air Monitoring Requirements:

The Contractor shall:

1. Provide air monitoring equipment including sample filter cassettes of the type and quantity required to properly monitor operations and personnel exposure surveillance throughout the duration of the Project.

2. Conduct initial exposure monitoring to determine if any employee performing construction tasks impacting lead paint may be exposed to lead at or above the OSHA Action Level of 30 micrograms per cubic meter. Monitoring shall continue as specified in the OSHA standard until a negative exposure assessment is developed.

3. Conduct personnel exposure assessment air sampling, as necessary, to assure that workers are using appropriate respiratory protection in accordance with OSHA Standard 1926.62 or the approved Lead Compliance Work Plan. Documentation of air sampling results must be recorded at the work Site within twenty-four (24) hours and shall be available for review until the job is complete.

F. Periodic Inspections of Abrasive Blast Cleaning Operations:

Where Abrasive Blast Cleaning Operations are to take place, the Contractor shall retain the services of IH firm personnel, working under the direct supervision of the same CIH who stamped the Lead Compliance Work Plan, to perform periodic inspections of the Site work practices and engineering controls, on a frequency to ensure/document Contractor compliance with the regulations. Periodic inspections shall be performed at least weekly while work impacting lead is occurring, but shall be at the frequency necessary to maintain Contractor compliance with the OSHA Lead in Construction Standard. Any exceptions to 29 CFR 1926.62 or the accepted Lead Compliance Work Plan shall be reported to the Contractor and the Engineer prior to the IH firm personnel leaving the Site and corrected immediately.

All findings of such periodic inspections shall be documented in writing to the Engineer no later than ten (10) days following the Site visit. At a minimum, the inspection report shall document the following:

1. Description of current work activities
2. Description of engineering controls being implemented
3. Description of PPE being utilized
4. Description of visual review of containment system effectiveness
5. Results of all air sampling received since date of last report
6. Narrative interpreting sample results and making recommendations as necessary
7. Description of waste management practices being utilized
8. Descriptions of exceptions noted and corrective action taken

The report shall include a signature from the IH firm employee that performed the Site inspection verifying that the Contractor’s work practices are in compliance with 29 CFR 1926.62

and the previously submitted and accepted Lead Compliance Work Plan. The CIH shall sign verifying their concurrence.

G. Lead Abatement Procedures:

The Contractor's Competent Person shall be at the Site at all times during work impacting lead.

Work impacting lead paint shall not begin until authorized by the Engineer, following a pre-work visual inspection by the Project Monitor or Engineer to verify existing conditions.

Any activity impacting lead painted surfaces shall be performed in a manner which minimizes the spread of lead dust contamination and generation of airborne lead.

The Contractor shall conduct exposure assessments for all tasks which impact lead paint in accordance with 29 CFR 1926.62(d) and shall implement appropriate personal protective equipment until negative exposure assessments are developed.

All work impacting the lead containing/coated materials shall be conducted within an established Regulated Area with a remote wash facility/decontamination system in accordance with "C. Wash Facilities" and the OSHA Lead in Construction Standard. In accordance with 29 CFR 1926.62, engineering controls and work practices shall be utilized to prevent the spread of lead dust and debris beyond the Regulated Area and limit the generation of airborne lead. For Abrasive Blast Cleaning Operations, such engineering controls shall include the use of a full negative pressure enclosure (NPE) in accordance with SSPC Guide 6 and Item #0603XXXA. All wastes containing lead paint shall be properly contained and secured for storage, transportation and disposal.

The Contractor shall ensure proper entry and exit procedures for workers and authorized persons who enter and leave the Regulated Area. All workers and authorized persons shall leave the Regulated Area and proceed directly to the wash or shower facilities where they will HEPA vacuum gross debris from work suit, remove and dispose of work suit, wash and dry face and hands, and vacuum clothes. Lead chips and dust must not be removed by blowing or shaking of clothing. Wash water shall be collected, filtered, and disposed of in accordance with Federal, State and local water discharge standards. Any permit required for such discharge shall be the responsibility of the Contractor.

Personnel shall be advised that they must not eat, drink, smoke, chew gum or tobacco, nor apply cosmetics while in the Regulated Area.

Data from the limited lead testing performed by the Engineer is documented in the reports listed in the "Notice to Contractor – Hazardous Materials Investigations" or is presented herein. Under no circumstances shall this information be the sole means used by the Contractor for determining the extent of lead painted materials. The Contractor shall be responsible for verification of all

field conditions affecting performance of the work as described in these Specifications in accordance with OSHA, USEPA, USDOT and CTDEP standards. Compliance with the applicable requirements is solely the responsibility of the Contractor.

BRIDGES

Bridge No. 00480, I-91 over Airport Road, Hartford, CT

- **Detectable amounts of lead were identified on the painted metal bridge surfaces of Bridge No. 00480.**
- **No paint identified on concrete surfaces of Bridge No. 00480.**

Girders, Cross Beams, Beam Ends, Bearings, Rockers, Diaphragms, Connection Plates, Columns, Railing Supports, Railings, etc.	**Metal**	**Tan, Silver**	**9.6-24.5 mg/cm^2**

- **TCLP waste stream sampling/analysis of the paint associated with the structural steel/metal bridge surfaces and railings characterized the paint waste as RCRA/CTDEEP hazardous waste.**

Paint debris (railings)	**250 mg/l**
Paint debris (structural)	**250 mg/l**

Bridge No. 00813, I-91 over US Routes 5 & 15, Hartford, CT

- **Detectable amounts of lead were identified on the painted metal bridge surfaces of Bridge No. 00813.**
- **No paint identified on concrete surfaces of Bridge No. 00813.**

Girders, Cross Beams, Beam Ends, Bearings, Rockers, Diaphragms, Connection Plates, Columns, Railing Supports, Railings, etc.	**Metal**	**Tan, Grey**	**0.0-30.7 mg/cm^2**

- **TCLP waste stream sampling/analysis of the paint associated with the structural steel/metal bridge surfaces and railings characterized the paint waste as RCRA/CTDEEP hazardous waste.**

Paint debris (railings)	**360 mg/l**

Paint debris (structural)	**440 mg/l**

Bridge No. 01466, I-91 over I-91 TR 827, Hartford, CT

- **Detectable amounts of lead were identified on the painted metal bridge surfaces of Bridge No. 01466.**
- **No paint identified on concrete surfaces of Bridge No. 01466.**

Girders, Cross Beams, Beam Ends, Bearings, Rockers, Diaphragms, Connection Plates, Columns, Railing Supports, Railings, etc.	**Metal**	**Tan, Grey**	**14.4-27.0 mg/cm^2**

- **TCLP waste stream sampling/analysis of the paint associated with the structural steel/metal bridge surfaces and railings characterized the paint waste as RCRA/CTDEEP hazardous waste.**

Paint debris (railings)	**320 mg/l**
Paint debris (structural)	**270 mg/l**

Bridge No. 05796, U.S. Route 15 over Silver Lane, East Hartford, CT

- **No paint identified on metal surfaces of Bridge No. 05796.**
- **No paint identified on concrete surfaces of Bridge No. 05796.**

Girders, Cross Beams, Beam Ends, Bearings, Rockers, Diaphragms, Connection Plates, Columns, Railing Supports, Railings, Fencing Abutments etc.	**Metal/Concrete**	**-**	**Not Painted**

Bridge No. 05922, I-91 NB over U.S. Route 15, Hartford, CT

- **No detectable amounts of lead were identified on the painted structural metal bridge surfaces of Bridge No. 05922.**
- **No paint identified on concrete surfaces or metal railing surfaces of Bridge No. 05922.**

Girders, Cross Beams, Beam Ends, Bearings, Rockers, Diaphragms, Connection Plates, Columns, etc.	**Metal**	**Tan**	**0.0 mg/cm^2 ND < 0.1 %**

- **TCLP analysis not warranted. Paint waste streams considered non-hazardous, non-RCRA waste.**

Bridge No. 6000A, U.S. Route 15 NB over I-91 NB, Route 2, CT River, and Railroad, Hartford, East Hartford, CT

- **No detectable amounts of lead were identified on the painted structural metal bridge surfaces of Bridge No. 6000A.**
- **No paint identified on concrete surfaces or metal railing/fencing surfaces of Bridge No. 6000A.**

Girders, Cross Beams, Beam Ends, Bearings, Rockers, Diaphragms, Connection Plates, Columns etc.	**Metal**	**Green**	**0.0 mg/cm^2 ND < 0.1%**

- **TCLP analysis not warranted. Paint waste streams considered non-hazardous, non-RCRA waste.**

Bridge No. 6000B, U.S. Route 15 SB over I-91 NB, Route 2, CT River, and Railroad, Hartford, East Hartford, CT

- **No detectable amounts of lead were identified on the painted structural metal bridge surfaces of Bridge No. 6000B.**
- **No paint identified on concrete surfaces or metal railing/fencing surfaces of Bridge No. 6000B.**

Girders, Cross Beams, Beam Ends, Bearings, Rockers, Diaphragms, Connection Plates, Columns, etc.	**Metal**	**Green**	**0.0 mg/cm^2 ND < 0.1%**

- **TCLP analysis not warranted. Paint waste streams considered non-hazardous, non-RCRA waste.**

Bridge No. 6000C, I-91 NB to U.S. Route 15 NB On Ramp over Reserve Road and Railroad, Hartford, CT

- **No detectable amounts of lead were identified on the painted structural metal bridge surfaces of Bridge No. 6000C.**
- **No paint identified on concrete surfaces or metal railing surfaces of Bridge No. 6000C.**

Girders, Cross Beams, Beam Ends, Bearings, Rockers, Diaphragms, Connection Plates, Columns, Railing Supports, Railings, etc.	**Metal**	**Green**	**0.0 mg/cm^2 ND < 0.1%**

- **TCLP analysis not warranted. Paint waste streams considered non-hazardous non-RCRA waste.**

Bridge Nos. 06043A, 06043B, U.S. Route 15 NB, SB over Main Street, East Hartford, CT

- **No paint identified on metal surfaces of Bridge No. 06043A & 06043B.**
- **No paint identified on concrete surfaces of Bridge No. 06043A & 06043B**

Girders, Cross Beams, Beam Ends, Bearings, Rockers, Diaphragms, Connection Plates, Columns, Railing Supports, Railings, Abutments etc.	**Metal/Concrete**	**-**	**Not Painted**

Bridge No. 06289, Route 3 NB over I-91, Wethersfield, CT

- **No detectable amounts of lead were identified on the painted structural bridge surfaces of Bridge No. 06289.**

Box Girders (Interior/Exterior), Cross Beams, Beam Ends, Bearings, Rockers, Diaphragms, Connection Plates, Columns, etc.	**Metal**	**Blue & White**	**0.0 mg/cm^2 ND < 0.1%**

- **TCLP analysis not warranted. Paint waste streams considered non-hazardous, non-RCRA waste.**

CULVERTS

Culvert No. 02555, 1-91 over Clark Dike Service Road, Hartford, CT

- **No painted metal/concrete surfaces identified**

Culvert No. 03244, I-91 & TR 827 over drainage, Hartford, CT

- **No painted metal/concrete surfaces identified**

Culvert No. 03613, I-91 & TR 827 over drainage, Hartford, CT

- **No painted metal/concrete surfaces identified**

Culvert No. 03614, TR 828 & Route 15 SB Exit 87 over drainage, Hartford, CT

- **No painted metal/concrete surfaces identified**

Culvert No. 06654, Airport Road over drainage, Hartford, CT

- **No painted metal/concrete surfaces identified**

SIGNS

Sign No. 21460, I-91 SB, Hartford, CT

- **Detectable amounts of lead were identified on the painted metal support surface of Sign No. 21460.**

Sign Support	**Metal**	**Tan**	**0.1-0.2 mg/cm^2**

- **TCLP waste stream sampling/analysis of the paint associated with the metal sign support surfaces and railings characterized the paint waste as non-hazardous, non-RCRA waste.**

Paint debris (sign support)	**1.2 mg/l**

Sign No. 21510, I-91 NB, Hartford, CT

- **Detectable amounts of lead were identified on the painted metal support surface of Sign No. 21510.**

Sign Support	**Metal**	**Tan**	**0.1-0.2 mg/cm^2**

- **TCLP waste stream sampling/analysis of the paint associated with the metal sign support surfaces and railings characterized the paint waste as non-hazardous, non-RCRA waste.**

Paint debris (sign support)	**1.0 mg/l**

Sign No. 21349, I-91 NB, Hartford, CT

- **No painted surfaces identified on Sign No. 21349**

Sign "Hartford-City Line", I-91 NB, Hartford, CT

- **No painted surfaces identified on Sign "Hartford-City Line"**

Sign "Exit 27-Regional Market-Food, Phone Gas, Lodging, Diesel", I-91 NB, Hartford, CT

- **No painted surfaces identified on Sign "Exit 27-Regional Market-Food, Phone Gas, Lodging, Diesel"**

Sign No. 21004, U.S. Route 5/15 NB, East Hartford, CT

- **No detectable amounts of lead were identified on the painted metal support surfaces of Sign No. 21004.**

Sign Support	**Metal**	**Light Brown**	**ND < 0.1%**

- **TCLP analysis not warranted. Paint waste streams considered non-hazardous non-RCRA waste.**

Sign No. 21002, U.S. Route 5/15 NB, East Hartford, CT

- **No detectable amounts of lead were identified on the painted metal support surfaces of Sign No. 21002.**

Sign Support	**Metal**	**Light Brown**	**ND < 0.1%**

- **TCLP analysis not warranted. Paint waste streams considered non-hazardous non-RCRA waste.**

****Note: Detectable levels of lead were also identified on the structural steel/metal bridge/railing components at Bridge Nos. 01456, 01457, 01459 & 01460, however they are not projected to be impacted by the bridge rehabilitation project. Should lead painted metal bridge components at these bridges be required to be impacted during construction, work shall cease immediately until the Engineer can determine the extent of any lead paint impact and implement proper procedures. Further, any paint waste generated from the structural steel/metal bridge/railing components at the bridges would be characterized as RCRA/CTDEEP hazardous waste.**

The Contractor shall submit a Lead Compliance Work Plan to CTDOT outlining the exact procedures that will be used to perform the work, contain the spread of lead debris and protect the employees performing the required renovation work impacting the lead paint. No work shall be started by the Contractor until the Work Plan is approved by the Engineer.

All work impacting the lead paint materials shall be conducted within an established Regulated Area with a remote wash facility/decontamination system in accordance with "C. Wash Facilities" and the OSHA Lead in Construction Standard. In accordance with 29 CFR 1926.62, engineering controls and work practices shall be utilized to prevent the spread of lead dust and debris beyond the Regulated Area and limit the generation of airborne lead. All wastes containing lead paint shall be properly contained and secured for storage, transportation and disposal.

Where abrasive blast cleaning techniques are to be utilized on surfaces coated with lead paint they must be conducted in accordance with the OSHA worker protection and USEPA RCRA/CTDEEP waste disposal standards, and shall be conducted in accordance with Item #0603XXXA "Abrasive Blast Cleaning and Field Painting of Structure (Site No. X)" following SSPC-SP10 "Near White Blast Cleaning" procedures and utilizing a full negative pressure enclosure (NPE) in accordance with SSPC Guide 6 and Item #0603XXXA.

At Bridge Nos. 00480, 00813, 01466, the Engineer has previously characterized the projected paint waste stream associated with the structural steel/metal bridge components as RCRA/CTDEEP Hazardous waste. If the paint is to be removed from the substrate surfaces by abrasive blast cleaning and/or miscellaneous tasks, the paint shall be handled and disposed of in accordance with USEPA/CTDEEP Hazardous Waste Regulations and Item #0603222A "Disposal of Lead Debris from Abrasive Blast Cleaning."

Any scrap metal components generated shall be segregated and recycled as scrap metal at the Contractor's previously submitted scrap metal recycling facility. The recycling of scrap metal (regardless of lead paint concentration) is exempt from USEPA RCRA and CTDEEP Hazardous Waste Regulation.

Should lead contamination be discovered outside of the Regulated Area, the Contractor shall immediately stop all work in the Regulated Area, eliminate causes of such contamination and take steps to decontaminate non-work areas.

Special Requirements for miscellaneous renovation activities impacting lead (other than abrasive blast cleaning operations):

1. Demolition/Renovation:

    a. Demolish/renovate in a manner which minimizes the spread of lead contamination and generation of lead dust.

    b. Implement dust suppression controls, such as misters or local exhaust ventilation, to minimize the generation of airborne lead dust.

    c. Segregate work areas from non-work areas through the use of barrier tape or drop cloths.

    d. Clean up immediately after renovation/demolition has been completed.

2. Chemical Removal (if allowed by the Engineer):

    a. Apply chemical stripper in quantities and for durations specified by manufacturer.

    b. Where necessary, scrape lead paint from surface down to required level of removal (such as stabilized surface or bare substrate with no trace of residual pigment). Use sanding, hand scraping, and dental picks to supplement chemical methods as necessary.

    c. Apply neutralizer compatible with substrate and chemical agent to substrate following removal in accordance with manufacturer's instructions.

d. Protect adjacent surfaces from damage from chemical removal.

e. Maintain a portable eyewash station in the work area.

f. Require that workers wear respirators that protect them from chemical vapors.

g. Do not apply caustic agents to aluminum surfaces.

3. Mechanical Paint Removal:

a. Provide sanders, grinders, rotary wire brushes, or needle gun removers equipped with a HEPA filtered vacuum dust collection system. Cowling on the dust collection system for orbital-type tools must be capable of maintaining a continuous tight seal with the surface being abated. Cowling on the dust collection system for reciprocating-type tools shall promote an effective vacuum flow of loosened dust and debris. Inflexible cowlings may be used on flat surfaces only. Flexible contoured cowlings are required for curved or irregular surfaces.

b. Provide HEPA vacuums that are high performance designed to provide maximum static lift and maximum vacuum system flow at the actual operating vacuum condition with the shroud in use. The HEPA vacuum shall be equipped with a pivoting vacuum head.

c. Remove lead paint from surface down to required level of removal (i.e. stabilized surface, bare substrate with no trace of residual pigment, etc.). Use chemical methods, hand scraping, and dental picks to supplement abrasive removal methods as necessary.

d. Protect adjacent surfaces from damage from abrasive removal techniques.

e. “Sandblasting” or other abrasive blast cleaning type removal techniques shall not be allowed unless in accordance with methods as specified within this Item.

4. Component Removal/Replacement:

a. Wet down components which are to be removed to reduce the amount of dust generated during the removal process.

b. Remove components utilizing hand tools, and follow appropriate safety procedures during removal. Remove the components by approved methods which will provide the least disturbance to the substrate material. Do not damage adjacent surfaces.

c. Clean up immediately after component removals have been completed. Remove any dust located behind the component removed.

H. Prohibited Removal Methods:

The use of heat guns in excess of 700 °Fahrenheit to remove lead paint is prohibited.

The use of sand, steel grit, air, CO_2, baking soda, water jet, or any other blasting media to remove lead or lead paint without the use of a HEPA ventilated contained negative pressure enclosure is prohibited.

Power/pressure washing shall not be used to remove lead paint, unless explicitly specified for use by the Engineer.

Compressed air shall not be utilized to remove lead paint, unless explicitly specified for use by the Engineer.

Power tool assisted grinding, sanding, cutting, or wire brushing of lead paint without the use of cowled HEPA vacuum dust collection systems is prohibited.

Lead paint burning, busting of rivets painted with lead paint, welding of materials painted with lead paint, and torch cutting of materials painted with lead paint is prohibited. Where cutting, welding, busting, or torch cutting of materials is required, lead paint in the affected area must be removed first.

Chemical stripping of coatings from bridge components is prohibited in areas where Abrasive Blast Cleaning is to be performed, and is generally prohibited in all areas unless specifically allowed by the Engineer.

Chemical strippers containing Methylene Chloride are always prohibited.

I. Clean-up and Visual Inspection:

The Contractor shall remove and containerize all lead waste material and visible accumulations of debris, paint chips and associated items.

During clean-up the Contractor shall use rags and sponges wetted with lead-specific detergent and water as well as HEPA filtered vacuum equipment.

The Engineer will conduct a visual inspection of the work area(s) in order to document that all surfaces have been maintained as free as practicable of accumulations of lead in accordance with 29 CFR 1926.62(h). If visible accumulations of waste, debris, lead paint chips or dust are found in the work area, the Contractor shall repeat the cleaning, at the Contractor's expense, until the area is in compliance. The visual inspection will detect incomplete work, damage caused by the abatement activity, and inadequate clean up of the work Site.
During Abrasive Blast Cleaning Operations:

All debris shall be contained and vacuum collected daily or more frequently as directed by the Engineer, due to debris buildup. Such debris, abrasive blast residue, rust and paint chips shall be stored in leakproof storage containers in the secured storage area, or as directed by the Engineer. The storage containers and storage locations shall be reviewed by and be acceptable to the Engineer and shall be located in areas not subject to ponding.

All storage containers (roll offs or drums) shall have a protective liner and removable lid. These containers shall not have any indentations or damage that would allow seepage of the contained material.

If 55 gallon barrels are used, staging is required: 55 gallon barrels shall be stored together in two (2) rows of five (5). The Contractor shall maintain a minimum lane clearance of 36 inches between each (barrel lot of ten (10)).

The Contractor shall maintain a secure storage area, which shall be large enough to handle all debris. The Contractor shall store debris only in the secured storage area. During abrasive blast cleaning operations, all surface preparation debris shall be vacuum collected from the containment enclosure and removed to the abrasive recycling reclaimer unit, and the coating debris shall be conveyed to the secured storage area at the conclusion of the work shift. The Contractor shall account for all coating debris conveyed to the secured storage area and all coating debris transported from the Project for disposal.

The secure storage area shall consist of an eight- (8-) foot high fenced-in area with a padlocked entrance. Storage containers shall not be used on the Project until and unless they have been reviewed and approved by the Engineer. Storage containers and areas shall be located so as not to cause any traffic hazard. Container storage areas shall be in locations that are properly drained, where runoff water shall not be allowed to pool, and shall be out of the 100-year flood plain. The containers shall be placed on pallets or other approved material and not directly on the ground.

Storage containers shall be closed and covered with a waterproof tarpaulin at all times except during placement, sampling and disposal of debris.

J. Post-Work Regulated Area Deregulation:

Following an acceptable visual inspection, any engineering controls implemented may be removed.

A final visual inspection of the work area shall be conducted by the Competent Person and the Project Monitor or Engineer to ensure that all visible accumulations of suspect materials have been removed and that no equipment or materials associated with the lead paint removal remain. If this final visual inspection is acceptable, the Contractor will reopen the Regulated Area and remove all associated signs.

The Contractor shall restore all work areas and auxiliary areas used during work to conditions equal to or better than original. Any damage caused during the performance of the work activity shall be repaired by the Contractor at no additional expense to the State.

K. Waste Disposal/Recycling:

Metallic debris shall be segregated and recycled as scrap metal at an approved metal recycling facility.

Concrete, brick, etc. coated with any amount of lead paint cannot be crushed, recycled or buried on-site to minimize waste disposal unless tested and found to meet the RSR GA/Residential standards.

All hazardous lead debris shall be disposed of in accordance with Item 0603222A "Disposal of Lead Debris from Abrasive Blast Cleaning."

L. Project Closeout Data:

Provide the Engineer, within thirty (30) days of completion of the work under this item, a compliance package which shall include, but not be limited to, the following:

1. Competent person's (supervisor) job log;
2. Certification that all requirements of the Lead Compliance Work Plan and OSHA Lead in Construction Standards, including training, medical surveillance, biological monitoring and medical removal protection, have been followed;
3. Copies of each periodic inspection report;
4. Report on regulatory compliance prepared by the CIH based on the periodic inspections performed.
5. OSHA-compliant personnel air sampling data;
6. Completed waste shipment papers for non-hazardous lead debris waste disposal or recycling and scrap metal recycling.

M. Non Compliance:

Failure of the Contractor to implement the requirements of 29 CFR 1926.62, its Lead Compliance Work Plan, or any other requirement of this item will, at the sole discretion of the Engineer, result in the suspension of all Contract work until such deficiencies are corrected.

Method of Measurement:

This item will include all noted services, equipment, facilities, testing and other associated work, including up to three (3) CTDOT Project representatives. Services provided to any CTDOT

Project representatives in excess of three (3) representatives will be measured for payment in accordance with Article 1.09.04 – "Extra and Cost-Plus Work."

1. Within thirty (30) calendar days of the award of the Contract, the Contractor shall submit to the Engineer for acceptance a breakdown of its lump sum bid price for this item detailing:

   a. The development costs associated with preparing the Lead Compliance Work Plan in accordance with these Specifications.

   b. The cost per month for the duration of the Project to implement the Lead Compliance Work Plan and provide the services of the CIH and IH firm.

2. If the lump sum bid price breakdown is unacceptable to the Engineer; substantiation showing that the submitted costs are reasonable shall be required.

3. Upon acceptance of the payment schedule by the Engineer, payments for work performed will be made as follows:

   a. The lump sum development cost will be certified for payment.

   b. The Contractor shall demonstrate to the Engineer monthly that the Lead Compliance Work Plan has been kept current and is being implemented and the monthly cost will be certified for payment.

   c. Any month where the Lead Compliance Work Plan is found not to be current or is not being implemented, the monthly payment for this item will be deferred to the next monthly payment estimate. If the Lead Compliance Work Plan is not current or being implemented for more than thirty (30) calendar days, there will be no monthly payment.

   d. Failure of the Contractor to implement the Lead Compliance Work Plan in accordance with this Specification will result in the withholding of all Contract payments.

Basis of Payment:

The lump sum price bid for this item shall include: services, materials, equipment, all permits, notifications, submittals, personal air sampling, personal protection equipment, incidentals, temporary enclosures, fees and labor incidental to activities impacting lead removal, treatment and handling of lead contaminated materials and the transport and disposal of any non-hazardous, non RCRA lead debris waste and scrap metal.

Final payment will not be made until all Project closeout data submittals have been completed and provided to the Engineer. Once the completed package has been received in its entirety and has been accepted by the Engineer, final payment will be made to the Contractor.

Pay Item	Pay Unit
Lead Compliance for Abrasive Blast Cleaning & Miscellaneous Tasks	Lump Sum

ITEM #0090693A - SPARE PARTS

DESCRIPTION: This item shall consist of furnishing surge suppressors and electronic drivers for use as replacement parts for LED roadway luminaires.

MATERIALS: Surge suppressers shall be rated for use in 480 volt circuits. The surge suppressor shall be supplied by the manufacturer of the LED luminaires approved for use on this project (installed under contract Item Nos. 1005600A, 1005601A, 1005602A and 1005603A) and shall be identical in all respects to the surge suppressers supplied with the LED luminaires. The Contractor shall supply the following quantities:

- 20kV/20kA, 480 volt suppressors (for item nos. 1005601A, 1005602A and 1005603A): Quantity = 40 units.

- 10kV/5-10kA, 480 volt suppressors (for item no. 1005600A): Quantity = 10 units.

Electronic Drivers shall be rated for 480 volt circuits and shall operate at 60 Hz. The electronic drivers shall be supplied by the manufacturer of the LED luminaires approved for use on this project (installed under contract Item Nos. 1005600A, 1005601A, 1005602A and 1005603A) and shall be identical in all respects to the drivers supplied with the LED luminaires. The Contractor shall supply the following quantities:

480 volt Driver (for item No. 1005600A - 4,500* lumen fixture): Quantity = 3 units.
480 volt Driver (for item No. 1005600A - 12,000* lumen fixture): Quantity = 5 units.
480 volt Driver (for item No. 1005602A - 16,000* lumen fixture): Quantity = 5 units.
480 volt Driver (for item No. 1005603A - 20,000* lumen fixture): Quantity = 5 units.

(* Approximate lumen value)

CONSTRUCTION METHOD: Under this item the Contractor shall supply replacement (spare) parts consisting of surge suppressors and electronic drivers in the quantities listed. The spare parts shall be supplied by the manufacturer of the LED luminaires approved for use on this project (installed under contract Item Nos. 1005600A, 1005601A, 1005602A and 1005603A) and shall be identical in all respects to the parts supplied with the LED luminaires.

The Contractor shall deliver the spare parts to ConnDOT District 1 Electrical Maintenance located Jennings Road in Hartford. The Contractor shall contact Mr. Augusto Grazuna (860-566-3156) to arrange a delivery time. The Contractor shall transfer all replacement parts in one delivery.

METHOD OF MEASUREMENT: This work will be measured for payment as a lump sum for the materials as specified, complete and accepted.

BASIS OF PAYMENT: This work will be paid for at the contract lump sum price for "Spare Parts", complete and accepted in place, which price shall include all materials including surge suppressors, electronic drivers, delivery, and all labor, tools, equipment and work incidental thereto.

ITEM #0100502A - SURVEY GRADE GPS UNIT

Description: The work under this item shall include furnishing, configuring, installing and maintaining a Global Positioning System (GPS) unit for Department use and shall include training of Department representatives on the use of the GPS unit provided.

Materials: The Contractor shall provide one (1) Trimble SPS 985 GPS unit and one (1) Trimble Tablet for use by the Engineer and the Project inspection staff. The Contractor shall maintain the GPS unit and software, and shall provide a replacement within two (2) working days, in the event of breakdown, damage or theft. Activation of the GSM modem within the tablet shall also be provided by the Contractor.

The GPS unit provided shall include, and be licensed to operate, the same versions of GPS planning software, data collection software, navigation software, stakeout software and post-processing software. All software provided (including firmware) shall be the most current available from the manufacturer at the time of bidding. The GPS unit shall be replaced every two (2) years with new/upgraded units until Project completion, as directed by the Engineer. Upon completion of the Project, all purchased GPS units shall become the property of the Department.

The GPS unit shall be survey grade with the following capabilities:

1. The GPS unit shall include both standard USB cable and Bluetooth wireless technology for data transfer.
2. Data shall be capable of being copied onto or from a removable industry standard data storage card (e.g., secure digital SD Card). Each GPS unit shall include two data storage cards, each with a maximum capacity of 4 GB.
3. The tablet supplied with each instrument shall meet or exceed the standards and specifications of Trimble Tablet w/SCS900 software.
4. All hardware, software and firmware shall be the latest releases available at the time of equipment delivery.
5. The Contractor shall provide the following software modules for each GPS unit
    a. TBCHCE : surface tools module, and advanced drafting module
    b. SCS900 : roading module and advanced measurements module
6. The GPS unit shall be able to import/export, and display point and alignment data in XML format, and shall be able to import graphics files in DGN or DXF format.
7. The GPS unit shall have an internal, or modular, rechargeable battery system capable of operating a minimum of eight (8) hours (may include interchangeable batteries), and shall include a battery charger.
8. The GPS unit shall include a hard or soft shell carry case, and operation manuals.
9. The GPS unit shall be equipped to receive Global Positioning System (GPS), GLONASS and GNSS position data.

10. The GPS unit shall be equipped to receive and be capable of using Real Time Kinematics (RTK) correctional data (current version of RTCM format) either through conventional base station(s) or through a private subscription service. This shall include all necessary communication devices, systems, data service plans and communications to meet the minimum required accuracy and not exceed a second latency at the rover. Whichever communication method is used to broadcast correctional data, the Contractor shall ensure that the RTK data shall be available at all locations across the entire Project site during all hours of construction and inspection operations. In the event that a private subscription service is used for RTK surveys, no baseline shall be longer than 30 km.
11. The GPS unit shall include the capability to "localize" both the horizontal and vertical control to local Project monumentation (also known as calibrate), while using RTK corrections from a reference network. No other datum than that used for Project control shall be used. NAD 83 CORS or NAD 83/96 will not be compatible with the existing survey control.
12. The GPS unit shall include either an integrated or modular communication device capable of receiving RTK correctional data.
13. The GPS unit shall have the ability to display the number of satellites tracked at any one time and indicate the accuracy quality of each measurement relative to the strength of signals and the GDOP (Geometric Dilution of Precision).
14. The GPS unit shall include dual frequency receivers.
15. All necessary software shall be included (including communication drivers) to allow conversion and export of data in a format suitable for use in MicroStation™. Firmware used on the GPS unit shall be verified as interoperable with MicroStation/Inroads™ software.
16. The tablet shall permit the user to program and store multiple configurations (also known as user preferences) prior to the actual field measurements. Configurations shall be capable of being stored and recalled in the field.
17. The GPS unit shall include one (1) fixed-height rover rod of 2.0 m in length, one (1) attachable bipod which is compatible with the rover rod, and one (1) topo shoe.
18. All GPS units must be capable of tracking 120 channels and must be IP67 rated (for dirt and moisture) at a minimum.
19. Provide manufacturer's warranty for all equipment.

The GPS Tablet or Data collector shall meet the following standards:

1. Be capable of being shared by total stations and GPS Receivers.
2. Be capable of Bluetooth, wireless LAN and 900 MHz communication.
3. Run on Microsoft Windows Mobile 5 or Windows CE 6.0 operating system or approved equal.
4. Have an alphanumeric keypad.

5. Include 128 MB SDRAM, 512 MB internal nonvolatile storage memory.
6. Include LI-ion Ion Rechargeable Batteries and chargers, with both office and automobile chargers capable of operating for a minimum of eight (8) hours under all conditions.
7. Meet MIL-STD-810F and Ip67 standards for waterproofing, humidity, sand, dust, vibration, and be capable of sustaining a 1.2-meter (4-foot) drop onto hard surfaces.
8. Have daylight/anti-glare compatible touch screen and screen protectors.
9. Have available RS232, USB, compact flash or SD card slots.
10. Be capable of data transfers to PC inclusive of all cables, hardware, locks, etc., for both field and office operations.
11. Be capable of data transfers compatible with existing CTDOT Bentley MicroStation and Inroads CADD operations and standards.
12. Have available industry standard survey coordinate geometry routines.
13. Tablet docking station shall be provided.

Submittals:

1. The Contractor shall submit one (1) proposal for an initial quantity of one (1) GPS unit. The proposal shall be for new equipment. The cost of the training, as detailed under "Construction Methods," shall be included in the proposal.
2. The Contractor shall submit for the Engineer's approval the name, resume and manufacturer's certification of the person(s) proposed to provide training services to the Engineer and their representatives.

Construction Methods: The Contractor shall furnish, configure, install, and maintain the GPS unit and provide training for Department representatives on the operation of the GPS unit.

All GPS surveying shall conform to "Guidelines and Specifications for Global Navigation Satellite System Land Surveys in Connecticut," as adopted on June 26, 2008, by the Connecticut Association of Land Surveyors, Inc. (78 Beaver Road, Wethersfield, Connecticut 06109 USA; www.ctsurveyor.com).

GPS Training Requirements:

The Contractor shall provide training to the Department representatives on the use of the GPS unit provided. The training shall consist of a minimum of one (1) - eight (8) hour training session for GPS localization/calibration of the Project site. In addition, a minimum of two (2) separate eight (8) hour training sessions on the use and operation of the GPS units during the first year of the Contract shall be provided. One (1) of these sessions shall occur within one (1) week of delivery of GPS unit to the Site. The second session shall occur upon the request of the Engineer. One (1) additional eight (8) hour minimum training session shall be provided during each additional Contract year that the GPS unit is in service.

Training shall be led by a manufacturer-verified trainer, approved by the Engineer. The training shall occur at the Engineer's Field Office or at another location agreed to by the Engineer.

Method of Measurement: The work and materials required for this item will be measured for payment as provided for under Article 1.09.04—Extra and Cost-Plus Work.

The sum of money shown on the estimate and in the itemized proposal as "Estimated Cost" for this work will be considered the bid price even though payment will be made only for actual cost of training, equipment, material, accessories, labor, and maintenance. The estimated cost figure is not to be altered in any manner by the bidder. Should the bidder alter the amount shown, the altered figures will be disregarded and the original price will be used in determining the total amount for the Contract.

Basis of Payment:

The sum of money shown on the estimate and in the itemized proposal as "Estimated Cost" for this work shall be considered the bid price even though payment will be made only for the actual "Survey-Grade GPS Unit" provided, for which price shall include all authorized training, equipment, material, accessories, labor, and maintenance.

Pay Item	Pay Unit
Survey-Grade GPS Unit	Est.

ITEM #0101000A - ENVIRONMENTAL HEALTH AND SAFETY

Description:

Under this Item, the Contractor shall establish protocols and provide procedures to protect the health and safety of its employees and subcontractors as related to the proposed construction activities performed within the Project Areas of Environmental Concern (AOECs). Work under this Item consists of the development and implementation of a written site-specific Health and Safety Plan (HASP) that addresses the relative risk of exposure to documented hazards present within Project limits. The HASP shall establish health and safety protocols that address the relative risk of exposure to regulated substances in accordance with 29 CFR 1910.120 and 29 CFR 1926.65. Such protocols shall only address those concerns directly related to site conditions.

Note: The Engineer will prepare a site-specific health and safety plan which is compatible with the Contractor's plan and will be responsible for the health and safety of all Project Inspectors, Department employees and consulting engineers.

Materials:

The Contractor must provide chemical protective clothing (CPC) and personal protective equipment (PPE) as stipulated in the Contractor's HASP during the performance of work in areas identified as potentially posing a risk to worker health and safety for workers employed by the Contractor and all subcontractors.

Construction Methods:

1-Existing Information: The Contractor shall utilize all available information and existing records and data pertaining to chemical and physical hazards associated with any of the regulated substances identified in the environmental site investigations to develop the HASP. A list of documents containing this data is found in "Notice to Contractor – Environmental Investigations".

2-General: The requirements set forth herein pertain to the provision of workers' health and safety as it relates to proposed Project activities when performed in the presence of hazardous or regulated materials or otherwise environmentally sensitive conditions. THE PROVISION OF WORKER HEALTH AND SAFETY PROTOCOLS WHICH ADDRESS POTENTIAL AND/ OR ACTUAL RISK OF EXPOSURE TO SITE SPECIFIC HAZARDS POSED TO CONTRACTOR EMPLOYEES IS SOLELY THE RESPONSIBILITY OF THE CONTRACTOR.

The Contractor shall be responsible for the development, implementation and oversight of the HASP throughout the performance of work within the limits of the AOEC(s), as identified in the Contract Documents, and in other areas identified by the Engineer, where site conditions may

pose a risk to worker health and safety and/or the environment. **No physical aspects of the work within the AOECs shall begin until the HASP is reviewed by the Engineer and is determined to meet the requirements of the specifications. However, the Contract time, in accordance with Article 1.03.08, will begin on the date stipulated in the Notice to Proceed.**

3-Regulatory Requirements: All construction related activities performed by the Contractor within the limits of the AOECs, or in other areas where site conditions may pose a risk to worker health and safety and/or the environment, shall be performed in conformance with 29 CFR 1926, Safety and Health Regulations for Construction and 29 CFR 1910, Safety and Health Regulations for General Industry. Conformance to 29 CFR 1910.120, Hazardous Waste Site Operations and Emergency Response (HAZWOPER) may also be required, where appropriate.

4-Submittals: Three copies of the HASP shall be submitted to the Engineer within four (4) weeks after the Award of Contract or four (4) weeks prior to the start of any work in the AOECs, HAOECs, or GWAOEC, but not before the Award of the Contract. The HASP shall include copies of the Contractor-designated Health and Safety Officer's (HSO) training certificates as well as a demonstration of the required experience, as indicated in Section 5-HASP Provisions (b) (iii) of this Item.

The HASP shall be developed by a qualified person designated by the Contractor. This qualified person shall be a Certified Industrial Hygienist (CIH), Certified Hazardous Material Manager (CHMM), or a Certified Safety Professional (CSP). The qualified person shall have review and approval authority over the HASP and be identified as the Health and Safety Manager (HSM). The HASP shall bear the signature of said HSM indicating that the HASP meets the minimum requirements of 29 CFR 1910.120 and 29 CFR 1926.65.

The Engineer will review the HASP within four (4) weeks of submittal and provide written comments as to deficiencies in and/or exceptions to the plan, if any, to assure consistency with the specifications, applicable standards, policies and practices, and appropriateness given potential or known site conditions. Items identified in the HASP which do not conform to the specifications will be brought to the attention of the Contractor, and the Contractor shall revise the HASP to correct the deficiencies and resubmit it to the Engineer for determination of compliance with this Item. The Contractor shall not be allowed to commence work activities in the AOEC(s), as shown on the Plans, or commence work in other areas where site conditions exist which may pose a risk to worker health and safety and/or the environment, until the HASP has been reviewed and accepted by the Engineer. No claim for delay in the progress of work will be considered for the Contractor's failure to submit a HASP that conforms to the requirements of the Contract.

5-HASP Provisions:

(a) General Requirements: The Contractor shall prepare a HASP covering all Project site work regulated by 29 CFR 1910.120(b)/ 1926.65(b) to be performed by the Contractor and all subcontractors under this Contract. The HASP shall establish in detail, the protocols necessary for the recognition, evaluation, and control of all hazards associated with each task performed under this Contract. The HASP shall address site-specific

safety and health hazards of each phase of site operation and include the requirements and procedures for employee protection. The level of detail provided in the HASP shall be tailored to the type of work, complexity of operations to be performed, and hazards anticipated. Details about some activities may not be available when the initial HASP is prepared and submitted. Therefore, the HASP shall address, in as much detail as possible, all anticipated tasks, their related hazards and anticipated control measures.

The HASP shall interface with the Contractor's Safety and Health Program. Any portions of the Safety and Health Program that are referenced in the HASP shall be included as appendices to the HASP. All topics regulated by the 29 CFR 1910.120(b)(4) and those listed below shall be addressed in the HASP. Where the use of a specific topic is not applicable to the Project, the HASP shall include a statement to justify its omission or reduced level of detail and establish that adequate consideration was given the topic.

(b) Elements:

(i) Site Description and Contamination Characterization: The Contractor shall provide a site description and contaminant characterization in the HASP that meets the requirements of 29 CFR 1910.120/1926.65.

(ii) Safety and Health Risk Analysis/Activity Hazard Analysis: The HASP shall address the safety and health hazards on this site for every operation to be performed. The Contractor shall review existing records and data to identify potential chemical and physical hazards associated with the site and shall evaluate their impact on field operations. Sources, concentrations (if known), potential exposure pathways, and other factors as noted in CFR 1910.120/126.65, paragraph (c)(7) employed to assess risk shall be described. The Contractor shall develop and justify action levels for implementation of engineering controls and PPE upgrades and downgrades for controlling worker exposure to the identified hazards. If there is no permissible exposure limit (PEL) or published exposure level for an identified hazard, available information from other published studies may be used as guidance. Any modification of an established PEL must be fully documented.

The HASP shall include a comprehensive section that discusses the tasks and objectives of the site operations and logistics and resources required to complete each task. The hazards associated with each task shall be identified. Hazard prevention techniques, procedures, and/or equipment shall be identified to mitigate each of the hazards identified.

(iii) Staff Organization, Qualifications and Responsibilities: The HASP shall include a list of personnel expected to be engaged in site activities and certify that said personnel have completed the educational requirements stipulated in 29 CFR 1910.120 and 29 CFR 1926.65, are currently monitored under a medical surveillance program in compliance with those regulations, and that they are fit for work under "level C" conditions.

The Contractor shall assign responsibilities for safety activities and procedures. An outline or flow chart of the safety chain of command shall be provided in the HASP. Qualifications, including education, experience, certifications, and training in safety and health for all personnel engaged in safety and health functions shall be documented in the HASP. Specific duties of each on-site team member should be identified. Typical team members include but are not limited to Team Leader, Scientific Advisor, Site Safety Officer, Public Information Officer, Security Officer, Record Keeper, Financial Officer, Field Team Leader, and Field Team members.

The HASP shall also include the name and qualifications of the individual proposed to serve as Health and Safety Officer (HSO). The HSO shall have full authority to carry out and ensure compliance with the HASP. The Contractor shall provide a competent HSO on-site who is capable of identifying existing and potential hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees and who has authorization to take prompt corrective measures to eliminate or control them. The qualifications of the HSO shall include completion of OSHA 40-hour HAZWOPER training (including current 8-hour refresher training); 8-hour HAZWOPER supervisory training; a minimum of one (1) year of working experience with the regulated compounds that have been documented to exist within Project limits; a working knowledge of Federal and State safety regulations; specialized training or documented experience (one (1) year minimum) in personal and respiratory protective equipment program implementation; the proper use of air monitoring instruments, air sampling methods, and procedures; and certification training in first aid and CPR by a recognized, approved organization such as the American Red Cross.

The primary duties of the HSO shall be those associated with worker health and safety. The Contractor's HSO responsibilities shall be detailed in the written HASP and shall include, but not be limited to the following:

(A) Directing and implementing the HASP.

(B) Ensuring that all Project personnel have been adequately trained in the recognition and avoidance of unsafe conditions and the regulations applicable to the work environment to control or eliminate any hazards or other exposure to illness or injury (29 CFR 1926.21). All personnel shall be adequately trained in procedures outlined in the Contractor's written HASP.

(C) Authorizing Stop Work Orders, which shall be executed upon the determination of an imminent health and safety concern.

(D) Contacting the Contractor's HSM and the Engineer immediately upon the issuance of a Stop Work order when the HSO has made the determination of an imminent health and safety concern.

(E) Authorizing work to resume, upon approval from the Contractor's HSM.

(F) Directing activities, as defined in the Contractor's written HASP, during emergency situations; and

(G) Providing personal monitoring where applicable and as identified in the HASP.

(iv) Employee Training Assignments: The Contractor shall develop a training program to inform employees, supplier's representatives, and official visitors of the special hazards and procedures (including PPE, its uses and inspections) to control these hazards during field operations. Official visitors include but are not limited to Federal Agency Representatives, State Agency Representatives, Municipal Agency Representatives, Contractors, subcontractors, etc. This program shall be consistent with the requirements of 29 CFR 1910.120 and 29 CFR 1926.65.

(v) Personal Protective Equipment: The plan shall include the requirements and procedures for employee protection and should include a detailed section on respiratory protection. The Contractor shall describe in detail and provide appropriate PPE to insure that workers are not exposed to levels greater than the action level for identified hazards for each operation stated for each work zone. The level of protection shall be specific for each operation and shall be in compliance with all requirements of 29 CFR 1910 and 29 CFR 1926. The Contractor shall provide, maintain, and properly dispose of all PPE.

(vi) Medical Surveillance Program: All on-site Contractor personnel engaged in 29 CFR 1910.120/1926.65 operations shall have medical examinations meeting the requirements of 29 CFR 1910.120(f) prior to commencement of work.

The HASP shall include certification of medical evaluation and clearance by the physician for each employee engaged in 29 CFR 1910.120/1926.65 operations at the site.

(vii) Exposure Monitoring/Air Sampling Program: The Contractor shall submit an Air Monitoring Plan as part of the HASP which is consistent with 29 CFR 1910.120, paragraphs (b)(4)(ii)(E), (c)(6), and (h). The Contractor shall identify specific air sampling equipment, locations, and frequencies in the air-monitoring plan. Air and exposure monitoring requirements shall be specified in the Contractor's HASP. The Contractor's CIH shall specify exposure monitoring/air sampling requirements after a careful review of the contaminants of concern and planned site activities.

(viii) Site Layout and Control: The HASP shall include a map, work zone delineation (support, contamination, reduction, and exclusion), on/off-site communications, site access controls, and security (physical and procedural).

(ix) Communications: Written procedures for routine and emergency communications procedures shall be included in the Contractor's HASP.

(x) Personal Hygiene, Personal Decontamination and Equipment Decontamination: Decontamination facilities and procedures for PPE, sampling equipment, and heavy equipment shall be discussed in detail in the HASP.

(xi) Emergency Equipment and First Aid Requirements: The Contractor shall provide appropriate emergency first aid kits and equipment suitable to treat exposure to the hazards identified, including chemical agents. The Contractor will provide personnel that have certified first aid/CPR training on-site at all times during site operations.

(xii) Emergency Response Plan and Spill Containment Program: The Contractor shall establish procedures in order to take emergency action in the event of immediate hazards (i.e., unsuspected waste material, a chemical agent leak or spill, fire, or personal injury). Personnel, facilities, and subcontractors supplying support in emergency procedures will be identified. The emergency equipment to be present on-site and the Emergency Response Plan (ERP) procedures, as required 29 CFR 1910.120, paragraph (1)(1)(ii) shall be specified in the ERP. The ERP shall be included as part of the HASP. This ERP shall include written directions to the closest hospital as well as a map showing the route to the hospital.

(xiii) Logs, Reports and Record Keeping: The Contractor shall maintain safety inspections, logs, and reports, accident/incident reports, medical certifications, training logs, monitoring results, etc. All exposure and medical monitoring records are to be maintained according to 29 CFR 1910 and 29 CFR 1926. The format of these logs and reports shall be developed by the Contractor to include training logs, daily logs, weekly reports, safety meetings, medical surveillance records, and a phase-out report. These logs, records, and reports shall be maintained by the Contractor and be made available to the Engineer.

The Contractor shall immediately notify the Engineer of any accident/incident. Within two working days of any reportable accident, the Contractor shall complete and submit to the Engineer an accident report.

(xiv) Confined space entry procedures: Confined space entry procedures, both permit required and non-permit required, shall be discussed in detail.

(xv) Pre-entry briefings: The HASP shall provide for pre-entry briefings to be held prior to initiating any site activity and at such other times as necessary to ensure that employees are apprised of the HASP and that this plan in being followed.

(xvi) Inspections/audits: The HSM or HSO shall conduct inspections or audits to determine the effectiveness of the HASP. The Contractor shall correct any deficiencies in the effectiveness of the HASP.

6-HASP Implementation: The Contractor shall implement and maintain the HASP throughout the performance of work. In areas identified as having a potential risk to worker health and

safety, and in any other areas deemed appropriate by the HSO, the Contractor shall be prepared to immediately implement the appropriate health and safety measures, including but not limited to the use of PPE, and engineering and administrative controls.

If the Engineer observes deficiencies in the Contractor's operations with respect to the HASP, they shall be assembled in a written field directive and given to the Contractor. The Contractor shall immediately correct the deficiencies and respond, in writing, as to how each was corrected. Failure to bring the work area(s) and implementation procedures into compliance will result in a Stop Work Order and a written directive to discuss an appropriate resolution(s) to the matter. When the Contractor demonstrates compliance, the Engineer shall remove the Stop Work Order. If a Stop Work Order has been issued for cause, no delay claims on the part of the Contractor will be honored.

Disposable CPC/PPE, i.e. disposable coveralls, gloves, etc., which come in direct contact with hazardous or potentially hazardous material shall be placed into 55-gallon USDOT 17-H drums and disposed of in accordance with Federal, State, and local regulations. The drums shall be temporarily staged and secured within the WSA until the material is appropriately disposed.

7-HASP Revisions: The HASP shall be maintained on-site by the Contractor and shall be kept current with construction activities and site conditions under this Contract. The HASP shall be recognized as a flexible document which shall be subject to revisions and amendments, as required, in response to actual site conditions, changes in work methods and/or alterations in the relative risk present. All changes and modifications shall be signed by the Contractor's HSM and shall require the review and acceptance by the Engineer prior to the implementation of such changes.

Should any unforeseen hazard become evident during the performance of the work, the HSO shall bring such hazard to the attention of the Contractor and the Engineer as soon as possible. In the interim, the Contractor shall take action, including Stop Work Orders and/or upgrading PPE as necessary to re-establish and maintain safe working conditions and to safeguard on-site personnel, visitors, the public, and the environment. The HASP shall then be revised/amended to reflect the changed condition.

Method of Measurement:

1-Within thirty (30) calendar days of the award of the Contract, the Contractor shall submit to the Engineer for acceptance a breakdown of the lump sum bid price for this Item detailing:

(a) The development costs associated with preparing the HASP in accordance with these Specifications.
(b) The cost per month for the duration of the Project to implement the HASP and provide the services of the HSM and the HSO.

2-If the lump sum bid price breakdown is unacceptable to the Engineer; substantiation showing that the submitted costs are reasonable shall be required.

3-Upon acceptance of the payment schedule by the Engineer, payments for work performed will be made as follows:

(a) The lump sum development cost will be certified for payment.

(b) The Contractor shall demonstrate to the Engineer monthly that the HASP has been kept current and is being implemented, and the monthly cost will be certified for payment.

(c) Any month where the HASP is found not to be current or is not being implemented, the monthly payment for the Environmental Health and Safety Item shall be deferred to the next monthly payment estimate. If the HASP is not current or being implemented for more than thirty (30) calendar days, there will be no monthly payment.

(d) Failure of the Contractor to implement the HASP in accordance with this Specification shall result in the withholding of all Contract payments.

Basis of Payment:

This work will be paid for at the Contract lump sum price for "Environmental Health and Safety" which shall include all materials, tools, equipment, and labor incidental to the completion of this Item for the duration of the Project to maintain, revise, monitor, and implement the HASP. Such costs include providing the services of the HSM and HSO, Contractor employee training, CPC, PPE, disposal of PPE and CPC, medical surveillance, decontamination facilities, engineering controls, monitoring, and all other HASP protocols and procedures established to protect the Health and Safety for all on-site workers.

Pay Item	Pay Unit
Environmental Health and Safety	L.S.

ITEM #0101050A - ELUR SOIL MANAGEMENT AND RESTORATION

Description:

A portion of the Materials Innovation and Recycling Authority (MIRA)-owned South Meadows Mid-Connecticut Facility (Gate 20 Reserve Road, Hartford, Connecticut), as shown on the Project Plans, is located within the Project limits and is subject to an Environmental Land Use Restriction (ELUR). Under this Item, the Contractor shall manage and segregate soil and restore areas including engineered controls within the portion of the MIRA property subject to the ELUR and overlapping the Project Limits. The contamination present and a description the engineered controls are identified in the "Notice to Contractor – MIRA Property ELUR".

Materials:

All materials shall conform to the State of Connecticut DOT Standard Specifications for Roads, Bridges, and Incidental Construction Form 817, as supplemented, and to the requirements of the Contract.

Orange geotextile fabric material shall conform to the requirements of Section M.08.01 of the specifications.

HDPE pavers shall conform to existing pavers or approved equivalent.

Submittals:

Contractor shall submit the following in accordance with Form 817 Article 1.20-1.05.02 or in accordance with NOTICE TO CONTRACTOR – SUBMITTALS.

Submit Product Data for all materials to be incorporated in the ELUR management and restoration, including, but not limited to the orange geotextile fabric and HDPE pavers.

Construction Methods:

A. General

Intrusive work that will encounter or disturb the impacted soil within the area subject to the ELUR, including any modifications or repairs to Site, will be performed by the Contractor in accordance with this specification, modified as needed for the work proposed, and the Regulations of Connecticut State Agencies (RCSA). Additional activities, not described herein, may be required and methods shall be modified (as needed) to meet the project-specific goals in a manner consistent with the ELUR. Adjustments to the protocols outlined within may be made, on a case by case basis, with the concurrence of the Property owner and the Engineer.

The Contractor shall notify the Engineer at least thirty (30) days prior to the initiation of construction activities within the area subject to the ELUR.

When the ELUR is encountered during the course of the work, health and safety provisions shall conform to the appropriate sections of the Contract. Provisions may include implementation of engineering controls, air and personal monitoring, the use of chemical protective clothing (CPC), personal protective equipment (PPE), and decontamination procedures.

The Contractor will be responsible for the safe performance of all intrusive work, the structural integrity of excavations, proper disposal of excavation de-watering fluids, control of runoff from open excavations into other nearby areas, and for structures that may be affected by excavations (such as building foundations and footings).

The Contractor will ensure that Site activities will not interfere with, or otherwise permanently impair or compromise the engineered controls and certify that such engineered controls are fully restored following completion of intrusive activities.

MIRA, its Contractor(s), and/or other persons holding an interest in the property will provide periodic environmental oversight during activities in the areas subject to the ELUR when potentially impacted soil is to be excavated, backfilled, or transported, and/or when excavation dewatering activities are occurring. The schedule of periodic oversight shall be determined based on best professional judgment, including the licensed environmental professional (LEP) review, and the nature, duration, and extent of the excavation activity.

All equipment and materials required as a part of this Item shall be used in a manner acceptable to the Engineer and in accordance with the manufacturer's recommendations.

B. Material Segregation, Storage, and Handling

In order to ensure that the mixing of materials with different contaminant concentrations is minimized to the greatest extent possible, excavation, handling and staging of contaminated materials should be completed using a phased approach. In areas where the polluted soil is located at a depth of four or more feet beneath clean soil, the top two or four feet of clean soil shall be segregated from the contaminated soil beneath. In areas where HDPE pavers are encountered, the overlying soil shall be removed and the pavers shall be peeled back with care to minimize breakage of the sections and maximize reuse of the pavers during site restoration.

All suitable Controlled Material excavated from the areas subject to the ELUR may be reused. Excess or unsuitable soil that cannot be reused must be transported to the Waste Stockpile Area (WSA) and placed within a designated storage bin for waste characterization.

Excavation of soil and associated subsurface debris shall be performed in a manner that limits mixing of materials with different levels and types of contamination to the highest degree possible. Transfer of contaminated materials from the excavation to WSA shall be conducted in

accordance with Item 0101117A, as to prevent the spread of contamination, or potentially contaminated materials across the Site.

Where excess soil is expected to be generated, a preliminary segregation plan should be established based on existing data. If deemed appropriate, soil with the potential to have the highest chemical concentrations shall be segregated for off-site reuse, recycling, and disposal of. This segregation will allow the Project to prioritize the on-site reuse of the least impacted material, as applicable, and prioritize the off-site management of soil with potentially greater chemical impacts.

During performance of the work, an environmental consultant will be onsite, on behalf of the State, to screen soil for the evaluation the potential presence of impacts. Soil screening methods include the following:

- **Visual -** Soil with visual presence of impact should be segregated for potential off-site management and disposal.
- **Olfactory -** Soil with strong odors (e.g., chemical, petroleum) should be segregated for potential off-site management and disposal.
- **Instrument -** Soil with photoionization detector (PID) readings above action levels shall be segregated for potential off-site management and disposal.

Soils segregated based on previous environmental data and field screening results that requires off-site disposal will be further tested at the WSA to evaluate management and disposal options.

C. Management of Soils

Soil removed during excavations will be utilized to backfill the excavations to the maximum extent practical (only if back-filled in the order in which it was removed from the excavation to ensure placement of impacted soils below layers rendering them inaccessible) or will be characterized to evaluate reuse, recycling and/or disposal options in accordance with Items 0202315A and 0101126A.

D. Cover and Backfill Materials

This section describes methods to be followed for the import, handling and placement of backfill material from off-site sources.

- All materials proposed for import onto the MIRA site will be approved by the property owner and/or approved representative in compliance with the provisions of this SMP prior to receipt at the MIRA property.
- Material from industrial sites, spill sites, or other environmental remediation sites will not be imported to the MIRA property.

1. Requirements for Imported Material

For the purposes of this specification, the terms "Clean Cover", "Cover", "Clean Fill" and "Clean Soil" are all used interchangeably to describe the material placed above soil containing substances exceeding the RSR criteria to render the polluted soil inaccessible, and/or borrow source materials for import to the Site for any other project-related reasons.

The following requirements apply to Clean Soil material targeted for on-site use:

Off-site sources shall comply with the term "Clean Fill" as defined in Section 22a-209-1 of the Regulations of RCSA, except that the approved material shall not contain ceramics and asphalt paving fragments. Note that by reference in the "clean fill" definition contained in 22a-209-1, the provisions of 22a-133k-(h)(3) of the RSRs apply. Those provisions include the following:

Polluted soil from a release area may be treated to achieve concentrations of substances that do not exceed either the applicable direct exposure criteria or pollutant mobility criteria. After such treatment, such soil may be reused on the parcel from which it was excavated or on another parcel approved by the Commissioner, provided that such reuse is consistent with all other provisions of Sections 22a-133k-1 through 22a-133k-3, inclusive, of the Regulations of Connecticut State Agencies and:

(A) Prior to reuse, a map showing the location and depth of proposed placement of such soil is submitted to the Commissioner;

(B) Such soil is not placed below the water table;

(C) Such soil is not placed in an area subject to erosion; and

(D) Any such soil in which the concentration of any substance exceeds the pollutant mobility criteria applicable to a GA area is not placed over soil and ground water which have not been affected by a release at the parcel at which placement is proposed; and

(E) For soils polluted with PCB, the Commissioner has issued a written approval in accordance with by section 22a-467 of the General Statutes.

Additional requirements and provisions include:

- Off-site sources may contain substances in concentrations that do not exceed the I/C DEC contained in Appendix A of the RSRs or constituents considered to be "additional polluting substances" for which criteria were approved for use at the Site by the CT DEEP on December 2, 2011 multiplied by a factor of 0.80, except the factor shall be 1.0 for substances which have the same I/CDEC and RDEC.
- Off-site sources may contain substances in concentrations that do not exceed the GB PMC contained in Appendix B of the RSRs or constituents considered to be "additional polluting substances" for which criteria were approved for use at the Site by the CT DEEP on December 2, 2011 multiplied by a factor of 0.80, except the factor shall be 1.0 for substances which have the same GB PMC and GA PMC.

- Off-site sources shall not contain PCBs exceeding 1 mg/kg or any of the following as defined in Section 22a-209-1 of the RCSA: (1) municipal solid waste and (2) special wastes and hazardous waste as defined in 40 CFR PART 261.
- Material generated from on-site remediation and excavation activities may contain substances that do not exceed the I/CDEC and GB PMC of the RSRs or constituents considered to be "additional polluting substances" for which criteria were approved for use at the Site by the CT DEEP on December 2, 2011 and shall not contain any of the following as defined in Section 22a-209-1 of the RCSA: (1) municipal solid waste and (2) special wastes and hazardous waste as defined in 40 CFR PART 261.

2. Imported Material Testing

The Engineer shall test "Clean Cover", "Cover", "Clean Fill" and "Clean Soil" imported from off-site sources as follows:

- Three composite samples shall be collected from the source area and shall be analyzed by the test methods contained in Item #4 below;
- One composite sample shall be collected for every 200 cubic yards delivered to the Site for the first 1,000 cubic yards from a single off-site source area by the test methods contained in Item #4 below;
- One composite sample shall be collected for every 500 cubic yards delivered to the Site following the first 1,000 cubic yards and shall be analyzed only for any constituent that exceeded 50% of the criteria contained in this sub-article for any sample collected in Items #1 & #2 above;
- The following EPA test methods apply to samples collected for the purposes of establishing suitability of use:
    - Volatile Organic Compounds via SW-846 Method 8260
    - Semi-Volatile Organic Compounds via SW-846 Method 8270;
    - PCBs via SW-846 Method 3550B/8082;
    - Pesticides via SW-846 Method 3550B/8081;
    - Herbicides via SW-846 Method 8151;
    - RSR Metals via SW-846 Method 6010;
    - Mercury – via SW-846 Method 7470; and
    - Extractable Total Petroleum Hydrocarbons by Connecticut approved method.

Pollutant Mobility determinations requiring leaching methods will be performed via the Synthetic Precipitation Leaching Procedure (SPLP). Hazardous Waste determinations will be performed via the TCLP method.

Trucks entering the MIRA property with imported soils will be appropriately covered. Imported soils will be stockpiled separately from excavated materials and may be covered to prevent dust releases.

D. Site Restoration

Following completion of all intrusive activities, the impacted area shall be restored to a condition consistent with the ELUR that assures protection of human health and the environment. Site restoration will not be considered complete until the specific ELUR requirements are re-established as follows:

- Soil at concentrations in excess of the DEC, as defined in Section 22a-133k-1 of the RCSA, are rendered inaccessible through one or more of the following methods within the area subject to the ELUR:
    - The polluted soil is located at a depth of four or more feet beneath Clean Soil as defined above;
    - The polluted soil is located two or more feet below a paved surface comprised of a minimum of three inches of bituminous concrete, of which two feet may include the depth of any material used as sub-base for the pavement; or
    - The polluted soil is located beneath an existing building or beneath various permanent structures for which notice has been provided to the CT DEEP.
- Soil at concentrations in excess of the DEC or PMC, as defined in Section 22a-133k-1 of the RCSA, is located beneath a restored/reestablished engineered control (orange geotextile warning layer or HDPE pavers).

Prior to backfilling with Clean Soil, the orange geotextile shall be replaced so that it overlaps the existing orange geotextile warning layer by 1 foot. HDPE pavers shall be replaced and interlocked with existing paver sections. In the event that the existing bituminous concrete is thicker than 3 inches, then the Contractor shall match the existing thickness of bituminous concrete.

Additional site restoration activities (e.g., final grading, reseeding, removal of safety, security and erosion/sedimentation control measures, etc.) will be completed on a project-specific basis and to the satisfaction and approval of MIRA.

Method of Measurement:

This work will be measured for payment at the Lump Sum cost for managing and segregating soil and restoring areas and engineered controls within the portion of the MIRA property subject to the ELUR and overlapping the Project Limits.

Basis of Payment:

This work will be paid for at the Contract Lump Sum, which shall include all materials, tools, labor, equipment, and work needed to manage and segregate soil and restore areas and engineered controls within the portion of the MIRA property subject to the ELUR and overlapping the Project Limits.

Transporting and stockpiling materials at the WSA and covering, securing, and maintaining the stockpiled materials throughout the duration of the Project shall be paid for under Item 101117A. Securing, construction and dismantling of the WSA shall be paid for under Item 101128A. Handling and disposal of contaminated groundwater will be paid for under Item 0204210A. Payment for dust control activities shall be made under the appropriate Contract items.

Pay Item	Pay Unit
ELUR Soil Management and Restoration	Lump Sum

ITEM #0101109A - HAZARDOUS MATERIALS EXCAVATION

Description:

Work under this Item is intended to provide specific procedural requirements to be followed during the excavation of Hazardous Materials from within the Hazardous Areas of Environmental Concern (HAOECs) as shown on the Plans. This supplements the Specification Sections 2.02, 2.03, 2.06, and 2.86 wherever Hazardous Materials are encountered. Work under this item shall include transporting and stockpiling materials at the WSA; and covering, securing, and maintaining the stockpiled materials throughout the duration of the Project. All materials, excluding the existing pavement structure (asphalt and subbase), rock, ledge, and concrete, excavated within the HAOECs are to be considered Hazardous Materials.

Hazardous concentrations of regulated substances have been documented to exist within the Project. These substances include either TSCA-regulated substances, as defined in 40 CFR Parts 700-702, or RCRA-regulated substances, as defined in 40 CFR Parts 261-265 or in CGS Section 22a-449. Specific information concerning the detected substances and their concentrations is documented in the reports listed in the "Notice to Contractor – Environmental Investigations."

Materials:

Materials shall be as shown on the Project Plans.

Plastic Sheet: Polyethylene plastic sheeting for underlayment shall be at least 30 mil thick. Polyethylene plastic sheeting covering excavated material shall be at least 10 mil thick. Both types of sheeting shall have a minimum width of ten feet.

Covers for roll-off/storage containers shall be made of polyethylene plastic, or similar water-tight material, that is of sufficient size to completely cover top opening and can be securely fastened to the container.

Sand Bags: Sandbags used to secure the polyethylene cover shall be at least 30 pounds.

Sorbent Boom: Shall be eight inch in diameter and ten feet long and possess petrophilic properties. Sorbent booms shall also have devices, (i.e. clips, clasps, etc.), for connection to additional lengths of boom.

Construction Methods:

A. General

A minimum of 48 hours prior to beginning excavation in any HAOECs, the Contractor must submit to the Engineer for review (1) the transporter's current US DOT Certificate of Registration and (2) the transporter's current Hazardous Waste Transporter Permits for Connecticut, the

hazardous waste destination state, and any other applicable states. The Contractor must also notify the Engineer of its selected disposal facility. If the information submitted is complete and acceptable to the Engineer, then the Engineer will obtain a temporary EPA ID number for this work. No excavation shall begin until the Contractor has the EPA ID number.

When Hazardous Materials are encountered during the course of the work, health and safety provisions shall conform to the appropriate sections of the Contract. Provisions may include the implementation of engineering controls, air and personal monitoring, use of chemical protective clothing (CPC), personal protective equipment (PPE), decontamination procedures and providing a Health and Safety Officer (HSO) on site during construction activities in the HAOECs.

Unless otherwise directed by the Engineer, Hazardous Materials removed from various excavations within HAOECs shall be transported directly from their point of origin on the Project to the WSA. Hazardous materials shall be segregated from other excavated materials within the WSA. Stockpiles of different types of Hazardous Materials (i.e. railroad ties, concrete, earth, etc.), as well as materials generated from different HAOECs, shall not be commingled inside the WSA. The bins shall be lined with 30 mil polyethylene sheeting prior to placement of materials. The excavated material shall be placed on a secondary sheet of 10 mil polyethylene, and covered with 10 mil polyethylene sheeting within the bins as shown on the Project Plans. The Contractor shall plan excavation activities within HAOECs in consideration of the capacity of WSA, and the material testing and disposal requirements of the applicable Contract item. **No claims for delay will be considered based on the Contractor's failure to coordinate excavation activities as specified herein.**

The Engineer will sample the stockpiled Hazardous Materials to meet the acceptance criteria of the treatment/recycling/disposal facilities submitted by the Contractor. The Contractor is hereby notified that laboratory turnaround time is expected to be fifteen (15) working days. Turnaround time is the period of time beginning when the Contractor notifies the Engineer which facility it intends to use and that the bin within the WSA is full and ready for sampling and ending with the Contractor's receipt of the laboratory analytical results. Any change of intended treatment/recycling/disposal facility may prompt the need to resample and will therefore restart the time required for laboratory turnaround. The laboratory will furnish such results to the Engineer. Upon receipt, the Engineer will make available to the Contractor the results of the final waste characterization determinations. **No delay claim will be considered based upon the Contractor's failure to accommodate the laboratory turnaround time as identified above.**

B. Transportation and Stockpiling

In addition to following all pertinent Federal, State and local laws or regulatory agency policies, the Contractor shall adhere to the following precautions during transport of Hazardous Materials:

- Transported Hazardous Materials are to be covered prior to leaving the point of generation and are to remain covered until the arrival at the WSA;
- All vehicles shall have secure, watertight containers free of defects for material transport;

- All vehicles departing the excavation site are properly logged to show the vehicle identification, driver's name, time of departure, destination, and approximate volume and content of materials carried;

- No material shall leave the excavation area until there is adequate lay down area prepared in the WSA;

- Transport vehicles shall not leave the excavation site for the WSA until gross contamination is removed; and,

- Documentation must be maintained indicating that all applicable laws have been satisfied and that the materials have been successfully transported and received at the WSA.

Construction of the WSA shall be completed prior to the initiation of construction activities generating Hazardous Materials. Plastic polyethylene sheeting shall underlay all excavated Hazardous Materials to ensure that seepage of material or water from the WSA is prevented. Measures shall be implemented to divert rainfall away from the WSA.

No Hazardous Materials shall be excavated or transported to the WSA until registration under the General Permit for Contaminated Soil and/or Sediment Management (Staging and Transfer) has been obtained by ConnDOT, if required.

Placement of sorbent boom along the perimeter of the WSA shall be conducted when soil is saturated with petroleum product.

Excavated Hazardous Materials shall be staged as shown on the Project Plans or as directed by the Engineer.

C. WSA Maintenance

The Contractor shall provide all materials, equipment, tools and labor necessary to perform its activities within the WSA. Such activities include, but are not limited to, handling and management of stockpiles and drummed CPC/PPE, uncovering and recovering stockpiles, maintenance of the WSA, replacement of damaged components (i.e. sand bags, polyethylene sheeting, etc.), and waste inventory record management. The Contractor shall manage all materials handled in the WSA in such a way as to minimize tracking of potential Hazardous Materials across the site and off-site, and minimize dust generation.

Each stockpile shall be securely covered when not in active use with polyethylene sheeting of sufficient size to prevent the generation of dust and infiltration of precipitation. Such sheeting shall be secured with sandbags to prevent wind erosion.

The staged stockpiles shall be inspected at least daily by the Contractor to ensure that the cover and containment have not been damaged and that there is no apparent leakage from the pile. If the plastic cover has been damaged, or there is evidence of leakage, the Contractor shall

immediately replace the cover or containment as needed to prevent the release of materials to the environment from the piles.

An inventory of stockpiled materials and drummed CPC/PPE shall be conducted on a daily basis. Inventory records shall indicate the approximate volume of material/drums stockpiled per day; the approximate volume of material/drums stockpiled to date; material/drums loaded and transported off-site for disposal; any materials loaded and transported for on-site reuse; and identification of stockpiles relative to their points of generation.

Following the removal of all stockpiled Hazardous Materials, any residue shall be removed from all surfaces of the WSA as directed by the Engineer. This operation shall be accomplished using dry methods such as shovels, brooms, mechanical sweepers, or a combination thereof. Residue shall be disposed of as Hazardous Materials.

D. Dewatering

Dewatering activities shall conform to Items in pertinent articles of the Contract.

E. Decontamination

All equipment shall be provided to the work site free of gross contamination. The Engineer may prohibit from the site any equipment that in his opinion has not been thoroughly decontaminated prior to arrival. Any decontamination of the Contractor's equipment prior to arrival at the site shall be at the expense of the Contractor. The Contractor is prohibited from decontaminating equipment on the Project site that has not been thoroughly decontaminated prior to arrival.

The Contractor shall furnish labor, materials, tools and equipment for decontamination of all equipment and supplies that are used to handle Hazardous Materials. Decontamination shall be conducted at an area designated by the Engineer and shall be required prior to equipment and supplies leaving the Project, between stages of the work, or between work in different AOECs (non-hazardous) and HAOECs.

The Contractor shall use dry decontamination procedures. Residuals from dry decontamination activities shall be collected and managed as Hazardous Materials. If dry methods are unsatisfactory as determined by the Engineer, the Contractor shall modify decontamination procedures as required subject to the Engineer's approval.

F. Dust Control

The Contractor shall implement a fugitive dust suppression program in accordance with the Specifications to prevent the off-site migration of particulate matter and/or dust resulting from excavation, loading and operations associated with Hazardous Materials. It shall be the Contractor's responsibility to supervise fugitive dust control measures and to monitor airborne particulate matter. The Contractor shall:

1. Employ reasonable fugitive dust suppression techniques.
2. Visually observe the amounts of particulate and/or fugitive dust generated during the handling of materials. If the apparent amount of fugitive dust and/or particulate matter is not acceptable to the Engineer, the Engineer may direct the Contractor to implement corrective measures at his discretion, including, but not limited to, the following:
   (a) apply water to pavement surfaces
   (b) apply water to equipment and excavation faces; and
   (c) apply water during excavation, loading and dumping.

Method of Measurement:

The work of Hazardous Material Excavation will be measured for payment by the number of cubic yards of material excavated within the HAOECs and taken to the WSA. This measurement will be in accordance with and in addition to the quantity measured for payment of the applicable excavation item in Specification Sections 2.02, 2.03, 2.06, and 2.86, and the Contract Special Provisions. Excess excavations made by the Contractor beyond the payment limits specified in the Contract are not permitted. Such excess material will not be measured for payment, and the Contractor assumes all responsibility for costs associated with the appropriate handling, management and disposal of this material.

Equipment decontamination, the collection of residuals, and the collection and disposal of liquids generated during equipment decontamination activities will not be measured separately for payment.

Basis of Payment:

This work will be paid for at the Contract unit price, which will be in addition to the Contract unit price for the applicable excavation item in Specification Sections 2.02, 2.03, 2.06, and 2.86. The unit price shall include: transportation to and stockpiling Hazardous Materials at the WSA; covering and maintaining the stockpiles within the WSA throughout the duration of the Project; and all tools, equipment, material and labor incidental to this work.

This price shall also include equipment decontamination; the collection of residuals generated during decontamination and placement of such material in the WSA; and the collection and disposal of liquids generated during equipment decontamination activities.

Securing, construction and dismantling of the WSA will be paid for under Item 0101128A. Handling and disposal of contaminated groundwater will be paid for under the appropriate Contract items. Payment for dust control activities will be made under the appropriate Contract items.

Pay Item	Pay Unit
Hazardous Materials Excavation	CY

ITEM #0101117A - CONTROLLED MATERIALS HANDLING

Description:

Work under this Item is intended to provide specific procedural requirements to be followed by the Contractor during the excavation of Controlled Materials from within any Area of Environmental Concern (AOEC), as shown on the Project Plans. This supplements Specification Sections 2.02, 2.03, 2.06, and 2.86, and Contract Special Provisions for excavation wherever contaminated materials are encountered. Work under this item shall include transporting and stockpiling materials at the Waste Stockpile Area (WSA); and covering, securing, and maintaining the stockpiled materials throughout the duration of the Project. All materials, excluding the existing pavement structure (asphalt and subbase), rock, ledge, and concrete, excavated within AOECs are to be considered Controlled Materials.

Controlled Materials consisting of non-hazardous levels of regulated substances have been documented to exist within the Project. Such contamination is documented in the reports listed in the "Notice to Contractor – Environmental Investigations." Where contaminated soil is excavated, special handling, disposal, and documentation procedures will be required. All suitable Controlled Materials excavated within the AOECs may be reused as fill/backfill within its originating AOEC or another AOEC with similar contaminants (i.e. AOECs 2-1, 2-2, and 2-3 have similar contaminants).

Excess or unsuitable Controlled Materials that cannot be reused within the Project limits, as determined by the Engineer, must be transported to and stockpiled in the WSA, sampled by the Engineer, and transported off-site for disposal, if necessary.

Materials:

The required materials are detailed on the Project Plans. All materials shall conform to the requirements of the Contract.

Plastic Sheet: Polyethylene plastic sheeting for underlayment shall be at least 30 mil thick. Polyethylene plastic sheeting for covering excavated material shall be a thickness of 10 mil. Both shall be at least 10 feet wide.

Covers for roll-off/storage containers shall be made of polyethylene plastic, or similar water-tight material, that is of sufficient size to completely cover top opening and can be securely fastened to the container.

Sand Bags: Sandbags used to secure polyethylene covers shall be at least 30 pounds.

Sorbent Boom: Shall be 8 inches in diameter and 10 feet long and possess petrophilic and hydrophobic properties. Sorbent booms shall also have devices (i.e. clips, clasps, etc.) for connection to additional lengths of boom.

Construction Methods:

A. General

When Controlled Materials are encountered during the course of the work, health and safety provisions shall conform to the appropriate sections of the Contract. Provisions may include implementation of engineering controls, air and personal monitoring, the use of chemical protective clothing (CPC), personal protective equipment (PPE), and decontamination procedures.

All suitable Controlled Materials excavated from the AOECs may only be reused within its originating AOEC or another AOEC with similar contaminants, as determined by the Engineer. Controlled Materials that are to be immediately reused within its originating AOEC or another AOEC with similar contaminants shall be temporarily stockpiled adjacent to the excavation for reuse.

Controlled Materials that are to be reused at a later date within its originating AOEC or another AOEC with similar contaminants may be temporarily stockpiled at another location within the Project limits, as allowed by the Engineer. Only the volume of Controlled Material that is reasonably estimated to be reused shall be temporarily stockpiled in this way. Individual stockpiles of Controlled Materials that are to be reused at a later date shall be covered with polyethylene plastic sheeting at all times, except when the piles are being worked, and shall have proper erosion and sedimentation controls.

Excess Controlled Materials from the AOECs that cannot be reused within the Project limits must be transported directly to the WSA and placed within a designated storage bin for disposal characterization sampling by the Engineer.

The stockpiles of excavated Controlled Materials shall be maintained as shown on the Project plans. The Contractor shall plan excavation activities within the AOECs in consideration of the capacity of WSA and the material testing and disposal requirements of the applicable Contract item. **No claims for delay shall be considered based on the Contractor's failure to coordinate excavation activities as specified herein.**

The Engineer will sample the stockpiled Controlled Materials at a frequency and for the constituents to meet the acceptance criteria of the treatment/recycling/disposal facilities submitted by the Contractor. The Contractor is hereby notified that laboratory turnaround time is expected to be fifteen (15) working days. Turnaround time is the period of time beginning when the Contractor notifies the Engineer which facility it intends to use and that the stockpile is ready for sampling and ending with the Contractor's receipt of the laboratory analytical results. Any change of intended treatment/recycling/disposal facility may prompt the need to resample and will therefore restart the time required for laboratory turnaround. The laboratory will furnish such results to the Engineer. Upon receipt, the Engineer will make available to the Contractor the results of the final waste characterization determinations. **No delay claim will be**

considered based upon the Contractor's failure to accommodate the laboratory turnaround time as identified above.

B. Transportation and Stockpiling

In addition to following all pertinent Federal, State and local laws or regulatory agency policies, the Contractor shall adhere to the following precautions during transport of non-hazardous materials:

- Transported Controlled Materials are to be covered prior to leaving the point of generation and are to remain covered until the arrival at the WSA;
- All vehicles departing the site are properly logged to show the vehicle identification, driver's name, time of departure, destination, and approximate volume and content of materials carried;
- All vehicles shall have secure, watertight containers free of defects for material transportation;
- No material shall leave the site until there is adequate lay down area prepared in the WSA; and,
- Documentation must be maintained indicating that all applicable laws have been satisfied and that the materials have been successfully transported and received at the WSA.

Construction of the WSA shall be completed prior to the initiation of construction activities generating Controlled Materials. Plastic polyethylene sheeting shall underlay all excavated Controlled Materials. Measures shall be implemented to divert rainfall away from the WSA.

No Controlled Materials shall be excavated or transported to the WSA until registration under the "General Permit for Contaminated Soil and/or Sediment Management (Staging and Transfer)" has been obtained by ConnDOT.

Placement of sorbent boom along the perimeter of the WSA shall be conducted when soil is saturated with petroleum product.

Excavated materials shall be staged as shown on the Project Plans or as directed by the Engineer.

C. WSA Maintenance

The Contractor shall provide all necessary materials, equipment, tools and labor for anticipated activities within the WSA. Such activities include, but are not limited to, handling and management of stockpiles and drummed CPC/PPE; uncovering and recovering stockpiles; maintenance of WSA; replacement of damaged components (i.e. sand bags, plastic polyethylene

sheeting, etc.); and waste inventory record management. The Contractor shall manage all materials in the WSA in such a way as to minimize tracking of potential contaminated materials across the site and off-site, and minimize dust generation.

Each stockpile shall be securely covered when not in active use with a cover of sufficient size to prevent generation of dust and infiltration of precipitation. The cover shall be to prevent wind erosion.

The staged stockpiles shall be inspected at least daily by the Contractor to ensure that the cover and containment have not been damaged and that there is no apparent leakage from the pile. If the cover has been damaged, or there is evidence of leakage from the piles, the Contractor shall immediately replace the cover or containment as needed to prevent the release of materials to the environment from the piles.

An inventory of stockpiled materials and drummed CPC/PPE shall be conducted on a daily basis. Inventory records shall indicate the approximate volume of material/drums stockpiled per day; the approximate volume of material/drums stockpiled to date; material/drums loaded and transported off-site for disposal; any materials loaded and transported for on-site reuse; and identification of stockpiles relative to their points of generation.

Following the removal of all stockpiled Controlled Materials, residuals shall be removed from surfaces of the WSA as directed by the Engineer. This operation shall be accomplished using dry methods such as shovels, brooms, mechanical sweepers or a combination thereof. Residuals shall be disposed of as Controlled Materials.

D. Dewatering

Dewatering activities shall conform to Items in pertinent articles of the Contract.

E. Decontamination

All equipment shall be provided to the work site free of contamination. The Engineer may prohibit from the site any equipment that in his opinion has not been thoroughly decontaminated prior to arrival. Any decontamination of the Contractor’s equipment prior to arrival at the site shall be at the expense of the Contractor. The Contractor is prohibited from decontaminating equipment on the Project that has not been thoroughly decontaminated prior to arrival.

The Contractor shall furnish labor, materials, tools and equipment for decontamination of all equipment and supplies that are used to handle Controlled Materials. Decontamination shall be conducted at an area designated by the Engineer and may be required prior to equipment and supplies leaving the Project, between stages of the work, or between work in different AOECs.

Dry decontamination procedures are recommended. Residuals from dry decontamination activities shall be collected and managed as Controlled Materials. If dry methods are

unsatisfactory as determined by the Engineer, the Contractor shall modify decontamination procedures as required subject to the Engineer's approval.

F. Dust Control

The Contractor shall implement a fugitive dust suppression program in accordance with the Contract to prevent the off-site migration of particulate matter and/or dust resulting from excavation, loading and operations associated with Controlled Materials. It shall be the Contractor's responsibility to supervise fugitive dust control measures and to monitor airborne particulate matter. The Contractor shall:

1. Employ reasonable fugitive dust suppression techniques.
2. Visually observe the amounts of particulate and/or fugitive dust generated during the handling of Controlled Materials. If the apparent amount of fugitive dust and/or particulate matter is not acceptable to the Engineer, the Engineer may direct the Contractor to implement corrective measures at his discretion, including, but not limited to, the following:

    (a) apply water to pavement surfaces
    (b) apply water to equipment and excavation faces; and
    (c) apply water during excavation, loading and dumping.

G. Permit Compliance

The Contractor shall comply with the terms and conditions of the CTDEEP "General Permit for Contaminated Soil and/or Sediment Management (Staging and Transfer)," including the General Operating Conditions and the Specific Operating Conditions, except that the Engineer will conduct all soil/sediment characterization and perform all record keeping. In particular, the Contractor shall:

1. Operate, maintain and repair the WSA in conformance with the requirements of the General Permit.
2. Maintain a communications system capable of summoning fire, police, and/or other emergency service personnel.
3. Prevent unauthorized entry onto the stockpiles by the use of fences, gates, or other natural or artificial barriers.
4. Separate incidental excavation waste to the satisfaction of the receiving facility or to an extent that renders the contaminated soil and/or sediment suitable for its intended reuse.
5. Isolate and temporarily store incidental waste in a safe manner prior to off-site transport to a facility lawfully authorized to accept such waste.
6. Not store more that 100 cubic yards of incidental waste at any one time.
7. Sort, separate and isolate all hazardous waste from contaminated soil and/or sediment.
8. Prevent or minimize the transfer or infiltration of contaminants from the stockpiles to the ground as detailed in "B. Transportation and Stockpiling" above.
9. Securely cover each stockpile of soil as detailed in "C. WSA Maintenance" above.

10. Minimize wind erosion and dust transport as detailed in "F. Dust Control" above.
11. Use anti-tracking measures at the WSA to ensure the vehicles do not track soil from the WSA onto a public roadway at any time.
12. Instruct the transporters of contaminated soil and/or sediment of best management practices for the transportation of such soil (properly covered loads, removing loose material from dump body, etc.).
13. Control all traffic related to the operation of the facility in such a way as to mitigate the queuing of vehicles off-site and excessive or unsafe traffic impact in the area where the facility is located.
14. Ensure that except as allowed in section 22a-174-18(b)(3)(C) of the Regulations of Connecticut State Agencies, trucks are not left idling for more than three (3) consecutive minutes.

Method of Measurement:

The work of Controlled Material Handling will be measured for payment by the number of cubic yards of Controlled Material excavated within the AOECs and taken to the WSA. This measurement shall be in accordance with and in addition to the quantity measured for payment of the applicable excavation item in Specification Sections 2.02, 2.03, 2.06, and 2.86, or the Contract Special Provisions, as applicable. Excess excavations made by the Contractor beyond the payment limits specified in the Contract will not be measured for payment and the Contractor assumes all costs associated with the appropriate handling, management and disposal of this material.

Equipment decontamination, the collection of residuals, and the collection and disposal of liquids generated during equipment decontamination activities will not be measured separately for payment.

Basis of Payment:

This work shall be paid for at the Contract unit price, which shall include all transportation from the excavation site to the final WSA, including any intermediate handling steps; stockpiling Controlled Materials at the WSA; covering, securing, and maintaining the individual stockpiles within the WSA throughout the duration of the Project; and all tools, equipment, material and labor incidental to this work.

This price shall also include equipment decontamination; the collection of residuals generated during decontamination and placement of such material in the WSA; and the collection and disposal of liquids generated during equipment decontamination activities.

All materials, labor and equipment associated with compliance with the General Permit for Contaminated Soil and/or Sediment Management (Staging and Transfer) will not be measured separately, but will be considered incidental to the item "Controlled Materials Handling."

Securing, construction and dismantling of the WSA shall be paid for under Item 101128A. Handling and disposal of contaminated groundwater will be paid for under Item 0204210A. Payment for dust control activities shall be made under the appropriate Contract items.

Pay Item	Pay Unit
Controlled Materials Handling	CY

ITEM #0101125A - PORTABLE TURBIDITY METER

Description: Under this item, the Contractor shall be responsible for furnishing a Portable Turbidity Meter for measuring the turbidity of storm water for compliance with the State of Connecticut Department of Energy and Environmental Protection's General Permit for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities. The EPA compliant device shall be a portable meter having a 0-1000 NTU (Nephelometric Turbidity Units) range and a high accuracy at low ranges (<0.05 NTU). The meter selected shall be submitted to the Engineer for approval.

Materials: The turbidity meter shall conform to the EPA Method 180.1 standards for testing. The portable turbidity meter shall be comparable to the Hanna Portable Turbidity Meter, HI 98703, with Fast Tracker Technology which includes five (5) sample cuvettes and caps, calibration cuvettes, silicone oil, cuvette cleaning cloth, batteries, AC adapter, instruction manual, and a rugged carrying case. The meter shall have a Tag Identification System, to verify that samples have been taken at pre-established locations during inspections and for recording multiple location sites.

Construction Methods: The Contractor shall provide the Turbidity Meter for the Department's use until final stabilization of the project site for monitoring turbidity of stormwater effluent for compliance of the National Pollution Discharge Elimination System.

Method of Measurement: This item will be measured for payment by the number of Portable Turbidity Meters of the type accepted and utilized.

Basis of Payment: This item will be paid for at the Contract Unit Price each for "Portable Turbidity Meter", complete and in place, which price shall include all materials, tools, equipment, and labor incidental thereto.

Pay Item	Pay Unit
Portable Turbidity Meter	ea.

ITEM #0101126A - DISPOSAL OF HAZARDOUS WASTE

Description:

Work under this item shall consist of the loading, transportation and final off-site disposal of Hazardous Materials (excluding dewatering fluids), which have been generated from various excavations within the Hazardous Areas of Environmental Concern (HAOECs), brought to the WSA, and determined to be contaminated with regulated substances at hazardous concentrations. These materials contain hazardous concentrations of TSCA-regulated substances, as defined in 40 CFR Parts 700-702, or RCRA-regulated substances, as defined in 40 CFR Parts 261-265 or in CGS Section 22a-449.

Specific information concerning the detected substances and their concentrations is documented in the reports listed in the "Notice to Contractor – Environmental Investigations." These materials, after proper characterization by the Engineer, shall be transported from the WSA by a licensed hazardous waste transporter approved by the Department and disposed of at an EPA-permitted and Department-approved hazardous waste landfill within 90 days from the date of generation. These materials may require special handling within the WSA in order to isolate them from controlled materials being stored therein.

The Contractor must use one or more of the following Department-approved disposal facilities for the disposal of hazardous waste:

Clean Earth of North Jersey, Inc. (AKA CENJ) 115 Jacobus Avenue South Kearney, NJ 07105 (732) 541-8909; Cheryl Coffee	Clean Harbors of Braintree, Inc. 1 Hill Avenue Braintree, MA 02184 (781) 380-7100; David Medina
ACV Enviro (AKA Cycle Chem) 217 South First Street Elizabeth, NJ 07206 (908) 354-0210; Gordon Mayfield	Environmental Quality Company Wayne Disposal Facility 49350 North I-94 Service Drive Belleville, MI 48111 (800) 592-5489; Debbie Oleskienko
Envirite of PA 730 Vogelsong Road York, PA 17404 (717) 846-1900; Karla Mercer	EnviroSafe Corporation Northeast (Triumvirate) 263 Howard Street Lowell, MA 01852 (978) 453-7772; Michael Hoye

Heritage Hazardous Waste Landfill (Heritage Environmental Services, LLC) 4370 West County Road 1275N Roachdale, IN 46172 (315) 406-9342; Steve Cross	Stericycle (AKA PSC Environmental Systems) 275 Allens Avenue Providence, RI 02905 (401) 781-6340; Chris Sheldon
Stablex, Canada, Inc. 760 Industrial Blvd. Blainville, Quebec J7C 3V4 (450) 430-9230; Claude Forte	Stericycle (Republic Environmental Systems) 2869 Sandstone Drive Hatfield, PA 19440 (215) 822-2676; Rich Scheule

The above list contains treatment/recycle/disposal facilities which can accept the waste stream generated by the project in quantities that may be limited by their permits and their operations restrictions. It is the responsibility of the contractor to verify that a facility will be available and capable of handling the volume as well as the chemical and physical characteristics of material generated by the project.

Construction Methods:

A. Material Disposal

The Engineer will sample materials stored at the WSA for final waste characterization at a frequency established by the selected disposal facilities. The Contractor shall designate to the Engineer which facility it intends to use prior to samples being taken. The Contractor is hereby notified that laboratory turnaround time is expected to be fifteen (15) working days. Turnaround time is the period of time beginning when the Contractor notifies the Engineer which facility it intends to use and that the bin within the WSA is full and ready for sampling and ending with the Contractor's receipt of the laboratory analytical results. Any change of intended disposal facility may prompt the need to resample and will therefore restart the time required for laboratory turnaround. The laboratory will furnish such results to the Engineer. Upon receipt, the Engineer will make available to the Contractor the results of the final waste characterization determinations. **No delay claim will be considered based upon the Contractor's failure to accommodate the laboratory turnaround time as identified above.**

The Contractor shall obtain and complete all paperwork necessary to arrange for material disposal, including disposal facility waste profile sheets. It is solely the Contractor's responsibility to coordinate the disposal of Hazardous Materials with its selected treatment/recycling/disposal facility(s). Upon receipt of the final approval from the facility, the Contractor shall arrange for the loading, transport and treatment/recycling/disposal of the materials in accordance with all Federal and State regulations. **No claim will be considered based on the failure of the Contractor's disposal facility(s) to meet the Contractor's production rate or for the Contractor's failure to select sufficient facilities to meet its production rate.**

Any material processing (including but not limited to the removal of woody debris, scrap metal, pressure-treated and untreated wood timber, large stone, concrete, polyethylene sheeting or similar material) required by the Contractor's selected facility will be completed by the Contractor prior to the material leaving the site. It is solely the Contractor's responsibility to meet any such requirements of its facility. Any materials removed shall be disposed of or recycled in a manner acceptable to the Engineer at no additional cost. If creosote treated timbers are removed, they will be disposed of in accordance with Article 1.04.05.

All hazardous waste manifests utilized to accompany the transportation of the waste material shall be prepared by the Contractor a minimum of 24 hours in advanced and signed by an authorized Department representative, as Generator, for each truck load of material that leaves the site. The Contractor shall forward the appropriate original copies of all manifests to the Engineer the same day the material leaves the Project site.

A load-specific certificate of disposal, signed by the authorized agent representing the waste disposal facility, shall be obtained by the Contractor and promptly delivered to the Engineer for each load.

B. Material Transportation

Excavated materials determined to be hazardous shall be transported in compliance with the applicable federal regulations. Transport vehicles shall not have any indentations or damage and must be free from leaks, and discharge openings must be securely closed during transportation.

In addition to all pertinent Federal, State and local laws or regulatory agency polices, the Contractor shall adhere to the following precautions during the transport of Hazardous Materials off-site:

- Transported Hazardous Materials are to be covered sufficiently to preclude the loss of material during transport prior to leaving the site and are to remain covered until the arrival at the selected treatment/recycling/disposal facility.

- All vehicles departing the site are to be properly logged to show the vehicle identification, driver's name, time of departure, destination, and approximate volume, and contents of materials carried;

- No materials shall leave the site unless a disposal facility willing to accept all of the material being transported has agreed to accept the type and quantity of waste;

- Documentation must be maintained indicating that all applicable laws have been satisfied and that the materials have been successfully transported and received at the disposal facility; and,

- The Contractor shall segregate the waste streams (i.e. soils, railroad ties, etc.) as directed

by the receiving disposal facility.

C. Equipment Decontamination

All equipment shall be provided to the work site free of gross contamination. The Engineer may prohibit from the site any equipment that in his opinion has not been thoroughly decontaminated prior to arrival. Any decontamination of the Contractor's equipment prior to arrival at the site shall be at the expense of the Contractor. The Contractor is prohibited from decontaminating equipment on the Project that has not been thoroughly decontaminated prior to arrival.

The Contractor shall furnish labor, materials, tools and equipment for decontamination of all equipment and supplies that are used to handle Hazardous Materials. Decontamination shall be conducted at an area designated by the Engineer and shall be required prior to equipment and supplies leaving the Project, between stages of the work, and between work in different AOECs.

The Contractor shall use dry decontamination procedures. Residuals from dry decontamination activities shall be collected and managed as Hazardous Materials. If the results from dry methods are unsatisfactory to the Engineer, the Contractor shall modify decontamination procedures as required.
The Contractor shall be responsible for the collection and treatment/recycling/disposal of any liquid wastes that may be generated by its decontamination activities in accordance with applicable regulations.

D. EPA ID Number

Prior to the generation of any hazardous waste, the Contractor shall notify the Engineer of its selected hazardous waste transporter and disposal facility. The Contractor must submit to the Engineer (1) the transporter's current US DOT Certificate of Registration and (2) the transporter's current Hazardous Waste Transporter Permits for the State of Connecticut, the hazardous waste destination state and any other applicable states. The Engineer will then obtain an EPA ID number that he will forward to the Contractor. Any changes in transporter or facility shall be immediately forwarded to the Engineer for review.

Method of Measurement:

The work of "DISPOSAL OF HAZARDOUS WASTE" will be measured for payment as the actual net weight in tons of material delivered to the disposal facility. Such determinations shall be made by measuring each hauling vehicle on the certified permanent scales at the disposal facility. Total weight will be the summation of weight bills issued by the facility specific to this Project.

The disposal of excavated materials, originally anticipated to be hazardous materials, but determined by characterization sampling <u>not</u> to contain hazardous concentrations of regulated chemicals (Controlled Materials) will <u>not</u> be measured for payment under this Item. Disposal of these materials will be handled in accordance with the provisions of Item 0202315A – Disposal

of Controlled Material. Excess excavations made by the Contractor beyond the payment limits specified in Specification Sections 2.02, 2.03, 2.06, and 2.86, or the Contract Special Provisions (as appropriate) will not be measured for payment and the Contractor assumes all responsibility for costs associated with the appropriate handling, management and disposal of this material.

Equipment decontamination, the collection of residuals, and the collection and disposal of liquids generated during equipment decontamination activities will not be measured separately for payment.

Basis of Payment:

This work will be paid for at the Contract unit price, which shall include the loading and transportation of Hazardous Materials from the WSA to the disposal facility and the disposal of such materials; the preparation of manifests and fees paid; and all equipment, materials, tools, and labor incidental to loading, transporting, and disposal of materials. **This unit price will be applicable to all of the Contractor-selected disposal facilities for the duration of the Project.**

This price shall also include equipment decontamination; the collection of residuals generated during decontamination and placement of such material in the WSA; and the collection and disposal of liquids generated during equipment decontamination activities.

Payment for disposal of materials found to be non-hazardous, based upon characterization sampling results, will not be made under this Item, but under Item 0202315A – Disposal of Controlled Material.

Pay Item	Pay Unit
Disposal of Hazardous Waste	Ton

ITEM #0101128A - SECURING, CONSTRUCTION AND DISMANTLING OF A WASTE STOCKPILE AND TREATMENT AREA

Description:

Work under this Item shall consist of the securing, construction, and dismantling of the temporary Waste Stockpile Areas (WSAs) at the locations designated on the Project plans and in accordance with the Contract. All Controlled and Hazardous Materials excavated during construction activities shall be stockpiled in the WSAs. The WSAs shown on the Project plans are to be used exclusively for temporary stockpiling of excavated materials from within the Areas of Environmental Concern (AOECs) and Hazardous Areas of Environmental Concern (HAOECs) for determination of disposal classification.

Materials:

The required materials are detailed on the Project plans. All materials shall conform to the State of Connecticut DOT Standard Specifications for Roads, Bridges, and Incidental Construction Form 817, as supplemented, and to the requirements of the Contract. The Wethersfield WSA shall be raised to an elevation above the 500-year floodplain. Fill material required to raise the WSA in accordance to Project plans or as determined by the Engineer.

Construction blocks shall be solid precast rectangular concrete six (6) feet in length, two (2) feet in height, and three (3) feet in depth.

Polyethylene plastic sheeting for underlayment shall be a thickness of thirty (30) mil and minimum width of ten (10) feet.

Sand bags used to secure polyethylene sheeting soil covers shall have a minimum weight of thirty (30) pounds.

Sedimentation Control System shall conform to Section 2.19.02 of the Specifications.

Processed Aggregate Base shall conform to Section 3.04.02 of the Specifications.

Hay bales shall conform to the requirements of Section 2.18.02 of the Specifications.

Crushed stone for the anti-tracking pad shall conform to the gradation for No. 3 stone as shown in Section M.01.01 of the specifications.

Geotextile fabric material shall conform to the requirements of Section M.08.01 of the specifications.

Chain Link Fence: Materials for chain link fence shall conform to the requirements of Section 9.13 and Section M.10.05.

Bituminous Concrete shall conform to Section 4.06.02 of the Specifications.

Bituminous Concrete Curb shall conform to Section 8.15.02 of the Specifications.

Roll-off/Storage Containers shall be of watertight, steel-body construction, of the size specified and able to handle the storage and subsequent transportation of material to the disposal facility.

Construction Methods:

There are two WSAs shown on the Project plans, one located in a commuter lot in Hartford (WSA 1) and the other located in Wethersfield (WSA 2). WSA 2 is designated as the primary WSA and shall be constructed in accordance with the Contract at the location shown on the Project plans. WSA 1 is secondary and will only be constructed and utilized if deemed necessary by the Engineer.

The Contractor may request permission from the Engineer to modify the layout of the WSAs at its own expense in such a way as to better accommodate its stockpiles of reusable material and the stockpiles for disposal. Should the Contractor request such modification and the Engineer approve the change, this will in no way relieve the Contractor of its responsibility for complying with the Connecticut Department of Energy and Environmental Protection (CTDEEP) "General Permit for Contaminated Soil and/or Sediment Management (Staging and Transfer)", its responsibility to plan excavation activities within AOECs in consideration of the capacity of WSAs, the material testing and disposal requirements of the applicable Contract item, and any other requirements related to WSA capacity.

Construction of the WSA shall be completed prior to the initiation of construction activities generating Controlled or Hazardous Materials. The Contractor is responsible for the maintenance and protection of all utilities potentially affected during WSA construction. The Contractor shall locate and mark all existing utilities potentially affected prior to initiating WSA construction.

The proposed locations of the WSAs shall be cleared of any debris and vegetation as directed by the Engineer. Any objectionable materials, which may result in damage to the polyethylene sheeting underlayment, shall be removed prior to stockpiling excavated Controlled or Hazardous Materials.

The Contractor shall comply with the terms and conditions of the CTDEEP "General Permit for Contaminated Soil and/or Sediment Management (Staging and Transfer)", including the General Operating Conditions and the Specific Operating Conditions, except that the Engineer will conduct all soil characterization and perform all record keeping. In particular, the Contractor shall:

1. Construct the WSAs in conformance with the requirements of the General Permit.

2. Install fences, gates, or other barriers (natural or artificial) to prevent unauthorized entry onto the stockpiles.
3. Install anti-tracking measures at the WSAs to minimize vehicle tracking of soil from the WSA onto the public roadway.
4. Post and maintain a sign that is visible from a distance of at least twenty-five (25) feet at the WSA identifying the name of the permittee (State of CT, Department of Transportation), the DOT field office phone number, the hours of operation for the WSA, and the phrase, "Temporary Soil Staging Area". Lettering shall be at least one inch (1") high with a minimum overall sign dimension of four (4) feet wide by two (2) feet high. Such sign is only required if the capacity of the WSA is equal to or greater than 1,000 cubic yards. If initially the WSA capacity is less than 1,000 cubic yards and the WSA capacity is subsequently increased, the Contractor shall post and maintain the required sign at no additional cost to the State, prior to stockpiling the additional material.

Following the removal of all stockpiled material, the Contractor shall use dry decontamination procedures for all surfaces of the WSA as directed by the Engineer. Residual materials shall be disposed of as Controlled or Hazardous Materials. If the results from dry methods are unsatisfactory to the Engineer, the Contractor shall modify decontamination procedures as required.

The Contractor shall be responsible for the collection and treatment/recycling/disposal of any liquid wastes that may be generated by its decontamination activities in accordance with applicable regulations.

Upon completion of the Project and following removal of all residual Controlled or Hazardous Materials, the Contractor shall dismantle the WSA and return the area to original condition. During dismantling, the Contractor shall remove all materials such as polyethylene sheeting and sand bags. Materials shall be disposed of by the Contractor as solid waste in accordance with the Contract and all Federal, State, and local regulations.

Operation and maintenance of the WSAs shall be included under Item 0101117A "Controlled Material Handling" and/or Item 0101109A "Hazardous Materials Excavation".

Method of Measurement:

This work will be measured for payment at the Lump Sum cost for securing and construction of the WSAs.

Basis of Payment:

This work will be paid for at the Contract Lump Sum, which shall include all materials, tools, labor, equipment, permits, and work needed to secure, construct, decontaminate, and dismantle the WSAs, including all clearing, grubbing, grading, clean up, site restoration, and seeding.

All materials, labor, and equipment associated with compliance with the General Permit for Contaminated Soil and/or Sediment Management (Staging and Transfer) will not be measured separately, but will be considered incidental to the item "Securing, Construction and Dismantling of a Waste Stockpile and Treatment Area".

Pay Item	Pay Unit
Securing, Construction and Dismantling of a Waste Stockpile and Treatment Area	L.S.

ITEM #0101130A - ENVIRONMENTAL WORK - SOLIDIFICATION

Description:

Under this Item, the Contractor shall be responsible for the solidification of Controlled Materials containing free draining liquids, as may be necessary during the performance of work operations prior to off-site disposal. Materials shall be dewatered prior to the addition of solidification material.

The Contractor shall submit within seven (7) days of the Notice to Proceed, for the Engineer's review, a detailed methodology and plan of operation for the solidification of materials.

Materials:

The materials used for solidification shall be a naturally occurring material such as diatomaceous earth or other material as approved by the Engineer. Said material shall be in a dry state prior to use in solidification operations. No polymers or other synthetic materials shall be allowed.

Construction Methods:

A. Submittals

The Contractor shall submit for the Engineer's review, a plan showing the location of solidification material storage and proposed mixing location as well as a detailed narrative describing the equipment, materials and methodology to be used. The Contractor shall include his proposed methods to remove or drain away free liquid (as determined by ASTM) prior to the addition of any solidification materials to Controlled Materials. Should solidification fail to eliminate free liquids as proposed, the Contractor will be required to revise the solidification plan at no additional cost to the State.

B. Solidification

Upon visual examination, if Controlled Materials have free liquids present, the Contractor may, with concurrence of the Engineer, add dry materials to absorb free-standing liquids, utilizing a methodology accepted by the Engineer. The Contractor shall dewater Controlled Materials prior to the addition of solidification materials to the satisfaction of the Engineer. All dewatering fluids shall be handled in accordance with the Contract. Solidification procedures shall be subject to monitoring by the Engineer.

The maximum quantity of solidification material that may be used by the Contractor shall be limited to twenty (20) percent, by volume, of the material being solidified. Should this procedure be ineffective in the elimination of the presence of free-standing liquids, the Contractor shall submit alternate methods for the removal of free-standing water. The

Contractor shall also submit the additional costs of the proposed alternative to the Engineer for review. No alternative methods of solidification shall be initiated until reviewed and accepted by the Engineer.

Method of Measurement:

This work shall be measured for payment as the actual weight of solidification material used by the Contractor. The Contractor shall demonstrate the amount of solidification material used by the original weight tickets from a certified scale. The weight tickets shall show the weight of the material brought to the site and subsequently used in solidification operations.

If no certified scale is available, the Engineer may allow for the calculation of the weight by a summation of sealed, pre-measured bags.

Basis of Payment:

This work shall be paid for at the Contract unit price for solidification material used and accepted by the Engineer. Such price shall include all labor, materials, tools, and equipment incidental to the work including transportation of the materials to the Project and the addition of solidification material to excavated materials.

Pay Item	Pay Unit
Environmental Work - Solidification	Ton

ITEM #0101143A - HANDLING AND DISPOSAL OF REGULATED ITEMS

Description:

Work under this item shall include the management (handling and disposal) of regulated items and all associated work by persons who are employed by a CTDEEP permitted Spill Contractor and trained/certified in accordance with OSHA Hazard Communication regulations. Regulated items include hazardous and other materials and wastes, the disposal of which is restricted by Federal and/or State laws and regulations, and which may be a component of equipment or other items located on-site. Regulated items include those listed herein, or additional similar items identified on site by the Engineer. Work under this item does not include asbestos containing materials, lead paint, contaminated or hazardous soils.

Activities shall be performed in accordance with, but not limited to, the current revision of the USEPA & CTDEEP Hazardous Waste Regulations (40 CFR 260-282, 22a-209 and 22a-449(c)), USEPA PCB Regulations (40 CFR 761), USEPA Protection of Stratospheric Ozone (40 CFR 82), OSHA Hazard Communication (29 CFR 1910.1200), OSHA Hazardous Waste & Emergency Response Regulations (29 CFR 1910.120), USDOT Hazardous Materials Regulation (49 CFR 171-180), OSHA, RCRA, CERCLA, CAA, TSCA, and all other laws and regulations.

The work activities include the removal, handling, packing, labeling, transport, manifesting, and recycling or disposal of various regulated items at the Project site prior to beginning planned renovation/demolition activities.

The Contractor is solely responsible for verifying actual locations and quantities of the items with hazardous/regulated material/waste constituents and for their proper handling and disposal. The recycling or proper disposal, as appropriate, of all regulated items shall be completed prior to the initiation of any demolition or renovation activities.

Materials:

All materials shall be suitable for the management of regulated items and shall meet all applicable federal, state and local regulations. Such materials include, but are not limited to, proper containers, packing materials, labels, signs, shipping papers, personnel protective equipment (PPE) and spill kits.

Construction Methods:

(1) Allowable Disposal/Recycling Facilities

Disposal facilities for RCRA-hazardous, TSCA-hazardous, Connecticut Regulated, and Universal wastes shall be chosen from among those listed below. No other facility shall be used for these types of wastes without the written approval of the Engineer.

Advanced Disposal Services
Greentree Landfill
635 Toby Road
Kersey, PA 15846
Phone: (814) 265-1744 Fax: (814) 265-8745
MSW, C&D, asbestos, PCB remediation waste <50 ppm, petroleum contaminated soils, nonhazardous solid wastes

Advanced Disposal
(managed by Interstate Waste Services)
7095 Glades Pike
Summerset, PA 15501
Phone: (814) 444-0112 Fax: (814) 444-0127
MSW, C&D debris, residual waste, sewer sludge, incinerator ash, asbestos

Allied Waste Niagara Falls Landfill, LLC
5600 Niagara Falls Blvd.
Niagara, NY 14304
Phone: (716) 285-3344 Fax: (716) 285-3398
Non-hazardous waste, industrial solid waste, municipal sewage treatment sludge, contaminated soil & debris, asbestos waste, C&D debris, industrial process sludge

American Lamp Recycling, LLC
26 Industrial Way
Wappingers Falls, NY 12590
Phone: (845) 896-0058 Fax: (845) 896-1520
Mercury containing device, universal waste

Tradebe (Bridgeport United Recycling, Inc.)
50 Cross Street
Bridgeport, CT 06610
Phone: (203) 334-1666 Fax: (203) 334-1439
RCRA & CRW waste oil, fuel, wastewater

Clean Earth of Carteret
24 Middlesex Ave..,
Carteret, NJ 07008
Phone: (732) 541-8909 Fax: (732) 541-8505
Concrete, brick, block, street sweepings, stone, rock, asphalt and petroleum contaminated soil

Clean Earth of Philadelphia, Inc.
3201 South 61 St.,
Philadelphia, PA 19153
Phone: (215) 724-5520 Fax: (215) 724-2939
Petroleum contaminated soil

Clean Earth of North Jersey, Inc. (aka CENJ)
115 Jacobus Ave,
South Kearny, NJ 07105
Phone: (973) 344-4004 Fax: (973) 344-8652
RCRA liquid and solid, asbestos

Clean Earth of Southeast Pennsylvania, Inc.
7 Steel Road,
Morrisville, PA 19067
Phone: (215) 428-1700 Fax: (215) 428-1704
Petroleum contaminated soil
Clean Harbors Environmental Services, Inc.
2247 South Hwy. 71,
Kimball, NE 69145
Phone: (308) 235-1012 Fax: (308) 235-4307
RCRA liquid, solid & sludge

Clean Harbors Environmental Services, Inc.
Cleveland Facility
2900 Rockefeller Ave.,
Cleveland, OH 44115
Phone: (216) 429-2401 Fax: (216) 883-1918
RCRA liquid: aqueous organic & inorganic wastewater

Clean Harbors Environmental Services, Inc.
Spring Grove Facility
4879 Spring Grove Ave.,
Cincinnati, OH 45232
Phone: (513) 681-6242 Fax: (513) 681-0869
RCRA liquid, solid & sludge: aqueous organic & inorganic wastewater, PCB wastewater treatment

Clean Harbors of Baltimore, Inc.
1910 Russell St,
Baltimore, MD 21230
Phone: (410) 244-8200 Fax: (410) 752-2647
RCRA liquid: aqueous organic & inorganic wastewater

Clean Harbors of Braintree, Inc.
1 Hill Avenue,
Braintree, MA 02184
Phone: (781) 380-7134 Fax: (781) 380-7193
RCRA & TSCA liquid & solid

Clean Harbors of Connecticut, Inc.
51 Broderick Road,
Bristol, CT 06010
Phone: (860) 583-8917 Fax: (860) 583-1740
RCRA & CRW liquid

Clean Harbors of Woburn
(Murphy's Waste Oil Services, Inc.)
252 Salem Street,
Woburn, MA 01801
Phone: (781) 935-9066 Fax: (781) 935-8615
RCRA liquid: oil, oil/water mixtures; CRW oil filters, oily soil & debris, F001/F002 contaminated oils, antifreeze

Clinton Landfill
242 Church Street
Clinton, MA 01510
Phone: (978) 365-4110 Fax: (978) 365-4106
Comm-97 soils and other materials subject to a BUD and additional review by MADEP (*2-week lead time for review by MADEP)

Colonie Landfill (Waste Connections, Inc.)
1319 Louden Rd,
Cohoes, New York 12047
Phone: (518) 783-2827 Fax: (518) 786-7331
Non-haz. wastes, special wastes, contaminated soil

Cumberland County Landfill
(aka Community Refuse Services
Managed by Interstate Waste Services)
135 Vaughn Road,
Shippensburg, PA 17257
Phone: (717) 729-2060 Fax: (717) 423-6822
Municipal solid waste, non-hazardous waste

ACV Enviro (aka Cycle Chem & General Chemical Corp.)
217 South First Street,
Elizabeth, NJ 07206
Phone: (908) 355-5800 Fax: (908) 355-0562
RCRA, TSCA liquid and solid

Envirite of PA (US Ecology)
730 Vogelsong Road,
York, PA 17404
Phone: (717) 846-1900 Fax: (717) 854-6757
RCRA hazardous wastes

Environmental Quality Company:
Wayne Disposal Facility
(aka EQ Michigan Disposal Waste Treatment Plant and Wayne Disposal Inc. Site #2)
49350 North I-94 Service Drive
Belleville, MI 48111
Phone: (734) 697-2200 Fax: (734) 699-3499
RCRA & TSCA liquid and solid

US Ecology (Environmental Quality Detroit Inc.)
1923 Frederick Street,
Detroit MI 48211
Phone: (734) 329-8017 Fax: (313) 923-3375
RCRA & CRW liquid wastewater

Environmental Soil Management of New York, LLC (ESMI of New York)
304 Towpath Road,
Fort Edward, NY 12828
Phone: (518) 747-5500 Fax: (518) 747-1181
Petroleum contaminated soil

Environmental Soil Management of NH
67 International Dr.
Loudon, NH 03307
Phone: (603) 783-0228 Fax: (603) 783-0104
Petroleum contaminated soil

Triumvirate (Formerly EnviroSafe Corporation Northeast & Jones Environmental Services)
263 Howard Street,
Lowell, MA 01852
Phone: (978) 453-7772 Fax: (978) 453-7775
RCRA & TSCA liquid and solid

Hazelton Creek Properties, LLC*
(Hazelton Mine Reclamation Project)
280 South Church St.,
Hazelton, PA 18201
Phone: (570) 574-1010 Fax: (570) 457-3395
Fresh, brackish or marine dredge material, coal ash, cement kiln dust, lime kiln dust, co-gen ash, regulated fill
*Please note that if this facility is to be used, each bin letter will require an additional 10 day (or more) waiting period on top of the 15 day lab period designated in the specs to allow for PADEP review.

Heritage Hazardous Waste Landfill (Heritage Environmental Services, LLC)
4370 W County Rd 1275 N
Roachdale, IN 46172
Phone:(765) 435-2704 Fax: (315) 687-3898
Hazardous Wastes, Asbestos

Manchester Landfill
311 Olcutt St.,
Manchester, CT 06040
Phone: (860) 647-3248 Fax: (860) 647-3238
Municipal solid waste, non-hazardous waste, contaminated soil

Northeast Lamp Recycling, Inc.
250 Main Street,
East Windsor, CT 06088
Phone: (860) 292-1992 Fax: (860) 292-1114
CRW solid waste, mercury containing devices & universal waste

Stericycle (Northland Environmental, LLC)
(aka PSC Environmental Systems)
275 Allens Ave.,
Providence RI 02905
Phone: (401) 781-6340 Fax: (401) 781-9710
RCRA liquid and solid

Ontario County Landfill
(Managed by Casella Waste)
3555 Post Farm Road,
Stanley, NY 14561
Phone: (585) 526-4420 Fax: (585) 526-5459
Municipal solid waste, non-hazardous waste solid, special wastes including asbestos, ash from boilers/incinerators, contaminated soil, demo debris

Paradise Heating Oil, Inc.
Quimby Street,
Ossining, NY 10562
Phone: (631) 926-2576 Fax: (718) 294-2226
CRW waste oil liquid

Phoenix Soil, LLC
58 North Washington Street
Plainville, CT 06062
Phone: (860) 747-8888 Fax: (203) 757-4933
Contaminated Soil

Red Technologies Soil
232 Airline Avenue
Portland, CT 06980
Phone: (860) 342-1022 Fax: (860) 342-1042
Temporary Storage & Transfer of contaminated soil

Republic Services Conestoga Landfill
420 Quarry Road
Morgantown, PA 19543
Phone: (610) 286-6844 Fax: (610) 286-7048
MSW, C&D debris, residual waste, contaminated soil, asbestos *Please note that if this facility is to be used, each bin letter will require an additional 10 day (or more) waiting period on top of the 15 day lab period designated in the specs to allow for PADEP review.

Stericycle (Formerly Republic Environmental Systems (aka Philip Services Corporation (PSC) Republic)
2869 Sandstone Dr.,
Hatfield PA 19440
Phone: (215) 822-8995 Fax: (215) 997-1293

RCRA & TSCA industrial solid & sludge, aqueous waste, contaminated soil, PCB waste, oil & petroleum waste, organic waste

Soil Safe, Inc.
378 Route 130, Logan Township,
Bridgeport NJ 08085
Phone: (410) 872-3990 x1120
Fax: (410) 872-9082
Soil contaminated with petroleum or metals, some industrial waste solids

The Southbridge Recycling & Disposal Park
165 Barefoot Rd.
Southbridge, MA 01550
Phone: (508) 765-9723, (603) 235-3597
Fax: (508) 765-6812
MSW, non-hazardous C & D waste, contaminated soil for cover

Stablex Canada, Inc.
760 Industrial Blvd.
Blainville Quebec J7C 3V4
Phone: (450) 430-9230 Fax: (450) 430-4642
RCRA liquid and solid, industrial wastes

Ted Ondrick Company, LLC
58 Industrial Road,
Chicopee, MA 01020
Phone: (413) 592-2566 Fax: (413) 592-7451
Petroleum contaminated soil

Tradebe Treatment & Recycling
136 Gracey Ave.
Meriden, CT 06451
Phone: (203) 238-8114 Fax: (203) 238-6772
RCRA, CRW wastewater, oil, hazardous waste fuels, hazardous and non-hazardous waste water

Tunnel Hill Reclamation
2500 Township Road, 205 Route 2
New Lexington, OH 43764
Phone: (914) 713-0203 Fax: (914) 713-0672
Municipal solid waste, non-hazardous waste, contaminated soils

Waste Management
RCI Fitchburg Landfill
Fitchburg Princeton Road,
Westminister, MA 01473
Phone: (978) 355-6821 Fax: (978) 355-6317
Solid: MSW, non-hazardous waste, C&D, contaminated soil for use as cover material under MADEP COMM-97 policy

Turnkey Landfill (Waste Management of NH)
TLR III Refuse Disposal Facility
90 Rochester Neck Road, PO Box 7065
Rochester, NH 03839
Phone: (603) 330-2197 Fax: (603) 330-2130
Solid: MSW, C&D, PCB remediation waste (<50ppm), virgin petroleum contaminated soil, CRW solid waste

The category of material accepted by each facility listed above is for informational purposes only. The Contractor shall verify facility acceptance of each type of regulated item.

(2) Submittals

Thirty (30) days prior to commencement of work involving the management of regulated items, the Contractor shall submit to the Engineer for approval, the following documentation:

1. Copy of Spill Contractor Permit registration issued by the CTDEEP.
2. Hazard communication training for all employees performing this work.
3. Biohazardous Waste Compliance Plan as outlined in Section 3(c)
4. Names of the treatment facilities, recycling facilities and/or disposal facilities the Contractor intends to use to receive each type of regulated item.
5. Hazardous Material Transporter USDOT Certificate of Registration for each waste transporter.
6. Hazardous Material Transporter Permit for the State of Connecticut, the destination state(s), and all other applicable states for each waste transporter.

Contractor shall provide the Engineer with a minimum of 48 hours notice in advance of scheduling, changing or canceling work activities.

(3) Regulated Item Management Provisions

(a) General Requirements

The Contractor's OSHA Competent Person shall be in control on the job site at all times during hazardous material management work activities. This person must be capable of identifying existing hazards, possess the authority to implement corrective measures to reduce/eliminate the hazards, comply with applicable Federal, State and Local regulations that mandate work practices, and be capable of performing the work of this contract. All employees who perform regulated material management related work shall be properly trained and qualified to perform such duties.

All labor, materials, tools, equipment, services, testing, insurance, and incidentals which are necessary or required to perform the work in accordance with applicable governmental regulations, industry standards and codes, and these specifications, shall be provided by the Contractor.

Ladders and/or scaffolds shall be in compliance with OSHA requirements, and of adequate length, strength and sufficient quantity to support the scope of work. Use of ladders/scaffolds shall be in conformance with OSHA 29 CFR 1926 Subpart L and X requirements.

Work performed at heights exceeding six feet (6') shall be performed in accordance with the OSHA Fall Protection Standard 29 CFR 1926 Subpart M including the use of fall arrest systems as applicable.

Inventory data from investigative surveys throughout the buildings are included herein and are presented for informational purposes only. Under no circumstances shall this information be the sole means used by the Contractor for determining the quantities or extent of the regulated items to be managed. The Contractor shall be responsible for verification of all field conditions affecting performance of the work. The Contractor shall submit to the Engineer for concurrence any additional items not listed herein that it believes to be regulated items included under this item. However, compliance with applicable requirements is solely the responsibility of the Contractor.

The Engineer will provide a Project Monitor to monitor the activities of the Contractor and inspect the work required. Environmental sampling shall be conducted as deemed necessary by the Engineer. Spill areas shall be cleaned by the Contractor until accepted by the Engineer. The Engineer may sample the spill area to demonstrate Contractor compliance with an acceptable standard.

(b) Personnel Protection

Prior to commencing work, the Contractor shall provide hazard communication training to all employees as necessary in accordance with OSHA 29 CFR 1926.59 and 29 CFR 1910.1200 and instruct all workers in all aspects of personnel protection, work procedures, emergency procedures and use of equipment including procedures unique to this project. Worker health and safety protocols that address potential and/or actual risk of exposure to site specific hazards are solely the responsibility of the Contractor.

The Contractor shall provide respiratory protection that meets the requirements of OSHA as required in 29 CFR 1910.134 and 29 CFR 1926.1000. A formal respiratory protection program, including appropriate medical surveillance, must be implemented in accordance with OSHA standards. The Contractor shall, as necessary, conduct exposure assessment air sampling, analysis and reporting to ensure the workers are afforded appropriate respiratory protection.

The Contractor shall provide and require all workers to wear appropriate personnel protective equipment, including protective clothing and respiratory protection, as required, within regulated work areas which exceed OSHA Personnel Exposure Limits (PELs) or when handling hazardous materials.

(c) Regulated Item Management Work Procedures

The Contractor shall not begin work until the Project Monitor is on-site.

Prior to beginning work on-site, the Contractor shall prepare waste characterization profile forms for each type of waste stream to be generated and forward such forms to the Engineer for review, approval and signature. Upon approval, the Contractor shall forward such forms to the appropriate disposal facilities for acceptance.

The Contractor shall utilize all appropriate engineering controls and safety and protective equipment while performing the work in accordance with OSHA, USEPA, USDOT, CTDEEP and Connecticut Department of Public Health DPH regulations.

The Contractor shall employ work practices so as to minimize the disturbance of the constituents in the regulated items, and prevent breakage and spills. In the event of a spill, the Contractor shall cordon off the area and notify the Engineer. The Contractor is responsible to have spills and the effected areas decontaminated to the acceptance of the Engineer by personnel trained in hazardous waste operator emergency response.

The Contractor shall carefully and properly remove, handle, pack, label and manifest all of the regulated items in waste containers specified and suitable to contain the waste in accordance with all federal and state regulations.

Prior to transportation and recycling and/or disposal, all proper USEPA, OSHA, CTDEEP and USDOT labels and placards shall be affixed to the waste containers and hazardous materials shipping papers such as waste manifests/bills of lading shall be completed.

Prior to renovation/demolition, properly remove, handle, pack, label, transport, manifest and recycle or dispose of the regulated items from those listed below:

The following hazardous/ regulated materials, wastes and items have been identified at the following Bridge Nos and will be impacted by the rehabilitation work.

Bridge No. 00480, I-91 over Airport Road, Hartford, CT

Pendant mounted luminaries under bridge.

- **Connecticut Regulated Waste (CRW) – PCB ballasts, chemical solids & liquids**
- **Universal waste (UW) – used electronics, Hg lamps & ampoules, batteries**

Bridge No. 00813, I-91 over US Routes 5 & 15, Hartford, CT

Pendant mounted luminaries under bridge.

- **Connecticut Regulated Waste (CRW) – PCB ballasts, chemical solids & liquids**
- **Universal waste (UW) – used electronics, Hg lamps & ampoules, batteries**

Bridge No. 01459, I-91 over Great Meadow Road, Wethersfield, CT

Pendant mounted luminaries under bridge.

- **Connecticut Regulated Waste (CRW) – PCB ballasts, chemical solids & liquids**
- **Universal waste (UW) – used electronics, Hg lamps & ampoules, batteries**

Bridge No. 01460, I-91 over Wethersfield Cove, Wethersfield, CT

Pole mounted streetlights above.

- **Connecticut Regulated Waste (CRW) – PCB ballasts, chemical solids & liquids**
- **Universal waste (UW) – used electronics, Hg lamps & ampoules, batteries**

Bridge No. 01466, I-91 over I-91 TR 827, Hartford, CT

Pendant mounted luminaries under bridge.

- **Connecticut Regulated Waste (CRW) – PCB ballasts, chemical solids & liquids**
- **Universal waste (UW) – used electronics, Hg lamps & ampoules, batteries**

Bridge No. 05796, U.S. Route 15 over Silver Lane, East Hartford, CT

Pendant mounted luminaries under bridge.

- **Connecticut Regulated Waste (CRW) – PCB ballasts, chemical solids & liquids**
- **Universal waste (UW) – used electronics, Hg lamps & ampoules, batteries**

Bridge No. 05922, I-91 NB over U.S. Route 15, Hartford, CT

Pendant mounted luminaries under bridge

- **Connecticut Regulated Waste (CRW) – PCB ballasts, chemical solids & liquids**
- **Universal waste (UW) – used electronics, Hg lamps & ampoules, batteries**

Bridge No. 6000A, U.S. Route 15 NB over I-91 NB, Route 2, CT River, and Railroad, Hartford, East Hartford, CT

Pendant mounted luminaries under bridge (only above land).

- **Connecticut Regulated Waste (CRW) – PCB ballasts, chemical solids & liquids**
- **Universal waste (UW) – used electronics, Hg lamps & ampoules, batteries**

Bridge No. 6000B, U.S. Route 15 SB over I-91 NB, Route 2, CT River, and Railroad, Hartford, East Hartford, CT

Pendant mounted luminaries under bridge (only above land).

- **Connecticut Regulated Waste (CRW) – PCB ballasts, chemical solids & liquids**
- **Universal waste (UW) – used electronics, Hg lamps & ampoules, batteries**

Bridge No. 6000C, I-91 NB to U.S. Route 15 NB On Ramp over Reserve Road and Railroad, Hartford, CT

Pendant mounted luminaries under bridge and pole mounted streetlights above.

- **Connecticut Regulated Waste (CRW) – PCB ballasts, chemical solids & liquids**
- **Universal waste (UW) – used electronics, Hg lamps & ampoules, batteries**

Bridge Nos. 06043A, 06043B, U.S. Route 15 NB, SB over Main Street, East Hartford, CT

Existing luminaries to remain.

Prior to construction activity which would disturb such materials, properly remove, handle, pack, label, transport, manifest and recycle or dispose of the regulated items from those listed below:

Homeless activity was observed beneath/at Bridge Nos. 6000A, 6000B, including, but not limited to human waste, sharps, bedding/clothing, etc. with the potential for contamination with human fluids presenting a potential exposure to blood borne pathogens and a need for management/disposal as biohazardous waste.

- **Biohazardous/Blood Borne Pathogen (BBP) Waste – human fecal waste, sharps, bedding, clothing with potential for contamination with human fluids.**

The Contractor shall submit a Biohazardous Waste Compliance Work Plan to CTDOT outlining the exact procedures that will be used to perform the work and protect the employees performing the biohazardous waste work. No biohazardous work shall be started by the Contractor until the Engineer has been notified and the Work Plan has been approved by the Engineer.

Regular construction/demolition (C&D) or trash from site shall not be mixed in with the potential biohaz materials (sharps/needles. feces, etc.)

No soil removal will be considered for payment under this Item without the approval of the Engineer.

Upon discovery of any previously unidentified regulated items during renovation activities, the Contractor shall immediately notify the Engineer and work shall cease in that area until the Engineer can determine the extent of any impact and proper handling procedures are implemented.

Efforts shall be made to recycle the constituents of the regulated items rather than dispose of them in accordance with the waste minimization efforts required under RCRA.

RCRA hazardous waste shall not be stored on the job site in excess of 90 calendar days from the accumulation start date.

Connecticut Regulated Waste shall not be transported to a RCRA or TSCA permitted facility for disposal, unless otherwise allowed by the Engineer in writing.

All non-RCRA hazardous waste materials, regulated waste materials and recyclable waste items shall be manifested separately from RCRA and TSCA hazardous waste, and documented properly on non-hazardous waste manifests, waste shipment records, bills of lading or other appropriate shipping papers for transportation to the recycling and/or disposal facility.

The Contractor shall prepare each lab pack list and shipping document (manifests, waste shipment records, bills of lading, etc.) with all of the required information completed (including types of waste, proper shipping name, categories, packing numbers, amounts of waste, etc.) in accordance with applicable federal and state regulations. The document will be signed by an authorized agent representing ConnDOT as the Generator for each load that is packed to leave the site.

The Contractor shall forward the appropriate original copies of shipping papers to the Engineer the same day the regulated items leave the project site.

All vehicles departing the site transporting hazardous materials shall display proper USDOT placards, as appropriate for the type of waste being transported.

(d) Project Closeout Documents:

Within thirty (30) days after completion of the on-site project work, the Contractor shall submit to the Engineer copies of the following completed documents:

1. Hazardous Waste Manifests
2. Waste Shipment Records/Bills of Lading
3. Recycling Receipts

Documents 1. through 3. must include the signature of an authorized disposal facility representative acknowledging receipt of hazardous materials.

Method of Measurement:

The work of "Handling and Disposal of Regulated Items" shall be provided for in accordance with Article 1.04.05 – Extra Work.

Basis of Payment:

The work of "Handling and Disposal of Regulated Items" shall be paid for in accordance with Article 1.04.05 – Extra Work, which price shall include the management, removal, handling, packing, labeling, transport, manifesting, recycling or disposal of the regulated constituents in the specific equipment/items scheduled for impact at the project site, and all equipment, materials, tools and labor incidental to the work.

Final payment will not be made until completed copies of all Manifest(s), Waste Shipment Records, Bills of Lading and/or Recycling Receipts have been provided to the Engineer. Once

completed and facility-signed copies have been received in their entirety, the Engineer will make the final payment.

Pay Item	Pay Unit
Handling and Disposal of Regulated Items	Estimate

ITEM #0202315A - DISPOSAL OF CONTROLLED MATERIALS

Description:

Work under this item shall consist of the loading, transportation and final off-site disposal/ recycling/treatment of controlled materials (excluding dewatering fluids) that have been generated from various excavations within the Areas of Environmental Concern (AOECs), brought to the WSA and determined to be contaminated with regulated substances at non-hazardous levels. This contamination is documented in the reports listed in the "Notice to Contractor – Environmental Investigations."

The results contained in the environmental investigation reports listed in the "Notice to Contractor – Environmental Investigations" show levels of various contaminants that the Contractor may encounter during construction. Actual levels found during construction may vary and such variations will not be considered a change in condition provided the material can still be disposed as non-hazardous at one or more of the disposal facilities listed herein. The controlled materials, after proper characterization by the Engineer, shall be taken from the WSA, loaded, transported to and treated/recycled/disposed of at a permitted treatment/recycle/disposal facility listed herein.

The Contractor must use one or more of the following Department-approved treatment/recycle/ disposal facilities for the disposal of <u>non-hazardous</u> materials:

Clean Earth of Carteret 24 Middlesex Avenue Carteret, NJ 07008 (732) 541-8909; Cheryl Coffee	Clean Earth of Philadelphia 3201 S. 61 Street Philadelphia, PA 19153 (215) 724-5520; Mike Kelly
Clean Earth of New Jersey 115 Jacobus Avenue South Kearny, NJ 07105 (732) 541-8909; Cheryl Coffee	Clinton Landfill 242 Church Street Clinton, MA 01510 (978) 365-4110; Chris McGown
Colonie Landfill 1319 Louden Road Cohoes, NY 12047 (518) 951-0794; Eric Morales (518) 783-2827	Cumberland County Landfill 135 Vaughn Road Shippensburg, PA 17257 (717) 729-2060; Don Demkoviz
Dudley Reclamation Project 123 Oxford Avenue Dudley, MA 01571 (978) 663-2623; Jarret Everton	ESMI of New York, LLC 304 Towpath Road Fort Edward, NY 12828 (518) 747-5500; Peter Hansen

ESMI of New Hampshire, LLC 67 International Drive Louden, NH 03307 (603) 783-0228; Stephen Raper	Hazelton Creek Properties, LLC * 280 South Church Street Hazelton, PA 18201 (570) 207-2000; Allen Swantek (570) 574-1010
Manchester Landfill 311 Olcott Street Manchester, CT 06040 (860) 647-3248; Brooks Parker	Ontario County Landfill 3555 Post Farm Road Stanley, New York 14561 (603) 235-3597; Scott Sampson
Clean Earth of Connecticut 58 North Washington Street Plainville, CT 06062 (860) 747-8888; Sue Brenner	Red Technologies LLC 232 Airline Avenue Portland, CT 06980 (860) 342-1022; Christopher Windangle
Republic Services Conestoga Landfill 420 Quarry Road Morgantown, PA 19543 (717) 246-4640; James Kuhn	Soil Safe, Inc. 378 Route 130 Logan Township Bridgeport, NJ 08085 (410) 872-3990 ext. 1123; Mike Kozak
Southbridge Recycling and Disposal Park 165 Barefoot Road Southbridge, MA 01550 (508) 765-9723; Scott Sampson	Ted Ondrick Company, LLC 58 Industrial Road Chicopee, MA 01020 (413) 592-2566; Alan Desrosiers
Waste Management: RCI Fitchburg Landfill Fitchburg Princeton Road Westminster, MA 01473 (978) 355 6821; Frank Sepiol	

* Note: each bin will require an additional 10 days (or more) for PADEP to review analytical data and approve material for disposal prior to facility acceptance of material. This is in addition to all other restrictions and wait periods defined below.

The above list contains treatment/recycle/disposal facilities which can accept the waste stream generated by the project in quantities that may be limited by their permits and their operations restrictions. It is the responsibility of the contractor to verify that a facility will be available and capable of handling the volume as well as the chemical and physical characteristics of material generated by the project.

Construction Methods:

A. Material Disposal

The Engineer will sample materials stored at the WSA at a frequency established by the selected treatment/recycling/disposal facilities. The Contractor shall designate to the Engineer which facility it intends to use, as well as the facility acceptance criteria and sampling frequency, prior to samples being taken. The Contractor is hereby notified that laboratory turnaround time is expected to be fifteen (15) working days. Turnaround time is the period of time beginning when the Contractor notifies the Engineer which facility it intends to use and that the bin within the WSA is full and ready for sampling and ending with the Contractor's receipt of the laboratory analytical results. Any change of intended treatment/recycling/disposal facility may prompt the need to resample and will therefore restart the time required for laboratory turnaround. The laboratory will furnish such results to the Engineer. Upon receipt, the Engineer will make available to the Contractor the results of the final waste characterization determinations. **No delay claim will be considered based upon the Contractor's failure to accommodate the laboratory turnaround time as identified above.**

The Contractor shall obtain and complete all paperwork necessary to arrange for material disposal (such as disposal facility waste profile sheets). It is solely the Contractor's responsibility to co-ordinate the disposal of controlled materials with its selected treatment/recycling/disposal facility(s). Upon receipt of the final approval from the facility, the Contractor shall arrange for the loading, transport and treatment/recycling/disposal of the materials in accordance with all Federal and State regulations. **No claim will be considered based on the failure of the Contractor's selected disposal facility(s) to meet the Contractor's production rate or for the Contractor's failure to select sufficient facilities to meet its production rate.**

Any material processing (including but not limited to the removal of woody debris, scrap metal, pressure-treated and untreated wood timber, large stone, concrete, polyethylene sheeting or similar material) required by the Contractor's selected facility will be completed by the Contractor prior to the material leaving the site. It is solely the Contractor's responsibility to meet any such requirements of its facility. Any materials removed shall be disposed of or recycled in a manner acceptable to the Engineer at no additional cost. If creosote treated timbers or railroad ties are removed, they will be disposed of as a general cost of the Project.

All manifests or bills of lading utilized to accompany the transportation of the material shall be prepared by the Contractor a minimum of 24 hours in advance and signed by an authorized Department representative, as Generator, for each truck load of material that leaves the site. The Contractor shall forward the appropriate original copies of all manifests or bills of lading to the Engineer the same day the material leaves the Project.

A load-specific certificate of treatment/recycling/disposal, signed by the authorized agent representing the disposal facility, shall be obtained by the Contractor and promptly delivered to the Engineer for each load.

B. Material Transportation

In addition to all pertinent Federal, State and local laws or regulatory agency polices, the Contractor shall adhere to the following precautions during the transport of controlled materials off-site:

- Transported controlled materials are to be covered sufficiently to preclude the loss of material during transport prior to leaving the site and are to remain covered until the arrival at the selected treatment/recycling/disposal facility.

- All vehicles departing the site are to be properly logged to show the vehicle identification, driver's name, time of departure, destination, and approximate volume, and contents of materials carried.

- No materials shall leave the site unless a treatment/recycling/disposal facility willing to accept all of the material being transported has agreed to accept the type and quantity of waste.

C. Equipment Decontamination

All equipment shall be provided to the work site free of gross contamination. The Engineer may prohibit from the site any equipment that in his opinion has not been thoroughly decontaminated prior to arrival. Any decontamination of the Contractor's equipment prior to arrival at the site shall be at the expense of the Contractor. The Contractor is prohibited from decontaminating equipment on the Project that has not been thoroughly decontaminated prior to arrival.

The Contractor shall furnish labor, materials, tools and equipment for decontamination of all equipment and supplies that are used to handle Controlled Materials. Decontamination shall be conducted at an area designated by the Engineer and shall be required prior to equipment and supplies leaving the Project, between stages of the work, and between work in different AOECs.

The Contractor shall use dry decontamination procedures. Residuals from dry decontamination activities shall be collected and managed as Controlled Materials. If the results from dry methods are unsatisfactory to the Engineer, the Contractor shall modify decontamination procedures as required.

The Contractor shall be responsible for the collection and treatment/recycling/disposal of any liquid wastes that may be generated by its decontamination activities in accordance with applicable regulations.

Method of Measurement:

The work of "DISPOSAL OF CONTROLLED MATERIALS" will be measured for payment as the actual net weight in tons of material delivered to the treatment/recycling/disposal facility. Such determinations shall be made by measuring each hauling vehicle on the certified permanent scales at the treatment/recycling/disposal facility. Total weight will be the summation of weight bills issued by the facility specific to this Project. Excess excavations made by the Contractor beyond the payment limits specified in Specification Sections 2.02, 2.03, 2.06, and 2.86, or the Contract Special Provisions (as appropriate) will not be measured for payment and the Contractor assumes responsibility for all costs associated with the appropriate handling, management and disposal of this material.

The disposal of excavated materials, originally anticipated to be controlled materials, but determined by characterization sampling not to contain concentrations of regulated chemicals (non-polluted or "clean" materials) will not be measured for payment under this item but will be considered as surplus excavated materials and will be paid in accordance with Article 1.04.05.

Any materials stored in the WSA, and which are reused within Project limits, will not be measured for payment under this item. This material will be paid for under Item 0202318A – Management of Reusable Controlled Material or in accordance with Article 1.04.05 in the item's absence.

Equipment decontamination, the collection of residuals, and the collection and disposal of liquids generated during equipment decontamination activities will not be measured separately for payment.

Any material processing required by the Contractor-selected disposal facility, including the proper disposal of all removed materials other than creosote treated wood, will not be measured for payment.

Basis of Payment:

This work will be paid for at the Contract unit price, which shall include the loading and transportation of controlled materials from the WSA to the treatment/recycling/disposal facility; the fees paid to the facility for treatment/recycling/disposal; the preparation of all related paperwork; and all equipment, materials, tools, and labor incidental to this work. **This unit price will be applicable to all of the listed disposal facilities and will not change for the duration of the Project.**

This price shall also include equipment decontamination; the collection of residuals generated during decontamination and placement of such material in the WSA; and the collection and disposal of liquids generated during equipment decontamination activities.

Pay Item	Pay Unit
Disposal of Controlled Materials	Ton

ITEM #0202452A - TEST PIT

Description: Test pits shall be performed for determining the location of underground utilities. This work shall consist of the removal and satisfactory disposal of all materials, the removal of which is necessary for the proper completion of the work, at the locations show on the plans or as ordered, and backfilling, all in accordance with these specifications.

Utility facilities to be located shall include pipes, conduits, service connections, handholes, structures, tanks, utility appurtenances, and any miscellaneous items directed by the Engineer such as telltales/ markers on the existing pipes, etc.

Construction Methods: Test pits shall be made in conformity with the requirements of the plans or as ordered by the Engineer. The Contractor shall furnish and employ such shores, braces, pumps, etc., as may be necessary for the protection of property, proper completion of the work and the safety of the public and employees of the Contractor and the Department. All bracing, etc., shall be removed when no longer required for the construction or safety of the work.

The Contractor shall perform test pits to determine the location of the IMS underground infrastructure including conduits, handholes, pullboxes, Manholes, etc.

At locations where the IMS underground infrastructure such as Type I or Type II handholes are significantly below grade, handhole extensions should be installed to raise the covers to grade. Handhole installations above grade are not acceptable because they are subject to damage from DOT mowing operations.

At locations where the IMS underground infrastructure such as Type I or Type II handholes, manholes or pullboxes are minimally below grade, the area surrounding the handhole should be re-graded and seeded so that the IMS underground infrastructure can be found in the future.

Wherever portions of existing full-depth bituminous concrete pavement are to be removed in conjunction with test pits, they shall be removed to neat lines. Where the limits of the areas in which such bituminous pavement is to be removed are adjacent to existing bituminous concrete pavement that is to remain in place, the limits shall be cut by a method approved by the Engineer.

The Contractor shall perform field surveys to establish the horizontal and vertical location and to document the type and size of the utilities at each test pit. The work shall be performed in accordance with the requirements of Section 9.80, Construction Staking. The Contractor shall furnish the Engineer copies of all test pit data.

After the test pit is completed, the Contractor shall notify the Engineer. The test pit shall not be backfilled until directed by the Engineer.

When backfilling is required, the material used shall be of a quality satisfactory to the Engineer and shall be free from large or frozen lumps, wood, and other extraneous material. All backfill placed below subgrade shall be placed in layers of not more than 6 inches (150 millimeters) in depth after compaction and shall be thoroughly compacted by means of mechanical rammers or vibrators or by pneumatic tampers. Hand tampers shall be used only upon written permission of the Engineer. Unless otherwise ordered by the Engineer, the backfill shall be brought to the surface of the surrounding ground or subgrade and neatly graded.

All suitable material removed in making the excavation shall be used for backfill unless otherwise directed by the Engineer. All surplus or unsuitable material shall be removed and disposed of as directed and in accordance with the handling and disposal of controlled material, as required. Should additional material be required for backfilling, it may be obtained from the Project excavation or from borrow pits, gravel pits, or elsewhere as the Engineer may direct.

Test pits performed within Areas of Environmental Concern (AOEC) or Low Level Areas of Environmental Concern (LLAOEC) shall meet the requirements for controlled material handling listed elsewhere in the specifications. Excess material generated from these areas which cannot be reused back on-site will require disposed in accordance with the applicable specifications and will be paid for under the appropriate environmental items and not included in the cost of the test pit. Test Pits performed in the area of Environmental Land Use Restrictions (ELUR) on and adjacent to the Materials Innovation and Recycling Authority (MIRA) property shall meet the requirements for ELUR soil management and restoration listed elsewhere in the specifications. If any of the existing engineered controls are encountered and impacted in the ELUR they shall be restored in accordance with the specification for ELUR Soil Management and Restoration and paid for separately under the corresponding item.

Method of Measurement: Test pits will be measured as each excavated, backfilled, surveyed, documented, and accepted per site and as directed by the Engineer. There will be no separate measurement for mobilization and demobilization associated with this item.

Basis of Payment: Test Pits will be paid for at the contract unit price each complete in place and accepted, which price shall include all materials, equipment, tools, handhole extensions, covers, surveys, and labor incidental thereto per site.

The price shall also include backfilling, patching roadways, and sidewalks in kind, restoration of the ground where required and the disposal of surplus material. No additional payment will be made for shoring, bracing, pumping, and bailing or for material or equipment necessary for the satisfactory completion of the work. If “Granular Fill” or “Reuse Stockpiled Materials” are used for backfill, payment will be made at their respective contract unit prices. If handling and disposal of contaminated materials or restoration of ELUR engineered controls is required, they shall be paid for under the applicable items and not included in the cost of the test pit.

Pay Item	Pay Unit
Test Pit	ea.

ITEM #0202574A - RESET MONUMENT

Description: Work done under this item consists of removing existing survey boundary monuments in their entirety and setting a new survey boundary markers (monuments, disks in ledge or concrete structures, or capped rebar) along Right–of–Way lines in the same horizontal position as the removed monument and/or as directed by the Engineer.

Materials: CTDOT concrete boundary monuments, CTDOT boundary disks, and CTDOT capped reinforcing bars (rebar) will be provided by the Department. All other materials shall be the responsibility of the Contractor.

Construction Methods: The Contractor shall remove the existing monument called out on the plans in its entirety and as field verified to be in conflict with the proposed sidewalk ramp construction. All materials from excavated monument shall be removed and disposed of by the Contractor. The Contractor shall be responsible for all computations, location, staking, and setting of highway boundary markers at defined Right-of-Way Lines as shown on the plans and details or as directed by the Engineer.

The standard boundary marker will be the CTDOT concrete boundary monument. Boundary disks set in ledge or other structures and capped rebar will be used if, or when the Engineer determines that it is impractical to set a concrete boundary monument.

The setting of boundary markers shall not begin until all excavation, filling operations, grading and drainage has been completed and approval has been granted by the Engineer. To prevent a tripping hazard, the top surface of the monument including the CTDOT Boundary disk must be installed level with the surrounding concrete sidewalk surface.

The Contractor shall retain the services of a Land Surveyor licensed in the State of Connecticut to serve as Project Surveyor to directly oversee this work and to ensure that each marker has been set in accordance with CTDOT Standards. The Contractor shall provide the name, place of professional employment, business address, phone number, and license number of the Project Surveyor to the Department.

All boundary and staking computations shall be provided by the Project Surveyor to the Engineer and shall be approved by the District Survey Office prior to staking the locations of the boundary markers.

The Project Surveyor shall establish the location of the existing boundary markers called out on the plans or as directed by the Engineer. The existing boundary marker location shall be tied into at least 3 points for future replacement. This work shall meet or exceed a positional accuracy of 1:5000 (0.02’ per 100’) as defined in Section 20-300b-11 of the Regulations of Connecticut State Agencies.
Excavation for the existing survey monuments or for the placement of the new CTDOT Boundary Monuments shall be by hand or with a power auger. The use of a backhoe or other

heavy equipment for excavation purposes will not be allowed. The concrete monument shall be set plumb into the hole to the finished grade and backfilled and compacted in six inch (6") layers as shown on the attached detail or as directed by the Engineer.

In locations where the Engineer determines that concrete monuments cannot be set, the Project Surveyor shall set CTDOT Boundary disks or CTDOT Boundary capped rebar as directed. Rebar driving sleeves shall be used in the setting of capped rebar. All disks set in ledge or concrete shall be secured with "Rockite" hydraulic anchor cement, USP-Anchor-Set, Quikrete Anchoring Cement as approved by the Engineer and in accordance with the manufacturer's recommended procedures.

Concrete boundary monuments must be allowed to settle for fourteen days. Once all concrete boundary monuments are completed and allowed to settle and all other boundary markers are in place, the Contractor will notify the Engineer that the boundary marker disks are ready to be drilled. The CTDOT District Survey Office will verify the location of the boundary markers or monuments by drilling the location of the highway lines on the boundary monuments or markers within 60 days of notification from the Engineer.

If any boundary marker disks are found to be outside of the boundary point locations and are unable to be drilled, the boundary monuments or boundary markers shall be removed and replaced in accordance with the contract specifications and details. Once the boundary monuments or markers have been drilled and found to meet the contract standards, the Engineer shall notify the contractor of this acceptance.

Method of Measurement: This work will be measured for payment by the number of monuments; disks, capped rebar, of the type specified, complete, and accepted in place.

Basis of Payment: This work will be paid for at the contract unit price each for removal of the existing monument and setting of the new survey boundary marker complete and accepted in place, which price shall include all computations, equipment, tools, non-Department supplied materials, removal of surplus material, and labor incidental to the removal, location, staking and setting of boundary markers, and shall include any removal and replacement of non-conforming markers.

Pay Item:	Pay Unit
Reset Monument	EA

CONNECTICUT DEPARTMENT OF TRANSPORTATION
Boundary/Control Monument Setting Procedures

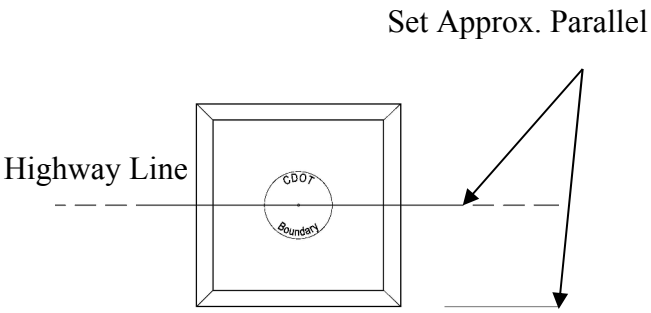


Fig. 1

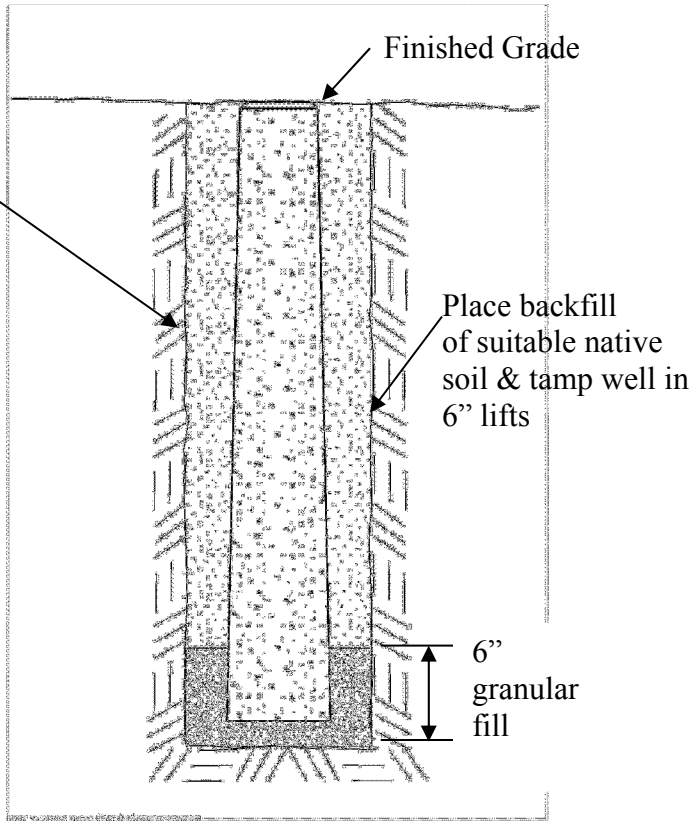


Fig. 2

Procedure "A"
Setting CT DOT Survey Monuments to a specific point:
The Project Surveyor shall compute and stake the layout of each new CHD monument to be set. The stake shall be a 2" x 2" x 18" (or larger) hardwood stake and tack. The new monument shall be tied in to three points, the hole dug and new monument placed as indicated above. The new monument is to be set plumb in the same horizontal position as the existing staked point to within three, one-hundredths (0.03') of a foot. It shall be positioned by the contractor, to an exact point, within the specified tolerance. Any monuments not falling within the specified limits shall be reset at the contractor's expense.

Procedure "B"
Setting CT DOT disc in ledge:
When a new CHD point falls on ledge which is exposed or within < 2' of the ground surface, a CT DOT disc may be set. A ¾" diameter hole shall be drilled to a depth of 3" and the surface of

the ledge leveled so that the disc sits flush when complete. Discs shall be affixed using "Rockite" hydraulic anchor cement, USP-Anchor-Set, Quikrete Anchoring Cement as approved by the Engineer and in accordance with the manufacturer's recommended procedures.

Procedure "C"

Setting CT DOT "RECHD" (Rebar w/cap):

This procedure shall follow the standards of Procedure "A" except a ¾" x 3' section of rebar is substituted for the traditional concrete monument. The rebar shall be driven with a protective sleeve and is also set to within three one-hundredths (0.03') of a foot of the staked point, then topped with a two (2") inch diameter CT DOT aluminum cap, which receives the final precise drill hole. The capped "Re-CHD" shall be set flush to the ground.

ITEM #0202601A - SETTLEMENT PLATFORM

Description:

The work to be done under this Section includes, but is not limited to, the following, which includes all labor materials, equipment and services necessary and incidental to the proper execution as shown on the contract drawings and as specified herein.

1. Performing all operations for furnishing, installing, protecting, maintaining, and modifying (for areas requiring raising of grade) settlement platforms as described herein and shown on the Contract Drawings.

2. The approximate locations and numbers of settlement platform installations are shown on the Drawings. Locations may be adjusted in the field, as directed by the Engineer, to avoid existing underground utilities, foundations, or other obstructions, and to minimize conflicts with the Contractor's proposed staging plan.

3. As part of the work under this Section, the Contractor shall survey the as-built plan locations and the ground surface elevation at each settlement platform installation. The contractor shall survey the ground surface, added lengths, and modifications to settlement platforms for areas requiring raising of grade.

The Contractor shall submit the following information for review by the Engineer in compliance with Section 1.03 - Award and Execution of the Contract:

1. The name, qualifications and experience record of the personnel or subcontractor(s) who will install the settlement platforms.

At least six (6) weeks prior to installation of any settlement platforms, the Contractor shall submit the following information for review by the Engineer:

1. Recommended installation and monitoring procedures for settlement platforms.

Within one (1) week following settlement platform installation, the Contractor shall submit to the Engineer as-built drawings and installation records for all settlement platforms. This submission shall include, but shall not be limited to:

1. Date of installation.

2. Name of personnel and organization responsible for installation.

3. Surveyed settlement platforms plan locations. Locations shall be referenced to the station and offset and the coordinate grid system shown on the Drawings.

4. Details of each installation: base elevation, sizes, dimensions, materials, backfill, locations of the various components of the installations relative to ground surface, and ground surface elevation.

Ground surface elevations settlement platforms shall be established to the nearest 1/8 inch.

The time period(s) for submittals are the minimum required by the Engineer to review, evaluate and respond to the Contractor. If, after review, the Engineer requires re-submission for any reason, the specified time period(s) shall apply to the processing of re-submissions. The Contractor is responsible for scheduling specified submittals and re-submittals to prevent delays in the work.

Installation of all settlement platforms shall be done by personnel or subcontractors having demonstrated experience in the installation procedures as specified herein.

All settlement platform installations shall be performed in the presence of the Engineer, who will also record data following installation during the course of the work. No settlement platform installation shall be conducted unless the State's representative is present at the settlement platform location to record pertinent data and observe the work. Work completed without the Engineer present will not be accepted.

The contractor shall be responsible for winterizing all settlement platforms as necessary to keep them functional year round. The Contractor shall ensure year round access to the settlement platforms which will include, but not be limited to snow removal.

Materials:

The 2 inch black steel pipe shall conform to ASTM A-120. The iron flange shall conform to the requirements of AASHTO M105, Class No. B. The plywood shall be of exterior grade of any species. The bolts, nuts, and washer shall conform to ASTM A-307. Compacted Sand shall be Sand Cover conforming to Subsection M.05.02, of the Standard Specifications.

Construction Methods:

All settlement platforms shall be installed in the presence of the Engineer. The Contractor shall cooperate with the Engineer and shall provide and maintain adequate lighting, if required. The Contractor shall allow access to the work area at all times for the purpose of observing settlement platforms and obtaining data. The Contractor shall determine the elevation and location of all settlement platforms a minimum of two (2) weeks prior to commencing placement of any embankment fill.

The Contractor shall be responsible for any and all damage to public and private utilities

incurred during settlement platform installation. The Contractor may request alternative settlement platform locations to avoid utilities or other conflicts subject to approval by the Engineer.

The Contractor shall be responsible for the flow of traffic around the work at all times and shall provide all required traffic control devices in accordance with the contract item "Maintenance and Protection of Traffic".

Settlement platforms that are found to be damaged, inoperative or not installed as specified herein shall be immediately replaced by the Contractor, at no additional cost to the State.

The Contractor shall furnish and install additional settlement platforms of the types specified herein, beyond that shown on the drawings, when directed by the Engineer.

The Engineer anticipates initially obtaining data settlement platforms during the work according to the monitoring schedule identified on the plans. The schedule will be revised during construction, as determined by the Engineer to best meet the needs of the State.

The prosecution of work is further defined in Section 1.08 of these Special Provisions and the Contractor is herein notified by reference that adherence to the requirements of those provisions is necessary for final approval of the settlement platform item.

The Contractor shall protect and maintain settlement platforms until the completion of the Contract. Any settlement platforms damaged or otherwise rendered non-functional shall be repaired or replaced with a new installation within five (5) working days at no additional cost to the State. Repair or replacement work shall conform to the requirements specified herein for settlement platforms.

The Contractor shall provide and maintain well-delineated protection devices at the surface on all settlement platforms.

Installation of Settlement Platforms:

1. The settlement plate shall be placed on a 6 inch thick bed of sand compacted level with existing grade.

2. Sufficient pipe shall be furnished for each platform to reach at least 4 feet above the fill at all times, or 1 foot above the top surface of the final fill height. The riser pipes shall be plumb. Riser pipes shall be permanently marked with file cuts to show heights above the platforms.

3. The settlement platforms shall be protected to prevent disturbance during placement of all fill.

Method of Measurement:

Settlement platforms shall be measured by the number of units installed and accepted by the Engineer.

Basis of Payment:

This work will be paid for at the contract unit prices for the items listed below which price shall include all materials, tools, equipment and labor incidental to the installation, maintenance, monitoring and modification due to placement of fill, thereto.

Pay Item	**Pay Unit**
Settlement Platform	Each

ITEM #0202630A - DEFORMATION MONITORING POINTS (DMPS)

Description: Settlement monitoring instrumentation is present along the shoulder of Interstate 91 northbound, related to an adjacent, ongoing project. The planned widening of I91 NB is expected to impact some of these instruments.

This item consists of removal and replacement of select instruments.

Six existing instruments along the I91 NB shoulder are expected to be impacted by construction, generally located between project Stations 104+50 and 109+25. All six of the instruments are referred to as Deformation Monitoring Points (DMPs). Five of these are considered "Type-2" and one is "Type-3". The same terminology will be used in this Special Provision.

Existing Type-2 DMPs generally consist of a 5-foot long piece of #6 steel rebar that has been driven vertically into the ground such that the top of the rebar is a few inches below grade. The rebar has been capped with a plastic survey marker cap and the capped rebar is protected by an 8-inch diameter steel curb box with a bolt-on cover and a 24-inch long skirt concreted in place.

The existing Type-3 DMP generally consists of a reflective survey marker, attached with epoxy to a vertical support member of a highway sign.

Demolish the five Type-2 DMPs located along the shoulder. Remove protective curb boxes, remove rebars by pulling vertically and dispose of materials.

Demolish the single Type-3 DMP attached to the highway sign support. Detach from the steel column and dispose of the reflective marker.

Install five new Type-2 DMPs at the locations indicated on project plans.

Materials: New Type-2 DMPs shall generally consist of a (minimum length) 10-foot long piece of #6 (or larger diameter) steel rebar that has been driven vertically into the ground such that the top of the rebar is about three (3) inches below design finish grade.

The exposed top of the driven rebar shall be protected by an 8-inch diameter steel curb box with a bolt-on cover and a minimum 24-inch long skirt, concreted in place. See attached detail.

Construction Methods: Provide all labor and materials to perform the scope of work. Secure all required permits and provide maintenance and protection of traffic (M&PT) measures to satisfy the Connecticut Department of Transportation's requirements.

The vertical steel rods or rebars for the Type-2 DMPs shall be installed by driving from the ground surface. Because portions of the slope below will be reinforced with synthetic geogrids, advancement of drill casing, augers or other drill tooling will not be permitted. Installation will require punching to ensure piercing of the synthetic geogrids. Excavation to install protective curb boxes shall be done using hand tools only.

Maintain existing DMPs until such time that the replacement DMPs can be installed. The period between demolition of the existing DMPs and installation of the replacement DMPs shall not exceed one (1) calendar month.

Coordinate installation such that Freeman Companies personnel are present to observe and document installation as it occurs. Freeman's Instrumentation Manager is Christopher Tonzi who can be reached at 860-251-9550.

Approximately one week after installation, provide M&PT to facilitate survey location of the newly installed instruments by a Freeman Companies survey crew. Freeman survey crew will replace the plastic survey caps on the rebars and also replace the Type-3 DMP if the new sign support column is located within the same project stationing.

The Contractor shall maintain the DMPs during the construction phase and shall be able to re-establish or replace DMPs for all locations damaged during construction.

Method of Measurement: The item, being paid for on a lump sum basis, will not be measured for payment.

Basis for Payment: This work will be paid for at the contract lump sum price for the following pay item, which price shall include the demolition and disposal of select existing instruments and furnishing and installation of replacement Deformation Monitoring Points.

Pay Item	**Pay Unit**
DEFORMATION MONITORING POINTS	LS

ITEM #0202637A - UTILITY MONITORING POINT

CONNDOT Form 817, SECTION 2.03, Structure Excavation, shall apply with the following additional items:

Description: This item consists of installing Utility Monitoring Points (UMPs) and monitoring movement of locations shown on the plans during construction. The monitoring program shall be adequate to document any settlement or horizontal movement of the pipeline during construction activities. The monitoring program shall be in conformance with the minimum requirements detailed in this specification or as noted on the plans for quantity of monitoring points, intervals for recording data, procedures and period of time for reporting to the Engineer, maintenance of points, and removal of points after the completion of the work.

Materials: UMPs shall be constructed of materials suitable for use as survey reference points and as approved by the Engineer. The material shall be dimensionally stable and the points installed in a manner to allow for easily repeatable survey readings to be taken at the points. Settlement monitoring points shall consist of a metal flange placed over the pipeline in a hand- or vacuum-excavated excavation, and a steel rod bolted or welded to the flange that extends upward to ground surface, as shown on the attached detail.

Construction Methods: UMPs shall be established as shown on the plans within the limits of construction a minimum of two days prior to the commencement of any construction. Initial readings shall be recorded both at the time of point installation and prior to the commencement of construction activities, to establish baseline readings.

UMPs shall be established by the Contractor for the specific purpose of providing a reliable, reproducible reference point compatible with the survey equipment to be used by the Contractor for the monitoring program.

The Contractor shall take location readings on the established UMPs using survey equipment capable of reading to a precision of 1/16-inch in both the horizontal and vertical dimension. The monitoring points shall be monitored at the following minimum intervals:

- Prior to commencement of construction activities near each UMP location.
- Immediately following installation of micropiles for bridge support and installation of temporary excavation retaining systems.
- Daily during active construction on the adjacent Abutments 1 and 2, wingwalls, and adjacent construction.
- After the completion of construction activities near a UMP location.
- The next working day after rainfall in excess of 1-inch in a 24-hour period on site.
- As directed by the Engineer.

Any points that have measured movement exceeding ¼-inch shall be immediately brought to the attention of the Engineer, and construction activities in the immediate vicinity of the movement shall be ceased until any necessary corrective action has been taken or as ordered by the

Engineer. The Contractor shall modify the means and methods associated with any construction activities that result in movement exceeding ½-inch.

Survey data shall be reduced and tabulated by the Contractor, in a format approved by the Engineer, and shall be submitted to the Engineer in hard copy format. Tabulated data shall be submitted weekly except for locations with measured movement at or exceeding ¼-inch, where the reduced data shall be submitted daily.

The Contractor shall maintain the UMPs during the construction phase and shall be able to re-establish or replace UMPs for all locations damaged during the time periods when monitoring is required at a given location. New baseline UMP reference data shall be established for replacement points prior to resuming construction activities at a given location.

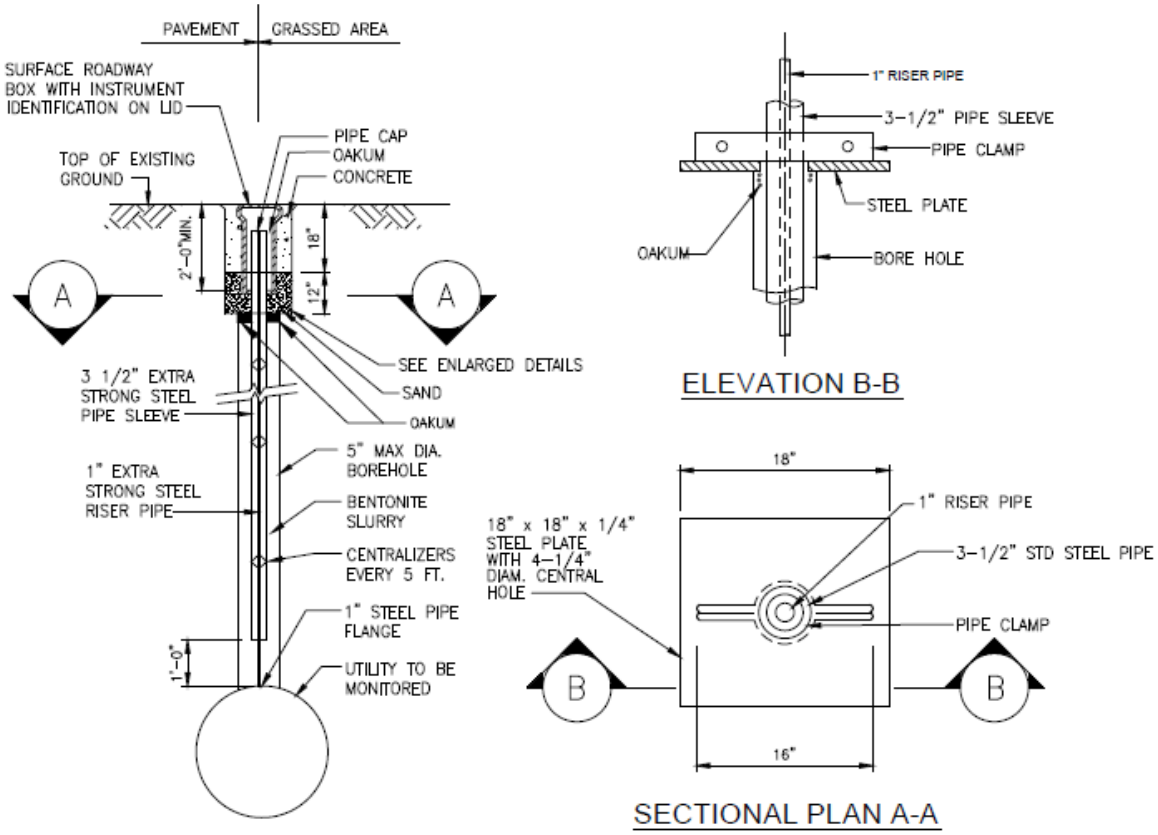
Upon completion of the construction at a given location, the Contractor shall remove UMPs installed and restore the original condition of the affected location, unless the Engineer and the facility owner approve abandonment of the UMPs in place.

Method of Measurement: The item, being paid for on an each basis, will not be measured for payment.

Basis for Payment: This work will be paid for at the contract each price for the following pay item, which price shall include the furnishing and installation of UMPs, survey monitoring of UMPs at the required intervals, maintenance and protection of UMPs, replacement of damaged UMPs, removal of UMPs, the recording and processing of data, the transfer of data to the Engineer and all transportation, materials, equipment, tools and labor incidental thereto:

Pay Item	**Pay Unit**
UTILITY MONITORING POINT	EA.

Attachment: UMP Detail



UTILITY MONITORING POINT □UMP□

NOT TO SCALE

ITEM #0202913A - CONDITION SURVEY (SITE NO. 3)
ITEM #0202916A - CONDITION SURVEY (SITE NO. 6)
ITEM #0202917A - CONDITION SURVEY (SITE NO. 7)

Description:

Work under this item consists of performing condition surveys and monitoring.

Work shall include, but not necessarily be limited to:

1. Conducting pre- and post-construction condition surveys.

2. Laying out, furnishing, installing, protecting, maintaining, monitoring, and preparing reports for all monitoring instrumentation: Crack Monitors, Deformation Monitoring Points, and Vibration Monitors.

3. Replacement of failed, damaged or stolen instrumentation.

4. Notifying the Engineer and taking immediate remedial action to prevent the Limiting Values from being reached. Meeting with the Engineer to review current field conditions to determine further steps to be taken, before exceeding the limiting values.

5. Making adjustments to the demolition, pile extraction, sheeting/shoring and ground improvement means and methods in order not to exceed the Limiting Values.

6. Removal of all monitoring instruments, Crack Monitors, Deformation Monitoring Points, and Vibration Monitors as specified herein, or as directed by the Engineer at the completion of construction activities.

Materials:

Crack Monitors:
Crack monitors shall be two piece acrylic plate type monitors with crosshairs on one piece and fine grid on the other, mounted on each side of the crack with appropriate screws or quick setting epoxy as manufactured by Avongard Products, U.S.A., Ltd., Preservation Resource Group, Inc. (PRG) or approved equal.

Deformation Monitoring Points (DMPs):
These are to be used as targets in monitoring by conventional survey methods. The target shall be the head of a stainless or galvanized steel bolt drilled and grouted into the structure

or other devices approved by the Engineer that will allow repeatable and reproducible elevation readings when measured with conventional survey equipment.

Vibration Monitors:
Provide three-component seismographs or vibration monitors, capable of measuring and recording particle velocity data and frequency in three mutually perpendicular directions. The Contractor's vibration specialist shall install, maintain, and calibrate the vibration monitoring instruments in accordance with the instrument manufacturer's recommendations. Any instrument showing indication of damage, malfunction, or erratic functioning shall be immediately replaced with a calibrated, functioning instrument.

Construction Methods:

Pre and Post-Conditions Surveys and Crack Monitoring:

The Contractor shall engage the services of a qualified, independent professional, acceptable to the Engineer to conduct pre- and post- construction surveys of the main structure. Work under this item included furnishing all necessary labor, equipment and materials to perform the condition surveys and monitor cracks. Work also includes contacting the owner by certified letter to obtain permission for entry required for the work.

A pre-construction condition survey shall be completed and 5 copies of the survey and initial monitoring measurements submitted at least 10 days prior to the start of ground improvement or at an earlier stage of construction if requested by the Engineer. Initial crack monitoring measurements are to be included in this report.

The pre-construction condition survey shall consist of a visual inspection, photograph and video documentation, and written description of bridge structure. Descriptions shall identify any existing cracks, damage, or other defects and shall include such information to make it possible to determine the effect, if any, of the construction operations on the defect. Where significant cracks or damage exists, or for defects too complicated to describe in words, photographs shall be taken and made part of the record. In addition, the significant cracks shall, with consent of the owner, be instrumented with crack monitors to record any movement of the crack. Where crack monitors are not installed, crack width measurements shall be made with suitable measuring devices. Initial crack monitoring measurements shall be recorded in the presence of Engineer and Owner's representative. All parties shall sign the record copy of the form used to record the initial readings.

The initial record of each property examined shall be signed by the representatives present and, if practicable, by the Owners of the property, whether or not they are present at the examinations.

A post-construction condition survey will be conducted upon completion of the ground

improvement, or at a later date if requested by the Engineer.

The post-construction condition survey shall repeat the process used in the pre-construction survey, paying particular attention to any areas where complaints of damage have been received or damage claims have been filed. Notice shall be given to all interested parties so that they may be present during the post-construction condition survey. A form shall be provided to all representatives attending the post-construction survey showing the initial crack reading measurements and shall provide a location to record the final measurements. Crack monitors shall be read during the final examination and can be removed if no change is noted from the initial readings. If a change is noted, the crack gauge shall remain in place until approval is given by the Engineer to remove the crack monitor. Mounting hardware or adhesives shall be removed and the surface restored when the crack gauges are removed. Representatives present shall sign the record copy of the monitoring form used to record the final readings. Crack monitors shall not be removed until the Owner or Owner's representative signs the record copy of the form recording the final crack monitoring readings.

The final record of the bridge structure examined shall be signed by the representatives present and, if practicable, by the Owner, whether or not they are present at the examinations.

The Contractor shall submit 5 copies of the pre- and post-construction condition surveys including all documentation to the Engineer within 10 days of the completion of the post- construction condition survey.

Monitoring
Requirements:

A. Monitoring Instrumentation Installation:

1. Install the DMPs and Vibration Monitors at the locations directed by the Engineer. A minimum of four DMP locations and two Vibration Monitor locations shall be established.

2. Crack Monitor locations will be determined and installed as part of the pre- construction condition survey.

3. All DMPs and Crack Monitors shall be installed in the presence of the Engineer.

4. Contractor to coordinate uninterrupted access, power supply (if applicable) and wireless signal (if applicable).

5. All DMPs and crack monitors shall be securely fixed at the approved locations and position, so that the instruments are capable of resisting disturbance from vandalism. Establish the initial elevation of DMPs to a

precision of 1/8 inch (3 mm).

6. DMP benchmarks shall be selected by the contractor and protected from damage for the duration of the work.

7. The Engineer reserves the right to modify the DMP and Vibration Monitor layout as is deemed necessary to monitor the impact of the Contractor's proposed method of construction. The DMPs shall be arranged so that monitoring can continue until completion without interruption. Adequate access for maintenance and reading of the DMPs shall be provided.

B. Monitoring Schedule and Submittal:

1. All DMPs and Crack Monitors / crack measurement points shall be installed and initial readings completed with the pre-construction condition survey as noted above.

2. In addition to the initial readings, DMPs and Crack Monitors / crack measurement points shall be monitored:

- Prior to the start of and then at least daily during the ground improvement process.

- Five days before, the day before, and then daily during ground improvement.

- One week after completion of ground improvement, and then weekly until there is no change in readings.

The Engineer may increase the frequency of monitoring at no additional cost should there be any changes in the measurements or other indications of movement.

Measurements shall be submitted on a form showing both the past and current measurements. A hard copy of the form with any changes from the previous days measurements circled shall be given to the Engineer by the morning after the day the readings were taken. A typed and signed form shall be submitted on a weekly basis during periods requiring monitoring, unless the Engineer approves submittal less frequently.

3. The Contractor shall monitor construction induced vibrations continuously ground improvement is being conducted. If monitoring results associated with construction activities at certain distances from the structures result in readings less than 25 percent of the limiting values, the Engineer solely at his discretion may reduce the continuous monitoring requirement.

4. The Contractor's vibration specialist shall maintain a log of all vibration producing activities for which ground vibrations were monitored. The vibration monitoring log shall include the recorded maximum peak particle velocity and the associated frequency and the date and time for each event recorded and the type and location of the vibration producing activity, location of monitoring instruments, and the closest distance from the vibration producing activity to the monitoring instrument. In addition to immediate verbal and email notifications of significant vibrations, the vibration specialist shall submit weekly reports of vibration monitoring to the Engineer during periods when such monitoring is required. The monitoring reports shall include the vibration monitoring record data, a location plan showing areas of construction activity and monitoring locations, and a written narrative summarizing the vibration monitoring performed and the results.

C. The Contractor shall respond to the monitored readings from instrumentation as follows:

1. Implement remedial action if readings approach the Limiting Values of ½" for DMPs, 1/8" for Crack Monitors / crack measurement points, and a peak particle velocity (i.e. ground vibrations) immediately adjacent to a vibration monitoring locations of 0.5 inch per second. The term "peak particle velocity" shall be considered to mean the resultant vector sum of particle velocities in three mutually perpendicular directions at any instant in time.

2. Take all necessary steps so that the limiting values are not exceeded. The Contractor may be directed to suspend activities in the affected area with the exception of those actions necessary to avoid exceeding the limiting value.

3. If any readings exceed 50 percent of the Limiting Values, the Contractor shall:

a. Halt operations that are causing the instrument response values to reach 50 percent of the Limiting Value.

b. Meet with the Engineer to discuss response actions.

c. Implement the reviewed plan of action, which includes modifications to the Contractor means and methods necessary to reduce the potentially damaging effects of the construction activities such that the Limiting Values are not reached.

D. Damage to Instrumentation:

1. The Contractor shall protect all DMPs, Crack Monitors, and Vibration Monitors from damage due to construction operations, weather, and vandalism.

2. If an instrument is damaged or unusable, the Contractor's instrumentation personnel shall replace the damaged DMP or Crack Monitor within 72 hours, at no additional cost to the State. The Engineer will be the sole judge of work stoppage in the vicinity of the damaged or unusable instrument until it is again operational, at no additional cost to the State.

E. Removal of Instruments:

1. Prior to completion of the Contract, the Contractor shall remove all above instrumentation and restore the surface to the Owner's satisfaction.

2. All instruments or portions hereof removed by the Contractor shall become the property of the Contractor.

Method of Measurement:

Within sixty (60) calendar days of the award of the Contract, the Contractor shall submit to the Engineer for approval a cost breakdown of his lump sum bid prices by site for these items. The submission must include substantiation showing that the cost breakdowns submitted are reasonable based on the Contractor's lump sum bids. The cost breakdown shall be in accordance with the following payment schedule:

Pre-Construction Surveys: The cost to develop and perform pre-construction surveys meeting site requirements. The cost shall not exceed 20 percent of the lump sum value for a given site.

Furnishing and Installation of Monitoring Devices: The cost to procure and install all required devices at each site. The cost shall not exceed 20 percent of the lump sum value for a given site.

Monitoring and Maintenance of Devices: The number of months and monthly cost to perform the required monitoring and prepare documentation at each site. The cost shall be a minimum of 40 percent of the lump sum value for a given site.

Post-Construction Surveys and Removal of Monitoring Devices: The cost to perform the post- construction surveys and remove monitoring devices at each site. The cost shall be a minimum of 5 percent of the lump sum value for a given site.

Basis of Payment:

This work will be paid for at the contract lump sum price for "Condition Survey (Site No. X)" which price shall include all materials, tools, equipment and labor for the required work at

each site including: the services of an independent professional to perform the pre- and post-construction surveys; furnishing, installation, monitoring, and removal of crack monitor gauges/measurement points and DMPs; furnishing, installation, monitoring, and removal of instrumentation to record vibration; preparation of reports; notification of the Engineer of any readings which reach 50 percent of the Limiting Values; and adjusting the means and methods in order not to exceed the Limiting Values.

Item	**Pay Unit**
Condition Survey (Site No. X)	Lump Sum

ITEM #0204213A - HANDLING CONTAMINATED GROUNDWATER

Description:

Under this Item, the Contractor shall collect, manage, treat, and dispose of contaminated groundwater generated during dewatering operations within the designated Groundwater Area of Environmental Concern (GWAOEC) within the Project limits.

Contaminated groundwater is defined as "groundwater which has been generated from excavations within the designated GWAOEC containing substances at concentrations that exceed the effluent limits for the Connecticut Department of Energy and Environmental Protection (CTDEEP) General Permit for the Discharge of Groundwater Remediation Wastewater, Discharges to Surface Water". The presence of contaminants removable through control of settleable solids does not constitute contaminated groundwater. Groundwater contamination caused by the Contractor's activities or work practices is also not considered contaminated groundwater.

The contamination and groundwater depth at the time of the investigation is documented in the reports listed in the "Notice to Contractor – Environmental Investigations". Contaminants and depth to groundwater is provided for the Contractor's information and may be influenced by factors such as seasonal groundwater table changes, tidal changes, drought or flooding conditions, local withdrawals from the aquifer, local construction, etc. Additional information with regard to soil descriptions and groundwater observations may also be available as part of geotechnical investigations conducted for the project.

The Contractor shall contain contaminated groundwater and 1) treat it on-site prior to discharge to sanitary sewer; 2) treat it on-site prior to discharge to surface water; or 3) transport water to an off-site treatment/disposal facility.

This Item does not apply to the possible diversion of existing storm water flow around the construction site during Project activities. Diversion of existing storm water or surface flows shall be completed in accordance with the Contract and all applicable permits. This item also does not include process water or wastewater generated by the Contractor's work activities.

Construction Methods:

A. General

It is the Contractor's responsibility to determine the expected groundwater generation rate from construction activities, select the appropriate groundwater management method, and size its system capacity to meet those dewatering needs.

All equipment required as a part of this Item shall be installed in a location and manner acceptable to the Engineer and in accordance with the manufacturer's recommendations. Equipment shall be decontaminated prior to arrival at the Project, decontaminated prior to being moved to another area of the project, and then decontaminated before it leaves the Project, at no additional cost to the State. Solids (soil or sediment) generated by on-site dewatering activities shall be brought to the Waste Stockpile Area (WSA) for testing and characterization by the Engineer.

The Contractor is responsible for operating and maintaining the equipment at all times when dewatering in the GWAOEC occurs. This includes providing appropriate supervision during evenings, weekends, and holidays. If the system is intended to operate unattended, a remote alarm system acceptable to the Engineer shall be installed to monitor critical system operating parameters and the Contractor shall be responsible for providing rapid emergency response during non-working hours in the event a system malfunction occurs. A list of names and phone numbers shall be displayed in the immediate vicinity of the system for emergency contacts.

The Contractor shall report releases from the groundwater treatment system due to overfilling or equipment/piping failure to the CTDEEP Spill Response Unit in accordance with RCSA 22a-450 and provide the Engineer with all information, including the CTDEEP case number. All costs related to spill response associated with the Contractor's on-site containment or treatment system will be the responsibility of the Contractor.

The Contractor shall collect all samples related to permit compliance in the presence of the Engineer. The Contractor shall provide informational copies of all groundwater analytical results and discharge monitoring reports to the Engineer as they are generated.

The Contractor shall operate the dewatering equipment at a rate that removes the groundwater that naturally infiltrates the excavation. The Contractor shall not cause a hydraulic gradient that draws groundwater into the excavation at an excessive rate. Additional treatment required due to the mobilization of off-site contaminants caused by the Contractor dewatering at an excessive rate will be the responsibility of the Contractor.

Additional treatment related to the Contractor's work activities (i.e. treatment or increased charges due to changes in pH or introduction of different contaminants into the groundwater) and management and disposal of excess water related to the Contractor's process water or wastewater will not be included under this item but will be considered a part of the Contractor's cost for the item under which the work is being performed.

B. Groundwater Management Methods

The Contractor shall use one or more of the following methods for the management and disposal of contaminated groundwater. Based on project specifics and site constraints, the Contractor may choose to use more than one of the following methods on a single project. All methods may not be possible at the site due to sanitary sewer or permitting restrictions.

1. On-Site Treatment System with Discharge to Sanitary Sewer

a. Contractor Submittals

At least fourteen (14) days prior to any submittal to the Publicly Owned Treatment Works (POTW) or CTDEEP, the Contractor shall submit the treatment system design, which has been sealed by a Professional Engineer licensed in the State of Connecticut to the Engineer for review and comment. Equipment shall prevent sediments and solids, as well as contaminants in excess of the permit allowable effluent concentrations, from entering the sanitary sewer. This submittal shall include a schematic or diagram that shows all treatment system equipment, well point locations, pump set-ups in excavations, sedimentation control methods, system location, method of conveyance, flow rates, pipe sizes, valve locations, sampling ports, discharge locations, electrical power connection, etc.

The Contractor shall submit the manufacturer's data sheets, assembly details and performance data on all treatment equipment. If dewatering equipment is to remain on site between October 15 and April 15, the Contractor shall include its method to prevent the treatment system equipment from freezing (heat tape, immersion heaters, etc.).

The Contractor shall detail its method to collect and contain water in its excavations. The Contractor shall also describe in detail its methods for limiting the quantity of water entering the excavation, including shoring, location of well points, limiting excavation size, preventing entry of surface water into the excavation, etc. The Contractor shall also include its assumptions and flow rate calculations related to the sizing of the system.

It is the Contractor's responsibility to design and properly size the system to accommodate the anticipated contaminants and dewatering rates based on its construction activities, POTW limitations, and permit requirements. The Contractor is alerted that construction activities may be limited based on permit restrictions or POTW limitations.

No claim for delay or request for additional time will be considered based upon the Contractor's failure to accommodate the review process.

b. Permits

Groundwater generated by construction activities within a GWAOEC shall be appropriately treated and discharged to the sanitary sewer system within Project limits. Management and discharge of contaminated groundwater shall be accomplished in accordance with a CTDEEP General Permit and POTW requirements. The Contractor shall be responsible for registering under the General Permit, any other necessary State or local permits, and all associated fees.

The CTDEEP General Permit for the Discharge of Groundwater Remediation Wastewater is available at www.ct.gov/deep. The Contractor shall submit the most

current permit registration form to the CTDEEP. A minimum lead-time of six (6) weeks can be expected to process and submit the registration, in addition to coordination time with the POTW. **No claim for delay or request for additional time will be considered based upon the Contractor's failure to accommodate the permitting process.** The Contractor shall not submit the permit registration to the CTDEEP prior to the Engineer's review of and comment on the treatment system.

The Contractor shall submit a copy of the CTDEEP permit certificate of registration to the Engineer prior to initiating any discharge.

All testing required by the general permit shall be conducted by a laboratory certified by the Connecticut Department of Public Health (DPH) for the method specified in the permit. The Contractor shall submit copies of the analytical results to the all parties specified in the permit terms and conditions and to the Engineer.

No claim for delay or request for additional time will be considered based upon the Contractor's failure to design a system to meet this performance specification. It is the Contractor's responsibility to properly size the treatment system and temporary containment tanks based on its anticipated flow rates from construction activities and to determine the level of treatment required to meet permit discharge limits.

c. Treatment System Operation

The Contractor shall ensure that all personnel involved in the groundwater treatment operations understand the terms of the General Permit. In the event of a conflict between the requirements of the Contract and the permit, the more stringent will apply.

The Contractor shall not commence work activities within any GWAOEC until such time as:

i. the temporary groundwater treatment system design is reviewed by the Engineer and comments are adequately addressed,

ii. the system is installed in accordance with the accepted design and is completely operational, and

iii. a copy of the Contractor's permit certificate of registration has been submitted to the Engineer.

The Contractor shall make any sanitary sewer tie-in modifications necessary to accommodate the treatment unit only after obtaining approval from the Engineer and the POTW.

The Contractor shall take all meter readings required by the permit and forward them to the appropriate parties.

The Contractor shall collect all samples related to permit compliance in the presence of the Engineer and shall submit copies of the analytical results and discharge monitoring reports to the appropriate agency(ies) as required by the General Permit terms and conditions. The Contractor shall provide informational copies of all analytical results and discharge monitoring reports to the Engineer as they are generated. In the event of an exceedance, the Contractor shall immediately comply with the "***Duty to Correct, Record, and Report Violations***" section of the General Permit. The Contractor shall provide the Engineer a copy of the required CTDEEP reporting and then document its review of the treatment system and all actions taken to correct the exceedance in writing to the Engineer within 48 hours of receiving laboratory data documenting the exceedance.

If the discharge must be suspended due to an effluent violation, the Contractor shall only restart the discharge after obtaining all necessary approvals from the CTDEEP/POTW and in full compliance with the General Permit and any amendments imposed thereto.

No claim for delay, request for additional time, or request for additional design/redesign costs for the system will be considered based upon the Contractor's failure to design/redesign a system to meet this performance specification.

2. On-Site Treatment System with Discharge to Surface Water

   a. Contractor Submittals

   At least fourteen (14) days prior to <u>any</u> submittal to the CTDEEP, the Contractor shall submit the treatment system design, which has been sealed by a Professional Engineer licensed in the State of Connecticut, to the Engineer for review and comment. Equipment shall prevent sediments and solids, as well as contaminants in excess of the permit allowable effluent concentrations, from discharging. This submittal shall include a schematic or diagram that shows all treatment system equipment, well point locations, pump set-ups in excavations, sedimentation control methods, system location, method of conveyance, flow rates, pipe sizes, valve locations, sampling ports, discharge locations, electrical power connection, etc.

   The Contractor shall submit the manufacturer's data sheets, assembly details and performance data on all treatment equipment. If dewatering equipment is to remain on site between October 15 and April 15, the Contractor shall include its method to prevent the treatment system equipment from freezing (heat tape, immersion heaters, etc.).

   The Contractor shall detail its method to collect and contain water in its excavations. The Contractor shall also describe in detail its methods for limiting the quantity of water entering the excavation, including shoring, location of well points, limiting excavation size, preventing entry of surface water into the excavation, etc. The Contractor shall also include its assumptions and flow rate calculations related to the sizing of the system.

It is the Contractor's responsibility to design and properly size the system to accommodate the anticipated contaminants and dewatering rates based on its construction activities and permit requirements. The Contractor is alerted that construction activities may be limited based on permit restrictions.

No claim for delay or request for additional time will be considered based upon the Contractor's failure to accommodate the review process.

b. Permits

Groundwater generated by construction activities within a GWAOEC shall be appropriately treated and discharged to surface water within Project limits. Management and discharge of contaminated groundwater shall be accomplished in accordance with a CTDEEP General Permit. The Contractor shall be responsible for registering under the General Permit and all associated fees.

The CTDEEP General Permit for the Discharge of Groundwater Remediation Wastewater is available at www.ct.gov/deep. The Contractor shall submit the most current permit registration form to the DEEP. A minimum lead-time of six (6) weeks can be expected to process and submit the registration. **No claim for delay or request for additional time will be considered based upon the Contractor's failure to accommodate the permitting process.** The Contractor shall not submit the permit registration to the CTDEEP prior to review of and comment on the treatment system by the Engineer.

The Contractor shall submit a copy of the CTDEEP permit certificate of registration to the Engineer prior to initiating any discharge.

All testing required by the General Permit shall be conducted by a laboratory certified by the Connecticut Department of Public Health (DPH) for the method specified in the permit. The Contractor shall submit copies of the analytical results to the all parties specified in the permit terms and conditions and to the Engineer.

No claim for delay or request for additional time will be considered based upon the Contractor's failure to design a system to meet this performance specification. It is the Contractor's responsibility to properly size the treatment system and temporary containment tanks based on its anticipated flow rates from construction activities and to determine the level of treatment required to meet permit discharge limits.

For sites where the receiving water body does not qualify the site for registration under the CTDEEP General Permit for the Discharge of Groundwater Remediation Wastewater Directly and the discharge is anticipated to continue for 30 days or less, the Contractor may qualify for a CTDEEP Temporary Authorization (TA) to discharge to surface water. The Contractor will be bound to the terms and conditions of the TA the same as if it were a permit. If the Contractor applies for, and receives, a TA from the CTDEEP, all other

requirements of this specification will apply, except that where the specification refers to a permit, the TA will be substituted.

c. Treatment System Operation

The Contractor shall ensure that all personnel involved in the groundwater treatment operations understand the terms of the General Permit. In the event of a conflict between the requirements of this Item and the permit, the more stringent will apply.

The Contractor shall not commence work activities within any GWAOEC until such time as:

i. the temporary groundwater treatment system design is reviewed by the Engineer and comments are adequately addressed,

ii. the system is installed in accordance with the accepted design and is completely operational, and

iii. a copy of the Contractor's permit certificate of registration has been submitted to the Engineer.

The Contractor shall take all meter readings required by the permit and forward them to the appropriate parties.

The Contractor shall submit copies of the analytical results and discharge monitoring reports to the appropriate agency(ies) as required by the General Permit terms and conditions. The Contractor shall provide informational copies of all analytical results and discharge monitoring reports to the Engineer as they are generated. In the event of an exceedance, the Contractor shall immediately comply with the "***Duty to Correct, Record, and Report Violations***" section of the General Permit. The Contractor shall provide the Engineer a copy of the required CTDEEP reporting and then document its review of the treatment system and all actions taken to correct the exceedance in writing to the Engineer within 48 hours of receiving laboratory data documenting the exceedance.

If the discharge must be suspended due to an effluent violation, the Contractor shall only restart the discharge after obtaining all necessary approvals from the CTDEEP and in full compliance with the General Permit and any amendments imposed thereto.

No claim for delay, request for additional time, or request for additional design/redesign costs for the system will be considered based upon the Contractor's failure to design/redesign a system to meet this performance specification.

3. Off-Site Treatment and Disposal

At least 14 days prior to any work involving the dewatering of contaminated groundwater, the Contractor shall submit for the Engineer's review and comment its proposed system to collect and contain the contaminated groundwater. This submittal shall include schematics of proposed pump set-ups in excavations; sedimentation control measures; probable location of temporary containment tanks; schematics of proposed method to transfer liquids from temporary containment tanks to transport vehicles; schematic of proposed method to off-load liquids at the off-site permitted treatment/disposal facility; documentation that transport vehicles hold a "Waste Transportation Permit" for contaminated liquids per CGS 22a-454; and the name of the disposal facility from the following list of Department-approved and CTDEEP-permitted treatment facilities for State-regulated liquid disposal:

Clean Harbors of CT 51 Broderick Road Bristol, CT 06010 (860) 583-8917	Bridgeport United Recycling 50 Cross Street Bridgeport, CT 06610 (203) 238-6745
Tradebe Treatment and Recycling Northeast, LLC 136 Gracey Avenue Meriden, CT 06450 (203) 238-8114	

All testing required to meet facility acceptance parameters shall be conducted by the Contractor in the presence of the Engineer. The Contractor is hereby notified that laboratory turnaround time is expected to be fifteen (15) working days. The Contractor shall provide informational copies of the laboratory results to the Engineer. **No delay claim will be considered based upon the Contractor's failure to accommodate the laboratory turnaround time as identified above or to design its system with sufficient holding capacity to accommodate this requirement.**

The Contractor shall obtain and complete all paperwork necessary to arrange for disposal of the contaminated groundwater (such as disposal facility waste profile sheets). It is solely the Contractor's responsibility to coordinate the disposal with its selected facility. Upon receipt of the final approval from the facility, the Contractor shall arrange for the loading, transport and disposal in accordance with all Federal and State regulations. **No claim will be considered based on the failure of the Contractor's selected disposal facility(s) to meet the Contractor's production rate or for the Contractor's failure to select sufficient facilities to meet its production rate.**

The Contractor will be responsible for disposal of the entire shipment as the Hazardous Waste Generator for water that undergoes a change in waste classification due to the Contractor's work activities or processes (i.e. contaminated groundwater being classified characteristically hazardous for pH due to grouting operations).

Method of Measurement:

Within fourteen (14) calendar days after addressing the Engineer's comments on the proposed system(s) for Handling Contaminated Groundwater, the Contractor shall submit to the Engineer for approval a cost breakdown of its lump sum bid price. The submission must include substantiation showing that the cost breakdown submitted is reasonable based on the Contractor's lump sum bid. The cost breakdown shall be in accordance with the following payment schedule:

a. The cost to prepare the design for proposed system(s) for Handling Contaminated Groundwater, including preparation and submittal of all permit registration applications, in accordance with these specifications. Design costs shall not exceed 10% of the total cost of the item.

b. The procurement and installation cost for the proposed system(s) for Handling Contaminated Groundwater in accordance with these specifications. Procurement and installation costs shall not exceed 20% of the total cost of the item.

c. Equipment decontamination and demobilization and restoration of site. Decontamination and demobilization costs shall not exceed 10% of the total cost of the item.

d. The remaining costs for operation, monitoring, permit compliance, sampling and analysis, disposal costs, and maintenance of the proposed system(s), including cleaning of the temporary containment tanks of settled solids, transporting of solids to the WSA, and transportation of the contaminated dewatering wastewater to an off-site permitted treatment/disposal facility in accordance with these specifications shall be divided evenly throughout the duration of the project work involving contaminated groundwater at the discretion of the Engineer.

Increased costs directly related to the Contractor's operation (i.e. treatment or increased charges due to changes in pH or additional contaminants, treatment and disposal of excess water related to process or waste water, etc.) will not be paid under this item but will be considered a part of the Contractor's cost for the item under which the work is being performed.

Basis of Payment:

This work will be paid for at the Contract lump sum price for "Handling Contaminated Groundwater" which price shall include: all work and materials involved with handling contaminated groundwater from within the GWAOEC and shall include all equipment, materials, tools and labor incidental to removal of the contaminated groundwater from the excavation; conveying contaminated groundwater from the dewatering point to the temporary containment tanks and groundwater treatment facility; treatment; conveying discharge of contaminated wastewater to a sanitary sewer, surface water or off-site disposal at a permitted treatment/disposal facility (including transportation); disposal or recycling of used treatment media (i.e. bag filters and spent carbon); permit applications; disposal and permit fees; POTW

fees; electrical costs; sampling and documentation costs; laboratory costs; design and monitoring; mobilization, operation, and maintenance of the system; site work; all required equipment decontamination; transportation of solids to the WSA; and equipment demobilization.

Sedimentation control associated with work under this Item will be paid under the appropriate items of the Contract.

Pay Item	Pay Unit
Handling Contaminated Groundwater	Lump Sum

ITEM #0204402A - HANDLING WATER (SITE NO. 2)
ITEM #0204408A - HANDLING WATER (SITE NO. 8)

Description:

Work under this item shall consist of the construction of such water diversion dam, flow diversions, barriers, temporary bypass pipe or other such protective facilities and methods as are necessary for the conduction of water beyond the limits of construction and the removal of all such temporary structures and facilities upon the completion of the permanent work or as required. The handling of water shall be in accordance with the requirements of Section 01.10. For the purposes of this specification, such work shall be understood to mean any temporary type of protective facility which the Contractor elects to build or use to satisfy, and which does satisfy, the conditions for the installation of the water diversion such as sand bags. The handling of flood flows and the protection of existing structures, and any or all of the finished construction during high water, are included in the scope of work under this item.

Materials:

As required and approved by the Engineer. Water diversion dam may be concrete blocks with plastic sheets, sandbags or other material approved by the Engineer of the Contractor's choosing. If required, Pump Discharge Basin shall conform to the "2002 Connecticut Guidelines for Soil Erosion and Sediment Control" Section 13, Dewatering.

Construction Methods:

The Contractor shall investigate and verify existing stream conditions, and evaluate the need for, and the type of protection and facilities required. Before commencing construction, the Contractor shall furnish the Engineer with details of the plan and methods he proposes to use for handling water and accomplishing the work. The Contractor may use concrete blocks or other types of protective facilities as approved by the Engineer. The furnishings of such plans and methods shall not relieve the Contractor of any of his responsibility for the safety of the work and for the successful completion of the project.

If required, temporary bypass pump and pipe shall be designed and sized by the Contractor and submitted to the Engineer for approval.

The height of any water diversion dam, flow diversions, pipes and barriers shall conform to the details indicated in the plans and in the specification. Alternative methods of handling water proposed by the Contractor must be submitted to the engineer for review. Modification and application of environmental permits due to alternative handling water scheme shall be the responsibility of the contractor. All such temporary structures or facilities shall be safely

designed, extended to sufficient depth and be of such dimensions and water-tightness so as to assure construction of the permanent work. They shall not interfere with proper performance of the work. Their construction shall be such as to permit excavation for the permanent work to the limits shown on the plans. Interior dimensions shall give sufficient clearance for construction. Movements or failures of the temporary protection facilities, or any portions thereof, which prevents proper completion of the permanent work shall be corrected at the sole expense of the Contractor.

Any pumping from within the areas of construction shall be done in such a manner as to prevent the possibility of movement of water through any fresh concrete. No pumping will be permitted during placing of concrete or for a period of 24 hours thereafter, unless it be done from a suitable sump properly located with sufficient pumping capacity to protect against damage from sudden rising of water. Any pumped water must be discharged in accordance with the requirements of Section 01.10.

Unless otherwise provided, or directed, all such temporary protective work shall be removed and disposed of in an approved manner when no longer required.

The Contract shall be responsible for the scheduling of work under this item so as not to interfere with any sequence of operations developed for this project. Delays as a result of work required under this item shall not constitute a claim for an extension of contract time.

The Contractor shall be aware of overhead utility wires within the project limits which shall be required to remain in service for the duration of the project. Contractor means and methods shall be adjusted to accommodate these utilities. Any required coordination with the impacted utilities during construction to hold or shift wires without service interruption shall be the responsibility of the Contractor.

Method of Measurement:

This item, being paid on a lump sum basis, will not be measured for payment.

Basis of Payment:

Payment for this item will be made at the contract lump price for “Handling Water (Site No. 2)” or, “Handling Water (Site No. 8)” complete and accepted, which price shall include all tools, material, equipment, labor and work incidental to the construction; reconstruction; related environmental controls used in Handling Water; handling of the stream flow during construction; the removal and disposal of all protective works or facilities; disposal of water removed from the construction; damages incurred by the Contractor, and any damages to existing facilities and to work in progress, materials or equipment from flows or high stages of the stream.

ITEM #0207150A - LIGHTWEIGHT FILL

Description:
Work shall consist of furnishing and placement of lightweight fill in the formation of embankments or as backfill in front of and behind structures. This work shall be performed as hereinafter specified, to the dimensions indicated on the plans, or as directed by the Engineer. This item shall also consist of furnishing and placing crushed stone or gravel in burlap bags at the inlet ends of weep holes in structures to the dimensions indicated on the plans or as ordered by the Engineer.

Materials:
Lightweight fill shall be a rotary kiln expanded shale aggregate meeting the requirements of ASTM C 330. No by-product slags, cinders or by-products of coal combustion shall be permitted. The aggregate shall consist of tough, durable, non-corrosive particles with the following gradation:

Square Mesh Sieves	Percent Passing by Weight
1”	100
3/4”	90 - 100
3/8”	10-50
No. 4	0 – 15
No. 200	0 - 10

The dry loose unit weight shall be less than 50 pcf. The lightweight aggregate supplier shall submit verification of an in-place compacted total unit weight (by methods defined in AASHTO T99) of less than 65 pcf. For purposes of this specification, the total unit weight is defined as the maximum dry density multiplied by one plus the moisture content (as a decimal). For example, if the maximum dry density is 45 pcf and the moisture content is 9%, the total unit weight is 49 pcf).

The maximum soundness loss when tested with 5 cycles of magnesium sulfate shall be 10 percent (ASTM C 88). The maximum Los Angeles Abrasion loss when tested in accordance with ASTM C 131 (B grading) shall be 40 percent.

The lightweight aggregate producer shall submit verification that the angle of internal friction is equal to or greater than 40 degrees when measured in a triaxial compression test on a laboratory sample with a minimum diameter of 250 mm.

The materials for bagged stone shall conform to the following requirements: the crushed stone or gravel shall conform to the grading requirements of Article M.01.01 for No. 3 or No. 4 coarse aggregate or a mixture of both; the bag shall be of burlap and shall be large enough to contain one cubic foot of loosely packed granular material.

Construction Methods: When applicable and except where noted below, lightweight fill placement shall conform to the requirements of Sections 2.02.03 and 2.16.03 of the Standard Specifications, Form 817.

The lightweight fill shall be placed in layers of a thickness of 1.5 ft to a maximum of 2.0 ft. Each layer shall be compacted by the use of self-propelled vibratory compaction equipment with static mass (weight) less than 6,600 lbs. The minimum number of passes shall be two (2) and the maximum four (4). The actual lift thickness and exact number of passes shall be determined by the Engineer depending on the type of compaction equipment. The contractor shall take all necessary precautions during construction activities in operations on or adjacent to the lightweight fill to ensure that the material is not over compacted. Construction equipment, other than for compaction, shall not be operated on the exposed lightweight fill.

Where weep holes are installed within the limits of lightweight fill, bagged stone shall be placed around the inlet end of each weephole, to prevent movement of the lightweight fill material into the hole. Approximately one cubic foot of crushed stone or gravel shall be enclosed in each of the burlap bags. All bags shall then be securely tied at the neck with cord or wire so that the enclosed material is contained loosely. The filled bags shall be stacked at the weep holes to the dimensions shown on the plans or as directed by the Engineer. The bags shall be unbroken at the time lightweight fill material is placed around them and bags which are broken or burst prior to or during the placing of the lightweight fill material shall be replaced at the expense of the contractor.

Method of Measurement: Lightweight fill shall be measured in place after compaction. There shall be no direct payment for bagged stone, but the cost thereof shall be considered as included in the cost of the work for "Lightweight Fill".

Basis of Payment: This work will be paid for at the contract unit price per cubic yard for “Lightweight Fill”, complete in place, which price shall include all materials, transportation, tools, equipment and labor incidental thereto.

Pay Item	**Pay Unit**
Lightweight Fill	C.Y.

ITEM #0209013A - UNDERPINNING (SITE NO. 3)
ITEM #0209016A - UNDERPINNING (SITE NO. 6)

DESCRIPTION:

The scope of work includes supplying the materials, labor, equipment, and procedures for conventional pit underpinning for frost protection of existing footings at bridge pier structures.

Underpinning shall be designed by a Registered Engineer and performed by the Contractor or specialty contractor if required. If any requirement specified herein or shown will result in damage to a facility, utility or structure using the equipment and methods proposed by the Contractor, he/she shall notify the Department in writing substantially in advance and prior to beginning the work. It is the Contractor's responsibility to perform the underpinning in such a manner so as not to adversely affect existing active roadways or structures.

Subsurface and overhead utilities are present. Utility locates, realignments or deactivations shall be arranged by the Contractor prior to the commencement of work. The Contractor shall be solely responsible for all damages resulting from underpinning activities.

AASHTO LRFD Bridge Design Specifications, CONNDOT's Bridge Design Manual, CONNDOT's Geotechnical Manual and CONNDOT Form 817 shall be used for this work in addition to the project plans and specifications as standards for successful performance of the work.

SUBMITTALS:

Shop Drawings: Drawings and calculations for underpinning which detail the complete underpinning design shall be prepared under the direct supervision of a Civil Engineer registered in the State of Connecticut. All computations and drawings shall bear the seal of the Design Engineer, and shall include the following:

1. Methods of temporary and permanent support.
2. Sequence of operations.
3. Support of excavation.
4. Dewatering.
5. Methods of vertical and horizontal load transfer.
6. Construction monitoring system (instrumentation).
7. Restoration.
8. Design of tie backs where required.
9. Civil Engineer's name and official registration stamp.

Contractor: Information on the contractor to complete the underpinning:

1. Name of the firm.

2. An account of firm experience in installing the type of underpinning specified which demonstrates successful completion on similar projects.
3. A list of available equipment and personnel.
4. A list of at least two installations of such systems including names and addresses of the owner's representatives.

Construction Monitoring:

Condition Inspection: The Contractor shall have a conditional inspection report, prepared by personnel acknowledged to be qualified by experience, of the structure in the immediate vicinity of the work to be performed under this section which may reasonably be expected to be affected by the work. This report, as a minimum, shall include a videotape and written description of the physical features. **The Engineer responsible for the design of the underpinning shall visit the site to review existing conditions and ensure the feasibility of the proposed design with existing conditions observed. A written report of the site visit shall be included in the documentation submitted.**

Instrumentation: In order to detect any movement of buildings or structures that may be affected by his work, the Contractor shall, prior to excavation, establish a system of vertical and horizontal control points, on or about such buildings or structures, tied to bench marks and indices sufficiently remote as not to be removed or affected by his operations. The proposed system shall be submitted to the Resident Engineer for approval prior to commencing any work.

1 Readings shall be taken of these points and permanently recorded prior to the start of excavation.

2. Structures to be underpinned or temporarily supported in place shall have visual methods of determining movement inscribed or firmly affixed on each footing or wall to be underpinned and/or supported, and at additional locations as directed by the Engineer. The method used is optional with the Contractor but must be capable of being read to an accuracy of 0.005 feet.

3 Readings shall be taken daily or more often if necessary during the progress of underpinning or support operations by a qualified person under the direction of a Professional Engineer, and for a period of four weeks after completion of such operations. The frequency of these readings may be reduced at a specific location upon approval of the Engineer.

4 Copies of original notes and subsequent readings shall be submitted on an approved form to the Engineer without delay after observations have been made. Any settlement and/or horizontal movement detected shall be reported immediately to the Engineer as shall any cracks, sags, or damage of any nature not noted in the original preconstruction survey. In the event of such movement or damage, the Contractor shall take immediate remedial action, and shall keep the Engineer informed of results.

MATERIALS:

Dry Pack: Dry pack shall consist of one part portland cement, one part mortar sand, and enough water to make the mixture "ball" when squeezed.

Concrete: Concrete for underpinning shall have a minimum 28-day compressive strength of 3,000 psi. Concrete proportioning shall be as indicated in CONNDOT Form 817.

Flowable fill: shall be in conformance with the special provision “Controlled Low Strength Material”.

EQUIPMENT:

Noise: All jack hammers and compressors shall have mufflers to minimize ambient noise.

Excavating Equipment: All excavating equipment shall be OSHA approved for operating within an interior space. All equipment to be utilized shall be reviewed and approved by the Construction Manager prior to commencing any work.

CONSTRUCTION METHODS:

1 CONCRETING

Concrete shall be as specified herein, with 4-inch slump and thoroughly vibrated. Provide three 6-inch deep keyways at joints between adjacent sections of underpinning.

2 UNDERPINNING DESIGN

The complete underpinning design is the responsibility of the contractor. Underpinning shall be designed to support all lateral and surcharge loadings from subsoils and existing structure. The design of the underpinning, including proposed underpinning system, calculations, and design drawings, shall be prepared by a licensed engineer registered in the State of Connecticut. All computations and drawings shall be stamped and submitted for review and approval prior to commencing any work.

3 SEQUENCING

The means and methods of installing the underpinning is the responsibility of the contractor. The underpinning shall be installed in a sequence to insure the adequate support of the existing foundations at all times. If the underpinning work will cause any portion of the existing foundation to become inadequately supported at any intermediate stage, or in instances where existing foundations will become permanently unsupported, the Contractor shall install tiebacks or other suitable systems to support all anticipated loads. Sheet and brace underpinning pits if soil will not stand on a vertical cut during this operation, or as required for safety of workmen. Repack any voids behind sheeting to prevent sloughing which could cause settlement of existing foundations.

4 DEWATERING

The Contractor shall collect seepage or runoff water, which may enter the excavations and divert such water into sumps, from which it shall be pumped into drainage channels or storm sewers. If the seepage causes unstable side or bottom conditions with potential for loss of ground, the Contractor shall install a system to lower the ground water level in the excavations to such elevations that result in obtaining a stable, substantially dry subgrade for the completion of underpinning operations.

5 RESTORATION

Restoration of portions of the structure damaged, removed, or altered by the Contractor in furtherance of his operations shall be restored to the equivalent condition existing prior to the start of work and shall be to the satisfaction of the Engineer.

Method of Measurement:

Measurement of the underpinning shall be on a lump sum basis, complete in place. The Contractor will be required to meet the performance specification outlined herein and provide all testing specified herein.

Basis of Payment:

This work will be paid for at the contract lump sum price for "Underpinning (Site No. X)" which price shall include all materials, tools, equipment and labor for the required work, complete in place and accepted by the Engineer, including: the design, supply, and all submittals including design computations, working plans, drawings, daily reports, contingency plan; on-site control representative to verify and report all installation procedures, and the testing agency performing quality assurance work.

Condition surveys and monitoring of existing facilities for settlements during underpinning activities shall be performed and paid under the items "Condition Survey".

ITEM #0210116A - STONE CHECK DAM

Description: The work shall consist of furnishing, installing, maintaining and removing a stone check dam.

Materials: Materials shall conform to the following sections of Form 817:

Rip Rap: Section M.12.01.4
Crushed stone: Section M.02
Gradations: Section M.01

Construction Methods: Stone check dams shall be placed to the lines and dimensions as detailed on the drawings and as directed. Hand shaping of the inlet side face of the dam may be required. The height of the dam shall be as shown on the construction plans or as directed by the Engineer, minimum height shall be 1 ft. The dam shall extend fully between the sides of the channel and be of constant cross section throughout.

Method of Measurement: This work shall be measured for payment by the actual number of stone check dams constructed complete in place, and accepted, as shown on the construction plans or as directed by the Engineer.

Basis of Payment: This work will be paid at the contract unit price each for "Stone Check Dam", complete in place, which price shall include all materials, equipment, tools, and labor to install, maintain and remove incidental thereto.

Pay Item	Pay Unit
Stone Check Dam	ea.

ITEM #0216012A - CONTROLLED LOW STRENGTH MATERIAL

Description: Controlled Low Strength Material (CLSM) is a self consolidating, rigid setting material to be used in backfills, fills, structural fills and elsewhere as indicated on the plans, or as directed by the Engineer. The flow and set time characteristics of CLSM shall be designed to meet the specific job conditions. All CLSM material covered by this specification shall be designed to be hand excavatable at any time after placement. It shall be composed of a mixture of portland cement, aggregate, and water with the option of using fly ash, slag cement, air-entraining agents, and other approved admixtures.

Materials: All materials utilized in the CLSM mix design shall be in accordance with the applicable requirements of Article M.03.01

Composition: The composition of the CLSM shall be in accordance with the requirements set forth in Article M.03.01-General Composition of Concrete Mixes, as well as the applicable sections of ACI 229R. The Contractor shall submit each proposed mix design, with all supporting data, to the Engineer for review and approval at least two weeks prior to its use.

The setting time of CLSM materials shall be designed so as to achieve the strength necessary to comply with the time constraints called for under the Maintenance and Protection of Traffic requirements of the project specifications. The use of chloride accelerators is not permitted.

The minimum compressive strength of the CLSM material shall be 30 pounds per square inch (psi) and the maximum compressive strength of the CLSM shall be 150 pounds per square inch (psi) when tested in accordance with ASTM D4832 after 56 days.

The CLSM mix design shall utilize a nominal maximum size of No. 8 aggregate as specified in M.01.01.

CLSM mixes shall have a minimum of 20% entrained air when tested in accordance with AASHTO T152.

Construction Methods: CLSM shall only be placed when the ambient temperature is at least 32° F and rising. CLSM material shall be deposited within 2 hours of initial mixing.

CLSM may be placed by chutes, conveyors, buckets or pumps depending upon the application and accessibility of the site. Should voids or cavities remain after the placement of the CLSM, the Contractor shall modify the placement method or flow characteristics of the CLSM. Voids or cavities which have not been filled properly shall be corrected as directed by the Engineer and at the Contractor's expense.

Method of Measurement: This work will be measured for payment by the actual number of cubic yards of "Controlled Low Strength Material installed and accepted within the pay limits shown on the contract plans or as directed by the Engineer.

Basis of Payment: This work will be paid at the contract unit price per cubic yard "Controlled Low Strength Material," which price shall include all materials, equipment, tools and labor incidental thereto.

ITEM #0219011A - SEDIMENTATION CONTROL AT CATCH BASIN

Description

This work shall consist of furnishing, installing, cleaning, maintaining, replacing, and removing sedimentation control at catch basins at the locations and as shown on plans and as directed by the engineer.

Materials

Sack shall be manufactured from a specially designed woven polypropylene geotextile sewn by a double needle machine, using a high strength nylon thread. Sack shall be manufactured by one of the following or an approved equal:

Siltsack®
SI Geosolutions:
www.sigeosolutions.com
(800)621-0444

Dandy Sack™
Dandy Products Inc.
P.O. Box 1980
Westerville, Ohio 43086
Phone: 800-591-2284
Fax: 740-881-2791
Email: dlc@dandyproducts.com
Website: www.dandyproducts.com

FLeXstorm Inlet Filters
Inlet & Pipe Protection
24137 W. 111th St - Unit A
Naperville, IL 60564
Telephone: (866) 287-8655
Fax: (630) 355-3477

The sack will be manufactured to fit the opening of the catch basin or drop inlet. Sack will have the following features: two dump straps attached at the bottom to facilitate the emptying of sack and lifting loops as an integral part of the system to be used to lift sack from the basin. The sack shall have a restraint cord approximately halfway up the sack to keep the sides away from the catch basin walls, this cord is also a visual means of indicating when the sack should be emptied. Once the strap is covered with sediment, the sack should be emptied, cleaned and placed back into the basin.

Construction Methods

Installation, removal, and maintenance shall be per manufacturer instructions and recommendations.

Method of Measurement

Sedimentation Control at Catch Basin will be measured as each installed, maintained, accepted, and removed. There will be no separate measurement for maintenance or replacement associated with this item.

Basis of Payment

"Sedimentation Control at Catch Basin" will be paid for at the contract unit price each complete in place and accepted, which price shall include all maintenance throughout construction, materials, equipment, tools, and labor incidental thereto.

Pay Item	Pay Unit
Sedimentation Control at Catch Basin	EA

ITEM #0401152A - CONCRETE PAVEMENT REPLACEMENT FOR ROADWAY (FULL-DEPTH)

Description: This work shall consist of replacing full-depth concrete pavement at locations shown on the plans or as designated by the Engineer.

Materials: The materials for this work shall meet the requirements for Pavement Concrete under Section M.03. Reinforcing steel shall be as specified in Section M.06.01.

The Contractor shall submit the following Portland cement concrete mix designs to the Engineer for approval:

Mix I: For use when the ambient air temperature is 65 degrees F or higher and where there is unrestricted cure time. The required air content is 6-1/2 +/- 1-1/2 percent.

Mix II: For use when the ambient air temperature is 65 degrees F or higher and where there is restricted cure time. If used, accelerating admixtures shall be non-chloride, and shall conform to AASHTO M194. The required air content is 6-1/2 ± 1-1/2 percent. The minimum compressive strength at 6 hours is 1800 psi.

Mix III: For use when the ambient air temperature at the time of placement falls between the range of 30 to 65 degrees F. The required air content is 6-1/2 ± 1-1/2 percent. The minimum compressive strength at 6 hours is 1800 psi.

Mix IV: For use when reinforcement spacing or other space limitations require aggregate sizes to be adjusted. This mix must exclusively include Type III cement at a minimum of 850 lbs. per cubic yard of concrete. In addition, this mix shall meet the requirements of Section 18, "Cold Weather Concreting," of the Construction Methods. The required air content is 6-1/2 +/- 1-1/2 percent. The minimum compressive strength at 6 hours is 1800 psi.

The mix design submittals must include 6-hour compressive test results of trial mixes or project numbers and results where previously used.

Mix designs must be submitted at least 30 days prior to the start of the work.

Insulating material shall conform to the requirements of ASTM C578.

Expansion joint material shall conform to AASHTO M153, Type 2.

Bond breaking material for the dowel shall consist of Paraffin wax, lithium grease, or other semi-solid, inert lubricant.

Retention disks shall be no larger than twice the diameter of the dowel bar, made of plastic and shall fit the dowel tightly enough to stay secure up against the cut face of the concrete slab so that no chemical anchoring material can leak from the drilled dowel holes.

Chemical anchoring material shall conform to Type VIII epoxy bonding compound meeting the requirements of ASTM D1763.

All dowel bars, dowel bar basket assemblies, and tie bars shall conform to the most current requirements of Section M.06.01.

Construction Methods:

Construction Methods not specifically covered in this specification shall conform to Section 4.01.03.

1. INSPECTION OF THE CONCRETE SLABS:

Before any existing concrete is removed, the Engineer will perform an inspection of the concrete slabs or of the asphalt pavement overlaying the concrete slabs and designate areas where concrete removal is required. The lateral limits of each area to be removed and replaced will be marked by the Engineer. The minimum length of the patch will be 6 feet, and the patch width will be the full width of the existing slab to be patched.

2. SAWING OF THE CONCRETE PAVEMENT:

The existing pavement to be removed shall be sawed full-depth along the transverse and longitudinal boundaries designated by the Engineer.

The equipment shall be capable of sawing neat vertical faces along the patch boundaries. Saw cuts with a toothed wheel saw blade shall **ONLY** be permitted inside the patch boundaries to facilitate the concrete removal operation. In this case, however, a minimum 3-inch clearance must be maintained between the internal cuts and the boundaries of the patch. If the Contractor over saws with a toothed wheel into the adjacent concrete slabs, then the Contractor shall replace said slabs at no cost to the State.

Over sawing into the adjacent slabs or shoulders to ensure that full-depth cuts have been achieved in the corners shall be minimized. All over sawed areas shall be thoroughly cleaned and filled with approved crack sealant.

The sawing operation may be performed in advance of the concrete-removal operation. However, it shall be limited to a distance not to exceed the amount of patching that can be completed during the next five (5) working days. This distance shall be determined by the Engineer, based on past performance of the Contractor.

3. REMOVAL OF DETERIORATED CONCRETE:

Concrete slab removal shall be limited to the amount of pavement that can be removed and replaced during the allowable work shift. All deteriorated concrete shall be removed within the limits marked or where designated by the Engineer.

The concrete slabs shall be lifted out by means of chains, lift-pins, or other approved devices. In-place breaking of concrete shall not be permitted. During the removal operation, utmost care shall be exercised to minimize disturbance and damage to the subbase, adjacent pavement, or bituminous shoulder. Any areas damaged during either the concrete sawing or removal operations shall be repaired by extending the patch boundary. These repairs shall be made under the direction of the Engineer, at no cost to the State.

4. BITUMINOUS CONCRETE REMOVAL:

Where existing bituminous material is to be replaced with concrete, the adjacent concrete pavement shall be cut full-depth, to provide a fresh cut face, and removed. Utmost care shall be exercised to minimize disturbance and damage to the subbase, adjacent pavement, or bituminous shoulder. Adjacent concrete edges shall be cleaned and exhibit a vertical face. Unacceptable concrete surfaces shall be re-cut as directed by the Engineer.

5. SUBBASE/SUBGRADE PREPARATION:

After the concrete and/or bituminous concrete have been removed, all disturbed or loose subbase/subgrade material shall be raked back into place and compacted with a small plate compactor. Any significant loss of granular base material during the removal of any deteriorated pavement shall be replaced with Processed Aggregate Base and compacted with a plate compactor at no extra cost. Protection of the subbase/subgrade following the concrete removal shall be the responsibility of the Contractor and no additional payment will be allowed for repairs or replacement of the disturbed or lost subbase/subgrade.

When, in the opinion of the Engineer, the subbase/subgrade is in a saturated condition or not suitable for concrete placement, the Contractor shall be required to excavate an additional depth as designated by the Engineer. Subbase replacement material shall meet the requirements for Processed Aggregate Base in accordance with Section M.05. Construction methods for this material shall be in accordance with Section 3.04.03. The Engineer may also require that the Contractor install underdrains in accordance with Section 7.51. Any excavation and replacement of unsuitable granular base materials or installation of underdrain will be paid for separately.

6. HOLE DRILLING REQUIREMENTS:

The face of the existing concrete pavement shall be drilled for insertion of the smooth epoxy coated steel bars as shown and specified on the Contract drawings. The use of hand held drills shall not be permitted. The holes shall be drilled with a drilling machine meeting the following requirements:

a. The machine shall produce holes such that each individual dowel's longitudinal axis is aligned parallel to the longitudinal axis of the pavement slabs.

b. The forward and reverse travel of the drills shall be controlled by mechanically applied pressure. The drills shall be equipped with tungsten carbide bits. Drill guide bushings will be required to prevent eccentricity of the drilled holes.

c. The drill and the pressure mechanism shall be matched to drill the holes for the dowels in 30 seconds or less.

d. The drills, pressure mechanisms, guide bushings, centralizer collars, and drill feeds shall be gang mounted and shall consist of not less than three (3) independently powered and driven drills. The drill feeds shall be constructed such that all drill bits shall be parallel to one another. Each drill bit shall pass through a centralizer collar which shall be replaced as wear demands. The driven drill bits shall impart a pressure against the face of the concrete not to exceed 40 psi.

The drilling machine shall be mounted on a tractor or other suitable piece of equipment so that it can be easily transported and quickly positioned at each repair location. The drilling machine shall be approved by the Engineer prior to actual use.

The holes shall be drilled deep enough to accommodate the half the specified length of the dowel (plus cap if used). The diameter of the hole shall be 1/12 inch greater than the diameter of the specified dowel diameter. When in the opinion of the Engineer drill wear is such that the hole diameter exceeds the diameter of the dowel bar by 1/8 inch, the Contractor shall replace the drill bits and/or guides. The holes and face of the existing concrete shall be cleaned with compressed air after drilling is complete.

Any tie bars installed shall follow the same general hole drilling requirements above except that the holes will be drilled to accommodate No. 4 epoxy coated deformed tie bars, 30 inches long.

7. DOWEL BAR INSTALLATION:

Dowel bars shall be No. 9 epoxy coated steel bars and shall be used in all fixed transverse joints. All dowel bars shall be 18 inches long, and embedded 9 inches into the adjacent slabs.

Chemical anchor material shall be used to secure the dowel bars in place as shown on the Contract drawings. Chemical anchor material shall be placed by using a flexible long-nose tube that injects the material into the back of the hole in accordance with the manufacturer's recommendations.

Under no circumstances will the practice of dipping the dowel bars in the chemical anchorage material be permitted.

The bar shall be inserted into the hole while being rotated at least 1 complete revolution so that the material in the bottom of the hole is forced up and around the bar. A retention disk shall be placed

on the leading end of the bar before it is inserted into the hole so that as the bar is inserted and rotated, only the excess chemical anchorage material is allowed to escape. The space around the bar shall be completely filled with chemical anchorage material and shall be free of voids.

Retention disks shall be polymeric material or aluminum with a non-reactive flexible gasket material and shall be approved for use by the Engineer. The design and installation of the retention disk shall be such that there will be no metal to metal contact between the retention disk and the dowel bars.

The exposed end of the dowel bar that will be encased in the new poured concrete shall be greased with an approved bond breaker, as specified, to prevent the newly poured concrete from bonding to the smooth dowel bar.

Any tie bars installed shall No. 4 epoxy coated deformed bars embedded 15 inches into the adjacent slab.

8. FORMS FOR SLAB REPLACEMENTS ADJACENT TO SHOULDER:

Forms shall be utilized on the bituminous shoulder side of the patch. In order to accommodate the side forms, the Contractor shall saw cut full-depth and excavate 6 inches beyond the lateral width of the form into the adjacent shoulder. Forms shall extend longitudinally along the existing shoulder pavement a minimum of 1 foot beyond the transverse limits of the patch. The forms shall be secured to prevent movement during concrete placement. After the removal of the form, the excavated portion of the shoulder shall be replaced with the Superpave mix designated on the Project, in accordance with Section 4.06 and shall be true to the line and grade of the new patch and existing shoulder.

9. POLYETHYLENE SHEET:

A 4 mil thick polyethylene sheet, with all-around dimensions of 3 inches less than those of the repair area, shall be secured to the subbase prior to placement of the concrete.

10. CONCRETE PLACEMENT:

Placement for Mixes I and II may commence only when the air temperature is between 65 and 95 degrees F and when the anticipated minimum and maximum temperatures for the 48 hours immediately after placement of concrete shall be between 40 and 95 degrees F.

When the air temperature is below 65 degrees F, or when the anticipated temperature is expected to fall below 40 degrees F within 48 hours of the concrete placement, **ONLY** Mixes III or IV shall be used. When Type III is used, the temperature of the concrete at point of placement shall be between 70°F and 95°F.

Placement of concrete shall not be permitted if the air temperature is, or can be expected to be outside the range specified for that particular mix design. The anticipated minimum and maximum

temperatures shall be based on NOAA reports which the Contractor shall obtain on a daily basis. All temperatures shall be measured in the shade.

Concrete shall not be placed when it is raining or when rain is forecast within 2 hours of placement.

Vibration shall be used to thoroughly consolidate the concrete throughout the entire patch area. Approved spud-type vibrators with head diameters of 2 inches minimum shall be used to consolidate the concrete. Vibrators shall be capable of transmitting 10,000 to 15,000 vibrations per minute. The vibrators shall be held vertically and vibration shall be done full-depth over the entire area in a uniform pattern. Utmost care shall be exercised to ensure that the concrete around the dowel bars and slab edges has been properly consolidated.

11. JOINTS:

Unless otherwise specified or dictated by the Engineer, if an existing transverse contraction or expansion joint falls within the limits of a patch, the contraction or expansion joint shall be replaced with a joint of the same type, as shown on the Contract drawings. If it is determined by the Engineer that an existing contraction joint or previously placed full-depth bituminous patch is experiencing expansion, the full-depth repair shall be done with the specified expansion joint. Unless otherwise specified or dictated by the Engineer, all mid-slab repairs shall be replaced with the specified transverse contraction joint. Longitudinal tie bars will only be replaced, as specified, when the patch is the full length of an entire slab or greater. Patches less than a full slab length shall not be required to replace the tie bars. **Payment for the expansion, contraction or longitudinal joints will be included in the cost of the work.**

Finished joints shall not deviate more than 1/4 inch in the horizontal alignment.

If repairs 12 feet or greater are performed, the Contractor may establish a "dummy joint" in the middle of the patch to control shrinkage cracking. The dummy joint may be formed by tooling or saw cutting, as specified. More than one dummy joint may be established as long as it is at least 6 feet from any other transverse joint or dummy joint. The Contractor shall determine the use of dummy joints and inform the Engineer of the intent to use them prior to performing the patch work.

For full slab length replacements, a full dowel basket joint assembly shall be installed in the middle of the replaced slab to create an additional transverse joint. Transverse contraction joints shall create a plane of weakness by forming or cutting grooves in the surface of the pavement as specified on the plans. Formed grooves shall be made by depressing an approved tool or device into the plastic concrete. The tool or device shall remain in-place until the concrete has attained its initial set and shall then be removed without disturbing the adjacent concrete. Sawed contraction joints shall be created by sawing grooves in the surface of the pavements of the dimensions shown on the plans with an approved concrete saw. If sawing of the joint is performed it shall commence as soon as the concrete has hardened sufficiently to permit sawing without excessive raveling, usually 4 to 24 hours. All transverse contraction joints constructed using full dowel basket assemblies shall be tooled or sawed before uncontrolled shrinkage cracking takes place. If a transverse expansion joint is installed it shall be installed as specified.

If a new transverse joint with a dowel bar assembly is established in the middle of a full slab repair, dummy joints may still be installed following the criteria stated above.

12. FINISHING:

After the concrete has been placed to a level slightly above the existing pavement surface, a vibrating plate or screed shall be drawn over the surface at a uniform speed, without stopping, in order to strike-off the patch surface even with the adjacent pavement surface. The patch shall then be floated to a smooth finish. The type of screed or plate shall be approved by the Engineer.

No additional water shall be used to facilitate the finishing of the patch surface. Finishing operations shall be completed before initial set takes place. Patches less than 10 feet long shall be screeded parallel to the centerline. Patches greater than 10 feet long shall be screeded perpendicular to the centerline.

When placed adjacent to pavement with no deformations, the surface of the patch shall not vary more than 1/4 inch in a distance of 10 feet when a 10-foot-long straightedge is placed on the surface at any angle. Sags or depressions in the surface of the patch area that exceed the 1/4-inch tolerance shall be repaired at the expense of the Contractor. Upward deviations in the hardened patch surface shall be ground down by approved machinery or replaced, at the expense of the Contractor, as directed by the Engineer. When placed adjacent to pavement with deformations, the surface of the patch shall be finished to best blend or match the grade and shape of the adjacent deformed pavement.

13. CURING:

As soon as initial set of the concrete has occurred in Mixes I and II, curing mediums shall be applied. Initial set is defined as having occurred when no cement paste is lifted from the repair when the surface is lightly rubbed with the fingers of one's hand. If asphalt pavement is to be placed on the repaired concrete area, spray on, liquid curing, or any curing compound that may interfere with the asphalt overlay bonding to the repaired concrete cannot be used.

Mix I Curing: If liquid curing compounds can be used they shall conform to Section 4.01.03-B7a. If liquid curing compounds cannot be used, a sheet of 4 mil polyethylene shall be placed and secured over the repair area. When the ambient temperature is anticipated to fall below 50 degrees F, insulation curing material, as described below, shall be utilized.

Mix II Curing: If liquid curing compounds can be used they shall conform to Section 4.01.03-B7a. In addition, a sheet of 4 mil polyethylene shall be placed over the repair area, in conjunction with insulating curing material. This insulating material shall be a minimum of 2 inch thick. It shall have a minimum certified R value of ten (10). The insulating material shall extend at least 12 inches beyond the limits of the repair area, and shall be kept in intimate contact with the pavement surrounding the patch area to prevent wind intrusion beneath. It shall be weighted down with sand

bags weighing a minimum of 15 pounds each. The sand bags shall be placed a minimum of 2 feet on center around the patch area.

Mix III Curing: Curing shall be in accordance with the manufacturer's recommendations with the following restrictions: When asphalt is specified to be placed on the repaired concrete no curing methods or materials that may interfere with the bonding of the asphalt to the repaired concrete shall be used.

Mix IV Curing: The curing methods for this mix shall be the same as for Mix II, with the exception that liquid curing compound shall not be used. Any variations to this prescribed method of curing shall be approved in writing by the Engineer prior to its use.

14. INSPECTION:

Any pavement defects or shrinkage cracks resulting from improper placement or curing methods shall be repaired, or the patch replaced, by the Contractor at no cost to the State.

15. TESTING:

The Contractor shall make test cylinders under the supervision of a representative of the Department. The dimensions, type of cylinder mold and number of cylinders will be specified by the Engineer.

A portable compression testing machine shall be provided by the Contractor and available on site for cylinder testing. All testing and equipment shall conform to ASTM C39. NOTE: This compression machine must be calibrated in accordance with the provisions of Section 5, ASTM C39.

16. TIME SCHEDULE:

Traffic will be allowed on areas of the roadway where the Contractor has placed and finished the full-depth patches (with bituminous cover if required), after the attainment of 1,800 psi compressive strength.

If the concrete has not attained the above compressive strength requirements within 6 hours, the Contractor shall remove and replace the concrete patch, including any additional saw cutting, drilling and bar installation at its own expense during the next scheduled work shift.

If replacement operations are not completed within the given traffic lane closure time period, then the Contractor shall provide at its own expense, a full-depth bituminous concrete patch, or a temporary precast concrete platform, to allow full traffic operations over these areas. Steel plates may be used in lieu of bituminous concrete to span excavations that are 10 feet long or less and if vehicle speed limits do not exceed 25 miles per hour. These plates shall be secured to the existing slabs to prevent movement, as directed by the Engineer. Bituminous concrete shall be placed to provide a taper before and after the steel plates.

The plate, platform or bituminous patch shall be removed and all work shall be completed on the patch during the next scheduled work shift. Installation and removal shall be done as directed by and to the satisfaction of the Engineer.

17. TEMPORARY CONCRETE PLATFORMS:

Temporary Concrete Platforms may be used to allow full traffic operations (as outlined above), or to enhance the production schedule.

18. COLD WEATHER CONCRETING:

When Mix IV is utilized for cold weather concreting as described herein, the following additional requirements shall apply:

a. The polyethylene sheeting referred to under Section 10 shall be eliminated.

b. During cold weather, only those chemical anchoring materials whose cure time is not affected by cold temperatures shall be used.

c. Just prior to the placement of the Mix IV concrete, the subbase and surrounding patch interfaces shall be thoroughly wetted with hot water having a minimum temperature of 175 degrees F. This wetting shall be continued until these interfaces are substantially heated, but in no case shall the residual ponding of water be allowed to occur within the patch area. The method of wetting the patch area shall be approved by the Engineer prior to its use.

Immediately after the wetting operation is concluded, the Mix IV concrete shall be placed into the patch area. Due to the fact that rapid wetting, material placement, consolidation and finishing are paramount to the success of this operation, the failure of the Contractor to follow the prescribed, approved methods shall be grounds for the rejection of those materials in place.

Method of Measurement:

This work will be measured for payment by the actual number of cubic yards of concrete placed in acceptable patches.

Expansion, contraction and longitudinal joints will not be measured for payment.

Removal of unsuitable subbase material and replacement with Processed Aggregate Base will be measured separately, as directed by the Engineer.

Installation of underdrain will be measured on the basis of linear feet of underdrain installed as directed by the Engineer.

Patching of the shoulder pavement that was removed to install the side forms will be measured based on the number of tons of the designated Superpave mix used, compacted and accepted by the Engineer.

If the existing roadway is composite pavement (bituminous over concrete), any bituminous concrete placed on the repaired concrete pavement will be measured under the appropriate Superpave item as specified in Section 4.06. Material for Tack Coat will be measured as outlined in Section 4.06.04-5.

Basis of Payment:

This work will be paid for at the Contract unit price per cubic yard of "Concrete Pavement Replacement for Roadway (Full-Depth)," complete in place which shall include removal and disposal of all materials including but not limited to deteriorated concrete, bituminous pavement, steel reinforcement, and transverse joints. The price shall also include any required sawing of concrete and bituminous pavement, preparation of the patch area, furnishing, placement, finishing and curing of the concrete, subbase preparation, all drilling, furnishing and installation of the dowel bars, retention disks, steel reinforcement, Transverse Expansion Joints, Transverse Contraction Joints, re-establishment of longitudinal tie bars, insulating material, 4 mil polyethylene sheets, chemical anchoring material, and all tools and materials incidental thereto. The cost of furnishing, installing, and removal of temporary Concrete Platforms shall also be included.

No direct payment will be made for the concrete testing equipment, the instruction in its use, in-situ testing, the concrete in or curing of the required cylinders as specified hereinbefore, but the cost of this work shall be considered included in the general cost of the work.

Removal of unsuitable subbase material will be paid for at the Contract unit price per cubic yard for "Earth Excavation."

Replacement of unsuitable subbase material will be paid for at the Contract unit price per cubic yard for "Processed Aggregate Base."

Installation of subgrade drains will be paid for at the Contract unit price per linear foot for "Underdrain."

Patching of the shoulder to facilitate placement of the side forms will be paid for at the Contract unit price per ton for the Superpave mix designated on the Project.

If the existing roadway is composite pavement (bituminous over concrete), any replacement of the bituminous directly above the new concrete patch will be paid for at the Contract unit price per ton for the Superpave mix designated on the Project. Material for tack coat will be paid for at the Contract unit price per gallon for "Material for Tack Coat."

Pay Item	Pay Unit
Concrete Pavement Replacement for Roadway (Full-Depth)	c.y.

ITEM #0401154A - CONCRETE PAVEMENT UNDERSEALING

Description:
The work under this item shall consist of pressure insertion of flowable, high-density polyurethane material beneath the concrete pavement slabs where indicated on the plans, verified in the field and as ordered by the Engineer. The intent of this procedure is to fill voids directly beneath the slab for the purpose of slab stabilization. The Contractor shall verify void locations and determine the completeness of void repairs by performing Ground Penetrating Radar (GPR) before and after the operation.

Materials:
The material shall be a high density polyurethane. The Contractor shall submit material certifications in conformance with Section 1.06. The high density polyurethane material shall reach 90% of full compressive strength within 15 minutes of being injected. The high density polyurethane shall exhibit the following physical characteristics and properties:

PROPERTY	TEST	RESULTS
Density (pcf)	ASTM D-1622	5.65 – 5.90
Compressive Strength (psi)	ASTM D-1621	65 – 95
Tensile Core (psi)	ASTM D-1623	70 – 100
Shear Strength (psi)	ASTM C-273	40 – 85
Closed Cell Content %	ASTM D-2858	85 – 95
K-Factor (BTU in/hr ft^2)	ASTM C-518	0.130 – 0.140
Percent Volume Change	ASTM D-2126	
Humid Age-28 Days (158^{o}F, 95% Humidity)		+5.0 to +11.0
Freeze-5 Days (-20^o F, Dry)		-0.1 to –0.9

Construction Methods:
After performing the GPR field verification operations, the Contractor shall submit a working drawing that will identify materials and methods for stabilization operations, hole pattern spacing, hole diameter and depth, all equipment necessary for the operation, quantity control to monitor potential losses, environmental monitoring plan, proof testing for refusal and slab grade control. The Contractor shall monitor and measure slab movements during injection to keep slab elevations stable. The working drawing submittal shall also include the Contractor's experience performing high density polyurethane injection for concrete slab repairs.

Traffic shall remain off slabs for a period equal to initial set time plus one hour, or as per manufacturer's recommendations, whichever is longer. When adjacent travel lanes are scheduled for stabilization, the work shall be performed within twenty-four hours to ensure uniform slab support.

Twenty-four (24) to forty-eight (48) hours after stabilization, the Contractor shall test the stabilized slabs using GPR to check the effectiveness of the injection operation. Any areas

deemed to be insufficiently filled, shall be reinjected and another GPR test run will be performed.

Method of Measurement: This work will be measured by the number of square feet of concrete pavement undersealing measured at the top of slab area determined by 3 feet on the outside of the hole pattern as accepted by the Engineer. Overlapping areas will be measured only once for payment.

Basis of Payment: This work will be paid for at the Contract unit price per square feett for "Concrete Pavement Undersealing" which price shall include all mobilization, pre-injection GPR verification, submittal of working drawings and injection plan, furnishing and installation of materials, equipment, tools, and labor incidental thereto. The cost will also include GPR testing to verify void locations and sufficiency of void repairs. No payment will be made to remobilize if verification tests reveal insufficient filling beneath the slabs. No additional payment will be made for mobilization and GPR tests as a result of insufficient filling of voids, but the cost will be included in the bid price of the work.

Pay Item	Pay Unit
Concrete Pavement Undersealing	s.f.

ITEM #0404100A - BITUMINOUS CONCRETE PATCHING – FULL DEPTH

Description: This work shall consist of repairing marked areas of failed flexible (bituminous concrete) pavement as follows:

a) Sawcutting, removal and proper disposal of pavement and granular base,
b) Grading and compacting remaining subbase or subgrade,
c) Furnishing, installation and compaction of processed aggregate base,
d) Application of tack coat on the vertical edges of the patch, and
e) Placement of Hot-Mix Asphalt (HMA), or an equivalent Polymer Modified Asphalt PMA, at the same thickness as surrounding pavement, (minimum 6 inches), and as shown on the plans.

Materials: Materials for this work shall consist of the following:

a) Processed Aggregate Base shall meet the requirements of Article M.05.01.
b) HMA S0.5, HMA S0.375 (when requested by the Contractor and approved by the Engineer at least 5 days in advance) shall meet the requirements of Section M.04. An equivalent PMA may be used meeting the requirements of Sections M.04. All HMA, or PMA, shall be Traffic Level 2 unless indicated otherwise on the plans.
c) Tack coat shall meet the requirements of Section M.04.
d) Geotextile, where called for, shall be High Survivability Separation geotextile listed on the Department's Qualified Products List: http://www.ct.gov/dot/LIB/dot/documents/dresearch/conndot_qpl.pdf.

Construction Methods:

Equipment: Equipment for this work shall include pavement cutting, removal, material handling, and compaction equipment to perform all patching operations. Compaction equipment shall include steel-wheeled roller, vibratory plate compactor and jumping jack compactor, capable of compacting granular and HMA, or PMA, materials to specified requirements. The Contractor shall also provide a 10 foot straightedge.

1. The Engineer will mark areas for patching, which will extend a minimum of 1 foot beyond all edges of failed pavement wherever possible. The minimum length and width dimension of any area to be patched shall be 36 inches; the minimum depth shall be 18 inches.
2. Sawcut the existing pavement at the marked areas, excavate and remove all bituminous and granular layers to the depth indicated on the plans.
3. Once the existing bituminous concrete and granular material is removed, grade and compact the remaining subbase or subgrade. A minimum of 4 passes, or coverages, must be made by any one compaction device.
4. Install and compact processed aggregate base in accordance with Article 3.04.03, to the depth shown on the plans (minimum 12 inches).
5. In areas where the subgrade is unstable, geotextile material may be installed prior to

aggregate base installation, as shown on the plans or as directed by the Engineer.

6. The cut sides of the excavated areas shall be wiped or swept clean, tack coat shall be applied covering the entire area of the vertical bituminous concrete faces and allowed to cure.
7. HMA S0.5, or PMA S0.5, shall be placed in lifts between 2" and 3", shall have a final lift thickness placed at 2" and be placed as shown in the plans. HMA S0.375, or PMA S0.375, shall be placed in lifts between 1.5" and 2.5", shall have a final lift thickness placed at 1.5" and be placed as shown in the plans. Pavement placement shall also be in accordance with Subarticle 4.06.03-6. The Contractor shall confirm that the surface elevation of the finished patch matches the elevation of the surrounding pavement surface to within 1/4 inch using the 10 foot straightedge.
8. All excavated materials shall be properly disposed of at the end of the work shift.

Method of Measurement: This work will be measured by the number of square yards of accepted patched areas. Geotextile will be measured by the number of square yards placed.

Basis of Payment: This work will be paid for at the Contract unit price per square yard for "Bituminous Concrete Patching-Full Depth," complete and accepted. The price shall include all tools, materials, labor, and equipment including sawcutting, pavement and granular base excavation, removal and disposal, grading, compacting, Processed Aggregate Base, tack coat application and HMA, or PMA placement. Geotextile will be paid at the Contract unit price per square yard for "Geotextile (Separation – High Survivability)" placed which shall include all tools, materials, labor, and equipment for placement of this item.

Pay Item	Pay Unit
Bituminous Concrete Patching – Full Depth	s.y.
Geotextile (Separation – High Survivability)	s.y.

ITEM #0404101A - BITUMINOUS CONCRETE PATCHING - PARTIAL DEPTH

Description: This work shall consist of sawcutting, removing and properly disposing of deteriorated bituminous concrete pavement. It shall also include removal and proper disposal of deteriorated, spalled, broken, damaged or delaminated Portland Cement Concrete (PCC) pavement base, compaction of granular base, application of tack coat on the PCC base and vertical faces of the sawcut, and placement of bituminous concrete according to the Plans or as directed by the Engineer.

In areas where there is no underlying PCC, the work shall consist of sawcutting, removing and properly disposing of deteriorated bituminous concrete pavement, regrading and recompacting the existing granular base, cleaning and application of tack coat on the vertical faces of the sawcut, and placement of Hot-Mix Asphalt (HMA) or an equivalent Polymer Modified Asphalt (PMA) at the same thickness as surrounding pavement, (maximum 6 inches), and as shown on the plans.

Materials: All materials for this work shall meet the requirements of Section M.04 and shall consist of the following:

- HMA S0.5, HMA S0.375 (when requested by the Contractor and approved by the Engineer at least 5 days in advance) or an equivalent PMA. All HMA, or PMA, shall be Traffic Level 2 unless indicated otherwise on the plans.
- Tack coat

Construction Methods: Equipment for this work shall include pavement cutting, removal, material handling, vacuum, small compaction equipment and a maximum 15 pound jackhammer. The Contractor shall supply a steel crow/pry bar (approximate length - 6 feet) weighing 15-25 lbs. Compressed air equipment (minimum 100 psi) and a 10 foot straightedge shall also be provided.

All equipment used to place and compact the HMA, or PMA, shall meet the requirements of Section 4.06. Due to the nature of this work, the equipment shall be medium and small size to fit excavated areas to be patched. It is also expected that placement of HMA, or PMA, will require hand work or a combination of equipment and hand work methods and tools to achieve the required results.

1. The Engineer will mark out all areas for patching. The minimum length and width dimensions of any given partial depth patch shall be 24 inches. Any area to be patched shall completely encompass the entire distressed pavement area and extend at least 6 inches beyond into the surrounding pavement wherever possible.
2. If it is determined that poor or inadequate granular base is contributing to the distress in the asphalt layers, the Engineer may direct that it be removed and processed aggregate be placed and compacted.
3. Sawcut the bituminous concrete at the marked areas to a maximum depth of 6 inches, but not into the underlying concrete pavement.

4. Remove existing bituminous concrete pavement from within the sawcut.
5. Vacuum the debris and use compressed air to clean the surface of the underlying concrete pavement.
6. The Engineer will sound the PCC pavement with the 6 foot crow bar and delineate area(s) to be patched. The 6 foot crow bar will be dropped by the Engineer (or their designee) from approximately one foot to sound the concrete.
7. Maximum 15 pound hammers shall be used to loosen delineated PCC pavement.
8. Vacuum the debris in combination with other acceptable means to remove all loose materials.
9. If granular base is exposed, it shall be graded and compacted using jumping jack or vibratory plate compactors. A minimum of 4 passes, or coverages, must be made by the compaction device. If existing granular base material is lost during the excavation of the deteriorated pavement, the Contractor shall add material meeting the requirements of Section 3.04. Compaction of the granular base shall meet the density requirements of Section 3.04.
10. The excavated areas shall be cleaned by wiping, sweeping and use of compressed air to the satisfaction of the Engineer.
11. Tack coat shall be applied covering the entire area of the PCC base and the vertical bituminous concrete faces and allowed to break or cure.
12. HMA S0.5, or PMA S0.5, shall be placed in lifts between 2 inches and 3 inches thick, shall have a final lift thickness placed at 2 inches thick and shall be placed as shown in the plans. HMA S0.375, or PMA S0.375, shall be placed in lifts between 1.5 inches and 2.5 inches thick, shall have a final lift thickness placed at 1.5 inches and shall be placed as shown in the plans. Pavement placement shall also be in accordance with Subarticle 4.06.03-6. The Contractor shall confirm that the surface elevation of the finished patch matches the elevation of the surrounding pavement surface to within 1/4 inch using the 10 foot straightedge.
13. All excavated materials shall be properly disposed of at the end of the work shift.

Method of Measurement: This work will be measured by the number of square yards of patched bituminous concrete completed and accepted.

Basis of Payment: This work will be paid for at the Contract unit price per square yard for "Bituminous Concrete Patching - Partial Depth" completed and accepted. The price shall include all tools, materials, labor, and equipment, including sawcutting, pavement removal and disposal, grading and compaction of existing granular base, cleaning, tack coat application, and HMA, or PMA, placement and compaction.

There will be no additional compensation for replacing granular base material lost during the excavation of the deteriorated pavement.

Inadequate or poor granular base foundations that cannot be recompacted as determined by the Engineer will be paid for at the Contract unit price per cubic yard of "Processed Aggregate Base."

Pay Item	Pay Unit
Bituminous Concrete Patching - Partial Depth	s.y.

ITEM #0406125A - BITUMINOUS CONCRETE SURFACE PATCH

Description: This work shall consist of milling out deteriorated bituminous concrete pavement to a depth between 1.5 to 2.5 inches, disposing of pavement millings, sweeping and cleaning, application of tack coat on all surfaces within milled area, and placement of Hot-Mix Asphalt (HMA) or an equivalent Polymer Modified Asphalt (PMA) to match the elevation of the surrounding pavement.

For road sections being milled and paved, all patching operations must be completed after milling is complete and before paving begins. All patching operations shall be completed within one working day following milling and shall be completed before traffic is permitted to resume on the exposed roadway.

Materials: Materials for this work shall consist of the following:

1. HMA S0.375 or an equivalent PMA meeting the requirements of Sections 4.06 and M.04. All HMA, or PMA, shall be Traffic Level 2 unless indicated otherwise on the plans.
2. Tack coat meeting the material requirements in Sections 4.06 and M.04.

Construction Methods:

Equipment for this work shall include, but is not limited to, the following:

1. Milling machine: A milling machine designed and built for milling flexible pavements. It shall be self-propelled with sufficient power, traction, and stability to maintain depth and slope and shall be capable of removing the existing bituminous concrete pavement.

   The milling machine shall be equipped with a built-in automatic grade averaging control system that can control the longitudinal profile and the transverse cross-slope to produce the specified results. The longitudinal controls shall be capable of operating from any longitudinal grade reference, including string line, contact ski (30 feet minimum), non-contact ski (20 feet minimum), or mobile string line (30 feet minimum). The transverse controls shall have an automatic system for controlling cross-slope at a given rate. The Engineer may waive the requirement for automatic grade or slope controls where warranted.

   The rotary drum of the machine shall use carbide tip tools spaced not more than 5/8 inches apart. The forward speed of the milling machine shall be a maximum of 45 feet/minute. The tools on the revolving cutting drum must be continually maintained and shall be replaced as warranted to provide a uniform pavement texture.

   The Contractor may request to perform a test strip to demonstrate that the required surface tolerance can be attained at an increased forward speed. The test strip shall be a maximum length of 500 feet and shall have the same criteria for surface tolerance as specified herein. The final decision for implementing the increased forward speed will be made by the Engineer.

   The machine shall be equipped with an integral pickup and conveying device to immediately remove milled material from the surface of the roadway and discharge the millings into a truck, in one operation. The machine shall also be equipped with a means of effectively limiting the amount of dust escaping from the milling and removal operation. When milling smaller areas or areas where it is impractical to use the above

described equipment, the Contractor may be permitted to use a lesser equipped milling machine, if approved by the Engineer.

In addition, the minimum milling width shall be 20 inches, making the minimum achievable patch size 20 inches by 20 inches, or 0.30 square yards.

2. 10 foot straight edge.
3. Sweeper: A sweeper, equipped with a water tank, capable of remove millings and loose debris.
4. Air compressor: An air compressor capable of producing 100 psi, oil free, compressed air for cleaning the milled pavement surface.
5. Hot air lance: A hot air lance that can deliver 100 psi, oil free heated air to clean and dry the pavement surface. The compressed air emitted from the tip of the lance shall achieve a temperature of at least 1500° F.
6. Paving and compaction equipment: Paving and compaction equipment meeting the requirements of Section 4.06. It is expected that much of the placement will require hand work or a mixture of equipment and hand tools to achieve the required results. Smaller compaction equipment, including vibratory plate compactors, will be allowed by the Engineer to achieve the required results. At all times the Contractor is required to meet the density and compaction and all other requirements specified in Sections 4.06 and M.04.
7. Portable lighting equipment: If the work is performed at night a truck towed light tower and driver shall be provided for use by the Engineer for all marking, installation and inspection of the patches.

The work shall include, but is not limited to, the following:

1. Demarcating: The Engineer will mark out areas for patching and will determine the appropriate milling depth between 1.5 inches and 2.5 inches. The minimum length and width dimension of the patch shall be 20 inches. Any area to be patched shall completely encompass the entire distressed pavement area and extend at least 6 inches beyond into the surrounding pavement wherever possible.
2. Milling: Mill marked out areas to specified depths
3. Sweeping, Cleaning and Drying: Sweep the milled surface clean and allow milled areas to dry. Any moisture in or on the milled areas must be allowed to evaporate or be removed with the assistance of the hot air lance. When the milled area is dry to the satisfaction of the Engineer, it shall be blown clean of any residual dust or debris using compressed air.
4. Applying Tack Coat: Apply tack coat to the entire clean and dry milled area, including the sides/walls of the area to be patched, and in accordance with the requirements of Section 4.06.
5. Placing Patch Material: After the tack coat has had sufficient time to cure or break, HMA S0.375, or equivalent PMA, shall be placed and compacted to the requirements above and in Section 4.06. The Contractor shall confirm that the surface elevation of the finished patch matches the elevation of the surrounding pavement surface to within 1/4 inch using the 10 foot straightedge.

Method of Measurement: This work will be measured by the number of square yards of patched bituminous concrete completed and accepted.

Basis of Payment: This work will be paid for at the Contract unit price per square yard of "Bituminous Concrete Surface Patch." The price shall include all tools, materials, labor and equipment; milling, removing, and disposing of pavement millings; sweeping and cleaning of the milled area; drying the milled area; applying tack coat to the milled area; and placement and compaction of HMA or PMA.

Pay Item	Pay Unit
Bituminous Concrete Surface Patch	s.y.

ITEM #0406127A - BITUMINOUS CONCRETE FULL DEPTH PATCH

Description: This work shall consist of furnishing and installing a temporary bituminous concrete patch for drainage or utility trenches as detailed on the plans or as ordered by the Engineer. The work shall include providing a minimum 6" of Hot Mix Asphalt (HMA) on 18" of Processed Aggregate. The work shall also consist of sweeping and cleaning, application of tack coat on all surfaces within cut area, and placement of Hot-Mix Asphalt (HMA) or an equivalent Polymer Modified Asphalt (PMA) to match the elevation of the surrounding pavement.

Materials: Materials for this work shall consist of the following:

1. HMA S0.5 or an equivalent PMA meeting the requirements of Sections 4.06 and M.04. All HMA, or PMA, shall be Traffic Level 2 unless indicated otherwise on the plans.
2. Tack coat meeting the material requirements in Sections 4.06 and M.04.

Construction Methods: Work under this item shall conform to the requirements of Section 4.06 and M.04.

Method of Measurement: This work will be measured by the number of square yards of patched bituminous concrete completed and accepted.

Basis of Payment: This work will be paid for at the Contract unit price per square yard of "Bituminous Concrete Full Depth Patch." The price shall include all tools, materials, labor and equipment; applying tack coat to adjacent concrete pavement; and placement and compaction of Processed Aggregate, HMA or PMA. Cutting concrete pavement and bituminous concrete pavement, removal of concrete pavement and drainage operations are all covered and paid under the respective items.

Pay Item	Pay Unit
Bituminous Concrete Full Depth Patch	s.y.

ITEM #0406180A - HOT-MIX ASPHALT SMOOTHNESS ADJUSTMENT

Description: The Engineer will evaluate the final pavement surface for smoothness (rideability) to either pay a bonus or assess a penalty based on determination of smoothness of the HMA surface lift. This item will apply to pavement construction included in the project requiring a minimum of two (2) lifts of bituminous concrete (Hot-Mix Asphalt (HMA), Polymer-Modified Asphalt (PMA), or Warm-Mix Asphalt (WMA)) in which the combined total compacted depth of bituminous concrete placed is 3 inches or greater and the surface lift is at least 1.5 inches thick. All provisions and requirements of Section 4.06 Bituminous Concrete apply, unless specifically stated otherwise within this item.

Construction Methods:

Definitions:

Surface Lift: The uppermost lift of bituminous-concrete paving.

Roadway segment: A segment of highway designated to receive pavement rehabilitation that includes paving at least 2 lifts, the combined thickness of which is 3 inches or greater. A roadway segment contains 1 or 2 directions of travel, through lanes in each direction, and any additional shoulder area, paved median area, ramp(s), and/or auxiliary lanes designated to receive paving.

Lane: An area of pavement designated to carry traffic in a given direction.

Measured Lane: A lane subject to a hot-mix asphalt pavement smoothness adjustment as indicated in this item. Ramps, shoulders, and certain other features are excluded from the adjustment as described below.

Tenth Mile Segment: The subset of a measured lane that will be evaluated for smoothness and used as the basis for payment adjustments. Each measured lane shall be divided into tenth (0.1) mile segments. Some tenth mile segments may be less than a full tenth (0.1) mile because of a boundary such as the end of the lane or a bridge without an asphaltic plug joint. Payment adjustments shall be based on the smoothness and tonnage of the surface lift of each tenth (0.1) mile segment.

Lift Pay Thickness (inches): The thickness shown on the plans for the surface lift of the measured lane.

Tenth Mile Segment Pay Area (square yards): The area of the travelway of a tenth (0.1) mile segment as determined from the plans. If striping exists, measurement shall be the area bounded by the lane striping and beginning and ending termini of the tenth (0.1) mile segment. Where a segment's travelway width varies (for example, a low speed lane which narrows as it begins or terminates within the 0.1 mile), the Pay Area shall reflect the actual travelway area.

ARAN: Automatic Road Analyzer: A vehicle operated by the State that collects roadway profile data. It provides IRI data every 16.4 feet for both the right and left wheel paths.

IRI (inches/mile): International Roughness Index, developed by the World Bank to quantify roughness.

ProVAL: Free FHWA sponsored software that is used to analyze road roughness.

Average IRI (MRI) (inches/mile): The average of the right and left wheelpath IRIs for a tenth mile (528 foot) segment as computed by analyzing ARAN data with ProVAL software.Hot-Mix Asphalt**:** Whenever reference is made to Hot-Mix Asphalt (HMA), the reference shall apply to HMA, PMA, and WMA.

This item will be applied separately to each roadway segment that is included in this Contract and designated to be measured for a Hot-Mix Asphalt smoothness adjustment as indicated in this item. The Engineer will calculate smoothness (as represented by ProVAL MRI) and cost adjustments separately for each tenth mile segment in each measured lane.

Evaluation Methods

Trial Evaluation - Prior to the placement of the surface lift of pavement, the Engineer will furnish the Contractor with IRI values for tenth mile (0.1mile) segments for the right and left wheel paths that result from the Engineer's evaluation of the material placed to date. The actual time of the "trial" evaluation shall be coordinated between the Engineer and the Contractor. The "trial" evaluation shall be limited to 1 test lane in each direction of travel. Final evaluations for payment or penalty will measure all lanes of interest (as described below) in each direction of travel. The trial IRI values will serve as a guide to the Contractor in evaluating the level of conformance with the smoothness specification.

Data Collection and IRI Computation –The final pavement surface will be evaluated for smoothness using a State ARAN vehicle. The ARAN measures the IRI in each wheelpath (right and left) for each lane of travel over the Project. If a State ARAN vehicle is unavailable, the Engineer may substitute another suitable method of obtaining IRI values with a World Bank Class II profiler that allows calculation of smoothness adjustments as indicated in this item.

ProVAL will be used to calculate an MRI value for each tenth (0.1) mile segment.

The evaluation will be subject to the following:

1. Only mainline travel lanes will be evaluated. This will include climbing lanes, operational lanes, and turning roadways that are 0.4 miles (2,112 feet) or greater in length. For smoothness purposes, the length of a climbing lane includes where the lane is at least half of its full normal width. Likewise, the length of an acceleration lane is from the tip of the painted gore of the on ramp to where the lane width diminishes to half of its normal width. These climbing and acceleration lengths determine both whether a lane should be measured for smoothness and the section of the lane that will be measured for smoothness.

2. Data collection will start approximately 100 feet prior to, and end approximately 100 feet after the transverse construction joints at the Project limits. The pay area will be limited to the limits of the paving as defined by the transverse construction joints at the start and end of the Project.

3. Construction joints inside the Project will not be excluded from the area measured for smoothness.
4. Smoothness data and payment adjustments will not be computed for the following Project sections:

    - Ramps
    - Climbing lanes, operational lanes, acceleration lanes, deceleration lanes, and turning roadways less than 0.4 miles (2,112 feet) in length
    - Shoulders and gore areas

Pavement on horizontal curves which have a 900 foot or less centerline radius of curvature, and pavement within the super-elevation transition of these curves

5. Bridge decks will be included if they are paved as part of the Project, have 2 lifts totaling 3 inches of HMA, and have an asphaltic plug or similar product for bridge joints. Structures with exposed concrete, elastomeric concrete or steel joint systems will be excluded.

6. Transition sections of varying thickness of pavement (created by milling or paving) leading into or away from pavement changes such as bridge decks or underpasses or Project end points will be excluded if the deck or underpass is excluded. A length of 50 feet on either end of a transition will be excluded from measurement of IRI, but not from payment of an adjustment. The 50 foot length will have the same payment adjustment as the immediately adjacent tenth (0.1) mile section.

7. If a deck or underpass is excluded and there is no transition section adjoining it, then a length of 50 feet before and after the deck or underpass will be excluded for measurement, but included for payment similar to 6 above.

8. Data will be collected within 30 days of the completion of the entire surface lift of pavement, or within 30 days of the completion of any corrective work on the pavement. The Contractor, at its own expense, will be allowed to correct any areas prior to the collection of data. The Contractor shall notify the Engineer in writing of its intent to do so along with a proposed schedule for corrective work that includes an anticipated date that data collection can be performed. The completion of the entire final lift of pavement or any corrective work includes, but is not limited to, all associated work such as pavement markings, sawing and sealing of joints, and installation of bridge asphaltic plug joints.

   To minimize the number of times the ARAN van is needed, all final surface lift paving in both directions of travel must be completed before calling on the ARAN van to measure the smoothness. However, if final surface lift paving extends beyond a single paving season, then the ARAN van shall be used to measure the final surface lifts completed each paving season.

9. No testing will be conducted during rain or under other conditions deemed unacceptable by the Engineer. During testing, the roadway must be free of moisture and other deleterious materials which might affect the evaluation. Any work associated with preparing the roadway for the evaluation (for example, sweeping), will not be measured for payment.

10. The option on the State ARANs to apply the 250 mm (10 inch) filter, which represents the footprint length of a typical tire, will be NOT be selected, because a similar 12 inch filter is already pre-applied by the ARAN van when the data is collected.

11. Measurements and locations are understood to have an accuracy limited to what can be attained by reviewing data and photos collected by the ARAN van. The Department will not be required to conduct surveys in addition to the ARAN van measurements.

Method of Measurement: Rideability Adjustments (RA) for pavement smoothness will be

applied to all HMA in the surface lift of all measured lanes in both directions, as specified herein. It will be computed and paid or a penalty will be assessed for each tenth (0.1) mile segment.

Tonnages for payment will be calculated based on the theoretical volume of HMA as determined by the typical sections and distances measured by the ARAN van and assuming a density of 0.0575 tons per SY per inch of HMA thickness. The quantity of bituminous concrete used to determine the RA for each tenth (0.1) mile segment will be calculated by using the equation below:

Segment Tons = HMA Lift Thickness x Tenth Mile Segment Pay Area x 0.0575
(tons) (inches) (s.y.) (tons/s.y.·inch)

Rideability Adjustment (RA) Percent (%) - The RA bonus or penalty and applicable pay factor percentage for each tenth (0.1) mile segment will be determined based on its MRI. Each tenth (0.1) mile segment MRI will be classified into one of the following MRI ranges shown in Table 1 and the applicable pay factor percentage for the segment derived.

Table 1 Rideability Pay Factor Schedule

MRI (inches per mile)	**Pay Factor (%)**	**(RA)**
Less than 50	+10	Bonus
50 to 60	+(60 – AIRI)	Bonus
60 to 80	0	0
80 to 120	1.25 x (80 – AIRI)	Penalty
over 120	- 50	Penalty

Basis of Payment: Bonuses or Penalties will be computed for each tenth (0.1) mile segment. For each segment, the HMA Pay Factor and tonnage of the surface lift will be determined as described above. The adjustment to the Estimated cost will be determined by the following formula:

Smoothness Adjustment = Segment Tons x Pay Factor / 100 x HMA Unit Cost

For example, a 1.06 mile measured lane with surface lift thickness of 2 inches has 11 segments with lengths, average travelway widths, and MRI values as shown in Table 2 below. Assuming a unit cost bid price for HMA of $85 per ton, the smoothness adjustments for each segment would be as shown in Table 2. The unit cost used shall be the Contract bid price ($/ton) for the material used in the surface lift without Asphalt Adjustment Cost applied to it.

Table 2 HMA Smoothness Adjustment Example Calculations

Segment	Length (miles)	Average Width (ft)	Area (SY)	HMA Lift Thick-ness (inch)	HMA Computed Tons (Area x thickness x 0.0575)	MRI (in/ mile)	Pay Factor (%)	Adjust ($) (Tons x Pay Factor /100 x Unit cost)
1	0.1	4	235	2	26.99	72	0	0
2	0.1	9	528	2	60.72	50	10	516
3	0.1	12	704	2	80.96	40	10	688
4	0.1	12	704	2	80.96	90	-12.5	-860
5	0.1	12	704	2	80.96	100	-25	-1720
6	0.1	12	704	2	80.96	50	10	688
7	0.1	12	704	2	80.96	77	0	0
8	0.1	12	704	2	80.96	55	5	344
9	0.1	12	704	2	80.96	55	5	344
10	0.1	8	469	2	53.97	51	9	413
11	0.06	4	141	2	16.19	62	0	0
							Total:	413

For the surface lift in this measured lane, there would be a $413 bonus.

Adjustments for smoothness will not be made for areas the Engineer determines to be defective and require removal and replacement of the HMA.

Pay Item	Pay Unit
Hot Mix Asphalt Smoothness Adjustment	Estimated Cost

ITEM #0406195A - FILLING JOINTS AND CRACKS IN BITUMINOUS CONCRETE PAVEMENT

1. Description: This work consists of furnishing and applying a hot-applied mixture of Performance-Graded (PG) asphalt binder and polyester fibers into bituminous concrete pavement surface cracks, raveled longitudinal joints, and raveled transverse joints. It shall be constructed in accordance with these specifications and in close conformity with the lines, grades, thickness, and typical cross section shown on the plans or established by the Engineer. Filling Joints and Cracks in Bituminous Concrete Pavement may be used in conjunction with other joint and crack treatments including (but not limited to) joint and crack sealing and joint or crack repair (patching), in which case the relative sequence of crack treatments will be prescribed in the plans, Notice to Contractor, or other Contract Documents.

1.1 Definitions and Use of Terminology:

a. Longitudinal joints: Joints formed along the direction of travel (longitudinally) between adjacent paving passes (or by handwork or other means) on the surface lift of a bituminous-concrete pavement structure. This includes joints formed by patching, utility work trenching, widening, new construction, and reconstruction.

b. Transverse joints: Joints formed perpendicular to the direction of travel on the surface lift of a bituminous-concrete pavement structure. This includes joints formed by patching, utility work trenching, widening, new construction, and reconstruction.

c. Longitudinal cracks: Cracks, the endpoints of which are more distant in the direction of roadway travel than across the width of the pavement.

d. Transverse cracks: Cracks, the endpoints of which are at least as distant across the width of the pavement as they are along the direction of travel.

e. Longitudinal joint-reflection cracks in composite pavement: Longitudinal cracks formed atop the underlying longitudinal joint of a Portland-cement-concrete pavement which has been surfaced with bituminous concrete pavement.

f. Raveled longitudinal joints: Defined as longitudinal joints formed between subsequent paver passes (or by handwork or other means) that have lost, due to aging of the pavement surface, at least ½ inch (in depth) of the original pavement surface material placed. This includes joints formed by patching, utility work trenching, widening, new construction, and reconstruction.

g. Raveled transverse joints: Defined as transverse joints formed between paver passes (or by handwork or other means) that have lost, due to aging of the pavement surface, at least ½ inch

(in depth) of the original pavement surface material placed. This includes joints formed by patching, utility work trenching, widening, new construction, and reconstruction.
h. Surface lift of pavement: The thickness of the last lift of pavement placed prior to performing crack sealing. A lift is defined as single bituminous-concrete mixture placed at a defined thickness in a single paver pass (or by handwork.)

i. For purposes of this document, the use of the term/word "crack," including all work specified for "cracks" herein, shall also apply to "raveled longitudinal joints" and "raveled transverse joints," unless otherwise specified. In other words, for example, if this specification specifies that all "cracks" are to be cleaned, then all "raveled longitudinal joints" and all "raveled transverse joints" are to be cleaned in the same way as a "crack." This pertains to all aspects of this document, unless otherwise specified herein.

2. Materials: The hot-applied crack filling material shall be composed of a mixture of Performance Graded Asphalt Binder and polyester fibers blended to provide 4.5 to 5.5 percent polyester fibers by weight. No field mixing of the fibers is allowed. The crack filling material (with fibers) shall be prepackaged and arrive on site ready to be placed in the melter applicator. The materials shall meet the following requirements:

2.a Polyester Fibers.
A General Certification from the manufacturer is required for this material. The polyester fibers must meet the following requirements:

Length: 6.4 mm ± 0.05 mm (0.25 inches ± 2 mils)
Crimps: (ASTM D-3937) None
Tensile Strength, (ASTM D-2256)* 480 MPa (69,600 psi) minimum
Denier, (ASTM D-1577)* 3.0 to 6.0
Specific Gravity 1.32 to 1.40
Melting Temperature 245 ºC (473 ºF) minimum
Ignition Temperature 540 ºC (1000 ºF) minimum
* This data must be obtained prior to cutting the fibers.

2.b Performance Graded (PG) Asphalt binder
The Performance Graded (PG) Asphalt binder shall be Performance Grade 76-22 and shall meet the requirements of AASHTO M-320(M) and AASHTO R-29(M). The Contractor shall submit a Certified Test Report and bill of lading representing each delivery in accordance with AASHTO R-26(M). The Certified Test Report must also indicate the asphalt binder specific gravity at 77°F, rotational viscosity at 275°F and 329°F, and a mixing and compaction viscosity-temperature chart as if the asphalt binder were to be used as binder for the construction of hot-mix asphalt. The blending of PG asphalt binder from different Suppliers is strictly prohibited. Contractors who blend PG asphalt binders will be classified as a Supplier and will be required to certify the asphalt binder in accordance with AASHTO R-26(M).

2.c Optional Filling Barrier Material - Clean, dry sand.

Sand shall conform to the requirements of Standard Specifications Section M.03.01, Fine Aggregate, except that the gradation requirements shall be replaced with the following:

Square Mesh Sieve	Percent Passing By Weight:
No. 8	100
No. 50	10-40
No. 100	0-10
No. 200	0- 3

The contractor must submit to the Engineer all Material Safety Data Sheet documents from the material manufacturer(s) prior to the commencement of work. During work progress, the contractor must submit to the Engineer the manufacturer's certificate of testing for compliance to applicable specifications for each batch or lot of material utilized on the contract.

3. Equipment: The equipment used by the contractor shall include, but be not limited to, one or more of each of the following:

(1) Melter Applicator: The unit shall consist of a boiler kettle equipped with pressure pump, hose, and applicator wand; the boiler kettle may be a combination melter and pressurized applicator of a double-boiler type with space between the inner and outer shells filled with heat transfer oil. Heat transfer oil shall have a flash point of not less than 600°F. The kettle shall include a temperature control indicator and a mechanical agitator. The kettle shall be capable of maintaining the treatment material at the manufacturer's specified application temperature range. The kettle shall include an insulated applicator hose and application wand. The hose shall be equipped with a shutoff control. The kettle shall include a mechanical fullsweep agitator to provide continuous blending. The unit shall be equipped with thermometers to monitor the material temperature and the heating oil temperature. The unit shall be equipped with thermostatic controls that allow the operator to regulate material temperature up to at least 425 °F.

(2) Application Wand and Squeegee Applicator: The material shall be applied with a wand followed by a squeegee applicator. The squeegee applicator shall be of commercial/industrial quality designed with a "U" shaped configuration. It shall be of a size adequate to strike off, flush with the surrounding pavement surface and without overflow around the sides, all hot joint and crack filler placed to fill joints and cracks. This tool shall be either attached to the applicator wand or used separately as its own long handled tool.

(3) Hot Air Lance: The unit shall be designed for cleaning and drying the pavement surface cracks. Minimum compressed air capacity shall be 100 psi. The compressed air emitted from the tip of the lance shall be flame free and be capable of achieving a temperature of at least 1500°F.

4. Construction Methods: The crack filling operation shall proceed in accordance with the requirements of the "Maintenance and Protection of Traffic" and "Prosecution and Progress" specifications.

(1) Weather Requirements: Work will not be performed unless the pavement is dry. No frost, snow, ice or standing water may be present on the roadway surface or within the cracks. No work shall be done if the ambient temperature is below 40º F during the field application operations.

(2) Material Mixing Procedure: The prepackaged material shall be added to the melter applicator. It shall then be heated and mixed/circulated to the recommended application temperature. The crack fill material shall never exceed 400 °F.

(3) Cracks and Raveled Longitudinal and Transverse Joints to be Filled: The width and depth requirements for "cracks" and "raveled longitudinal and raveled transverse joints" to be sealed is not the same. The requirements for cracks and raveled joints is stated below.

All crack and raveled joint width determinations shall be made by measuring the pavement crack or joint width flush at the surface of the pavement to be filled. A straightedge shall be used whenever necessary to establish the location or limits of the "flush" surface of the pavement. Note: The width determinations made to identify joints and cracks to be filled may not be the same as the finished width after placement of the filler material. The act of striking off all filler placed may cause the finished appearance of a filled joint or crack to be wider that what was initially measured. This final width is not the width to be used to determine whether a crack or joint should be filled under this specification. It is the width measured before placement of any filler that is to be used to determine the appropriate widths of cracks and joints to be filled.

All pavement surface cracks from $^1/_8$ inches in width up to 1.5 inches in width shall be prepared and filled as stated below. Cracks that are between $^1/_8$ of an inch and 1.5 inches, but eventually taper in width below the minimum $^1/_8$ of an inch, shall also be prepared as stated below. Only cracks that are less than $^1/_8$ of an inch throughout their entire length shall be excluded.

Transverse cracks, where a portion of the crack (50 percent or less) exceeds a width of 1.5 inches, up to 2 inches, shall also be prepared and filled as stated below.

All raveled longitudinal and raveled transverse joints to be sealed shall be raveled, or have a loss of aggregate, of at least ½ inch in depth at the joint's deepest point. The minimum width of a raveled joint must be ½ inches. The maximum width of the raveled joint to be sealed is 3 inches. Any raveled joints exceeding the width and depth requirements specified above should be repaired or patched by some other method.

(4) Crack and Raveled Longitudinal and Transverse Joint Preparation: Pavement surface cracks, raveled longitudinal joints, and raveled transverse joints to be filled shall be treated with a hot-air lance prior to application of the crack seal material. Two passes, minimum, shall be made with the hot-air lance. The hot air lance operation shall proceed at a rate no greater than 120 feet per minute. There shall be no more than 10 minutes time lapse between the second hot-air lance treatment and the material application. Should this time be exceeded the Contractor shall make an additional pass(es) with the hot air lance. The use of the hot air lance is not intended to heat the crack. It is to be used to blow all debris from the crack to the depths specified below and to remove any latent moisture or dampness from inside the crack until the inside of the crack is completely dry in the opinion of the Engineer. "Moisture" does not include standing water. The hot air lance is not to be used to "boil off" or blow standing water from the bottom of a crack. If standing water is present in the bottom of any crack, the sealing operation shall be postponed until such time that the standing water evaporates naturally. The Contractor may be allowed to use compressed, oil-free, air (not heated) to blow standing water from a crack to help accelerate the natural evaporation of any standing water. If this is done, the crack must be allowed to dry naturally until all standing water is visibly gone. Then the hot air lance may be used. If a crack is already completely dry, in the opinion of the Engineer, the hot air lance should be operated at its lowest temperature possible.

The hot air lance is to be used to blow all debris from the crack to a depth of at least 0.75 inches for cracks between $^{1}/_{8}$ inches and ¾ inches in width, and to a depth of 1.25 inches for cracks between ¾ inches and 1.5 inches in width.

In the event that cracks or are packed tightly with debris, dirt, vegetation, or other material except previously placed sealant or filler, the Contractor shall use a vertically mounted power driven wire brush to remove debris and vegetation and burnish the sides of the crack to the depths specified above. Cracks treated with the wire power brush shall subsequently be treated with a hot air lance as described in this section. The conjunction of the use of the wire power brush and the hot-air lance treatment shall result in the complete removal of all material in the crack (except previously placed sealant or filler) to the depths specified above such that the sides of the crack are completely free and clean of any debris and moisture as described in this section.

In the event that existing open cracks and joints are open or void to depths greater than 2 inches below the pavement surface, the Contractor, at his own option, may place a filling barrier composed of clean dry sand as specified herein. It may be used to fill the bottom of open cracks or joints that are devoid of material at least 2.0 inches below the elevation of the pavement surface. The barrier material shall be placed so that the bottom of crack filling material is placed 1.25 inches below the elevation of the pavement surface. A filling barrier will not be allowed for cracks and joints wider than 1.5 inches in width or for cracks less than 0.5 inches wide.

(5) Crack Filling: All cracks that have been prepared for treatment are to be filled to refusal along their entire length. The treatment material shall be maintained at the manufacturer's specified application temperature range at all times. The filling operation shall be suspended if the temperature of the crack filling material falls outside the specified/recommended temperature range and shall remain suspended until the crack filling material is brought with in the specified temperature range. Filled cracks are to be squeegeed immediately following application of the crack filling material, striking excess filler flat to the adjacent pavement surface. There shall be no build-up of treatment material above or adjacent to the crack at any time. In cases where the initial application of crack filler material fails to fill the crack or shrinks upon cooling such that there is a depression formed of at least one quarter of an inch or greater, a second application of sealant shall be placed over the first application to fill the crack adequately as described above.

(6) Protection of Filled Cracks and Joints: No traffic shall be permitted on the pavement until the crack fill material is set, whereas the crack fill material does not track and is not subject to deformation or pull-out by traffic. If the work under this item is being performed prior to placing a hot mix overlay or other surface treatment, a detackifier or blotting agent will not be allowed. If work under this item is not followed by placement of an overlay of any kind, a detackifier can be used. If a detackifier and/or blotting agent is used it shall be one recommended by the supplier of the crack filling material and shall be used as recommended by the supplier, except that no paper, cotton, or other organic materials shall be allowed for either blotting or detackifying. Information on the type and usage of a detackifier and/or blotting agent shall be presented to the Engineer prior to its use. Any acceptance of the detackifier and/or blotting agent shall be granted by the Engineer in writing.

(7) Surplus Treatment Material: Treatment material remaining in the contractor's kettle at the close of the daily work session shall be discarded. At no time shall treatment material be re-heated for use in subsequent crack filling applications unless permitted by the Engineer following a review of field operation circumstances.

(8) All debris generated from the operations described above shall be removed from the roadway by the Contractor and disposed in accordance with State of Connecticut law.

5. Acceptance of Work: When work is complete on the project, or on a project location if multiple locations are included in the project, an inspection of the work shall be scheduled with the Engineer. The Engineer will note all deficiencies including areas exhibiting adhesion failure, cohesion failure, tracking of sealant material, missed cracks or joints, and/or other factors that show the work is not acceptable. Work identified by the Engineer as not acceptable shall be re-done at the Contractor's expense. The Contractor shall notify the Engineer upon completion of required corrective work, or upon completion of work on the project location if corrective work is not required.

6. Method of Measurement: This work shall be measured by the number of linear feet, of pavement cracks or joints filled as indicated in the Contract plans and documents and as measured, verified, and accepted by the Engineer.

7. Basis of Payment: The number of linear feet of pavement surface cracks and joints that are filled, as verified and accepted by the Engineer, shall be paid for at the contract unit price per linear foot. The price shall include all materials, equipment, tools, and labor incidental thereto. No payment will be issued to the contractor prior to document submittals required.

Pay Item	Pay Unit
0406196A - Filling Joints and Cracks in Bituminous Concrete Pavement	L.F.

ITEM #0406273A - MILLING OF BITUMINOUS CONCRETE – (OVER 4 TO 8 INCHES)

Description: This work shall consist of the milling, removal, and disposal of existing bituminous concrete pavement.

Construction Methods: The Contractor shall remove the bituminous concrete material using means acceptable to the Engineer. The pavement surface shall be removed to the line, grade, and existing or typical cross-section shown on the plans or as directed by the Engineer.

The bituminous concrete material shall be disposed of offsite by the Contractor at an approved disposal facility unless otherwise stated in the Contract.

Any milled surface, or portion thereof, that is exposed to traffic shall be paved within five (5) calendar days unless otherwise stated in the plans or Contract.

The equipment for milling the pavement surface shall be designed and built for milling bituminous concrete pavements. It shall be self propelled with sufficient power, traction, and stability to maintain depth and slope and shall be capable of removing the existing bituminous concrete pavement.

The milling machine shall be equipped with a built-in automatic grade averaging control system that can control the longitudinal profile and the transverse cross-slope to produce the specified results. The longitudinal controls shall be capable of operating from any longitudinal grade reference, including string line, contact ski (30 feet minimum), non-contact ski (20 feet minimum), or mobile string line (30 feet minimum). The transverse controls shall have an automatic system for controlling cross-slope at a given rate. The Engineer may waive the requirement for automatic grade or slope controls where the situation warrants such action.

The rotary drum of the machine shall use carbide or diamond tipped tools spaced not more than ⅝ inch apart. The forward speed of the milling machine shall be limited to no more than 45 feet/minute. The tools on the revolving cutting drum must be continually maintained and shall be replaced as warranted to provide a uniform pavement texture.

For projects that are 5000 feet in length or greater, the Contractor may submit a request in writing to perform a test strip(s) to demonstrate that the same surface tolerance can be attained at an increased forward speed. The submission shall include:

- Increased forward speed(s) to be tested
- Location of the test strip(s)
- Length of test strip(s)
- Make and model of the milling machine
- Type of drum (Standard or Fine)

The increased forward speed shall be made in 5 ft/min. increments from the maximum 45 ft/min. per test strip. The test strip(s) shall have a minimum length of 250 feet, a maximum length of 500 feet and shall have the same criteria for surface tolerance as noted in this Specification. The surface tolerance shall be verified by a Contractor supplied 10 foot straightedge with measurements taken every 50 feet and at any location the Inspector deems appropriate within the test strip. In no case shall the forward speed be allowed to increase beyond 60 feet/minute. The final decision for implementing or continuing approved increased forward speed will be at the discretion of the Engineer.

If an increase in forward speed is approved, the same equipment used for the test strip shall be used throughout the milling operation. If at any time during approved increased speed there is evidence of gouging, cupping, delamination or any surface texture outside of the tolerances within this specification is evident, the forward speed shall be reduced to a maximum of 45 feet/minute for the remainder of the project.

The machine shall be equipped with an integral pickup and conveying device to immediately remove material being milled from the surface of the roadway and discharge the millings into a truck, all in one operation. The machine shall also be equipped with a means of effectively limiting the amount of dust escaping from the milling and removal operation.

When milling smaller areas or areas where it is impractical to use the above described equipment, the use of a lesser equipped milling machine may be permitted when approved by the Engineer.

Protection shall be provided around existing catch basin inlets, manholes, utility valve boxes, and any similar structures. Any damage to such structures as a result of the milling operation is the Contractor's responsibility and shall be repaired at the Contractor's expense.

To prevent the infiltration of milled material into the storm drainage system, the Contractor shall take special care to prevent the milled material from falling into the inlet openings or inlet grates. Any milled material that has fallen into inlet openings or inlet grates shall be removed at the Contractor's expense.

Surface Tolerance: The milled surface shall provide a satisfactory riding surface with a uniform textured appearance. The milled surface shall be free from gouges, longitudinal grooves and ridges, oil film, and other imperfections that are a result of defective equipment, improper use of equipment, or poor workmanship. The Contractor, under the direction of the Inspector, shall perform random spot-checks with a Contractor supplied ten-foot straightedge to verify surface tolerances at a minimum of five (5) locations per day. The variation of the top of two ridges from the testing edge of the straightedge, between any two ridge contact points, shall not exceed ⅜ inch. The variation of the top of any ridge to the bottom of the groove adjacent to that ridge shall not exceed ⅜ inch. Any unsatisfactory surfaces produced are the responsibility of the Contractor and shall be corrected at the Contractor's expense and to the satisfaction of the Engineer.

The depth of removal will be verified by taking measurements every 250 feet per each pass of the milling machine, or as directed by the Engineer. These depth measurements shall be used to monitor the average depth of removal.

Where a surface delamination between bituminous concrete layers or a surface delamination of bituminous concrete on Portland cement concrete causes a non-uniform texture to occur, the depth of milling shall be adjusted in small increments to a maximum of +/- ½ inch to eliminate the condition.

When removing bituminous concrete pavement entirely from an underlying Portland cement concrete pavement, all of the bituminous concrete pavement shall be removed leaving a uniform surface of Portland cement concrete, unless otherwise directed by the Engineer.

Any unsatisfactory surfaces produced by the milling operation are the Contractor's responsibility and shall be corrected at the Contractor's expense and to the satisfaction of the Engineer.

No vertical faces, transverse or longitudinal, shall be left exposed to traffic unless the requirements below are met. This shall include roadway structures (catch basins, manholes, utility valve boxes, etc.). If any vertical face is formed in an area exposed to traffic a temporary paved transition shall be established according to the requirements shown on the plans. If the milling machine is used to form a temporary transition, the length of the temporary transition shall conform to Special Provision Section 4.06 - Bituminous Concrete, "Transitions for Roadway Surface," the requirements shown on the plans, or as directed by the Engineer. At all permanent limits of removal, a clean vertical face shall be established by saw cutting prior to paving.

Roadway structures shall not have a vertical face of greater than one (1) inch exposed to traffic as a result of milling. All structures within the roadway that are exposed to traffic and greater than one (1) inch above the milled surface shall receive a transition meeting the following requirements:

For roadways with a posted speed limit of 35 mph or less*:

1. Round structures with a vertical face of greater than 1 inch to 2.5 inches shall be transitioned with a hard rubber tapered protection ring of the appropriate inside diameter designed specifically to protect roadway structures.
2. Round structures with a vertical face greater than 2.5 inches shall receive a transition of bituminous concrete formed at a minimum 24 to 1 (24:1) taper in all directions.
3. All rectangular structures with a vertical face greater than 1 inch shall receive a transition of bituminous concrete formed at a minimum 24 to 1 (24:1) taper in all directions.

*Bituminous concrete tapers at a minimum 24 to 1 (24:1) taper in all directions may be substituted for the protection rings if approved by the Engineer.

For roadways with a posted speed limit of 40, 45 or 50 mph:

1. All structures shall receive a transition of bituminous concrete formed at a minimum 36 to 1 (36:1) taper in the direction of travel. Direction of travel includes both the leading and trailing side of a structure. The minimum taper shall be 24 to 1 (24:1) in all other directions.

For roadways with a posted speed limit of greater than 50 mph:

1. All structures shall receive a transition of bituminous concrete formed at a minimum 60 to 1 (60:1) taper in the direction of travel. Direction of travel includes both the leading and trailing side of a structure. The minimum taper shall be 24 to 1 (24:1) in all other directions.

All roadway structure edges and bituminous concrete tapers shall be clearly marked with fluorescent paint. The paint shall be maintained throughout the exposure to traffic.

The milling operation shall proceed in accordance with the requirements of the "Maintenance and Protection of Traffic" and "Prosecution and Progress" specifications, or other Contract requirements. The more stringent specification shall apply.

Prior to opening an area which has been milled to traffic, the pavement shall be thoroughly swept with a sweeper truck. The sweeper truck shall be equipped with a water tank and be capable of removing the millings and loose debris from the surface. The sweeper truck shall operate at a forward speed that allows for the maximum pickup of millings from the roadway surface. Other sweeping equipment may be provided in lieu of the sweeper truck where acceptable by the Engineer.

Any milled area that will not be exposed to live traffic for a minimum of 48 hours prior to paving shall require a vacuum sweeper truck in addition to, or in lieu of, mechanical sweeping. The vacuum sweeper truck shall have sufficient power and capacity to completely remove all millings from the roadway surface including any fine particles within the texture of the milled surface. Vacuum sweeper truck hose attachments shall be used to clean around pavement structures or areas that cannot be reached effectively by the main vacuum. Compressed air may be used in lieu of vacuum attachments if approved by the Engineer.

Method of Measurement: This work will be measured for payment by the number of square yards of area from which the milling of asphalt has been completed and the work accepted. No area deductions will be made for minor unmilled areas such as catch basin inlets, manholes, utility boxes and any similar structures.

The depth of removal will be calculated by taking measurements at a minimum every 250 feet per each pass of the milling machine, or as directed by the Engineer. The average depth of each section will determine which payment item is applicable.

Basis of Payment: This work will be paid for at the Contract unit price per square yard for "Milling of Bituminous Concrete (0 to 4 inches)," "Milling of Bituminous Concrete (Over 4 to 8 inches)" and "Milling of Bituminous Concrete (Greater Than 8 inches)." This price shall include all equipment, tools, labor, and materials incidental thereto.

No additional payments will be made for multiple passes with the milling machine to remove the bituminous surface.

No separate payments will be made for cleaning the pavement prior to paving; providing protection and doing handwork removal of bituminous concrete around catch basin inlets, manholes, utility valve boxes and any similar structures; repairing surface defects as a result of the Contractors negligence; providing protection to underground utilities from the vibration of the milling operation; removal of any temporary milled or paved transition; removal and disposal of millings; furnishing a sweeper truck and sweeping after milling. The costs for these items shall be included in the Contract unit price.

Pay Item	Pay Unit
Milling of Bituminous Concrete – (Over 4 to 8 inches)	S.Y.

ITEM #0406275A - FINE MILLING OF BITUMINOUS CONCRETE (0 TO 4 INCHES)

Description: This work shall consist of the milling, removal, and disposal of existing bituminous concrete pavement.

Construction Methods: The Contractor shall remove the bituminous concrete material using means acceptable to the Engineer. The pavement surface shall be removed to the line, grade, and existing or typical cross-section shown on the plans or as directed by the Engineer.

The bituminous concrete material shall be disposed of offsite by the Contractor at an approved disposal facility unless otherwise stated in the Contract.

Any milled surface, or portion thereof, that is exposed to traffic shall be paved within five (5) calendar days unless otherwise stated in the plans or Contract.

The equipment for milling the pavement surface shall be designed and built for milling bituminous concrete pavements. It shall be self propelled with sufficient power, traction, and stability to maintain depth and slope and shall be capable of removing the existing bituminous concrete pavement.

The milling machine shall be equipped with a built-in automatic grade averaging control system that can control the longitudinal profile and the transverse cross-slope to produce the specified results. The longitudinal controls shall be capable of operating from any longitudinal grade reference, including string line, contact ski (30 feet minimum), non-contact ski (20 feet minimum), or mobile string line (30 feet minimum). The transverse controls shall have an automatic system for controlling cross-slope at a given rate. The Engineer may waive the requirement for automatic grade or slope controls where the situation warrants such action.

The machine shall be able to provide a 0 to 4 inch deep cut in one pass. The rotary drum of the machine shall use carbide or diamond tipped tools spaced not more than $^{5}/_{16}$ inch apart. The forward speed of the milling machine shall be limited to no more than 45 feet/minute. The tools on the revolving cutting drum must be continually maintained and shall be replaced as warranted to provide a uniform pavement texture.

The machine shall be equipped with an integral pickup and conveying device to immediately remove material being milled from the surface of the roadway and discharge the millings into a truck, all in one operation. The machine shall also be equipped with a means of effectively limiting the amount of dust escaping from the milling and removal operation.

When milling smaller areas or areas where it is impractical to use the above described equipment, the use of a lesser equipped milling machine may be permitted when approved by the Engineer.

Protection shall be provided around existing catch basin inlets, manholes, utility valve boxes, and any similar structures. Any damage to such structures as a result of the milling operation is the Contractor's responsibility and shall be repaired at the Contractor's expense.

To prevent the infiltration of milled material into the storm drainage system, the Contractor shall take special care to prevent the milled material from falling into the inlet openings or inlet grates. Any milled material that has fallen into inlet openings or inlet grates shall be removed at the Contractor's expense.

Surface Tolerance: The milled surface shall provide a satisfactory riding surface with a uniform textured appearance. The milled surface shall be free from gouges, longitudinal grooves and ridges, oil film, and other imperfections that are a result of defective equipment, improper use of equipment, or poor workmanship. The Contractor, under the direction of the Inspector, shall perform random spot-checks with a Contractor supplied ten-foot straightedge to verify surface tolerances at a minimum of five (5) locations per day. The variation of the top of two ridges from the testing edge of the straightedge, between any two ridge contact points, shall not exceed ¼ inch. The variation of the top of any ridge to the bottom of the groove adjacent to that ridge shall not exceed ¼ inch. Any unsatisfactory surfaces produced are the responsibility of the Contractor and shall be corrected at the Contractor's expense and to the satisfaction of the Engineer.

The depth of removal will be verified by taking measurements every 250 feet per each pass of the milling machine, or as directed by the Engineer. These depth measurements shall be used to monitor the average depth of removal.

Where a surface delamination between bituminous concrete layers or a surface delamination of bituminous concrete on Portland cement concrete causes a non-uniform texture to occur, the depth of milling shall be adjusted in small increments to a maximum of +/- ½ inch to eliminate the condition.

When removing bituminous concrete pavement entirely from an underlying Portland cement concrete pavement, all of the bituminous concrete pavement shall be removed leaving a uniform surface of Portland cement concrete, unless otherwise directed by the Engineer.

Any unsatisfactory surfaces produced by the milling operation are the Contractor's responsibility and shall be corrected at the Contractor's expense and to the satisfaction of the Engineer.

No vertical faces, transverse or longitudinal, shall be left exposed to traffic unless the requirements below are met. This shall include roadway structures (catch basins, manholes, utility valve boxes, etc.). If any vertical face is formed in an area exposed to traffic, a temporary paved transition shall be established according to the requirements shown on the plans. If the milling machine is used to form a temporary transition, the length of the temporary transition shall conform to Special Provision Section 4.06 –Bituminous Concrete, "Transitions for Roadway Surface," the requirements shown on the plans, or as directed by the Engineer. At all

permanent limits of removal, a clean vertical face shall be established by saw cutting prior to paving.
Roadway structures shall not have a vertical face of greater than one (1) inch exposed to traffic as a result of milling. All structures within the roadway that are exposed to traffic and greater than one (1) inch above the milled surface shall receive a transition meeting the following requirements:

For roadways with a posted speed limit of 35 mph or less*:

1. Round structures with a vertical face of greater than 1 inch to 2.5 inches shall be transitioned with a hard rubber tapered protection ring of the appropriate inside diameter designed specifically to protect roadway structures.
2. Round structures with a vertical face greater than 2.5 inches shall receive a transition of bituminous concrete formed at a minimum 24 to 1 (24:1) taper in all directions.
3. All rectangular structures with a vertical face greater than 1 inch shall receive a transition of bituminous concrete formed at a minimum 24 to 1 (24:1) taper in all directions.

*Bituminous concrete tapers at a minimum 24 to 1 (24:1) taper in all directions may be substituted for the protection rings if approved by the Engineer.

For roadways with a posted speed limit of 40, 45 or 50 mph:

1. All structures shall receive a transition of bituminous concrete formed at a minimum 36 to 1 (36:1) taper in the direction of travel. Direction of travel includes both the leading and trailing side of a structure. The minimum taper shall be 24 to 1 (24:1) in all other directions.

For roadways with a posted speed limit of greater than 50 mph:

1. All structures shall receive a transition of bituminous concrete formed at a minimum 60 to 1 (60:1) taper in the direction of travel. Direction of travel includes both the leading and trailing side of a structure. The minimum taper shall be 24 to 1 (24:1) in all other directions.

All roadway structure edges and bituminous concrete tapers shall be clearly marked with fluorescent paint. The paint shall be maintained throughout the exposure to traffic.

The milling operation shall proceed in accordance with the requirements of the “Maintenance and Protection of Traffic” and “Prosecution and Progress” specifications, or other Contract requirements. The more stringent specification shall apply.

Prior to opening an area which has been milled to traffic, the pavement shall be thoroughly swept with a sweeper truck. The sweeper truck shall be equipped with a water tank and be capable of removing the millings and loose debris from the surface. The sweeper truck shall operate at a forward speed that allows for the maximum pickup of millings from the roadway surface. Other

sweeping equipment may be provided in lieu of the sweeper truck where acceptable by the Engineer.

Any milled area that will not be exposed to live traffic for a minimum of 48 hours prior to paving shall require a vacuum sweeper truck in addition to, or in lieu of, mechanical sweeping. The vacuum sweeper truck shall have sufficient power and capacity to completely remove all millings from the roadway surface including any fine particles within the texture of the milled surface. Vacuum sweeper truck hose attachments shall be used to clean around pavement structures or areas that cannot be reached effectively by the main vacuum. Compressed air may be used in lieu of vacuum attachments if approved by the Engineer.

Method of Measurement: This work will be measured for payment by the number of square yards of area from which the milling of asphalt has been completed and the work accepted. No area deductions will be made for minor unmilled areas such as catch basin inlets, manholes, utility boxes and any similar structures.

Basis of Payment: This work will be paid for at the Contract unit price per square yard for "Fine Milling of Bituminous Concrete (0 to 4 Inches)." This price shall include all equipment, tools, labor, and materials incidental thereto.

No additional payments will be made for multiple passes with the milling machine to remove the bituminous surface.

No separate payments will be made for cleaning the pavement prior to paving; providing protection and doing handwork removal of bituminous concrete around catch basin inlets, manholes, utility valve boxes and any similar structures; repairing surface defects as a result of the Contractors negligence; providing protection to underground utilities from the vibration of the milling operation; removal of any temporary milled or paved transition; removal and disposal of millings; furnishing a sweeper truck and sweeping after milling. The costs for these items shall be included in the Contract unit price.

Pay Item	Pay Unit
Fine Milling of Bituminous Concrete (0 to 4 Inches)	S.Y.

ITEM #0406276A - MICRO-MILLING OF BITUMINOUS CONCRETE (0 TO 2 INCHES)

Description: This work shall consist of the milling, removal, and disposal of existing bituminous concrete pavement.

Construction Methods: The Contractor shall remove the bituminous concrete material using means acceptable to the Engineer. The pavement surface shall be removed to the line, grade, and existing or typical cross-section shown on the plans or directed by the Engineer.

The bituminous concrete material shall be disposed of offsite by the Contractor at an approved disposal facility unless otherwise stated in the Contract.

Any milled surface, or portion thereof, that is exposed to traffic shall be paved within five (5) calendar days unless otherwise stated in the plans or Contract.

The equipment for milling the pavement surface shall be designed and built for milling bituminous concrete pavements. It shall be self propelled with sufficient power, traction, and stability to maintain depth and slope and shall be capable of removing the existing bituminous concrete pavement.

The milling machine shall be equipped with a built-in automatic grade averaging control system that can control the longitudinal profile and the transverse cross-slope to produce the specified results. The longitudinal controls shall be capable of operating from any longitudinal grade reference, including string line, contact ski (30 feet minimum), non-contact ski (20 feet minimum), or mobile string line (30 feet minimum). The transverse controls shall have an automatic system for controlling cross-slope at a given rate. The Engineer may waive the requirement for automatic grade or slope controls where the situation warrants such action.

The machine shall be able to provide a 0 to 2 inch deep cut in one pass. The rotary drum of the machine shall use carbide or diamond tipped tools spaced not more than $^{3}/_{16}$ inch apart. The forward speed of the milling machine shall be limited to no more than 45 feet/minute. The tools on the revolving cutting drum must be continually maintained and shall be replaced as warranted to provide a uniform pavement texture.

The machine shall be equipped with an integral pickup and conveying device to immediately remove material being milled from the surface of the roadway and discharge the millings into a truck, all in one operation. The machine shall also be equipped with a means of effectively limiting the amount of dust escaping from the milling and removal operation.

When milling smaller areas or areas where it is impractical to use the above described equipment, the use of a lesser equipped milling machine may be permitted when approved by the Engineer.

Protection shall be provided around existing catch basin inlets, manholes, utility valve boxes, and any similar structures. Any damage to such structures as a result of the milling operation is the Contractor's responsibility and shall be repaired at the Contractor's expense.

To prevent the infiltration of milled material into the storm drainage system, the Contractor shall take special care to prevent the milled material from falling into the inlet openings or inlet grates. Any milled material that has fallen into inlet openings or inlet grates shall be removed at the Contractor's expense.

Surface Tolerance: The milled surface shall provide a riding surface with a corduroy textured appearance with a groove depth of 1/16 inch. The milled surface shall be free from gouges, longitudinal grooves and ridges, oil film, and other imperfections that are a result of defective equipment, improper use of equipment, or poor workmanship. No area shall have a depth greater than ⅛ inch when measured with a ten (10) foot straightedge. Any unsatisfactory surfaces produced are the responsibility of the Contractor and shall be corrected at the Contractor's expense and to the satisfaction of the Engineer.

The depth of removal will be verified by taking measurements every 250 feet per each pass of the milling machine, or as directed by the Engineer. These depth measurements shall be used to monitor the average depth of removal.

No vertical faces, transverse or longitudinal, shall be left exposed to traffic unless the requirements below are met. This shall include roadway structures (catch basins, manholes, utility valve boxes, etc.). If any vertical face is formed in an area exposed to traffic, a temporary paved transition shall be established according to the requirements shown on the plans. If the milling machine is used to form a temporary transition, the length of the temporary transition shall conform to Special Provision Section 4.06 – Bituminous Concrete, "Transitions for Roadway Surface," the requirements shown on the plans, or as directed by the Engineer. At all permanent limits of removal, a clean vertical face shall be established by saw cutting prior to paving.

Roadway structures shall not have a vertical face of greater than one (1) inch exposed to traffic as a result of milling. All structures within the roadway that are exposed to traffic and are greater than one (1) inch above the milled surface shall receive a transition meeting the following requirements:

For roadways with a posted speed limit of 35 mph or less:

1. All structures shall receive a transition of bituminous concrete formed at a minimum 24 to 1 (24:1) taper in all directions.

For roadways with a posted speed limit of 40, 45 or 50 mph:

1. All structures shall receive a transition of bituminous concrete formed at a minimum 36 to 1 (36:1) taper in the direction of travel. Direction of travel includes both the leading

and trailing side of a structure. The minimum taper shall be 24 to 1 (24:1) in all other directions.

For roadways with a posted speed limit of greater than 50 mph:

1. All structures shall receive a transition of bituminous concrete formed at a minimum 60 to 1 (60:1) taper in the direction of travel. Direction of travel includes both the leading and trailing side of a structure. The minimum taper shall be 24 to 1 (24:1) in all other directions.

All roadway structure edges and bituminous concrete tapers shall be clearly marked with fluorescent paint. The paint shall be maintained throughout the exposure to traffic.

The milling operation shall proceed in accordance with the requirements of the "Maintenance and Protection of Traffic" and "Prosecution and Progress" specifications, or other Contract requirements. The more stringent specification shall apply.

Prior to opening an area which has been milled to traffic, the pavement shall be thoroughly swept with a sweeper truck. The sweeper truck shall be equipped with a water tank and be capable of removing the millings and loose debris from the surface. The sweeper truck shall operate at a forward speed that allows for the maximum pickup of millings from the roadway surface. Other sweeping equipment may be provided in lieu of the sweeper truck where acceptable by the Engineer.

Any milled area that will not be exposed to live traffic for a minimum of 48 hours prior to paving shall require a vacuum sweeper truck in addition to, or in lieu of, mechanical sweeping. The vacuum sweeper truck shall have sufficient power and capacity to completely remove all millings from the roadway surface including any fine particles within the texture of the milled surface. Vacuum sweeper truck hose attachments shall be used to clean around pavement structures or areas that cannot be reached effectively by the main vacuum. Compressed air may be used in lieu of vacuum attachments if approved by the Engineer.

Method of Measurement: This work will be measured for payment by the number of square yards of area from which the milling of asphalt has been completed and the work accepted. No area deductions will be made for minor unmilled areas such as catch basin inlets, manholes, utility boxes and any similar structures.

Basis of Payment: This work will be paid for at the Contract unit price per square yard for "Micro Milling of Bituminous Concrete (0 to 2 inches)." This price shall include all equipment, tools, labor, and materials incidental thereto.

No additional payments will be made for multiple passes with the milling machine to remove the bituminous surface.

No separate payments will be made for cleaning the pavement prior to paving; providing protection and doing handwork removal of bituminous concrete around catch basin inlets,

manholes, utility valve boxes and any similar structures; repairing surface defects as a result of the Contractors negligence; providing protection to underground utilities from the vibration of the milling operation; removal of any temporary milled or paved transition; removal and disposal of millings; furnishing a sweeper truck and sweeping after milling. The costs for these items shall be included in the Contract unit price.

Pay Item	**Pay Unit**
Micro-Milling of Bituminous Concrete (0 to 2 Inches)	S.Y.

ITEM #0406277A - REMOVAL OF EXISTING WEARING SURFACE

Description: Work under this item shall consist of the complete removal and disposal of the existing bituminous concrete wearing surface, membrane waterproofing and bond breaker covering the reinforced concrete bridge deck and approach slabs as shown on the plans, as ordered by the Engineer and in accordance with these Specifications.

Construction Methods: The Contractor shall remove the bituminous concrete wearing surface, membrane waterproofing and bond breaker using means acceptable to the Engineer to completely expose the underlying concrete deck and approach slab, without damaging the deck, approach slabs, roadway materials, and structures which are to remain intact.

Acceptable mechanical methods for removal of bituminous concrete surface on a structure can be one of the following:

Micro-milling - The rotary drum of the machine shall use carbide or diamond tipped tools spaced not more than $^{3}/_{16}$ inches apart, capable of leaving a smooth, uniform pattern of striations with a maximum forward speed of 45 feet/minute.

Fine Milling – The rotary drum of the machine shall use carbide or diamond tipped tools spaced not more than $^{5}/_{16}$ inches apart, capable of leaving a smooth, uniform pattern of striations with a maximum forward speed of 45 feet/minute.

Alternate methods may be submitted to the Engineer for review and acceptance. Demonstration of the alternate removal method shall be performed prior to consideration.

All particles and aggregate adhering to the exposed concrete that could, in the Engineer's opinion, cause failure of, or puncture the new membrane shall be removed. The existing bituminous concrete wearing surface, membrane waterproofing, and bond breaker that are removed shall be disposed of offsite by the Contractor unless otherwise noted in the Contract or as directed by the Engineer.

Prior to removal of bituminous concrete wearing surface the Contractor shall conduct a survey. A minimum of four (4) representative depth measurements shall be taken per span for a span up to 100 feet in length to predetermine the overlay thickness. An additional measurement shall be taken for each 25 feet in span length. If depth of overlay varies across the structure, it shall be clearly marked to aid in the removal operation. Survey locations shall be filled with bituminous material if the milling operation will not be completed within five (5) days or at the direction of the Engineer.

The existing bituminous concrete wearing surface and membrane waterproofing shall be removed in their entireties to the limits shown on the plans. The removal operations shall not begin until the Contractor is prepared to perform the permanent patching or repair to the underlying concrete within five (5) working days. If this is in conflict with "Prosecution and

Progress," "Maintenance and Protection of Traffic," or other Contract requirements, the more stringent specification shall apply.

Protection shall be provided around existing catch basin inlets, bridge scuppers, manholes, utility valve boxes, median barriers, parapets, and other roadway structures. Any damage to such structures as a result of removal operations is the Contractor's responsibility and shall be repaired at the Contractor's expense.

A uniform textured riding surface shall be provided and maintained. The surface shall be free from gouges, longitudinal grooves and ridges, oil film, and other imperfections that are a result of defective equipment, improper use of equipment, poor workmanship, or inadequate survey. Any unsatisfactory surfaces caused by the removal operations are the Contractor's responsibility and shall be corrected at the Contractor's expense and to the satisfaction of the Engineer prior to opening the surface to traffic.

Any raised structures shall be delineated with traffic control devices, as directed by the Engineer. Installation of traffic control devices will be included under the costs for "Maintenance and Protection of Traffic," payment for the devices will be under the applicable items.

No vertical face, transverse or longitudinal, shall be left exposed to traffic unless the requirements below are met. This shall include roadway structures (catch basins, manholes, utility valve boxes, etc.). If any vertical face is formed in an area exposed to traffic, a temporary paved transition shall be established according to the requirements shown on the plans. If the milling machine is used to form a temporary transition, the length of the temporary transition shall conform to Special Provision Section 4.06 –Bituminous Concrete, "Transitions for Roadway Surface," the requirements shown on the plans, or as directed by the Engineer. At all permanent limits of removal, a clean vertical face shall be established by saw cutting prior to paving.

Roadway structures shall not have a vertical face of greater than one (1) inch exposed to traffic as a result of milling. All structures within the roadway that are exposed to traffic and greater than one (1) inch above the milled surface shall receive a transition meeting the following requirements:

For roadways with a posted speed limit of 35 mph or less*:

1. Round structures with a vertical face of greater than 1 inch to 2.5 inches shall be transitioned with a hard rubber tapered protection ring of the appropriate inside diameter designed specifically to protect roadway structures.
2. Round structures with a vertical face greater than 2.5 inches shall receive a transition of bituminous concrete formed at a minimum 24 to 1 (24:1) taper in all directions.
3. All rectangular structures shall receive a transition of bituminous concrete formed at a minimum 24 to 1 (24:1) taper in all directions.

*Bituminous concrete tapers at a minimum 24 to 1 (24:1) taper in all directions may be substituted for the protection rings if approved by the Engineer.

For roadways with a posted speed limit of 40, 45 or 50 mph:

- All structures shall receive a transition of bituminous concrete formed at a minimum 36 to 1 (36:1) taper in all directions of travel. Direction of travel shall include both the leading and trailing sides of a structure. The minimum taper shall be 24 to 1 (24:1) in all other directions.

For roadways with a posted speed limit of greater than 50 mph:

- All structures shall receive a transition of bituminous concrete formed at a minimum 60 to 1 (60:1) taper in the direction of travel. Direction of travel shall include both the leading and trailing sides of a structure. The minimum taper shall be 24 to 1 (24:1) in all other directions.

All roadway structure edges and bituminous concrete tapers shall be clearly marked with fluorescent paint. The paint shall be maintained throughout the exposure to traffic.

Prior to opening an area which has been milled to traffic, the pavement shall be thoroughly swept with a sweeper truck. The sweeper truck shall be equipped with a water tank and be capable of removing the millings and loose debris from the surface. The sweeper truck shall operate at a speed that allows for the maximum pickup of millings from the roadway surface. Other sweeping equipment may be provided in lieu of the sweeper where acceptable by the Engineer.

Method of Measurement: This work will be measured for payment by the number of square yards of bituminous concrete wearing surface removed to expose the underlying concrete deck or approach slabs. No area deductions will be made for minor unmilled areas such as scuppers, joints, and any similar structures.

Basis of Payment: This work will be paid for at the contract unit price per square yard for **"**Removal of Existing Wearing Surface," complete and accepted, which price shall include the depth measurements, removal of wearing surface, removal of membrane waterproofing and bond breaker, saw cutting, and all equipment, tools and labor.

No additional payments will be made for multiple passes with the milling machine to remove the bituminous surface.

No separate payments will be made for cleaning the pavement prior to paving; providing protection and doing handwork removal of bituminous concrete around catch basin inlets, bridge scuppers, manholes, utility valve boxes, median barriers, parapets, joints and any similar structures; repairing surface defects as a result of Contractor negligence; providing protection to underground utilities from the vibration of the milling operation; removal of any temporary milled transition; removal and disposal of millings; furnishing a sweeper truck and sweeping after milling. The costs for these items shall be included in the Contract unit price.

Pay Item	**Pay Unit**
Removal of Existing Wearing Surface	S.Y.

ITEM #0406287A - RUMBLE STRIPS - AUTOMATED

ITEM #0406288A - RUMBLE STRIPS - MANUAL

Description:
Work under this item shall consist of installing rumble strips on asphalt highway shoulders where shown on the plans or where directed by the Engineer, and in conformance with these specifications.

Construction Methods:
The Contractor shall pre-mark the location of the edge of the cut, and the beginning and ending points of the sections, prior to the installation of the rumble strips. The Engineer shall review and approve the locations.

The Contractor shall arrange for a technical representative, from the company which produces the milling machine to be used on the project, who will be required to be on-site from the beginning of the operation in order to ensure results that meet the requirements of the plans and specifications until such time the Engineer is satisfied.

Rumble strips should not be installed on bridge decks, in acceleration and deceleration lanes, at drainage structures, at loop detector sawcut locations, or in other areas identified by the Engineer.

Automated (Wide Shoulders):
The equipment shall be able to install the rumble strips in sections where the shoulder width from the edge line to an obstruction is greater than or equal to 4 feet. Where there are no obstructions, the equipment shall be used in sections where the shoulder width from the edge line is a minimum of 3 feet. The equipment shall consist of a rotary type cutting head with a maximum outside diameter of 24" and shall be a minimum of 16" long. The cutting head(s) shall have the cutting tips arranged in such a pattern as to provide a relatively smooth cut (approximately 1/16 of an inch between peaks and valleys) in one pass. The cutting head shall be on its own independent suspension from that of the power unit to allow the tool to self align with the slope of the shoulder or any irregularities in the shoulder surface. The equipment shall include suitable provisions for the application of water to prevent dusting. The Contractor shall use a machine capable of creating the finished pattern at a minimum output of 60 rumble strips per minute.

Manual (Narrow Shoulders):
The equipment shall be able to install the rumble strips in sections where the shoulder width from the edge line to an obstruction is between 3 feet and 4 feet. The cutting head(s) shall have the cutting tips arranged in such a pattern as to provide a relatively smooth cut (approximately 1/16 of an inch between peaks and valleys) in one pass. The equipment shall include suitable provisions for the application of water to prevent dusting.

Finished Cut (Automated or Manual)
The rumble strips shall have finished dimensions of 7" (+/- 1/2") wide in the direction of travel and shall be a 16" (+/- 1/2") long measured perpendicular to the direction of travel. The depressions shall have a concave circular shape with a minimum 1/2" depth at center (maximum allowable depth is 5/8" measured to a valley). The rumble strips shall be placed in relation to the roadway according to the patterns shown in the plans or on the Rumble Strip Details. Alignment of the edge of the cut shall be checked and verified by the Engineer.

The cutting tool shall be equipped with guides to provide consistent alignment of each cut in relation to the roadway.

The Contractor shall pick up any waste material resulting from the operation in a manner acceptable to the Engineer. This waste material shall be disposed of in accordance with Subarticle 2.02.03-10(a).

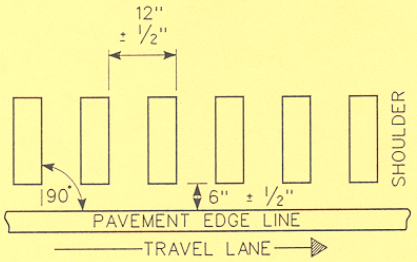
The work area shall be returned to a debris-free state prior to re-opening to traffic.

The Contractor shall provide all traffic control according to the Maintenance and Protection of Traffic Specification included elsewhere in the contract.

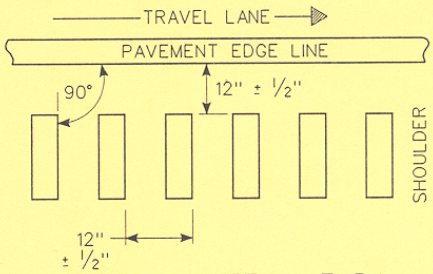
Method of Measurement:
This work will be measured for payment by the actual number of feet of shoulder where the rumble strips are placed and accepted. This distance shall be measured longitudinally along the edge of pavement with deductions for bridge decks, acceleration and deceleration lanes, drainage structures, loop detector sawcut locations, and other sections where the rumble strips were not installed.

Basis of Payment:
This work will be paid for at the Contract unit price per foot for "Rumble Strips - Automated" or "Rumble Strips - Manual." The price shall include furnishing all equipment, tools, labor, a technical representative and work incidental thereto and also disposal of any waste material resulting from the operation. The Contractor will not be paid under the item "Rumble Strips - Manual" if the field conditions allow for the use of the "Rumble Strips - Automated" item, even if the manual method was used.

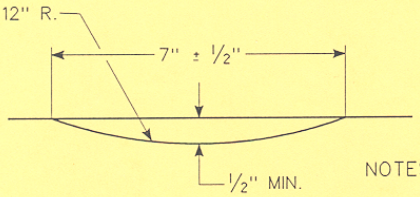
DETAILS AND SECTIONS OF RUMBLE STRIPS



LOCATION DETAIL (TYP.)
LEFT SHOULDER



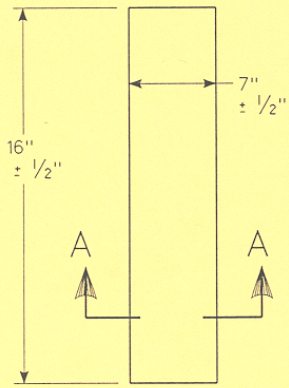
LOCATION DETAIL (TYP.)
RIGHT SHOULDER



SECTION A-A
NO SCALE

NOTES:

1. RUMBLE STRIP ALIGNMENT SHALL GENERALLY BE STRAIGHT AND OFFSET APPROXIMATELY 6" IN THE LEFT SHOULDER AND 12" IN THE RIGHT SHOULDER FROM THE OUTER EDGE OF THE EDGE LINE AND SHALL BE AT LEAST 12" FROM THE LONGITUDINAL JOINT IN COMPOSITE PAVEMENTS. THIS OFFSET MAY BE ADJUSTED TO ACCOMMODATE VARIATIONS IN THE EDGE LINE AND THE SHOULDER WIDTH.



PLAN DETAIL

FILE: RUMBLE.MDS

CONNECTICUT
DEPARTMENT OF TRANSPORTATION
BUR. OF ENGINEERING & HWY. OPERATIONS
DIVISION OF TRAFFIC ENGINEERING

RUMBLE STRIP DETAILS

ENGINEER Erika B. Smith DATE 10-18-99

SUBMITTED Stephen J. Masiatka DATE 10-20-99
TRAFFIC SUPERVISING ENGR.

APPROVED _____ DATE 10-20-99
PRINCIPAL ENGINEER

SCALE - NONE

ITEM # 0406287A
ITEM # 0406288A

3 OF 4

TYPICAL TREATMENTS FOR INSTALLING RUMBLE STRIPS
RUMBLE STRIPS IN LEFT SHOULDER, IF APPLICABLE
DIRECTION OF TRAFFIC
RESUME RUMBLE STRIPS AT END OF TAPER OF ACCELERATION LANE
RESUME RUMBLE STRIPS AT BEGINNING OF PHYSICAL GORE AND END RUMBLE STRIPS AT END OF PHYSICAL GORE
END RUMBLE STRIPS AT BEGINNING OF TAPER OF DECELERATION LANE
TYPICAL TREATMENT FOR RAMPS
PAVEMENT EDGE LINE
1.5 Ft.
1.5 Ft.
RUMBLE STRIPS (TYP.)
RUMBLE STRIPS (TYP.)
(1) FOR DISTANCES OF 3 Ft. OR MORE, CONTINUE RUMBLE STRIPS ALONG SHOULDER.
TYPICAL TREATMENT FOR OBSTRUCTIONS
(I.E. CATCH BASINS OR MANHOLES)
FILE: RUMBLE.MDS
1.5 Ft. (TYP.)
TYPICAL TREATMENT FOR LOOP DETECTOR SAWCUT LOCATIONS
3 Ft.
3 Ft.
EXPANSION JOINTS
3 Ft.
3 Ft.
TYPICAL TREATMENT FOR BRIDGES
NOTE: NARROW SHOULDERS APPROACHING BRIDGES MAY RESULT IN ENDING THE RUMBLE STRIPS AT THE GUIDE RAIL APPROACH
SCALE - NONE
CONNECTICUT
DEPARTMENT OF TRANSPORTATION
BUR. OF ENGINEERING & HWY. OPERATIONS
DIVISION OF TRAFFIC ENGINEERING
TYPICAL TREATMENTS FOR INSTALLATION OF RUMBLE STRIPS
ENGINEER
SUBMITTED
TRAFFIC SUPERVISING ENGR.
APPROVED
PRINCIPAL ENGINEER
DATE 10-18-99
DATE 10-20-99
DATE 10-20-99
ITEM # 0406287A
ITEM # 0406288A
4 OF 4

ITEM #0406289A - REMOVAL OF RUMBLE STRIPS

Description:
Work under this item shall consist of removing rumble strips through milling and repaving with hot mix asphalt (HMA) where shown on the plans or where directed by the Engineer, and in conformance with these specifications. The surface lift of the existing pavement shall be removed by milling out the existing rumble strip to a depth of 1.5 to 2.5 inches. The milled surface shall be swept by hand or machine and then be blown clean with compressed air or a hot air lance. Tack coat is to be applied to the milled surface and any vertical or semi-vertical walls formed by the milling. The milled out area shall then be filled and compacted with HMA S0.375.

Definitions:
Surface lift of pavement: The thickness of the last lift of pavement placed prior to performing crack sealing. A lift is defined as single bituminous-concrete mixture placed at a defined thickness in a single paver pass (or by handwork.)

Materials:
Materials for this work shall consist of the following:

Hot-mix Asphalt (specifically HMA S0.375) conforming to the requirements of Sections 4.06 and M.04 of the Standard Specifications.

Tack coat conforming to the material requirements for tack coat in Sections 4.06 and M.04 of the Standard Specifications.

Equipment:
Equipment for this work shall include, but is not limited to, the following:

Milling machine – A milling machine designed and built for milling HMA pavements. It shall be self propelled with sufficient power, traction, and stability to maintain depth.

The rotary drum of the machine shall utilize carbide tip tools spaced not more than 5/8 inches apart. Use of a fine-milling drum with a tighter tooth spacing of 0.3 inches is desirable, but optional. The forward speed of the milling machine shall be limited to no more than 45 feet/minute. The tools on the revolving cutting drum must be continually maintained and shall be replaced as warranted to provide a uniform pavement texture. It must include dust control equipment during the removal process.

It shall be capable of removing the existing pavement to a width of 2 to 10 inches wider than the rumble strip.

A wider milling width may be used in cases where two rumble strips are located near and parallel to each other, as may occur in a median area; see Construction Methods.
Sweeper – A hand broom is acceptable for smaller areas when approved by the Engineer. If a mechanized sweeper is used, it shall be equipped with a water tank and be capable of removing the

millings and loose debris from the surface. Other sweeping or vacuum type equipment may be provided in lieu of the sweeper where acceptable by the Engineer.

Air compressor – The unit shall consist of an air compressor capable of producing 100 psi, oil free, compressed air for blowing the milled pavement surface clean.

Hot air lance – The unit shall be designed for cleaning and drying the pavement surface. It shall consist of an air compressor capable of delivering 100 psi, oil free heated air. The compressed air emitted from the tip of the lance shall be flame free and be capable of achieving a temperature of at least 1500°F.

Paving and compaction equipment – All equipment used to place and compact the hot mix asphalt required for this work shall meet the requirements of Section 4.06 of the Standard Specifications, except no grade and slope control shall be required. Also, due to the nature of this work, it is expected that much of the placement of hot mix asphalt will require hand work. Either vibratory plate compactors or rollers may be used for compaction.

Construction Methods:
The Contractor shall pre-mark the location of the beginning and ending points of the sections, prior to the removal of the rumble strips. The Engineer shall review and approve the limits of removal.

The width of milling shall be as specified on the Plans or other specifications. If no other width specification exists, the width of milling shall be 2 to 10 inches wider than the existing rumble strip. Rumble strips are typically about 16 inches wide. If there are two rumble strips located near and parallel to one another, as may occur in median areas, and if they both can be removed by a single pass of a wider milling machine without adversely affecting drainage, safety, or quality of results, then a wider milling machine may be used. In this case the length measured for pay will be the sum of the lengths of the two individual rumble strips. Milling widths wider than specified above may be used with the written permission of the Engineer.

The depth of removal shall be as shown on the Plans, or as detailed in specifications, or as directed by the Engineer, generally from 1.5 to 2.5 inches. The intent is to remove the surface lift. If there are no Plans or other specifications, mill 1.5 to 2.5 inches as needed to match the thickness of the surface lift. The Engineer may alter the milling depth based on conditions discovered as work is in progress. It is expected that the milling depth will not exceed 2.5 inches. If the surface lift is 3 inches thick and it is in good condition, as determined by the Engineer, mill only 1.5 inches deep, unless directed otherwise by the Plans, project specifications, or Engineer.

As specified in the requirements for milling, the milled surface shall be swept clean (by hand if necessary.) Once all millings are removed by sweeping, the milled areas shall be allowed to dry if necessary. Any moisture in or on the milled areas must be allowed to evaporate or be removed with the assistance of a hot air lance as specified above. Once the milled area is deemed dry by the Engineer it shall be blown with compressed or hot lance air, as specified above, so that no debris or dust is present on or within the milled area.

Once deemed clean by the Engineer, the milled area, including the sides/walls of the milled area, shall receive an application of tack coat as specified above and in Section 4.06 of the Standard Specifications.

After the tack coat has had sufficient time to cure or break, HMA S0.375 (Superpave Level 2) shall be placed and compacted to the requirements above and in Section 4.06 of the Standard Specification. It shall be compacted to match the elevation of the surrounding pavement surface.

At all times the Contractor is required to meet the density and compaction and all other requirements specified in Sections 4.06 and M.04 of the Standard Specifications and any supplementals that have been issued by the bid date of the project.

The Contractor shall resurface the milled area prior to opening the roadway to traffic. The milled area shall be swept, cleaned with compressed air, tacked and repaved in the same day.

Precaution should be taken to avoid damage to the existing roadway materials that are to remain in place. If damage occurs, it must be repaired by the Contractor at no additional cost to the State. The methods employed in performing the work and all equipment, tools, machinery and plant used in handling material and executing any part of the work shall be subject to the approval of the Engineer before the work is started; and whenever found unsatisfactory, it shall be changed and improved as required by the Engineer.

The Contractor shall pick up any waste material resulting from the operation in a manner acceptable to the Engineer. This waste material shall be disposed of in accordance with Subarticle 2.02.03-10(a).

Method of Measurement:
This work will be measured for payment by the actual number of linear feet of rumble strips removed. This distance shall be measured longitudinally along the edge of pavement with deductions for bridge decks, acceleration and deceleration lanes, drainage structures, loop detector sawcut locations, and other sections where the rumble strips were not previously installed. If two rumble strips are near one another and are removed by a single milling machine pass, the length measured for pay will be the sum of the lengths of the two rumble strips.

Basis of Payment:
This work will be paid for at the Contract unit price per linear foot for "Removal of Rumble Strips." The price shall include the removal of the existing rumble strips, furnishing all materials, placement, and compaction of the HMA, equipment, tools, labor, and work incidental thereto and also disposal of any waste material resulting from the operation.

Pay item	**Pay Unit**
Removal of Rumble Strips	L.F.

ITEM #0406314A - 80 MIL (2 mm) PAVEMENT MARKING GROOVE 5" WIDE (130 mm)

ITEM #0406315A - 80 MIL (2 mm) PAVEMENT MARKING GROOVE 7" WIDE (180 mm)

ITEM #0406316A - 80 MIL (2 mm) PAVEMENT MARKING GROOVE 9" WIDE (230 mm)

ITEM #0406317A - 80 MIL (2 mm) PAVEMENT MARKING GROOVE 13" WIDE (330 mm)

Description:
Work under this item shall consist of grooving the pavement surface in a continuous or regularly spaced fashion for the placement of recessed pavement markings. Unless otherwise noted, the groove shall be 1 inch (25 mm) wider than the anticipated pavement marking. The groove for double-yellow centerline markings shall consist of two grooves, each 5 inches (130 mm) wide.

Groove Width: 5 inches (130 mm) wide for 4-inch (100 mm) markings
7 inches (180 mm) wide for 6-inch (150 mm) markings
9 inches (230 mm) wide for 8-inch (220 mm) markings
13 inches (330 mm) wide for 12-inch (300 mm) markings

Groove Depth: 0.080 inches (2 mm) ± 0.010 inches (0.25 mm)

The groove shall not be installed continuously for intermittent pavement markings, but only where markings are to be applied.

The groove shall not be installed on metal bridge decks, on bridge joints, at drainage structures, at loop detector sawcut locations, or in other areas identified by the Engineer.

Equipment:
The grooving equipment shall be equipped with a free-floating, depth-controlled head which provides a consistent groove depth over irregular pavement surfaces. The grooving head shall only be equipped with diamond saw blades. Any ridges in the bottom of the groove shall have a maximum height of 0.015 inches (0.38 mm).

The grooving equipment shall be capable of installing a groove 6 inches (150 mm) away from any vertical or horizontal obstruction.

Construction Methods:
The pavement marking groove shall be installed in accordance with the current ConnDOT pavement marking standard drawings.

The Contractor shall establish control points for measuring offsets and pre-marks along the entire distance of pavement being grooved. Prior to installation of the groove, the Contractor shall verify the equipment is capable of installing the correct width and spacing of the groove. The control points, pre-marks, and equipment will be reviewed by the Engineer prior to commencement of the work.

The groove will be considered defective if any edge of the groove varies more than 0.25 inch (6.35 mm) in a 10-foot length (3 m), or if the alignment of the groove visibly deviates from the normal alignment of the road.

Final Cleaning: The Contractor shall immediately collect all debris and dust resulting from the grooving operation by vacuuming the pavement groove and adjacent pavement surface. Collected debris and any waste material shall be properly disposed of by the Contractor.

The work area shall be returned to a debris-free state prior to re-opening to traffic.

Repair of Unacceptable Groove:
The Contractor shall repair any defective groove(s) to the satisfaction of the Engineer. All work in conjunction with this repair shall be performed at no additional cost to the State.

Pavement Marking Requirements:
The Contractor is required to install permanent epoxy resin pavement markings in the grooves before the lane or roadway is opened to live traffic. If the permanent pavement markings cannot be installed before the lane or roadway is opened to live traffic, temporary 0.005-inch (0.125 mm) hot-applied waterborne pavement markings without glass beads shall be installed before the lane or roadway is opened to live traffic at no additional cost to the State. Within 10 calendar days, permanent epoxy resin pavement markings shall be applied in the groove over the 0.005-inch (0.125 mm) hot-applied waterborne pavement markings.

Groove Depth Gauge:
The Contractor shall supply the Engineer with two accurate, easily readable gauges with which to verify groove depth for the duration of the project. The gauges shall be delivered no less than one week prior to the anticipated beginning of grooving operations. Gauges shall be accompanied by manufacturer's instructions for their use. The gauges will be returned to the Contractor at the conclusion of the project.

Method of Measurement:
This work will be measured for payment by the number of linear feet (meters) of groove installed in the pavement as ordered and accepted by the Engineer.

Basis of Payment:
This work will be paid for at the contract unit price per linear feet (meters) of "Pavement Marking Groove" installed in the pavement and accepted. This price shall include cleaning of the pavement, all materials, equipment, tools, depth gauges, and labor incidental thereto, and disposal of any waste material resulting from the operation.

Pay Item	**Pay Unit**
80 Mil (2 mm) Pavement Marking Groove 5" (130 mm) Wide	L.F. (m)
80 Mil (2 mm) Pavement Marking Groove 7" (180 mm) Wide	L.F. (m)
80 Mil (2 mm) Pavement Marking Groove 9" (230 mm) Wide	L.F. (m)
80 Mil (2 mm) Pavement Marking Groove 13" (330 mm) Wide	L.F. (m)

ITEM #0406737A - REPAIR BITUMINOUS CONCRETE PAVEMENT

Description:
Work under this item shall consist of repairing bituminous concrete pavement as required to maintain safe and efficient movement of traffic through the work site and detour routes as determined by the Engineer. This work will also include additional Maintenance and Protection of Traffic operations necessary to perform the work.

When it is determined by the Engineer that an area requires repairs, the Contractor will prepare a work plan to perform the repairs. The work plan shall consist of the labor, equipment and material to perform the repairs. The plan shall also include estimated costs, anticipated dates, times and schedule for the proposed activities.

All work will be performed in accordance with the plan details and Section 4.06 of these special provisions.

Materials:
Materials shall conform to Section M.04.

Construction Methods:
Construction Methods shall conform to the details as shown in the plans and to Article 4.06.03.

Method of Measurement:
The measurement for payment of "Repair Bituminous Concrete Pavement" will be paid for in accordance with Article 1.09.04 Extra and Cost Plus work. The sum of money shown on the estimate and in the itemized proposal as "Estimated Cost" for this item will be considered the bid price even though payment will be made only for actual work performed and accepted by the Engineer.

Basis of Payment:
The item "Repair Bituminous Concrete Pavement" be paid for in accordance with Article 1.09.04 to restore the existing pavement to a safe and efficient condition in accordance with special provisions, plan details and as directed by the Engineer.

The cost of any necessary Maintenance and Protection of Traffic outside of concurrent operations or patterns will be included.

ITEM #0406999A - ASPHALT ADJUSTMENT COST (ESTIMATED COST)

Description: The Asphalt Adjustment Cost will be based on the variance in price for the performance-graded binder component of hot mix asphalt (HMA), Polymer Modified Asphalt (PMA), and Ultra-Thin Bonded Hot-Mix Asphalt mixtures completed and accepted during the Contract.

The Asphalt Price is available on the Department of Transportation website at:

http://www.ct.gov/dot/asphaltadjustment

Construction Methods:

An asphalt adjustment will be applied only if all of the following conditions are met:

I. For HMA and PMA mixtures:
   a. The HMA or PMA mixture for which the adjustment would be applied is listed as a Contract item with a pay unit of tons.
   b. ***The total quantity for all HMA and PMA mixtures in the Contract or individual purchase order (Department of Administrative Service contract awards) exceeds 1000 tons or the Project duration is greater than 6 months.***
   c. The difference between the posted *Asphalt Base Price* and *Asphalt Period Price* varies by more than $5.00 per ton.

II. For Ultra-Thin Bonded HMA mixtures:
   a. The Ultra-Thin Bonded HMA mixture for which the adjustment would be applied is listed as a Contract item.
   b. The total quantity for Ultra-Thin Bonded HMA mixture in the Contract exceeds:
      i. 800 tons if the Ultra-Thin Bonded HMA item has a pay unit of tons.
      ii. 30,000 square yards if the Ultra-Thin Bonded HMA item has a pay unit of square yards.

      Note: The quantity of Ultra-Thin Bonded HMA measured in tons shall be determined from the material documentation requirements set forth in the Ultra-Thin Bonded HMA item Special Provision.
   c. The difference between the posted *Asphalt Base Price* and *Asphalt Period Price* varies by more than $5.00 per ton.
   d. No Asphalt Adjustment Cost will be applied to the liquid emulsion that is specified as part of the Ultra-Thin Bonded HMA mixture system.

III. Regardless of the binder used in all HMA or PMA mixtures, the Asphalt Adjustment Cost will be based on PG 64-22.

The Connecticut Department of Transportation (CTDOT) will post on its website, the average per ton selling price (asphalt price) of the performance-graded binder. The average is based on the high and low selling price published in the most recent available issue of the **Asphalt Weekly Monitor®** furnished by Poten & Partners, Inc. under the "East Coast Market – New England, New Haven, Connecticut area," F.O.B. manufacturer's terminal.

The selling price furnished from the Asphalt Weekly Monitor ® is based on United States dollars per standard ton (US$/ST).

Method of Measurement:

Formula: **HMA x [PG%/100] x [(*Period Price - Base Price*)] = $ ____**

where

- **HMA:**
  1. For HMA, PMA, and Ultra-Thin Bonded HMA mixtures with pay units of tons: The quantity in tons of accepted HMA, PMA, or Ultra-Thin Bonded HMA mixture measured and accepted for payment.
  2. For Ultra-Thin Bonded HMA mixtures with pay units of square yards: The quantity of Ultra-Thin Bonded HMA mixture delivered, placed, and accepted for payment, calculated in tons as documented according to the Material Documentation provision (Construction Methods, paragraph G) of the Ultra-Thin Bonded HMA Special Provision.
- ***Asphalt Base Price***: The asphalt price posted on the CTDOT website 28 days before the actual bid opening posted.
- ***Asphalt Period Price***: The asphalt price posted on the CTDOT website during the period the HMA or PMA mixture was placed.
- **PG%:** Performance-Graded Binder percentage
  1. For HMA or PMA mixes:
     - PG% = 4.5 for HMA S1 and PMA S1
     - PG% = 5.0 for HMA S0.5 and PMA S0.5
     - PG% = 6.0 for HMA S0.375, PMA S0.375, HMA S0.25 and PMA S0.25
  2. For Ultra-Thin Bonded HMA mixes: PG% = Design % PGB (Performance Graded Binder) in the approved job mix formula, expressed as a percentage to the tenth place (e.g. 5.1%)

The asphalt adjustment cost shall not be considered as a changed condition in the Contract as result of this provision since all bidders are notified before submission of bids.

Basis of Payment: The "Asphalt Adjustment Cost" will be calculated using the formula indicated above. A payment will be made for an increase in costs. A deduction from monies due the Contractor will be made for a decrease in costs.

The sum of money shown on the Estimate and in the itemized proposal as "Estimated Cost" for this item will be considered the bid price although the adjustment will be made as described above. The estimated cost figure is not to be altered in any manner by the bidder. If the bidder should alter the amount shown, the altered figure will be disregarded and the original cost figure will be used to determine the amount of the bid for the Contract.

Pay Item	Pay Unit
Asphalt Adjustment Cost	est.

ITEM #0502184A - SPECIAL TRACKWORK GRADE CROSSING

Description:

This item consists of the removal of the section of railroad track at the Highway/Rail At-Grade crossing at Reserve Road including transition zones; the furnishing and installation of a precast concrete slab type crossing system including transition ties; the full depth roadway reconstruction associated with the crossing replacement; and spot tie replacement in accordance with the plans, these specifications and as directed by the Engineer and the Railroad.

Materials:

The precast concrete crossing system shall be a slab style system designed to support E-80 train loadings. Acceptable systems include STARTRACK standard system as manufactured by Oldcastle Precast; TraCast Crossing system as manufactured by OMNI Rail; or approved equal.

Timber cross ties shall be new 7" x 9" Grade 3 track ties, 100% end plated and with minimum preservative retention of 8 pounds per cubic foot. Transition ties shall be 10'-0" in length. Cross ties for spot tie replacement shall be 8'-6" in length. Track spikes shall be new steel cut spikes 5/8" x 6" with medium carbon content with a minimum of four spikes provided per tie plate for all new ties. Ties and spikes shall meet the general requirements of the AREMA Chapters 5 and 30.

Other track material required for fastening rail to the crossing panels shall be per the requirements of the panel manufacturer.

Insulated joints shall be new premium quality in accordance with AREMA (latest edition), match existing rail size and subject to approval by the Engineer.

Geotextile shall conform to the requirements of sub article M.08.01-19.

Rail size shall be 132 RE matching existing and shall be in accordance with AREMA Chapter 4, Part 2 (latest edition).

Ballast shall be crushed trap rock or granite. It shall be: a) composed of angular fragments which are clear and free from deleterious substances; b) of proper gradation; and c) meet all requirements of this specification. Additionally, ballast shall be in conformance with AREMA Chapter 1 Part 2 (latest edition) except as specified herein.

Gradation: Ballast shall conform to the following gradation (Sieves must conform to the current version of ASTM E11 – Standard Specification for Woven Wire Test Sieve Cloth and Test Sieves:

Size No.	Ballast Type	Amounts Finer Than Each Sieve (Sq. Opening Laboratory Sieve-Pct. By Wgt.) 2 in.	1 ½ in.	1 in.	¾ in.	½ in.	3/8 in.	#4
4	A	100	90–100	20-55	0-15	-	0-5	-

Subbase shall conform to the requirements of M.02.02.

Bedding material shall conform to the requirements of M.08.03.

Bituminous pavement shall conform to the requirements of M.04.

Construction Methods:

The Contractor shall perform a field inspection and survey of the track section in the immediate vicinity of the crossing to be replaced, and this information shall be used to restore the track to its original geometry at the conclusion of the crossing replacement. The Contractor shall confirm the location of existing insulated bolted rail joints for planning rail removal and replacement limits. The Contractor shall replace the rail section including insulated joints from the nearest bolted rail joint beyond the transition tie areas. The Contractor shall not cut the existing rail unless specifically approved by the Engineer and the Railroad.

The Contractor shall submit a working plan to the Engineer and Railroad for review addressing the limits of track to be removed, the method of removal of the crossing material, installation of the replacement crossing material, installation of transition ties and replacement rail complete with all required track materials, and surfacing of track. All track installation shall be performed by an experienced railroad track installer with reinstalled track geometry meeting the minimum requirements of Federal Rail Administration (FRA) Class 4 track. The Contractor or subcontractor performing the track work shall use qualified personnel trained, experienced and skilled in track construction of the type required under the Contract. Prior to the start of related work, the Contractor shall submit to the Engineer for review and comment the qualifications of the key personnel responsible for the track construction on the Project. All track construction for the Project shall be performed by or under the supervision of the key personnel qualified and experienced for such work and acceptable to the Engineer. Track installation shall be performed with specialized track equipment including a ballast regulator and tamper equipped with lining and surfacing capabilities.

The Contractor shall be required to prepare and submit detailed shop drawings for all Concrete Highway/Rail At-Grade Crossing System Units and insulated joints, to be installed under this Contract per Section 1.05.02 of the Standard Specifications.

The Concrete Highway/Rail At-Grade Crossing System Units shall be installed according to the Project Plans and Details and in accordance with Manufacturer instructions. The units shall be installed over graded, leveled, and compacted subbase and bedding material. Geotextile separation fabric shall be installed under and up the sides of the subbase.

The full depth roadway reconstruction work associated with the replacement of the crossing shall conform to the applicable requirements of Articles 2.02, 2.09, 2.12 and 4.06 of the Standard Specifications.

All Contractor activities related to the replacement of the crossing including Contractor use of hi-rail equipment and access to the track shall be in accordance with Section 1.05, Article 1.05.06 – Cooperation with Utilities (Including Railroads), NTC-Work on Railroad Property and all other applicable Railroad specifications.

The Contractor shall assume that the condition of the rail joints, tie plates and connecting hardware are in a condition satisfactory for their function and can be removed, stored, and re-installed in a workman like manner without a need for replacement with the exception of tie spikes and insulated joints. Tie spikes within the limits of the track removal are to be replaced with new spikes furnished by the Contractor. The Contractor shall assume that all ballast is fouled and is not suitable for restoration of the track at the completion of the crossing installation.

The Market Industrial Spur will be taken out of service by the Railroad from the main line switch to the north extending beyond the Farmer's Market to the south during the single multiple day outage for the replacement of the crossing. The Contractor shall remove the track section required for their work; install the concrete crossing; install and surface the track to its original geometry. The Contractor shall supply, place and compact the ballast layer in the tie transition areas as shown on the plans.

In addition to the track work associated with the replacement of the crossing and the transition ties, the Contractor shall perform spot tie replacement within the limits and in the quantities identified on the plans. Individual ties to be replaced will be identified by the Railroad in advance of the crossing replacement, and the Contractor shall replace such ties during the track outage scheduled for the crossing replacement. The Contractor shall supply, place and compact the ballast in the area of spot tie replacement as required and shall line and surface the track for the complete limits of the grade crossing and spot tie replacement activity.

All existing timber ties removed shall be handled and disposed of in accordance with applicable environmental compliance specifications.

Method of Measurement:

This item shall be paid for on a lump sum basis and will not be measured for payment.

Basis of Payment:

This work shall be paid for at the contract lump sum price for "SPECIAL TRACKWORK GRADE CROSSING", which price shall include all materials, tools, equipment and labor incidental to the field inspection and survey of the existing track; removal and disposal of existing track crossing and track materials; furnishing and installation of a precast concrete slab type crossing, transition and standard timber cross ties; furnishing, installation and surfacing of continuous welded rail including all related track materials and ballast; and all full depth roadway reconstruction required for the crossing replacement at Reserve Road.

Underdrain, outlet for underdrain, conduit, and pavement markings associated with the crossing replacement will be paid under the applicable unit priced items.

ITEM #0503030A - REMOVAL OF BRIDGE DECK CONCRETE

Work under this item shall conform to the requirements of Section 5.03 of the Standard Specifications, Form 817, amended as follows:

5.03.01 - Description: add the following:

Work under this item shall consist of the removal and satisfactory disposal of the existing concrete deck. The concrete shall be sawcut to delineate the removal limits. Those items to be removed and disposed of shall include, but not be limited to the concrete bridge deck, concrete bridge parapet, metal bridge rail, bridge drainage scupper if applicable and concrete bridge sidewalk if applicable, as shown on the plans or as directed by the Engineer. This work shall also include the installation and maintenance of a debris shield under the existing bridge concrete deck to be removed.

5.03.03 - Construction Methods: Add the following:

Upon the completion of the removal of the HMA wearing surface and prior to the removal of the concrete deck, the contractor shall record existing top of concrete elevations taken along the center line of each steel girder at the bearing locations and at 10 feet intervals between the bearings.

Removal of Bridge Deck Concrete: All work shall proceed as directed by and to the satisfaction of the Engineer in accordance with the details shown on the plans and the requirements of Special Provisions Maintenance and Protection of Traffic and Section 1.08, “Prosecution and Progress”.

The removal shall not result in damage to any permanent construction (new or existing), to utilities, or to adjoining property. If any damage occurs it shall be repaired by the Contractor to the satisfaction of the Engineer at no additional expense to the State.

Wherever arc gouging or flame cutting will be used for removal of metail bridge rail on wingwalls, existing lead paint must first be removed from around the area to be affected. See the special provisions for “Localized Paint Removal and Field Painting of Existing Steel (Site No. X)” for the applicable description and construction methods.

The Contractor shall prepare and submit to the Engineer for review in accordance with Article 1.05.02 working drawings, computations and written procedures for the removal of the bridge deck concrete. Acceptance of the Contractor’s plans shall not be considered as relieving the Contractor of any responsibility.

The Contractor shall support and protect the existing utilities during the removal of the existing bridge concrete deck.

5.03.04 - Method of Measurement: Delete the entire content of the article and replace with the following:

Concrete bridge deck and concrete bridge sidewalk removed under this item shall be measured for payment by the volume in cubic yards, measured in place prior to removal.

5.03.05 - Basis of Payment: Delete the entire content of the article and replace with the following:

This work will be paid for at the contract unit price, per cubic yard, for "Removal of Bridge Deck Concrete", which price shall include all equipment, tools and labor incidental thereto, including the installation, maintenance and removal of a debris shield, as directed by the Engineer.

Pay Item	Pay Unit
Removal of Bridge Deck Concrete	C.Y.

ITEM #0503206A - REMOVAL OF SUPERSTRUCTURE (SITE NO. 12)

Work under this item shall conform to the requirements of Section 5.03 amended as follows:

5.03.01 - Description:

Delete the first two paragraphs and replace with the following:

Work under this item shall consist of the removal and satisfactory disposal of the superstructure. Those items to be removed and disposed of shall include, but not be limited to concrete deck and beams, diaphragms, bituminous wearing surface, parapets, railings, fencing, bearings and any other items that may be attached thereto as shown on the plans or as directed by the Engineer. The Contractor shall carefully remove the Metal Bridge Rail Protective Fence for salvage as outlined in the Notice to Contractor – Salvage.

5.03.03 - Construction Methods:

Add the following:

General: All work shall proceed as directed by and to the satisfaction of the Engineer and in accordance with the details shown on the plans, or as approved by the Engineer. In addition, all work shall be in accordance with requirements for the construction staging as shown on the plans.

Removal of Superstructure: The superstructure shall be dismantled in accordance with the methods proposed by the Contractor and approved by the Engineer. All work shall proceed as directed by and to the satisfaction of the Engineer in accordance with the details shown on the plans and the requirements of the Special Provisions "Maintenance and Protection of Traffic" and "Prosecution and Progress", contained elsewhere in these Specifications.

Material not designated for salvage shall become the property of the Contractor and shall be removed from the job site and disposed of by the Contractor.

Metal Bridge Rail Protective Fence is designated for salvage and shall be carefully removed to prevent damage and delivered to the appropriate location as listed on the Notice to Contractor – Salvage.

The removal shall not result in damage to any permanent construction (new or existing) or to adjoining property. If any damage does occur the Contractor shall repair it to the satisfaction of the Engineer at no additional expense to the State.

It is the responsibility of the Contractor to protect all utilities and existing roadways throughout the duration of the removal of superstructure. Contractor shall coordinate all activities with impacted utilities. Contractor shall repair any damage to existing roadways or utilities at no additional expense to the State.

Working Drawings: The Contractor shall also prepare and submit for review, working drawings, including computations, and written procedures for the removal of the superstructure in accordance with Article 1.05.02. Nine copies of working drawings shall be submitted to the Engineer. Removal may proceed only after receiving approvals from the Engineer. Acceptance of the Contractor's plans shall not be considered as relieving the Contractor of any responsibility.

Method of Measurement:

Delete the entire article and replace with the following:

This work, being paid for on a lump sum basis, will not be measured for payment. Removal of the Metal Bridge Rail Protective Fence, storage and transport to the designated location shall not be measured separately for payment but shall be included in the cost of this item.

Basis of Payment:

Delete the second and third paragraphs and replace with the following:

This work will be paid for at the contract lump sum price for "Removal of Superstructure" which price shall include the removal and disposal of the superstructure and its components as well as removal, salvage and transport of those items listed above and all equipment, tools and labor incidental thereto.

Pay Item	**Pay Unit**
Removal of Superstructure (Site No. 12)	L.S.

ITEM #0503313A - GROUND IMPROVEMENT (SITE NO. 3)
ITEM #0503316A - GROUND IMPROVEMENT (SITE NO. 6)

Description:

The scope of work includes supplying the materials, labor, equipment, and procedures for ground improvement consisting of aggregate piers (herein generically referred to as Ground Improvement). Ground Improvement Elements shall be installed with techniques specially adapted to installation below the natural groundwater level.

A testing program shall be implemented prior to production Ground Improvement consisting of performance of pre-treatment and post-treatment borings or cone penetrometer test probes at the proposed test location. A modulus test load test shall be performed as specified herein substantiating the performance criteria.

Ground Improvement shall be designed and performed by the specialty Ground Improvement Contractor. If any requirement specified herein or shown will result in damage to a facility, utility or structure using the equipment and methods proposed by the Specialty Contractor, he/she shall identify the impact, and notify the Department in writing substantially in advance and prior to beginning the work. It is the Specialty Contractor's responsibility to perform ground improvement in such a manner so as not to adversely affect existing active roadways (i.e., Route 15 or I-91 travel lanes), the existing bridge pier and abutments during staged construction and the recently completed initial stages of this new construction during construction of subsequent stages of this project.

Ground Improvement spoil shall be disposed of by the General Contractor as directed by the Engineer and in accordance with Section 1.10.

Subsurface and overhead utilities are present. Utility locations, realignments or deactivations shall be arranged by the Contractor prior to the commencement of work. The Contractor shall be solely responsible for all damages resulting from ground movements associated with Ground Improvement activities.

AASHTO LRFD Bridge Design Specifications, CONNDOT's Bridge Design Manual, CONNDOT's Geotechnical Manual and CONNDOT Form 817 shall be used for this work in addition to the project plans and specifications as standards for successful performance of the work.

The Contractor is to take measures to minimize noise in all project areas, as required under Section 1.10.05 – Construction Noise Pollution.

Materials:

Aggregate. Aggregate used by the Contractor shall be pre-approved by the Engineer and shall demonstrate suitable performance during testing.

1. Potable water or other suitable source shall be used to increase aggregate moisture content or batch on-site grout where required.

Concrete. Concrete used by the Specialty Contractor shall be pre-approved by the Engineer and shall be of the required strength as required by the design.

Grout. Grout used by the Specialty Contractor shall be pre-approved by the Engineer and shall be of the required strength as required by the design.

Construction Methods:

1 – Qualifications

Submit to the Engineer, at least 21 days prior to commencement of any work or as otherwise noted, details of the experience of the specialty ground improvement contractor and shall have a minimum of 5 year experience with the installation of rammed aggregate piers, and completed at least 15 projects in New England, with at least five of those being in the State of Connecticut, and be of similar complexity and size.

Qualifications of the operator and foreman shall also be submitted and shall have a minimum of 5 year experience with the installation of aggregate piers, on projects of similar complexity and size.

The ground improvement contractor shall have the design and plans prepared by professional engineer registered in the State of Connecticut. The registered professional engineer shall have a minimum of 5 years of experience in the design of ground improvement systems similar in size and complexity to the project.

The specialty ground improvement contractor performing the borings or cone penetrometer test probes, if chosen as the confirmation testing, on the site shall demonstrate a minimum of 5 years of experience completing activities similar to those required for the confirmation test borings.,

2 - Ground Improvement Design Requirements

The specialty Ground Improvement Contractor shall implement Ground Improvement in a manner so as to limit total post construction settlements to less than 1 inch and differential settlements to less than ½ inch within the improved zone, and attain bearing resistances as shown below:

Item	Unfactored Resistance (KSF)	Factored Resistance (KSF)	Resistance Factor
Service	4	4	1
Strength	20	11	0.55

See section 3 – Submittals, Test Program of this special provision for test program acceptance criteria.

3 – Vibration Restrictions

Construction induced vibrations shall be kept to under 2 inches per second for structures within 100 feet of the location of the work during installation activities. Vibration monitoring through the use of seismographs will be required for the duration of the ground improvement activities, and shall monitor for as long as the work continues daily.

A minimum of one seismograph shall be placed at the structure closest to the work. If the threshold limit is met, then all work shall cease until a plan to limit further vibrations can be instituted.

4 - Submittals

Submit the following to the Engineer for approval at least 21 days prior to commencement of any work or as otherwise noted. All work plans, drawings and calculations shall be signed and stamped by a Professional Engineer licensed in the State of Connecticut:

1. Design Computations
   a. A written report which describes the overall Ground Improvement design. Design information shall include, but not be limited to, element configurations, materials, capacity and spacing, bearing capacity analysis, global stability analyses, settlement analyses, explanation of soil properties, element installation termination criteria, and embedment depth in the bearing stratum.

   b. Applicable code requirements and design references.

   c. Critical design sections

d. Design criteria including design parameters for settlement calculations.

e. Safety factors

f. Design calculation sheets with the project number, Ground Improvement area location, designation, date of preparation, initials of designer and checker, and page number at the top of each page. Provide and index page with the design calculations.

g. Design notes including an explanation of any symbols and computer program used in the design.

2. Working Plans and Drawings

a. Field layout of Ground Improvement and equipment.

b. Location and pattern of proposed Ground Improvement, diameter of aggregate piers, and other necessary details (shop drawings).

c. Concrete or grout mix designs if required.

d. Aggregate gradation, sources of materials, environmental compliance for materials, and material data demonstrating compliance with requirements as given herein.

e. Manufacturer's literature and description of the proposed equipment and procedures to be used for Ground Improvement.

f. Installation techniques which will be utilized to address the nature of the potential obstructions within the upper soil stratum.

g. Detailed plan for containment, segregation, and disposal of spoils including methods to handle contaminated material, if encountered. This shall be the responsibility of the General Contractor, but shall be coordinated with the Specialty Contractor. The plan shall include silt fences, dewatering sumps, hay bales, collection or any other means necessary to control and prevent spoils and runoff from entering the adjacent areas (i.e., offsite areas or active roadways). The plan shall comply with sediment and erosion control requirements shown on the Drawings and contained in the project permit. Sediment and erosion control and disposal of water shall be performed using Best Management Practices and in accordance with federal, state, and local regulations.

h. Details of settlement/heave monitoring program with established threshold values including contingencies for modified means and methods of Ground Improvement should threshold values be approached. This shall be

the responsibility of the General Contractor during ground improvement activities

i. Details of vibration monitoring program with established threshold values including contingencies for modified means and methods of Ground Improvement should threshold values be approached.

j. Contingency should modified means and methods of ground improvement be required due to approaching of threshold values or presence of subsurface obstructions. The work associated with this plan may be shared by both the Specialty and General Contractor depending on the alternative method required. The submittal should clearly state responsibility for tasks. As an example, if removal of obstructions will be required, this would fall under the activities and responsibility of the General Contractor. If an alternate installation method is required, this would be the responsibility of the Specialty Contractor.

k. The quality control test program for the aggregate pier system, meeting the design requirements noted herein.

3. Daily Ground Improvement Reports.

Daily reports will be submitted during the performance of test and production Ground Improvement providing the information listed below. A sample of the report forms considered for use by the Specialty Contractor shall be provided as part of the submittal process for the Engineer's review, comment, and approval prior to the start of work.

a. Footing and pier element location and label.

b. Pre-auger diameter and soil conditions encountered during drilling.

c. Pier element length.

d. Planned and actual element elevations at top/bottom of element.

e. Average lift thickness of each element.

f. Volume of aggregate used in each element.

g. Documentation of any unusual conditions.

h. Type and size of densification equipment used.

i. Time and duration of each pier installation.

4. Test Program

The Specialty Contractor's test program shall be provided as part of the submittal process for the Engineer's review, comment, and approval prior to the start of work. Elements of the test program include:

a. The test program shall include a minimum of one modulus test for each type of ground improvement installed. The test shall be conducted on a sacrificial pier/column in locations subject to approval by the Engineer.

b. The test shall consist of applying loads to a steel plate placed over the aggregate column and measure deflection. Test shall be conducted in increments up to 150 percent of the limit state top of pier stress.

c. Prior to and after installation of ground improvement columns/piers at the test location, a minimum of two (2) pre-treatment and two (2) post-treatment borings or cone penetrometer test probes, respectively, shall be conducted by a specialty contractor engaged by the specialty ground improvement contractor. The tests will be used as a supplement to the full-scale footing load test to confirm the performance criteria specified herein. The General Contractor shall provide uninterrupted access to the test locations to facilitate timely performance of the required pre-treatment and post-treatment testing..

d. The specialty ground improvement contractor shall submit information upon completion of the test program providing the production installation parameters necessary such that all production ground improvement work at least meets the minimum parameters utilized for the test program. Significant deviations in installation parameters during production from those established during the test program should not be made unless prior justification is provided and substantiated

e. The Specialty Contractor must also submit a report summarizing the testing upon completion. The report shall indicate that testing verifies the aggregate pier design is appropriate. It shall be prepared by a professional Engineer registered in the State of Connecticut, and affirm that the aggregate pier design meets the performance criteria specified herein.

5. Contingency Plan.

The Specialty Contractor shall submit a plan indicating what the Specialty Contractors will do if settlement, heave or vibration levels greater than the

threshold levels occur. The plan shall include modifications to the means and methods or alternative Ground Improvement techniques as required to successfully meet the specified performance criteria.

5 - Equipment

1. Ground Improvement Systems: Pier Ground Improvement installation equipment shall be of sufficient capacity, length and size to install Ground Improvement as specified herein and meet the performance criteria.

2. Aggregate Storage and On-Site Transportation**:** The Specialty Contractor shall coordinate its efforts with the General Contractor and ensure equipment with respect to aggregate storage such that test and production work proceeds in a timely and expeditious manner.

3. Auxiliary Equipment: Spare parts and/or equipment shall be available on site to maintain Ground Improvement and support equipment in satisfactory operating conditions at all times during execution of the work.

6 - Ground Improvement Installation

The installation of Ground Improvement for this work shall be as specified herein, as indicated on the Drawings, and as required by the Contractor's Engineer to meet the performance criteria specified herein.

1. Work Hours.

    a. Traffic operations shall be maintained at all times in accordance with the special provisions "Maintenance and Protection of Traffic" and "Prosecution and Progress".

2. Construction Procedure

    Prior to start of Ground Improvement, the General Contractor shall expose existing underground utilities at a sufficient number of points to adequately determine the locations. The general procedure for constructing each individual Ground Improvement pier shall be as required by the Specialty Contractor to meet the performance criteria herein and as substantiated by the Test Program.

    a. Prepare the work area and complete subgrade preparation by the General Contractor prior to Specialty Contractor beginning work.

    b. Spoils shall be removed in a timely manner to prevent interruption of work.

Ground improvement spoil shall be disposed of by the General Contractor as directed by the Engineer and in accordance with Section 1.10.

c. Prior to, during and following pier installation, positive drainage shall be provided to protect the site from wet weather and surface ponding of water.

d. The location of piers shall be field marked by the Specialty Contractor using survey stakes or similar means at locations shown on the submitted layout drawings.

3. Construction Requirements

a. The Ground Improvement piers shall be constructed to the lines, grades, depths and cross sections indicated on the submitted plans and performed according to the procedures approved by the Engineer during the submittal process. The submittal procedure does not relieve Specialty the Contractor from the responsibility of meeting the performance criteria specified herein.

b. Additional Ground Improvement piers shall be installed, as directed by the Engineer, at no additional cost to the Department, if the minimum bearing capacity requirements have not been satisfied.

c. Horizontal Alignments

Piers shall be installed within 6 inches of the locations indicated on the submitted and approved plans. Piers installed outside of the above tolerances should be evaluated on a case by case basis by the Specialty Contractor's Engineer and if deemed unacceptable shall be rejected and replacement piers shall be installed.

d. Vertical Alignments

Pier inclination shall be vertical as confirmed by observation of the tooling above grade during installation operations.

e. Presence of Obstructions

If the penetration cannot be completed to the depth shown on the submitted and approved drawings because of the presence of an obstruction, the Specialty Contractor shall implement the contingency plan for predrilling, excavation to remove the obstruction (by the General Contractor) or be temporarily moved to the next column location and the situation reported to the Engineer. The installation of that pier shall resume when a plan of action has been decided. If excavation is required such that potential adverse impact could occur to existing critical areas, a contingency plan should be

implemented such that the required Ground Improvement can be attained in a manner such that no adverse impact occurs to existing critical facilities or features.

The presence of obstructions shall be noted and recorded on the daily shift logs.

f. Segregation and Disposal of Spoil.

No spoils, runoff, or sediment of any kind shall be allowed to enter the drainage system, or be discharged to adjacent areas. Segregation and disposal of spoils including methods to handle contaminated material, if necessary, shall be carried out in accordance with an approved work plan prepared by the Contractor, and the sediment and erosion control requirements shown on the Drawings and contained in the project permit. All disposal shall be done using Best Management Practices and in accordance with federal, state, railroad, and local regulations.

g. Prevention of Ground Heave, Settlement or Excessive Vibration Levels

The General Contractor shall implement means and methods of Ground Improvement in such a manner so as not to adversely impact existing structures or features or newly constructed portions of a prior stage.

Ground heave or settlement shall not exceed the criteria established in this specification section as measured by surface control points located at selected locations. If settlement or heave exceeds 0.5 inches, Ground Improvement shall stop, the Engineer shall be notified, and a meeting shall be held to review the Specialty Contractor's contingency plan and actions to be taken by the Specialty Contractor. The contingency plan shall then be implemented, with any necessary modifications agreed upon at the meeting.

h. Control Points

Control points for monitoring settlement and heave shall be the responsibility of the General Contractor, and consist of surface control points within 500 feet of any pier installation. They shall be located at all structures within 500 feet, at 100 foot intervals along roadways and at any identified critical utilities or structures. Surface control points/locations shall be installed as shown on the General Contractor's submittal and as agreed to by the Engineer.

Control points shall be monitored prior to the start of pier installation and on a weekly basis during pier installation, except any point within 100 feet of pier installation shall be monitored on a daily basis. Results shall be submitted to the Engineer on the day they are obtained.

i. Condition Surveys and Monitoring

Condition surveys and monitoring of existing facilities for vibration and settlements during Ground Improvement activities shall be performed and paid for by the General Contractor.

j. Production Work

The same equipment, materials, and procedures as those determined in the test program to give optimum and satisfactory results shall be used to perform the production work described herein. Reasonable variations from the test procedure will be permitted based upon variations in required factored bearing resistances. The Specialty Contractor shall submit these reasonable variations for pre- approval and substantiate the variations will not impact meeting the minimum performance criteria specified herein.

7 - Daily Ground Improvement Reports.

Daily reports will be submitted during the performance of test and production Ground Improvement providing the information as detailed under **Construction Methods**, **3 – Submittals**.

7 - Quality Control and Quality Assurance.

1. Control by Specialty Contractor

The pier installer shall verify and report all installation procedures. The installer shall immediately report any unusual conditions encountered during installation to the pier Designer and the Engineer.

Refer to section **1 – Qualifications** of this special provision for experience requirements for the Control Representative and the quality assurance firm.

Method of Measurement:

Measurement of the ground improvement shall be on a lump sum basis, complete in place, which shall include, but not be limited to mobilization and demobilization, installation, materials and testing. Removal of obstructions and preparation of the subgrade by the General Contractor shall not be included in this payment item. The Specialty Contractor will be required to meet the performance specification outlined herein and provide all testing specified herein.

Basis of Payment:

This work will be paid for at the contract lump sum price for "Ground Improvement (Site No. X)" which price shall include all materials, tools, equipment and labor for the required work, complete in place and accepted by the Engineer, including: the design, supply, and installation of the aggregate pier ground improvement system; test program; all submittals including design computations, working plans, drawings, daily ground improvement reports, contingency plan; and proper disposal of ground improvement spoil.

Condition survey and monitoring of existing facilities for vibration and settlements during ground improvement activities shall be performed by the General Contractor.

ITEM #0503904A - JACKING FOR BEARING REPLACEMENT

Description:
Work under this item shall consist of designing, furnishing, installing, maintaining and removing temporary jacking systems (falsework bents, towers, or devices) that can raise the existing superstructure members the minimum amount necessary to replace the bearings and patch beam seats as shown on the plans, in accordance with these specifications, and as directed by the Engineer. Work under this item shall also include designing, furnishing, installing, maintaining and removing OSHA compliant work platforms at the abutments and piers necessary for bearing replacement, excavation and backfilling at the abutments and piers necessary to install the jacking frames and construction of temporary footings.

Materials:
Steel, timber or any other material or combination of materials may be used for the temporary jacking and supporting of the beams.

The materials used shall be of satisfactory quality, and capable of safely carrying the anticipated loads. All materials shall be approved by the Engineer before use.

Work platforms and railings shall be designed for OSHA Loads.

Construction Methods:
Prior to construction, the Contractor shall submit working drawings, design computations and catalog cuts for review in accordance with Article 1.05.02. The design shall conform to the AASHTO Standard Specifications for Highway Bridges and the AASHTO Guide Design Specifications for Bridge Temporary Works.

The design computations shall include, but not be limited to, the following:

1. Material designations and material lists.

2. Allowable loads or capacities for all structural members and components. Appropriate reductions in allowable stresses and loads shall be used in design when other than new or undamaged materials are used in the construction of the temporary jacking system.

3. Soil or pavement bearing capacities, if applicable.

4. Anticipated lifting loads.

5. Anticipated design loads and stresses on structural members and components.

6. References for all design equations.

The working drawings shall include, but not be limited to, the following:

1. General Notes.

2. Details of jacking/framing assembly such as bents, towers etc.

3. Model number and capacity for each jack – The rated capacity shall be at least 1.5 times the anticipated lifting load. Each jack shall have its rated capacity clearly shown on the attached manufacturer's name plate. The jacks shall be hydraulically operated.

4. Schematic diagram showing the jacks, hoses, pumps, gages and any other jacking equipment – Pressure gages or other load measuring devices shall be used to monitor the applied lifting pressure. The jacks shall be individually employed or joined to operate collectively.

5. Maximum anticipated lifting load for each jacking point location.

6. Anticipated lift at each jacking point location.

7. Conversion table listing hydraulic pressures and their equivalent lifting forces.

8. Jacking procedures outlining the complete sequence of operations to be followed when jacking.

9. A Plan showing the layout of the jacking point locations and the details of the bracing and supporting members. All connections shall be detailed. Jacks shall be set level.

10. Details of proposed modifications to the existing structure and the methods of restoration. All modifications to the bridge shall be removed unless otherwise permitted by the Engineer to remain. Welds are to be removed by grinding or "arc" gouging without damaging the base metal that is to remain. No holes shall be drilled into or concrete removed from the superstructure.

11. The location, length, and type of temporary barriers placed for protection of the jacking system.

The working drawings and design calculations shall be signed and sealed by a Professional Engineer licensed in the State of Connecticut, who shall also be available for consultation interpreting his drawings and calculations, and in the resolution of any problem that may occur during the performance of the work. Please note that each working drawing must be sealed.

The furnishing of calculations and working drawings shall not serve to relieve the Contractor of any responsibility for the safety of the work or the successful completion of the work.

The catalog cuts shall contain the specifications for the jacks.

The Contractor shall field verify all working drawing dimensions before fabricating any materials. The jacking system shall be installed and detailed on the working drawings. The jacking system, once installed, shall not prohibit the Contractor from performing any work required by the contract plans. The Engineer may require that any lifting equipment which he deems to be inadequate or faulty be removed from the project site. The Contractor shall have two spare jacks available during the jacking operation.

The amount of jacking shall be the minimal amount as required to accomplish the work as detailed on the plans. The differential lift between adjacent girders shall not exceed 1/8 inch anytime during the jacking or lowering of the girders

Jacking against the concrete deck or any portion thereof shall not be permitted.

For the replacement of expansion bearings, all the beam ends along a substructure unit shall be uniformly jacked the minimum amount necessary to complete the work detailed on the contract plans. For the replacement of fixed bearings, only the beam ends at a substructure unit noted in the plans shall be jacked the minimum amount necessary to complete the work detailed on the contract plans.

The applied lifting force at each jacking point location shall not exceed the maximum anticipated lifting load without approval by the Engineer.

The Contractor shall carefully inspect and maintain the jacking system during its use.

After the beams are raised, blocking may be installed as necessary to support the superstructure while work is performed on replacing the bearings and patching beam seats if required.

After the bearings have been replaced and accepted, the beam ends shall be uniformly lowered until all loads are carried by the bearings.

When the jacking system is no longer required, the Contractor shall promptly remove and dispose of the equipment and materials. The area shall be restored to its original condition and to the satisfaction of the Engineer. The jacking stiffener and the temporary footings if required installed for jacking operations shall remain permanently in place.

The Contractor shall be responsible for any damage caused to any part of the structure, utilities, pavement, or vehicular traffic as a result of the work required by this special provision. He shall repair and/or replace any such damage at no cost to the State, and to the satisfaction to the Engineer.

The contract plans depict one method of jacking the beams at the bridge abutments and the piers. The contractor may submit alternative methods, supported by working drawings and design computations (see earlier paragraphs for submission requirements), for review and approval by the Engineer.

The existing steel bearing assemblies shall be removed subsequent to the jacking operations in accordance with the details provided in the contract plans and disposed of by the Contractor.

The Contractor is cautioned about the presence of existing conduits and wires attached to the underside of the superstructure and face of the piers and abutments which may be within the limits of jacking operations. The proposed jacking procedure shall include temporary relocation of the conduits and wires while maintaining service.

Method of Measurement:
This work shall be measured for the payment by the number of beam ends jacked, supported, and lowered. No additional measurement shall be made for jacking a beam end multiple times. Furnishing, installation and removal of OSHA compliant work platforms at abutments and piers, construction of temporary footings if required and excavation and backfilling at abutments and piers necessary to install jacking frames and temporary relocation of existing conduits and wires if required will not be measured for payment.

Condition survey and monitoring of existing facilities for settlement during jacking shall be performed and paid for under the item "Condition Survey".

Basis of Payment:
This work shall be paid for at the contract unit price each "Jacking for Bearing Replacement", complete and accepted, which price shall include all materials, tools, equipment, design and furnishing of working drawings and labor incidental thereto including the furnishing, installation and removal of OSHA compliant work platforms at abutments and piers, excavation and backfilling at abutments and piers construction of temporary footings and temporary relocation of existing conduits and wires if required.

ITEM #0503996A - RECONSTRUCT CONCRETE DECK AND BACKWALL

Description:
The work under this item shall consist of the partial removal and reconstruction of bridge backwalls and the end of decks as shown on the plans, and as directed by the Engineer. Work under this item shall confirm to the requirements of Articles 5.03, 6.01 and 6.02, supplemented and amended as follows.

Materials:
The materials shall conform to the following requirements:

1) Class "F" Concrete: Sections 6.01 and M.03

2) Deformed Steel Bars (Epoxy Coated): Sections 6.02 and M.06.01

3) Closed Cell Elastomer: Section M.03

Construction Methods:
The ends of bridge decks and portions of backwalls to be removed shall be exposed and ½" minimum depth sawcuts shall be made at the removal limits with care taken to avoid cutting existing steel being retained. The concrete shall be removed with hand operated pneumatic or electric chipping hammers with care taken to protect the concrete and reinforcing steel to remain. Dowels shall be drilled and grouted into the backwall with bar placed to have a minimum 2" of cover. Existing reinforcing steel shall be cleaned and any uncoated reinforcing shall be coated with epoxy resin. The backwall shall be formed and concrete placed to the plan dimensions.
After the backwall concrete has reached strength, the elastomer and roofing felt shall be placed, additional reinforcing steel placed, and the deck end formed and concrete placed to the plan dimensions.

Method of Measurement:
This work will be measured for payment as the calculated volume in cubic yards of backwall and deck reconstructed to the limits shown on the plans or as ordered by the Engineer. Miscellaneous materials necessary for completion of the work such as felt, joint seal, reinforcing steel, epoxy resin, grout and closed cell elastomer will not be measured for payment.

Basis of Payment:
This work will be paid for at the contract unit price per cubic yard for "Reconstruct Concrete Deck and Backwall", complete in place, which price shall include sawcutting concrete, removal of concrete, drilling and grouting dowels, cleaning reinforcing steel to remain, applying epoxy resin to uncoated reinforcing steel, forming and placing concrete for the backwall, placing elastomer, placing additional reinforcement steel, and forming and placing concrete for the deck, and all materials, equipment, tools and labor incidental thereto.

Pay Item	Pay Unit
Reconstruct Concrete Deck End and Backwall	CY

ITEM #0507425A - RAISE MANHOLE

Work under these items shall conform to the requirements of Sections 5.07 and 6.01, supplemented and amended as follows:

Description: Work under this item shall include the excavation, removal of the frame, cover and any grade adjustment brick courses of an existing manhole. Work shall also include raising the existing manhole utilizing precast concrete riser slabs, tongue and groove riser units, eccentric cones and/or concrete blocks. Work also includes the installation of grade adjustment brick riser courses as necessary to achieve the proper grade and the installation of ladder rungs.

Materials: The materials to be used shall be those indicated on the plans or ordered by the Engineer and shall conform to Article M.08.02.

Protective compound material shall conform to Subarticle M.03.01-11.

Mortar shall conform to Article M.11.04.

Ladder rungs shall be copolymer polypropylene plastic and submitted for review and approval.

Construction Methods:

The Contractor shall cut/remove a portion of the existing manhole to a structural solid location prior to rebuilding and raising the structure. Cutting and removing of the existing manhole shall be done in such a manner that the structural integrity of the remaining portion of the manhole is not compromised.

If the structural integrity of the existing manhole is compromised by the Contractor's removal operations then the Contractor shall repair or replace the manhole to the satisfaction of the Engineer.

The manhole shall be backfilled using excavated material or other suitable material in accordance with the plans.

Method of Measurement: The work required to raise a manhole shall be measured for payment by the number of manholes raised and paid for under the item RAISE MANHOLE.

Repair or replacement of a manhole whose structural integrity has been compromised by the Contractor's removal operations will not be measured for payment.

Basis of Payment: This work will be paid for at the contract unit price each for "Raise Manhole", complete in place, which price shall include all materials, equipment, tools and labor incidental thereto.

Excavation to remove and raise the manhole will not be paid for separately, but will be included in the above noted item. Sheeting, shoring, bracing or any temporary support required to maintain the stability of the excavation will be included the price of the above noted items.

No payment will be made for the repair or replacement of a manhole whose structural integrity has been compromised by the Contractor's removal operations. If required, this work shall be performed at no additional cost to the State.

Pay Item	Pay Unit
Raise Manhole	ea.

ITEM #0507858A - JUNCTION BOX OVER 10' DEEP

Work under these items shall conform to the requirements of Sections 5.07 and 6.01, supplemented and amended as follows:

Description: Under this item the Contractor shall design, fabricate, transport and install precast concrete junction box/chambers to be incorporated in a storm drainage collection system in accordance with the plans and specifications. The Contractor shall design and construct the junction chambers to be watertight units capable of handling traffic loads as specified herein.

Materials: All material shall conform to Article M.08.02 supplemented and amended as follows:

Connections between junction chamber structure and pipe shall be flexible, watertight, be applicable for the type of pipe connected and shall conform to the provisions of ASTM C923.

Connections between precast units shall be flexible, watertight and shall conform to the provisions of ASTM C443.

Catch basins shall be constructed of precast units in accordance with M.08.02-4, "Precast Units for Drainage Structures." Galvanizing shall meet the requirements of M.06.03. Butyl rubber joint seal shall meet the requirement of ASTM 990. Masonry units shall be laid in full mortar beds. Metal fittings for catch basins shall be set in full mortar beds or otherwise secured as shown on the plans.

Mortar shall conform to the requirements of Article M.l1.04 - Mortar.

All inserts, fixtures and hardware cast into the concrete shall have a corrosion-resistant coating or be fabricated from a non-corrosive material suitable for the intended use. The coating shall be either an epoxy material or galvanizing, applied mechanically or by the hot-dip process. All hardware shall be as specified on the working drawings.

Non-shrink grout conforming to the requirements of Sub-Article M.03.01-12 shall be used to fill lifting holes, grout joints and other filling as required to construct the catch basin.

Design Requirements:

Working Drawings:

Before fabrication, the Contractor shall submit working drawings for the junction chamber to the Engineer for review in accordance with Article 1.05.02. Working drawing submissions shall be signed, sealed and dated by a qualified Professional Engineer licensed to practice in Connecticut. Drawings shall include but not be limited to:

• Plan and cross section of junction chamber, showing chamber dimensions, wall thickness, floor thickness, and roof slab thickness. Junction chambers shall have no sump and the floor shall be constructed with a formed invert to transition between the inlet and outlet pipes.
• Type, size, location and spacing of steel reinforcing and inserts for anchoring threaded deformed steel bars. Bending diagrams, material lists and catalog cuts for inserts shall be provided.
• Type, size and location of lifting holes and seating fixtures. All fixtures (inserts, etc.) cast permanently into the box shall be recessed a minimum of ¾ in.
• Location and size of all holes cast for inlet and outlet pipes, manhole and catch basin risers or frames, etc. Additional reinforcement around wall openings shall be designed and detailed.
• Complete details regarding the location of joints and the type, size and locations of gaskets and pipe boots. Joints shall be keyed.
• Material designations for all components, including but not limited to those identified above.
•Manufacturer, product and part number for each component shall also be included in the submittal.
• Supporting Design Computations for junction chambers. Chambers shall be designed for AASHTO MS 18 live load using Load factor Design.

Construction Methods: Work under these items shall conform to the requirements of Sections 5.07 and 6.01, supplemented as follows:

The bottom of the box shall be placed at the elevation indicated on the plans or as directed by the Engineer. Precast units for the junction box shall not be placed until the Engineer has approved the depth of excavation and the suitability of the material below the box. Granular fill shall be placed as indicated on the plans or as directed by the Engineer.

Method of Measurement: This item will be measured by the actual number of junction chambers completed and accepted. A catch basin located above the junction chamber and connected to the chamber is included in the item and will not be measured separately for payment.

Basis of Payment: Completed and accepted junction chambers will be paid for at the contract unit price, each, for the junction chamber specified. The unit price shall include the design of the junction chamber, submittal of working drawings and incorporation of review comments. The unit price shall also include all materials, bedding material, tools, equipment and labor incidental thereto. The catch basin located above the junction chamber and connected to the box will be included for payment under this item. Reinforcing steel, threaded inserts, miscellaneous hardware, lifting and seating fixtures, non-shrink grout, and placement of concrete to fill voids are all included in the cost of the junction chamber.

Placement of any required granular fill will be paid for under the item "Granular Fill" in accordance with Form, Section 2.13.

Sheeting, shoring, bracing or any support of excavation to maintain trench walls will be included in the bid unit price for the junction chamber installation.

This work will be paid for at the contract unit price per each for “Junction Chamber”, complete in place, which price shall include all materials, transportation, equipment, tools and labor incidental thereto.

Pay Item	Pay Unit
Junction Box	ea.

ITEM #0511001A - BRIDGE SCUPPER

Description:

Work under this item shall consist of furnishing and installing scuppers and grates where shown on the plans or where directed by the Engineer. All work to be done shall conform to the pertinent provisions of Sections 6.03, M.06 and M.07.

Materials:

Materials for the frames, hoppers and grates of the scuppers shall be structural steel conforming to the provisions of ASTM A709 Grade 50 and shall be manufactured in accordance with the plans. The bolts, nuts and locking device shall be stainless steel conforming to the provisions of ASTM A276 Type 316.

All welds shall be continuous. All joints shall be welded using two-sided ¼" fillet welds or ¼" PJP welds with a backing seal weld, as applicable.

The caulking shall be silicone sealant conforming to ASTM C-920 Type S, Grade NS, Class 40 or Federal Specifications TI-S-001543A (COM-NBS) Class A and TI-S-00230C (COM-NBS) Class A.

The contractor shall furnish Certified Test Reports for each batch in conformance with the requirements set forth in the Specifications.

Each hopper shall be shipped to the job site paper wrapped in a cardboard carton or box of other suitable material.

Steel scuppers and grates shall be galvanized by the hot-dip process in accordance with the requirements of ASTM A153.

If temporary support is required, support design shall be submitted to the engineer for approval.

Construction Methods:

Shop Drawings: Before fabricating any materials, the Contractor shall submit shop drawings to the Engineer for approval in accordance with Article 1.05.02-3. These drawings shall include; but not be limited to the following information:

A. A plan and elevation with details showing all lengths, fittings, supports and material designation needed to fabricate the scupper.

B. Commercial items shall be identified by manufacturer, trade name and catalog number and shall indicate sufficient details.

The installation of welded studs shall be in accordance with the requirements of Article 5.08.03. The scuppers shall be located and set to grade as shown on the plans or as directed by the Engineer. All connections shall be secure and watertight, including the connections to adjacent concrete.

Method of Measurement:

The scuppers will be measured for payment by the number of units installed, completed and accepted.

Scuppers and grates with necessary welded studs, bolts, nuts and washers and pipe extension will constitute one unit.

Basis of Payment:

This work will be paid for at the contract unit price each for "Bridge Scupper", complete in place, which price shall include all materials including, caulking, welded studs and all equipment, tools and labor incidental thereto.

ITEM #0512011A - 8" PIPE FOR BRIDGE DRAINAGE
ITEM #0512012A - 10" PIPE FOR BRIDGE DRAINAGE
ITEM #0512015A - 16" PIPE FOR BRIDGE DRAINAGE

Description: This item shall consist of furnishing and installing the fiberglass pipe, fittings including reducers, expansion joints, wyes, cleanouts, hangers, supports, chemical anchors, inlets, slotted outlet covers, hoppers, protective shielding and appurtenances, for drainage of bridge deck to the lines and grades designated on the plans, or as directed by the Engineer. Item shall also include removal and disposal of all existing drainage pipes and associates hardware and anchorages.

Materials:

All fiberglass components of the bridge drainage piping system shall be supplied by a single manufacturer with the exception of the fiberglass junction boxes.

The fiberglass pipe shall be Reinforced Thermosetting Resin Pipe (RTRP) which shall satisfy the requirements of ASTM Specification D 2996 RTRP-I lAA-1111. The pipe shall qualify for a 10 ksi minimum short term rupture strength hoop tensile stress.

Pipe joints shall be straight bell-and-spigot, tapered bell-and-spigot or flanged.

Fittings including wyes, cleanouts, reducers, and other types of manufactured elbows shall have a smooth interior with a minimum centerline radius of one and one half (1-1/2) times the pipe diameter. Cleanout end caps, inlets, and slotted outlet covers shall be fiberglass and shall attach to the cleanout pipe fitting using a flanged connection with a minimum of 4 bolts and a sealing gasket.

All fittings shall be static rated at 100 psi with a safety factor of three (3) times the static rating, in accordance with ASTM D1599.

The adhesive to be used for joining pipe segments shall consist of epoxy resin and a hardener curing agent having a minimum pot life of 15 minutes at 80°F which when fully cured develops the strength capacity of the pipe, in accordance with the manufacturer's recommendations.

The color of all fiberglass piping components shall be "concrete-gray". The Contractor shall submit a color sample to the Engineer for approval. A U.V. inhibitor shall be incorporated in the epoxy resin.

Pipe Supports

Structural steel for pipe support members, clamps, hangers, junction box supports, anchorage plates, and shims shall conform to the requirements of ASTM A709, Grade 50 and shall be galvanized after fabrication to meet the requirements of ASTM A123.

Threaded rods, anchor bolts, bolts and nuts shall conform to the requirements of ASTM A449, A563-Grade DH, A194-Grade 2H or F436 as applicable. All hardware shall be hot dip galvanized in accordance with ASTM A153 or A123 as applicable.

Welding required for fabrication of the pipe supports shall be in accordance with the current AWS specifications.

Anchorage System

Pipe supports shall be connected to concrete with stainless steel anchors selected from the Connecticut Department of Transportation approved products list, and shall be installed per manufacturer's instructions and recommendations. Threaded concrete inserts shall be compatible with the galvanized steel threaded rods and designed to develop pullout and shear loads exceeding the required working loads of the section of pipe to be supported.

The Contractor may propose chemical anchor systems as a substitution for the concrete inserts. Anchoring systems are subject to the approval of the Engineer and shall exceed the working load requirements shown on the plans and shall be of non-corrosive materials suitable for the application. Chemical anchors and testing shall be in accordance with Section M.03.01-15 of the Standard Specifications.

Non shrink grout filler material shall be in accordance with Section M.03.01.

Neoprene pads, 1/8" thick shall be bonded to all surfaces of steel pipe supports or hangers in direct contact with the fiberglass pipe. The neoprene shall conform to the requirements of ASTM D4637, Type II, Class SR. The adhesive bonding agent for attaching the neoprene to the pipe support clamp surface shall be "Quick Gel Instant Adhesive" manufactured by Loctite Corporation, Rocky Hill, Connecticut, or an approved equal recommended by the manufacturer of the neoprene.

High Strength Bolts shall conform to the requirements of ASTM A325. Threaded rods and associated nuts and washers shall be Type 304 Stainless Steel.

Hex nuts shall conform to ASTM A563, Grade DH or ASTM A194, Grade 2H. Washers shall conform to ASTM F436.

High strength bolts including hex nuts and washers shall be mechanically galvanized in conformance with ASTM B695, Class 50.

The Contractor shall furnish a Certified Test Report and a Materials Certificate for the pipe joining adhesive, and all other fiberglass components of the piping system, in conformance with the requirements set forth in 1.06.07.

Construction Methods:

Shop Drawings:

Before fabricating any materials, the Contractor shall take all field measurements necessary to assure proper fit of the finished work, and shall submit shop drawings to the Engineer for approval in accordance with Article 1.05.02-3. These drawings shall include, but not be limited to the following information:

A. A layout plan and elevation showing all lengths, elevations, fittings, supports, cleanouts, expansion devices if required, appurtenances and material designations.

B. Commercial items shall be identified by manufacturer, trade name and catalog number and shall indicate sufficient details.

C. Pipe supports and hangers and all other support devices shall be fully detailed.

D. All field measurements shall be submitted for reference.

Installation: The pipe shall be installed to the lines and grades shown on the plans and shall be securely attached to the structure.

The adhesive for joining pipes shall be mixed and applied in strict accordance with directions included in the adhesive kit, or as directed by the representatives of the manufacturer. The surfaces of the joint shall be coated with the adhesive immediately before joining adjacent lengths of pipe. After properly joining two adjacent sections, the pipe supports and clamps shall be properly tightened to hold the pipe in place.

Method of Measurement: This work will be measured for payment by the actual number of linear feet of pipe for bridge drainage of the size specified, completed and accepted, measured in place along the axis of the pipe through all fittings from the pipe connector at the scupper pan to it terminus at or below grade.

Basis of Payment: This work will be paid for at the contract unit price per linear foot of "XX" Pipe for Bridge Drainage", complete in place, which price shall include all materials including fiberglass pipe, pipe supports, hangers, cleanouts, inlets, slotted outlet covers, hoppers, protective shielding and supports, including hardware, all equipment, tools and labor incidental thereto.

Structural steel members and appurtenances detailed to support the pipe shall be considered incidental to the cost of the fiberglass pipe.

Pay Item	Pay Unit
8" Pipe for Bridge Drainage	lf
10" Pipe for Bridge Drainage	lf
16" Pipe for Bridge Drainage	lf

ITEM #0514310A - POST TENSIONING PIER CAP

Description:

Work under this Item shall consist of designing, furnishing, installing, stressing and grouting prestressing tendons in the caps of each pier at locations indicated on the plans, including all tendons, anchoring hardware, additional reinforcing steel for the post-tensioning system, metal ducts including supports, grout, grout tubes, vent tubes and all other necessary materials and equipment to complete the work. This work may be performed in multiple phases as indicated on the plans.

Materials:

Prestressing Steel Strands/Tendons: Prestressing tendons shall conform to ASTM 416, Grade 270 (Low Relaxation) and shall have an ultimate strength as shown on the plans.

Anchorage Assembly: All units comprising an anchorage assembly shall be capable of developing the ultimate strength of the attached tendons without visible deformation, and shall be furnished complete with all necessary fittings. All deformed bars, wire, mesh or structural shapes that are required for disturbing the end anchorage loads shall conform to the requirements of Article M.06.01 and M.06.02.

Post-Tensioning Ducts: Ducts shall be high-density polypropylene (HDPP) with continuous spiral or hoop ribs at frequent and regular intervals. HDPP plastic shall contain material to protect against degradation from ultra-violet light. The duct shall be thermally stable in the temperature range of -30 degrees Fahrenheit to +120 degrees Fahrenheit. The duct shall have a minimum wall thickness of 0.08 inches (2 mm). The duct shall be specifically designed to be compatible with the intended post-tensioning anchorage system. Duct connections shall include positively sealed couplings between individual duct segments and between the ducts and the anchorage assembly. Duct tape will not be allowed as a means to provide a positive seal.

Permanent Grout Cap: Provide all post-tensioning tendon anchors with permanent, heavy duty, plastic grout caps mechanically secured and sealed against the anchor plate with a compressible, neoprene O-ring. The cap shall include a grout outlet vent of ¾" minimum diameter. The permanent grout cap shall completely cover the anchor head wedge plate, wedges and strand tails.

Pipe for Grout Ports, Vents and Drains: Pipes shall be provided for grout ports, vents and drains to allow the escape of air, water, bleedwater and the free flow of grout. Pipes shall have an inner diameter of at least 3/4 inch. The pipe shall be flexible, HDPE or HDPP plastic material compatible with that of the main plastic duct for the tendon. The plastic components shall not react with concrete or encourage corrosion of the post-tensioning steel, and must be free of all water-soluble chlorides. The connection of the grout pipes to the ducts and anchor components shall create a seal that does not allow leaks or ingress of water, chlorides or other corrosive

agents. To facilitate inspection of the complete filling of a tendon with grout, direct grout vents shall be placed at high points (crests) to exit the top of the pier cap or other appropriate surface. The system shall include caps and seals to all vents to prevent ingress of water or corrosive agents into the tendon.

Grout: The Contractor shall submit a grout mix that is specifically manufactured for grouting prestressing tendons conforming to the requirements stated herein. The grout mix shall generally conform to the following requirements:

a. The grout mix shall have an unrestrained volumetric expansion of not less than 3% nor more than 8%.
b. The grout mix shall have a minimum 28 day compressive strength of 5,000 psi, when tested by methods conforming to the requirements of ASTM C109.
c. The water content of the grout shall be kept as low as possible for grouting. However, the water cement ratio (by mass) shall not exceed 0.44.
d. Admixtures, if used, shall not contain chlorides in excess of .005 percent of the mass of the cement used. Nor shall it contain fluorides, sulphates or nitrates.

Material tests for the proposed grout shall be completed by the Contractor at least 30 days prior to the installation of the grout.

1. Compressive Strength shall be tested according to ASTM C942 "Standard Test Method for Compressive Strength of Grouts" using 2" cube specimens. The minimum strength of the grout shall be 3000 psi at seven days and 5,000 psi at 28 days.
2. Volume change shall be tested in accordance with ASTM C1090 "Standard Test Method for Measuring Changes in Height of Cylindrical Specimen from Hydraulic Cement Grout." A value of 0.0% to less than +0.1% at 24 hours and no more than +0.2% at 28 days is acceptable.
3. Flow Test: Grouts shall be tested according to ASTM C939 "Standard Test Method for Flow of Grout, modified by filling the flow cone above the standard level, and measuring the time to fill a one-liter container. The efflux time should be between 5 and 30 seconds immediately after mixing. After allowing the grout to stand for 30 minutes without agitation and then remixing for 30 seconds, the efflux time should be less than 30 seconds.
4. A wet density value for the grout shall be established in the laboratory using an American Petroleum Institute Mud Balance (API Recommended Practice 13B-1: "Standard Procedures for Field Testing Water-Based Drilling Fluids") for the maximum and minimum recommended water dosage. The values determined from this testing should be compared to those provided by the Manufacturer. Once this range has been established, wet density can be monitored in the field to ensure that grout water content is appropriate, using an American Petroleum Institute Mud Balance (API Recommended Practice 13B-1: "Standard Procedures for Field Testing Water-Based Drilling Fluids").

The Contractor shall provide a Certified Test Report that the mix submitted shall meet the requirements stated herein in conformance with requirements set forth in Article 1.06.07. Also the Contractor shall provide, when requested by the Engineer, samples of the grout mix for testing and approval.

Water shall conform to the requirements of Article M.03.01. Chlorides and nitrates shall not be used. The water shall be potable.

Testing Prestressing Steel: All strand to be shipped to the site shall be assigned a lot number and tagged for identification purposes. The Contractor shall submit one seven wire strand that is 6 feet long and one typical tendon consisting of proposed number of strands 6 feet long. All samples submitted shall be representative of the lot to be furnished and, in the case of strand, it shall be taken from the same master roll. All materials specified for testing shall be furnished to the Engineer for testing, free of cost, in ample time for testing and approval. Approval of the material must be obtained before the material is incorporated in the work.

The Contractor shall also furnish one anchorage assemblies, complete with distribution plates of each size or type to be used, if anchorage assemblies are not attached to tendon samples. Where a common distribution plate is used for anchoring a number of tendons, two equivalent plates for single tendon shall be furnished.

Working Drawings: Before construction, the Contractor shall submit working drawings to the Engineer for approval in accordance with Article 1.05.02. These drawings shall include but not be limited to the following information:

1. Complete details of all materials to be used in the post-tensioning system.
2. Complete details of the method, materials and equipment the Contractor proposes to use in the prestressing operation. Such details shall outline the method and sequence of stressing, jacking force, strain due to jacking and effective force for each tendon, and give complete specifications and details of the prestressing steel and anchorage devices and other data pertaining to the prestressing operation.
3. Complete details of the method, materials and equipment the Contractor proposes to use in the grouting operation, including the manner of mixing, the equipment to be used, step by step procedure to be followed and the sequence for grouting of the conduits.
4. Details of all quality control and quality assurance measures that will be used during the stressing and grouting procedures.
5. The size of the anchorage assemblies and pockets shall be detailed.
6. The manner of securing the duct and other components into place, including the interval of tie-downs.
7. The size and locations of grout ports, vent ports and drain ports.
8. Details of recesses of grout ports, vents and drain ports meeting the follow criteria:
    a. All grout vents or ports that exit or enter the top of the pier cap shall have a recess not less than 2 inches or more than 3-1/2 inches in diameter around the pipe. The depth of the recess shall not be less than 2-1/2 inches or more than 3 inches.
    b. Each pipe shall have a separate recess. Merging of pipes into one large recess will not be allowed. The spacing of recesses shall provide at least 6 inches of concrete (edge to edge of recesses) so that if a recess or pipe is breached only one tendon will be at risk. Multiple grout pipes attached to an individual tendon at one location (such as a grout pipe from an anchor trumpet and grout pipe from cap attached to that anchor) may be housed in one recess.

c. The sides of each recess shall have an irregular or corrugated finish to ensure a good mechanical bond.
d. The recess shall be made with a material that can be easily removed such as corrugated polyethylene or other suitable material.

9. Details and materials to be used to fill grout port recesses.
10. Method of forming and placement of concrete at anchorage recesses.

The working drawings shall also include four (4) sets of design computations for the proposed method of prestressing prepared and sealed by a Professional Engineer licensed to practice in the State of Connecticut. The design computations shall include, but not be limited to, the following information:

1. Computed losses for each tendon, such as creep and shrinkage of concrete, elastic shortening, creep of steel, losses in post-tensioned prestressing steel due to sequence of stressing, friction, wobble, and take up of anchorages, and all other losses peculiar to the method or system of prestressing that may take place or have been provided for.
2. The design of the local zone reinforcement that is consistent with the anchorage assembly proposed. Certified test report may be submitted in lieu of calculations for prefabricated anchorage assemblies with integral local zone reinforcement. The anchorage assembly shall be designed so that the maximum bearing stress on concrete at service load conforms to the requirements of AASHTO LRFD Bridge Design Specifications, Seventh Edition, Article 5.10.9.7.2 – Bearing Resistance.
3. Jacking force for each tendon or bar.
4. Estimated elongation of tendons during stressing accounting for the actual properties of the tendons and ducts
5. Effective force for each tendon or bar
6. Anchorage bearing stress at service load
7. The required concrete strength required for stressing operations
8. Jacking sequence
9. All other computations required for the system of prestressing being used including a blank field stressing report that will be used during stressing. The report shall contain calculations that account for the actual area and modulus of elasticity of the tendons being used.
10. Method of cutting strand extensions after stressing
11. Method of installing sealing of the anchorage caps and sealing the anchorages
12. Detailed methods of grouting including, but not limited to:
    a. Direction of grouting
    b. Method of elimination of air voids during grouting
    c. Method of eliminating excess water

The development of the working drawings should be based on the following documents:

1. FHWA Post-Tensioning Tendon Installation and Grouting Manual, FHWA-NHI-13-026
2. ASBI Guide Specification for Grouted Post-Tensioning

Installation of the post-tensioning system shall not commence until the working drawings are accepted.

Deviations from prestressing details on the working drawings will not be permitted unless details of such deviations are submitted, in advance of use, for approval. The approval by the Engineer of any proposed method, materials or equipment shall not be construed as relieving the Contractor, in any respect, of full responsibility for successfully completing the prestressing operations in accordance with the requirements of these special provisions.

Construction Methods:

Placement of post-tensioning hardware in the forms: The post-tensioning systems shall be placed in the forms prior to placement of concrete in accordance with the plans and working drawings. The following provisions shall be followed during placement of the post-tensioning system:

The Contractor shall ensure that the post-tensioning anchorage assemblies are:

- The correct type and size for the type and size of tendon used
- Supplied with permanent, heavy duty, plastic caps with O-ring seal
- Properly aligned and well supported by formwork
- Provided with anchor pocket or block-out that is of correct size, shape and orientation
- Provided with correct bursting reinforcement at correct location and spacing

The Contractor shall ensure that the post-tensioning ducts are:

- Installed to correct profile (line and level)
- Tied and correctly supported at frequent intervals.
- Connected with positively sealed couplings between pieces of duct and between ducts and anchors.

The Contractor shall ensure that grout injection ports, vent and drains are:

- The correct type and size.
- Correctly located, connected and sealed to ducts.
- Ports or vents at anchors are oriented correctly.
- Grout pipes are taken to proper exit surface.
- Grout pipes, ducts and connections are sealed before concrete is placed
- Provided with recesses for removal of excess materials after grouting

Permanent plastic grout caps shall be installed during casting and prior to tendon installation to keep ducts clean and dry. Caps shall be removed for tendon installation and replaced prior to grouting. Temporary caps may be used if they are replaced by permanent caps before grouting.

Placement of Tendons: The Contractor shall take special care with the handling of all prestressing steel and related components. Any tendon or component thereof, becoming kinked, deformed or otherwise damaged will be rejected. Tools which would mar or damage the tendons or bar shall not be used. The prestressing components shall be free from corrosion when installed, and the Contractor shall take the appropriate measures to prevent corrosion of the tendons after installation. Welding to or near the prestressing steel is not permitted because of the possibility of arcing. If arcing causes damage to the prestressing steel the steel shall be rejected.

The tendons and other components shall be completely free from oil, grease and other foreign material. Any cleaning required must be done in a manner approved by the Engineer.

The Contractor shall ensure that:

- Ducts are clear for installation (ducts may be tested by passing through a suitably sized torpedo prior to installing the tendons)
- Number and size of strands per tendon is correct
- Strands are in satisfactory condition (i.e. no rust etc.)
- Tendons are installed in their correct duct locations
- Anchor plates and wedges (or nuts) are properly installed on each strand
- Verify that the concrete strength is satisfactory for stressing
- Tendons are stressed in the correct sequence to the required force and elongation as specified on the approved working drawings
- All stressing records are made and kept

Stressing of Tendons:

Post-tensioning shall not begin until the concrete has attained the minimum compressive strength (f 'ci) shown on the working drawings. The compressive strength shall be determined by testing standard cylinders made and cured identically with the pier cap(s) or column (s), as appropriate.

The Contractor shall certify to the Engineer that a skilled representative of the prestressing method will be available to the Contractor to give such aid and instruction in the use of the prestressing equipment and the installation of materials as is required to obtain satisfactory results.

The skilled representative shall be present during the initial placing of prestressing tendons, the stressing of the tendons. The representative shall remain on the job until, in the opinion of the Engineer, each operation is proceeding smoothly and the workers are familiar with the work required for each operation. The Contractor shall also arrange to have the representative present at such other times as the Engineer may request.

The tendons or bars shall be stressed in the order indicated on the working drawings so that lateral and vertical eccentricity of the prestress will be a minimum.

Post-tensioning shall be done with approved hydraulic jacking equipment. All jacks shall be equipped with accurate pressure gauges. All combinations of jacks and gauges shall have been calibrated by an approved testing agency immediately prior to start of the prestressing operations on this project. After being six calendar months on the same project, all combinations of jacks and gauges shall be recalibrated. The Contractor shall furnish the Engineer certified and notarized calibration charts and tables for each combination of jack and gauge.

The post-tensioning forces shall be measured by the calibrated pressure gauges. An initial force, sufficient to remove any slack from the tendon shall be applied. The strain between the initial force and the total required force will be measured. A record shall be kept of gauge pressures and elongations at all times and shall be submitted to the Engineer. The Contractor shall calculate the

estimated elongation of the tendon based on the actual area of strand (as stated on the strand certificate) and the actual modulus of elasticity (as stated on the strand certificate) and the actual duct used. If the measured strain varies by more than 5% from the calculated strain, the Contractor shall carefully check his operation to find and correct the source of error before the operation is allowed to continue.

The protruding ends of tendon shall be cut after post-tensioning, in a manner prescribed on the working drawings.

Pressure Test before Grouting: The Contractor shall pressure test all duct assemblies prior to grouting - preferably before installing tendons. Run tests with caps installed and vents plugged and check for possible leaks. Properly seal all leaks as necessary before grouting.

Grouting of Ducts:
The grouting of ducts shall be in accordance with the accepted working drawings.

The Contractor shall certify to the Engineer that a skilled representative of the grout manufacturer will be available to the Contractor to give such aid and instruction in the use of the grouting equipment as is required to obtain satisfactory results. The representative shall be from the company that is supplying the grout, or be a technician that has successfully completed *Grouting Certification Training* from the American Segmental Bridge Institute (ASBI). The technician shall provide the training certificate if requested by the Engineer. The representative shall be used to address procedures that are not specifically covered in the working drawings or changes to the procedures discovered during the grouting operations.

The temperature of the pier cap at the time of grouting shall be about 50°F and shall be maintained above 50°F for at least three days after grouting.

The method of grouting shall be such as to insure the complete filling with grout of all voids within the duct.

The Contractor shall complete a trial batch mix of the grout at least 48 hours before grouting commences using the equipment, materials, and proportions proposed for use on the project. A detailed written mix design showing the exact brand and batch quantities of pre-packaged grout and water including dosages shall be submitted at least 48 hours prior to the trial batch. If the proposed grout mix design does not produce acceptable trial batch results, the mix design shall be revised and another trial batch shall be completed. Results from previous projects will not be considered acceptable documentation.

The mixer for the grout shall be a high speed colloidal mixer specifically designed for grouting of post-tensioning ducts. The mixer shall be capable of producing grout which is free of lumps and undispersed cement. The pump for the grout shall be of the positive displacement type, and shall be able to product an outlet gauge pressure of at least 150 psi. The pump shall have seals adequate to prevent the loss of grout and also to prevent the introduction of oil, air, or other

foreign substances into the grout. The grouting equipment shall utilize gravity feed to the pump inlet.

The ingredients shall be mixed sufficiently to produce a uniform thoroughly blended grout with a minimum of air entrapped. Excessive temperature rise due to extended mixing shall be avoided. After mixing, the grout shall be passed through a strainer into pumping equipment which provides for recirculation. No additional water shall be added to the grout after mixing. No grout shall be used more than one-half hour after mixing.

An on-line device to limit the grout pumping gauge pressure shall be set at a maximum of 150 psi. If the grout reaches the limiting pressure, the grouting operation shall be stopped and the grout flushed from the entire duct. The grouting operation shall not resume until the restriction is located and corrected by the Contractor.

During the grouting operation, standby water flushing equipment shall be provided. The water flushing equipment shall be in addition to, and separate from, the grouting equipment; shall use a different power source than the grouting equipment; shall have sufficient capacity to flush out any partially grouted enclosures when blockage or breakdown of grouting equipment occurs and shall be capable of developing a gauge pressure of at least 250 psi.

The grout will be tested during construction to ensure that the material meets the requirements of this specification. The following test will be performed by the Engineer.

1. Compressive Strength shall be tested according to ASTM C942 Standard Test Method for Compressive Strength of Grouts using 2" cube specimens. The minimum strength of the grout shall be 3000 psi at seven days and 5,000 psi at 28 days.
2. Wet density will be monitored in the field to ensure that grout water content is appropriate, using an American Petroleum Institute Mud Balance (API Recommended Practice 13B-1: "Standard Procedures for Field Testing Water-Based Drilling Fluids"). The results of this test shall be within the limits determined during pre-construction testing.

The Engineer will perform tests on the grout and will provide equipment. The Contractor shall operate his equipment and provide samples as required.

At the completion of the grouting, all valves shall remain closed until the grout has cured, except the vent tubes located at the high points of the duct, which shall remain opened during the curing of the grout.

No external loads shall be applied to the pier cap before grout in all ducts has reached the minimum 28 day compressive strength.

Post-grouting procedures: After the grout has hardened, trim grout pipes that exit through top of the pier cap to 1 inch above bottom of the formed recess. Seal trimmed grout pipes with permanent plastic cap (or plug) screwed or glued to pipe. Remove all traces of recess forming

material and thoroughly clean sides and bottom of each recess to sound, dry concrete surface. Fill each recess with non-shrink grout.

Method of Measurement:

This work will be measured for payment by the actual number of linear feet of pier cap that has been post tensioned and accepted, regardless of the number of post tension ducts used in each pier cap. Measurement will be made in a linear horizontal plane along the center line of each pier cap, from face of anchorage to face of anchorage. There will be no additional measurement for curvature of ducts or for multiple phase stressing.

Basis of Payment:

Payment for this work will be made at the contract unit price per linear foot for "Post Tensioning Pier Cap", as shown on the plans, completed and accepted in place. This price shall include all costs of design, materials including reinforcing steel specifically required for the post tensioning system, multiple phase stressing, transportation, tools, labor, equipment and work incidental thereto. The design and preparation of working Drawings shall also be included in the Contract unit price.

Pay Item	Pay Unit
Post Tensioning Pier Cap	Linear Foot

ITEM #0520032A - ELASTOMERIC CONCRETE HEADER

Description:
Work under this item shall consist of saw-cutting, removing and disposing of hot mix asphalt and membrane, furnishing all required labor, equipment, material, and perform all operations necessary for the installation of elastomeric concrete for bridge expansion joint headers, in accordance with the detail as shown on the plans, as directed by the Engineer, and in accordance with the requirements of these specifications.

Materials:
The elastomeric concrete material shall be field-mixed and shall consist of two-part polymer, kiln-dried pre-graded aggregate, and bonding agent with the material being supplied as a unit by the Manufacturer.

A Materials Certificate will be required in accordance with Article 1.06.07 certifying the conformance of the elastomeric concrete for expansion joint headers components to the requirements set forth in this specification.

Each container of product furnished shall be delivered to the job site in the Manufacturer's original sealed container. Each container shall be labeled to include the name of material, Manufacturer's name and contact information, expiration date, mixing instructions, material safety data sheets and the Manufacturer's lot/batch number. All materials must be stored in accordance with the Manufacturer's written recommendations and as approved by the Engineer. Materials whose shelf-life has expired shall not be used in the project.

Provide material that complies with the following minimum requirements at either 14 days or at the end of the specified curing time. In addition to the following requirements, the elastomeric concrete header shall be resistant to water absorption, chemical, UV, ozone exposure and capable of withstanding temperature extremes.

Elastomeric Concrete Properties at 24 hr. Cured Stage	Test Method	Requirement
Compressive Strength, Method B	ASTMC579	Min. 2000 psi
Bond Shear Strength	ASTM C882	Min. 700 psi
Abrasion Resistance Wear Index	ASTM C501	Max. 1
Resilience	ASTM D695	Min. 70%
Durometer Hardness	ASTM D2240	Min. 50
Bond Strength to Concrete	ASTM C882	Min. 450 psi

The following Elastomeric Concrete products are qualified for use under this item:

Silspec 900 PNS Nosing System
Silicone Specialties Corp.
P.O. Box 50009
Tulsa, OK 74150
Phone: (918) 587-5567

WaboCrete II
Watson Bowman Acme
95 Pineview Drive
Amherst, NY 14228
Phone: (716) 817-5410

Construction Methods:

This work shall proceed in stages in accordance with the traffic requirements in the special provisions "Maintenance and Protection of Traffic" and "Prosecution and Progress". The Contractor must provide sufficient material, readily available at the site prior to beginning construction to complete the entire elastomeric concrete header as detailed on the plans, within the allowable time period or as directed by the Engineer. If the project involves removing the existing hot mix asphalt overlay and placing a new hot mix asphalt overlay, the new overlay must be placed full depth at the joint before the elastomeric concrete header work begins.

The Contractor shall saw cut the hot mix asphalt overlay full depth in order to delineate the limit of the elastomeric concrete headers. Care shall be taken not to saw into the surface of the concrete deck below. At the time of installation of the elastomeric concrete header, all existing material shall be removed from the header location, including the membrane. All surfaces in the new header location shall be cleaned of all dust, dirt, debris and other loose materials, as recommended by the Manufacturer and to the satisfaction of the Engineer. The surfaces shall also be frost free. Additionally, the bonding surfaces shall be abrasive blast cleaned if recommended by the Manufacturer. Following blast cleaning, when required, the surfaces shall again be wiped clean to remove any remaining dust. Whenever blast cleaning is performed under this specification the Contractor shall take adequate measures to ensure that the blast cleaning will not cause damage to adjacent traffic or other facilities.

The saw-cut edge of the bituminous concrete shall act as the form for the elastomeric concrete. Block outs shall be formed in the elastomeric concrete headers on the joint side, as required to accept the subsequent installation of the preformed joint seal, if shown on the plans.

An experienced technical representative from the Manufacturer, acceptable to the Engineer, shall be present during initial installations of the elastomeric concrete header to provide the Contractor aid and independent instruction as required to obtain an installation satisfactory to the Engineer. The technical representative must certify that the elastomeric concrete header

was installed to the manufacturer's recommendations.

Elastomeric concrete is moisture sensitive. Therefore, new decks and deck ends that have been reconstructed or patched as part of this project shall be properly cured prior to the placement of the elastomeric concrete. The Contractor should follow the manufacturer's recommendations for curing and substrate moisture before installation of elastomeric concrete headers.

Tools, equipment, and techniques used to prepare the elastomeric concrete material and the location that it is being placed shall be approved by the Engineer and the Manufacturer's technical representative prior to the start of construction.

Prepare and apply bonding agent to areas specified by the Manufacturer and in accordance with manufacturer's instruction. The bonding agent shall be allowed to cure undisturbed for a minimum of one hour prior to installation of the elastomeric concrete header or longer if required by the Manufacturer or the Engineer.

The mixing and installation of the two-part elastomeric concrete header shall be done in strict conformance with the Manufacturer's written recommendations including the use of static mixing devices, if so indicated. Traffic must not be allowed on the newly-placed elastomeric concrete header to let the material cure properly prior to opening the work area to traffic according to the Manufacturer specification. During curing time the elastomeric concrete header should be protected from any damage.

Form, place and cast the elastomeric concrete headers to smoothly match the surface of the finished roadway. Finish the surface to a moderately rough texture such as that produced by a wood float.

After the preformed joint seal is in place, the complete joint system shall prevent water from reaching the underside of the deck. If water leakage is occurring under, around or through the elastomeric concrete header, the header shall be removed and replaced at the Contractor's expense.

Method of Measurement:

This work will be measured for payment by the volume, in cubic feet, of elastomeric concrete header installed into the final work. The width of the header shall be the average width measured perpendicular to the adjacent joint, between the curb faces. The depth of the header shall be taken as the nominal header depth, as indicated on the plans or as ordered by the Engineer. The length of the header shall be taken as a single measurement along the centerline of the header, between the outer limits of the installed material, regardless of the number of recesses, opening or voids filled with the elastomeric concrete material. The volume for payment shall be calculated by multiplying the width times the depth times the length defined above.

Basis of Payment:

This work will be paid for at the contract unit price, per cubic foot for “Elastomeric Concrete Header", complete in place, including the cost of saw-cutting of hot mix asphalt overlay to delineate the vertical edges of the elastomeric concrete headers; removal and disposal of hot mix asphalt and membrane; abrasive blast cleaning; cleaning of the bonding surfaces; furnishing, mixing, constructing and curing the elastomeric concrete headers; and the cost of all services associated with the technical representative; all other materials, equipment, tools, and labor incidental thereto and performance of all operations necessary for the installation of elastomeric concrete headers.

Providing the Manufacturer’s Representative and the Manufacturer’s warranty will be incidental to the item “Elastomeric Concrete Header” and shall be included under the contract unit price.

Pay Item	**Pay Unit**
Elastomeric Concrete Header	C.F.

ITEM #0520036A - ASPHALTIC PLUG EXPANSION JOINT SYSTEM

Description: Work under this item shall consist of furnishing and installing an asphaltic plug expansion joint system (APJ) in conformance with ASTM D6297, as shown on the plans, and as specified herein.

Work under this item shall also consist of the removal and disposal of bituminous concrete, membrane waterproofing, existing joint components and sealing elements, cleaning and sealing median barrier joints, parapet joints, and sidewalk joints.

Work under this item excludes the removal of Portland cement concrete headers.

Materials: The APJ component materials shall conform to ASTM D6297 and the following:

Aggregate: The aggregate shall meet the following requirements:

a) Loss on abrasion: The material shall show a loss on abrasion of not more than 25% using AASHTO Method T96.
b) Soundness: The material shall not have a loss of more than 10% at the end of five cycles when tested with a magnesium sulfate solution for soundness using AASHTO Method T 104.
c) Gradation: The aggregate shall meet the requirements of Table A below:
d) Dust: aggregate shall not exceed 0.5% of dust passing the #200 sieve when tested in accordance with AASHTO T-11.

Table A

Square Mesh Sieves	**1" (25.0 mm)**	**¾" (19.0 mm)**	**½" (12.5 mm)**	**⅜" (9.5 mm)**	**No. 4 (4.75 mm)**
% passing	**100**	**90 - 100**	**20 - 55**	**0 - 15**	**0 - 5**

A sample of the aggregate shall be submitted to the Department with a Certified Test Report in accordance with Article 1.06.07 for each 20 tons of loose material or its equivalent number of bags delivered to the job site. The Certified Test report must include a gradation analysis resulting from a physical test performed on the actual material that accompanies the report.

Anti-Tacking Material: This material shall be a fine graded granular material with 100% passing the $^{3}/_{16}$" sieve and no more than 5% passing the #200 when tested in accordance with AASHTO T-27.

Backer Rod: All backer rods shall satisfy the requirements of ASTM D5249, Type 1.

Bridging Plate: The bridging plates shall be steel conforming to the requirements of ASTM A36 and, unless otherwise indicated on the contract drawings, shall be a minimum ¼" thick and 8" wide. For joint openings in excess of 3" the minimum plate dimensions shall be ⅜"

thick by 12" wide. Individual sections of plate shall not exceed 4' in length. Steel locating pins for securing the plates shall be size 16d minimum, hot-dip galvanized, and spaced no more than 12" apart. Steel locating pins shall not be used for permanent joints with preformed joint seal.

Concrete Leveling Material: Shall be a cementitious-based material that conforms to ASTM C928 Standard Specification for Packaged, Dry, Rapid-Hardening Cementitious Materials for Concrete Repair, for R3 performance requirements in Table 1 and achieve the following:

a. Final set in 45 Minutes
b. 2500 psi compressive strength in 24 hours
c. 5000 psi compressive strength in 7 days

Parapet Sealant: The sealant used in parapet joint openings shall be a single component non-sag silicone sealant that conforms to the requirements of ASTM D5893, unless shown otherwise on the contract plans.

Sidewalk Sealant: The sealant used in sidewalk joint openings shall be a rapid cure, self-leveling, cold applied, two-component silicone sealant, unless shown otherwise on the contract plans. The silicone sealant shall conform to the requirements listed in Table B:

Table B

Properties - As Supplied	**Test Method**	**Requirement**
Extrusion Rate	ASTM C1183	200-600 grams/min
Leveling	ASTM C639	Self-Leveling
Specific Gravity	ASTM D792	1.20 to 1.40
Properties - Mixed	**Test Method**	**Requirement**
Tack Free Time	ASTM C679	60 min. max.
Joint Elongation – Adhesion to concrete	ASTM D5329 [1,2,3]	600% min
Joint Modulus @ 100% elongation	ASTM D5329 [1,2,3]	15 psi max
Cure Evaluation	ASTM D5893	Pass @ 5 hours

1. Specimens cured at 77±3^{0}F and 50±5% relative humidity for 7 days
2. Specimens size: ½"wide by ½"thick by 2" long
3. Tensile Adhesion test only

The date of manufacture shall be provided with each lot. No sealant shall be used beyond its maximum shelf-life date.

The two–part silicone sealants shown in Table C are known to have met the specified requirements:

Table C

Product	Supplier
Dow Corning 902RCS	Dow Corning Corporation 2200 W Salzburg Road Auburn, Michigan 48611
Wabo SiliconeSeal	BASF/Watson Bowman Acme Corporation 95 Pineview Drive Amherst, New York 14228

Other two-component silicone joint sealants expressly manufactured for use with concrete that conform to the aforementioned ASTM requirements will be considered for use provided they are submitted in advance for approval to the Engineer. Other joint sealants will be considered for use only if a complete product description is submitted, as well as documentation describing at least five installations of the product. These documented installations must demonstrate that the product has performed successfully for at least three years on similar bridge expansion joint applications.

A Materials Certificate and Certified Test Report for the asphaltic binder shall be submitted by the Contractor in accordance with the requirements of Article 1.06.07 certifying that the asphaltic binder satisfies the requirements of the most current version of ASTM D6297.

A Materials Certificate for all other components of the APJ, leveling material, backer rod and sealant used in sealing parapet and sidewalk joint openings, shall be submitted by the Contractor in accordance with the requirements of Article 1.06.07

Construction Methods: The APJ shall be installed at the locations shown on the plans and in stages in accordance with the traffic requirements in the special provisions "Maintenance and Protection of Traffic" and "Prosecution and Progress".

At least 30 days prior to start of the work, the Contractor shall submit to the Engineer for approval a detailed Quality Control Plan for the installation of the APJ. The submittal shall include:

a) A list of all manufactured materials and their properties to be incorporated in the joint system, including, but not limited to the asphaltic binder, anti-tack material, backer rod, sealant, leveling material, as well as the aggregate's source.
b) A detailed step by step installation procedure and a list of the specific equipment to be used for the installation. The Quality Control Plan must fully comply with the specifications and address all anticipated field conditions, including periods of inclement weather.

The APJ shall not be installed when bituminous concrete overlay or joint cutout is wet. The APJ shall only be installed when the bridge superstructure surface temperature is within the limits specified in Table D and when the ambient air temperature is within the range of 45^0F to 95^0F. The bridge superstructure surface temperature range is determined using the thermal movement range provided on the contract plans for the proposed APJ deck installation location and the selected APJ product.

Table D

Installation Restrictions	
Designed Deck Joint Thermal Movement Range[2]	**Bridge Superstructure Surface Temperature[1]**
0" to 1"	45° F to 95° F
1-1/8"	45° F to 90° F
1-1/4"	45° F to 80° F
1-3/8"	45° F to 70° F
1-1/2"	45° F to 65° F

1. *The superstructure surface temperature shall be determined from the average of three or more surface temperature readings taken at different locations on the interior girder surfaces by the Contractor as directed by the Engineer. Temperature measurements of the superstructure shall be taken by the contractor with a calibrated hand held digital infrared laser-sighted thermometer on the surfaces of an interior steel girder, or interior concrete girder protected from direct sunlight. The infrared thermometer to be supplied by the Contractor for this purpose shall meet certification requirements of EN61326-1, EN61010-1, and EN60825-1 maintained by the European Committee for Electrotechnical Standardization (CENELEC). The thermometer shall have a minimum distance-to-spot ratio of 50:1 and shall have adjustable emissivity control. The thermometer shall have a minimum accuracy value of $\pm$1% of reading or $\pm 2^oF$, whichever is greater. The thermometer shall be used in strict accordance with the manufacturer's written directions. An additional infrared thermometer satisfying the same standards to be used in this application shall also be provided to the Engineer for quality assurance purposes.*
2. *Linear interpolation may be used to determine an allowable surface temperature range for thermal movement ranges in between values shown in the table, as approved by the Engineer.*

Prior to installing the APJ, the Contractor shall determine the exact location of the deck joint beneath the bituminous concrete overlay.
The APJ shall be installed symmetrically about the deck joint opening to the dimensions shown on the plans or as directed by the Engineer; not to exceed 24 inches measured perpendicular to the deck joint. The proposed saw cut lines shall be marked on the bituminous concrete overlay by the Contractor and approved by the Engineer, prior to saw-cutting. The saw-cuts delineating the edges of the APJ shall extend full depth of the bituminous concrete overlay.

The existing bituminous concrete overlay, waterproofing membrane and/or existing expansion joint material, within the saw cut limits shall be removed and disposed of by the Contractor to create the joint cutout.

Concrete surfaces that will support the bridging plates shall be smooth and form a plane along and across the deck joint. Rough or damaged concrete surfaces shall be repaired with a leveling compound meeting the requirements of this specification. Deteriorated concrete areas within the joint limits shall be repaired as directed by the Engineer: such repairs, when deemed necessary by the Engineer, shall be compensated for under the applicable concrete deck repair items in the Contract. The existing and repaired concrete surfaces shall provide continuous uniform support for the bridging plate and prevent the plate from rocking and deflecting.

Prior to the installation of the backer rod, all horizontal and vertical surfaces of the joint cutout shall be abrasive blast cleaned using an oil-free, compressed air supply. The entire cutout shall then be cleared of all loose blast media, dust, debris and moisture using an oil-free, hot air lance capable of producing an air stream at 3,000ºF with a velocity of 3,000 feet per second.

A single backer rod, with a diameter at least 25% greater than the existing joint opening at the time of installation, shall be installed at an inch below the bridging plate in the existing deck joint opening between the concrete edges.

Asphaltic binder shall be heated to a temperature within the manufacturer's recommended application temperature range which shall be provided in the Quality Control Plan. During application, the temperature of the binder shall be maintained within this range. In no case shall the temperature of the binder go below 350º F nor exceed the manufacturer's recommended maximum heating temperature.

Asphaltic binder shall then be poured into the joint opening until it completely fills the gap above the backer rod. A thin layer of binder shall next be applied to all horizontal and vertical surfaces of the joint cutout.

Bridging plates shall be abrasive blast-cleaned on-site prior to installation and then placed over the deck joint opening in the joint cutout. The plates shall be centered over the joint opening and secured with locating pins along its centerline. The plates shall be placed end to end, without overlap, such that the gap between plates does not exceed ¼". The plates shall extend to the gutter line and be cut to match the joint's skew angle, where concrete support exists on both sides of the joint. Within APJ installation limits, where concrete support does not exist at both

sides of the joint opening (such as where a bridge deck end abuts a bituminous concrete roadway shoulder), bridging plates shall not be installed. Installed bridging plates shall not rock or deflect in any way. After installation of bridging plates, a thin layer of asphaltic binder shall be applied to all exposed surfaces of the plates.

The remainder of the joint cutout shall then be filled with a mixture of hot asphaltic binder and aggregate prepared in accordance with the submitted Quality Control Plan and the following requirements:

- The aggregate shall be heated in a vented, rotating drum mixer by the use of a hot-compressed air lance to a temperature of between 370° F. to 380° F. This drum mixer shall be dedicated solely for the heating and, if necessary, supplemental cleaning of the aggregate. Venting of the gas and loose dust particles shall be accomplished through ¼" drilled holes spaced no more than 3" on center in any direction along the entire outside surface of the drum
- Once the aggregate has been heated, it shall then be transferred to a secondary drum mixer where it shall be fully coated with asphaltic binder. A minimum of two gallons of binder per 100lbs of stone is required.
- The temperature of the aggregate and binder shall be monitored by the contractor with a calibrated digital infrared thermometer.
- The coated aggregate shall be loosely placed in the joint cutout in lifts not to exceed 2 inches.
- Each lift shall be leveled, compacted and then flooded with hot asphaltic binder to the level of the aggregate to fill all voids in the coated aggregate layer. The surface of each lift shall be flooded until only the tips of the aggregate protrude out of the surface.
- The final lift shall be placed such that no stones shall project above the level of the adjacent overlay surface following compaction of the coated aggregate.
- Following installation of the final lift, sufficient time and material shall be provided to allow all voids in the mixture to fill. This step may be repeated as needed.
- The joint shall then be top-dressed by heating the entire area with a hot-compressed air lance and applying binder. The final joint surface must be smooth with no protruding stones and be absent of voids.
- Once top-dressed, the joint shall have an anti-tack material spread evenly over the entire surface to prevent tracking.

The Contractor shall be responsible for removing all binder material that leaks through the joint and is deposited on any bridge component, including underside of decks, headers, beams, diaphragms, bearings, abutments and piers.

Traffic shall not be permitted over the joint until it has cooled to 130º F when measured with a digital infrared thermometer. Use of water to cool the completed joint is permitted.

Sidewalk, parapet, and/or curb joint openings

Before placement of any sealing materials in parapets, curbs, or sidewalks, the joints shall be thoroughly cleaned of all scale, loose concrete, dirt, dust, or other foreign matter by abrasive blast cleaning. Residual dust and moisture shall then be removed by blasting with oil free compressed air using a hot air lance. Projections of concrete into the joint space shall also be removed. The backer rod shall be installed in the joint as shown on the plans. The joint shall be clean and dry before the joint sealant is applied. Under no circumstances is the binder material to be used as a substitute for the joint sealant.

Whenever abrasive blast cleaning is performed under this specification, the Contractor shall take adequate measures to ensure that the abrasive blast cleaning will not cause damage to adjacent traffic or other facilities.

The joint sealant shall be prepared and placed in accordance with the manufacturer's instructions and with the equipment prescribed by the manufacturer. Extreme care shall be taken to ensure that the sealant is placed in accordance with the manufacturer's recommended thickness requirements.

The joint sealant shall be tooled, if required, in accordance with the manufacturer's instructions.

Primer, if required, shall be supplied by the sealant manufacturer and applied in accordance with the manufacturer's instructions.

When the sealing operations are completed, the joints shall be effectively sealed against infiltration of water. Any sealant which does not effectively seal against water shall be removed and replaced at the Contractor's expense.

Any installed joint that exhibits evidence of failure, as determined by the Engineer, such as debonding, cracking, rutting, or shoving of the APJ mixture shall be removed and replaced full-width and full–depth to a length determined by the Engineer at no additional cost to the State.

Method of Measurement: This work will be measured for payment by the number of cubic feet of "Asphaltic Plug Expansion Joint System" installed and accepted within approved horizontal limits. No additional measurement will be made for furnishing and installing backer rod and joint sealant in the parapets, concrete medians, curbs and/or sidewalks.

Basis of Payment: This work will be paid for at the contract unit price per cubic foot for "Asphaltic Plug Expansion Joint System," complete in place, which price shall include the saw-cutting, removal and disposal of bituminous concrete, membrane waterproofing, existing joint components and sealing elements, the furnishing and placement of the leveling compound, cleaning of the joint surfaces, furnishing and installing bridging plates, the furnishing and installing of the asphaltic plug joint mixture, the cost of furnishing and installing joint sealant in the parapets, concrete medians, curbs and sidewalks, and all other materials, equipment including, but not limited to, portable lighting, tools, and labor incidental thereto. No additional

payment shall be made for the 12” wide bridging plates that are required for deck joint openings with widths in excess of 3”.

If directed by the Engineer, additional deck repairs will be addressed and paid for under the applicable concrete deck repair items in the Contract.

ITEM #0520040A - STRIP SEAL EXPANSION JOINT SYSTEM FOR REHABILITATION PROJECTS

Description: Work under this item shall consist of removal of a bridge joint system including headers, if applicable, removal of concrete to provide a blockout envelope in deck and curb, removal of bituminous pavement as shown on the plans, application of membrane waterproofing system, and furnishing and installing of a Strip Seal Expansion joint system in a steel reinforced concrete header as shown on the plans, as directed by the Engineer, and in accordance with these specifications. It also includes installation and removal of all temporary materials used to complete this work and making and testing of concrete cylinders. Where steel plates cover the joint, it includes removal of steel plates and installation of the joint system within the sidewalk and parapet as shown on the plans. Furnishing and installing steel plates and anchorages are also included when shown on the plans.

Materials:

A) Strip Seal System:

The following Strip Seal expansion joint systems are qualified for use under this item:

Strip Seal Expansion Joint System	Manufacturer
Wabo StripSeal with Type M or Type Q steel rails, and SE-400 or SE-500 glands	Watson Bowman & Acme Corp. 95 Pineview Drive Amherst, NY 14228
D.S.Brown Co. Steelflex Strip Seal with Type SSCM2 steel rail and the A2R-400 gland	D.S. Brown Company 300 East Cherry Street North Baltimore, OH 45872

Additionally, the joint system components shall conform to the following:

Steel Extrusions: The extrusions shall conform to the requirements of ASTM A588.

Extrusion Anchorage: The steel extrusions shall be anchored in both the deck and curb areas with anchors spaced a maximum 6” on center. The anchorages shall be headed stud anchors, a minimum 1/2" diameter and 6” long, and conform to the requirements of Article M.06.02-12 of the Form 816.

Strip Seal Gland: The gland shall be extruded polychloroprene.

A Materials Certificate will be required in accordance with Article 1.06.07 certifying the conformance of the strip seal expansion joint system components to the requirements set forth in this specification.

Other joint systems which utilize a strip seal set in steel extrusion with dual sets of anchors set 6" on center will be considered for use under this item provided sufficient product documentation is furnished. Such documentation may consist of other State approvals or proof of successful performance of a completed test installation. Approval is at the discretion of the Engineer.

B) Reinforcement: Deformed steel bars shall be galvanized and shall conform to the requirements of Article M.06.01.

C) Concrete: Concrete material shall be composed of a quick setting cement, fine aggregate, coarse aggregate and water. This concrete shall harden within 40 minutes, and develop min. compressive strengths of 1,000 psi within one hour after set and 3,000 psi within three days.

The Contractor shall design and submit a quick setting mix to the engineer for approval. The mix proportions and method of application shall be in accordance with the manufacturer's recommendations. Sources of supply of all the materials shall be clearly indicated.

Fine aggregate shall conform to the requirements of Subarticle M.03.01-2.

The coarse aggregate shall conform to the requirements of Subarticle M.03.01-1. The required grading shall be obtained by using 100 percent of No. 67 size coarse aggregate. Grading of the aggregate shall conform to the gradation table of Article M.01.01.

Water shall conform to the requirements of Subarticle M.03.01-4.

Unless otherwise approved by the Engineer, the quick setting cement shall be a cementitious-based product. The following products are qualified for use under this item:

Emaco T-415
Master Builders, Inc.
23700 Chagrin Blvd.
Cleveland, OH 44122
800-628-7378

Perma-Patch
Dayton Superior Corporation
PO Box 355
Oregon, IL 61061
800-745-3707

Rapid Set DOT Cement
CTS Cement Manufacturing
1023 Dogwood Lane
West Chester, PA 19382
215-429-4956

Speed Crete Green Line
Tamms Industries
730 Casey Ave.
Wilkes-Barre, PA 18702
800-218-2667

Fastcrete
Silpro Corporation
2 New England Way
Ayer, MA 01432
508-772-4444

Other cementitious-based products not currently approved by the Department may be substituted provided that the Contractor submits to the Department the manufacturer's literature and a sufficient quantity of the proposed patching materials for field testing and evaluation. Further information regarding approval procedures may be obtained by contacting the Department's Research and Materials Testing Laboratory at 280 West Street, Rocky Hill, CT 06067. No substituted material shall be used until it has been approved in writing by the Department.

D) Steel Plates: Steel plates at curbs and sidewalks shall conform to ASTM A36 and shall be hot-dip galvanized after fabrication in accordance with ASTM A123.

E) Drop-in expansion anchors shall be flush type and stainless steel conforming to AISI 303 and ASTM A582.

F) Socket head cap screws shall be flat head style stainless steel conforming to the requirements of ASTM F593, Group 1.

G) Chemical Adhesive: Chemical anchoring material shall conform to the requirements of Subarticle M.03.01-15.

H) Waterproofing Membrane: Materials shall conform to the following requirements:

1. Rapid cure modified primer shall conform to ASTM D41.

2. Modified liquid bitumen shall conform to the following tests. Softening Point; ASTM D-36M: Penetration at 77°F; ASTM D-5: Flexibility; CGSB 37-GP-50M: Elongation at 77°F; 700%; Flash Point; ASTM D-92: Flow at 140° F; ASTM D-5329.

3. Sheet Membrane shall be Sopralene Flam Anti-Rock, or approved equal.
   Marketed by QBA, Inc.
   24 Woodland Drive
   Woodstock, CT 06281
   (860) 963-9438

I) Pavement: See Plans

J) Expansion Joint Filler: Preformed expansion joint filler for all bridges shall conform to the requirements of AASHTO M 153, Type I and Type II.

K) Backer Rod: The backer rod used to prevent pavement from entering the deck expansion joint shall satisfy the requirements of ASTM D5249, Type 1. Backer rod used in curb areas in conjunction with the silicone sealant shall conform to the requirements of ASTM D5249, Type 3.

L) Silicone Joint Seal: The sealant used in parapet expansion joint openings shall be a single component non-sag silicone sealant that conforms to the requirements of ASTM D5893.

The sealant used in sidewalk expansion joint openings shall be a rapid cure, self-leveling, cold applied, two-component silicone sealant. The silicone sealant shall conform to the following requirements:

Properties- As Supplied	Test Method	Requirement
Extrusion Rate	ASTM C 1183	200-600 grams/min
Leveling	ASTM C 639	Self Leveling
Specific Gravity	ASTM D 792	1.20 to 1.40

Properties – Mixed	Test Method	Requirements
Tack Free Time	ASTM C 679	60 min. max.
Joint Elongation (Adhesion to concrete)	ASTM D 5329 [1,2,3]	600% min
Joint Modulus @ 100% elongation.	ASTM D 5329[1,2,3]	15 psi max
Cure Evaluation	D 5893	Pass @ 5 hours

1. Specimens cured at 77±3^{0}F. and 50±5% relative humidity for 7 days
2. Specimens size: ½"wide by ½"thick by 2" long
3. Tensile Adhesion test only

The date of manufacture shall be provided with each lot. No sealant shall be used beyond its maximum shelf-life date.

The following two–part silicone sealants are known to have met the specified requirements:

Dow Corning 902RCS
Supplied by Dow Corning Corporation
2200 W Salzburg Road
Auburn, Michigan 48611

Wabo SiliconeSeal
Supplied by Watson Bowman Acme Corporation
95 Pineview Drive
Amherst, New York 14228

Other two-component silicone joint sealants expressly manufactured for use with concrete that conform to the aforementioned ASTM requirements will be considered for use provided they are submitted in advance for approval to the Engineer. Other joint sealants will be considered for use

only if a complete product description is submitted, as well as documentation describing at least five installations of the product. These documented installations must demonstrate that the product has performed successfully for at least three years on similar bridge expansion joint applications.

Construction Methods: Before fabricating any section of the expansion joint, the Contractor shall submit shop drawings to the Engineer for approval in accordance with Article 1.05.02. These drawings shall include but not be limited to the following information:

a. The name of the manufacturer.

b. Strip seal, steel extrusion, and designations and model numbers.

c. Details of a typical expansion joint section including the anchorage and method of temporary support.

d. Details at parapets, sidewalks and curbs.

e. Plan of the joint showing the location and details of shop and field splices in the steel extrusions. All field splices will require a weld procedure be submitted on the form designated by the Department to the Engineer for review and approval.

f. The complete details of the methods, materials and equipment proposed to be used in the installation.

g. The maximum and minimum joint installation widths including an ambient temperature table for joint widths between 40° F and 90° F in 10° F increments.

h. A narrative of installation procedures for all aspects of the work.

Two weeks prior to the scheduled work of the membrane waterproofing system, the Contractor shall submit to the Department the manufacturer's recommended installation method which shall include, but not be limited to:

1) substrate preparation requirements/methods,
2) substrate moisture check procedure,
3) primer application procedure,
4) waterproof membrane application and installation procedure including tie-ins to adjacent membrane waterproofing systems,
5) waterproof membrane repair procedure.

An experienced technical representative of the membrane's manufacturer shall be present during the installation of the torch-applied membrane waterproofing system at the first site to

require this work. The representative shall provide to the Contractor aid and instruction as required to obtain an installation satisfactory to the Engineer. The Contractor shall have on site all necessary product information relative to proper installation of the joint system.

The surface of the deck to which membrane will be applied shall be free of sharp protrusions or depressions greater than 1/8". Areas not meeting this requirement shall be ground to form a smooth transition across the deck surface.

Prior to priming, the surface shall be dry, clean, and free of laitance, oil, and foreign materials. Tightly adhered membrane, which cannot be removed by scraping using heavy pressure, may be left-in-place.

Immediately prior to priming, air temperature and substrate temperature shall be at least 40º F and rising. The primer shall only be applied when the moisture content of the substrate surface is 6 percent or less, and when the temperature of the substrate exceeds the dew point by at least 5º F. Moisture tests shall be performed (minimum 1 each per every 50 square yards) at locations determined by, and in the presence of, the Engineer using a Contractor-supplied portable electronic surface moisture meter that is calibrated annually and a copy of the calibration certification shall accompany the meter.

The primer shall be applied in one coat so that it thoroughly covers the entire surface to be membraned with an overall coverage rate of 200 s.f./gal or as recommended by the manufacturer. The primer may be applied by brush, roller, or sprayer. The primer shall cure tack-free in accordance with the manufacturer's recommendations before application of the waterproofing membrane.

If applicable, waterproofing shall begin at a predetermined curb line. At curb lines, a modified liquid bitumen material shall be placed to completely seal the inside corner where the horizontal concrete deck meets the vertical curb face. A 20 inch wide strip of membrane shall then be placed 2 inches minimum up the curb and onto the concrete deck. Care shall be taken to insure that this curb strip is pressed firmly against the curb and into the inside corner then torch welded in place.

If so directed, additional strips of waterproofing shall be placed over any other areas of the concrete surface which are believed to require special attention.

The membrane shall be installed in a shingled pattern so that water is permitted to drain to the low areas of the deck without accumulating against the seams. Laps shall be a minimum of 3" and be sealed in accordance with the manufacturer's recommendations.

The waterproofing membrane shall be welded by torch onto the prepared substrate in accordance with the manufacturer's recommended procedure to assure bond with the primed surface and elimination of air bubbles. The Contractor shall be responsible for the protection of adjacent areas.

Prior to suspension of work for any reason, all exposed edges shall be heated, troweled and sealed in accordance with the manufacturer's recommendations.

Care shall be taken to prevent injury to the finished membrane by the passage of men and equipment. Vehicular traffic shall not be allowed to pass over the finished membrane waterproofing. Any damage which may occur shall be patched or repaired in accordance with the manufacturer's recommendations and any significant areas showing a lack of bond shall be cause for removal and re-application of the waterproofing membrane at no additional cost to the State.

Prior to application of bituminous overlay, any blisters found in the applied membrane shall be punctured with a torch-heated pick inserted at an approximate 45º angle. Blisters found subsequent to paving shall be punctured in the same manner.

Drainage holes, if and where located, shall be maintained. The waterproofing membrane shall be neatly slit and folded down into the drain holes. An 8-inch square of ¼-inch galvanized wire mesh (23 gauge) supplied by the Contractor, shall be placed over the drain then the membrane system torch-welded as required.

Unless otherwise shown on the plans or indicated in the Special provisions, welding shall be done in accordance with the latest edition of the ANSI/AASHTO/AWS D1.5M/D1.5 Bridge Welding Code. All field welders shall possess a valid welder certification card issued by the Department's Division of Materials Testing. If such person has not been engaged in welding operations on a Department project or project acceptable to the Department within a period of six months, or if he cannot produce an approved welding certification dated within the previous twelve months from a welding agency acceptable to the Engineer, he shall be required to re-qualify through examination. The Engineer may require re-examination of anyone whose quality of work he questions.

The steel extrusions shall be fabricated in sections and be made continuous by welding during placement. The strip seal shall be fabricated and installed in one piece. No field splicing of the seal will be permitted.

A competent technical representative of the manufacturer shall be present during the installation of the steel extrusions to provide the Contractor such aid and instruction as required to obtain a satisfactory installation, to the approval of the Engineer.

Installation

The strip seal expansion joint system shall be installed at the locations shown on the plans and in stages in accordance with the traffic requirements in the special provisions "Maintenance and Protection of Traffic" and "Prosecution and Progress".

The Contractor shall create a blockout at the end(s) of the concrete deck, approach slab, parapet and/or curb sections that is to receive the strip seal joint system, by removing the existing joint system and modifying the appropriate structure elements as detailed in the contract plans.

Care shall be taken to limit damage to the structure elements and the reinforcement to remain. After removal of bituminous overlay, and before concrete removal begins, delineate the removal area with saw cuts as shown on the plans. Where necessary to construct headers in backwalls, additional bituminous concrete and or subbase material shall be removed. Concrete shall be removed by means of pneumatic hammers approved by the Engineer.

The weight of pneumatic hammers shall not exceed 30 pounds for concrete removal above the top reinforcing steel nor 15 pounds for concrete removal below the top reinforcing steel. The depth of concrete removal shall be at least that shown in the details, 1 inch below the reinforcing steel, but shall be such as to include all spalled, delaminated, or otherwise deteriorated concrete. The Engineer will be sole determiner of what constitutes deteriorated concrete, using sounding methods or other evaluation measures at his discretion.

The existing transverse reinforcement shall be removed and replaced as shown on the plans or as directed by the engineer. The new transverse header reinforcement shall be continuous at construction joints. Where the existing reinforcing steel is damaged or corroded, it shall be cut out and replaced with new reinforcing steel of the same size. Where existing reinforcing steel which is to remain in place is determined by the Engineer to have insufficient cover, it shall be either replaced or adjusted as directed. New steel shall be attached beneath existing steel with a minimum lap of 15". Concrete shall be removed to a minimum of depth of 1" below the new steel. Any sound reinforcing steel damaged during the concrete removal operations, shall be repaired or replaced by the Contractor at his expense as directed by the Engineer. Sound reinforcing steel which is in the proper position in the slab shall be left in place and cleaned of all concrete, the smaller fragments to be removed with hand tools.

Adequate measures shall be taken by the Contractor to prevent concrete debris, tools and/or materials from dropping below the structure. All debris shall be satisfactorily disposed of by the Contractor.

Drilling and grouting of steel dowels shall be as shown on the plans and in accordance with the chemical adhesive's manufacturer's recommendations such that the grouted dowels will be able to develop, in tension, 100 percent of its specified yield strength.

Holes for the dowels shall be located as shown on the plans. The holes shall clear the existing reinforcement and provide the minimum cover as shown on the plans. If existing reinforcing is encountered during the drilling operation, the hole shall be relocated.

Hole drilling methods shall not cause spalling, cracking, or other damage to the existing concrete. The weight of the drill shall not exceed 15 pounds. Those areas damaged by the Contractor shall be repaired in a manner suitable to the Engineer and at no expense to the State.

The steel extrusions and anchorage shall be sandblasted in accordance with SSPC-SP-7, Brush-Off Blast Cleaning, prior to placement. The extrusions shall be aligned with the deck cross slope and breaks in the cross slope. Both the leading and trailing sides of the extrusion shall be recessed ¼" below the adjacent headers as shown on the plans. The extrusions shall be

firmly and accurately held in position prior to and during the placement of the concrete header by temporary supports. Temporary supports shall be designed to account for any thermal movements of the structure through the first 24-hour temperature cycle. Adjacent sections of extrusion shall be butt welded together—provisions shall be made in the installation sequencing to maximize the weldable area. All field welding shall be accomplished by an AWS certified Welder.

Forms shall be used to keep the concrete from entering the open joint between the concrete deck slabs or parapet sections.

The entire concrete surface shall be dampened. All free water shall be removed from the area.

Mixing and placing concrete should not be done unless the ambient temperature is above 35°F. All mixing shall be accomplished by means of a standard drum-type portable mixer. A continuous type mobile mixer may be used if permitted by the Engineer. The Contractor shall calibrate the mobile mixer under supervision of the Engineer. Calibration shall be in accordance with the applicable sections of ASTM method C685. The total mix shall be limited to the quantity that can be mixed, placed and cured to allow access by vehicles in accordance with MP&T specifications.

The concrete mix shall be spread evenly and thoroughly compacted using concrete vibrators. The concrete shall be placed, with a trowel if necessary, to insure that it completely fills the header below the extrusion and to prevent honeycombing and voids. The headers shall be finished to match the final cross-slope and grade of the roadway so that it will be flush with the adjacent roadway surface or as shown on the plans.

The surface shall be float finished. Finishing operations shall be completed before initial set takes place. Cured areas having a hollow sound when chain dragged or tapped (indicating delamination), shall be replaced by the Contractor at his expense until replacement concrete, acceptable to the Engineer is in place.

Tolerances in Finished Surfaces: The surface profile of the area shall not vary more than one-eighth inch in a distance of 10 feet, when a 10 foot long straightedge is placed on the surface at any angle relative to the centerline of the bridge. Humps that exceed the one-eighth inch tolerance shall be ground down by approved machinery. Sags or depressions in the surface of the area that exceed one-eighth inch tolerance shall be repaired by removal of the concrete in the depression over an area determined by the Engineer to a depth of one inch below the reinforcing steel in the deck or backwall and repaired in the previously described manner.

Where necessary to gain access to construct headers in parapets and sidewalks the Contractor shall remove, store and reinstall sliding plates. Where the Contractor is unable to reinstall existing screws for anchoring sliding plates the Contractor shall submit for approval of the Engineer a method to adequately secure the plates.

New galvanized steel plates shall be installed using expansion anchors and flathead cap screws. Expansion anchors shall be installed in accordance with the manufacturer's recommendations. Flat head cap screws shall be coated with anti-seize material prior to installation.

Welding details, procedures and testing methods shall conform to ANSI/AASHTO/AWS D1.5:2008 Bridge Welding Code, unless otherwise noted

Test Cylinders: The Contractor shall make and perform compressive strength tests on representative cylinders under the supervision of the Engineer. The dimensions, type of cylinder mold and number of cylinders shall be specified by the Engineer. Traffic shall not be permitted on patched surfaces until the patch material attains a strength of 1800 psi, as determined by breaks of the test cylinders.

A portable compression testing machine shall be provided by the Contractor and available on site for cylinder testing. All testing and equipment shall conform to ASTM C39.

Note: This compression machine must be calibrated in accordance with the provisions of Section 5, ASTM C39.

After the extrusions and headers have been placed, the strip seal shall be installed in a continuous length along the deck and up the parapets/curbs. An adhesive lubricant shall be used to install the strip seal in the steel extrusions as required by the manufacturer. No field splices will be permitted.

Any strip seal that is punctured, ruptured, cracked, bent or damaged in any other way shall be removed and replaced by the Contractor at no additional cost to the State.

All work shall be done in accordance with the special provisions for "Maintenance and Protection of Traffic" and Prosecution and Progress" contained elsewhere within.

Method of Measurement: This work will be measured for payment by the number of linear feet of strip seal, installed and accepted, measured from gutterline to gutterline, unless otherwise noted in the plans, along the centerline of the joint. Work at the parapet or curb turn-up sections will not be measured for payment but shall be considered included in the general cost of the work. Installed and accepted strip seals in sidewalks will be measured for payment from the gutterline to the face of the parapet, along the centerline of the joint.

Basis of Payment: This work will be paid for at the contract unit price per linear foot for "Strip Seal Expansion Joint System", complete in place, which price shall include all materials, equipment, tools, and labor incidental thereto.

ITEM #0520041A - PREFORMED JOINT SEAL

Description: Work under this item shall consist of furnishing and installing a preformed joint seal as shown on the plans and in conformance with these Specifications or as directed by the Engineer. Work shall also include a pre-installation survey for measurement of the existing joint opening width and preparation of the joint opening surfaces as needed to ensure proper performance of the preformed joint seal. The preformed joint seal shall seal the deck surface in accordance with the plans and prevent water from seeping through the joint area.

Materials: The preformed joint seal shall be one of the following:

1. Silicoflex:
   RJ Watson, Inc -- Bridge and Structural Engineered Systems
   78 John Glenn Drive
   Amherst, New York 14228
   Tel: (716) 691-3301 Fax: (716) 691-3305
   Website: http://www.rjwatson.com

2. V-Seal:
   D.S. Brown Company
   300 East Cherry Street
   North Baltimore, Ohio
   Tel: (419) 257-3561
   Website: http://www.dsbrown.com

3. Bridge Expansion Joint System (B.E.J.S.):
   EMSEAL Joint Systems Ltd.
   25 Bridle Lane,
   Westborough, MA 01581
   Tel: (508) 836-0280
   Website: http://www.emseal.com

A Materials Certificate for all components of the selected preformed joint seal shall be submitted by the Contractor in accordance with the requirements of Article 1.06.07

Construction Methods: All work at each joint location shall be accomplished in conformance with the traffic requirements in the Special Provisions, "Maintenance and Protection of Traffic" and "Prosecution and Progress".

At all joint locations, the Contractor shall perform a survey of the existing joint openings. This information shall include, but not be limited to:

a) Joint opening width (taken at distances along the length of the joint not to exceed 6')
b) Temperature at time of measurement of joint opening width.
c) Identification of sharp discontinuities in the joint alignment or its surfaces.

At least 30 days prior to start of the work, the Contractor shall submit a detailed Quality Control Plan to the Engineer for review and comment for the installation of the selected joint system. The submittal shall include:

a) All information gathered during field survey.
b) A list of all manufactured materials and their properties to be incorporated in the joint system, including, but not limited to the primer, bonding agent, sealant, and the sealing element.
c) A detailed step by step installation procedure and a list of the specific equipment to be used for the installation.

The Quality Control Plan must fully comply with the specification's requirements and address all known and anticipated field conditions, including periods of inclement weather.

A technical representative of the selected joint system, approved by the manufacturer, shall be notified of the scheduled installation a minimum of 2 weeks in advance and be present to provide direction and assistance for the first joint installation and succeeding joint installations until the Contractor becomes proficient in the work and to the satisfaction of the Engineer.

Tools, equipment, and techniques used to prepare the joints and materials shall be approved by the Engineer and the manufacturer's technical representative prior to the start of construction.

The minimum temperature for installing any of the qualified preformed joint seals is 40 degrees Fahrenheit and rising, ambient air temperature. The joint surfaces shall be completely dry before installing any of the components of the selected joint seal. The selected joint seal cannot be installed immediately after precipitation or if precipitation is forecasted. Joint preparation and installation of the selected preformed joint seal must be done during the same day.

Any discontinuities, projections, divots or other anomalies in the joint opening surfaces that would negatively affect the performance of the preformed joint seal shall be remedied by the Contractor by methods recommended by the manufacturer and as approved by the Engineer.

All vertical faces adjacent to the joint opening shall be sandblasted prior to application of any of the joint seal components. All remnants of the prior existing joint sealing system (rubberized gland, silicone sealant, etc…) shall be removed from the existing headers to remain. Any discontinuities or sharp projections into the plane of the joint shall be ground smooth prior to sandblasting. Whenever abrasive blast cleaning is performed under this Specification, the Contractor shall take adequate measures to ensure that the abrasive blast cleaning will not cause damage to adjacent traffic or other facilities. Traffic will not be allowed to pass over the joint after sandblasting has occurred.

Following sandblasting, the joint's surfaces shall be wiped down or blown clean as recommended by the manufacturer.

The selected joint sealing system shall be installed continuously with no splices in the preformed seal in the roadway section, as recommended by the manufacturer of the selected preformed joint seal, or as directed by the Engineer.

When the sealing operations are completed, the joint opening shall be effectively sealed against infiltration of water. Any seal that does not effectively seal against water shall be removed and replaced at the Contractor's expense.

Treatment at gutterline and curbs/parapets:
At curbs, the preformed joint sealing element shall run continuously from the roadway section through the upturn at the curb and continue as shown on the plans.

At parapets or walls, the joint sealing element shall be upturned at the parapet/wall for a continuous seal through this transition. Use of a prefabricated piece (fabricated a minimum of 24 hours prior to use) to "make" the bend at the wall is allowed, though field splicing of this prefabricated piece shall not be allowed in the roadway section (BEJS by EMSEAL is exempt from this restriction). Parapets and walls shall be sealed for the entire vertical portion and across the top with the sealing element—bends and splices nine inches above the curbline and higher are allowed to be field fabricated.

Method of Measurement: This work will be measured for payment by the number of linear feet of preformed joint sealing system installed. The measurement will be made at the top surface and along the centerline of the joint and shall include all portions of the installation in the roadway, in the curbs and sidewalk(s), and within parapets, barriers and medians.

Basis of Payment: This work will be paid for at the Contract unit price, per linear foot, for "Preformed Joint Seal" complete in place, including all materials, equipment, tools, and labor incidental thereto.

Included in the contract unit price is the pre-installation survey of the existing joint opening and the cost of assistance from a technical representative of the selected joint system.

Pay Item	Pay Unit
Preformed Joint Seal	L.F.

ITEM #0520420A - PREFABRICATED EXPANSION JOINT (MOVEMENT CAPACITY 7")

ITEM #0520456A - PREFABRICATED EXPANSION JOINT SYSTEM

Description:

ITEM #0520420A – PREFABRICATED EXPANSION JOINT (MOVEMENT CAPACITY 7"): THIS ITEM SHALL BE UNDERSTOOD TO BE THE WABOFLEX SR 6.5A JOINT WHICH HAS A MOVEMENT CAPACITY OF 6.5". To be used at locations noted on the plans.

ITEM #0520456A – PREFABRICATED EXPANSION JOINT SYSTEM: THIS ITEM SHALL BE UNDERSTOOD TO BE THE WABOFLEX SR 9 JOINT WHICH HAS A MOVEMENT CAPACITY OF 9". To be used at locations noted on the plans.

Work under this item shall consist of furnishing, accurately setting, securely supporting and installing a prefabricated expansion joint system at the correct grade and elevation as shown on the plans and in conformance with these specifications. This item shall also include installing reinforced concrete headers and adjacent concrete in parapets and installing an elastomeric trough below the prefabricated joint and the removal of additional material necessary for proper fit of the new joint as shown on the plans or as directed by the Engineer. The prefabricated expansion joint system shall seal the deck surface in accordance with the plans and prevent water from seeping through the joint area.

Materials:

1 - Acceptable Manufacturer: The manufacturer supplying the prefabricated expansion joint and joint model shall be:

Watson Bowman ACME
Company 95 Pineview Drive
Amherst, New York 14228
Tel: (716) 691-7566 Fax: (716) 691-9239
Web site: http://www.wbacorp.com

Model: WaboFlex SR 9 and SR 6.5A.

2 - Structural Steel: Structural steel plates and sections in the joint assembly shall conform to the requirements of ASTM A709 Grade 50. The structural steel plates shall be galvanized in accordance with ASTM A123.

3 – Bedding Compound: Apply edge void sealant as a bedding material to the block out

base prior to placement of the elastomeric gland. Material shall be a one part polysulfide synthetic rubber sealant conforming to Federal Specification TT-S-00230C Type II Non-Sag.

4 – Threaded Rods: Threaded Rods shall conform to ASTM A307. Heavy hex nuts shall conform to AASHTO M291. The washers shall conform to AASHTO M223, Grade 50. The threaded rods, nuts, and washers shall be hot-dip galvanized in accordance with AASHTO M232 and M111 as applicable.

5 – Welded Studs: The welded studs shall conform to the requirements of Subarticle M.06.02- 4.

6 – Expansion Anchors: Dropin expansion anchors, or approved equal shall be flush type and stainless steel conforming to AISI 303 and ASTM A582.

7 – Cap Screws: Socket head cap screws shall be flat head style stainless steel conforming to the requirements of Article F593, Group 1.

8 – Zinc Paint: Field touch-up paint for use at approved field welds and to repair damaged areas of the galvanizing shall be a paint that contains zinc dust and conforms to MIL-P-21035.

9 – Certified Test Reports: The Contractor shall submit a Certified Test Report and a Materials Certificate in conformance with Article 1.06.07 and a sample of all threaded rods, nuts, and washers for testing prior to their installation. The Contractor shall not install any anchor bolts or threaded connection rods prior to receipt of the approved test results and approval by the Engineer. A Certified Test Report is also required to certify that galvanizing has been performed to the requirements of ASTM A 123 after fabrication is complete.

10 – Elastomeric Trough: The trough material shall be fabric reinforced neoprene rubber.. Neoprene shall meet the requirements of ASTM D378, ASTM D412, ASTM D471, ASTM D573, ASTM D624 and ASTM D2240. The attachment hardware shall be ASTM A36 steel galvanized in accordance with ASTM A153. The silicone joint sealant used to seal the elastomeric trough shall be chosen from the list specified in Form 817, section M.03.08-5-b-2.

11 - Galvanized Reinforcing Bars: Deformed steel bars in the concrete headers shall be galvanized and shall conform to the requirements of Article M.06.01.

12 - Connectors: All trough connection bolts other than the welded bolts to the splash plate shall be made of stainless steel in accordance with ASTM F593. The welded bolts to the splashplate shall conform to the requirements of ASTM A325 and shall be galvanized in accordance with ASTM A123.

All nuts and washers shall be stainless steel in accordance with ASTM F594 for stainless

bolts. All others shall conform to ASTM A563 Grade DH or DH3 and the corresponding washers shall conform to ASTM F436. Nuts and washers shall be galvanized in accordance with ASTM A153.

13 – Anchor Bolts: The chemical anchoring material for anchor bolts shall conform to sub article M.03.01-15 and shall be selected from the Department's qualified products list.

Construction Methods:

Before fabricating any materials, the Contractor shall submit shop drawings to the Engineer for approval in accordance with Article 1.05.02. These drawings shall include but not be limited to the following information:

1. Plan and section of the joint system.

2. Complete details of all components and sections including tongue and groove joints and all materials incorporated into the expansion joint system.

3. All ASTM, AASHTO, or other material designations.

4. Requirements for storage of joint system and details of temporary support of joint for shipping, handling, and job site storage and installation. This shall include setting the joint width for temperature.

All steel components to be galvanized shall be galvanized only after all drilling, welding and other fabrication is complete. Repair of damaged galvanizing shall be performed in accordance with ASTM A780. Paint containing zinc dust shall be applied by brush. Spray application will not be allowed. Paint shall be thoroughly and frequently stirred to ensure that adequate solids are applied.

The joint opening shall be abrasive-blasted to remove all laitance and contaminants which may cause bonding problems. The joint opening should be blown clean using compressed air greater than 90 psi. Compressed air shall be free of oil.

The newly exposed reinforcing steel and concrete faces shall be cleaned of loose or powder-like rust, oil, solvent, grease, dirt, dust, bitumen, loose particles, and foreign matter just prior to placing the concrete.

The expansion joint system shall be delivered to the job site and stored in accordance with the Manufacturer's written requirements and as approved by the Engineer.

Lifting locations, lifting mechanisms, and temperature setting devices shall be as shown on the Working Drawings.

Damage to the joint system during shipping or handling will be cause for rejection of the joint system.

To aid in assuring proper installation of each expansion joint system in the field, the Contractor shall have available at the job site during the installation process the services of a qualified installation technician who is a full-time employee of the Manufacturer of the expansion system to be installed in this project. Recommendations made by the expansion joint Manufacturer's installation technician, on or off the job site, and approved by the Engineer shall be adhered to by the Contractor.

The joint Manufacturer's installation technician shall advise the Contractor and certify to the Engineer that the proper installation procedures are followed. All certifications to the Engineer shall be in writing, signed and dated by the Manufacturer's installation technician.

The prefabricated expansion joint system shall be installed in strict accordance with the Manufacturer's written instructions and the advice of the Manufacturer's installation technician. The permanently installed joint system shall match the finished roadway profile and grades. The Contractor shall take all necessary measurements to ensure that the joint will conform to the roadway cross section and that the proposed joint meets the remaining portion of the joint with minimal opening between the two to prevent adverse effects when traffic is resumed. The work shall proceed in accordance with the special provision, "Maintenance and Protection of Traffic". Plating across a joint that is incomplete, poorly installed or poorly matched to the existing portion of joint will not be allowed. If such a situation arises, the Contractor shall remove the section(s) that were poorly installed and install new portions as required to reopen traffic, as directed by the Engineer. Only tongue and groove joints will be allowed across the roadway section. A tolerance of 1/16" in height or elevation is to be maintained between tongue and groove joints.

The Contractor shall take precautions to protect the joint systems from damage at all times. Prior to installation of the joint, the block out and supporting system shall be protected from damage and construction traffic. The Contractor shall remove the existing joint in a manner that will not leave remaining components vulnerable to damage from traffic. Should damage occur, the Contractor shall restore the joint or replace an additional portion as directed by the Engineer.

The prefabricated expansion joint system shall be set to the proper width for the structure temperature at the time of setting. Information to assist in setting the joint opening is provided on the plans. The Engineer shall make the final joint width determination in the field. The joint shall be laid out such that both lines of threaded rods that anchor the joint to the steel plates shall be laid on straight and parallel lines from gutter line to gutter line. The proposed joint opening should be set such that the joint device will be centered over the opening at 50 degrees F.

The Contractor shall provide the Department with three additional, 6-foot sections of the WaboFlex SR after the work has been completed for future replacement needs. These

sections are in addition to any defective sections, which should be replaced at no additional cost to the Department.

All forms and debris that tend to interfere with the free action of the expansion joint system shall be removed.

All dimensions are based on the original bridge as-built plan set. The Contractor shall obtain necessary field measurements of girder width and girder spacing in order to verify compatibility with the elastomeric through and splash plate system as detailed prior to the fabrication and installation.

Welding shall conform to the ANSI/AASHTO/AWS D1.5 (2008) – Bridge Welding Code.

Method of Measurement:

This work will be measured for payment by the number of linear feet of prefabricated expansion joint installed and accepted, measured from gutter line to gutter line, unless otherwise noted in the plans, along the centerline of the joint. Work at the parapet or curb turn-up sections will not be measured for payment but shall be considered included in the general cost of the work. Installed and accepted prefabricated joints in sidewalks will be measured for payment from the far edge of the sidewalk slab to the outside face of the parapet, as shown on the plans, along the centerline of the joint.

Basis of Payment:

This work will be paid for at the contract unit price per linear foot for "Prefabricated Expansion Joint" with the specified movement capacity, complete and accepted, which price shall include the cost of furnishing and installing new prefabricated expansion joints, elastomeric troughs, galvanized reinforcing bars in the concrete headers, technical representative personnel, and all other materials, equipment, tools, and labor incidental thereto. The cost of construction staking to establish alignment of the joint and any survey needed to establish joint length and beveling requirements will be included in the general cost of this work.

Pay Item	**Pay Unit**
Prefabricated Expansion Joint (Movement Capacity 7”)	LF
Prefabricated Expansion Joint System	LF

ITEM #0520902A - INSTALLATION OF FINGER JOINTS

Description:

Work under this item shall consist of furnishing and installing a steel finger expansion joint including steel curb and parapet closure assemblies, anchor studs, anchorage devices, anchor bolts, shipping devices, concrete header all in accordance with these specifications and in conformity to the lines, elevations, and locations shown on the plans. The work shall conform to the general requirements of Section 6.03 – Structural Steel.

Materials:

Structural steel shapes and plates shall conform to the requirements of ASTM A709 Grade 50. The complete assembly shall be galvanized after fabrication in conformance with the requirements of ASTM A123.

Anchor bolts shall conform to ASTM F1554 Grade 36. Anchor bolt nuts shall conform to ASTM F563.

Anchor bolts, nuts and washers shall be mechanically galvanized to conform to the requirements of ASTM B695, Class 50.

Anchor studs shall be standard welded anchor studs, conforming to the requirements of Article M.06.02
Fasteners used to secure the sliding cover plate at the parapets shall conform to ASTM F593 and F594 (Type 316 Stainless Steel). The fasteners shall be recessed in the sliding plate such that the top of the fastener is flush with the sliding plate surface. This will require countersunk holes and flat head fasteners.

Field touch up paint for use at field welds and to repair damaged areas of the galvanizing shall be a zinc paint conforming to MIL-P-21035.

Concrete in the deck headers, curbs, sidewalks and parapets shall conform to Class F Concrete.

Construction Methods:

Shop Drawings: Before fabricating any section of expansion joint, the Contractor shall submit shop drawings to the Engineer for approval in accordance with Article 1.05.02(b). These drawings shall include but not be limited to the following information:

A. The complete details of the method, materials and equipment proposed to be used in the installation.

B. Plan of the joint showing the location of splices, welds, anchor studs, anchoring devices and erection angles.

C. Complete details of fabrication of curb, sidewalk and parapet closure assemblies.

D. Table of joint opening widths for various installation temperatures.

E. Means of adjusting width and grade of the prefabricated joint assemblies.

Surfaces to which are to be welded shall be cleaned and all protrusions shall be removed by grinding or other suitable methods.

Fabrication shall be in accordance with Article 6.03.03. The AWS Structural welding Code D1.1 – Steel may be used for fabrication of the assembly.

Studs or any other mechanism used to anchor the finger joint assembly into the concrete shall be accurately installed in the shop at the locations shown on approved shop drawings.

Stud welding shall be in accordance with Article 5.08.03 with the exception that testing studs by bending with hammer blows is not required.

The assembled expansion joint shall not be installed until the deck concrete on the adjacent slabs has cured for a minimum of 10 days, and all superimposed dead loads have been placed on the adjacent spans except those which cannot be placed because of required construction sequence. Movement of the joint due to future superimposed dead loads shall be provided for by adjusting the width of the joint accordingly.

The profile of the joint in the pavement area shall conform to the roadway cross section. The expansion joint assembly shall be preset, in accordance with approved shop drawings, joint setting data and specifications. The assembly shall be properly secured for shipping. Provision shall be made for final field adjustment at the time of installation.

All movements due to factors such as shrinkage, creep and midspan deflection shall be properly accounted for prior to this final adjustment.

Concrete headers and adjacent portions of curbs, sidewalks and parapets shall be constructed in accordance with the applicable requirements of Article 6.01.03 of Form 817.

Method of Measurement:

This work will be measured for payment by the actual number of linear feet of joint completed and accepted, measured along the center line of the joint from curb line to curb line. The length of joint continuing up the curb and along the surface of parapets and sidewalks shall not be measured for payment.

Basis of Payment:

This work will be paid for at the contract unit price per linear foot for "Installation of Finger Joints", complete in place, which price shall include all materials, including finger plates, structural supports, sliding plates, shipping devices, hardware, concrete and all equipment, and labor incidental thereto.

Pay Item	Pay Unit
Installation of Finger Joints	L.F.

ITEM #0521003A - BEARING REPLACEMENT WITH ELASTOMERIC BEARING PADS

Description:

Work under this item shall consist of removal and disposal of existing expansion bearings including sole plates, cutting of existing anchor rods, preparation of bearing surfaces, furnishing and installing new elastomeric bearing assemblies including steel load plates, sole plates, bolster and shims and furnishing and welding steel plates over holes in bottom bolster plates and bottom flanges where anchor rods have been removed for bearing replacement.

Materials:

All materials shall be approved by the Engineer.

Steel for the sole plates, load plates, bolts and shims shall be as specified on the structural drawings and/or conform to the requirements of Article M.06.02-Structural Steel and Other Structural Materials. Load and sole plates are not required to meet the requirements for Charpy V-notch testing. A shop primer coat shall be applied to the steel load plates after the elastomeric pads have been vulcanized to the steel plates.

The internal steel laminae shall be as specified on the structural drawings.

The elastomeric bearing pad shall be as specified on the structural drawings.

Elastomeric bearing pads shall conform to the requirements of Section 5.21 – Elastomeric Bearing Pads.

Construction Methods:

The contractor shall take adequate precautions to prevent any materials and debris from the work operations from dropping to the area below. This debris shall be disposed of properly.

Prior to removing existing welds, the existing lead paint shall first be removed from the girder around the weld. See the special provision for "Abrasive Blast Cleaning and Field Painting of Beam Ends (Site No. X)" for the description and construction methods for existing paint removal and application of shop primer coat for new steel load plates.

Prior to removal of existing bearings, Contractor shall field verify all dimensions required for fabrication of new bolsters.

After the removal of the existing bearings, the existing anchor rods shall be removed ½" below the top of the concrete pedestal and the void filled with non-shrink grout, the concrete pedestal upon which the elastomeric bearings are to rest shall be carefully finished, by patching and/or

grinding as necessary, to a smooth level surface to the required elevation, and shall show no variation from a true plane greater than 1/16 inch and as directed by the Engineer and in accordance with Article 5.21.03.

The elastomeric bearing pads shall be installed at an ambient temperature between 40 degrees F and 80 degrees F. The elastomeric bearing pads shall be set so that their side faces are vertical after application of full dead load at 50 degrees F.

The elastomeric bearing assembly shall be field welded or bolted to the existing beam or bolster. When welded the temperature of the steel adjacent to the elastomer shall not exceed 200 degrees F during field welding between the beam bottom flange and the sole plate or bolster and shall be monitored with temperature indicating crayons. Welding details, procedures, and testing methods shall conform to the current edition of the ANSI/AASHTO/AWS D1.5 Bridge Welding Code.

The elastomeric bearings shall bear uniformly on all surfaces under full dead load. If uniform bearing is not present, the gaps beneath the bearing shall be filled with elastomeric shims. The Contractor, in the presence of the Engineer, shall measure the gaps to determine the limits of the areas requiring shims.

The Contractor shall raise the superstructure and install shims as required to provide uniform bearing of the bearing pads. The individual shims shall be bonded to the elastomer portion of the bearing with adhesive applied over the entire shim interface. The surface preparation, applications and curing of the adhesive shall be in accordance with the manufacturer's recommendations. If shims in excess of 1/8 inch are required, multiple shims shall be bonded together. Shimming of areas that vary in thickness shall be done by stepping the shims. Contractor shall also have the option of providing steel shims between load and sole plates to make up larger gaps. Steel shims shall be the same size in plan of the load and sole plates and be bolted in place by the same bolts passing through the load and sole plates.

Method of Measurement:

Each elastomeric bearing pad assembly shall be counted for payment when installed complete and accepted in place.

Basis of Payment:

This work will be paid for at the contract unit price each for "Bearing Replacement with Elastomeric Bearing Pads", complete in place, which price shall include removing and disposing of the existing bearing assemblies including bolsters, sole plates, cutting of existing anchor rods, preparing the bearing surfaces, furnishing and installing new elastomeric bearing assemblies including steel sole plates, load plates, shims and bolsters and furnishing and welding steel plates over holes in bottom bolster plates and bottom flanges where anchor rods have been removed for bearing replacement, field welding of bearing assembly to the existing beam or bolster and all equipment, tools and labor incidental thereto and shall include the cost of furnishing test pads.

This item shall also include the shop prime coat painting of the steel load plates after the elastomeric pads have been vulcanized to the plates, sole plates, and bolster plates.

Removal of existing lead paint prior to the removal of existing welds and field applied top coat of paint on steel sole plates, load plates, and bolsters shall be paid under the item "Abrasive Blast Cleaning and Field Painting of Beam Ends (Site No. X)".

Pay Item	Pay Unit
Bearing Replacement with Elastomeric Bearing Pads	EA

ITEM #0522405A - POT, SPHERICAL OR DISC BEARINGS (200 KIPS)
ITEM #0522413A - POT, SPHERICAL OR DISC BEARINGS (350 KIPS)
ITEM #0522417A - POT, SPHERICAL OR DISC BEARINGS (450 KIPS)
ITEM #0522420A - POT, SPHERICAL OR DISC BEARINGS (500 KIPS)
ITEM #0522430A - POT, SPHERICAL OR DISC BEARINGS (700 KIPS)
ITEM #0522432A - POT, SPHERICAL OR DISC BEARINGS (750 KIPS)
ITEM #0522452A - POT, SPHERICAL OR DISC BEARINGS (1100 KIPS)
ITEM #0522455A - POT, SPHERICAL OR DISC BEARINGS (1250 KIPS)
ITEM #0522460A - POT, SPHERICAL OR DISC BEARINGS (1400 KIPS)
ITEM #0522464A - POT, SPHERICAL OR DISC BEARINGS (1600 KIPS)

Description: The work covered by this specification shall consist of designing, furnishing, fabrication and installation of high-load multi-rotational bearings, including all materials located below the girder flange plate and above the supporting element, in accordance with the plans and specification. This work also includes attachment of the bearings assemblies to the girders and supporting elements via bolting, welding, and/or anchor rods. The high-load multi-rotational bearings may be of any type covered by this specification provided they are supplied by only one manufacturer. The bearing load capacity indicated in parentheses in the title of this special provision designates the service limit state maximum vertical design load.

Materials: All material used in the construction of bearings shall fully comply with the latest editions of the AASHTO LRFD Bridge Design Specifications Section 14 and of the AASHTO LRFD Construction Specifications Section 18, and as indicated below:

Steel: All steel, except steel for guide bars and shear-restriction pins and sleeves shall conform to ASTM A709, Grade 50. Guide bars and shear-restriction devices shall be as detailed by the manufacturer, unless otherwise specified.

Stainless steel sliding surfaces shall conform to ASTM A167 or A240 Type 304 with a surface finish of 20 micro-inches rms. or less. Welded stainless steel overlay shall be produced using Type 309L electrodes.

High Strength Bolts: High strength bolts, where required, shall conform to the requirements of ASTM F3125 Grade A325 (formerly ASTM A325) and shall conform to the requirements of M.6.05.02-5.

Anchor Rods: Anchor rods shall conform to the requirements ASTM F1554 Grade 105 (Fy = 105 ksi), unless noted otherwise on the Plans. The anchor rods, nuts, washers, and couplers shall

be galvanized in accordance with ASTM 123 and ASTM 153. Where couplers are required per the plans, they shall be fabricated such that the anchor bolt and anchor rod cannot be threaded past the midpoint of the coupler.

Polytetraflouroethylene (PTFE): PTFE sliding surfaces shall be virgin filled PTFE sheets or PTFE fabric. PTFE resin shall be virgin material (not reprocessed) meeting the requirements of ASTM D1457. Filler material, shall be milled glass fibers, carbon or other inert filler materials.

Where the PTFE is to be epoxy bonded, the PTFE shall be etched by the sodium naphthalene or sodium ammonia etching process.

Sealing Ring: Sealing rings shall be made of brass, round in cross section, and shall conform to Federal Specification QQB626, composition 22, half hard.

Lubricant (Pot Bearing Disc): Lubricant for pot bearing discs shall be a silicone compound conforming to MIL-S-8660, or an equal approved by the Engineer.

Prefabricated Pads: Prefabricated pads shall be 1/8 inch thick and shall conform to the requirements of M.12.02-2.

Non-Shrink Grout: The non-shrink grout shall conform to the requirements of M.03.01-12, and shall be flowable type capable of being pumped with a positive displacement pump through an opening 1/8 inch in diameter.

Coatings: After fabrication, the bearing assembly shall be metalized in accordance with *S8.2-2017 Specification for Application of Thermal Spray Coatings for Steel Bridges.* The metalized surfaces shall be sealed and covered with a top coat. The color of the top coat shall closely match the color of the steel girder. Areas where field welding is to occur shall not be shop coated to be cleaned and painted after welding using the same paint system as the steel girder.

Paint shall conform to the requirements of the contract special provision item "Structural Steel (Site No. X)", unless otherwise indicated on the plans.

Material Certification: The Contractor shall provide a Certified Test Report and Materials Certificate for the following materials in accordance with the requirements of Article 1.06.07:

Elastomer disk
PTFE Sheets
High strength bolts
Zinc silicate primer
Prefabricated Pads
Non-Shrink Grout

The Engineer shall reserve the right to request any additional certifications at no additional cost to the State.

The Contractor shall provide a Materials Certificate for steel and lubricant for elastomeric discs (pot bearing) in accordance with requirements of Article 1.06.07.

Construction Methods:

Design: High load multi-rotational bridge bearings shall be pot, disc or spherical bearings designed for the strength and service limit state design loads and rotations shown on the plans. The design and fabrication of high load multi-rotational bridge bearing shall comply with the latest editions of the AASHTO LRFD Bridge Design Specifications Section 14, and the AASHTO LRFD Construction Specifications Section 18, and as specified herein:

Design calculations and detailed working drawings for the bearings shall be sealed by a Professional Engineer, licensed in the State of Connecticut, and submitted to the Engineer for review, in accordance with the requirements of Article 1.05.02. The drawings shall include, but not be limited to, the following:

A. Plan view and section elevations, providing all fabrication dimensions and required surface finishes.
B. All ASTM, AASHTO, and other material designations.
C. Bearing design capacity for load, translation, and rotation at strength and service limits states.
D. A Schedule of all bearing offsets if required by the project.
E. Shop paint or coating requirements.
F. A warning note shall be inserted on all pot bearing shop plans or working drawings on which field welding is required that no welding current shall be permitted to pass between pot and piston components.

The design calculations shall be complete, verifying conformance of the bearing to provisions of this specification.

General Requirements: Multi-Rotational bearings shall be designed to accommodate the loads, forces and movements specified in the bearing schedule. Particular care shall be taken that all components of the bearings provide adequately for the horizontal loads and forces specified.

Maximum design stresses for all bearing components shall not exceed the allowable design stresses of the latest editions of the AASHTO LRFD Bridge Design Specifications Section 14 and the applicable sections of this specification.

Minimum rotation capacity (Rb) shall be the sum of Rs + R.

Minimum horizontal load capacity for fixed and guided bearings shall be as specified on the contract plans but in no case less than 15% of the vertical dead load shown on the plans. Expansion bearings shall be designed for additional movement capacity, in each direction, beyond the design movement indicated on the plans. The additional movement capacity shall be 10% of the design movement or 1 inch, whichever is greater. Spacing between the guides of the bearing do not require this additional movement capacity.

Where shown on the plans, an auxiliary plate shall be provided for all bearings as noted in the specification herein. The auxiliary plate shall be designed to fit between the bearing proper and the masonry plate. The auxiliary plate shall be engaged with the bearing proper by means of a properly designed shop weld, or by a "saucer-like" machined recess to snugly fit the base of the bearing. The purpose of the auxiliary plate is the following:

a. to provide a means of field installation adjustment and sufficient horizontal restraint for the base of the bearing proper without a field weld directly to the bearing where access is often difficult

b. to simplify the future removal and replacement of the bearing assembly in the event maintenance is required

c. to reduce the possibility of heat damage to critical bearing components during field welding installation

Bearing shall be designed so that all rotational and sliding elements can be replaced with a minimum lifting not to exceed 0.5 inch.

All specified machined surface finish tolerances shall be verified using a calibrated profilometer provided by the Contractor and approved by the Engineer.

Overall bearing height if different from that shown on the contract plans shall be accompanied by the necessary adjustment in the bearing pad elevation. Overall bearing height shall be not more than 0.25 inches greater than, nor zero (0) inches less than detail dimension provided on the fabrication working drawings.

All finished bearing components shall be painted in accordance with the Contract special provision item for "Structural Steel (Site No. X)", or "Abrasive Blast Cleaning and Painting of Structure (Site No. X)", as provided on the plans, except for the following materials and surfaces: elastomer, stainless steel, PTFE, brass sealing ring, inside surfaces of pot bearing pot, and pot bearing piston in contact with elastomer.

Welding shall conform to the requirements of AWS D1.1 Structural Welding Code and shall comply with the latest edition of the AASHTO LRFD Bridge Design and Construction Specifications requirements.

Pot Bearing Requirements:

The pot shall be machined from a single solid piece of steel. The pot inside diameter (Dp) shall be the same as the elastomeric disc.

No coating shall be applied to the inside surface of the pot to be in contact with the elastomeric disc, except silicone lubricant required for the lubrication.

The disc shall be lubricated with a silicone compound conforming to the requirements of MIL-S-8660 or other approved equal.

Pistons shall have the lower corner chamfered at 45 degrees for a maximum depth equal to 1.7 times the diameter of the sealing ring where the seal will seat wholly within the piston thickness (above elastomeric disc), and 1.2 times the diameter where it extends into the elastomeric disc.

Rings shall be rolled into a circle from round rod cut according to the LRFD Bridge Design Specifications and brazed or soldered to form a ring. The brazing or soldering process shall be adequate to fully develop the tensile strength of the rod. The ring shall fit the pot snugly (ANSI Class LC1, Standard Fit) so that it is in full contact with the pot wall and the top of the elastomer when installed. Tensile stress in the ring as a result of elongation at maximum bearing design rotation and maximum vertical and horizontal design loads shall not exceed 0.55 x Fy.

Silicone lubricant shall be applied to all surfaces in contact with the ring during assembly.

Spherical Bearings Requirements:

The radius of the spherical element concave PTFE surface shall be determined such that the resulting geometry of the bearing is capable of withstanding the greatest ratio of horizontal load to vertical load under all loading conditions to prevent unseating of the concave element.

The concave surface shall face down whenever possible.

PTFE fabric in the free-state shall be a minimum of 0.08 in. thick when measured in accordance with ASTM D1777.

Minimum center thickness of spherical surfaces shall be 0.75 inch.

The edge thickness of the convex element shall be a minimum of 0.75 inch for bearings directly on concrete or 0.5 inch for bearings directly on steel.

Disc Bearing Requirements:

Steel contact surface for elastomeric disc: Inside surfaces facing the elastomeric disc shall receive a commercial shot blast finish in accordance with SSPC SP-6.

Non-Rotational Bearing Element Requirements:

PTFE: Maximum contact stresses on the PTFE at the service limit state shall comply with AASHTO LRFD Bridge Design Specifications Table 14.7.2.4-1.

Stainless Steel: The stainless steel surface shall cover the mating surface in all operating positions plus one inch in each direction of movement.

Stainless steel sheet shall be seal-welded around the entire perimeter using techniques which ensure it remains in contact with the backing plate.

Guide Bars and Guide Keys:

Central Guide keys may be made integral by machining from the solid. Where a separate key or guide bar is used they shall be fitted in a keyway slot machined to give a press fit and bolted or welded to resist overturning. Guide bars may be made integral by machining from the solid or fabricated from bars welded, bolted, and or recessed at the manufacturing option.

Guide bars and central guide keys shall be designed for the specified horizontal forces, but not for less than 15% of the vertical capacity of the bearing.

The sum of clearances between guided surfaces shall not exceed 1/8 inch. Net contact area between guiding surfaces must remain constant throughout all operating positions.

All guide bars and guide keys shall be self-aligning and shall bear on elements of suitable size and strength to resist lateral forces indicated on the plans (i.e., guides in pot bearings must bear against piston components; guides in spherical bearings must bear against unfixed spherical components.)

Guiding directly between fixed bearing components shall not be permitted. Stainless steel and PTFE are required on guiding surfaces. The compressive stress on PTFE shall not exceed the following average bearing stresses:

	Unfilled PTFE	Filled PTFE
All loads except seismic loads	3,500 psi	3,500 psi

(PTFE on guiding surfaces need not be designed for seismic loading.)

Edge load pressure due to all loads and rotation (except seismic) shall not exceed 5,000 ksi for filled or unfilled PTFE.

PTFE on guiding surfaces shall be 3/16 inch minimum thickness, epoxy bonded into a square edged recess 3/32 inch deep in the substrate. In addition, the PTFE shall be mechanically fastened by a minimum of two screws into the substrate, located at a distance equal to twice the nominal screw diameter from the end of the PTFE strip. The top of the screws shall be recessed an amount not less than the minimum of one half the PTFE relief.

Travel Stops: Travel stops if detailed on the plans shall be capable of resisting the horizontal forces specified. The stops shall be set at 150% of the longitudinal movement or as directed on the plans.

Top Plate, Sole Plate, Auxiliary Plate, and Masonry Plate Requirements:

Where top plates, sole plates, and masonry plates bear on concrete the concrete bearing stress on the loaded area shall not exceed the limits specified in latest editions of the AASHTO LRFD Bridge Design Specifications.

Top or sole plates, if necessary, shall be beveled where they bear on steel to such that the lower surface of the top plate is level in the transverse and longitudinal directions when the bridge is open to traffic.

Special consideration shall be given to the design of top and sole plates (or plate to which sliding elements are attached) to assure that any bending forces imparted during field installation do not deflect the sliding surfaces. (The top or sole plate, for example, may be subject to extreme bending forces during a retrofit installation as a result of vertical load conditions prior to the completion of field welding.)

The top, sole, or masonry plates shall be shop welded to the bearing proper, unless otherwise noted on the plans. Auxiliary plates, where required, shall be located between the bearing proper and the masonry plate. The auxiliary plate shall be shop welded to the bearing proper, or shall have a "saucer-like" recess which shall snugly fit and restrain the bearing, and have adequate capacity to resist all required design forces. All field welds required for the anchoring of the lower bearing unit shall be limited to the interface between the masonry plate and auxiliary plate.

The top, sole, auxiliary, or masonry plates shall be designed for all required shear and bending forces in accordance with the latest editions of the AASHTO LRFD Bridge Design Specifications. If a recess is machined for the bearing or guide bars, it shall be not less than 1/2 inch in depth. The recessed surface on which the bearing proper will bear shall be machined to a

tolerance equal to 0.0005 x the diameter or width or recess. The minimum thickness of the auxiliary plate after machining of the recess shall be 1 inch.

Unless otherwise approved by the Engineer, the auxiliary and sole plates shall extend a minimum of 1 inch beyond the plan limit of the pot (or lower spherical element); bearing travel stops; or other bearing components in all plan directions, to provide access for required field welds.

Testing Requirements:

Sampling and testing shall be performed on bearings as specified in the latest AASHTO LRFD Bridge Construction Specifications Section 18.1.5 with the exception of the Long Deterioration Test, to ensure the requirements of the specification have been met. All tests described in the aforementioned Section 18.1.5 shall be performed in accordance with specified requirements therein and as specified herein.

Tests shall be performed on randomly selected samples from the production bearings. One bearing per "lot" shall be tested. One lot shall not exceed a single contract or project quantity. One lot shall not exceed 25 bearings. A lot shall consist of those bearings of the same type within a "Load Category". Bearing types shall be fixed type bearings or expansion type bearings. Guided and non-guided expansion bearings will be considered a single type.

One load category shall consist of bearings of differing vertical load capacity within a load range as outlines below:

- For bearings less than or equal to a service limit state load capacity of 1000 kips, the Load Category shall be based on a range of 500 kips.

- For bearings greater than a service limit state load capacity of 1000 kips but less than or equal to 3000 kips capacity, the Load Category shall be based on range of 1000 kips.

- For bearings in excess of 3000 kips capacity the Load Capacity shall be based on a range of 2000 kips.

Long-Term Deterioration Test: This test shall be performed on at least one expansion bearing, manufactured for the project, with a rated service limit state load capacity of 300 Kips or higher. The test does not have to be performed if documentation is submitted demonstrating a Long-Term Deterioration Test has been successfully performed and accepted on another Connecticut Department of Transportation project, for a bearing of equal or greater capacity, and of the same type and material properties to be supplied for the current project. The successful Long-Term Deterioration Test must have been completed within one year of the current project advertising date.

Only bearings from lots from which test specimens have passed all the above requirements will be approved for use in the structure.

Bearings with capabilities that exceed the manufacturer's testing capacity shall be tested at an approved testing laboratory. If suitable test equipment is not available in the United States, alternative testing/inspection procedures will be agreed between the Engineer and the manufacturer.

Shipping and Packing:

Bearing assemblies shall be securely fixed together as units so that they may be shipped to the job site and stored without relative movement of the bearing parts or disassembly at any time. Bearings shall be wrapped in moisture resistant and dust resistant material to protect against shipping and job site conditions.

Care shall be taken to ensure that bearings at the job site are stored in a dry sheltered area free from dirt or dust until installation.

When bearings are to be inspected on site, they shall be inspected within one week of arrival and may not be disassembled except under the supervision of the manufacturer or his representative or with the written approval of the manufacturer. Following inspection, the wrapping shall be reapplied and the bearings kept clean until installation.

Removal of top plates of bearings for separate attachment to the structure is not permitted except under the direct supervision of the manufacturer and by approval of the Engineer.

Installation Requirements:

Bearings shall be evenly supported over their upper and lower surfaces under all erection and service conditions.

Bearings shall be lifted only by their underside or specially designed lifting lugs.

When installing bearings, extreme care shall be exercised to protect bearing surfaces from damage and contamination.

The bearing assembly shall be aligned with the superstructure as shown on the plans. On guided bearings, special care must be taken to properly align the guiding mechanism with the designated expansion direction of the structure as shown on the plans.

Bearing straps or retaining clamps shall be left in place as long as possible to ensure parts of bearings are not inadvertently displaced relative to each other. Care must be taken to remove straps or clamps before any normal structural movement takes place.

Offsets of upper and lower bearing parts shall be set as required by the plans to compensate for loan deflection, temperature movement, and elastic shortening and creep of post-tensioned concrete superstructure as the case may be.

Bearings installed on a concrete substructure shall be installed over a preformed fabric pad, or shall bear upon non-shrink grout, as indicated on the plans.

Bearings shall be installed over a prefabricated pad on a concrete bearing pad. The concrete bearing pad surface shall be prepared to the correct elevation and finished to the following flatness tolerance:

For bearings seats up to 3.1 in. in length or width: ±0.06 in
For bearings seats over 3.1 in. but less than 4.5 in.: ±0.09in.
Bearing seats over 4.5 in.: ±0.125 in
There shall be no projecting irregularities exceeding 0.03 in.
Bearings seats shall be level within 1:200 slopes.

The masonry plate shall be installed level to within 1:200 slopes. The anchor rod protrusions above the masonry plate surface shall be cut off with the annulus filled with non-shrink epoxy grout that shall be installed in accordance with the manufacturers written recommendations.

The mating surface with the superstructure shall be a plane surface to within a slope of 1:200.

Following alignment of the bearing components, the bearing shall be field welded or bolted in position as shown on the plans. Welding procedures shall be established by the Contractor to restrict the maximum temperature of the bonded PTFE surfaces to 300° F and maximum temperature of the elastomer (Polyether-urethane, Neoprene or Natural Rubber) to 250°F. Temperatures shall be determined by temperature indicating wax pencils or other suitable means.

Welding current shall at no time be permitted to pass through the piston/pot assembly.

Particular care should be exercised to mask and protect the PTFE and polished stainless steel surfaces to protect them from blast abrasive and paint application during construction.

The Contractor shall repair any damage to bearing finishes following installation at no cost to the State as directed by the Engineer.

Bearings shall receive touch-up painting after installation as in accordance with other Contract special provision items addressing the painting of structural steel.

A continuous bead of silicone, 1/4 inch thick, shall be applied along the interface between auxiliary plate and the bearing proper following completion of metallizing where the bearing proper is retained by a recessed opening in the auxiliary plate.

Method of Measurement: This work will be measured for payment by the number of each pot, spherical or disc bearing of the load capacity indicated, fabricated, installed, and accepted.

Basis of Payment: This work will be paid for at the contract unit price for "Pot, Spherical or Disc Bearings" of the load capacity indicated, complete in place, which price shall include the design, all materials, fabrication, testing (including extra bearings if required for testing), equipment and labor incidental thereto. It also shall include the installation, including the masonry plate, grout or pad, and all materials, tools and labor incidental thereto.

ITEM #0586510.10A - SPECIAL MANHOLE 0-10’ DEEP

Description:

This item shall consist of constructing a manhole over an existing pipe, constructing a cast-in-place base slab and installing precast manhole in conformity with the lines, grades, dimensions and details shown on the plans, or as ordered, and in accordance with the provisions of the standard specifications for the various materials and work which constitute the completed manhole installation.

Materials:

Materials shall conform to the applicable requirements of Articles M.08.02 and M.11.04 of the Form 817 Standard Specifications.

Method of Measurement:

Manhole installations will be measured as each.

Basis of Payment:

Manhole installation will be paid for at the contract unit price each for "Special Manhole, 0-10’ Deep", which price shall include excavation, removal and disposal of all masonry, installation of precast concrete units, concrete base slab, backfill, and all equipment, tools and labor incidental thereto.

Pay Item	Pay Unit
Special Manhole, 0-10’ Deep	ea.

ITEM #0586510.20A - SPECIAL MANHOLE 0-20’ DEEP

Description:

This item shall consist of constructing a manhole over an existing pipe, constructing a cast-in-place base slab and installing precast manhole in conformity with the lines, grades, dimensions and details shown on the plans, or as ordered, and in accordance with the provisions of the standard specifications for the various materials and work which constitute the completed manhole installation.

Materials:

Materials shall conform to the applicable requirements of Articles M.08.02 and M.11.04 of the Form 817 Standard Specifications.

Method of Measurement:

Manhole installations will be measured as each.

Basis of Payment:

Manhole installation will be paid for at the contract unit price each for "Special Manhole, 0-20’ Deep", which price shall include excavation, removal and disposal of all masonry, installation of precast concrete units, concrete base slab, backfill, and all equipment, tools and labor incidental thereto.

Pay Item	Pay Unit
Special Manhole, 0-20’ Deep	ea.

ITEM #0586850.01A - HYDRODYNAMIC SEPARATOR (SITE NO. 1)
ITEM #0586850.02A - HYDRODYNAMIC SEPARATOR (SITE NO. 2)
ITEM #0586850.03A - HYDRODYNAMIC SEPARATOR (SITE NO. 3)

Description: Hydrodynamic separators are proprietary devices manufactured for stormwater treatment. The hydrodynamic separator shall be a precast concrete structure and include an internal chamber with features that induce a swirling, circular, or spiraling flow pattern in the stormwater flow that separate and trap sediment and pollutants in a chamber that can be accessed for later removal.

This item will consist of furnishing and construction of a hydrodynamic separator, a flow diversion structure, manholes and pipes in the location, grades, treatment capacity and to the dimensions and details shown on the contract drawings, and in accordance with these specifications or as directed by the Engineer. The work also includes the preparation of hydraulic design calculations for the hydrodynamic separator(s) and flow diversion structure(s) as specified herein.

The hydrodynamic separator shall be assembled and installed in strict compliance with the Manufacturer's instructions unless otherwise directed by these specifications or by the Engineer. Internal flow controls / diversion components, external appurtenances, concrete manhole riser sections, manhole frames and covers, reinforcing, threaded inserts, lifting and seating fixtures, non-shrink grout, and all other necessary materials and equipment to complete the work shall be included.

This item shall also include the cleaning of the hydrodynamic separator of all sediment and debris every 90 days, or as needed, from when they are put into service, until final acceptance of the project.

Approved Products and Manufacturer Information: Proprietary hydrodynamic separators currently approved by the Department are listed in Table 1 "**CONNDOT LIST OF APPROVED HYDRODYNAMIC SEPARATORS**". Company contact information is provided for convenience. *As the company information frequently changes, the Department is not responsible for its accuracy.*

The Engineer will reject any proposed hydrodynamic separator that is not listed in Table 1.

The listed products have been approved for use on Department projects based on only a general review of the product's construction, function and treatment capabilities. **Therefore, the approved list shall not be construed to mean that all products appearing on the list are suitable to any specific project site or drainage design.**

Performance: The stormwater treatment performance of the selected hydrodynamic separator shall be based on the water quality flow (WQF) as defined and calculated in accordance with the Department's current version of the Drainage Manual.

The hydrodynamic separator shall be designed to treat the entire WQF as indicated on the contract drawings or specifications, without bypass, either through the separator's internal components or at the flow diversion structure.

TABLE 1 – CONNDOT LIST OF APPROVED HYDRODYNAMIC SEPARATORS

HYDRODYNAMIC SEPARATOR PRODUCT NAME	COMPANY INFORMATION
Downstream Defender	Hydro International 94 Hutchins Drive Portland, Maine 04102 (207) 756-6200 http://www.hydrointernational.biz/us/index_us.php
FloGard Dual-Vortex Hydrodynamic Separator	Oldcastle Precast 151 Old Farms Road Avon, CT 06001-2253 800-579-8819 www.oldcastlestormwater.com
High Efficiency CDS	Contech Stormwater Solutions 200 Enterprise Drive Scarborough, Maine 04074 (800)-925-5240 http://www.contech-cpi.com/stormwater/13
Vortechs	
Vortsentry	
Hydroguard	Hydroworks, LLC 525Boulevard Kenilworth, NJ 07033 (888)-290-7900 / (908)-272-4411 http://www.hydroworks.org/
Stormceptor OSR	Rinker Materials – Stormceptor 69 Neck Road Westfield, MA 01085 (800)-909-7763 / (413) 246-7144 www.rinkerstormceptor.com
Stormceptor STC	
V2B1	Environment 21 8713 Read Road, P.O. Box 55 East Pembroke, New York 14056-0055 (800)-809-2801 / (585)-815-4700 www.env21.com

Hydrodynamic separator systems and models that have been pre-approved for use on Department projects and their corresponding maximum allowable WQF's for stormwater treatment are shown in **Table 2**, "**PERFORMANCE MATRIX FOR CONNDOT APPROVED**

HYDRODYNAMIC SEPARATORS". The Engineer will reject any proposed hydrodynamic separator system/model that is not listed in Table 2.

For more severe storm events that produce flows up to and including the drainage design flow (DDF) and which result in flows greater than the WQF being directed to the hydrodynamic separator from the flow diversion structure, the hydrodynamic separator shall be capable of conveying the portion of the DDF directed to it without surcharging the upstream storm drainage system and re-suspending previously trapped sediment.

The WQF to be treated and the portion of the DDF directed to the hydrodynamic separator when the drainage system is operating at its design flow are shown on the Hydrodynamic Separator Design Data Sheets (Form A - Design). A separate form for each hydrodynamic separator site on the project is attached to this specification.

Sediment Storage Capacity: Settleable solids shall accumulate in a location within the hydrodynamic separator structure that is accessible for cleaning and maintenance but not susceptible to resuspension. Direct access through openings in the precast concrete unit shall be provided to the sediment storage chamber and all other chambers to facilitate maintenance.

The standard sediment storage capacities for Department pre-approved hydrodynamic separator systems/models are shown in **Table 3**, "**STANDARD SEDIMENT STORAGE CAPACITY FOR CONNDOT APPROVED HYDRODYNAMIC SEPARATORS***"*. The sediment storage capacities listed in Table 3 are values based on standard structure dimensions and anticipated maintenance requirements.

Some standard hydrodynamic separator models may be modified as determined by the Manufacturer to increase the sediment storage capacity. When a modification is proposed by increasing the depth of the standard structure, the sediment storage capacity of the proposed structure shall be determined in accordance with **Table 4, "SEDIMENT STORAGE CAPACITY CALCULATION"**.

The Contractor shall be responsible for verifying the standard sediment storage capacity of the hydrodynamic separator unit(s) and coordinating any proposed modifications to increase sediment storage capacity with the Manufacturer(s). All proposed modifications and revised sediment storage capacity determinations shall be clearly documented in the working drawing submission to the Department.

The minimum sediment storage capacities required for each hydrodynamic separator site on the project are shown on the Hydrodynamic Separator Design Data Sheets (Form A – Design) attached to this specification.

Hydraulic Design: The Contractor shall prepare or have prepared a hydraulic grade line (HGL) analysis for an evaluation of the selected hydrodynamic separator and the design of the flow diversion structure as described in this section. The HGL analysis shall be performed for both the

WQF and the DDF. The analysis shall be consistent with the methodology described in Section 11.12 of the Department's Drainage Manual.

Head loss coefficients, to be used in the HGL analysis, shall be determined in accordance with Section 11.12.6 for all structures except the hydrodynamic separator, which shall be obtained from the Manufacturer. Documentation shall be submitted demonstrating how the coefficient was derived either through calculation and/or testing data. A benching factor of 1.0 shall be applied to the flow diversion structure.

The HGL analysis (or portion of) that was performed for the design of the storm drainage systems and preparation of the construction plans, including the design of the flow diversion structure and evaluation of a "generic" hydrodynamic separator, is shown on the Hydrodynamic Separator Design Data Forms (Form A – Design) attached to this specification.

TABLE 2 - PERFORMANCE MATRIX FOR CONNDOT APPROVED HYDRODYNAMIC SEPARATORS

Maximum WQF (cfs)	Product Model								
	Downstream Defender	*Flogard*	*High Eff. CDS*	*Hydroguard*	*Stormceptor OSR*	*Stormceptor STC*	*Vortechs*	*Vortsentry*	*V2B1*
0.4	4-ft	DVS-36	2015-4G; 2015-4	HG 4	065	450	1000	VS30	2
0.5	4-ft	DVS-36	2015-4G; 2015-4	HG 4	065	900	1000	VS30	2
0.6	4-ft	DVS-36	2015-4G; 2015-4	HG 4	065	900	1000	VS40	2
0.7	4-ft	DVS-48	2015-4G; 2015-4	HG 4	140	900	1000	VS40	2
0.8	4-ft	DVS-48	2015-4G; 2015-4	HG 4	140	900	1000	VS40	2
0.9	4-ft	DVS-48	2015-4G; 2015-4	HG 4	140	1200	1000	VS40	3
1.0	4-ft	DVS-48	2015-4G; 2015-4	HG 4	140	1800	1000	VS40	3
1.1	4-ft	DVS-48	2015-4G; 2015-4	HG 4	140	1800	1000	VS40	4
1.2	6-ft	DVS-48	2015	HG 5	140	2400	1000	VS50	4
1.3	6-ft	DVS-60	2015	HG 5	140	2400	1000	VS50	4
1.4	6-ft	DVS-60	2015	HG 5	140	2400	2000	VS50	4
1.5	6-ft	DVS-60	2020	HG 5	140	2400	2000	VS50	6
1.6	6-ft	DVS-60	2020	HG 5	140	2400	2000	VS50	6
1.7	6-ft	DVS-60	2020	HG 5	250	2400	2000	VS50	6
1.8	6-ft	DVS-60	2020	HG 6	250	2400	2000	VS50	7
1.9	6-ft	DVS-60	2020	HG 6	250	3600	2000	VS60	7
2.0	6-ft	DVS-60	2020	HG 6	250	3600	2000	VS60	7
2.1	6-ft	DVS-60	2020	HG 6	250	3600	2000	VS60	9
2.2	6-ft	DVS-72	2025	HG 6	250	3600	2000	VS60	8
2.3	6-ft	DVS-72	3020, 3020-D	HG 6	250	3600	2000	VS60	8
2.4	6-ft	DVS-72	3035; 3035-D	HG 6	250	4800	2000	VS60	8
2.5	6-ft	DVS-72	3035; 3035-D	HG 6	250	4800	3000	VS60	10
2.6	6-ft	DVS-72	3035; 3035-D	HG 6	250	4800	3000	VS60	11
2.7	6-ft	DVS-72	3035; 3035-D	HG 7	250	4800	3000	VS60	11
2.8	6-ft	DVS-72	3035; 3035-D	HG 7	250	4800	3000	VS70	11
2.9	6-ft	DVS-72	3035; 3035-D	HG 7	250	4800	3000	VS70	12
3.0	6-ft	DVS-72	3035; 3035-D	HG 7	390	4800	3000	VS70	12

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TABLE 2 - PERFORMANCE MATRIX FOR CONNDOT APPROVED HYDRODYNAMIC SEPARATORS (continued)

Maximum WQF (cfs)	Product Model								
	Downstream Defender	*Flogard*	*High Eff. CDS*	*Hydroguard*	*Stormceptor OSR*	*Stormceptor STC*	*Vortechs*	*Vortsentry*	*V2B1*
3.1	8-ft	DVS-72	3035; 3035-D	HG 7	390	4800	3000	VS70	12
3.2	8-ft	DVS-72	3035; 3035-D	HG 7	390	4800	3000	VS70	12
3.3	8-ft	DVS-72	3035; 3035-D	HG 7	390	4800	3000	VS70	14
3.4	8-ft	DVS-72	3035; 3035-D	HG 7	390	6000	3000	VS70	14
3.5	8-ft	DVS-72	3030; 3030-DV, 3030-D; 4030-D	HG 7	390	6000	3000	VS70	14
3.6	8-ft	DVS-72	4030	HG 7	390	6000	3000	VS70	14
3.7	8-ft	DVS-84	4030	HG 8	390	6000	3000	VS70	14
3.8	8-ft	DVS-84	4030	HG 8	390	6000	4000	VS70	13
3.9	8-ft	DVS-84	4030	HG 8	390	7200	4000	VS70	15
4.0	8-ft	DVS-84	4030	HG 8	390	7200	4000	VS80	15
4.1	8-ft	DVS-84	4030	HG 8	390	7200	4000	VS80	15
4.2	8-ft	DVS-84	4030	HG 8	390	7200	4000	VS80	16
4.3	8-ft	DVS-84	4030	HG 8	390	7200	4000	VS80	16
4.4	8-ft	DVS-84	4030	HG 8	390	7200	4000	VS80	16
4.5	8-ft	DVS-84	4030	HG 8	390	7200	4000	VS80	16
4.6	8-ft	DVS-84	5640-D	HG 8	390	7200	4000	VS80	17
4.7	8-ft	DVS-84	5640-D	HG 8	390	7200	4000	VS80	17
4.8	8-ft	DVS-84	5640-D	HG 8	390	7200	4000	VS80	17
4.9	8-ft	DVS-84	5640-D	HG 8	390	11000s	4000	VS80	17
5.0	8-ft	DVS-84	5640-D	HG 9	390	11000s	4000	VS80	19
5.2	8-ft	DVS-84	4040-D	HG 9	390	11000s	4000	VS80	20
5.4	8-ft	DVS-96	4040-D	HG 9	390	11000s	4000	VS100	20
5.5	8-ft	DVS-96	4045-D	HG 9	390	11000s	5000	VS100	18
5.6	8-ft	DVS-96	4045-D	HG 9	560	11000s	5000	VS100	18
6.0	8-ft	DVS-96	4040	HG 9	560	11000s	5000	VS100	18
6.1	8-ft	DVS-96	4040	HG 9	560	11000s	5000	VS100	21

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TABLE 2 - PERFORMANCE MATRIX FOR CONNDOT APPROVED HYDRODYNAMIC SEPARATORS (continued)

Maximum WQF (cfs)	Product Model								
	Downstream Defender	*Flogard*	*High Eff. CDS*	*Hydroguard*	*Stormceptor OSR*	*Stormceptor STC*	*Vortechs*	*Vortsentry*	*V2B1*
6.3	8-ft	DVS-96	4040	HG 9	560	11000s	5000	VS100	25
6.4	10-ft	DVS-96	4040	HG 9	560	11000s	5000	VS100	25
6.5	10-ft	DVS-96	4040	HG 10	560	11000s	5000	VS100	25
6.9	10-ft	DVS-96	4040	HG 10	560	11000s	5000	VS100	25
7.0	10-ft	DVS-96	4040	HG 10	560	11000s	5000	VS100	22
7.1	10-ft	DVS-96	5042-D	HG 10	560	11000s	5000	VS100	22
7.2	10-ft	DVS-96	5042-D	HG 10	560	13000s	5000	VS100	22
7.3	10-ft	DVS-96	4045	HG 10	560	13000s	5000	VS100	22
7.5	10-ft	DVS-96	5653-D	HG 10	560	13000s	7000	VS100	22
7.7	10-ft	DVS-120	5653-D	HG 10	560	13000s	7000	VS100	22
7.8	10-ft	DVS-120	5653-D	HG 10	560	13000s	7000	VS100	50
7.9	10-ft	DVS-120	5653-D	HG 10	780	13000s	7000	VS100	50
8.0	10-ft	DVS-120	5658-D	HG 10	780	13000s	7000	VS100	50
8.2	10-ft	DVS-120	5658-D	HG 10	780	16000s	7000	VS100	50
8.5	10-ft	DVS-120	5658-D	HG 12	780	16000s	7000	VS100	50
8.6	10-ft	DVS-120	5658-D	HG 12	780	16000s	7000	VS100	50
8.9	10-ft	DVS-120	5678-D	HG 12	780	16000s	7000	VS100	50
9.0	10-ft	DVS-120	5678-D	HG 12	780	16000s	7000	VS120	50
9.2	10-ft	DVS-120	5678-D	HG 12	780	16000s	7000	VS120	50
9.5	10-ft	DVS-120	5050-DV	HG 12	780	16000s	7000	VS120	50
9.6	10-ft	DVS-120	5050-DV	HG 12	780	16000s	7000	VS120	50
10.0	10-ft	DVS-120	5050-DV	HG 12	780	16000s	9000	VS120	50
10.1	10-ft	DVS-120	5050-DV	HG 12	780	16000s	9000	VS120	50
10.5	10-ft	DVS-120	5050-DV	HG 12	780		9000	VS120	50
10.9	10-ft	DVS-120	5050-DV	HG 12	780		9000	VS120	50
11.0	10-ft	DVS-120	7070-DV	HG 12	780		9000	VS120	50
11.2	10-ft	DVS-120	7070-DV	HG 12	1125		9000	VS120	50

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TABLE 2 - PERFORMANCE MATRIX FOR CONNDOT APPROVED HYDRODYNAMIC SEPARATORS (continued)

Maximum WQF (cfs)	Product Model								
	Downstream Defender	*Flogard*	*High Eff. CDS*	*Hydroguard*	*Stormceptor OSR*	*Stormceptor STC*	*Vortechs*	*Vortsentry*	*V2B1*
11.5		DVS-120	7070-DV	HG 12	1125		9000	VS120	50
11.8		DVS-120	7070-DV	HG 12	1125		9000	VS120	50
11.9		DVS-120	7070-DV	HG 12	1125		9000	VS120	60
12.0		DVS-120	7070-DV	HG 12	1125		9000	VS120	60
12.1		DVS-120	7070-DV	HG 12	1125		9000	VS120	60
12.5		DVS-120	7070-DV	HG 12	1125		11000	VS120	60
13.0		DVS-120	7070-DV		1125		11000	VS120	60
13.5		DVS-120	7070-DV		1125		11000	VS120	60
13.6		DVS-120	7070-DV		1125		11000	VS120	60
14.0		DVS-144	7070-DV		1125		11000	VS120	60
14.5		DVS-144	7070-DV		1125		11000		60
14.9		DVS-144	7070-DV		1125		11000		60
15.0		DVS-144	7070-DV		1125		16000		60
15.5		DVS-144	7070-DV		1125		16000		60
15.7		DVS-144	7070-DV		1125		16000		60
16.0		DVS-144	7070-DV				16000		60
16.5		DVS-144	7070-DV				16000		60
17.0		DVS-144	7070-DV				16000		
17.5		DVS-144	7070-DV				16000		
18.0		DVS-144	7070-DV				16000		
18.5		DVS-144	7070-DV				16000		
19.0		DVS-144	7070-DV				16000		
19.7		DVS-144	7070-DV				16000		
20.0		DVS-144	10060-DV				16000		
21.5		DVS-144	10060-DV				16000		
22.3		DVS-144	10060-DV				1319		
25.0			10060-DV				1319		
25.2			10060-DV				1319		

TABLE 2 - PERFORMANCE MATRIX FOR CONNDOT APPROVED HYDRODYNAMIC SEPARATORS (continued)

Maximum WQF (cfs)	Product Model								
	Downstream Defender	*Flogard*	*High Eff. CDS*	*Hydroguard*	*Stormceptor OSR*	*Stormceptor STC*	*Vortechs*	*Vortsentry*	*V2B1*
27.6			10060-DV				1421		
29.3			10080-DV				1421		
30.0			10080-DV				1522		
31.2			10080-DV				1522		
33.6			100100-DV				1522		
35.0			100100-DV				1624		
38.2			100100-DV				1624		
40.0			100100-DV				1726		
43.2			100100-DV				1726		
49.3			100100-DV						

TABLE 3 - STANDARD SEDIMENT STORAGE CAPACITY FOR CONNDOT APPROVED HYDRODYNAMIC SEPARATORS

Sediment Storage (cubic yards)	**Product Model**								
	Downstream Defender	*Flogard*	*High Eff. CDS*	*Hydroguard*	*Stormceptor OSR*	*Stormceptor STC*	*Vortechs*	*Vortsentry*	*V2B1*
0.3		DVS-36					1000		
0.5	4-ft								
0.6							2000		
0.7		DVS-48		HG 4					
0.8					065	450		VS30	2; 3
0.9			2015-4G; 2015-4						
1.0 (minimum)							3000		
1.1					140	900			
1.2				HG 5					
1.3		DVS-60							
1.4							4000	VS40	
1.5			2015; 2020; 2025						
1.6									4
1.7				HG 6					
1.8	6-ft					1200			
1.9							5000		
2.0									
2.1									
2.2		DVS-72						VS50	
2.3				HG 7					
2.4									6; 7
2.5							7000		
2.6			3020, 3020-D; 3030, 3030-DV, 3030-D; 3035, 3035-D						
2.9					250	2400			

TABLE 3 - STANDARD SEDIMENT STORAGE CAPACITY FOR CONNDOT APPROVED HYDRODYNAMIC SEPARATORS (continued)

Sediment Storage (cubic yards)	Product Model								
	Downstream Defender	*Flogard*	*High Eff. CDS*	*Hydroguard*	*Stormceptor OSR*	*Stormceptor STC*	*Vortechs*	*Vortsentry*	*V2B1*
3.0				HG 8					
3.1							9000	VS60	
3.2									8; 9
3.3						1800			
3.4									
3.5		DVS-84							
3.6									
3.7	8-ft		5640-D						
3.8				HG 9					
3.9							11000		
4.0									
4.2									10; 11; 12
4.3			4030-D; 4040-D; 4045-D					VS70	
4.5									
4.6									
4.7									13
5.0				HG 10					
5.1									
5.3		DVS-96	5042-DV; 5050-DV						
5.5									
5.6			4030; 4040; 4045; 5653-D; 5658-D; 5678-D				16000	VS80	
5.7									
6.0						3600			
6.5									

TABLE 3 - STANDARD SEDIMENT STORAGE CAPACITY FOR CONNDOT APPROVED HYDRODYNAMIC SEPARATORS (continued)

Sediment Storage (cubic yards)	Product Model								
	Downstream Defender	*Flogard*	*High Eff. CDS*	*Hydroguard*	*Stormceptor OSR*	*Stormceptor STC*	*Vortechs*	*Vortsentry*	*V2B1*
6.6							1319		
6.9									
7.0									
7.1									
7.2									
7.3									14; 15; 16; 17; 18
7.5				HG 12					
7.6							1421		
7.7									
8.0									
8.3									
8.4			7070-DV						
8.6						4800			
8.7	10-ft				390		1522	VS100	
9.0									
9.5									
9.6									
9.9							1624		
10.0									
10.3		DVS-120							
10.5									19; 20
11.0									
11.2							1726		
11.3						6000			
11.5									21; 22
11.8									

TABLE 3 - STANDARD SEDIMENT STORAGE CAPACITY FOR CONNDOT APPROVED HYDRODYNAMIC SEPARATORS (continued)

Sediment Storage (cubic yards)	Product Model								
	Downstream Defender	*Flogard*	*High Eff. CDS*	*Hydroguard*	*Stormceptor OSR*	*Stormceptor STC*	*Vortechs*	*Vortsentry*	*V2B1*
12.0									
12.6								VS120	25
12.9					560				
13.0									
13.4						7200			
15.0									
17.5					780				
17.8		DVS-144	10060-DV;10080-DV; 100100-DV						
20.0									
22.3									50
25.0									
25.8					1125				
26.1						11000s			
26.2									
30.0									
34.1						13000s			
34.9									60
35.0									
38.7									
40.0									
40.7						16000s			

TABLE 4 - SEDIMENT STORAGE CAPACITY CALCULATION

Product	Sediment Storage Capacity (Volume) Calculation (cubic feet)
Downstream Defender	Inside Diameter (ft^2) of Structure x Distance (ft) from Bottom of Benching Skirt to Inside Floor of Structure
FloGard® Dual-Vortex	Inside Diameter (ft^2) of Structure x 1/2 Distance (ft) from Bottom of Vortex Tube to Inside Floor of Structure
High Efficiency CDS	Inside Diameter (ft^2) of Structure x Depth (ft) of Solids Storage Sump
Hydroguard	Inside Diameter (ft^2) of Structure x 1/2 Depth (ft) Below Outer Baffle Wall
Stormceptor STC	Inside Diameter (ft^2) of Structure x 1/2 Depth (ft) Below Drop Tee Inlet Pipe
Stormceptor OSR	Inside Diameter (ft^2) of Structure x 1/2 Depth (ft) Below Drop Tee Inlet Pipe
Vortechs	Inside Diameter (ft^2) of Grit Chamber x 1/2 Depth (ft) Below Opening in Swirl Wall
Vortsentry	Inside Diameter (ft^2) of Structure x Depth (ft) of Sediment Storage Sump
V2B1	Inside Diameter (ft^2) of Structure (D1) x 1/2 Depth (ft) Below Pipe Invert
Note: 1 cubic foot = 0.037 cubic yard or 1 cubic yard = 27 cubic feet	

Since the selected hydrodynamic separator and associated connecting pipes and structures may be different in type, configuration and performance than the one assumed in the design phase of the project, the hydraulic calculations performed for the drainage design must be replicated and revised to reflect any adjustments necessary to the drainage design for installation of the selected system, such as different flow-line elevations, head loss coefficient, pipe sizes, etc. The selected hydrodynamic separator shall be designed so as not to change the drainage system upstream of the flow diversion structure or to increase the HGL elevation upstream of the flow diversion structure. Any modifications necessary to the overall drainage design as a result of the Contractor selected hydrodynamic separator shall be the responsibility of the Contractor.

The new HGL analysis must demonstrate the following conditions:

1. The hydrodynamic separator can treat the WQF with no bypass. The HGL elevation at the flow diversion structure for the WQF shall be below the weir elevation and/or elevation of flow bypass that is listed in the design data form or shown in the plans, so that all of the WQF is directed to the hydrodynamic separator for treatment. The HGL elevation in the hydrodynamic separator at the WQF shall be below the elevation of internal bypass so that all of the WQF is treated by the system.

2. When the drainage system is operating at the DDF, the hydraulic computations must show that the HGL elevation at the flow diversion structure is lower than or equal to the HGL elevation shown on Form A for the DDF and the HGL elevation in the hydrodynamic separator must be a minimum of one foot below the top (ground) elevation of the structure. A HGL elevation in the flow diversion structure for the DDF which is higher than the corresponding HGL elevation shown on Form A may be approved by the Engineer only if hydraulic computations are submitted showing that the higher HGL elevation will provide a minimum of one foot of freeboard below the top (ground) elevation of the flow diversion structure and the upstream drainage structures, satisfying the design criteria stated in the Connecticut Department of Transportation Drainage Manual. To demonstrate compliance, the hydraulic analysis shall be extended to a point upstream in the drainage system that is not influenced by the proposed changes and where the results converge with the previous design analysis. In such a case, the Contractor shall request a copy of the design analysis from the Department. A freeboard less than one foot may be accepted by the Engineer on a case by case basis provided that a justification of the reason has been included with the HGL analysis.

3. When the drainage system is operating at the DDF, the resulting HGL elevation and flow split at the flow diversion structure has been designed such that the portion of the DDF directed to the hydrodynamic separator does not exceed the maximum flow shown on the Hydrodynamic Separator Design Data Sheets (Form A - Design). Documentation, however, must be provided that the flow in excess of the WQF can pass through the device without washout of the previously captured sediment or the device is equipped with an internal bypass to route the excess flow around the treatment chamber.

Upon conclusion of the HGL analysis, the Hydrodynamic Separator Design Data Sheets (Form B – Contractor Proposal) shall be completed by entering the HGL analysis data and other required information.

Hydrodynamic Separator Selection: To ensure compliance with the special provision, the selection process of a proprietary hydrodynamic separator for installation on a Department project is outlined by the following steps:

1. First, select the available product(s) from Table 2 (**PERFORMANCE MATRIX FOR CONNDOT APPROVED HYDRODYNAMIC SEPARATORS**) that meet or exceed the WQF treatment specified on the Hydrodynamic Separator Design Data Sheets (Form A - Design) attached to this specification. **The Engineer shall reject any proposed hydrodynamic separator system/model that is not listed in Table 2.**

2. Using Table 3 (**STANDARD SEDIMENT STORAGE CAPACITY FOR CONNDOT APPROVED HYDRODYNAMIC SEPARATORS**), check whether the initially selected product(s) in Step 1, meet or exceed the minimum sediment storage requirement specified on the Hydrodynamic Separator Design Data Sheets (Form A - Design). In some cases, the required sediment storage capacity will govern the model size required for the project. In lieu of selecting a larger model to accommodate the sediment storage requirement, the Contractor may submit working drawings as recommended by the Manufacturer, showing how a standard model has been modified to satisfy the sediment storage requirement. When a modification is proposed by increasing the depth of the standard structure, **Table 4 (SEDIMENT STORAGE CAPACITY CALCULATION)** shall be utilized to determine the sediment storage capacity of the proposed structure.

3. **Hydrodynamic separator system/models pre-approval by the Department shall not be construed to mean that all products appearing on Tables 2 and 3 are suitable to any specific project site or drainage design.** The Contractor shall verify the constructability of the selected hydrodynamic separator in relation to dimensional, structural, geotechnical and right-of-way constraints at each installation site. If revisions to the drainage design, including the system layout, are required to accommodate the selected separator, the Contractor shall provide working drawings showing the revised layout, including the position of the hydrodynamic separator and the number, positions and types of connecting structures, the design of the flow diversion structure, and any other components of the system within the pay limits. The working drawings shall be prepared in sufficient detail to perform a hydraulic analysis and confirm that the layout will fit the constraints of each site.

4. Upon determination that the WQF, sediment storage and constructability requirements have been met, the Contractor shall prepare or have prepared, a HGL analysis in accordance with the hydraulic requirements of this special provision, that includes the selected hydrodynamic separator and any revisions to the drainage design needed for the installation.

5. The Hydrodynamic Separator Design Data Sheets (Form B – Contractor Proposal) shall be completed and signed by a professional engineer licensed by the State of Connecticut.

6. *Acceptance of the computations by the Engineer must be obtained by the Contractor prior to the purchase or installation of any units.*

Materials: Materials utilized to fabricate, construct and install the precast concrete hydrodynamic separator including but not limited to precast concrete units, brick, concrete masonry units, manhole frames and covers shall meet the requirements specified in the Standard Specifications, Form 816, Article M.08.02, except that the 28 day compressive strength specified in Subarticle M.08.02-4, shall be a minimum of 4000 psi (27.6 MPa).

The Contractor shall provide a Materials Certificate in accordance with 1.06.07 for each unit delivered to the project. Upon request, the Contractor shall also provide Certified Test Reports for the fine and coarse aggregates and all cementitious materials, and the concrete mix design indicating the weight of each component, used in the construction of the precast units for review. The structures shall not be shipped until released by the Contractor's Quality Control Manager or designee.

The wall and slabs of the precast concrete units shall be designed to sustain HS20-44 (MS18) loading requirements.

Manholes and Catch Basins shall conform to Section 5.07 of Form 816.

Granular fill shall conform to the requirements of Article M.02.01 of Form 816.

Non-shrink grout shall conform to the requirements of Subarticle M.03 of Form 816.

Drainage pipe, sealant and gaskets shall conform to the requirements of Article M.08.01 of Form 817.

Mortar shall conform to the requirements of Article M.11.04 of Form 816.

Sealant used for the hydrodynamic separator unit(s) shall be resistant to oil and other hydrocarbons and conform to the requirements of ASTM C-443.

Working Drawings: Working drawings in accordance with Article 1.05.02 – 2 shall be required for the system selected by the Contractor. The working drawings shall include the HGL analysis and all other computations in strict accordance with the "Hydraulic Design" section of this special provision, including a completed Form B – Contractor Proposal.

If revisions to the layout of the system within the payment limits of this item are required to accommodate the selected separator, the working drawings shall also include plans that show the required revisions. These plans shall show the revised position of the hydrodynamic separator unit(s), and all revisions to connecting structures, pipes, elevations, and details, including the

design within the flow diversion structure. The revised plans shall also include the pay limit showing all the components of the system that are included in this lump sum pay item.
Working drawings shall also show details for construction, reinforcing joints, internal and external components, any cast-in-place appurtenances, locations and elevations of pipe openings, access manhole locations and elevations, and type / method of sealing pipe entrances.

Working drawings for each hydrodynamic separator on the project shall have all appropriate vertical dimensions referenced with elevations that are consistent with the project plans. In addition to any other structural, material or installation requirements, the working drawings shall clearly indicate the following information:

1. The elevation and flow rate when internal flow bypass would occur within the device.

2. The location, dimensions and volume (capacity) of the sediment storage area within the device.

The working drawings shall be sealed by a professional engineer licensed in the state where the devices are manufactured and that said engineer shall certify the device meets the minimum requirements of the ConnDOT Standards.

The working drawing submission by the Contractor shall consist of the following documents:

1. Working drawings for each hydrodynamic separator proposed for installation on the project.

2. Hydraulic design calculations including the head loss documentation and completed Hydrodynamic Separator Design Data Sheets (Form B – Contractor Proposal) with professional engineer signature for each hydrodynamic separator.

3. Copies of the pertinent construction plan, profile, cross section and detail sheets that have been annotated with any proposed drainage revisions that are required for the installation of the proposed hydrodynamic separator(s). If no changes are required, the submittal shall note same.

4. An Operations and Maintenance Manual for each hydrodynamic separator describing operations, inspection, maintenance procedures and any applicable warranty information.

Acceptance of the working drawing submission by the Engineer must be obtained by the Contractor prior to the fabrication of each hydrodynamic separator and diversion structure.

Construction Methods: The Contractor shall inspect the hydrodynamic separator and any accessory equipment upon delivery for general appearance, dimensions, soundness or damage in a manner acceptable to the Engineer. If any defects or damage are identified by the inspection, the unit shall be rejected by the Contractor and a new undamaged hydrodynamic separator shall be supplied. Any required adjustments of the separator shall be completed in accordance with

Manufacturer's recommendations. A Manufacturer's representative and the Engineer will inspect the hydrodynamic separator before installation.

The Contractor shall install the hydrodynamic separator structure in accordance with the Manufacturer's recommendations unless otherwise directed by this specification or by the Engineer. The hydrodynamic separator shall be installed plumb, level and aligned both vertically and horizontally with the inlet and outlet piping. The hydrodynamic separator shall be placed on a compacted granular fill base in accordance with the Manufacturer's specifications or a minimum thickness of 6" (150mm) whichever is larger. Anchoring systems shall be installed, where needed, to resist buoyancy forces. Care shall be taken not to damage the hydrodynamic separator during backfill and compaction.

Pipe openings in the hydrodynamic separator shall be sized to accept pipes of the specified size(s) and material(s) as shown on the contract drawings and shall be sealed by the Contractor in accordance with the requirements of this specification. The inlet and outlet pipe connections shall be watertight. The hydrodynamic separator shall be tested for leakage according to the Manufacturer's specifications and to the satisfaction of the Engineer. Any leaks must be found and corrected to the satisfaction of the Engineer prior to acceptance of the structure.

Access openings with manhole frames and covers shall be provided to all chambers of the hydrodynamic separator. The access openings and pipe openings shall be detailed on the working drawings to be submitted by the Contractor for review and acceptance by the Engineer.

All connecting structures and pipes included within the payment limits for this work shall be constructed in accordance with the applicable requirements of Article 5.07.03 and Article 6.51.03.

Method of Measurement: Design, construction, furnishing, installation and cleaning of the hydrodynamic separator, the flow diversion structure, manholes and pipes as shown on the contract drawings, including all internal and external appurtenances and materials used, will be paid for on a lump sum basis per site.

Basis of Payment: This work will be paid for at the contract lump sum for "HYDRODYNAMIC SEPARATOR", complete in place, which price shall include all work within the pay limits shown on the contract drawings for hydrodynamic separator. If revisions to the layout of the system within the payment limits for this item are required to accommodate the selected separator, the lump sum price shall also include all additional or revised connecting structures and pipes. The contract lump sum shall include, but not be limited to, the following:

1. Design, preparation, revisions of working drawings and hydraulic computations.

2. Concrete and reinforcing steel, sealant, cement, mortar, flexible rubber sleeves, internal and external components, brick and masonry, frames and covers used to construct access manholes.

3. Flow diversion structure, manholes and pipes as shown on the contract drawings, or as revised and shown on submitted working drawings accepted by the Engineer.

4. Structure excavation, back fill, and disposal of surplus material.

5. Compacted granular fill.

6. Trench excavation and bedding material.

7. Cleaning of the Hydrodynamic Separator, flow diversion structure, manholes and pipes as shown on the contract drawings (of all debris every 90 days, or as needed), during the duration of the project, shall also be included in the price of this item.

8. The Operations and Maintenance Manual for each hydrodynamic separator.

The price shall include but not be limited to all materials, testing, equipment, tools and labor incidental thereto.

Attachments: The following documents are attached to this specification:

1. Hydrodynamic Separator Design Data Sheets (Form A – Design), Sheets 1 & 2 of 2.

2. Hydrodynamic Separator Design Data Sheets (Form B – Contractor Proposal), Sheets 1 & 2 of 2 (blank), to be completed and submitted with the working drawings.

Pay Item	Pay Unit
HYDRODYNAMIC SEPARATOR (SITE No. X)	Lump Sum

SAMPLE DATA

CONNECTICUT DEPARTMENT OF TRANSPORTATION HYDRODYNAMIC SEPARATOR DESIGN DATA SHEETS (FORM A - DESIGN)

Project No	*Example*	Route No.	*0*	Prepared By:	*HD*	Date:	*4/1/2010*
Town	*Somewhere*	Location/Station	*Site 1*	Checked By:	*DM*	Date:	*4/1/2010*
				Company:	*ConnDOT*		

HYDROLOGIC DATA

Drainage Area (Acres)	*3.7*
Percent Impervious Area %	*53*
Time of Concentration (min.)	*11*
Drainage Design Flow (cfs)	*10.8*
Drainage Design Frequency (yr)	*10*
Water Quality Flow (cfs)	*1.7*

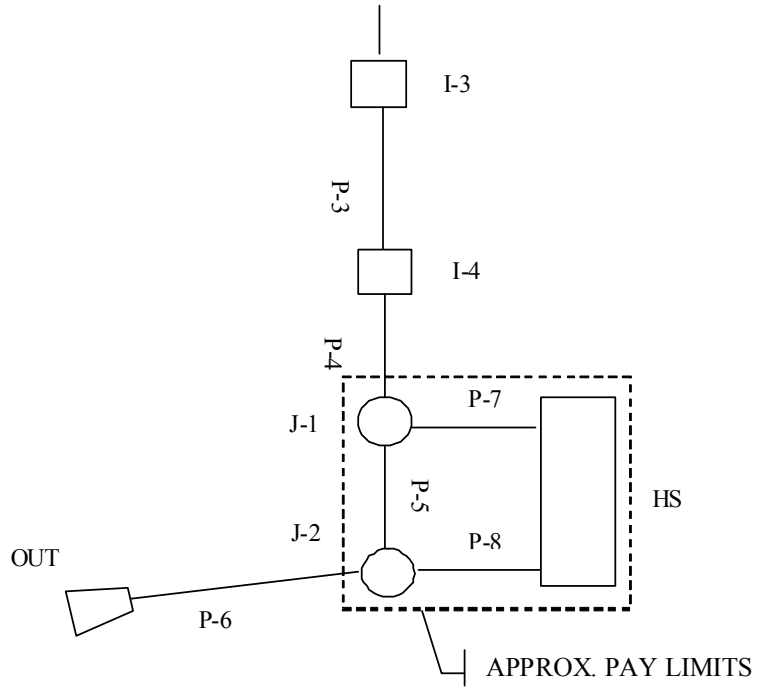
HYDRODYNAMIC SEPARATOR (HS)

Coordinates:		Datum:	
X:	*XXX,XXX*	Horiz.	*State Plane NAD83*
Y:	*YYY,YYY*	Vert.	*NGVD-1929*
Head loss coefficient		*1.75*	
Sediment Storage Capacity (cy):		HGL Elevation:	
Required	*1.0*	@ WQF	*104.13*
		@ Design Q	*104.85*
Maximum Flow to HS at Drainage Design Flow (cfs)			*4.3*

Comments:

FLOW DIVERSION STRUCTURE

Type	*4' Diameter Manhole*		
Weir and/or Bypass Elev.	*104.50*		
Weir Length (ft.)	*4*	Weir Coeff. (C)	*3.3*
HGL Elevation:		Flow Split @ Drainage Design Flow	
@ WQF	*104.20*	To HS	*3.2*
@ Design Q	*105.20*	Bypassing HS	*7.6*



Sketch (NTS) - Indicate Pay limits

Comments:

Sheet 1 of 2

SAMPLE DATA

CONNECTICUT DEPARTMENT OF TRANSPORTATION HYDRODYNAMIC SEPARATOR DESIGN DATA SHEETS (FORM A - DESIGN)

Project No:	*Example*	**Location/Station:**	*Site 1*	**Date:**	*4/1/2010*

HYDRAULIC GRADE LINE ANALYSIS

Pipe	Downstream Str.	Pipe Size (in)	Flow (cfs)	Ground Elev. OUT (ft)	Invert Elev. OUT (ft)	HGL OUT (ft)	Depth OUT (ft)	Vel. Head OUT (ft)	EGL OUT (ft)	Length (ft)	Friction Slope (ft/ft)	Friction Loss (ft)	EGL IN (ft)	Vel. Head IN (ft)	HGL IN (ft)	Depth IN (ft)	Invert Elev. IN (ft)	Ground Elev. IN (ft)	Upstream Str.	Headloss Coeff.	Str. headloss (ft.)
			WQF																		
P-6	OUT	24	1.70	106.48	103.04	103.47	0.43	0.19	103.65	25	0.0047	0.12	103.77	0.16	103.61	0.45	103.16	108.86	J-2	0.01	0.00
P-8	J-2	12	1.70	108.86	103.16	103.71	0.55	0.23	103.94	6	0.0058	0.03	103.97	0.21	103.76	0.57	103.19	108.86	HS	1.75	0.37
P-7	HS	12	1.70	108.86	103.19	104.13	0.94	0.08	104.21	6	0.0017	0.01	104.22	0.08	104.14	0.91	103.23	109.19	J-1	0.82	0.06
P-4	J-1	24	1.70	109.19	103.23	104.20	0.97	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	10	YR	DESIGN	FLOW																	
P-6	OUT	24	10.80	106.48	103.04	104.20	1.16	0.51	104.71	25	0.0048	0.12	104.83	0.49	104.34	1.18	103.16	108.86	J-2	0.05	0.02
P-8	J-2	12	3.20	108.86	103.16	104.36	1.20	0.26	104.62	6	0.0069	0.04	104.66	0.26	104.40	1.21	103.19	108.86	HS	1.75	0.45
P-7	HS	12	3.20	108.86	103.19	104.85	1.66	0.26	105.11	6	0.0069	0.04	105.15	0.26	104.89	1.66	103.23	109.19	J-1	1.18	0.31
P-4	J-1	24	10.80	109.19	103.23	105.20	1.97	0.18	105.38	88	0.0018	0.16	105.54	0.24	105.30	1.63	103.67	112.96	I-4	0.11	0.03
P-3	I-4	24	9.10	112.96	103.87	105.33	1.46	0.22	105.55	185	0.0041	0.76	106.31	0.43	105.88	1.08	104.80	109.55	I-3	----	----
P-6	OUT	24	10.80	106.48	103.04	104.2	1.16	0.51	104.71	25	0.0048	0.12	104.83	0.49	104.34	1.18	103.16	108.86	J-2	0.05	0.02
P-5	J-2	24	7.60	108.86	103.16	104.36	1.20	----	----	----	----	----	----	----	104.36	1.13	103.23	109.19	J-1	----	----

Sheet 2 of 2

CONNECTICUT DEPARTMENT OF TRANSPORTATION HYDRODYNAMIC SEPARATOR DESIGN DATA SHEETS (FORM B - CONTRACTOR PROPOSAL)

Project No		Route No.		PE Signature:	
Town		Location/Station			

HYDROLOGIC DATA (Copy from FORM A - DESIGN)	
Drainage Area (Acres)	
% Impervious Area	
Time of Concentration (min.)	
Drainage Design Flow (cfs)	
Drainage Design Frequency (yr)	
Water Quality Flow (cfs)	

Name:		Date:	
License No:		State:	
Company:			

HYDRODYNAMIC SEPARATOR (HS)			
Manufacturer			
Model Name			
Model No.			
Coordinates:		Datum:	
X:		Horiz.	
Y:		Vert.	
Sediment Storage Capacity (cy):		HGL Elevation:	
Required		@ WQF	
Installed		@ Design Q	
Head loss coefficient			

FLOW DIVERSION STRUCTURE			
Type			
Weir and/or Bypass Elev.			
Weir Length (ft.)		Weir Coeff. (C)	
HGL Elevation:		Flow Split @ Drainage Design Flow (cfs):	
@ WQF		To HS	
@ Design Q		Bypassing HS	

Sketch (NTS)

Comments:

Sheet 1 of 2

63-703 & 159-191

613

CONNECTICUT DEPARTMENT OF TRANSPORTATION HYDRODYNAMIC SEPARATOR DESIGN DATA SHEETS (FORM B - CONTRACTOR PROPOSAL)

Project No:		Location/Station:		Date:	

HYDRAULIC GRADE LINE ANALYSIS

Pipe	Downstream Str.	Pipe Size (in)	Flow (cfs)	Ground Elev. OUT (ft)	Invert Elev. OUT (ft)	HGL OUT (ft)	Depth OUT (ft)	Vel. Head OUT (ft)	EGL OUT (ft)	Length (ft)	Friction Slope (ft/ft)	Friction Loss (ft)	EGL IN (ft)	Vel. Head IN (ft)	HGL IN (ft)	Depth IN (ft)	Invert Elev. IN (ft)	Ground Elev. IN (ft)	Upstream Str.	Headloss Coeff.	Str. headloss (ft.)

Sheet 2 of 2

ITEM #0586850.01A
0586850.02A
0586850.03A

ITEM #0601044A - BRIDGE PARAPET CAP

Description:
The work under this item shall consist of the removal of the existing metal bridge rail and the construction of a cap on the existing bridge parapets as shown on the plans, and as directed by the Engineer. Work under this item shall conform to the requirements of Articles 5.03, 6.01 and 6.02, supplemented and amended as follows.

Materials:
The materials shall conform to the following requirements:

1) Class "F" Concrete: Sections 6.01 and M.03; except that maximum size of coarse aggregate shall be 3/8".

2) Deformed Steel Bars (Epoxy Coated): Sections 6.02 and M.06.01

3) The chemical anchoring material shall be capable of resisting 125% of the yield strength of the rebar and shall be approved by the Engineer. The materials shall be from the Department's approved product list.

Construction Methods:
The existing metal bridge rail shall be removed as shown on the plans. Removal shall not commence until the temporary barrier is placed and the work zone is adequately protected from intrusion of vehicles as approved by the Engineer.
All components of the metal bridge rail shall be removed and disposed of by the Contractor, with the exception of the embedded anchor bolts which may remain. The anchor bolts shall be cut to the top of the concrete parapet and disposed of by the Contractor. It is assumed that the bridge rail components contain lead paint and asbestos. Removal and disposal shall be in accordance with applicable environmental compliance items.

The modified parapet cap shall be constructed as shown on the plans.

Holes for the additional reinforcing shall be drilled into the concrete as shown on the plans. Drilling methods shall not cause spalling, cracking, or other damage to the existing concrete. The weight of the drill shall not exceed 20 lb. Those areas damaged by the Contractor shall be repaired by him, in a manner suitable to the Engineer, at no expense to the State. The hole diameter shall be as recommended by the Manufacturer of the chemical anchoring material for the specific diameter of the reinforcing steel bar.

Prior to drilling, a pachometer shall be used to locate and avoid existing steel. If other existing reinforcing bars are encountered during the drilling operation, the hole shall be relocated to clear the existing reinforcing as directed by the Engineer. Uncompleted holes shall be filled with grout and finished smooth to the contour of the surrounding concrete surface.

Fabrication and placement of reinforcing steel shall conform to the requirements of Article 6.02.

The reinforcing steel and the chemical anchoring material shall be installed in the holes prepared in accordance with the chemical anchoring Manufacturer's recommendations.

The existing concrete surface to which the new concrete will bond shall be prepared as follows: The cleaned concrete surface area to receive new concrete shall be wetted for a one hour period immediately prior to placement of the concrete. Any standing water shall be blown out with compressed air prior to application of concrete.

Mixing, placing, curing and finishing of the concrete shall be in accordance with Article 6.01. Any newly placed concrete having a hollow sound when sounded with a hammer shall be replaced by the Contractor at his expense by a method acceptable to the Engineer.

Method of Measurement:
This work will be measured for payment as the number of linear feet of bridge parapet cap, measured along the top of the completed cap to the limits shown on the plans, when completed and accepted.

Basis of Payment:
This work will be paid for at the contract unit price per linear foot for "Bridge Parapet Cap", complete in place, which price shall include removal and disposal of the existing bridge rail, drilling and grouting dowels into the top of the concrete parapets, furnishing and placing of reinforcement, concrete for the reconstructed parapet cap and all materials, equipment, tools and labor incidental thereto.
Also included in the cost of this item is any shielding required to protect traffic below the structure.

Pay Item	Pay Unit
Parapet Concrete Cap	LF

ITEM #0601053A - CLASS "50" CONCRETE

Description:

Work under this item shall consist of furnishing and placing concrete for the superstructure at Site No. 14, Bridge No. 06043A, including all necessary materials and equipment to complete the work. Work under this item shall conform to the pertinent requirements of Section 6.01 and M.03, supplemented and amended as follows:

Materials:

Concrete: The concrete shall be air-entrained concrete composed of Portland cement, fine and coarse aggregate, admixtures and water. The air-entraining feature may be obtained by the use of an approved air-entraining admixture. The entrained air content of the concrete immediately before the placement shall be between 4.5 and 7.5 percent. The testing of air content shall be performed in accordance with the requirements of ASTM C 231.

The consistency shall be determined by the AASHTO Method T 119. A uniform consistency shall be continuously maintained. Slump shall be 4" +/- 1".

The Contractor shall design and submit for the approval for the Engineer a concrete mix which shall attain minimum 28 day cylinder strength (f'c) of 5.0 ksi. Failure of any of the 28 day test cylinders to meet 90 percent of minimum 28 day cylinder strength (f'c) of 5.0 ksi or failure of the average to meet the 28 day cylinder strength (f'c) of 5.0 ksi shall be cause for rejection. The Contractor shall further provide a certified statement that the mix submitted meets these requirements.

The maximum water/cementitious material ratio by mass shall be 0.40.

The minimum mass of cementitious materials per cubic yard of concrete shall be 658 lb/cy.

Portland Cement: The Portland cement shall by Type I or Type II cement conforming to the requirements of Subarticle M.03.01-3.

Coarse Aggregate: The coarse aggregate shall conform to the requirements of M.03 and the required grading according to Table M.01.02-2 shall be No. 6 aggregate.

Water-Reducing Admixture: The Contractor may submit, for the approval of the Engineer, a water-reducing admixture for the purpose of increasing workability and reducing the water requirements of the concrete.

Calcium Chloride: The addition of calcium chloride to the mix will not be permitted.

Construction Methods:

The construction methods for this work shall conform to the requirements of Section 6.01 supplemented and amended as follows:

Working Drawings:

At least thirty (30) days before the erection of falsework and forms, the Contractor shall submit working drawings of falsework and forms to the Engineer of Bridge Design for approval in accordance with Article 1.05.02. These working drawings are required on the following conditions:

These working drawings shall include but not be limited to the following information:

1. Complete details of erection and removal plans of falsework, shoring and forms.
2. The computed falsework foundation pressures.
3. The computed settlements and deflections of falsework and forms.
4. Required camber of the forms to correct falsework settlement and form deflections.
5. Erection sequence for all shoring and support beams or girders.
6. Sequence of concrete placement.

Any work done or material ordered prior to approval of these drawings shall be at the Contractor's risk. Approval of the working drawings shall not serve to relieve the Contractor of any of his responsibility for the successful completion of the project.

At least thirty (30) days before the erection of falsework and forms, the Contractor shall submit information in accordance with Article 1.05.02 for review by the Engineer. This information shall include details of equipment to be used in placing and finishing of the concrete, including the number and type of personnel who will be engaged in placing the concrete. The personnel shall consist exclusively of persons with skill and experience appropriate to their working assignments.

The Contractor shall notify the Engineer and obtain written permission for placing of concrete at least 24 hours in advance of this placing of concrete.

Concrete shall not be placed until the Engineer has inspected the forms, form ties, the placing of the reinforcing steel, metal conduits, post-tensioning ducts and hardware, and anchorages, and has given his approval thereof.

When falsework is required to support the forms, the Contractor shall make proper allowances for the deflection and settlement of forms and form supports and for the deflection

and camber of substructure due to all operations, including post-tensioning.

If sequential placing of concrete is required, the concrete shall be placed in the sequence shown on contract plans.

Construction joints shall be made only where shown on the plans. Approval will not be given to place concrete in more than one operation where construction joints are not shown on the plans.

The concrete shall be vibrated. Both internal and external vibration shall be used when ordered by the Engineer. The vibrating shall be done with care in such a manner as to avoid displacement of reinforcing steel or other components. Concrete shall be carefully placed in the forms and vibrated sufficiently to produce a surface free from imperfections such as honeycomb, segregation, cracking, or checking.

Any deficiency, such as honeycomb or segregation, may be cause for rejection.

The forms, form supports and shoring under the superstructure shall be left in place until the girders are post-tensioned.

Concrete surfaces that are exposed to conditions causing premature drying shall be protected by covering within two (2) hours of placing.

The concrete for each pour sequence shall be kept constantly moist and protected against any drying action by method of curing specified herein for not less than seven (7) days after the placing of the concrete.

To allow for shrinkage, 12 hours must elapse before fresh concrete can be placed against a construction joint, unless otherwise authorized or ordered by the Engineer.

No patching of the completed girders will be allowed unless permitted by the Engineer. The Contractor's proposal for method and materials to be used in the patching operation shall be submitted to the Engineer for his/her approval. Any major patching, as determined by the Engineer, shall be done before any load is placed on that component of the structure. Failure to comply with the above shall be cause for rejection. Any concrete rejected, including all damaged reinforcing steel, shall be removed and replaced at no additional cost to the State.

Drilling for the setting of anchor bolts or utility supports will not be permitted.

Method of Measurement:

This work will be measure for payment by the actual volume in cubic yards of "Class "50" Concrete," completed and accepted in place in accordance with the plans or as ordered by the Engineer. No deduction will be made for the volume of reinforcing bars.

Basis of Payment:

Payment for this work will be made at the Contract unit price per cubic yard for "Class "50" Concrete," complete in place, which price shall include all materials, equipment, tools, labor and work incidental thereto, including heating and cooling, curing and all admixtures.

Pay Item	**Pay Unit**
Class "50" Concrete	C.Y.

ITEM #0601070A - CLASS "S" CONCRETE

SECTION 6.01 – CONCRETE FOR STRUCTURES is supplemented to provide for a Class "S" super-plasticized concrete:

Article 6.01 - Description: Class "S" concrete is to be used to fill and repair voids in horizontal and vertical surfaces of concrete areas greater than two (2) square feet and one inch (1") deep (exclusive of deck slabs) as detailed on the plans. Smaller areas of deterioration may be repaired as directed by the Engineer.

Work under this item shall consist of removing loose concrete, deteriorated concrete, and concrete overlaying hollow areas, and patching these areas as well as spalled and scaled areas with Class "S" Concrete formed to the original contour of the surface, unless otherwise directed by the Engineer. Work under this item shall also consist of removing sound concrete beneath reinforcing steel, a minimum of 1", in order to properly anchor the Class "S" repair material in place, the replacement of damaged reinforcing steel and the installation of Welded Wire Fabric (WWF) when indicated on the plans. The work shall also include any saw cutting or chiseling, sandblasting and cleaning of all areas. Work under this item shall also include sandblasting and cleaning any exposed reinforcing steel, and coating the exposed reinforcing steel with zinc-rich primer prior to placing concrete.

The Contractor shall not remove any concrete without prior approval by the Engineer for location and limits.

Article 6.01.02-Materials:

Portland Cement Concrete shall conform to Section M.03 as modified herein below:

M.03.01 – Component Materials is amended as follows:

1. **Coarse Aggregate:**
   (c) Gradation: Coarse Aggregate for the Class "S" concrete shall meet the following gradation requirements:

   For Class "S": The required grading shall be obtained by using 100 percent 3/8" coarse aggregate.

3. **Cement:** Add the following:
   Type I or II Portland Cement shall be used for Class "S" Concrete.

5. **Admixtures:**

(b) Other Chemical Admixtures: Add the following: The superplasticizer admixture shall be a high-range water reducer (HRWR) capable of increasing the slump of the mix from approximately 2.5 inches to 6.5 inches upon the addition of the amount recommended by the respective manufacturer. The HRWR shall conform to ASTM C494 Type F or Type G and shall be approved by the Engineer. The use of this material shall be in strict accordance with the respective manufacturer's written instructions and procedures.

M.03.02 – Mix Design Requirements is supplemented to include Class "S" Superplasticized Concrete.

TYPE	28 DAY MIN. COMPR. STR	PROPORT. BY WT. APPROX.	WATER PER BAG MAX.	CEM. FACTOR
Class "S"	4000 PSI	1:2.16:2.20	5.7 (Gals.)	7.0 (Bags/C.Y.)

M.03.04 – Curing Materials is amended as follows:

3. Liquid Membrane-Forming Compound: Add the following:
No liquid membrane forming compound shall be used for Class "S" Concrete.

Reinforcing Steel: Deformed Steel Bars and Welded Wire Fabric shall conform to the requirements of Article M.06.01.

Zinc Primer: The single component zinc primer shall conform to Military Specification MIL-P-26915, and shall be brush applied in two successive coats.

Article 6.01.03 - Construction Methods:

Article 6.01.03 is supplemented by adding the following. Where this specification deviates from the Standard Specifications, the intent of this special provision shall govern.

9. Curing Concrete: Add the following:
Concrete shall be cured by leaving forms on for seven (7) days and wetting them frequently.

Properties of the plastic concrete:
Air Entrainment: Class "S" concrete shall contain not less than 6.5 percent and not more than 8.5 percent entrained air at the time of placement.

Slump: Class "S" concrete shall have a slump range of 2 inches to 4 inches prior to the addition of the HRWR and from 6 inches to 8 inches slump after the addition of the HRWR.

The addition rates of the air-entraining admixture (A.E.A.) and the HRWR will vary. Frequent field testing of the air content and slump prior to and after addition of the HRWR will be the determining factor of actual addition rates for each admixture.

Mixing Concrete: For hand mixing of Class "S" concrete, the Contractor shall provide scale(s) approved by the Engineer in which cement and aggregate can be accurately weighed for the required mix proportions.

Note: The Contractor shall also have measuring graduates marked for the proportioning of the A.E.A. and the HRWR. Do not mix the A.E.A. and the HRWR together before adding to the mix; the resultant solution will not work. DO NOT add the A.E.A. and the HRWR at the mixer simultaneously; these admixtures must be added separately in the mixing cycle. All manufactured materials shall be stored, mixed and used in strict accordance with the written recommendations of the respective manufacturers. The Contractor shall store and maintain the A.E.A. and the HRWR materials in clean original containers as delivered by the manufacturer.

Work Procedure:
Before any concrete is removed, the Contractor shall determine, in the presence of the inspector, the locations of all areas to be worked on under this item. The Contractor shall provide all scaffolding necessary to perform the required work. The limits of each area shall be suitably marked. Before any concrete is removed, the Engineer shall perform an inspection of the area to determine the exact limits and locations of all areas to be repaired.

The perimeter of each patch shall be saw cut 1 inch deep. Care shall be taken not to cut existing reinforcing.

Loose and deteriorated concrete shall be chipped away back to sound concrete and at least 1 inch beneath the reinforcing bars.

All surfaces of exposed concrete and reinforcing steel shall be thoroughly sandblasted and vacuumed immediately prior to forming. Following sandblasting, all surfaces shall be free of oil, solvent, grease, dirt, dust, bitumen, rust, loose particles and foreign matter.

Extreme care shall be taken, where reinforcing steel is uncovered, not to damage the steel. Pneumatic tools shall not be placed in direct contact with reinforcing steel. Maximum 15 lb. size hammers shall be used for general chipping and removal while smaller size hammers may be necessary behind reinforcing steel. Exposed reinforcing steel shall remain in place except where specifically indicated for removal by direction of the Engineer. Exposed reinforcing steel shall be sandblasted in accordance with SSPC-SP-6, Commercial Blast Cleaning, to remove all contaminants, rust and rust scale.

Where the existing reinforcing steel is severely corroded or damaged, new reinforcing steel shall be installed in accordance with the plans. Where existing steel is determined by the Engineer to have insufficient cover, the cover shall be increased to a minimum of 2 inches. New steel shall be attached to existing steel as directed by the Engineer.

When using sandblasting equipment, all work shall be shielded for the protection of the public.

All compressed air equipment used in cleaning, shall have properly sized and designed oil separators, attached and functional, to assure the delivery of oil-free air at the nozzle.

Adequate measures shall be taken by the Contractor to prevent concrete chips, tools and/or materials from entering into adjacent roadway lanes or dropping to areas below the structure. All debris shall be promptly swept up and removed from the site. All materials removed shall be satisfactorily disposed of by the Contractor. The Contractor shall design, furnish, install and remove temporary demolition shields to prevent debris from dropping below as directed by the Engineer.

The Contractor shall submit working drawings to the Engineer in accordance with Article 1.05.02. The debris shield shall remain in place during construction until the Engineer determines it is no longer needed. The Contractor is responsible for the integrity and maintenance of the shield during their use.

Forms and support systems shall be properly designed in accordance with 6.01.03-1. Forms shall be so designed that placement access shall be allowed at the top of the formwork assembly.

No bonding compounds shall be used before or during the placement of this concrete material. Concrete surfaces against which this material is to be placed shall be sound, tight, and thoroughly roughened by the removal and sandblasting procedures specified above. The exposed concrete surfaces shall be dampened with fresh water immediately prior to placement of the fresh concrete by "hosing" down the areas behind the forms as thoroughly as possible. Light rust formations on sandblasted reinforcing steel prior to concrete placement is normal and acceptable.

Prior to forming up vertical surfaces, reinforcing steel welded wire fabric shall be installed at the proper depth to those areas greater than 4 square feet and 1 inch deep as approved by the Engineer. The fabric shall be tied to any exposed reinforcing steel or anchored to sound concrete with powder actuated anchors, as approved by the Engineer.

When indicated on the plans, zinc anodes shall be attached to the exposed reinforcing steel as shown on the plans and as directed by the Engineer.

The minimum ambient air and patch area surface temperature shall be 45 deg. Fahrenheit and rising at the time of concrete installation.

Placement of the fresh concrete shall be in the maximum height lifts possible under the circumstances and all freshly placed concrete shall be consolidated during placement with adequately sized and effective vibrators.

Following curing and stripping, the exposed faces of new concrete shall be finished off with the use of the appropriate tools to blend in the physical appearance to the surrounding areas as much as possible.

Cured patched areas shall be sounded by the Engineer to detect the presence of any hollow spots. Such spots shall be removed and replaced by the Contractor at his own expense until a patch acceptable to the Engineer is in place.

Article 6.01.04 – Method of Measurement: Add the following:

Class "S" Concrete shall be measured for payment by the actual volume in cubic yard of concrete placed, and accepted by the Engineer. The volume of the patch shall be calculated by taking the face surface area defined by the sawcuts and multiplying it by the average depth of the patch.

There shall be no deduction for welded wire fabric and reinforcing steel within the patch.

Article 6.01.05 – Basis of Payment: Add the following:

"Class "S" Concrete" will be paid for at the contract unit price per cubic yard, complete in place, which price shall include locating and removing unsound material, saw cutting or chiseling, sandblasting, cleaning, application of zinc primer on the existing reinforcing steel, welded wire fabric, reinforcing steel, forming, placing, curing, stripping and finishing new concrete, and all materials, equipment, tools, labor and clean-up incidental thereto.

Pay Item	Pay Unit
Class “S” Concrete	C.Y.

ITEM #0601192A - SURFACE PATCH

Description: This work shall consist of sweeping and cleaning areas of deteriorated pavement of all loose and delaminated pavement materials, disposing of deteriorated pavement materials, application of tack coat, and placement of Hot-Mix Asphalt (HMA) or an equivalent Polymer Modified Asphalt (PMA) to match the elevation of the surrounding pavement.
For road sections being milled and paved, all patching operations must be completed after milling is complete and before paving begins. All patching operations shall be completed within one working day following milling and shall be completed before traffic is permitted to resume on the exposed roadway.

Materials: Materials for this work shall consist of the following:

1. HMA S0.25, HMA S0.375 or an equivalent PMA. All HMA, or PMA, shall be Traffic Level 2 unless indicated otherwise on the plans.
2. Tack coat.

Construction Methods:
Equipment for this work shall include a sweeper capable of remove millings and loose debris, an air compressor capable of producing 100 psi oil free compressed air for cleaning the area to be patched, tools for the placement of bituminous concrete, and pavement compaction equipment to perform patching operations, such as a plate compactor.

1. The Engineer will mark out areas for patching that are broken, damaged, distorted or delaminated in order to provide a suitable surface for placement of a layer of bituminous concrete or other surfacing material. Examples of such areas to be patched include potholes, open longitudinal joints, ruts and depressions.
2. Sweep and clean the areas to be patched in order to remove all loose and delaminated material to the satisfaction of the Engineer.
3. Clean off any residual dust or small debris using compressed air to the satisfaction of the Engineer, and allow area to fully dry.
4. A thin uniform tack coat, meeting the requirements of Section 4.06, shall be applied prior to patching. It shall cover 100% of the surface area of the patch, and be allowed to sufficiently cure or break.
5. Place and compact HMA S0.25, HMA S0.375, or an equivalent PMA, by means acceptable to the Engineer, and to the elevation meeting the surrounding pavement.

Method of Measurement: This work will be measured by the number of square feet of patched roadway completed and accepted.

Basis of Payment: This work will be paid for at the Contract unit price per square foot of "Surface Patch." The price shall include all tools, materials, labor, equipment, disposing of deteriorated materials, sweeping and cleaning, tack coat application, and placement and compaction of HMA or PMA.

Pay Item	Pay Unit
Surface Patch	s.f.

ITEM #0601270A - FULL DEPTH PATCH (HIGH EARLY STRENGTH CONCRETE)

Description: This item shall consist of the saw cutting concrete, removal of all deteriorated concrete for the full depth of the deck slab, furnishing and installing deformed steel bars, and reconstructing the slab with new concrete, where directed by the Engineer and as hereinafter specified.

Work under this item shall also include the providing of a safe access to the structure for the delineation of the repair locations and review of the performed work. The Contractor shall not perform any repair work without prior approval of the Engineer for location, limits and types of repairs.

Work under this item shall also include any required debris shield, which shall include furnishings, installing and design.

Materials: The materials shall conform to the following requirements:

1. High Early Strength Concrete – The high early strength concrete shall conform to one of the following:
   A. The Contractor shall design and submit to the Engineer for approval a high early strength concrete mix. This mix shall be air-entrained, and shall be composed of Portland cement, fine and coarse aggregates, approved admixtures and additives, and water. The mix shall contain between 4% and 7% entrained air, and shall attain a 6-hour compressive strength of 2,500 psi. Additionally, the mix shall contain shrinkage compensating additives such that there will be no separation of the patched area from the parent concrete. This shrinkage-compensating additive shall be utilized so as to produce expansion in the high early strength concrete of no more than 3%.
   B. In lieu of the above high early strength concrete mix, the Contractor may propose the use of a proprietary type mix that will meet the same physical requirements as those stated above. A mix design shall be submitted for this material, stating the percentage of each component to be utilized.
2. Regardless of the type of high early strength concrete proposed by the Contractor, substantive data that demonstrates the ability of the material to meet the specification requirements shall be submitted with the proposed mix design at least 2 weeks prior to its use.
3. Deformed Steel Bars: Section 6.02.

Construction Methods: Construction methods shall conform to the following requirements:

1. Inspection of the Structural Slab: Before any existing concrete is removed from the structural slab, the Contractor will provide the Engineer clear access to the bridge deck. During this time, the Engineer will perform an inspection of the structural slab and designate areas where concrete removal will be required. Due to the nature of the operations, the inspection can be performed only after some existing materials, notably overlays and waterproofing systems, have first been removed from the structural slab. It shall be the responsibility of the Contractor to arrange the construction schedule so that the required operations may be performed without causing delay to the work.

No operations will be performed by the Engineer until after the following construction work has been completed:

a) The existing bituminous overlay or concrete wearing course, if present, has been removed.
b) The existing waterproofing system, if present, has been removed.

The removal of these materials will be paid for under other applicable items.

It shall be the responsibility of the Contractor to inform the Engineer, in writing, of the date that a structure will be available for inspection operations. Notification shall be given to the Engineer at least 7 days prior to the date that the area in question will be in a condition acceptable to the Engineer.

The Contractor is hereby informed that the following time period will be necessary to perform the required inspection operations:

One (1) working day with suitable weather conditions per each 6,000 square feet, or portion thereof, of structural slab area.

The Contractor will not be allowed to do any further work to the structural slab, until all necessary inspection operations have been performed, unless given permission by the Engineer. The Contractor shall include any costs related to the allowance for this inspection in the general cost of the work.

2. Removal of Deteriorated Concrete: All deteriorated concrete shall be removed within the limits shown on the plans and where ordered by the Engineer. The lateral limits of each area to be repaired will be delineated by the Engineer and suitably marked. Where several areas to be repaired are very close together, the Engineer may combine these individual patches into a large area. The outlines of each such area shall first be cut to a depth of 1/2 inch with an approved power-saw capable of making straight cuts. In the event that reinforcing steel is encountered within the upper 1/2 inch depth during sawing operations, the depth of saw-cut shall immediately be adjusted to a shallower depth so as not to damage the steel bars. If so directed by the Engineer, saw cutting shall again be carried down to the 1/2 inch depth at other locations of repair provided reinforcing steel is not again encountered. Where over-breakage occurs resulting in a featheredge, the featheredge shall be squared up to a vertical edge in an approved manner. Where sawing is impractical, the areas shall be outlined by chisel or other approved means.

   The removal of concrete shall be by hydro-demolition or pneumatic hammer methods and shall be governed by the requirements set forth in the special provision Item "Partial Depth Patch" and as directed by the Engineer.

   The Contractor shall take adequate measures to prevent concrete debris from falling to any area below the structure and onto adjacent roadway lanes. All debris shall be promptly cleaned up and removed from the site. All material removed shall be satisfactorily disposed of by the Contractor.

   Where existing reinforcing steel is damaged or has insufficient cover as determined by the Engineer, it shall be cut out and replaced with new reinforcing steel the same size, with a minimum length for lap splices as indicated on the plans or as directed by the Engineer.

3. Surface Preparation: Sound reinforcing steel which is in the proper position in the slab shall be left in place and cleaned of all concrete. The smaller fragments shall be removed with hand tools or by water blast cleaning.

The newly exposed reinforcing steel and concrete faces shall be cleaned of loose or powder-like rust, oil solvent, grease, dirt, dust, bitumen, loose particles, and foreign matter just prior to patching.

Existing concrete surfaces against which the new patch will be placed shall be dampened. All free water shall be removed from the surface.

Forms shall conform to the pertinent requirements of Subarticle 6.01.03-1.

The cleaned concrete surface area to receive patching material shall be wetted for a 1 hour period immediately prior to placement of the concrete patch. Any standing water shall be blown out with compressed air prior to application of binding grout and patch material.

After wetting of the deck patch area to receive patching, and removal of the standing water, cement binding grout shall be scrubbed into the concrete patch bonding surface with stiff bristled brushes. All bonding surfaces in the patch area shall receive a coating of bonding grout within a time period not to exceed 5 minutes prior to placement of the concrete patch material.

4. Mixing, Placing, and Finishing: Mixing and placing concrete shall be done in accordance with the applicable portions of Article 6.01.03. Mixing and placing shall not be executed unless the ambient temperature is above 40 °F and rising.

   The concrete mix shall be properly placed to ensure complete contact around all reinforcing steel and against existing concrete at patch edges and compacted to a level slightly above the surrounding deck surface. Vibrators of the appropriate size shall be used for all consolidation of the concrete, regardless of the size of the patch area, with no hand tamping or rodding allowed. Concrete may be moved horizontally with the aid of hand tools, but not with the use of vibrators (excess vibration shall be avoided).

   Vibrating plates or vibrating screed shall be used on the surface of all patches for strike off and consolidation. After the concrete has been spread evenly and compacted to a level slightly above the adjacent concrete surface, the vibrating plate or screed shall be drawn over the surface at a uniform speed without stopping, in order to finish the surface smooth and even with adjacent concrete. The surface shall be float finished. Finishing operations shall be completed before initial set takes place.

5. Curing: Immediately after finishing of the patch area, a sheet of 4 mil polyethylene shall be placed over the repair area, in conjunction with insulating curing material. This material shall be a minimum of 2-inch thick closed cell extruded polystyrene insulation board that conforms with the requirements of ASTM C578. It shall have a minimum certified R-value of 10. The insulating material shall extend a minimum of 12 inches beyond the limits of the patch area, and shall be kept in intimate contact with the surrounding pavement surface to prevent lifting of the material. It shall be weighted down with sandbags that weight at least 15 pounds each. The sandbags shall be placed a minimum of 2 feet on center around the patch area.

   Cured patches, having a hollow sound when chain dragged or tapped (indicating delamination), shall be replaced by the Contractor at its expense until a patch acceptable to the Engineer is in place.

6. Tolerances in Finished Patch Surfaces: The surface profile of the patched area shall not vary more than 1/8 inch in a distance of 10 feet, when a 10 foot long straightedge is placed on the surface at any angle relative to the centerline of the bridge. Humps in the patch that exceed the 1/8 inch tolerance shall be ground down by approved machinery. Sags or depressions in the surface of the patch area that exceed 1/8 inch tolerance as determined by the Engineer shall be

repaired by removal of the concrete in the depression to a depth of 1 inch and repaired in the previously described manner.

7. Testing: The Contractor shall form, cure and test all concrete test cylinders under supervision of a representative of the Department. The dimensions, type of cylinder mold, number of cylinders, and method of curing shall be as directed by the Engineer.

   The Contractor shall provide a portable compressive testing machine, on Site, for the purpose of testing all compressive strength cylinders. All testing shall be in accordance with the requirements of ASTM C39. NOTE: This compressive testing machine must be calibrated in accordance with the provisions of Section 5, ASTM C39.

8. Time Schedule: Traffic will not be allowed on any areas where the Contractor has placed and finished concrete until the material has properly cured as specified, and has developed the required strength of 2,500 psi as determined by the compressive strength test, or until the Engineer authorizes its opening to traffic.

   All work shall proceed as required by the "Maintenance and Protection of Traffic" and "Prosecution and Progress" specifications elsewhere within the Contract.

Method of Measurement: This work will be measured for payment by the actual volume in cubic yards of replacement concrete, complete and accepted. No deduction will be made for the volume of reinforcing steel. Removal of concrete will not be measured for payment.

Basis of Payment: This work will be paid for at the Contract unit price per cubic yard for "Full Depth Patch (High Early Strength Concrete)" complete in place, which price shall include sawcutting and removal of concrete, surface preparation, furnishing and installing deformed steel bars, concrete replacement, debris shield, all equipment, tools, labor and work incidental thereto.

Pay Item	Pay Unit
Full Depth Patch (High Early Strength Concrete)	c.y.

ITEM #0601279A - CLASS "60" CONCRETE

Description:

Work under this item shall consist of furnishing and placing concrete for the various components of the substructure within the limits shown on the plans, including all necessary materials and equipment to complete the work and the design of the concrete mix. Work under this item shall conform to the pertinent requirement of Section 6.01 and M.03, supplemented and amended as follows:

Deviations from these Specifications require the written approval of the Engineer.

Materials:

Concrete:
The concrete shall be air-entrained concrete composed of Portland cement, fly ash, fine and coarse aggregate, admixtures and water. The air-entraining feature may be obtained by the use of an approved air-entraining admixture. The entrained air content of the concrete immediately before the placement shall be not less than 5 percent nor more than 7 percent. The testing of air content shall be performed in accordance with the requirements of ASTM C231. Fly ash shall be used to replace 15% by mass of the required Portland cement.

The consistency shall be determined by the AASHTO Method Tl 19. A uniform consistency shall be continuously maintained. Slump shall be not more than 3 inches.

The maximum water/cementitious material ratio by mass shall be 0.37.

The minimum mass of cementitious materials per cubic yard of concrete shall be 658 lbs.

The water soluble chloride ion content shall not exceed 0.06 percent by mass of cementitious materials.

The Contractor shall design and submit for the approval of the Engineer, a concrete mix which shall attain a minimum 28 day cylinder strength (fc) as shown on the plans.

Fly Ash:
The fly ash shall conform to the requirements of M.03.01-13.

Portland Cement:
The Portland cement shall be Type I or Type II cement conforming to the requirements of Sub article M.03.01-3.

Coarse Aggregate:
The coarse aggregate shall conform to the requirements of Article M.03.01 and the mix shall be designed utilizing a nominal maximum size of No. 6 aggregate.

Water Reducing Admixture:
The Contractor may submit, for the approval of the Engineer, a water-reducing admixture for the purpose of increasing workability and reducing the water requirements for the concrete.

Calcium Chloride:
The addition of calcium chloride to the mix will not be permitted.

Construction Methods:

The construction methods for this work shall conform to the requirements of Section 6.01.03 supplemented and amended as follows:

The design, engineering, and construction of forms shall be the responsibility of the Contractor. All external surfaces of the piers shall be formed using metal or approved equal forms that produce similar concrete texture, color and appearance. The formwork shall precisely follow the geometry of the elements as shown on the plans.

When falsework is required to support the forms, the Contractor shall make proper allowances for the deflection and settlement of forms and form supports and for the deflection and camber of substructure due to all operations, including post-tensioning. The Contractor shall submit working drawings of falsework and forms to the Engineer for approval in accordance with Article 1.05.02-3. These working drawings shall include but not be limited to the following information:

1. Complete details and erection plan of falsework and forms.
2. The computed falsework foundation pressures.
3. The computed settlements and deflections of falsework and forms.
4. Required camber of the forms to correct falsework settlement and form deflections.
5. Sequence of concrete placement.
6. Methods for management of Mass Concrete pours as defined in Article 6.01.03g including the use of thermal gradient measurement devices and methods for the control of temperatures during curing

Any work done or material ordered prior to approval of these drawings shall be at the Contractor's risk. Approval of the working drawings shall not serve to relieve the Contractor of any of his responsibility for the successful completion of the project.

At least thirty (30) days before the erection of falsework and forms, the Contractor shall submit information in accordance with Article 1.05.02 for review by the Engineer. This information shall include details of equipment to be used in placing and finishing of the concrete, including

the number and type of personnel who will be engaged in placing the concrete. The personnel shall consist exclusively of persons with skill and experience appropriate to their working assignments.

Concrete shall not be placed until the Engineer has inspected the forms, form ties, the placing of the reinforcing steel, and has given his approval thereof.

Cylinders for Compressive Strength Testing:

The concrete necessary to cast cylinders for compressive-strength determinations shall be furnished by the Contractor from each pour. The necessary personnel and forms for casting these specimens will be furnished by the Department and the number of specimens required will be specified by the Engineer. For the pier cap beams, half of the number of these cylinders shall be cured in an approved concrete cylinder box, or boxes, as described in Section 6.12 and used for determination of 28-day compressive strength. The other half shall be cured by the same methods used for curing the concrete in the field and shall be used for verifying minimum required compressive strength prior to removal of forms and supports under the pier cap, or post-tensioning.

Construction joints shall be made only where shown on the plans. Approval will not be given to place concrete in more than one operation where construction joints are not shown on the plans. The concrete in the cantilevered pier caps shall be placed symmetrically about the center, working outward from the co1umn(s).

The concrete shall be vibrated. Both internal and external vibration shall be used when ordered by the Engineer. The vibrating shall be done with care in such a manner as to avoid displacement of reinforcing steel or other components. Concrete shall be carefully placed in the forms and vibrated sufficiently to produce a surface free from imperfections such as honeycomb, segregation, cracking or checking.

Any deficiency such as honeycomb or segregation, may be cause for rejection.

The forms and form supports under the pier caps shall be left in place until the concrete has been post-tensioned.

To allow for shrinkage, 12 hours must elapse before fresh concrete can be placed against a construction joint, except as noted on contract plans or otherwise authorized or ordered by the Engineer.

Drilling for the setting of anchor bolts will not be permitted.

No load shall be imposed on the substructure for at least seven days after the concrete has been placed, and/or until the concrete has attained the minimum compressive strength shown on the plans as determined by test cylinders, or as approved by the Engineer.

No patching of the completed substructure will be allowed unless permitted by the Engineer. The Contractor's proposal for method and materials to be used in the patching operation shall be submitted to the Engineer for his approval. Any major patching of piers, as determined by the Engineer, shall be done before post-tensioning. Failure to do so shall be cause for rejection. Any concrete rejected, including all damaged reinforcing steel and other embedded components, shall be removed and replaced at no additional cost to the State.

Method of Measurement:

This work will be measured for payment by the actual volume in cubic yards of "Class "60" Concrete" completed and accepted in place in accordance with the plans or as ordered by the Engineer. No deductions will be made for the volume of reinforcing bars or post-tensioning materials.

Basis of Payment:

This work will be paid for at the contract unit price per cubic yard for "Class "60" Concrete", complete in place, which price shall include all materials, equipment, tools, labor and work incidental thereto, including heating and cooling, curing and all admixtures.

Pay Item	Pay Unit
Class "60" Concrete	Cubic Yard

ITEM #0601318A - PARTIAL DEPTH PATCH

Description: Work under this item shall consist of the removal of spalled, delaminated or otherwise deteriorated concrete from existing bridge decks, approach slabs and headers by pneumatic hammers or hydro-demolition methods, and replacement with fast setting patching material as shown on the plans, as directed by the Engineer and specified herein.

Where ordered by the Engineer, work under this item shall also include inspecting the underside of the deck concrete for popouts caused by the removal of deteriorated concrete.

Work under this item shall also include the furnishing and installation of wire ties for reinforcing bar and vertical supports on inadequately supported or vibrating reinforcing steel within deck patch areas, as ordered by the Engineer.

Work under this item shall also include any required debris shield, which shall include furnishings, installing and design.

Materials: The materials shall meet the following requirements:

1) Patching Material: The patching material shall be a concrete composed of a quick setting cement, fine aggregate, coarse aggregate and water. This concrete shall harden within 40 minutes, and develop minimum compressive strengths of 1,000 psi within 1 hour after set and 3,000 psi within 3 days.

   The Contractor shall design and submit a quick setting mix to the Engineer for acceptance. Said mix design shall meet the strength requirements noted above and shall attain a minimum of 2500 psi prior to allowing traffic on patched surfaces. The mix proportions and method of application shall be in accordance with the manufacturer's recommendations. Sources of supply of all the materials shall be clearly indicated.

   Fine aggregate shall meet the requirements of Subarticle M.03.01-2.

   The coarse aggregate shall meet the requirements of Subarticle M.03.01-1. The required grading shall be obtained by using 100% of No. 8 size coarse aggregate. Grading of the aggregate shall conform to the gradation for No. 8 stone in Article M.01.01.

   Water shall meet the requirements of Subarticle M.03.01-4.

   The quick setting cement shall be one of the following materials:

MasterEmaco T 415
BASF
23700 Chagrin Blvd.
Beachwood, OH 44122
216-839-7016
www.master-builders-solutions.basf.us

Perma Patch
Dayton Superior Corporation
7130 Ambassador Dr.
Allentown, PA 18106
800-745-3707
www.daytonsuperior.com

Rapid Set DOT Cement
CTS Cement Manufacturing
11065 Knott Ave. Suite A
Cypress, CA 90630
800-929-3030
www.ctscement.com

Speed Crete Green Line
Tamms Industries
730 Casey Ave.
Wilkes-Barre, PA 18702
800-218-2667
www.dpproducts.com/products/tamms.html

Fastcrete
Silpro Corporation
2 New England Way
Ayer, MA 01432
800-343-1501
www.silpro.com/products/fastcrete.shtml

Gypsum Based Materials will not be allowed.

Construction Methods:

Removal of concrete for partial depth patch will be performed by one of two methods: Hammer Demolition or Hydro-demolition. Prior to beginning any work, the Contractor shall provide submittals outlining intended method, as defined herein.

1) Inspection of the Deck: Before any existing concrete is removed, the Contractor shall provide the Engineer clear access to the bridge deck. During this time, the Engineer will perform an inspection of the structural slab and will designate areas where concrete removal shall be required. It shall be the responsibility of the Contractor to arrange the construction schedule so that the required operations may be performed without causing delay to the work.

   No operations will be performed by the Engineer until after the following construction work has been completed:

   a) The existing bituminous overlay or concrete wearing course, if present, has been removed.

   b) The existing waterproofing system, if present, has been removed.

   Note: The removal of this material will be paid for under other applicable items.

   It shall be the responsibility of the Contractor to inform the Engineer, in writing, of the date that a structure will be available for inspection operations. Notification shall be given to the Engineer at least 7 days prior to the date that the area in question will be in a condition acceptable to the Engineer.

   The Contractor is hereby informed that the following time period will be necessary to perform the required inspection operations:

   One working day with suitable weather conditions per each six thousand (6,000) square feet, or portion thereof, of deck area.

   The Contractor will not be allowed to do any further work to the structure, until all necessary inspection operations have been performed, unless given permission by the Engineer.

   The Contractor shall include any costs related to the allowance for this inspection in the general cost of the work.

2) Hammer Demolition: The maximum allowable noise level caused by equipment used for the removal of deck concrete shall not exceed 90 decibels on the "A" weighted scale, as measured at the nearest residence or occupied building. The Contractor shall demonstrate, to the satisfaction of the Engineer, that the equipment will meet this requirement before the use of such equipment will be allowed.

The weight of pneumatic hammers when used shall not exceed 30 pounds for concrete removal above the top reinforcing steel nor 15 pounds for concrete removal below the top reinforcing steel.

3) Hydro-Demolition Water and Equipment: All hydro-demolition equipment shall be capable of selectively removing spalled, delaminated or otherwise deteriorated concrete and cleaning the existing reinforcing steel of all rust and corrosion products by use of high-velocity water jets acting under continuous automatic control.

The hydro-demolition equipment shall consist of filtering and pumping units operating in conjunction with a remote-controlled robotics device.

All hydro-demolition equipment shall be equipped with an angled and rotating water nozzle to prevent interference of the existing reinforcing steel with the removal of concrete.

The maximum allowable noise level caused by equipment used for the removal of deck concrete shall not exceed ninety (90) decibels on the "A" weighted scale, as measured at the nearest residence or occupied building. The Contractor shall demonstrate, to the satisfaction of the Engineer, that the equipment will meet this requirement before the use of such equipment will be allowed.

The make and model numbers of hydro-demolition equipment shall be submitted for acceptance by the Engineer. No hydro-demolition work shall be initiated until this acceptance is granted.

The Contractor shall provide structurally adequate shields approved by the Engineer for protection of adjacent traffic lanes in the vicinity of the removal and cleanup operations.

Water used for the hydro-demolition shall be potable.

The Contractor is advised that the withdrawal of more than 50,000 gallons of water per day from a single source other than from a municipal water system shall require a diversion permit issued by the Department of Energy and Environmental Protection, Water Resources Unit, in accordance with the Connecticut Water Diversion Policy Act PA 84-402, CGS Sections 22a-365 through 22a-378.

4) Hydro-Demolition Drainage Runoff Control: At least 2 weeks prior to the planned initiation of hydro-demolition operations, the Contractor shall submit to the Engineer for acceptance a comprehensive plan for the hydro-demolition operation. This Hydro-Demolition Plan shall include the following:

a) Equipment
b) Containment
c) Filtration
d) Location of trial areas
e) Disposal of hydro-demolition runoff and concrete debris in conformance with these specifications

The Plan shall ensure that all concrete debris and particulate matter will be removed from hydro-demolition runoff water prior to its release to the environment.

The Plan shall include provision for the concurrent vacuuming of all runoff water at the immediate vicinity of the hydro-demolition operation. Runoff water shall be completely contained and vacuumed into a suitably sized water tight mobile tank for transport to a disposal site sedimentation basin acceptable to the Engineer.

Hydro-demolition operations shall proceed only with the simultaneous operation of a runoff water vacuum pickup in the immediate area of the hydro-demolition operation. Runoff water shall not be allowed to flow across adjacent travel lanes, across bridge joints nor through any existing bridge drainage system.

The size and location of the disposal site sedimentation basin shall be detailed in the Hydro-Demolition Plan. The sedimentation basin shall be properly sized so that uncontrolled overflow does not occur. At the conclusion of hydro-demolition operations, the sedimentation basin and all concrete debris shall be removed and the area restored to its original condition.

The Plan shall additionally conform to all applicable requirements of Section 1.10 Environmental Compliance of the Standard Specifications.

The acceptance by the Engineer of the Hydro-Demolition Plan shall in no way relieve the Contractor of any responsibility for its safe and effective performance.

5) Calibration and Testing of Hydro-Demolition Equipment: A trial area will be designated by the Engineer to demonstrate that the equipment, personnel and methods of operation are capable of producing satisfactory results. The trial area will consist of 2 patches, each of approximately 20 square feet, one area of deteriorated or defective concrete and one area of "sound" concrete as determined by the Engineer.

   Area of sound concrete is defined as: An area free from chemical defects, delamination, spalling, cracks, etc.

   In the "sound area of concrete," the equipment shall be programmed to remove concrete to a depth 1 inch $\pm$ 1/4 inch below the top reinforcing steel mat.

   After completion of the sound concrete test area, the equipment shall be located over the deteriorated or defective concrete and, using the same parameters as for sound concrete removal, shall remove all deteriorated or defective concrete. If a satisfactory result is obtained, these parameters may be used as a basis for production removal.

   If, after calibrating the hydro-demolition equipment and beginning removal operations in a particular zone or area, insufficient removal of concrete is observed, in the opinion of the Engineer, the Contractor shall recalibrate the hydro-demolition equipment for that zone or area to the satisfaction of the Engineer.

6) Removal of Deteriorated Concrete: All deteriorated concrete designated for removal under this construction item shall be removed within the limits shown on the plans and where ordered by the Engineer. The lateral limits of each area to be repaired will be delineated by the Engineer and suitably marked. Where several areas to be repaired are very close together, the Engineer may combine these individual patches into a large area. The outlines of each such area shall first be cut to a depth of 1/2 inch with a powersaw capable of making straight cuts prior to pneumatic demolition. In the event that reinforcing steel is encountered within the upper 1/2 inch depth during sawing operations, the depth of saw-cut shall immediately be adjusted to a shallower depth so as not to damage the steel bars. If so directed by the Engineer, saw cutting shall again be carried down to the 1/2 inch depth at other locations of repair provided reinforcing steel is not again encountered. Where over-breakage occurs resulting in a featheredge, the featheredge shall be squared up to a vertical edge in an acceptable manner. Where sawing is impractical, the area shall be outlined by chisel or other acceptable means.

All deteriorated concrete shall be removed by pneumatic hammers or hydro-demolition methods.

The depth of concrete removal shall be at least 1 inch below the top reinforcing steel mat but shall be such as to include all spalled, delaminated, or otherwise deteriorated concrete. The Engineer will be the sole determiner of what constitutes deteriorated concrete, using sounding methods or other evaluation measures.

Within 1 hour following the initiation of a concrete removal operation in any patch area, all loose concrete debris shall be removed, followed by water flushing of the existing concrete bonding surface to completely remove all traces of concrete debris and cement residue so that rebonding to the surface of the remaining sound concrete will be prevented. If it is not convenient to clean and flush the patch area within this time frame, all steel reinforcing and concrete bonding surfaces shall be cleaned subsequently by high pressure water blasting at a nozzle pressure not less than 3,000 psi with a sufficient volume to completely remove all rebonded debris and laitance.

Where the existing reinforcing steel is damaged or corroded, it shall be cut out and replaced with new reinforcing steel of the same size. Any sound reinforcing steel damaged during the concrete removal operations, shall be repaired or replaced by the Contractor at its expense, as directed by the Engineer. New steel shall be attached beneath or beside existing steel with a minimum splice length as indicated on the plans, or as directed by the Engineer. The concrete shall be removed to a minimum depth of 1 inch below the new steel.

7) Surface Preparation: Sound reinforcing steel which is in the proper position in the slab shall be left in place and cleaned of all concrete, the smaller fragments to be removed with hand tools in patch areas where pneumatic hammers were used.

Reinforcing bar wire ties and vertical supports shall be installed on inadequately supported or vibrating reinforcing steel, as directed by the Engineer.

The concrete surface and reinforcing steel to receive patching material shall be either sandblasted or water blasted, followed by air blasting in order to remove all loose particles and dust. All blasting operations shall be performed using techniques acceptable to the Engineer, taking care to protect all pedestrians, traffic, and adjacent property. All compressed air sources shall have properly sized and designed oil separators attached and functional to allow delivered air at the nozzle to be oil-free. The patch area shall be cleaned of all additional loose or powder-like rust, oil, solvent, grease, dirt, dust, bitumen, loose particles, and foreign matter just prior to patching.

If the patch area was not cleaned and flushed with clean water immediately following hydro-demolition, or if run-off from a nearby hydro-demolition operation was allowed to travel through the previously cleaned and flushed patch surface, all affected concrete and steel reinforcing bonding surfaces shall be water blast cleaned at a nozzle pressure not less than 3,000 psi as directed by the Engineer, to assure that all remaining bond inhibiting laitance is completely removed.

The entire concrete surface to be patched shall be dampened. All excess free water shall be removed from the patch area.

8) Mixing, Placing, and Finishing: Unless a winter operations plan has been submitted to the Engineer by the Contractor, mixing and placing concrete shall only take place when the ambient temperature is above 35°F or per manufacturer's recommendations, whichever is

higher. All mixing shall be accomplished by means of a standard drum-type portable mixer. A continuous type mobile mixer may be used if permitted by the Engineer. The Contractor shall calibrate the mobile mixer under supervision of the Engineer. Calibration shall be in accordance with the applicable sections of ASTM method C685. The total mix shall be limited to the quantity that can be mixed and placed in 15 minutes. The concrete mix shall be spread evenly and compacted to a level slightly above the pavement surface. Vibration, spading or rodding shall be used to thoroughly compact concrete and fill the entire patch area. Where practical, internal vibration shall be used in cases where concrete has been removed below the reinforcing steel. Hand tamping shall be used to consolidate concrete in smaller patches, including popouts.

Vibrating plates or vibrating screeds shall be used on the surface of all patches for strike off and consolidation. After the concrete has been spread evenly and compacted to a level slightly above the pavement surface, the vibrating plate or screed shall be drawn over the surface at a uniform speed without stopping, in order to finish the surface smooth and even with adjacent concrete.

The surface shall be float finished.

Finishing operations shall be completed before initial set takes place.

Cured patches, having a hollow sound when chain dragged or tapped, (indicating delamination), shall be replaced by the Contractor at its expense until a patch acceptable to the Engineer is in place.

9) Tolerances in Finished Patched Surfaces: The surface profile of the patched area shall not vary more than 1/8 inch in a distance of 10 feet, when a 10 foot long straightedge is placed on the surface at any angle relative to the centerline of the bridge. Humps in the patch that exceed the 1/8 inch tolerance shall be ground down by acceptable machinery. Sags or depressions in the surface of the patch area that exceed the 1/8 inch tolerance shall be repaired by removal of the concrete in the depression over an area determined by the Engineer to a depth of 1 inch and repaired in the previously described manner.

10) Underside of Bridge Deck Treatment: The Engineer will examine the underside of the bridge deck for popouts caused by the removal of deteriorated concrete. The exposed reinforcing steel shall be coated with epoxy resin where ordered by the Engineer. The exposed reinforcing steel, if any, which is to receive the epoxy resin coating material shall be cleaned of all loose or powder-like rust, oil, dust, dirt, loose particles, and other inhibiting matter just prior to coating.

The epoxy resin shall be mixed in accordance with the manufacturer's instructions. Also in accordance with the manufacturer's instructions, 2 coats of the mixed material shall be applied in uniform coats of approximately 2 to 3 mils dry film thickness each.

If the popouts extend beyond the bottom layer of reinforcing steel, the popouts shall be repaired as ordered by the Engineer.

11) Test Cylinders: The Contractor shall make and perform compressive strength tests on representative cylinders under the supervision of the Engineer in accordance with ACI requirements. The dimensions, type of cylinder mold and number of cylinders will be specified by the Engineer. Traffic shall not be permitted on patched surfaces until the patch material attains a strength of 2500 psi, as determined by breaks of the test cylinders.

A portable compression testing machine shall be provided by the Contractor and available on site for cylinder testing. All testing and equipment shall conform to ASTM C39.

Note: The compression machine must be calibrated in accordance with the provisions of Section 5, ASTM C39.

12) Time Schedule: Work under this item begun on any specific bridge during a construction season shall be completed, at least, to include this item, membrane waterproofing and placing of first course of wearing surface as soon as possible and specifically before the beginning of the construction season's winter shutdown.

All work shall proceed as required by the "Maintenance and Protection of Traffic" and "Prosecution and Progress" specifications elsewhere within the Contract.

Method of Measurement: This work will be measured for payment by the actual volume in cubic feet of patching material used in acceptable concrete deck patches, except where the Engineer determines that the Contractor has unnecessarily removed sound concrete. Where sound concrete has been unnecessarily removed, the replacement concrete will not be measured for payment. Providing safe access for delineation and inspection of the performed repairs will not be measured for payment.

Replacement of deteriorated rebar, coating of exposed rebar and repair of epoxy coated rebar at popouts, if required, will be measured for payment under other Contract items.

Basis of Payment: This work will be paid for at the Contract unit price per cubic foot of deck concrete repaired under "Partial Depth Patch," complete and accepted in place, which price shall include removal of deteriorated concrete, surface preparation of patch areas, concrete replacement, the furnishing and installation of reinforcing bar wire ties and vertical supports for inadequately supported existing reinforcing steel, inspection access, all materials, equipment, including the portable compression testing machine required for the testing of the repair material, tools, labor and work incidental thereto.

Replacement of deteriorated epoxy rebar, if required, will be paid for under the item "Deformed Steel Bars – Epoxy Coated" or "Deformed Steel Bars".

Epoxy resin coating of exposed rebar at the underside of the deck, if required, will be paid for under the item "Clean and Coat Exposed Reinforcing Steel."

Pay Item	Pay Unit
Partial Depth Patch	c.f.

ITEM #0601363A - CONCRETE ENCASEMENT

Description: This item shall consist of the encasing of conduit in trench and under roadways with Class "C" concrete for their protection, as shown on the plans, or as directed by the Engineer.

Materials: The materials shall conform to the requirements for Class "C" concrete as outlined and specified in Section 6.01.02.

Construction Methods: Construction methods shall conform to applicable portions of Section 6.01.03. Conduits shall be encased in concrete as directed on the plans and in accordance with the details provided in subset 01.05.05.

Method of Measurement: This work will be measured for payment by the actual volume in cubic yards of concrete encasement, complete and accepted. Excavation to expose the conduit and backfilling for this item shall be measured and paid for under Item No. 1001001A – Trenching and Backfilling.

Basis of Payment: This work will be paid for at the Contract unit price per cubic yard for "Concrete Encasement" complete in place, which price shall include preparation, concrete placement, all equipment, tools, labor and work incidental thereto.

Pay Item	Pay Unit
Concrete Encasement	c.y.

ITEM #0601549A - POST-TENSIONING TENDONS

Description:

Work under this Item shall consist of furnishing, installing, stressing and grouting prestressing in the Girder as indicated on the plans, including all tendons, anchoring hardware, reinforcing steel, metal ducts including supports, grout, grout tubes, vent tubes and all other necessary materials and equipment to complete the work.

Materials:

Prestressing Steel: Seven wire strand for the prestressing shall conform to the requirements of ASTM A416M, Grade 270, Low Relaxation.

Anchorage Assembly: All units comprising an anchorage assembly shall be capable of developing the ultimate strength of the attached tendons without visible deformation, and shall be furnished complete with all necessary fittings. All deformed bars, wire, mesh or structural shapes that are required for disturbing the end anchorage loads shall conform to the requirements of Article M.06.01.

Metal Duct: Sheathing for the tendons shall be rigid galvanizing steel tubing, of the proper dimensions, especially manufactured for this purpose. The duct shall be completely sealed against leakage of mortar into the duct.

Corrosion Inhibitor: Corrosion inhibitor shall consist of a vapor phase inhibitor (VPI) powder conforming to the provisions of Federal Specification MIL-P-3420 or as otherwise approved by the Engineer.

Grout: The Contractor shall design and submit to the Engineer the exact proportions of the materials he proposes to use. The grout mix shall consist of a mixture of portland cement, water, and expansive mixture approved by the Engineer. The grout mix shall conform to the following requirements:

1. The grout mix shall have an unrestrained volumetric expansion of not less than 3% nor more than 8%.

2. The grout mix shall have a minimum 28 day compressive strength of 4.6 ksi, when tested by methods conforming to the requirements of ASTM C109.

3. The water content of the grout shall be kept as low as possible for grouting. However, the water cement ratio (by mass) shall not exceed 0.44

4. Admixtures, if used, shall not contain chlorides in excess of 0.005 percent of the mass of the cement used. Nor shall it contain fluorides, sulphates or nitrates.

The Contractor shall provide a Certified Test Report that the mix submitted shall meet the requirements stated herein in conformance with requirements set forth in Article 1.06.07. Also the Contractor shall provide, when requested by the Engineer, samples of the grout mix for testing and approval.

Water shall conform to the requirements of Article M.03.01. Chlorides and nitrates shall not be used. The water shall be potable.

Portland cement shall be Type I or Type II cement conforming to the requirements of Article M.03.01.-3.

Tendon Grout: For grouting post tensioning ducts, provide a commercial, pre-packaged, thixotropic tendon grout. The grout shall consist of Type I or II portland cement, potable water, mineral additives, and other specified admixtures. The grout may not contain aluminum powder, gas generating components, expansive admixtures and admixtures containing chlorides. The grout shall be resistant to washout of cement, and have good flow characteristics and thixotropic properties.

Label each grout bag with application, date of manufacture, lot number, and mixing and pumping instructions. Use commercial, pre-packaged thixotropic grout, within six months of the manufacture date. The material shall be mixed in accordance with the manufacturer's recommendations.

Tendon grout shall meet the following specifications:

1. Grout shall be a Class C grout, as defined by Post-Tensioning Institute (PTI).
2. Total Chloride Ions, ASTM C 1152: Max. 0.08% by weight of cementitious material.
3. Fine Aggregate (if used): 99% passing the No. 50 sieve (300 microns)
4. Grout Strength, Average of three cubes, ASTM C942:
    a. Compressive Strength minimum 3.0 ksi in 7 days.
    b. Compressive Strength minimum 5.0 ksi in 28 days.
5. Permeability, ASTM Cl202: Permeability (as modified by PTI) less than 2500 coulombs after 6 hours using 30 volts on 28 day old grout.
6. Expansion, ASTM C940: Expansion between 0.0% and +2.0% for up to 3 hours
7. Wet Density, ASTM C185: Record maximum and minimum test values obtained (kg/l).
8. Initial Set Time, ASTM C953: Minimum 3 hours; Maximum 12 hours.
9. Volume Change, ASTM C1090:
    a. The vertical height change shall be at least 0.0%, but less than +0.1% at 24 hours.
    b. The maximum vertical height change shall be no greater than +0.2% at 28 days.
10. Pumpability and Fluidity Tests:

a. The efflux time for the grout immediately after mixing shall be between 5 and 30 seconds for a 1 liter discharge. This shall be measured using the modified version of ASTM C939 and a flow cone as described in the PTI Specification for Grouting of Post-Tensioned Structures by Section 4.4.5.2.

b. After the first test described above, let the sample stand for 30 minutes without further agitation and test again, remixing for 30 seconds prior to final flow measurement. The efflux time now shall not be more than 30 seconds and must be a value to completely discharge the 1 liter volume.

11. Bleed:

a. Wick Induced Bleed, ASTM C940 (PTI Modified): maximum 0.0% at 3 hours @ 70 °F (20 °C).

b. Schupack Pressure Bleed:

Vertical Rise, X (in)	Gelman Pressure (psi)	Max % Bleed
$0 \leq X \leq 24$	20	4
$24 < X \leq 72$	30	2
$72 < X < 1200$	50	0

The Contractor shall provide a Certified Test Report and a Material Certificate that the grout material meets the requirements stated herein in conformance with requirements set forth in Article 1.06.07.

Tendon Grout Trial Batch: Mix a trial batch of grout using the equipment, materials, and proportions proposed for use on the project at least 48 hours before grouting commences. At least 48 hours prior to the trial batch, submit a detailed written mix design showing the exact brand and batch quantities of pre-packaged grout and water including dosages proposed.

Perform the following tests:

1. Flow cone-Determine the efflux time at) quiescent time according to ASTM C939, modified as follows:
   a. Fill the flow cone to the top of the cone
   b. When thoroughly mixed, the efflux time of grout will be the time to fill a one liter (one quart) container that is placed directly under the flow cone. Ensure the efflux time of the grout immediately after mixing is between 5 and 30 seconds for a one liter (one quart) discharge.
   c. Let the grout stand for 30 minutes without agitation then retest as follows:
   d. Remix for 30 seconds
   e. Ensure the efflux time of the grout immediately after remixing is 30 seconds or less for a one liter (one quart) discharge
2. Bleeding - Determine wick induced bleeding according to ASTM C940 as modified by Post Tensioning Institute (PTI) guide specifications except limit the maximum allowable bleed to 0.0% at three hours.

3. Mud Balance - Determine a wet density value for mud balance comparative testing during grouting operations according to API RP l3B-1 (American Petroleum Institute).

4. Compressive Strength - Determine compressive strengths according to ASTM C109. Provide two sets of 3 cubes, for informational purposes only, to the Engineer for 7 and 28-day testing.

If the proposed grout mix design does not produce acceptable trial batch results, revise the mix design and perform another trial batch. Results from previous projects will not be considered acceptable documentation. Seven and 28-day test results will be used for documentation purposes only.

Field Tests of Production Grout: In order to ensure the correct consistency and density of daily production grout, fluidity and density testing shall be conducted to ensure the grout is within acceptable limits. Additional water must never be added to a mix to meet fluidity test requirements and surplus, discharged and tested grout should be properly discarded.

1. Prior to Injection at Inlet: The modified ASTM C939 test should be used where the flow cone is filled to the top, i.e. above the standard level, and the time to fil1 a one-liter container is measured. The efflux time should be between 5 and 30 seconds immediately after mixing. After allowing the grout to stand for 30 minutes without agitation and then remixing for 30 seconds, the efflux time should be less than 30 seconds. The density of a thixotropic grout may be sampled and checked at the inlet using the “mud-balance” test of the American Petroleum Institute (API RP 13B-1).

2. Discharge at Final Outlet: Immediately after a uniform flow of uncontaminated grout is obtained at the last outlet, a fluidity test should be performed on the grout discharged from the outlet using the modified ASTM C939 flow cone test. The maximum efflux time should be less than 30 seconds. Alternatively, the density of the discharge grout may be checked using the API mud-balance (API RP 13B-1).

Testing Prestressing Steel and Anchorages: All strand to be shipped to the site shall be assigned a lot number and tagged for identification purposes. Anchorage assemblies to be shipped shall be likewise identified.

All samples submitted shall be representative of the lot to be furnished and, in the case of strand, it shall be taken from the same master roll.

All materials specified for testing shall be furnished to the Engineer for testing, free of cost, in ample time for testing and approval. Approval of the material must be obtained before the material is incorporated in the work.

For seven wire strand tendon — one strand six (6) ft long and one typical tendon consisting of proposed number of strands six (6) ft long shall be furnished for testing.

The Contractor shall also furnish two anchorage assemblies, complete with distribution plates of each size or type to be used, if anchorage assemblies are not attached to tendon samples. Where a common distribution plate is used for anchoring a number of tendons, two equivalent plates for single tendon shall be furnished.

The anchorage assembly shall be designed so that the maximum bearing stress on concrete at service load conforms to the requirements of AASHTO LRFD Bridge Design Specifications.

Working Drawings

At least thirty (30) days prior to installation of post-tensioning components, the Contractor shall submit working drawings to the Engineer for approval in accordance with Article 1.05.02. These working drawings shall include but not be limited to the following information:

1. Complete details of the method, materials and equipment the Contractor proposes to use in the grouting operation, including the manner of mixing, the equipment to be used, step by step procedure to be followed and the sequence of grouting of the ducts.

2. The size of the anchorage assemblies and pockets shall be detailed.

3. The manner of securing the duct and other components into place, including the interval of tie-downs.

4. Complete specifications and details of the prestressing steel and anchorage system.

5. Jacking stresses.

6. Type of ducts.

7. Proposed arrangement of the prestressing steel in the members.

8. Exact location of anchorage system components, ducts, and other related elements. Show duct location data, including elevations, at least every 1/8th point of the span for each span.

9. Elongation calculations.

10. Anchorage bearing stress at service load.

11. Jacking sequence.

Submit the certifications specified in the following:

1. ASTM A416/A416M for uncoated seven-wire steel strand

Include with certification:

1. Representative load-elongation curve for each size and grade of strand and for each size of bar
2. Copy of the QC tests performed by the manufacturer

Approval of all working drawings must be obtained prior to the placing of metal ducts, tendons and anchorage assemblies in the forms.

Authorized Material List for Post-tensioning prestressing systems:

1. Dywidag (DSI)
2. Schwager Davis Inc. (SDI)
3. Stresssteel PT Systems
4. VSL

Deviations from prestressing details that have been approved by the Engineer will not be permitted unless details of such deviations are submitted, in advance of use, for approval. The approval by the Engineer of any proposed method, materials, or equipment shall not be construed as relieving the Contractor, in any respect, of full responsibility for successfully completing the prestressing operations in accordance with the requirements of these special provisions.

Construction Methods

Post-tensioning shall not begin until the concrete has attained the minimum compressive strength (f'_{ci}) shown on the plans. The compressive strength shall be determined by standard cylinders made and cured identically with the girders. The stressing of tendons and grouting of metal ducts shall be completed within fourteen (14) calendar days after the concrete has attained the minimum compressive strength (ksi). The tendons shall be tensioned in such an order that lateral and vertical eccentricity of prestress will be a minimum.

The Contractor shall certify to the Engineer that a skilled representative of the post-tensioning method will be available to the Contractor to give such aid and instruction in the use of the prestressing equipment and installation of materials as is required to obtain satisfactory results.

A skilled representative shall be present during the initial placing of post-tensioning tendons, the stressing of the tendons, and the grouting of the ducts. The representative shall remain on the job until, in the opinion of the Engineer, each operation is proceeding smoothly and the workmen are familiar with the work required for each operation. The Contractor shall also arrange to have the representative present at such other times as the Engineer may request.

Tendons shall be assembled on site; factory preassembled tendons will not be allowed.

All metal ducts and other components shall be tied securely into place at intervals shown on the working drawings. Concrete shall not be deposited in the forms until the Engineer has inspected and approved the placement of metal ducts, anchorages and distribution reinforcement, and has marked his approval on each metal duct.

All holes, openings and indentations in the ducts shall be repaired prior to placing the concrete. Holes or openings less than ¼" may be repaired with several wraps of waterproof tape. Holes or openings larger than ¼" shall be repaired with a split metal sleeve which shall overlap itself by 3", extend at least 3" on either side of the hole, be secured to the duct and be sealed with waterproof tape. Indentations which cannot be repaired shall be cut out and repaired as required above for holes greater than ¼". All repairs shall be subject to the approval of the Engineer.

After installation in the forms, the openings at the ends of metal ducts shall be sealed at all times to prevent the entry of water or debris.

After each pour of the concrete that comes in contact with the metal ducts, and before the initial set of the concrete occurs, an elastomeric plug, 6 millimeters in diameter less than the inside diameter of the duct, shall be passed through the ducts to insure that there is not blockage. If blockage is indicated, it shall be located and removed.

The tendons shall be stressed in an order indicated on the working drawings so that lateral and vertical eccentricity of the prestress will be a minimum.

The Contractor is instructed that special handling is required of all prestressing steel and related components. Any tendon, or component thereof, becoming kinked, deformed or otherwise damaged will be rejected. Tools that would mar or damage the tendons shall not be used. The prestressing components shall be free from corrosion when installed, and the Contractor shall take the appropriate measures to prevent corrosion of the tendons after installation. Welding to or near the prestresssing steel is not permitted because of the possibility of arcing. If arcing causes damage to the prestressing steel, the steel shall be rejected. The ducts, tendons and other components shall be completely free from oil, grease, and other foreign material. Any cleaning required must be done in the manner approved by the Engineer.

Post-tensioning shall be done with approved hydraulic jacking equipment. All jacks shall be equipped with accurate pressure gauges. All combinations of jacks and gauges shall have been calibrated by an approved testing agency immediately prior to start of the prestressing operations on this project. After being six calendar months on the same project, all combinations of jacks and gauges shall be recalibrated. The Contractor shall furnish the Engineer certified and notarized calibration charts and tables for each combination of jack and gauge.

The post-tensioning forces shall be measured by the calibrated pressure gauges. An initial force, sufficient to remove any slack from the tendon shall be applied. The strain between the initial force and the total required force will be measured. A record shall be kept of gauge pressures and elongations at all times and shall be submitted to the Engineer. If the measured strain varies by more than 5% from the calculated strain, the Contractor shall carefully check his operation to find

and correct the source of error before the operation is allowed to continue.

The protruding ends of tendon shall be cut after post-tensioning, in a manner prescribed by the Engineer, or as noted on the plans. A projection of at least 1", preferably more, beyond the anchorage wedge must remain. If the tendons are burned off, the cut must be made as quickly as possible in order to reduce heat penetrations in the tendons.

The ends of the grout tubes, vent tubes, and drain tubes shall be threaded and the exposed ends fitted with valves. All grout tubes at the end of ducts shall pass through the anchor plates.

Vent tubes and drain tubes that pass through exposed concrete surfaces shall be fitted with couplings and threaded extension pipes. The coupling shall be so located that, when removed, the remaining stub will be recessed at least 15mm from the face of the concrete. The grout tubes at each end of the duct shall be threaded and shall project at least 48 in. above the ends of the duct, and shall be fitted with shutoff valves at the tops of the tubes.

All vent or grout tubes at the high points of metal duct shall have a 1 in. diameter vertical tube attached to the vent tube with a reducer couplings. The 1 in. diameter vertical tube shall have a minimum length of 24 in. above the exposed concrete surface or a minimum volume of 10% of the grout volume in the metal duct contributing to the water low in the grout, whichever is greater. When required by the volume, the vertical tube diameter may be increased to 1.5 in. diameter, but the minimum length of the vertical shall remain 24 in. The top elevation of all 3 in. or 1.5 in diameter vertical tubes for a single duct shall not vary more than 3 in from a common level plane.

All water that may have collected in the metal ducts shall be blown out with oil free compressed air before starting grouting operation.

The temperature of the concrete at the time of grouting shall be above 10°C and shall be maintained above 10°C for at least three days after grouting.

The method of grouting shall be such as to ensure the complete filling with grout of all voids within the duct. The mixer for the grout shall be a high speed colloidal mixer specifically designed for grouting of post-tensioning ducts. The mixer shall be capable of producing grout which is free of lumps and undispersed cement.

The pump for the grout shall be of the positive displacement type, and shall be able to produce an outlet gauge pressure of at least 0.145 ksi.

The pump shall have seals adequate to prevent the loss of grout and also to prevent the introduction of oil, air, or other foreign substances into the grout.

The grouting equipment shall utilize gravity feed to the pump inlet.

During the grouting operation, standby water flushing equipment shall be provided. The water flushing equipment shall be in addition to, and separate from, the grouting equipment; shall use a

different power source than the grouting equipment; shall have sufficient capacity to flush out any partially grouted enclosures when blockage or breakdown of grouting equipment occurs and shall be capable of developing a gauge pressure of at least 0.3 ksi.

The ingredients shall be mixed sufficiently to produce a uniform thoroughly blended grout with a minimum of air entrapped. Excessive temperature rise due to extended mixing shall be avoided. After mixing, the grout shall be passed through a strainer into pumping equipment which provides for recirculation. No additional water shall be added to the grout after mixing. No grout shall be used more than one-half hour after mixing.

The Engineer will perform tests on the grout as specified within these specifications and in the "Recommended Practices for Grouting" by the Prestressed Concrete Institute. The Engineer will provide equipment and perform the testing. The Contractor shall operate his equipment and provide samples as required.

Grouting operation shall not start before the post-tensioning operation is complete for the entire girder.

Unless otherwise noted on plans, the grout shall be injected into the grout tubes from one end of the section of girder being post-tensioned.

The valves on all outlet tubes (drain, vent and grout tubes) shall be closed except for the outlet tube closest to the grouting end of the duct which shall be open. The initial pump gauge pressure shall be less than 40 psi, and shall gradually be increased until steady stream of grout, free of air and diluted grout, flows from the outlet tube. The outlet tube shall be closed and simultaneously, the next outlet tube, in the direction of flow of grout, shall be opened.

This process shall be repeated for each of the outlet tubes, until the grout tube at the far end of the duct becomes an outlet tube. Pumping shall continue until the flow from the outlet tube becomes uniform and free from air and diluted grout.

At the completion of the grouting, all valves shall remain closed until the grout has cured, except the grout tubes at each end of the duct and at the high points of the duct, which shall remain opened during the curing of the grout.

An on-line device to limit the grout pumping gauge pressure shall be set at a maximum of 0.145 ksi. If the grout reaches the limiting pressure, the grouting operation shall be stopped and the grout flushed from the entire duct. The grouting operation shall not resume until the restriction is located and corrected by the Contractor.

No external loads shall be applied to the bridge before grout in all ducts has reached the minimum 28 day compressive strength.

Method of Measurement:

This work will be measured for payment as "POST-TENSIONING TENDONS" and shall be measured by final pounds (lbf) of prestressing strands in the bridge. All items and activities associated with post-tensioning of the bridge shall be incidental to this bid item.

Basis of Payment:

Payment for this work will be made at the contract unit price per pound for "POST-TENSIONING TENDONS", as shown on the plans, completed and accepted in place. This price shall include all costs of design, materials, multiple phase stressing, transportation, tools, labor, equipment and work incidental thereto.

Pay Item	**Pay Unit**
Post-Tensioning Tendons	LB

ITEM #0601651A - RETAINING WALL (SITE NO. 1)
ITEM #0601653A - RETAINING WALL (SITE NO. 3)
ITEM #0601654A - RETAINING WALL (SITE NO. 4)
ITEM #0601656A - RETAINING WALL (SITE NO. 6)
ITEM #0601657A - RETAINING WALL (SITE NO. 7)

Description: This item will consist of designing, furnishing and constructing a retaining wall in the location, grades, and to the dimensions and details shown on the contract drawings, and in accordance with these specifications. Also included in this item shall be removal of existing masonry, furnishing and installing light standard anchorages, junction boxes, electrical conduit, anchorage for parapet mounted sign supports, underdrains and weep drains.

Retaining Wall Selection: The wall chosen shall be selected from the list shown on the contract drawings. The contract drawings may detail a cast-in-place reinforced concrete retaining wall. This type of retaining wall may also be used as an option. The Engineer will reject any proposed retaining wall that is not listed on the contract drawings.

The list on the contract drawings is for all proprietary retaining walls that are appropriate for each site. This list does not warrant that the walls can be designed to meet either the dimensional, structural, or geotechnical constraints at each site.

The following is a list of the Department's current approved proprietary retaining walls, no other proprietary retaining walls will be allowed:

NOTE: SEE THE CONTRACT DRAWINGS FOR THE SPECIFIC WALLS THAT ARE ACCEPTABLE FOR EACH SITE.

Prefabricated Modular Walls

1. Doublewal-Standard Module
Doublewal
173 Church Street
Yalesville, CT 06492
(203) 269-3119

2. T-Wall Retaining Wall System
The Neel Company
8328-D Traford Lane
Springfield, VA 22152
(703) 913-7858

Mechanically Stabilized Earth (MSE) Walls

1. Vist-A_Wall Systems
Big R Bridge Corporation
PO Box 1290
Greeley, CO 80632
(207) 232-3228

2. Tricon Retained Soil Wall
TEG Engineering, LLC
1505 44th Street
Wyoming, MI 49505
(616) 261-8630

3. Reinforced Earth Walls
The Reinforced Earth Company
133 Park Street
North Reading, MA 01864
(978) 664-2830

4. Retained Earth
The Reinforced Earth Company
1372 Oldbridge Road, Suite 101
Woodbridge, VA 22192
(703) 499-9818

Design: Design computations are not required for the cast-in-place wall detailed on the contract drawings except for any temporary earth retaining systems included in the lump sum item. The Contractor shall submit working drawings and design computations for temporary earth retaining systems in accordance with Article 7.14.03.

1 - Design Computations: If the Contractor chooses one of the proprietary wall options, he is fully responsible for the design, detailing and additional specifications required. The actual designer of the retaining wall shall be a qualified Professional Engineer licensed in the State of Connecticut. The designer must have designed at least three proprietary walls within the last three years.

2 - Designer's Liability Insurance: The Designer of the proprietary retaining wall shall secure and maintain at no direct cost to the Department, a Professional Liability Insurance Policy for errors and omissions in the minimum amount of One Million Dollars ($1,000,000). The Designer may, at his election, obtain a policy containing a maximum Two Hundred Fifty Thousand Dollars ($250,000) deductible clause, but if he should obtain a policy containing such a clause, the Designer shall be liable to the extent of the deductible amount. The Designer shall obtain the appropriate and proper endorsement to its Professional Liability Policy to cover the indemnification clause in this contract as the same relates to negligent acts, errors or omissions in the work performed by the Designer. The Designer shall continue this liability insurance coverage for a period of three years from the date of the acceptance of the work by the agency head as evidenced by a certificate of acceptance issued to the contractor or for three years after the termination of the contract, whichever is earlier, subject to the continued commercial availability of such insurance.

The Designer shall supply the certificate of this insurance to the Engineer prior to the start of construction of the wall. The designer’s insurance company shall be licensed in the State of Connecticut.

3 - Preliminary Submissions for Proprietary Retaining Walls: Prior to the start of fabrication or construction, the Contractor shall submit to the Engineer a design package, which shall include, but not be limited to the following:

a. Detailed Plans:

- Plan sheets shall be approximately 24" x 36".
- Stamped by a licensed Professional Engineer (Connecticut).

- Full plan view of the wall drawn to scale. The plan view must reflect the horizontal alignment and offset from the horizontal control line to the face of the wall. Beginning and ending stations, all utilities, signs, lights, etc. that affect the construction along with all property lines and easement lines adjacent to the wall shall be shown.

- Full elevation view of the wall drawn to scale. Elevation views should indicate the elevation at the top and bottom of walls, horizontal and vertical break points, and the location of finished grade.

- Typical cross sections drawn to scale including all appurtenances. Detailed cross section should be provided at significant reinforcement transitions such as wall ends.

- Details of all wall components and their connections such as the length, size and type of reinforcement and where any changes occur; modular component and facing details including reinforcing steel and reinforcement connections; joint material including geotextile filter location and horizontal joint compression material, etc.

- Drainage details for embankment backfill including attachment to outlets shown on contract drawings.

- Details of any roadway drainage pipe projecting through the wall, drainage structures adjacent to the wall, or any attachments to the wall. Details of the treatment of drainage swales or ditches shown on the contract drawings.

- Design parameters used along with AASHTO references.

- Material designations for all materials to be used.

- Detailed construction methods including a quality control plan. Construction quality control plans should include monitoring and testing frequencies (e,g, for setting batter and maintaining horizontal and vertical control). Construction restraints should also be listed in the details. Specific requirements for construction around obstructions should be included.

- Details of parapet attachments where required along with any lighting and/or signing requirements.

- Details of Architectural Treatment where required.

- Details of Temporary Earth Retaining Systems where required.
- Details of wall treatment where the wall abuts other structures.
- Treatment at underground utilities where required.

b. Design Computations:

- Stamped by a licensed Professional Engineer (Connecticut).
- Computations shall clearly refer to the applicable AASHTO provisions as stated in the Notes on the Contract Drawings.
- Documentation of computer programs including all design parameters.
- The design shall conform to the criteria listed below.

c. Construction Specifications:

- Construction methods specific to the proprietary retaining wall chosen. These specifications should include construction limitations including vertical clearance, right-of-way limits, etc. Submittal requirements for materials such as certification, quality, and acceptance/rejection criteria should be included. Details on connection of modular units and connection of reinforcements such that assurance of uniform stress transfer should be included.
- Any requirements not stated herein.

The submissions for proprietary retaining walls shall be treated as working drawings in accordance with Section 1.05 amended as follows:

a. 6 sets of each submission shall be supplied to the Department

b. The Contractor shall allow 21 days for the review of each submission. If subsequent submissions are required as a result of the review process, 21 days shall be allowed for review of each submission. No extensions in contract time will be allowed for the review of these submissions.

4 - Final Submissions for Proprietary Retaining Walls:

Once a proprietary retaining wall design has been reviewed and accepted by the Department, the Contractor shall submit the final plans. The final submission shall include one set of full size (approximately 24" x 36") mylar sheets and five sets of full size blue line copies.

Submission shall also adhere to "NOTICE TO CONTRACTOR – CONSTRUCTION CONTRACTOR DIGITAL SUBMISSIONS".

The final submission shall be made within 14 days of acceptance by the Department. No work shall be performed on the retaining wall until the final submission has been received.

Acceptance of the final design shall not relieve the Contractor of his responsibility under the contract for the successful completion of the work.

The actual designer of the proprietary retaining wall is responsible for the review of any shop drawings prepared for the fabrication of the wall. One set of full size blue line copies of all approved shop drawings shall be submitted to the Department's permanent records.

Submissions shall also adhere to "NOTICE TO CONTRACTOR – CONSTRUCTION CONTRACTOR DIGITAL SUBMISSIONS".

5 – General Design Requirements

a. All designs for proprietary walls and temporary earth retaining systems (if required) shall conform to the latest edition of the American Association of State Highway and Transportation Officials (AASHTO) Standard Specifications for Highway Bridges including the latest Interims published except as noted otherwise herein.

b. The wall design shall follow the dimensions of the wall envelope shown in the contract drawings.

For all proprietary walls, the top of the leveling pad or reinforced concrete toe footing shall be located at or below the bottom of the footing elevation shown on the contract drawings. If no footing elevation is shown, the minimum wall embedment shall be four feet as measured to the top of the leveling pad or toe footing.

If steps at the bottom of the wall are required, they shall be kept at or below the footing elevation shown on the contract drawings. Steps in addition to those shown on the contract drawings will be permitted at no additional cost to the Department.

c. The wall shall be designed to be within all property lines and easement lines shown on the contract drawings. If additional work areas are necessary for the construction of the proprietary retaining wall, the Contractor shall be responsible for obtaining the rights from the affected property owners. Copies of these rights shall be forwarded to the Department.

d. The top of the wall shall be at the top of the wall elevations shown on the contract drawings. Where coping or barrier is utilized, the wall face panel shall extend up into the coping or barrier a minimum of two inches. The top of the face panels may be level or sloped to meet the top of the wall line noted.

e. Cast-in-place concrete will not be an acceptable replacement for areas noted by the wall envelope, except for minor grouting of pipe penetrations and leveling required for coping or traffic barrier.

f. The wall shall be designed for a minimum live load surcharge equal to two feet of soil at a unit weight of 125 pounds per cubic foot. If there are specific live load surcharges acting on the wall, they shall also be accounted for. The minimum equivalent fluid pressure used to design the wall shall be 33 pounds per cubic foot per linear foot of wall.

g. If Lightweight Fill is shown on the contract drawings, the wall shall be designed for Lightweight Fill.

h. If shown on the contract drawings, the wall shall be designed for forces from light standards, parapet mounted signs, drainage structures and Noise Barrier.

i. If stated on the contract drawings, the wall shall be designed for seismic forces according to the AASHTO Specifications.

j. If the wall is detailed with a concrete parapet, the top two courses of prefabricated modular walls units shall be designed to support a transverse railing load of 10 kips. The 10 kip load may be distributed over the length of the parapet section between joints, but not exceeding 20 feet. Computations that verify the stability of the top two courses of the modular units shall be submitted to the Engineer.

k. The detailing and reinforcement in the parapet section above the gutterline or finished grade, including any light standard attachments, shall be as shown on the contract drawings.

l. The wall shall be designed to accommodate all roadway drainage and drainage structures as shown on the contract drawings.

m. The maximum allowable bearing pressure of the soil shall be as shown on the contract drawings. The bearing pressure stated assumes a uniform pressure distribution. If additional soils information is required by the Contractor's designer, it must be obtained by the Contractor and will not be reimbursed by the Department.

n. Parapet and Moment slab Design:

- General requirement for parapet and moment slab design:

  The parapet and moment slab shall be designed in accordance the AASHTO Standard LRFD Bridge Design Specifications – 2014, including the latest interim specifications and errata, amended as follows:

The parapet shall be designed and constructed of precast or cast-in-place concrete. The moment slab shall be designed and constructed of cast-in-place reinforced concrete.

Above the finished grade, the parapet dimensions, concrete and reinforcement shall conform to the Department's retaining wall parapet details. Below the finished grade, the parapet shall be designed to resist the forces specified in Table A13.2-1 of the AASHTO LRFD Bridge Design Specifications for the parapet types indicated below:

Parapet Type	AASHTO LRFD Test Level
42" High Standard Parapet	TL-4
32" High Standard Parapet	TL-3
Sidewalk Parapet	TL-3

The moment slab and its connection to the parapet shall be designed to resist, at a minimum, a transverse load equal to 133% of F_t. The length of the structural connection between parapet and moment slab assumed to resist transverse force F_t shall be the distance between parapet joints but not greater than 30 feet in any case. The length of the moment slab assumed to resist sliding and overturning may exceed parapet joint spacing but shall be no greater than 30 feet in any case. The moments shall be summed about the front face of the wall facing. All resistance factors shall be taken as 1.0. The internal angle of friction for the soil shall be assumed to be 34 degrees unless otherwise shown on the contract plans.

Minimum concrete cover for reinforcing steel shall be 2 inches for top bars and 3 inches for bottom bars

- Precast Concrete Parapet Alternative:

  Precast parapet sections shall be no less than 8 feet in length.

  Parapets shall include details for shear transfer between adjacent units by either concrete shear keys or steel dowels as follows:

  - Shear keys when used shall be monolithically cast in each parapet section or joint location. Shear keys shall be located vertically within the top 32 inches of the parapet and shall be a minimum of 24 inches in length with a tapered width between 3 and 4 inches, and a minimum interlock depth of 2 inches.

  - Steel dowels when used shall be a minimum of 3 in number, smooth, 14 inches long minimum, and 1 inch diameter at each parapet interface. Steel dowels shall be located in each parapet joint and spaced approximately 1 foot apart vertically. Steel dowels shall be

positioned to project equally into each adjoining parapet sections and shall be detailed to avoid impeding shrinkage and thermal movements. Bond breakers may be used with steel dowels for that purpose. Alternatively, pockets may be cast to receive steel dowels in adjacent parapet units. Pocket widths shall not exceed steel dowel diameters by more than ½ inch.

Moment slabs for precast concrete parapets shall be structurally continuous throughout the overall wall length. Construction joints are permitted in moment slabs.

- Cast-in-Place Parapet Alternative:

The minimum distance between parapet joints shall be 20 feet. Expansion and contraction joints shall be placed in accordance with Section 11.6 of the AASHTO LRFD Bridge Design specifications. Expansion and contraction joints shall be located a minimum of 10 feet from the nearest edge of a catch basin. Expansion and contraction joints shall be located a minimum of 6 feet from the centerline of light standard anchorages and junction boxes. Preformed expansion joint filler, ½ inch thick, shall be installed at the expansion joints in the parapet.

Parapets shall include details for shear transfer between sections by way of concrete shear keys or steel dowels as follows:

- Shear keys when used shall be monolithically cast in each parapet section or joint location. Shear keys shall be located vertically within the top 32 inches of the parapet and shall be a minimum of 24 inches in length with a tapered width between 3 and 4 inches, and a minimum interlock depth of 2 inches.

- Steel dowels when used shall be a minimum of 3 in number, smooth, 14 inches long minimum, and 1 inch diameter at each parapet interface. Steel dowels shall be located in each parapet joint and spaced approximately 1 foot apart vertically. Steel dowels shall be positioned to project equally into each adjoining parapet sections and shall be detailed to avoid impeding shrinkage and thermal movements. A bond breaker shall be used with steel dowels for that purpose.

Moment slabs for cast-in-place parapets shall extend to the outside face of the retaining wall as shown on the plans. Moment slabs for cast-in-place parapets shall be structurally continuous throughout the overall wall length except at parapet contraction and expansion joint locations where longitudinal reinforcing within 2 feet of the wall face shall be discontinuous for the

purpose of crack control. All remaining longitudinal reinforcing in moment slabs at parapet expansion and contraction joint locations shall be continuous. A vertical 1" deep chamfer on the exposed face of the moment should be provided in locations directly under parapet expansion and contraction joints. Construction joints are permitted in moment slabs for cast-in-place concrete.

6 - Design Requirements for Mechanically Stabilized Earth Walls: The design shall consider the internal stability of the wall mass as outlined below. The global stability of the structure, including slope stability, bearing capacity safety, and total and differential settlement is the responsibility of the Department.

a. Hydrostatic Forces: Unless specified otherwise, when a design high water surface is shown on the contract drawings at the face of the wall, the design stresses calculated from that elevation to the bottom of wall must include a three foot minimum differential head of saturated backfill. In addition, the buoyant weight of saturated soil shall be used in the calculation of pullout resistance.

b. Backfill: The friction angle of the Pervious Structure Backfill used in the reinforced fill zone for the internal stability design of the wall shall be assumed to be 34 degrees unless shown otherwise on the contract drawings. The friction angle of the in-situ soils shall be assumed to be a maximum of 30 degrees unless otherwise shown on the Contract drawings.

c. Soil Reinforcement: The soil reinforcement shall be the same length from the bottom to the top of each wall section. The reinforcement length defining the width of the entire reinforced soil mass may vary with wall height along the length of wall. The minimum length of the soil reinforcement shall be seventy percent of the wall height, H, or eight feet, whichever is greater.

The soil reinforcement length shall be sufficient to satisfy the sliding, overturning and pullout factors of safety designated in AASHTO Specifications and the minimum lengths required for external stability as recommended by the Department. Calculation of stresses and pullout factors of safety shall be in accordance with the AASHTO Specifications for Highway Bridges.

Calculations for stresses and factors of safety shall be based on assumed conditions at the end of the design life. The design life shall be 75 years unless otherwise indicated on the contract drawings. The design of soil reinforcements shall account for section loss as outlined in the AASHTO Specifications. All soil reinforcement shall be hot dipped galvanized.

7 - Design Requirements for Prefabricated Modular Walls: The general design of the wall shall be according to the AASHTO Specifications. The design shall consider the stability at each level of modules. The global stability of the structure, including slope stability, bearing capacity safety, and total and differential settlement is the responsibility of the Department.

a. Hydrostatic Forces: Unless specified otherwise, when a design high water surface is shown on the contract drawings at the face of the wall, the design stresses calculated from that elevation to the bottom of wall must include a three foot minimum differential head of saturated backfill. In addition, the buoyant weight of saturated soil shall be used in the calculation of pullout resistance.

b. Backfill: The friction angle of the Pervious Structure Backfill shall be assumed to be 34 degrees if sufficient amounts of pervious backfill are used. The friction angle of the in-situ soils shall be assumed to be a maximum of 30 degrees unless otherwise shown on the Contract drawings.

c. Infill: The maximum assumed unit weight of infill material used for determining the factor of safety for overturning shall be 100 pounds per cubic foot. If Doublewal modules are to be filled with crushed stone, the maximum assumed unit weight of the infill shall be 80 pounds per cubic foot.

d. Safety Factors: The minimum factors of safety shall be as specified in the AASHTO Specifications amended as follows. The factor of safety for T-Wall shall be 1.5 for pullout of the concrete stem. Shear keys are not to be included in these computations. Only resisting forces developed beyond the theoretical failure plane may be used in these computations.

Materials:

1 - Cast-in Place Concrete Walls: The materials furnished and used in the work shall be those prescribed within the Standard Specifications for Roads, Bridges and Incidental Construction, including supplemental specifications and applicable special provisions.

2 - Prefabricated Modular and Mechanically Stabilized Earth Walls: Materials shall conform to the following requirements and those not listed below shall be as prescribed within the Standard Specifications for Roads, Bridges and Incidental Construction, including supplemental specifications and applicable special provisions.

a. Concrete: The concrete shall conform to the requirements of Section M.03 and as follows:

Concrete for all precast components shall be air-entrained composed of portland cement, fine and coarse aggregates, admixtures and water. The air-entraining feature may be obtained by the use of either air-entraining portland cement or an approved air-entraining admixture. The entrained-air content shall be not less than four percent or more than seven percent. The concrete utilized shall be a mix which will attain a minimum 28-day strength (f'_c) of 4,500 pounds per square inch. The mix design shall be furnished to the Engineer.

Concrete for footings or unreinforced leveling pads shall be conform to the requirements of Class "A" Concrete. Class "F" Concrete shall be used for cast-in-place concrete copings.

Concrete Finish: Unless otherwise indicated on the contract drawings or elsewhere in the specifications, the concrete surface for the exposed face shall have an ordinary steel form finish. All non-exposed surfaces shall have a unformed finish which shall be free of open pockets of aggregate and surface distortions in excess of 1/4 inch.

Acceptance Criteria for Precast Components: Precast components shall be accepted for use in wall construction provided the concrete strength meets or exceeds the minimum compressive strength requirement, the soil reinforcement connection devices and the panel or module dimensions are within the manufacture's allowable tolerances and any chipping, cracks, honeycomb or other defects are within acceptable standards for precast concrete or repaired as determined by the Engineer.

It is recognized that certain cracks and surface defects are not detrimental to the structural integrity of the precast components if properly repaired. The Engineer shall determine the need for and proper method of such repair. All repairs shall be approved by the Engineer prior to acceptance of the precast component for use in wall construction.

Marking: The date of manufacture, the production lot number, and the piece-mark shall be clearly marked on the side of each panel or module.

b. Reinforcing Steel: Reinforcing steel shall conform to the requirements of ASTM A615, Grade 60.

c. Attachment Devices for Prefabricated Modular Walls: All structural connectors shall be hot dipped galvanized according to the requirements of ASTM A123 (AASHTO M-111). The minimum thickness of the galvanizing shall be based on the service life requirements in the AASHTO Specifications.

d. Soil Reinforcing and Attachment Devices for MSE Walls:

Soil Reinforcement: All soil reinforcement and structural connectors shall be hot dipped galvanized according to the requirements of ASTM A123 (AASHTO M-111). The minimum thickness of the galvanizing shall be based on the service life requirements as previously stated.

Steel strip reinforcement shall be hot rolled to the required shape and dimensions. The steel shall conform to AASHTO M223 (ASTM A572) Grade 65 unless otherwise specified.

Welded wire fabric reinforcement shall be shop fabricated from cold-drawn wire of the sizes and spacings shown on the plans. The wire shall conform to the requirements of ASTM A82, fabricated fabric shall conform to the requirements of ASTM A185.

Connection Hardware: Connection hardware shall conform to the details on the plans and the requirements in the special provisions or the plans. All fasteners shall be galvanized

according to the requirements of ASTM A-153 (AASHTO M-232). The minimum thickness of the galvanizing shall be based on the service life requirements as previously stated.

e. Joint Materials: All horizontal and vertical joints between panels shall be covered by a geotextile (separation-high survivability) conforming to the requirements of Article M.08.02-26. The minimum width and lap shall be twelve inches. Details of installation including connection of the geotextile to coping shall be provided.

f. Backfill: Backfill shall be Pervious Structure Backfill conforming to the requirements of Articles M.02.05 and M.02.06, or Lightweight Fill conforming to the Special Provision "Lightweight Fill"; as applicable.

In addition, the backfill for Mechanically Stabilized Earth Walls shall conform to all of the following requirements:

Electrochemical Requirements: The backfill material shall conform to the following electrochemical requirements:

PROPERTY	REQUIREMENT	TEST METHODS
Resistivity at 100% saturation	Minimum 3000 ohm-cm	ASTM G-57-78 AASHTO T-288-91I
pH	Acceptable Range 5-10	ASTM G-51-77 AASHTO T-289-91I
Chlorides	Maximum 100 ppm	ASTM D-512-88 AASHTO T-291-91I
Sulfates	Maximum 200 ppm	ASTM D-516-88 AASHTO T-290-91I

g. Smooth Steel dowels : Steel dowels used in parapets joints shall conform to the requirements of ASTM A36 and shall be galvanized in conformance with the requirements of ASTM A153.

Construction Methods:

1 - Cast-in-Place Concrete Walls: All construction methods for cast-in-place retaining walls shall be in accordance with the detailed requirements prescribed for the construction the appropriate items as specified in the Standard Specifications for Roads, Bridges, and Incidental Construction.

2 - Prefabricated Modular Walls: All construction methods for items not listed below shall be in accordance with the detailed requirements prescribed for the construction of the appropriate items as specified in the Standard Specifications for Roads, Bridges, and Incidental Construction.

a. Special Surface Treatment: If a special surface finish is proposed for the wall, before proceeding with production, a model modular unit shall be provided by the fabricator for the Engineer's approval to establish a guide and standard for the type of finish to be furnished on the exposed face. This model shall be kept at the fabricator's plant to be used for comparison purposes during production. Formed surfaces other than the exposed face shall not require a special finish.

b. Inspection and Rejection: The quality of materials, the process of manufacture, and the finished units shall be subject to inspection by the Engineer prior to shipment.

Modular units which have imperfect molding, honeycomb, open texture concrete, or broken corners shall be repaired to the satisfaction of the Engineer or shall be rejected. Insufficient compressive strength shall also be cause for rejection.

Modular units with special surface treatments shall be rejected if there are variations in the exposed face that deviate from the approved model as to color or texture in accordance with precast concrete industry standards.

c. Marking: The date of manufacture shall be clearly scribed on an inside surface of each modular unit.

d. On Site Representative: A qualified and experienced representative from the wall supplier shall be at the site at the initiation of the wall construction to assist the Contractor and the Engineer. If there is no more than one wall on a project then this criteria will apply to construction of the initial wall only. The representative shall also be available on as needed basis, as requested by the Engineer.

e. Installation: The modular units shall be installed in accordance with manufacturer's recommendations. Special care shall be taken in setting the bottom course of units to true line and grade.

The vertical joint opening on the front face of the wall shall not exceed 3/4 inch. Vertical tolerances and horizontal alignment tolerances measured from the face line shown on the contract drawings shall not exceed 3/4 inch when measured along an eight straightedge. The overall tolerance of the wall from top to bottom shall not exceed 1/2 inch per eight feet of wall height or one inch total, whichever is the lesser, measured from the face line shown on the contract drawings. A strip of geotextile shall be installed at all vertical joints.

Assembly of the various components shall be performed in such a manner that no undue strain or stress is placed on any of the members that constitute the completed structure.

f. Backfilling:

For sections where Lightweight Fill is shown on the contract drawings, all infill or backfill shall be placed according to the Special Provision, “Lightweight Fill”; supplemented according to the following:

For sections where Lightweight Fill is not specified, backfill shall be according to the following:

Doublewal:

Infill for modular units shall be placed, one course at a time, in lifts not exceeding two feet in thickness. The dry density of each lift of Pervious Structure Backfill placed inside the modular units, after compaction, shall not be less than 90 percent of the dry density for that material when tested in accordance with AASHTO T-180, Method D. Each lift shall be thoroughly compacted with a vibratory tamping device.

Placement of the Pervious Structure Backfill behind the wall shall closely follow erection of successive courses of modular units. At no time shall the difference in backfill elevation between the interior and exterior of the wall exceed six feet.

The units may be backfilled with crushed stone, provided that the design of the wall was based on a density of 80 pounds per cubic foot.

All Pervious Structure Backfill placed outside of the modular units shall be placed in accordance with the requirements of Article 2.16.03.

T-Wall:

Backfill placement shall closely follow erection of each course of modules. Backfill shall be placed in such a manner as to avoid any damage or disturbance to the wall materials or misalignment of the modules. Any wall materials which become damaged or disturbed during backfill placement shall be either removed and replaced at the Contractor's expense or corrected, as directed by the Engineer. Any backfill material placed within the wall envelope which does not meet the requirements of this specification shall be corrected or removed and replaced at the Contractor's expense.

Backfill shall be compacted to 95 percent of the maximum density as determined by AASHTO T-99, Method C or D (with oversize correction, as outlined in Note 7).

The moisture content of the backfill material prior to and during compaction shall be uniform throughout each layer. Backfill material shall have a placement moisture content less than or equal to the optimum moisture content. Backfill material with a placement moisture content in excess of the optimum moisture content shall be removed and reworked until the moisture content is uniform and acceptable throughout the entire lift. The optimum moisture content shall be determined in accordance with AASHTO T-99, Method C or D (with oversize correction, as outlined in Note 7).

If 30 percent or more of the backfill material is greater than 3/4 inch in size, AASHTO T-99 is not applicable. For such a material, the acceptance criterion for control of compaction shall be either a minimum of 70 percent of the relative density of the material as determined by a

method specification provided by the wall supplier, based on a test compaction section, which defines the type of equipment, lift thickness, number of passes of the specified equipment, and placement moisture content.

The maximum lift thickness after compaction shall not exceed ten inches. The Contractor shall decrease this lift thickness, if necessary, to obtain the specified density.

Compaction within three feet of the face of the modules shall be achieved by at least three passes of a lightweight mechanical tamper, roller or vibratory system. The specified lift thickness shall be adjusted as warranted by the type of compaction equipment actually used. Care shall be exercised in the compaction process to avoid misalignment or damage to the module Heavy compaction equipment shall not be used to compact backfill within three feet of the wall face.

At the end of each day's operation, the Contractor shall slope the last level of backfill away from the wall facing to direct runoff of rainwater away from the wall face. The Contractor shall control and divert runoff at the ends of the wall such that erosion or washout of the wall section does not occur. In addition, the Contractor shall not allow surface runoff from adjacent areas to enter the wall construction site.

3 - Mechanically Stabilized Earth Walls: All construction methods for items not listed below shall be in accordance with the detailed requirements prescribed for the construction of the appropriate items as specified in the Standard Specifications for Roads, Bridges, and Incidental Construction.

a. Special Surface Treatment: If a special surface finish is proposed for the wall, before proceeding with production, a model face panel shall be provided by the fabricator for the Engineer's approval to establish a guide and standard for the type of finish to be furnished on the exposed face. This model shall be kept at the fabricator's plant to be used for comparison purposes during production. Formed surfaces other than the exposed face shall not require a special finish.

b. Foundation Preparation: The foundation for the structure shall be graded level for a width equal to or exceeding the length of the soil reinforcements, or as shown on the plans. Prior to wall construction, the foundation, if not in rock, shall be compacted. Any foundation soils found to be unsuitable shall be removed and replaced with granular fill.

At each panel foundation level, an un-reinforced concrete leveling pad shall be provided as shown on the plans. The leveling pad shall be cast to the design elevations as shown on the plans.

c. On Site Representative: A qualified and experienced representative from the wall supplier shall be at the site at the initiation of the wall construction to assist the Contractor and the Engineer. If there is no more than one wall on a project then this criteria will apply to

construction of the initial wall only. The representative shall also be available on as needed basis, as requested by the Engineer.

d. Wall Erection: Panels shall be placed in successive horizontal lifts in the sequence shown on the plans as backfill placement proceeds. As backfill material is placed behind the panels, the panels shall be maintained in a vertical position. Vertical tolerances (plumbness) and horizontal alignment tolerances shall not exceed 3/4 inch in eight feet. The allowable offset in any panel joint shall be 3/4 inch. The overall vertical tolerance of the wall (plumbness from top to bottom) shall not exceed 1/2 inch per eight feet, or one inch total, which ever is the lesser, measured from the face line shown on the plans.

e. Placement of Reinforcements: Bending of reinforcements in the horizontal plane that results in a permanent deformation in their alignment shall not be allowed. Gradual bending in the vertical direction that does not result in permanent deformations is allowable.

Connection of reinforcements to piles or bending of reinforcements around piles shall not be allowed. A structural connection (yoke) from the wall panel to the reinforcement shall be used whenever it is necessary to avoid cutting or excessive skewing of reinforcements due to pile or utility conflicts.

Soil reinforcements shall be placed normal to the face of the wall, unless otherwise shown on the plans.

f. Backfill Placement: Backfill placement shall closely follow erection of each course of panels. Backfill shall be placed in such a manner as to avoid any damage or disturbance to the wall materials or misalignment of the facing panels. Any wall materials which become damaged or disturbed during backfill placement shall be either removed and replaced at the Contractor's expense or corrected, as directed by the Engineer. Any backfill material placed within the reinforced soil mass which does not meet the requirements of this specification shall be corrected or removed and replaced at the Contractor's expense.

Backfill shall be compacted to 95 percent of the maximum density as determined by AASHTO T-99, Method C or D (with oversize correction, as outlined in Note 7).

The moisture content of the backfill material prior to and during compaction shall be uniform throughout each layer. Backfill material shall have a placement moisture content less than or equal to the optimum moisture content. Backfill material with a placement moisture content in excess of the optimum moisture content shall be removed and reworked until the moisture content is uniform and acceptable throughout the entire lift. The optimum moisture content shall be determined in accordance with AASHTO T-99, Method C or D (with oversize correction, as outlined in Note 7).

If 30 percent or more of the backfill material is greater than 3/4 inch in size, AASHTO T-99 is not applicable. For such a material, the acceptance criterion for control of compaction shall be either a minimum of 70 percent of the relative density of the material as determined by a

method specification provided by the wall supplier, based on a test compaction section, which defines the type of equipment, lift thickness, number of passes of the specified equipment, and placement moisture content.

The maximum lift thickness after compaction shall not exceed ten inches, regardless of the vertical spacing between layers of soil reinforcements. The Contractor shall decrease this lift thickness, if necessary, to obtain the specified density. Prior to placement of the soil reinforcements, the backfill elevation at the face shall be level with the connection after compaction. From a point approximately three feet behind the back face of the panels to the free end of the soil reinforcements the backfill shall be two inches above the attachment device elevation unless otherwise shown on the plans.

Compaction within three feet of the back face of the panels shall be achieved by at least three passes of a lightweight mechanical tamper, roller or vibratory system. The specified lift thickness shall be adjusted as warranted by the type of compaction equipment actually used. Care shall be exercised in the compaction process to avoid misalignment of the panels or damage to the attachment devices. Heavy compaction equipment shall not be used to compact backfill within three feet of the wall face.

At the end of each day's operation, the Contractor shall slope the last level of backfill away from the wall facing to direct runoff of rainwater away from the wall face. The Contractor shall control and divert runoff at the ends of the wall such that erosion or washout of the wall section does not occur. In addition, the Contractor shall not allow surface runoff from adjacent areas to enter the wall construction site.

Method of Measurement: This work will be paid for on a lump sum basis and will not be measured for payment.

Basis of Payment: This work will be paid for at the contract lump sum for "RETAINING WALL (SITE NO. X)", complete in place, which price shall include all work shown within the pay limits shown on the contract drawings for the retaining wall including but not limited to the following:

1. Design and construction of the proprietary retaining wall.

2. Excavation required for the construction of the retaining wall.

3. Removal of existing masonry required for the construction of the retaining wall.

4. Design and construction of temporary earth retaining systems to retain the existing facilities during construction.

5. The furnishing, placing and compacting of all backfill within the payment lines.

6. The furnishing and placing of backfill drainage systems for the wall.

7. The furnishing and placing of rigid metal conduit, junction boxes, light standard anchorages, and other electrical appurtenances located within the wall proper.

8. The furnishing and placing of parapet mounted sign anchorages located within the wall proper.

9. Services of the On-Site Representative.

10. Any other work and materials shown on the plans for the retaining wall.

The price shall also include all materials, equipment, tools and labor incidental thereto.

If bedrock or boulders in excess of one cubic yard are encountered in the excavation, it shall be paid for under the item "Structure Excavation - Rock".

Pay Item	Pay Unit
Retaining Wall (Site No. 1)	LS
Retaining Wall (Site No. 3)	LS
Retaining Wall (Site No. 4)	LS
Retaining Wall (Site No. 6)	LS
Retaining Wall (Site No. 7)	LS

ITEM #0601789.10A - STAIN PROTECTION (SITE NO 10)
ITEM #0601789.15A - STAIN PROTECTION (SITE NO 15)

Description:

Work under this item shall consist of furnishing, installing and maintaining temporary coverings to protect substructure surfaces from rust stains as shown on the plans, in accordance with the specifications and as directed by the Engineer.

Materials:

Temporary coverings shall be reinforced polyethylene film with a minimum thickness of 4 mils. Tie wires and attachment devices used to hold and fasten the temporary coverings in place shall be manufactured from non-staining material.

Rust stain remover shall effectively remove rust stains and shall not harm or discolor concrete, steel, or other materials with which it may come into contact.

Construction Methods:

Temporary coverings shall be installed over all concrete surfaces that may be stained by water dripping from the weathering steel superstructure. The temporary coverings shall be installed prior to erection of any structural steel and shall not be removed until after all deck joints in the superstructure have been completed or sealed as shown on the plans. The coverings shall be securely fastened into place at all times. Damaged coverings shall be repaired immediately. The Engineer shall approve the limits and installation of all temporary coverings.

All staining which takes place due to ineffective coverings shall be removed by methods approved by the Engineer, at no additional cost to the State.

Method of Measurement:

This work, being paid for on a lump sum basis, will not be measured for payment.

Basis of Payment:

This work will be paid for at the contract lump sum price for "Stain Protection", at the site number designated, which price shall include all materials, equipment, tools, labor and work incidental thereto.

Pay Item	Pay Unit
Stain Protection (Site No. 10)	LS
Stain Protection (Site No. 15)	LS

ITEM #0601995A - CONCRETE FILLED BAGS

Description:

This item consists of placing fabric bags and filling them with concrete or cementitious grout as shown on the plans or as directed by the Engineer to fill voids in the existing scour protection system. This item is intended to be constructed in the dry.

Materials:

Fabric Bags shall be high strength water permeable fabric woven of 100 percent nylon or spun polyester providing a minimum fabric weight of 7.5 oz per square yard per single layer. Minimum grab tensile strength per single fabric layer shall be over 200 lbs/in in each direction. Thread count shall be designed for optimum filtering characteristics for removal of excess mix water and to restrict the possibility of foreign substances or river water from entering the concrete filled fabric bags. Fabric bags shall be constructed of double layer material with seams folded and double stitched. Each bag shall be provided with a self-closing inlet valve to accommodate insertion of a concrete pumping hose. Maximum bag size shall be as noted in the plans. Bags shall be manufactured specifically for scour mitigation.

Concrete shall be a pumpable fine aggregate Portland cement concrete. Materials shall conform to the requirements of Article M.03.01. The concrete shall have a minimum strength of 3000 psi at 28 days.

Construction Methods:

Fabric bags shall be placed at the locations shown on the plans or as ordered by the Engineer. Fabric bags shall be sized to fit securely and positioned to avoid dislodging or leaking when concrete is pumped to fill the bags. The Contractor shall conduct placement operations such that no concrete is released into the river. Care shall be taken not to exceed the bursting strength of the bags when filling. Broken bags shall be immediately removed and replaced. Bags shall be overlapped with previously placed bags in larger voids requiring multiple bags, and the bags shall be filled to match the surrounding ground levels around voids being filled.

Method of Measurement:

Concrete filled bags will be measured in place per cubic yard completed and accepted within the limits as shown on the plans or as ordered by the Engineer.

Basis of Payment:

This work will be paid for at the contract unit price per cubic yard for "Concrete Filled Bags", complete in place, which price shall include the concrete in the bags, fabric bags, equipment, tools and labor incidental thereto.

Pay Item	Pay Unit
Concrete Filled Bags	CY

ITEM #0602891A - DOWEL BAR SPLICER SYSTEM – EPOXY COATED

Description: Work under this item consists of furnishing and installing an epoxy coated dowel bar splicer system, where specified on the plans or as directed by the Engineer.

Materials: The dowel bar splicer system shall conform to the applicable requirements of Article M.06.01, Grade 60, and be free of external welding and marking. It shall be furnished with an integral flange, with nailing holes, and threaded with UNC or UN threads to a depth equal to 1.0 times the nominal diameter of the treads plus ¼-inch.

The dowel-in shall conform to the applicable requirements of Article M.06.01, Grade 60, with rolled thread corresponding to the dowel bar splicer. The root diameter of such thread shall offer a minimum cross sectional area of the nominal rebar size of the bar reinforcement being spliced by the system.

The completed splice shall meet or exceed the tensile requirements as specified in AASHTO LRFD Bridge Design Specifications, section 5.11.5.2.2.

Materials for epoxy coated dowel bar splicers shall be as specified under the item "Deformed Steel Bars – Epoxy Coated."

Construction Methods:
Construction methods for epoxy coated dowel bars shall be as specified under the item "Deformed Steel Bars – Epoxy Coated."

Before fabricating any materials, the Contractor shall submit shop drawings material lists, material designations and dowel bar lengths to the Engineer for approval in accordance with Article 1.05.02. Any expenses incidental to the revision of materials furnished in accordance with shop drawings and order lists to make them comply with the requirements of the plans, specifications and special provisions shall be borne by the Contractor.

All materials shall be stored on skids or other support above the ground and shall be protected from injury and surface contamination which will impair its bonding qualities.

Prior to placement of concrete, the dowel bars shall be cleaned of dirt, paint, oil, grease or other foreign materials.

Dowel bars shall be shipped in standard bundles, tagged and marked in accordance with the Code of Standard Practice of the Concrete Reinforcement Steel Institute.

All dowel bars shall be accurately placed in the position shown on the plans and firmly held during the placing and setting of concrete. The threaded ends of the dowel bars shall be properly aligned and screwed into the receiving end. The dowel bar shall be fully seated and properly

tightened to develop full capacity of the system. The method of tightening shall not damage the epoxy coating and shall be acceptable to the Engineer.

Method of Measurement: This work will be measured for payment by the number of two component dowel bar splicer systems installed, complete and accepted by the Engineer.

Basis Payment: This work will be paid for at the contract unit price per each for "Dowel Bar Splicer System – Epoxy Coated", which price shall include furnishing, fabricating, placing and all materials, equipment, tools, labor and work incidental thereto.

This work will also include all costs incidental to the preparation and furnishing of material lists and placement diagrams.

Pay Item	**Pay Unit**
Dowel Bar Splicer System – Epoxy Coated	Each

ITEM #0602910A - DRILLING HOLES AND GROUTING DOWELS

Description: The intent of this item is to drill holes and grout dowels and reinforcing steel for transverse and longitudinal concrete pavement joints. Work under this item shall consist of drilling holes in concrete and grouting dowels or reinforcing steel for concrete for pavement at the locations shown on the plans, in accordance with the plans, the manufacturer's recommendations, and as directed by the Contractor and approved by the Department.

This item only includes drilling holes and grouting dowels and reinforcing steel for joints in the new concrete pavement section on I-91 NB in Hartford to the limits shown on the plans. Drilling holes for concrete pavement replacement sections is included in a separate item Concrete Pavement Replacement for Roadway (Full-Depth).

Materials: The bonding material shall be a compound specially formulated to anchor steel bars in holes drilled into concrete for the purpose of resisting tension pull-out. The bonding material shall be selected from the Connecticut Department of Transportation Approved Product List.

The grout shall be a non-shrink grout conforming to Sub article M.03.01-12

The chemical anchoring material shall conform to Sub article M.03.01-15

A Materials Certificate and Certificate of Compliance shall be required for the adhesive bonding material in accordance with Part 3 Section 1.06.07, certifying the conformance of this material to the requirements stated herein.

Construction Methods: Before fabricating and materials, the Contractor shall submit manufacture's specifications and installation requirements for the chemical anchoring material to the Department for review in accordance with Part 3 Section 1.05.02. The Contractor shall submit the following to the Department for approval: type of drill, diameter of bit, method of cleaning holes and method of placement of the adhesive bonding material. Specifications and recommendations for the aforementioned may be obtained from the manufacturer of the adhesive bonding material.

The depth and diameter of each hole shall be as shown on the plans. If the diameter of a hole is not shown, the diameter of the hole shall conform to the manufacturer's recommendations for the diameter of the rebar being anchored.

Prior to placing the chemical anchoring material in the holes, the holes shall be cleaned of all dirt, moisture, dust and other foreign material. The reinforcing bars and the chemical anchoring material or grout shall be installed in the holes in accordance with the chemical anchoring material or grout manufacturer's recommendations. When grouting, each hole shall be blown clean with an air jet and then flushed with a jet of clean water. In the water-flushing operation, the pressure hose shall be extended to the bottom of the hole several times and withdrawn gradually each time. After flushing, the vertical holes shall be left full of clean water for a period

of 6 hours. Immediately prior to grouting all water shall be removed and the free water shall be removed with an air jet.

The weight of the drill shall not exceed 20 pounds. The reinforcing dowels shall be able to develop a pull-out resistance of 90 percent of their nominal yield strength when bonded at the embedment depths provided. The Contractor shall provide the minimum cover for the dowels as shown on the plans. If the existing reinforcing steel is encountered during drilling, the holes may be relocated only if approved by the Department. Drilling methods shall not cause spalling, racking, or other damage to the concrete. Those areas damaged by the Contractor shall be repaired by him in a manner suitable to the Department and at no expense to the State. The Contractor shall take necessary precautions to prevent any materials from falling onto the river below. For the adhesive bonding materials, a Certificate of Compliance and a Materials Certificate will be required in accordance with Part 3 Section 1.06.07, confirming the conformance of the adhesive bonding material to the requirements set forth these specifications.

Method of Measurement: This work will be measured for payment by each dowel or anchor rods grouted into drill holes, completed and accepted.

Basis of Payment: This work will be paid for at the contract unit price per each for "Drilling Holes and Grouting Dowels", which price shall include drilling and preparing holes, and applying adhesive bonding material in the hole. It shall also include all materials, except dowels, and all equipment, tools and labor incidental thereto.

Note: Furnishing dowels and reinforcing steel will be paid for under the appropriate reinforcing steel item "Deformed Steel Bars (Type)".

Pay Item	Pay Unit
Drilling Holes and Grouting Dowels	EA

ITEM #0602936A - DRILLING AND GROUTING REINFORCING BARS

Description: Work under this item shall consist of drilling holes into the existing concrete and grouting reinforcing bars into the holes. All work shall be as shown on the plans or as directed by the Engineer.

Materials: The grout shall be a non-shrink grout conforming to Article M.03.05.

The adhesive bonding material shall be a resin compound specially formulated to anchor steel bars in holes drilled into concrete for the purpose of resisting tension pull-out. The adhesive bonding materials shall conform to the requirements of M.03.07 of Form 817 and shall be selected from the Connecticut Department of Transportation Approved Product List.

Certification: A Materials Certificate shall be required for the adhesive bonding material in accordance with Article 1.06.07, certifying the conformance of this material to the requirements stated herein.

Construction Methods: The Contractor shall drill holes into the concrete to the depth and at the locations shown on the plans.

The Contractor shall submit the following to the Engineer for approval: type of drill, diameter of bit, method of cleaning holes and method of placement of the grout or adhesive bonding material. Specifications and recommendations for the aforementioned may be obtained from the manufacturer of the grout or adhesive bonding material.

The reinforcing bars shall be able to develop a pull-out resistance of 125 percent of their nominal yield strength when bonded at the embedment depths provided.

The Contractor shall provide the minimum cover for the bars as shown on the plans.

If the existing reinforcing steel is encountered during drilling, the holes may be relocated only if approved by the Engineer. When holes are relocated, the abandoned holes shall be filled with non-shrink grout or as directed by the Engineer.

Drilling methods shall not cause spalling, cracking, or other damage to the concrete. Those areas damaged by the Contractor shall be repaired by him in a manner suitable to the Engineer and at no expense to the State.

The materials and method used for this work should be suitable to the conditions encountered in the field.

Method of Measurement: This work will be measured for payment by the number of linear feet of drilled holes in which the bars are embedded and accepted. Holes encountering existing reinforcing steel that are terminated and patched will not be measured for payment.

Basis of Payment: This work will be paid for at the contract unit price per linear foot for "Drilling and Grouting Reinforcing Bars" which price shall include drilling and preparing holes and grouting reinforcing bars. It shall also include all material, except reinforcing bars, and all equipment, tools and labor incidental thereto. Reinforcing bars shall be furnished under the item "Deformed Steel Bars" or "Deformed Steel Bars – Epoxy Coated", as applicable.

Pay Item	Pay Unit
Drilling and Grouting Reinforcing Bars	L.F.

ITEM #0602937A - DRILLING AND GROUTING ANCHOR BOLTS

Description:

Work under this item shall consist of drilling holes in concrete and furnishing and grouting steel anchor bolts, nuts and washers at the bearing locations shown on the plans, in accordance with the plans, the manufacturer's recommendations, and as directed by the Engineer.

Materials: The materials shall conform to the following requirements:

1. The chemical anchor material shall be a resin compound specially formulated to anchor steel anchor bolts in holes drilled into concrete for the purpose of resisting tension pull-out. The chemical anchor material shall conform to Article M.03.07 of the Standard Specifications and be selected from the Department's Qualified Products List.

2. The anchor rods shall conform to Section M.06.02, except that the material shall be as specified on the Contract drawings.

3. Nuts shall conform to ASTM A563, Grade DH and shall be galvanized in accordance with ASTM A153.

4. Washers shall conform to ASTM F436, Type 1 and shall be quenched, tempered and galvanized in accordance with ASTM A153.

Construction Methods:

Before fabricating any materials, the Contractor shall submit shop drawings to the Engineer for review in accordance with Article 1.05.02.

These drawings shall include, but not be limited to the following:

1. Location and sizes of anchor bolts
2. Material lists
3. Material designations
4. Type of drill
5. Diameter of bit
6. Method of cleaning holes
7. Method of placement of the chemical anchor material

Specifications and recommendations for the aforementioned may be obtained from the manufacturer of the chemical anchor material. The weight of the drill shall not exceed 20 pounds.

The anchor bolts shall be able to develop a pull-out resistance of 90 percent of their nominal yield strength when bonded at the embedment depths provided.

Holes shall be drilled into the concrete at the locations shown on the plans. Core drilling is only allowed at locations indicated on the plans.

The depth and diameter of the hole shall conform to the manufacturer's recommendations for the diameter of the rod being anchored.

Drilling methods shall not cause spalling, cracking, or other damage to the existing concrete and existing reinforcing bars. Those areas damaged by the Contractor shall be repaired by him in a manner suitable to the Engineer and at no expense to the State.

If obstructions are encountered or drilled holes are out of alignment such that they cannot be used for anchor rod installation, the hole shall be abandoned and filled with non-shrink grout.

Prior to placing the chemical anchoring material in the holes, the holes shall be cleaned of all dirt, moisture, concrete dust and other foreign material. The anchor bolts or rods and the chemical anchoring material shall be installed in the drilled holes in accordance with the chemical anchoring material manufacturer's recommendations.

The Contractor, as directed by the Engineer, shall take adequate precautions to prevent any materials from dropping to the area below, which may result in damage to any existing construction or to adjoining property. Should any damage occur to the structure as a result of the Contractor's operations, the Contractor shall make repairs at his own expense. The repair work shall be approved in advance and shall be of a high quality acceptable to the Engineer.

Method of Measurement:

Anchor bolt or rod grouted into a drilled hole, completed and accepted, will be counted for payment based on linear feet of anchor rod embedded in concrete as required by the design plans or manufactures recommendations. Holes that are unsuitable and cannot be used for anchor bolt installation, will not be counted for payment.

Basis of Payment:
This work will be paid for at the contract unit price per linear foot for "Drilling and Grouting Anchor Bolts", which price shall include drilling, furnishing and installing the chemical anchoring material and anchor bolts in the holes and all material, equipment, tools, labor and work incidental thereto.

Pay Item	Pay Unit
Drilling and Grouting Anchor Bolts	L.F.

ITEM #0602980A - CLEAN AND COAT EXPOSED REINFORCING STEEL

Description: Work under this item shall consist of the removal of loose or delaminated concrete from the underside of existing bridge decks or stay-in-place forms by mechanical methods and the cleaning and coating of exposed reinforcing steel with epoxy resin, as directed by the Engineer.

Materials:

1. Epoxy Resin: The epoxy resin shall be a 2 component, moisture tolerant system with a minimum solids content of 65%, which meets the following requirements:
   a) Physical Requirements of (Mixed) Epoxy Resin System: A mixture of both components in the proportions recommended by the manufacturer shall have the following properties and meet the following test requirements:
      Viscosity – approximately 2000 centipoises
      Pot life – approximately 30 minutes
      Modulus of Elasticity – 190 ksi (ASTM D638)
      Resistance to Abrasion – 0.03 gm loss after 1000 cycles (Taber Abrader)
      Resistance to Cracking – No splitting or loss of bond of a 2.5 mil thickness with 1/8 in mandrel (ASTM D522)
   b) Packaging and Marking: The 2 components of the epoxy resin system furnished under these specifications shall be supplied in separate containers, which are non-reactive with the materials contained therein. The size of the container shall be such that the recommended proportions of the final mixture can be obtained by combining 1 container of 1 component with 1 or more whole containers of the other component.

      Containers shall be identified as base polymer and reacting system, and shall show the mixing directions and usable temperature range as defined by these specifications. Each container shall be marked with the name of the manufacturer, the lot or batch number, the date of packaging, pigmentation if any, and the quantity contained therein in pounds and gallons.

      Printed instructions from the manufacturer for mixing and applying the material shall be included.

      Potential hazards shall be so stated on the package in accordance with the Federal Hazardous Products Labeling Act.
2. Sampling: A representative sample of each component sufficient for the test specified shall be taken by a Department representative either from a well-blended bulk lot prior to packaging or by withdrawing 3 fluid ounce samples from no less than 5% by random selection of the containers comprising the lot or shipment. Unless the samples of the same component taken from containers show evidence of variability, they may be blended into a single composite sample to represent that component. The entire lot of both components may be rejected if samples submitted for testing fail to meet any requirements of this specification.
3. Control of Materials: A Materials Certificate will be required in accordance with Article 1.06.07, certifying the conformance of the epoxy resin to the requirements set forth in this specification.

Construction Methods:

1. Inspection of the Deck Underside: Before any existing concrete is removed from the underside of the deck, the Contractor will provide the Engineer clear access to the underside of the deck. During this time, the Engineer will perform an inspection of the deck and designate areas where concrete removal is required. The inspection will utilize visual assessment as well as sounding for delamination (hammer tapping).

   The Contractor must inform the Engineer, in writing, of the date that the bridge deck will be available for inspection operations and the method which will be used for access. Notification shall be given to the Engineer at least 7 days prior to the date so that the Engineer can plan accordingly and verify that the proposed method of access is acceptable.

   The Contractor will not perform any work to the deck, until all necessary inspection operations have been performed, unless given permission in writing by the Engineer. The Contractor shall include the time required for inspection in its overall construction schedule and shall include all costs associated with providing access for the Engineer in the bid unit price.
2. Removal of Deteriorated Concrete: All deteriorated concrete designated for removal under this item, shall be removed within the limits shown on the plans and where ordered by the Engineer. The lateral limits of each area of concrete to be removed will be delineated by the Engineer and suitably marked. The Engineer will be sole determiner of what constitutes deteriorated concrete, using sounding methods or other evaluation measures at his discretion.

   Hand tools shall be used first to remove loose and hollow sounding concrete. If the concrete cannot be removed with hand tools, the Engineer may authorize the use of pneumatic hammers. The weight of pneumatic hammers, when used shall not exceed 15 pounds. The Contractor shall provide structurally adequate shields approved by the Engineer for protection of waterways, railways, roadways, sidewalks, parking lots or any other areas accessible to the public, which are in the vicinity of the removal operations.
3. Cleaning Exposed Reinforcing Steel: All exposed reinforcing steel on the underside of the deck shall be cleaned and coated, regardless of whether the Contractor exposed it or it was already exposed at the beginning of the Project. The exposed reinforcing steel shall be cleaned of all concrete fragments, loose or powder-like rust, oil, dust, dirt, loose particles, and other bond inhibiting matter. Cleaning methods shall utilize wire brushing at a minimum, but may require more aggressive methods as recommended by the coating manufacturer or as directed by the Engineer. Cleaning shall be done just prior to coating and shall finish with the cleaned surfaces being wiped down to remove the remaining dust.
4. Coating Exposed Reinforcing Steel: The epoxy resin shall be mixed and applied in accordance with the Manufacturer's instructions. Only the reinforcing steel shall be coated. The surrounding concrete shall not be coated. Care shall be taken to coat all exposed portions of each bar's perimeter and all exposed surfaces where bars overlap or are in contact with each other.

Method of Measurement: This work will be measured for payment by the actual number of linear feet of reinforcing steel cleaned and coated with epoxy resin material and approved by the Engineer. The length of coated reinforcing steel shall be measured along the exposed face of the bar. Where bars are adjacent to each other, the length of each bar shall be measured. No deduction in length shall be made where bars overlap.

Basis of Payment: This work will be paid for at the Contract unit price per linear foot for "Clean and Coat Exposed Reinforcing Steel," complete and accepted, which price shall include all materials, equipment, tools and labor incidental thereto.

Pay Item	Pay Unit
Clean and Coat Exposed Reinforcing Steel	l.f.

ITEM #0603050A - REPAIR DEFECTIVE WELDS

Description: Work under this item shall consist of removing and replacing defective welds at the locations indicated on the plans or as directed by the Engineer. This work shall also include the placement of new welds where existing welds are missing.

Construction Methods: Before the Contractor is permitted to repair defective welds the Engineer will conduct a survey of the locations indicated on the plans to determine the exact locations and lengths of defective or missing welds.

For locations outside of the limits of beam end painting, the existing paint shall be removed and the new paint shall be applied in accordance with the item "Localized Paint Removal and Field Painting of Existing Steel (Site No. X)". For locations within the limits of beam end painting, the existing paint shall be removed and the new paint shall be applied in accordance with the item "Abrasive Blast Cleaning and Field Painting of Beam Ends (Site No. X)".

Welding details, procedures and testing methods shall conform to the latest ANSI/AASHTO/AWS D1.5: Bridge Welding Code, unless otherwise noted.

The defective welds shall be removed at least 2" beyond the end of any crack as designated by the Engineer. The Contractor shall remove the welds by grinding or "arc" gouging without damaging the base metal that is to remain. A minimum of 1/8" of weld metal shall be left in place if arc gouging is the selected removal method and the remaining weld metal shall be removed by grinding. Welders who perform arc gouging shall be SMAW certified. Fire resistant tarps shall be used as required to protect property below.

The Contractor shall then proceed with the re-welding of the arc gouged/ground areas in accordance with the plans. The Contractor is responsible for the stability of the structure and shall take the necessary precautions to ensure the structure remains stable during and after the arc gouging, grinding and welding process.

At locations where there is no existing weld, a new weld will be installed as shown on the plans or as directed by the Engineer.

After completion of the welding, the Contractor shall notify the Engineer that the welds are ready to be tested. The Contractor shall engage the services of qualified personnel to perform magnetic particle testing to verify that all cracked welds have been removed and the new welds are sound and free from defects. A report of the testing results shall be submitted to the Engineer for review. Any new welds found to be defective shall be removed and re-welded at the Contractor's expense.

The Contractor shall take measures to keep the areas under the bridge clean and free of debris, and to protect pedestrians and traffic from the work operations. The Contractor is responsible for any damage caused to any part of the structure, utilities, pavement below, or vehicular traffic as a result of the work required by the special provision. The Contractor shall repair

and/or replace any such damage to the satisfaction of the Engineer at no cost to the State.

Method of Measurement: This work will be measured for payment by the number of linear feet, measured along the toe of the weld, of new weld installed and tested for the purpose of repairing defective welds or installing new welds where they are missing. New welds judged defective by the Engineer, and which require re-welding by the Contractor, will not be measured for payment.

Basis of Payment: This work will be paid for at the contract unit price per linear foot for "Repair Defective Welds", complete in place, which includes providing access for the initial inspection, access as required for undertaking the work and allowing inspection of the ongoing work by the Engineer's representatives, testing of the completed welds, furnishing proper lighting, fire resistant tarps, and all other materials, equipment, tools and labor incidental thereto.

The cleaning and application of paint of all areas of weld repairs outside of limits of beam end painting shall be paid for under the item "Localized Paint Removal and Field Painting of Existing Steel (Site No. X)". The cleaning and application of paint of all areas of weld repairs within limits of beam end painting shall be paid for under the item "Abrasive Blast Cleaning and Field Painting of Beam Ends (Site No. X)".

Pay Item	Pay Unit
Repair Defective Welds	L.F.

ITEM #0603063A - STRUCTURAL STEEL (SITE NO. 3)
ITEM #0603906A - STRUCTURAL STEEL (SITE NO. 6)
ITEM #0603907A - STRUCTURAL STEEL (SITE NO. 7)
ITEM #0603930A - STRUCTURAL STEEL (SITE NO. 10)
ITEM #0603931A - STRUCTURAL STEEL (SITE NO. 11)
ITEM #0603915A - STRUCTURAL STEEL (SITE NO. 15)

Section 6.03 *is supplemented and amended as follows:*

6.03.01—Description: *After the third paragraph, add the following:*
" This special provision provides additional requirements for the surface preparation, shop painting, and field touch-up painting of new structural steel."

6.03.02—Materials: *After the second paragraph, add the following:*
" Painting materials for this work shall conform to the following:

- The Contractor shall select a three-coat system from the qualified product List A or B, issued by the Northeast Protective Coating Committee (NEPCOAT). The approved NEPCOAT listings may be found at the NEPCOAT website at http://www.nepcoat.org/
- The system chosen shall have a prime coat that has achieved a Class 'B' slip coefficient for faying surfaces. Top coat paint color shall be as noted on the plans.
- Both the shop painted and field touchup applied coating systems shall be of the same three-coat system. A compatible organic zinc rich primer shall be used for any necessary field touch up.
- The same coating material manufacturer shall furnish all materials for the complete coating system. Intermixing of materials within and between coating systems will not be permitted.
- Thinning of paint shall conform to the manufacturer's written instructions.

All components of the coating system and the mixed paint shall comply with the Emission Standards for Volatile Organic Compounds (VOC) Content Limits and Emission Standards stated in the Connecticut Department of Energy and Environmental Protection's Administration Regulation for the Abatement of Air Pollution, Sections 22a-174-41 through 41a and 22a-174-20(s), respectively."

6.03.03—Construction Methods: *Revise* Subarticle 4(f) "Field Erection - High Strength Bolted Connections" *as follows:*

Replace the first sentence of the fourth paragraph "Surface Conditions: At the time of assembly … other foreign material." *with the following:*
" Connection faying surfaces within portions of structural steel designated to be painted shall receive a single coat of primer in accordance with requirements stipulated elsewhere in this special provision."

Delete the fifth paragraph of Subarticle 4(f) *and the three bulleted paragraphs after it:* "Paint is permitted on … wire brushing is not permitted."

After the last paragraph of Article 6.03.03, *before* Tables A through C*, add the following:*

" The painting application shall be done in compliance with the following requirements:

Qualifications of Shop Painting Firm: All shop painting of structural steel must be performed by and in an enclosed shop that is certified by the SSPC Painting Contractor Certification Program QP-3, entitled "Standard Procedure for Evaluating Qualifications of Shop Painting Contractors" in the enclosed shop category or by a shop that holds an AISC Quality Certificate with a "Sophisticated Paint Endorsement" in the enclosed shop category. The firm shall be fully certified, including endorsements, for the duration of the surface preparation and coating application. A copy of the subject certification shall be provided to the Engineer prior to commencing any surface preparation or coating application.

The shop painting firm is required to have at least one (1) **Coating Application Specialist (CAS) (SSPC ACS/NACE No. 13)**-certified (Level II-Interim Status-Minimal) craft-worker. CAS-certified (Level II-Interim Status-Minimal) craft-worker(s) are required for all crews/craft-workers up to four (4) crew members. For each crew larger than four (4), an additional CAS-certified (Level II-Interim Status-Minimal) craft-worker shall be present on each painting/blasting crew during blast cleaning and spray application (Atmospheric and Immersion Service) operations. A crew-member is a person who is on the job performing hand-held nozzle blast cleaning and/or spray application of protective coatings on a steel structure. The certification(s) must be kept current for the duration of the Project work.

The complete coating system shall be applied in an enclosed shop except for field touch-up painting which shall be applied after all bolts are fully tensioned and deck formwork removed. The enclosed shop shall be a permanent facility with outside walls to grade and a roof where surface preparation and coating activities are normally conducted in an environment not subject to outdoor weather conditions or blowing dust.

Quality Control Inspection of Shop Painting: The firm performing shop painting of the structural steel shall have a written quality control (QC) program. A copy of the QC program and record keeping procedures shall be provided to the Engineer prior to commencing any surface preparation or coating application. The program shall contain, but not be limited to, the following:

1. Qualifications of QC staff.
2. Authority of QC staff. QC staff must have the authority to stop non-conforming work.
3. Procedure for QC staff to advise operation supervisor, in writing, of non-conforming work.
4. Sample copy of QC inspection reports that will document compliance with specifications.
5. Procedure for calibrating inspection equipment and recording calibration.
6. Procedure for repairing defective coating applications.

The Contractor or Shop shall provide at least one Quality Control Inspector for the duration of the shop application to provide Quality Control. The QC Inspector must be a National Association of Corrosion Engineers (NACE) Certified Coating Inspector Level 3 with Peer Review. The QC Inspector shall verbally inform the Engineer on a daily basis, of the progress and any corrective actions performed on the coating work. The QC Inspector shall be present during all cleaning and coating operations.

The Contractor or Shop shall be responsible for purchasing and providing the latest version of the NACE Coating Inspector Log Book(s) and all necessary inspection tools. The Contractor's QC Inspector shall stamp the front page of each inspector's log book used during painting operations. The stamped book(s) shall indicate the inspector's NACE certification number, certification expiration date and shall also be signed. All daily coating activity shall be recorded in the Log Book. Copies of the log entries shall be provided on a daily basis to the Department's Quality Assurance (QA) shop representative. Upon completion of the coating, the log book(s) shall then be furnished to the Department's QA shop representative.

Technical Advisor: The Contractor or Shop shall obtain the services of a technical advisor who is employed by the coating manufacturer to assist the Engineer and shop painting firm during this work. The technical advisor shall be a qualified representative and shall be made available at the Shop upon request by the QC Inspector or the Engineer.

Surface Preparation: The following steps shall be performed prior to abrasive blast cleaning of steel members:

1. All corners and edges shall be rounded to a 1/16-inch radius or chamfered to a 1/16-inch chamfer.
2. All fins, slivers and tears shall be removed and ground smooth.
3. All rough surfaces shall be ground smooth.
4. Flame cut edges shall be ground over their entire surface such that any hardened surface layer is removed, and subsequent abrasive blast cleaning produces the specified surface profile depth.

Immediately before abrasive blast cleaning all steel members shall be solvent cleaned in accordance with SSPC-SP1 - "Solvent Cleaning."

Abrasive blast cleaning shall be performed in accordance with SSPC-SP 10 - "Near White Blast Cleaning" using a production line shot and grit blast machine or by air blast. The abrasive working mix shall be maintained such that the final **surface profile** is within the range described herein.

The QC Inspector shall test the abrasive for oil, grease or dirt contamination in accordance with the requirements of ASTM D7393 and document the test results. Contaminated abrasive shall not be used to blast clean steel surfaces. The blast machine shall be cleared of all contaminated abrasive and then solvent cleaned thoroughly in accordance with SSPC-SP 1 "Solvent Cleaning." New uncontaminated abrasive shall be added. Abrasive shall be tested for contaminants in accordance with the requirements of ASTM D7393 prior to the start of blast cleaning operations and at least every four hours during the blast cleaning operations.

All compressed air sources shall have properly sized and designed oil and moisture separators, attached and functional, to allow air at the nozzle, either for blast cleaning, blow-off, painting or breathing, to be oil-free, and moisture-free. The equipment shall have sufficient pressure to accomplish the associated work efficiently and effectively.

The QC Inspector shall perform the blotter test and document the results at the start of each blasting shift and at least every four hours during the blasting operation to ensure that the compressed air is free of oil and moisture. The blotter test shall be performed in accordance with the procedure outlined in ASTM D4285. For contaminated air sources, the oil and moisture separators shall be drained and the air retested.

No surface preparation or coating shall be done when the relative humidity is at or above 80 percent or when the surface temperature of the steel is less than five (5) degrees Fahrenheit above the dewpoint temperature as determined by a surface thermometer and an electric or sling psychrometer.

Surface Profile: The steel surface profile shall be 1 to 3 mils. Each girder or beam shall have the surface profile measured at a minimum of three locations in accordance with the test requirements of ASTM D4417, Method C. Smaller pieces such as diaphragms shall have the surface profile measured at a minimum of three locations on one piece at the beginning of abrasive blast operations and at least every four hours and at the end of abrasive blast cleaning operations. This measurement shall be performed with both coarse (0.8-2.0 mils) and extra coarse (1.5-4.5 mils) replica tape. During this measurement, special attention shall be given to areas that may have been shielded from the blast wheels, such as the corners of stiffeners and connection plates. The impressed tapes shall be filed in the NACE Coating Inspector's Log Book.

Application Methods: The coating system shall be applied by spray equipment of a type and size capable of applying each coat within the required thickness range. The applicator shall strictly adhere to the manufacturer's written recommendations for application methods, cure times, temperature and humidity restrictions and recoat times for each individual coat of the specified system. However, in no case shall coatings be applied in ambient conditions that exceed the relative humidity and dewpoint temperature control limits specified herein. Brushes shall be used in areas where spray application will not achieve acceptable results. Brushing technique shall be performed in a manner that will provide a uniform, blended finish.

Conventional spray equipment with mechanical agitators shall be used for prime coat application.

All storage, mixing, thinning, application and curing techniques and methods shall be accomplished in strict accordance with the printed material data sheets and application instructions published by the respective coating material manufacturer.

Surfaces shall be painted with the specified prime coat material before the end of the same work shift that they were blast cleaned and before any visible rust back occurs. Applied coatings shall not have runs, sags, holidays, pinholes or discontinuities.

The dry film thickness shall be within the range specified in the manufacturer's printed literature for the specified coating system. Dry film thickness shall be measured in accordance with SSPC-PA 2. The prime, intermediate and top coats shall be of contrasting colors as determined by the Engineer. There shall be no color variation in the topcoat as determined by comparison with Federal Standard 595.

Areas Requiring Special Treatment: All steel surfaces shall receive the three-coat shop applied system as specified except the following particular area types which shall be treated as follows:

1. Faying surfaces of connections shall receive a single application of primer. The dry film thickness shall be no greater than the thickness tested on the coating manufacturer's Certified Test Report for slip coefficient.
2. All steel surfaces within four (4) inches of field welds shall receive a single mist coating of primer at 0.5 - 1.5 mils dry film thickness.
3. Top surfaces of top flanges that will be in contact with concrete shall receive a single mist coating of primer at 0.5 - 1.5 mils dry film thickness.
4. Edges and shop welds shall be locally hand-striped with a brush in the longitudinal direction with an additional coat of an appropriate zinc-rich primer prior to application of the full intermediate coat. The application of the striping materials shall be in accordance with the coatings manufacturer's written instructions. The striping material shall be a contrasting color to distinguish it from the primer and intermediate coats.
5. The interior surfaces of box girders, including bracing, shall be prepared in accordance with these specifications then coated with the first two coats of the three-coat system. The intermediate coat in these areas shall be white and match Federal Standard 595 Color Number 27925.

Adhesion: Adhesion strength of the fully coated assemblies shall be the more restrictive of the manufacturer's specified adhesion strength or at least 600 psi for systems with organic zinc primers and at least 250 psi for systems with inorganic zinc rich primers measured as per ASTM D4541 using apparatus under Annex A4. All adhesion test locations shall be recoated in accordance with this specification at no additional cost. The QC Inspector shall perform adhesion strength tests every 500 sf and shall document the adhesion strength test results.

If adhesion test results are less than the specified value, but equal to or greater than 80% of the specified value, four (4) additional adhesion tests shall be taken within the 500 sf area of the failed test. If any of the additional adhesion tests are less than the specified value, the coating shall be removed from the entire piece and re-applied at the Contractor's expense. If any adhesion tests are less than 80% of the specified value, the entire coating system shall be removed from the piece and re-applied at the Contractor's expense.

Smaller pieces such as diaphragms shall be analyzed in lots that have an overall coated surface area of approximately 500 sf.

Protection of Coated Structural Steel: All fully coated and cured assemblies shall be protected from handling and shipping damage with the prudent use of padded slings, dunnage, separators and

tie downs. Loading procedures and sequences shall be designed to protect all coated surfaces. Erection marks for field identification of members and weight marks shall be affixed in such a manner as to facilitate removal upon final assembly without damage to the coating system.

Field Touch-Up Painting of Shop Applied Coating: Field touch-up painting shall be undertaken by the Contractor for the purpose of completing coating applications of masked-off areas at splices, connections, and for the repair of coated surfaces damaged during shipment or construction, as directed by the Engineer. The Aesthetics of any field painting is very important. Every effort must be made to perform any field painting in a professional manner that does not affect the appearance or aesthetic value of the structural steel in any way. Significant color variations or texture changes between the shop painting and field painting will not be allowed. The Contractor will be required to perform any additional field painting work required to provide consistent color and texture throughout the structural steel. This is especially true for all Fascia surfaces and areas exposed to public view. The Engineer will be the sole judge on color variations and textures variations of the field painting.

The Painting Contractor shall submit for approval by the Engineer a complete coating application procedure for all touch-up painting and corrective work. .

The field applied coating for touch-up painting shall be the same system used in the shop applied application. The intermediate and topcoat material for field touch-up painting shall be from the same lot and batch used in the shop provided its shelf life has not expired. If the shelf life has expired, the same material of the same color from a different lot and batch shall be used.

Field application of coatings shall be in accordance with the manufacturer's written application guidelines and these specifications. All areas cleaned to bare metal must be coated with zinc-rich primer before any visible rusting occurs.

After all concrete is placed and the forms are removed, all rust, scale, dirt, grease, concrete splatter and other foreign material shall be completely removed from all painted surfaces. All surfaces to be field painted shall also be cleaned by solvent cleaning in accordance with SSPC-SP 1, hand tool cleaning SSPC-SP 2, and power tool cleaning SSPC-SP 3 and SSPC-SP 11. Areas cleaned to SSPC-SP 11 must have a 1-3 mil profile and must be primed prior to rusting. All debris generated from cleaning operations must be contained and properly disposed of by the Contractor.

Bolts, nuts, washers and surrounding areas shall receive brush applications of intermediate and topcoat after final tensioning. Careful attention shall be given to bolted connections to insure that all bolts, nuts and washers are fully coated and that no gaps are left unfilled and uncoated.

Damage to the coating system that extends to the steel surface (such as scratches, gouges or nicks), shall have the entire three-coat system locally reapplied after power tool cleaning to bare metal in **accordance with SSPC-SP 11. The coating system adjacent to the damage shall be feathered back to increase** the surface area for touch up painting. The area cleaned to SSPC-SP 11 shall be primed with a zinc-rich primer before rusting occurs.

Damage to the coating system that extends back only to the prime or intermediate coat, shall only have the topcoat applied. Application of the touch-up materials in these damaged areas shall be performed by brush only.

During any field painting the Contractor shall protect property, pedestrians, vehicular and other traffic upon, underneath, or in the vicinity of the bridge, and also all portions of the bridge superstructure and substructure against damage or disfigurement from errant coating materials.

Tarps shall be used to collect all surface preparation debris. The Contractor shall be responsible for disposing of all removed materials, including tarps.

Contractor – Subcontractor Qualifications: Contractors and subcontractors doing field touchup painting work are required to be certified by the SSPC Painting Contractor Certification Program (PCCP) to QP-1, entitled "Standard Procedure for Evaluating Qualifications of Painting Contractors (Field Application to Complex Structures)" at the time of field touchup coating application.

Contractors and subcontractors are required to have at least one (1) **Coating Application Specialist (CAS) (SSPC ACS/NACE No. 13)**-certified (Level II-Interim Status-Minimal) craft-worker. CAS-certified (Level II-Interim Status-Minimal) craft-worker(s) are required for all crews/craft-workers up to four (4) crew members. For each crew larger than four (4), an additional CAS-certified (Level II-Interim Status-Minimal) craft-worker shall be present on each painting/blasting crew during blast cleaning and spray application (Atmospheric and Immersion Service) operations. A crew member is a person who is on the job performing hand-held nozzle blast cleaning and/or spray application of protective coatings on a steel structure. The certification(s) must be full, not interim, and must be kept current for the duration of the Project work. If a Contractor's, subcontractor's or any craft-worker's certification expires, the firm will not be allowed to do any work on this item until the certification is reissued.

Requests for extension of time for any delay to the completion of the Project due to an inactive certification will not be considered and liquidated damages will apply. At the option of the Engineer, if such a delay will adversely impact the successful and timely completion of the Project, the Department may require the Contractor to engage another SSPC certified contractor to do the painting work at the prime contractor's expense.

Quality Control Inspection of Field Touchup Painting: The Contractor performing field touchup painting of the structural steel shall have a written quality control (QC) program. A copy of the QC program and record keeping procedures shall be provided to the Engineer prior to commencing any surface preparation or coating application. The program shall contain, but not be limited to, the following:

1. Qualifications of QC staff.
2. Authority of QC staff. QC staff must have the authority to stop non-conforming work.
3. Procedure for QC staff to advise operation supervisor, in writing, of non-conforming work.
4. Sample copy of QC inspection reports that will document compliance with specifications.
5. Procedure for calibrating inspection equipment and recording calibration.

6. Procedure for repairing defective coating applications.

The Contractor shall provide at least one (1) Coating Inspector who is a National Association of Corrosion Engineers (NACE) Certified Coating Inspector Level 3 with Peer Review for the duration of the field application to provide Quality Control. The QC Inspector shall verbally inform the Engineer on a daily basis, of the progress and any corrective actions performed on the coating work. The QC Inspector shall be present during all cleaning and coating operations.

The Contractor shall be responsible for purchasing and providing the latest version of the NACE Coating Inspector Log Book(s) and all necessary inspection tools. The Contractor's QC Inspector shall stamp the front page of each inspector's log book used during painting operations. The stamped book(s) shall indicate the inspector's NACE certification number, certification expiration date and shall also be signed. All daily coating activity shall be recorded in the Log Book. Copies of the log entries shall be provided on a daily basis to the Department's Quality Assurance (QA) field representative. Upon completion of the coating, the log book(s) shall then be furnished to the Department's QA field representative.

General: The word "PAINTED" followed by the month and year the painting of the structure is completed along with the ConnDOT Project Number and the manufacturer's abbreviations for each of the three coats, shall be stenciled on the inside of a fascia girder at mid-depth of the girder in three (3) inch high block letters located near the abutment, so as to be clearly visible from the ground below. Paint for stenciling information shall be of a contrasting color and be compatible with the topcoat."

6.03.05—Basis of Payment: *Add the following at the end of the second paragraph:*

"Payment for either method for new structural steel, complete in place, shall also include shop painting, all field touch-up painting and corrective or repair field painting, QC Inspector(s), QC Log Book(s) and testing equipment, technical advisor, "Painted" stencil, equipment, tools and labor incidental thereto."

ITEM #0603099.11A - STRUCTURAL STEEL REPAIRS (SITE NO. 11)

Work under this item shall conform to the requirements of Section 6.03 of Form 817, amended as follows:

Article 6.03.01 - Description is supplemented by the following:

This work shall consist of strengthening the existing steel girders by:

1. Adding new steel cover plates with high strength bolted connections to girder bottom flanges as shown on the plans.
2. Adding transverse stiffeners to existing girders by welding to webs and top and bottom flanges.
3. Any modifications to existing connection plates, existing or proposed transverse stiffeners, bearing stiffeners or existing bolted field splices to facilitate cover plate installation.

In areas where cover plates are to be installed, paint shall be removed and area repainted after the cover plate is installed. All surface preparation and priming of repair plates including the area around the repair shall be included in either "Localized Paint Removal and Field Painting of Existing Steel" or "Abrasive Blast Cleaning and Field Painting of Beam Ends (Site No. 11)" as applicable by its location on the structure.

Any miscellaneous shields, staging, scaffolding, temporary support or other work or items required to complete this work shall be considered incidental to this work, and included in the contract unit price.

Article 6.03.02 - Materials are supplemented by the following:

Structural steel (Low Alloy) shall conform to AASHTO M270 Grade 50 T2. The fabricator shall be certified by the AISc Quality Control Certification Program in Category MBr (Major Steel Bridges).

Welding details, procedures and testing methods shall conform to the ANSI/AASHTO/AWS D1.5 Bridge Welding Code.

Only primers are acceptable which have been tested, approved and are on the Qualified Products List for use for ConnDOT Projects. A current copy of the Qualified Products List for ConnDOT may be obtained from ConnDOT's website.

Article 6.03.03 - Construction Method is supplemented by the following:

Contractor shall coordinate and schedule the work under this item and schedule work with the work under items "Localized Paint Removal and Field Painting of Existing Steel" and "Abrasive

Blast Cleaning and Field Painting of Beam Ends (Site No. 11)", and shall be aware that there are specific surface preparation requirements for the faying surfaces between existing steel and the proposed repair plates.

Contractor shall field measure and develop shop drawings for approval and fabricate steel plates per the approved shop drawings.

The Contractor shall take all precautions necessary not to damage those portions of the superstructure that are to remain. Any portion of the superstructure to remain which becomes damaged as a result of the Contractor's operations shall be repaired to the satisfaction of the Engineer and at the Contractor's expense.

Certain repair locations may have obstacles that are in conflict with the work that is to be performed. Work required to move, remove, replace, work around, or modify any obstacles interfering with the structural steel repair work, such as drainpipes, diaphragms, cables, etc. shall be included in this item and be performed with no additional compensation. This work shall be deemed incidental to the unit price bid for these items.

Any cutting or grinding of existing steel shall be performed with care to avoid damaging or notching any of the material to remain. In the event the Contractor damages materials to remain during cutting operations, the Contractor shall replace, repair or reinforce the damaged areas as may be required to restore the area to existing conditions prior to damage. The work shall be performed by the Contractor, and as ordered by the Engineer, at the Contractor's expense.

Cutting may be performed by the carbon air arc cutting method, plasma cutting, or grinding. Flame cutting shall not be allowed. Carbon air arc cutting shall be done in a manner not to create excessive heat in the steel to remain. The Contractor shall use a temperature indicating crayon for 275 deg. F and 300 deg. F to monitor the temperature on the steel. These crayons shall be marked on the surface of the steel one (1) inch from the area being cut as ordered by the Engineer. Cutting shall be discontinued temporarily, to allow cooling, when the temperature in the base steel exceeds 275 deg. F. If the temperature exceeds 300 deg. F in the base steel, then carbon air arc cutting at that particular location shall be stopped permanently and other methods, such as grinding, shall be employed to cut within the same temperature restrictions.

The steel repairs at locations where cover plates are being added will not need to restrict live loads for the duration of the repair work.

Article 6.03.04 - Method of Measurement is supplemented by the following:

This work will be measured for payment by Lump Sum, complete in place, and accepted by the Engineer, including all labor, materials, equipment, tools, testing, bolts, nuts and washers necessary to complete the work described under this item.

Article 6.03.05 - Basis of Payment is supplemented by the following:

This work will be paid for at the contract unit price, Lump Sum, for "Structural Steel Repairs (Site No. 11)". This payment shall constitute full compensation for all labor, tools, materials, surface preparation, priming of the steel repairs, equipment, testing of welds and all other incidentals necessary to perform the work as described herein and as shown in the Contract Drawings.

The cleaning and application of paint of all areas of new cover plates or stiffeners outside of limits of beam end painting shall be paid for under the item "Localized Paint Removal and Field Painting of Existing Steel". The cleaning and application of paint of all areas of new stiffeners within limits of beam end painting shall be paid for under the item "Abrasive Blast Cleaning and Field Painting of Beam Ends (Site No. 11)".

Pay Item	Pay Unit
Structural Steel Repairs (Site No. 11)	LS

ITEM #0603222A - DISPOSAL OF LEAD DEBRIS FROM ABRASIVE BLAST CLEANING

Description:

Work under this item shall include the handling, loading, packing, storage, transportation and final off-site disposal of hazardous lead debris which has been generated in conjunction with work conducted under Item 0020905A – Lead Compliance For Abrasive Blast Cleaning and Miscellaneous Tasks.

The Engineer previously analyzed a representative sample of the lead debris prior to generation and found leachable lead above RCRA-hazardous levels. A summation of the analytical results is included here:

Site No.	TCLP Results
Bridge No. 00480 - Paint associated with the structural steel bridge/metal components	**250 mg/l 250 mg/l**
Bridge No. 00813 - Paint associated with the structural steel bridge/metal components	**440 mg/l 360 mg/l**
Bridge No. 01466 - Paint associated with the structural steel bridge/metal components	**270 mg/l 320 mg/l**

The Contractor shall comply with the latest requirements of the USEPA RCRA Hazardous Waste Regulations 40 CFR 260-274 and the DEEP Hazardous Waste Management Standards 22a-449(c).

Hazardous lead debris shall be transported from the Project by a licensed hazardous waste transporter approved by the Department and disposed of at an EPA-permitted and Department-approved hazardous waste landfill within 90 days from the date of generation.

The Contractor must use one or more of the following Department-approved disposal facilities for the disposal of hazardous waste:

Clean Earth of North Jersey, Inc., (CENJ) 115 Jacobus Avenue, South Kearny, NJ 07105 Phone: (973) 344-4004; Fax: (973) 344-8652	Clean Harbors Environmental Services, Inc. 2247 South Highway 71, Kimball, NE 69145 Phone: (308) 235-8212; Fax: (308) 235-4307
Clean Harbors of Braintree, Inc. 1 Hill Avenue, Braintree, MA 02184 Phone: (781) 380-7134; Fax: (781) 380-7193	Clean Harbors - Spring Grove Facility 4879 Spring Grove Ave., Cincinnati, OH 45232 Phone: (513) 681-6242; Fax: (513) 681-0869

Triumvirate (EnviroSafe Corporation Northeast) (Jones Environmental Services (NE), Inc.) 263 Howard Street, Lowell, MA 01852	Environmental Quality US Ecology Detroit, Inc. 1923 Frederick Street, Detroit, MI 48211 Phone: (800) 495-6059; Fax: (313) 923-3375
Stericycle (Republic Environmental Systems) 2869 Sandstone Drive, Hatfield, PA 19440 Phone: (215) 822-8995; Fax: (215) 997-1293	Stericycle (Northland Environmental, Inc.) (PSC Environmental Systems) 275 Allens Avenue, Providence, RI 02905 Phone: (401) 781-6340; Fax: (401) 781-9710
Environmental Quality Company: Wayne Disposal Facility 49350 North I-94 Service Drive Belleville, MI 48111 Phone: (800) 592-5489; Fax: (800) 592-5329	ACV Enviro (Cycle Chem) 217 South First Street, Elizabeth, NJ 07206 Phone: (908) 354-0210; Fax (908) 355-0562
Envirite of PA (US Ecology) 730 Vogelsong Road, York, PA 17404 Phone: (717) 846-1900; Fax: (717) 854-6757	Stablex, Canada, Inc. 760 Industrial Blvd. Blainville, Quebec J7C3V4 Phone: (451) 430-9230; Fax: (451) 430-4642

Construction Methods:

A. Submittals

The Contractor shall submit in writing, (1) a letter listing the names of the hazardous waste disposal facilities (from the above list) that the Contractor will use to receive hazardous material from this Project, and (2) a copy of each facility's acceptance criteria and sampling frequency requirements.

No facility may be substituted for the one(s) designated in the Contractor's submittal without the Engineer's prior approval. If the material cannot be accepted by any of the Contractor's designated facilities, the Department will supply the Contractor with the name(s) of other acceptable facilities.

B. EPA ID Number:

Prior to the generation of any hazardous waste on a contiguous per site basis, the Contractor shall notify the Engineer of its selected hazardous waste transporter and disposal facility. The Contractor must submit to the Engineer (1) the transporter's current US DOT Certificate of Registration and (2) the transporter's current Hazardous Waste Transporter Permits for the State of Connecticut, the hazardous waste destination state and any other applicable states. The Engineer will then obtain on a contiguous per site basis a temporary EPA Generators ID number for the site that he will forward to the Contractor. Temporary EPA ID numbers are good for six months from the date they are issued and can be extended once, for a maximum of six months and can't be used for longer than one year. The Contractor will be responsible for notifying the Engineer when an extension is needed. Any changes in transporter or facility shall be

immediately forwarded to the Engineer for review.

C. General:

Handling, storage, transportation and disposal of hazardous waste materials generated as a result of execution of this project shall comply with all Federal, State and Local regulations including the USEPA RCRA Hazardous Waste Regulations (40 CFR Parts 260-271), the CTDEEP Hazardous Waste Regulations (22a-209 and 22a-449(c)), and the USDOT Hazardous Materials Regulations (49 CFR Part 171-180).

All debris shall be contained and collected daily or more frequently as directed by the Engineer, due to debris buildup. Debris shall be removed by HEPA vacuum collection. Such debris, abrasive blast residue, rust and paint chips shall be stored in leak-proof storage containers in the secured storage site, or as directed by the Engineer. The storage containers and storage locations shall be reviewed by the Engineer and shall be located in areas not subject to ponding.

All storage containers (roll offs or drums) shall have a protective liner and removable lid. These containers shall not have any indentations or damage that would allow seepage of the contained material.

If 55 gallon barrels are used, staging is required: 55 gallon barrels shall be stored together in two rows of five. The Contractor shall maintain a minimum lane clearance of 36 inches between each (barrel lot of ten).

The Contractor shall maintain a secure storage site, which shall be large enough to handle all debris. The Contractor shall store debris only in the secured storage site. All lead debris shall be conveyed to the secured storage site at the conclusion of the work shift. The Contractor shall account for all debris conveyed to the secured storage site and all debris transported from the project for disposal.

The secure storage site shall consist of an 8-ft. high fenced-in area with a padlocked entrance. Storage containers shall not be used on the project until and unless they have been reviewed and approved by the Engineer. Storage containers and sites shall be located so as not to cause any traffic hazard. Container storage sites shall be in areas that are properly drained and runoff water shall not be allowed to pool and shall be out of the 100-year flood plain. The containers shall be placed on pallets or other approved material and not directly on the ground.

Storage containers shall be closed and covered with a waterproof tarpaulin at all times except during placement, sampling and disposal of debris.

The Engineer previously analyzed a representative sample of the lead debris prior to generation and found leachable lead above RCRA-hazardous levels. A copy of the analytical results can be supplied to the Contractor at the time of waste disposal upon request.

Materials other than direct paint related debris which are incidental to the paint removal work activities (tarps, poly, plywood, PPE, gloves, decontamination materials, etc) which may be contaminated with lead, shall be stored separately from the direct paint debris, and shall be sampled by the Engineer for waste disposal characterization testing. Such materials characterized as hazardous shall be handled/disposed of as described herein, while materials characterized as non-hazardous shall be disposed of as non-hazardous, non-RCRA lead waste under Item 0020905A.

Project construction waste materials unrelated to the paint removal operations shall NOT be combined/stored with paint debris waste and/or incidental paint removal materials as they are not lead contaminated and shall NOT be disposed of as hazardous waste. The Engineer's on-site Inspectors shall conduct inspections to verify materials remain segregated.

Hazardous waste materials are to be properly packed and labeled for transport by the Contractor is accordance with EPA, CTDEEP and USDOT regulations. The disposal of debris characterized as hazardous waste shall be completed within 90 calendar days of the date on which it began to be accumulated in the lined containers. Storage of containers shall be in accordance with current DEEP/EPA procedures.

The Contractor shall label containers with a 6-inch square, yellow, weatherproof, Hazardous Waste sticker in accordance with USDOT regulations.

The Contractor shall obtain and complete all paperwork necessary to arrange for material disposal, including disposal facility waste profile sheets. It is solely the Contractor's responsibility to co-ordinate the disposal of hazardous materials with its selected treatment/recycling/disposal facility(s). Upon receipt of the final approval from the facility, the Contractor shall arrange for the loading, transport and treatment/recycling/disposal of the materials in accordance with all Federal and State regulations. **No claim will be considered based on the failure of the Contractor's disposal facility(s) to meet the Contractor's production rate or for the Contractor's failure to select sufficient facilities to meet its production rate.**

The Contractor shall process the hazardous waste such that the material conforms with the requirements of the selected treatment/disposal facility, including but not limited to specified size and dimension. Refusal on the part of the treatment/disposal facility to accept said material solely on the basis of non-conformance of the material to the facility's physical requirements is the responsibility of the Contractor and no claim for extra work shall be accepted for reprocessing of said materials to meet these requirements.

All DOT shipping documents, including the Uniform Hazardous Waste Manifests utilized to accompany the transportation of the hazardous waste material shall be prepared by the Contractor and reviewed/signed by an authorized agent representing ConnDOT, as Generator, for each load of hazardous material that is packed to leave the site. The Contractor shall not sign manifests on behalf of the State as Generator. The Contractor shall forward the appropriate original copies of all manifests to the Engineer the same day the material leaves the Project site.

Materials not related to lead paint removal and/or characterized as non-hazardous waste shall NOT be shipped for hazardous waste disposal in accordance with USEPA RCRA hazardous waste minimization requirements.

A load-specific certificate of disposal, signed by the authorized agent representing the waste disposal facility, shall be obtained by the Contractor and promptly delivered to the Engineer for each load.

D. Material Transportation

Materials determined to be hazardous shall be transported in compliance with the applicable federal/state regulations. Transport vehicles shall have a protective liner and removable lid, shall not have any indentations or damage and must be free from leaks, and discharge openings must be securely closed during transportation.

In addition to all pertinent Federal, State and local laws or regulatory agency polices, the Contractor shall adhere to the following precautions during the transport of hazardous materials off-site:

- All vehicles departing the site are to be properly logged to show the vehicle identification, driver's name, time of departure, destination, and approximate volume, and contents of materials carried. Vehicles shall display the proper USDOT placards for the type and quantity of waste;

- No materials shall leave the site unless a disposal facility willing to accept all of the material being transported has agreed to accept the type and quantity of waste;

- Documentation must be maintained indicating that all applicable laws have been satisfied and that the materials have been successfully transported and received at the disposal facility; and,

- The Contractor shall segregate the waste streams (i.e. concrete, wood, etc.) as directed by the receiving disposal facility.

Any spillage of debris during disposal operations during loading, transport and unloading shall be cleaned up in accordance with EPA 40 CFR 265 Subparts C & D, at the Contractors expense.

The Contractor is liable for any fines, costs or remediation costs incurred as a result of their failure to be in compliance with this Item and all Federal, State and Local laws.

D. Equipment Decontamination:

All equipment shall be provided to the work site free of gross contamination. The Engineer may prohibit from the site any equipment that in his opinion has not been thoroughly decontaminated

prior to arrival. Any decontamination of the Contractor's equipment prior to arrival at the site shall be at the expense of the Contractor. The Contractor is prohibited from decontaminating equipment on the Project that has not been thoroughly decontaminated prior to arrival.

The Contractor shall furnish labor, materials, tools and equipment for decontamination of all equipment and supplies that are used to handle Hazardous Materials. Decontamination shall be conducted at an area designated by the Engineer and shall be required prior to equipment and supplies leaving the Project, between stages of the work.

The Contractor shall use dry decontamination procedures. Residuals from dry decontamination activities shall be collected and managed as Hazardous Materials. If the results from dry methods are unsatisfactory to the Engineer, the Contractor shall modify decontamination procedures as required.

The Contractor shall be responsible for the collection and treatment/recycling/disposal of any liquid wastes that may be generated by its decontamination activities in accordance with applicable regulations.

E. Project Closeout Documents:

The Contractor shall provide the Engineer, within 30 days of completion of the work, a compliance package; which shall include, but not be limited to, the following:

1. Copies of completed Hazardous Waste Manifests (signed by authorized disposal facility representative)
2. Completed Waste Shipment Records/Bills of Lading (signed by authorized disposal facility representative)
3. Completed Weigh Bills (indicating each loads net weight).

Method of Measurement:

The work of "DISPOSAL OF LEAD DEBRIS FROM ABRASIVE BLAST CLEANING" shall be measured for payment as the actual net weight in tons delivered to the treatment/disposal facility. Such determinations shall be made by measuring each hauling vehicle on the permanent scales at the treatment/disposal facility. Total weight shall be the summation of weigh bills issued by the facility specific to this project and waste stream.

The disposal of any lead painted debris, originally anticipated to be hazardous, but determined by characterization sampling <u>not</u> to contain hazardous concentrations of lead will <u>not</u> be measured for payment under this Item. Disposal of these materials will be handled in accordance with the provisions of Item 0020905A.

The collection and treatment/disposal of materials and liquids generated during equipment decontamination activities and cleaning/disposal of personal protective equipment (PPE) shall be considered incidental to work under this Item and will not be measured for separate payment.

Materials incidental to the construction, which become contaminated due to the lead debris removal, such as but not limited to, gloves, coveralls, tarps and filters shall be disposed of in accordance with this specification. These incidental materials shall be kept separate from the debris. These materials will not be measured for payment, but will be included in the general cost of the work.

Basis of Payment:

This work shall be paid for at the contract unit price per ton, which shall include the processing, loading, storage (including containers) and transportation of said materials from the temporary storage area to the final to the treatment/disposal facility; the treatment/disposal or recycling of said materials; the preparation of all related paperwork including manifests; fees; and all equipment, materials, tools, labor and work incidental to loading, transporting, treating/recycling and disposal of materials.

No separate payment shall be made under this Item for the on-site processing, transportation and treatment/disposal of materials not found to be hazardous based upon characterization sampling results.

No separate payment shall be made for the disposal of wastes generated in conjunction with equipment decontamination or the disposal of personal protective equipment (PPE). The cost of such disposal shall be considered incidental to the work under this Item.

Final payment will not be approved until completed copies of all Manifest(s) and Bills of Lading signed by an authorized disposal facility representative and all associated weight bills indicating each loads net weight have been provided to the Engineer. Once completed and facility-signed copies of all Manifest(s), Bills of Lading and associated weigh bills have been received in their entirety, the Engineer will review and approve the release of final payment to the Contractor.

Pay Item	Pay Unit
Disposal of Lead Debris from Abrasive Blast Cleaning	Ton

ITEM #0603481A - ABRASIVE BLAST CLEANING AND FIELD PAINTING OF BEAM ENDS (SITE NO. 3)

ITEM #0603484A - ABRASIVE BLAST CLEANING AND FIELD PAINTING OF BEAM ENDS (SITE NO. 6)

ITEM #0603485A - ABRASIVE BLAST CLEANING AND FIELD PAINTING OF BEAM ENDS (SITE NO. 7)

ITEM #0603489A - ABRASIVE BLAST CLEANING AND FIELD PAINTING OF BEAM ENDS (SITE NO. 11)

Description: Work under this item shall consist of surface preparation and field painting of steel components with a **2-coat system** as shown on the plans, as directed by the Engineer and in accordance with these specifications.

Components to be painted include, but are not limited to, the following: ends of beams and girders, diaphragms and cross frames, steel fixed bearings, steel components of expansion bearings, scuppers, drainage pipes and troughs, state-owned utility conduits, structural steel utility supports, all new structural steel installed for repair purposes, and all other metal components that are an integral part of the bridge system.

Privately-owned utilities, bridge rails, stay-in-place forms, fences, elastomeric bearing pads and bronze components shall be protected from damage by surface preparation and painting operations and are not to be painted. Any damage resulting from surface preparations, containment and/or overspray from paint operations shall be repaired by the Contractor at no cost to the State.

The amount of steel to be painted under this special provision varies by bridge Site, and is to be determined by the Contractor based on the information contained in the plans. Bidders shall examine the structures in this Contract and shall make their own determinations as to the work involved and conditions to be encountered.

Lead paint is presumed to be present at all bridge Sites and in all locations.

Submittals: A minimum of 20 calendar days before starting any surface preparation and coating application work, the painting contractor shall submit the following to the Engineer for acceptance:

1. A copy of the firm's written Quality Control Program used to control the quality of surface preparation and coating application including, but not limited to, ambient conditions, surface cleanliness and profile, coating mixing, dry film thickness, and final film continuity.
2. A copy of the firm's written surface preparation and application procedures detailing the Materials and Construction Methods for both accessible and inaccessible areas. All areas are deemed accessible, except those areas specifically designated as inaccessible. The

Engineer will be the sole judge in determining the exact locations of said inaccessible areas. Inaccessible areas may include: Between back to back angles, edges of top flanges of steel members in contact with concrete, and areas of visible non-removable impacted rust. Such locations designated as inaccessible shall be coated with special materials, such as penetrating sealer or equivalent, as recommended by the Manufacturer of the selected paint system (see Materials section below for paint systems). This written program must contain a description of all the equipment that will be used for removal of laminar and stratified rust, for surface preparation, including the remediation of soluble salts, and for paint mixing and application, including stripe coating. Coating repair procedures shall be included for both accessible and inaccessible areas.

3. A detailed description of the Contractor's enforcement procedures and the authority of personnel.
4. If the application of heat is proposed for coating application purposes, provide information on the heat containment and procedures that will be used, with data sheets for the equipment. Note: If heat is used for coating operations, the heat and containment must be maintained to provide the required temperatures for the duration of the cure period.
5. Containment plans (paint removal/collection of debris, surface preparation, coating applications, coating applications with heat, etc.).
6. Proof of SSPC-QP 1 qualifications, CAS-certification(s) and QP 2 qualifications, as applicable.
7. Coating product information, including coating manufacturer, product name, application instructions, technical data, MSDS and color chips.
8. Abrasive product information, including abrasive manufacturer, product name, technical data, and MSDS.

The Contractor shall not begin any paint removal work until the Engineer has accepted the submittals. The Contractor shall not construe Engineer acceptance of the submittals to imply approval of any particular method or sequence for conducting the work, or for addressing health and safety concerns. Acceptance of the programs does not relieve the Contractor from the responsibility to conduct the work in strict accordance with the requirements of Federal, State, or local regulations, this specification, or to adequately protect the health and safety of all workers involved in the Project and any members of the public who may be affected by the Project. The Contractor remains solely responsible for the adequacy and completeness of the programs and work practices, and adherence to them.

Materials: The materials for the coating system for this work shall conform to the requirements of Section M.07.02 amended as follows:

The coating system shall be one of the following **2-coat systems**:

Carbomastic 15
Carbothane 133 LV, manufactured by: Carboline
2150 Schuetz Road
St. Louis, MO 63146
(800) 848-4645

Epoxy Mastic Aluminum II HS Poly 250, manufactured by:	Sherwin Williams 425 Benton Street Stratford, CT 06615 (203) 377-1711 (800) 474-3794
Carbomastic 90 Carbothane 134 HS, manufactured by:	Carboline 2150 Schuetz Road St. Louis, MO 63146 (800) 848-4645

All materials for the complete coating system shall be furnished by the same coating material manufacturer with no subcontracted manufacturing allowed. Intermixing of materials within and between coating systems will not be permitted. Thinning of paint shall conform to the manufacturer's written recommendations. All components of the coating system and the mixed paint shall comply with the Volatile Organic Compounds (VOC) Content Limits and Emission Standards stated in the Connecticut Department of Energy and Environmental Protection's Administration Regulation for the Abatement of Air Pollution, Sections 22a-174-41 through 41a and 22a-174-20(s), respectively.

Note: If any of the above and/or following stipulated Contract specifications differ from those of the Manufacturer's recommended procedures or ranges, the more restrictive of the requirements shall be adhered to unless directed by the Engineer in writing.

The abrasive media for blast cleaning shall be recyclable steel grit.

Construction Methods:

Contractor - Subcontractor Qualifications: Contractors and subcontractors doing this work are required to be certified by the SSPC Painting Contractor Certification Program (PCCP) to QP 1 entitled "Standard Procedure for Evaluating Qualifications of Painting Contractors ("Field Application to Complex Structures"). When the work involves the disturbance of lead-containing paint, the Contractor and subcontractor are also required to be certified to SSPC-QP 2 "Standard Procedure for Evaluating the Qualifications of Painting Contractors to Remove Hazardous Paint."

Contractors and subcontractors are required to have at least one (1) **Coating Application Specialist (CAS) (SSPC ACS/NACE No. 13)-**certified (Level II-Interim Status-Minimal) craft-worker. CAS-certified (Level II-Interim Status-Minimal) craft-worker(s) are required for all crews/craft-workers up to four (4) crew members. For each crew larger than four (4), an additional CAS-certified (Level II-Interim Status-Minimal) craft-worker shall be present on each

painting/blasting crew during blast cleaning and spray application (Atmospheric and Immersion Service) operations. A crew-member is a person who is on the job performing hand-held nozzle blast cleaning and/or spray application of protective coatings on a steel structure. The certification(s) must be kept current for the duration of the Project work. If a Contractor's, subcontractor's or any craft-worker's certification expires, the firm will not be allowed to do any work on this item until the certification is reissued.

Requests for extension of time for any delay to the completion of the Project due to an inactive certification will not be considered and liquidated damages will apply. In addition, if any recoat times are exceeded, the affected areas shall be abrasive blast cleaned to SSPC-SP 6 and coatings reapplied in accordance with these specifications at no additional cost to the State. At the option of the Engineer, if such a delay will adversely impact the successful and timely completion of the Project, the Department may require the Contractor to engage another SSPC certified contractor to do the painting work at the prime contractor's expense.

Quality Control Inspections: The Contractor shall perform first line, in process Quality Control (QC) inspections. The Contractor shall implement a Quality Control Program accepted by the Engineer, including written daily reports, that ensures that the work accomplished complies with these specifications. Copies of these reports shall be provided daily to the Engineer. Contractor QC inspections shall include, but not be limited to the following:

- Suitability of protective coverings and containments
- Ambient conditions
- Surface preparation (solvent cleaning, hand/power tool or abrasive blast cleaning, etc.)
- Coating application (mixing, thinning, and wet/dry film thickness)
- Recoat times and cleanliness between coats
- Coating continuity (freedom from runs, sags, overspray, dryspray, pinholes, shadow-through, skips, misses, etc.)
- Final film acceptance

The personnel managing and performing the quality control program shall be NACE Certified Coating Inspector(s) (successfully completed Sessions I, II, III and Peer Review) or must be SSPC certified BCI level 2. The personnel performing the quality control tests shall be trained in the use of the quality control instruments. Documentation of training shall be provided. These personnel shall not perform surface preparation and painting.

Test Equipment and Materials: The Contractor shall furnish the following new test equipment and materials for use by the QC Inspector: Two PTC Surface Temperature Thermometers

1. Psychron 566 Psychrometer (Battery Operated) with two sets of batteries or a Bacharach Sling Psychrometer
2. U.S. Weather Bureau Psychrometric Tables
3. Hypodermic Needle Pressure Gage for nozzle pressure tests.
4. SSPC Visual Standards VIS 1, VIS 3, and/or VIS 4, as applicable.
5. Testex Spring Micrometer
6. Testex Press-O-Film Replica Tape, one roll (100 pieces) each of coarse and extra-coarse

per bridge span, or as specified by the Engineer.
7. Wet film thickness gage
8. PosiTest, Mikrotest or Elcometer Dry Film Thickness Gauge (FM)
9. SSPC Type 2 Dry Film Thickness Gauge per PA2
10. NIST (NBS) Calibration Standards Range: 0 – 39 mils

Quality Assurance Inspections: The Engineer may conduct Quality Assurance (QA) observations of any or all phases of the work. The presence or activity of Engineer inspections in no way relieves the Contractor of the responsibility to provide all necessary daily Quality Control inspections of its own and to comply with all requirements of this Specification.

The Contractor shall facilitate the Engineer's inspections as required, including allowing ample time for the inspections and providing suitable lighting (50 foot candles minimum at the surface as defined later in this specification). The Contractor shall furnish, erect and move scaffolding or other mechanical equipment to permit inspection and close observation of all surfaces to be cleaned and painted. This equipment shall be provided during all phases of the work. The Contractor shall notify the Engineer in advance of plans to remove staging used in cleaning and painting operations in order to allow for inspection. The QA inspection will be performed with the QA inspector's equipment when verifying the Contractor's test results in the field.

Safety: All Contractor activities associated with the coating work described and specified herein shall be conducted according to all applicable Federal (OSHA), State of Connecticut safety regulations and SSPC-PA Guide 3 entitled "A Guide to Safety in Paint Application."

Ambient Conditions: Surface preparation and coating application work shall only be done inside a containment enclosure as specified elsewhere in these specifications. Surface preparation or coating work shall be performed inside the containment enclosure meeting the following:

- The relative humidity is at or below 90 percent.
- The substrate is not damp or covered by frost or ice.
- The surface temperature and air temperature are between 50° F and 100° F.
- The surface temperatures of the steel and air are more than 5° F above the dewpoint temperature, as determined by a surface temperature thermometer and electric or sling psychrometer.

If the requirements of the coating manufacturer differ from the ranges provided above, comply with the most restrictive requirements unless directed otherwise by the Engineer in writing.

Protective Coverings: The Contractor shall protect property, pedestrians, vehicular, and other traffic upon, underneath, or near the bridge, and all portions of the bridge superstructure and substructure against abrasive blast cleaning damage or disfigurement from splatters, splashes, or spray of paint or paint materials. See the specification for "Class 1 - Containment and Collection of Surface Preparation Debris (Site No. X)." All coating overspray, drips and spills shall be contained. Maintain the integrity and security of all protective coverings and containment

materials throughout the entire Project.

Any paint chips, paint removal media (e.g., abrasives), coating or solvent that has escaped the Contractor's containment enclosure shall be cleaned up immediately. For bridges over water, the Contractor shall have on Site a sufficient quantity of spill containment boom and pads to contain a spill. The length of containment boom on Site shall be at least equal to twice the length of the active work site over the water.

Observed Steel Defects: If significant deficiencies, such as cracks or section losses, are found during cleaning or coating operations, the Contractor shall immediately notify the Engineer as to their extent. Significant deficiencies include the following:

a) Cracks in any part of the superstructure
b) Section loss more than 1/8" or section loss equal to or greater than 5 percent of flange thickness in the maximum moment areas (i.e. section loss in the middle one half of a single span structure).
c) Section loss more than ¼" or section loss equal to or greater than 25 percent of the flange thickness in other than the maximum moment areas (i.e. section loss up to quarter points of the middle one half of a single span structure).
d) Section loss more than 1/8" or section loss equal to or greater than 33 percent of web thickness in the maximum shear areas (i.e. section loss within five feet of the bearing center line).

Heating Devices: The Contractor may use heating devices to obtain and maintain a condition within the containment enclosure that is suitable for surface preparation and painting application, up to and including the minimum time to recoat, or minimum time to dry for service or topcoat. Heating devices shall be limited to gas or oil-fired indirect air heaters in which the combustion products are discharged separately from the forced airstream to an area outside the containment enclosure. The heating devices must be configured so as not to form condensation on cold surfaces or cause rust-back and must be automatically controlled. Information describing the proposed heating devices and the proposed heating procedures shall be provided a minimum of 20 days in advance for Engineer acceptance.

Lighting Requirements: A minimum illumination level of 20 foot-candles shall be provided throughout the inside of the containment enclosure during surface preparation and coating application work. A minimum illumination level of 50 foot-candles shall be provided at the location of the specific work task and for inspection. All lighting fixtures and related connectors located inside the containment enclosure must be explosion proof and UL listed.

Material Storage: The Contractor shall provide a suitable facility for the storage of paint that complies with all Federal and State laws and regulations.

This facility shall provide protection from the elements and ensure that the paint is stored at temperatures within the more stringent of (1) the manufacturer's written recommended temperatures, or (2) between 40° F and 100° F. If paint application takes place in conditions that

require heating of the containment, then the temperature of the stored paint shall be maintained at a similar temperature. Storage of paint shall be in reasonable proximity to the painting locations. The Engineer shall be provided access to the stored paint for inspection and to witness removal of the materials. The Contractor's facility for the storage of paint shall be subject to the approval of the Engineer.

Equipment: All equipment used in surface preparation and removal of debris, such as hoses, hoppers, recycling and vacuum machines that the Contractor brings to the Site, shall be clean and free of any prior debris.

Spray equipment, brushes and rollers used in application of coatings shall be sized sufficiently and be in proper working order to accomplish the work according to the manufacturer's written recommendations.

Compressed Air: All compressed air sources shall have oil and moisture separators, attached and functional, and properly designed and sized. The compressed air sources shall deliver air to the blast nozzle, for blowing down the surfaces, or for conventional spray application that is free of oil and moisture and of sufficient pressure to accomplish the associated work efficiently and effectively. The tanks on the air compressor and moisture separator shall be drained at the end of each workday. The compressed air source shall produce a minimum pressure of 90 psi at the nozzle during abrasive blast cleaning.

The Contractor shall verify that the compressed air is free of moisture and oil contamination in accordance with the requirements of ASTM D4285. The tests shall be conducted at least every four hours for each compressor system in operation. Sufficient freedom from oil and moisture is confirmed if soiling or discoloration is not visible on the paper. If air contamination is evidenced, the Contractor shall change filters, clean traps, add moisture separations or filters, or make other adjustments as necessary to achieve clean, dry, air.

Test Sections: Prior to surface preparation, the Contractor shall prepare a test section(s) on each structure to be painted in a location(s) that the Engineer considers to be representative of the existing surface condition and steel type for the structure as a whole. The test section(s) shall be prepared using the same equipment, materials and procedures as the production operations. The Contractor shall prepare the test section(s) to the specified level according to the appropriate SSPC written specifications and visual standards. The written requirements of the specification prevail in the event of a conflict with the SSPC visual standards. Only after a test section area has been approved shall the Contractor proceed with surface preparation operations. The test section(s) shall cover approximately 10 square feet each. Additional compensation will not be allowed the Contractor for preparation of test sections.

For the production cleaning operations, the specifications and written definitions, the test section(s), and the SSPC visual standards shall be used in that order for determining compliance with the Contract requirements.

Surface Preparation:

1 – Laminar and Stratified Rust: All laminar and stratified rust or corrosion products that have formed on any area of the existing steel surfaces and accessible rust formed along edges of connected plates or shapes of structural steel shall be removed. The tools used to remove these corrosion products shall be identified in the submittals and accepted by the Engineer. If the surface preparation or removal of rust results in nicks or gouges, the work will be suspended. The Contractor shall demonstrate that the necessary adjustments have been made to prevent a reoccurrence of the damage prior to resuming work.

2 – Commercial Blast Cleaning (SSPC-SP 6): Steel surfaces, including all new steel plates installed for structural repairs, shall be cleaned by the specified methods described in the SSPC Steel Structures Painting Manual, Volume 2 - Systems and Specifications, latest edition. The structural steel shall be abrasive blast cleaned according to SSPC-SP 6 "Commercial Blast Cleaning." Before and after blast cleaning, all dissolvable foreign matter, such as oil, grease, and dust shall be removed by wiping or scrubbing the surface with rags or brushes wetted with solvent in accordance with the provisions SSPC-SP 1 "Solvent Cleaning." Clean solvent and clean rags or brushes shall be used for the final wiping.

All foreign materials such as dirt, dust, rust scale, sand, bird droppings, and all materials loosened by abrasive blasting operations shall be completely removed by vacuuming before any painting operations are begun.

Following completion of the initial abrasive blast cleaning operations, the Contractor shall proceed with installation of new structural steel plates where required by the plans and as directed by the Engineer. The plates shall be delivered already coated with a zinc primer coat. After the plates have been welded in place and accepted, the new plates shall be coated with the same paint system used for the existing steel.

The cleaned surface shall be accepted by the Engineer before any painting. If the surface is determined to meet the requirements of SSPC-SP 6, painting operations can commence. The base coat shall be applied to the steel before the end of the day that preparation was performed and before the formation of any flash rusting or rerusting of the steel. Flash rusting or rerusting of the surface is unacceptable and requires additional blast cleaning prior to painting.

Failure of the Contractor to prepare and clean the surfaces to be painted according to these specifications shall be cause for rejection by the Engineer. All surfaces that are rejected shall be recleaned to the satisfaction of the Engineer according to these specifications, at no additional cost to the State.

3 – Steel Grit Abrasive Mix: The recyclable steel grit abrasive mix shall be maintained and monitored such that the final surface profile is within the range specified elsewhere in these specifications.

Before each reuse, the recyclable steel grit abrasive shall be cleaned of millscale, rust, paint, and other contaminants by an abrasive reclaimer.

On a weekly basis during blast cleaning operations, the Contractor shall verify that the recycled steel grit abrasives meet the requirements of SSPC-AB 2. If the abrasive fails the testing, all abrasive blast cleaning operations shall be suspended. The abrasive reclaimer shall be repaired and another abrasive sample will be required for testing after grit recovery and reclassification. For test results within the acceptable limits, abrasive blast cleaning may resume. Test results outside of the acceptable limits will require additional equipment repairs or replacement at no cost to the State. If additional repairs were performed, another sample will be required for testing after grit recovery and reclassification. If the test results continue to remain outside of the acceptable limits, the Contractor shall replace the abrasive reclaimer at no cost to the State.

4 - Surface Profile: The specified height of the steel surface profile shall be according to the manufacturer's written instructions and shall be uniform. Verification of the profile height will be done with Testex Replica Tape. A surface profile correction factor will be measured according to SSPC-PA 2, Section 2.2.4 with the dry film thickness gauge.

Painting Operation:

1 - General: All coatings shall be supplied in sealed containers bearing the manufacturer's name, product designation, batch number and mixing/thinning instructions. Leaking containers shall not be used. Storage, opening, mixing, thinning and application of coating materials shall be accomplished in strict accordance with the written requirements and procedures published by the respective coating material manufacturer and supplier. In the event of a conflict, the Contractor shall notify the Engineer in writing, and unless directed otherwise in writing, the requirements of this specification shall prevail. The Contractor shall always have at the Project Site the current copies of all material safety data sheets (MSDS), technical data, recommendations and procedures published by the coating manufacturer for the coating materials.

2 - Paint Mixing and Thinning: Thinning shall be performed only to the extent allowed by the manufacturer's written instructions, and only with the manufacturer's approved thinner. In no case shall thinning be permitted that would cause the coating to exceed the local VOC restrictions. For multiple component paints, only complete kits shall be mixed and used. Partial mixing is not allowed.

The ingredients in the containers of paint shall be thoroughly mixed by mechanical power mixers in the original containers, or as directed by the manufacturer, before use or mixing with other containers of paint. The paint shall be mixed in a manner that will break up all lumps, completely disperse pigment and result in a uniform composition. Paint shall be carefully examined after mixing for uniformity and to verify that no unmixed pigment remains on the bottom of the container. Excessive skinning or partial hardening due to improper or prolonged storage will be cause for rejection of the paint, even though it may have been previously inspected and accepted.

Multiple component coatings shall be discarded after the expiration of the pot life. Single component paint shall not remain in spray pots, painter's buckets or similar containers overnight. It shall be stored in a covered container and remixed before use.

The Engineer reserves the right to sample field paint (individual components and/or the mixed material) and have it analyzed. If the paint does not meet the product requirements due to excessive thinning or because of other field problems, the coating shall be removed from that section of the structure and replaced as directed by the Engineer.

3 – Methods of Application: All applicators of the specified coating material shall show proficiency on a test panel, or a portion of the structure as selected by the Engineer, to the satisfaction of the Engineer before commencing full-scale application.

The preferred method for coating application shall be by airless spray equipment. For striping and for application in areas where complex shapes or tight clearances will not allow spray application, the Contractor shall apply the coating material by appropriately designed and constructed rollers and brushes.

4 – Recoat Times: The recoat time of each coat of paint shall not deviate from the written recommendation of the manufacturer or the times specified in these specifications, complying with the most restrictive requirements unless directed otherwise by the Engineer in writing. If any individual time is exceeded, the affected areas shall be abrasive blast cleaned to SSPC-SP 6 and coatings reapplied in accordance with these specifications at no additional cost to the State.

5 – Film Continuity: All applied coatings shall exhibit no running, streaking, sagging, wrinkling, holidays, pinholes, top coat color or gloss variation, or other film defects. Failure of the Contractor to apply coatings that are free of film defects shall be cause for rejection by the Engineer. All coatings rejected shall be repaired to the satisfaction of the Engineer, at no additional cost to the State. Before doing any coating repair work, the Contractor shall submit to the Engineer for approval the procedures that will be used to repair the coating.

6 - Technical Advisor: It is mandatory that the Contractor obtain the services of a qualified technical advisor employed by the coating manufacturer. This advisor shall be familiar with the technical properties of the coating products and proper application methods. The technical advisor shall assist the Engineer and the Contractor in establishing correct application methods for the complete coating system. He/she shall be present at the work Site before the opening of the material containers and shall remain at the Site until the Engineer is satisfied that the Contractor's personnel have mastered the proper handling, mixing and application of the material. The Engineer may call the technical advisor back to the Site if there are concerns that the Contractor is not handling, mixing or applying the material correctly.

7 - Containment Plan: For each individual Site, the Contractor shall submit a plan of containment to the Engineer for acceptance. The plan shall be submitted twenty days before

commencing painting operation. The minimum containment enclosure for the intermediate and top coat shall conform to the requirements of SSPC Guide 6, Class 1A and the following. Components of the containment system must be made from flame retardant materials. Tarpaulin material shall be clean and impermeable to air and water. Joints shall be fully sealed except for entryways. Entryways shall use multiple flap overlapping door tarps to minimize dust escape through the entryway. All mists or dust shall be filtered with collection equipment. For truss bridges a ceiling shall also be included.

8 - Application:

2-COAT SYSTEM:

A - Primer Coat Application: All prepared surfaces shall be cleaned by vacuuming to remove dust, remaining debris, and other surface contaminants before coating. Such surfaces shall then be sprayed, brushed or rolled within the specified abrasive blast cleaning containment enclosure before the end of the day or before any visible rust-back occurs. If rust-back occurs, affected surfaces shall be recleaned to the satisfaction of the Engineer according to these specifications, at no additional cost to the state. All surfaces shall receive 1 coat of the primer coat. Temperature ranges (both steel and air) shall be the more restrictive of that specified in the Manufacturer's written application instructions or between 50º F. to 100º F., unless directed otherwise by the Engineer in writing. The dry film thickness shall be according to the Manufacturer's written instructions. The primer coat shall be of a contrasting color to the topcoat color. The dry film thickness will be checked for compliance per the guidelines of SSPC-PA 2.

All plate and shape edges, plate seams, back to back angle seams, pitted steel, and other sharp discontinuities shall be hand-striped with a brush in the longitudinal direction with the primer coat. Bolted connections shall also have all bolt heads and nuts hand-striped in a circular brush motion with the primer coat material. Stripe coats shall be applied before or after the full primer coat application. The primer coat material used for hand-striping shall be tinted to distinguish it from material used for the full primer coat application.

B - Top Coat Application: After the primer coat has cured per the Manufacturer's written recommendations (not to exceed 10 days), all previously coated surfaces shall receive the top coat. The cured and dry primer coat shall be clean and free of all surface and embedded contamination and dry-spray. If it is not clean and free of all contamination, and dry-spray, the surfaces shall be cleaned by using clean rags or brushes to water wipe, solvent wipe, or detergent wash and rinse. Power washing is not allowed. Temperature ranges (both steel and air) shall be the more restrictive of that specified in the Manufacturer's written application instructions or between 50º F. to 100º F., unless directed otherwise by the Engineer in writing. The dry film thickness shall be according to the Manufacturer's written instructions.

9 – Painting of New Steel: All new steel shall be painted with the same coating system selected for use at the beam ends, unless permitted otherwise in writing. After the new steel has been

fabricated, the steel shall be painted with the primer coat after preparation of the steel surfaces in accordance with the relevant requirements of this special provision including abrasive blast cleaning. All paint that is damaged by field welding operations or by any other operation shall be removed, the area cleaned to the satisfaction of the Engineer, and the affected areas repainted with the primer coat. The new steel shall then be painted with the rest of the paint system.

Method of Measurement: This item, being paid for on a lump sum basis for each bridge Site, will not be measured for payment.

Basis of Payment: This work will be paid for at the Contract lump sum price for "Abrasive Blast Cleaning and Field Painting of Beam Ends (Site No. X)," which price shall include all materials, equipment, abrasive blast cleaning and surface preparation, painting, coating of inaccessible areas, overspray containment enclosure, heating devices, tools, labor, and services of the technical advisor. No direct payment will be made for the cost of storage or hauling the paint and other materials to and from the bridge Site, but the cost thereof shall be included in the lump sum price as noted above.

The containment and collection of surface preparation debris shall be paid for under the item **"**Class 1 - Containment and Collection of Surface Preparation Debris (Site No. X)."

Disposal of spent abrasive contaminated by lead shall be paid for under the item, "Disposal of Lead Debris from Abrasive Blast Cleaning."

Pay Item	Pay Unit
Abrasive Blast Cleaning and Field Painting of Beam Ends (Site No. X)	l.s.

ITEM #0603546A - REMOVE AND REINSTALL GRATING

Description: Work under this item shall consist of the removal, on-site storage and reinstallation of portions of the metal grating system located along the median of the bridge, as shown on the plans and as directed by the Engineer. Work under this item shall also consist of providing and installing new anchors to support the grating system from the concrete median barrier.

Materials: Anchors shall be threaded stainless steel, with appropriate washers and nuts, of the size shown on the plans. The anchors will be a compatible component of a specific epoxy anchoring system designed to work in cast-in-place concrete.

The Contractor shall provide Manufacture's literature for the anchoring system and Materials Certificates and Certificates of Compliance in accordance with Article 1.06.07.

Materials for the replacement of damaged components shall be A36 steel or better and shall be hot dip galvanized after fabrication in conformance with the requirements of ASTM A123.

Construction Methods: Prior to removal of any components, the Contractor and the Inspector shall perform a visual survey of all grating components documenting any existing damage. The Contractor and the Inspector shall agree as to which portions of the grating system are to be removed and reinstalled and shall mark them accordingly. Only those portions marked shall be removed and paid for under this item. Each component to be removed will be marked with an understandable and durable labeling system indicating its position on the bridge and relationship to adjacent components.

After labeling, the Contractor shall carefully remove the components so as not to damage the components being removed nor any adjacent components remaining in place or other parts of the bridge. All removed components shall be transported to a safe on-site location for storage. Components shall be carefully handled and stored off of the ground so as not to damage their existing galvanized finish.

When the new concrete median barriers are complete and cured, the grating components will be transported back to the bridge and reinstalled at their proper location with the written authorization of the Engineer.

The anchorage systems shall be installed in accordance with the Manufacture's recommendations. The anchors shall be oriented and aligned such that the support brackets are vertical after installation and the top surface of individual grates are well aligned, meet flush and have only a small uniform gap between them, similar to their condition prior to removal.

Any components damaged during removal, transport, storage or reinstallation shall be repaired or replaced with newly fabricated components to the satisfaction of the Engineer and at no cost to the State. New components shall match the size, configuration and type of fabrication as the existing damaged component and shall be hot dip galvanized after fabrication.

Method of Measurement: This work will be measured for payment as the actual square footage of existing grating removed and reinstalled. Measurement shall be made along the top surface of the grating, from edge of frame to edge of frame, after it has been reinstalled and accepted. There shall be no measurement for payment of the support brackets.

Basis of Payment: This work will be paid for at the Contract unit price, per square foot for "Remove and Reinstall Grating" complete in place and accepted, which price shall include all materials, equipment, tools and labor incidental thereto. There shall be no payment for the fabrication of any replacement components, due to damage by the Contractor.

Pay Item	Pay Unit
Remove and Reinstall Grating	S.F.

ITEM #0603714A - CLASS 1 CONTAINMENT AND COLLECTION OF SURFACE PREPARATION DEBRIS (SITE NO. 3)

ITEM #0603633A - CLASS 1 CONTAINMENT AND COLLECTION OF SURFACE PREPARATION DEBRIS (SITE NO. 6)

ITEM #0603448A - CLASS 1 CONTAINMENT AND COLLECTION OF SURFACE PREPARATION DEBRIS (SITE NO. 7)

ITEM #0603652A - CLASS 1 CONTAINMENT AND COLLECTION OF SURFACE PREPARATION DEBRIS (SITE NO. 11)

Description: Work under this item shall consist of furnishing and erecting SSPC Guide 6 Class 1 containment enclosures with negative air pressure as required to contain and collect debris resulting from the removal of coatings in the preparation of steel surfaces for painting. Also included are the vacuum collection and the storage of debris in suitable containers.

The containment and collection of debris shall be done in strict conformance with current Federal Environmental Protection Agency (EPA) and Connecticut Department of Energy and Environmental Protection (DEEP) regulations.

Materials: Materials and equipment shall be of satisfactory quality to perform the work and shall not be used on the Project until and unless they have been reviewed and approved by the Engineer.

Rigid walls for the containment enclosure shall be comprised of plywood panels or corrugated panels of steel, aluminum or reinforced fiberglass. Flexible containment walls constructed of fire retardant tarpaulin material shall be impermeable to air and water.

Fifty Five (55) gallon barrels with resealable lids, or lined storage containers sized for the job shall be leakproof; shall conform to the Code of Federal Regulations Title 49, Chapter 1, Paragraph 173.510A (1), (5), and Paragraph 178.118; and shall not be used on the Project until and unless they have been reviewed and approved by the Engineer.

In meeting the requirements of these specifications, the Contractor shall supply portable battery-operated manometers with a pressure range of -1.00 to 10.00 in increments of 0.01 inches of water and a velocity range of 50 to 9990 feet per minute; and one or more portable lightmeters with a scale of 0.0-50.0 foot candles.

Construction Methods: The Contractor shall proceed with one of the following containment methods:

A. Containment enclosure with a suspended platform, or
B. Containment enclosure without a suspended platform.

A. Containment enclosures with a suspended platform:

At least two (2) months prior to any abrasive blast cleaning activities, the Contractor shall submit to the Department ten (10) complete copies of detailed working drawings and calculations prepared and stamped by a Professional Engineer (Mechanical and Civil) licensed in Connecticut, which drawings shall detail as described below, the proposed methods for such activities. The Contractor shall not commence with containment enclosure erection and abrasive blast cleaning until and unless the working drawings have been reviewed and approved by the Engineer, and shall proceed with such work only within approved containment enclosures.

The working drawings shall include the following:

1. A construction plan and drawings detailing proposed coating removal operations, abrasive debris classification and separation, removal and transport of waste to a secure storage site.
2. A plan and drawings detailing the proposed containment enclosure, including details of the following:
   - A. Rigid, solid floor or platform.
   - B. Containment walls with rigid and flexible materials.
   - C. Rigid supports and bracing for the floor and wall panels, rigid or flexible supports and bracing for flexible walls.
   - D. Calculations including localized overstress conditions, member stresses, H.S. load rating and maximum dead and live load imposed on the bridge by the containment enclosure, grit blasting/recycling equipment and HVAC equipment.
   - E. Maximum allowable load for the floor/platform.
   - F. Wind load and wind stresses imposed on the bridge by the containment enclosure shall be calculated and submitted.
   - G. Airflow and air re-circulation within the enclosure including a minimum negative pressure of 0.03 inches of water column (W.C.) relative to external ambient air and calculations. Airflow shall meet the SSPC Guide 6 requirements of 100 feet/minute cross draft and 50 feet/minute downdraft and the OSHA Ventilation Standards. The maximum cross sectional area for airflow within the enclosure shall be 400 square feet.
   - H. Connections to the bridge, i.e., clamps, rollers. (Note: Welding and bolting is not allowed.) Each connection to the bridge shall be designed by the Contractor's professional engineer, including the locations of all necessary load cells to verify compliance with the containment drawings and allowable containment construction loads. A digital load indicator shall be connected to the bridge connection load cells and be located in an area accessible to the Engineer. The load cell shall be capable of storing peak load readings.
   - I. Auxiliary stationary source lighting.
   - J. Dust collection and filtration equipment, including the equipment data sheets and airflow capacity.
   - K. Air intake points including filters, louvers, baffles, etc.
   - L. Entrance/Exit compartment completely sealed with airlocks.
   - M. Location of equipment and impact on traffic.
   - N. Elevation view of the containment enclosure with indications of any encroachments on the surroundings. The bridge vertical clearance shall be maintained throughout the project.

NOTE: The structure loading for containment design shall be in accordance with AASHTO using HS-20 loads. The allowable overstress for all conditions shall not exceed 20%.

B. Containment enclosures without a suspended platform:

At least two (2) months prior to any abrasive blast cleaning activities, the Contractor shall submit to the Department ten (10) complete copies of detailed working drawings and calculations prepared and stamped by a Professional Engineer (Mechanical and Civil) licensed in Connecticut, which drawings shall detail, as described below, the proposed methods for such activities. The Contractor shall not commence with containment enclosure erection and abrasive blast cleaning until and unless the working drawings have been reviewed and approved by the Engineer, and shall proceed with such work only within approved containment enclosures.

The working drawings shall include the following:

1. A construction plan and drawings detailing proposed coating removal operations, abrasive debris classification and separation, removal and transport of waste to a secure storage site.
2. A plan and drawings detailing the proposed containment enclosure, including details of the following:
   - A. Containment walls with rigid and flexible materials.
   - B. Rigid supports and bracing for the floor and wall panels, rigid or flexible supports and bracing for flexible walls.
   - C. Airflow and air re-circulation within the enclosure including a minimum negative pressure of 0.03 inches of water column (W.C.) relative to external ambient air and calculations. Airflow shall meet the SSPC Guide 6 requirements of 100 feet/minute cross draft and 50 feet/minute downdraft and the OSHA Ventilation Standards. The maximum cross sectional area for airflow within the enclosure shall be 400 square feet.
   - D. Connections to the bridge, i.e., clamps, rollers. (Note: Welding and bolting is not allowed.)
   - E. Auxiliary stationary source lighting.
   - F. Dust collection and filtration equipment, including the equipment data sheets and airflow capacity.
   - G. Air intake points including filters, louvers, baffles, etc.
   - H. Entrance/Exit compartment completely sealed with airlocks.
   - I. Location of equipment and impact on traffic.
   - J. Elevation view of the containment enclosure with indications of any encroachments on the surroundings. The bridge vertical clearance shall be maintained throughout the project.

In addition, if the bridge vertical clearance is greater than 30 feet, the wind load and wind stresses imposed on the bridge by the containment enclosure shall be calculated and submitted.

Reference information on enclosures can be obtained from the following sources:

- SSPC Guide 6
- Steel Structures Painting Manual, Volume 1

- NCHRP Report 265

The containment enclosure shall be sealed across the bridge deck underside between the girders with a rigid material. The floor shall be covered with a waterproof tarpaulin attached and sealed to the enclosure wall and floor around the entire enclosure perimeter. All edges of tarpaulins shall have a 2 foot flap that clamps over the connected edges around the entire perimeter. These flaps shall be completely fastened 12 inches on center for both edges and sealed completely with the tarpaulin manufacturer's recommended tape and caulk.

All equipment placement and work shall be in strict conformance with the Contract special provisions "Prosecution and Progress" and "Maintenance and Protection of Traffic." The Contractor shall perform all work in accordance with the requirements of any permits for this Project.

During abrasive blast cleaning, if the containment enclosure is allowing debris to escape, the Contractor shall immediately stop such work until the enclosure is repaired. Any debris released from the enclosure shall be cleaned up by the Contractor immediately.

The containment enclosure shall be disassembled if the wind velocity is greater than 40 miles per hour, if it is forecast to be higher or when directed by the Engineer. However, if the wind velocity is below 40 MPH, but high enough to cause the containment enclosure to billow and emit dust, the Contractor shall immediately cease abrasive blast cleaning and, after cleaning up all the debris, disassemble the enclosure.

All debris resulting from surface preparation shall be contained and vacuum collected daily or more frequently as directed by the Engineer, due to debris buildup. Such debris, abrasive blast residue and paint chips removed by hand or power tool cleaning, shall be stored in leakproof storage containers in the secured storage site, or as directed by the Engineer. Debris storage shall be in accordance with Connecticut Hazardous Waste Management Regulations.

If 55 gallon barrels are used, staging is required: 55 gallon barrels shall be stored together in 2 rows of 5. The Contractor shall maintain a minimum lane clearance of 36 inches between each lot (10 barrels per lot).

The Contractor shall maintain a secure storage site, which shall be large enough to handle all coating debris that is collected and stored on the Project Site at any time. The Contractor shall store coating debris only in the secured storage site. During abrasive blast cleaning operations, all surface preparation debris shall be vacuum collected from the containment enclosure and removed to the abrasive recycling reclaimer unit, and the coating debris shall be conveyed to the secured storage site at the conclusion of the work shift. The Contractor shall account for all coating debris conveyed to the secured storage site and all coating debris transported from the Project to the hazardous waste treatment/disposal facility. The Contractor is responsible for the proper handling of the surface preparation debris and coating debris. All spillage shall be cleaned up immediately.

The secure storage site shall consist of an 8 foot high fenced-in area with a padlocked entrance. Storage containers shall not be used on the Project until and unless they have been reviewed and approved by the Engineer. Storage containers and sites shall be located so as not to cause any traffic hazard. Container storage sites shall be in areas that are properly drained and runoff water shall not be allowed to pond. The containers shall be placed on pallets or other approved material and not directly on the ground.

Storage containers shall be closed and covered with a waterproof tarpaulin at all times except during placement, sampling, and disposal of the debris.

The Contractor shall furnish the inspector with two (2) new portable battery-operated manometers and light meters, per containment enclosure. Negative pressure verification with the portable manometers shall be done by the Engineer before and during abrasive blast cleaning and during vacuum collection of all surface preparation debris. The supplied instruments will become the property of the State upon Project completion.

Light at the steel surface within the enclosure shall be maintained by the Contractor at a minimum of 50 foot-candles as measured by a light meter. Such lighting shall be maintained throughout the surface preparation, painting, and inspection activities.

Equipment noise in excess of 90 decibels as measured at the closest residential, commercial or recreational areas, shall be lowered by the Contractor to a maximum of 90 decibels by the use of mufflers or other equipment approved by the Engineer prior to its use for this purpose.

Any air exhausted from the containment enclosure, abrasive-recycling equipment or vacuum equipment shall be passed through a filtering system. The Contractor is responsible for the design, effectiveness and maintenance of this filtering system. No discharge of debris dust shall be allowed.

The Contractor is liable for any fines, costs, or remediation costs incurred as a result of their failure to be in compliance with this special provision and all Federal, State, and local laws.

Method of Measurement: Work under this item will not be measured for payment, but will be paid for at the Contract lump sum price for each site. A site shall consist of an entire bridge structure, unless otherwise noted on the plans.

Basis of Payment: This work will be paid for at the Contract lump sum price for "Class 1 Containment and Collection of Surface Preparation Debris (Site No. X)," at the site designated. The price shall include all materials, equipment, tools, labor and work incidental thereto.

Pay Item	Pay Unit
Class 1 Containment and Collection of Surface Preparation Debris (Site No. X)	l.s.

ITEM #0603726A - EMBEDDED GALVANIC ANODES

Description: This item includes furnishing all labor, tools, materials, equipment and services necessary to properly install embedded galvanic anodes within concrete patches at locations where deteriorated concrete has been removed from existing structure elements in order to perform concrete repairs.

Embedded galvanic anodes are designed to provide localized corrosion protection. The anodes shall be selected and placed at the appropriate spacing along the perimeter of concrete patches or along the interface between new/existing concrete in order to mitigate the formation of new corrosion sites and arrest active corrosion within the existing concrete in adjacent areas.

Materials: The galvanic anodes shall be supplied by one of the following:

1. Vector Corrosion Technologies, Inc.
   3822 Turman Loop, Suite 102
   Wesley Chapel, FL 33544
   Tel: (813) 830-7566
   Website: www.vector-corrosion.com

2. Sika Corporation
   201 Polito Avenue
   Lyndurst, NJ 07071
   Tel: (800)-933-7452
   Website: www.sikaconstruction.com

3. BASF Corporation
   889 Valley Park Drive
   Shakopee, MN 55379
   Tel: (800)-243-6739
   Website: www.basf.com

4. Euclid Chemical Company
   19215 Redwood Road
   Cleveland, OH 44110
   Tel: (800)-321-7628
   Website: www.euclidchemical.com

For the purpose of this specification, an anode shall be defined as having a minimum zinc content of 5.6 oz. (160 grams). Anodes shall primarily consist of zinc and shall conform to the requirements of ASTM B418, for Type II (Z13000) and ASTM B6, for Special High Grade (Z13001) with an iron content of 15 ppm or less. The tie wires shall be un-spliced wires with loop ties at the ends for directly tying to the reinforcing steel.

Construction Methods: The Contractor shall submit Working Drawings in accordance with 1.05.02, showing specifics of the chosen anode system and installation, for the Engineer's

review. The Working Drawings shall include, but not be limited to:

- The specifics of each anode unit (size, material properties, etc.).
- Reinforcing bar size and spacing for each structure component in which anodes are to be placed and corresponding steel density. Reinforcing density may be obtained using the tables in the appendix to this special provision. Density shall be based on assumed reinforcing density based on As-Built drawings or actual observed reinforcing steel within exposed repair areas.
- If the actual observed reinforcing density is different that the assumed density, once the deteriorated concrete is removed, then the layout and spacing of the anodes will be revised accordingly, as directed by the technical representative and as approved by the Engineer.
- Schematic plans showing the layout of anodes and minimum spacing based on the reference tables provided in the appendix to this special provision, for a variety of repair configurations and reinforcing steel densities.

Anodes shall not be installed until the Working Drawings have been reviewed and approved.

A technical representative of the Manufacturer shall be notified of the scheduled installation of the anodes a minimum of 2 weeks in advance and be present to provide direction and assistance for the initial installations of anodes in concrete patches and succeeding anode installations until the Contractor becomes proficient in the work and to the satisfaction of the Engineer. The work for this item shall be performed in accordance with the Manufacturer's product specification and installed per the project details and as recommended by the technical representative of the Manufacturer.

Perform all deteriorated concrete removal, patch work, and cleaning of reinforcing steel as governed elsewhere within these contract documents. Tools, equipment, and techniques used to prepare the patch locations for installation of the anodes shall be approved by the Engineer prior to the start of construction. Reinforcing steel shall be clean and securely fastened together with tie wire to provide good electrical conductivity.

The Contractor shall supply a multi-meter and shall test the connections between anodes and reinforcing steel for electrical continuity, as directed by the technical representative. The Contractor shall place additional tie wires or re-tie connections as directed to provide the required continuity.

Install anodes and repair material immediately following preparation and cleaning of the steel reinforcement to prevent significant surface rust from forming.

Galvanic anodes shall be installed along the perimeter of the repair or interface as specified on the plans and in the approved Working Drawings. Anode spacing alterations may be proposed by the technical representative to account for variations in the reinforcing steel density, the level of chloride in the structure and the corrosiveness of the local environment. Such proposed changes in spacing shall be submitted for approval and shall only be permitted in writing by the Engineer. All approved deviations from the approved Working Drawings shall be accurately documented as As-Builts. Any changes shall maintain sufficient clearance between anodes and substrate to allow repair material to encase the anode.

Secure the galvanic anodes to the reinforcing bars along the patch edge as shown on the plans, using the anode tie wires. The tie wires shall be wrapped around the cleaned reinforcing steel and twisted tight to allow little or no free movement.

Provide sufficient clearance between anodes and substrate to allow repair material to encase anode. It is recommended to provide 2 inches of concrete cover over the anodes to prevent the finished patch from sounding hollow, when hammer-tapped. If less concrete cover is expected, place anode beside or beneath the bar and secure it to clean reinforcing steel. If sufficient concrete cover exists, the anode may be placed along a single bar or at the intersection between two bars and secured to each clean bar. Because anodes are used, concrete cover over the bars need not be built out when cover is at least one inch (25 mm).

Confirm electrical connection between anode tie wire and reinforcing steel by measuring DC resistance (ohm, Ω) or potential (mV) with a multi-meter. Electrical connection is acceptable if the DC resistance measured with multi-meter is less than 1 Ω or the DC potential is less than 1 mV.

Confirm electrical continuity of the exposed reinforcing steel within the repair area. If necessary, electrical continuity shall be established with the addition of steel tie wires. Electrical continuity between test areas is acceptable if the DC resistance measured with multi-meter is less than 1 Ω or the potential is less than 1 mV.

Prior to placing repair materials, pre-wet the concrete surface and the anodes to achieve a saturated surface dry condition. Do not soak the anodes for greater than 20 minutes (or less if specified by the Manufacturer). Repair concrete shall have a resistivity of 15,000 ohm-cm or less, to allow the galvanic cell to be completed. Repair concrete that exceeds this value will be considered on a case-by-case basis after consulting with the Technical Representative of the anode supplier.

Method of Measurement: For the purpose of measurement, each single anode meeting the definition of an anode in the Materials article above will be counted as one for payment. Anodes must be properly installed, tested and accepted in accordance with these specifications, the contract plans and supplemental requirements of the Manufacturer's technical representative, before they are counted.

Basis of Payment: This work will be paid for at the Contract unit price, per each for "Embedded Galvanic Anodes", complete and accepted in place, which price shall include all applicable materials, equipment, tools, and labor incidental thereto. The preparation of Working Drawings, the services of a technical representative, material application training and testing of installed anodes shall also be included in the Contract unit price.

Pay Item	**Pay Unit**
Embedded Galvanic Anodes	EA

APPENDIX TO
ITEM #0603726A – EMBEDDED GALVANIC ANODES

MINIMUM ANODE SPACING Based on 160g Zinc Mass	
Steel Density Ratio	Minimum Anode Spacing (Inches)
< 0.31	24
0.31 - 0.60	20
0.61 - 0.90	16
0.91 - 1.20	14
1.21 - 1.50	10
1.51 - 1.80	8
1.81 - 2.10	6

Enter Column 1 in the table above with the Steel Density Ratio from TABLE OF REINFORCING STEEL DENSITY RATIOS.
Select the minimum anode spacing in Column 2.

TABLE OF REINFORCING STEEL DENSITY RATIOS					
Bar Size	5				
(#)	**Spacing (Inches)**	6	9	12	18
5	6	0.65	0.55	0.49	0.44
	9	0.55	0.44	0.38	0.33
	12	0.49	0.38	0.33	0.27
	18	0.44	0.33	0.27	0.22
6	6	0.72	0.61	0.56	0.50
	9	0.59	0.48	0.43	0.37
	12	0.52	0.41	0.36	0.31
	18	0.46	0.35	0.29	0.24
7	6	0.79	0.68	0.62	0.57
	9	0.63	0.52	0.47	0.41
	12	0.56	0.45	0.39	0.34
	18	0.48	0.37	0.32	0.26
8	6	0.85	0.74	0.69	0.63
	9	0.68	0.57	0.51	0.46
	12	0.59	0.48	0.43	0.37
	18	0.50	0.39	0.34	0.28
9	6	0.92	0.81	0.75	0.70
	9	0.72	0.61	0.56	0.50
	12	0.62	0.51	0.46	0.40
	18	0.52	0.41	0.36	0.31

How to Use the Table of Reinforcing Steel Density Ratios:

1. Enter the table with the first bar size and spacing in the top two rows. Highlight that column.
2. Enter the bar size and spacing in the transverse direction in the first two columns. Highlight that row.
3. Follow the column and row to their intersection and read the reinforcing steel density in that cell.
4. Enter the Anode Spacing Table with the Reinforcing Steel Density to select the minimum anode spacing.

TABLE OF REINFORCING STEEL DENSITY RATIOS					
Bar Size	6				
(#)	**Spacing (Inches)**	6	9	12	18
5	6	0.72	0.59	0.52	0.46
	9	0.61	0.48	0.41	0.35
	12	0.56	0.43	0.36	0.29
	18	0.50	0.37	0.31	0.24
6	6	0.79	0.65	0.59	0.52
	9	0.65	0.52	0.46	0.39
	12	0.59	0.46	0.39	0.33
	18	0.52	0.39	0.33	0.26
7	6	0.85	0.72	0.65	0.59
	9	0.70	0.57	0.50	0.44
	12	0.62	0.49	0.43	0.36
	18	0.55	0.41	0.35	0.28
8	6	0.92	0.79	0.72	0.65
	9	0.74	0.61	0.55	0.48
	12	0.65	0.52	0.46	0.39
	18	0.57	0.44	0.37	0.31
9	6	0.98	0.85	0.79	0.72
	9	0.79	0.65	0.59	0.52
	12	0.69	0.56	0.49	0.43
	18	0.59	0.46	0.39	0.33

How to Use the Table of Reinforcing Steel Density Ratios:

1. Enter the table with the first bar size and spacing in the top two rows. Highlight that column.
2. Enter the bar size and spacing in the transverse direction in the first two columns. Highlight that row.
3. Follow the column and row to their intersection and read the reinforcing steel density in that cell.
4. Enter the Anode Spacing Table with the Reinforcing Steel Density to select the minimum anode spacing.

TABLE OF REINFORCING STEEL DENSITY RATIOS					
Bar Size	7				
(#)	**Spacing (Inches)**	6	9	12	18
5	6	0.79	0.63	0.56	0.48
	9	0.68	0.52	0.45	0.37
	12	0.62	0.47	0.39	0.32
	18	0.57	0.41	0.34	0.26
6	6	0.85	0.70	0.62	0.55
	9	0.72	0.57	0.49	0.41
	12	0.65	0.50	0.43	0.35
	18	0.59	0.44	0.36	0.28
7	6	0.92	0.76	0.69	0.61
	9	0.76	0.61	0.53	0.46
	12	0.69	0.53	0.46	0.38
	18	0.61	0.46	0.38	0.31
8	6	0.98	0.83	0.75	0.68
	9	0.81	0.65	0.58	0.50
	12	0.72	0.57	0.49	0.41
	18	0.63	0.48	0.40	0.33
9	6	1.05	0.89	0.82	0.74
	9	0.85	0.70	0.62	0.55
	12	0.75	0.60	0.52	0.45
	18	0.65	0.50	0.43	0.35

How to Use the Table of Reinforcing Steel Density Ratios:

1. Enter the table with the first bar size and spacing in the top two rows. Highlight that column.
2. Enter the bar size and spacing in the transverse direction in the first two columns. Highlight that row.
3. Follow the column and row to their intersection and read the reinforcing steel density in that cell.
4. Enter the Anode Spacing Table with the Reinforcing Steel Density to select the minimum anode spacing.

TABLE OF REINFORCING STEEL DENSITY RATIOS					
Bar Size	8				
(#)	**Spacing (Inches)**	6	9	12	18
5	6	0.85	0.68	0.59	0.50
	9	0.74	0.57	0.48	0.39
	12	0.69	0.51	0.43	0.34
	18	0.63	0.46	0.37	0.28
6	6	0.92	0.74	0.65	0.57
	9	0.79	0.61	0.52	0.44
	12	0.72	0.55	0.46	0.37
	18	0.65	0.48	0.39	0.31
7	6	0.98	0.81	0.72	0.63
	9	0.83	0.65	0.57	0.48
	12	0.75	0.58	0.49	0.40
	18	0.68	0.50	0.41	0.33
8	6	1.05	0.87	0.79	0.70
	9	0.87	0.70	0.61	0.52
	12	0.79	0.61	0.52	0.44
	18	0.70	0.52	0.44	0.35
9	6	1.11	0.94	0.85	0.76
	9	0.92	0.74	0.65	0.57
	12	0.82	0.64	0.56	0.47
	18	0.72	0.55	0.46	0.37

How to Use the Table of Reinforcing Steel Density Ratios:

1. Enter the table with the first bar size and spacing in the top two rows. Highlight that column.
2. Enter the bar size and spacing in the transverse direction in the first two columns. Highlight that row.
3. Follow the column and row to their intersection and read the reinforcing steel density in that cell.
4. Enter the Anode Spacing Table with the Reinforcing Steel Density to select the minimum anode spacing.

TABLE OF REINFORCING STEEL DENSITY RATIOS					
Bar Size	9				
(#)	**Spacing (Inches)**	6	9	12	18
5	6	0.92	0.72	0.62	0.52
	9	0.81	0.61	0.51	0.41
	12	0.75	0.56	0.46	0.36
	18	0.70	0.50	0.40	0.31
6	6	0.98	0.79	0.69	0.59
	9	0.85	0.65	0.56	0.46
	12	0.79	0.59	0.49	0.39
	18	0.72	0.52	0.43	0.33
7	6	1.05	0.85	0.75	0.65
	9	0.89	0.70	0.60	0.50
	12	0.82	0.62	0.52	0.43
	18	0.74	0.55	0.45	0.35
8	6	1.11	0.92	0.82	0.72
	9	0.94	0.74	0.64	0.55
	12	0.85	0.65	0.56	0.46
	18	0.76	0.57	0.47	0.37
9	6	1.18	0.98	0.88	0.79
	9	0.98	0.79	0.69	0.59
	12	0.88	0.69	0.59	0.49
	18	0.79	0.59	0.49	0.39

How to Use the Table of Reinforcing Steel Density Ratios:

1. Enter the table with the first bar size and spacing in the top two rows. Highlight that column.
2. Enter the bar size and spacing in the transverse direction in the first two columns. Highlight that row.
3. Follow the column and row to their intersection and read the reinforcing steel density in that cell.
4. Enter the Anode Spacing Table with the Reinforcing Steel Density to select the minimum anode spacing.

ITEM #0603729A - LOCALIZED PAINT REMOVAL AND FIELD PAINTING OF EXISTING STEEL

Description: Work under this item shall consist of paint removal and field painting of the existing steel at designated areas. The work shall include containments, paint removal, collection of paint and associated debris, surface preparation and field painting. Designated areas include: areas specifically designated on the plans and those areas where construction activities require the removal of the existing coatings to accomplish other Contract work (such as, but not limited to, arc gouging or welding). The paint removal is required because of the possible presence of hazardous paint containing lead or other hazardous metals. The paint removal is required to comply with OSHA and DEEP regulations.

Privately-owned utilities, bridge rails, stay-in-place forms, fences, elastomeric bearing pads and bronze components shall be protected from damage by surface preparation and painting operations and are not to be painted.

Submittals: A minimum of 20 calendar days before starting any paint removal, surface preparation and coating application work, the painting Contractor shall submit the following to the Engineer for acceptance:

1. A copy of the firm's written Quality Control Program used to control the quality of surface preparation and coating application including, but not limited to, ambient conditions, surface cleanliness and profile, coating mixing, dry film thickness and final film continuity.
2. A copy of the firm's written surface preparation and application procedures. This written program must contain a description of the equipment that will be used for surface preparation, including the remediation of soluble salts, and for paint mixing and application. Coating repair procedures shall be included.
3. A detailed description of the Contractor's enforcement procedures and the authority of personnel.
4. Containment plans (paint removal/collection of debris, surface preparation, coating applications, coating applications with heat, etc.).
5. If the application of heat is proposed for coating application purposes, provide information on the heat containment and procedures that will be used, with data sheets for the equipment. **Note**: If heat is used for coating operations, the heat and containment must be maintained to provide the required temperatures for the duration of the **cure** period.
6. Proof of SSPC-QP1 qualifications, CAS-certification(s) and QP2 qualifications, as applicable.
7. Proof that the finish coat complies with the color and gloss retention performance criteria of SSPC Paint 36, Level 3, for accelerated weathering.
8. Coating product information, including coating manufacturer, product name, application instructions, technical data, MSDS and color chips.

The Contractor shall not begin any paint removal work until the Engineer has accepted the submittals. The Contractor shall not construe Engineer acceptance of the submittals to imply

approval of any particular method or sequence for conducting the Work, or for addressing health and safety concerns. Acceptance of the programs does not relieve the Contractor from the responsibility to conduct the work in strict accordance with the requirements of Federal, State, or local regulations, this specification, or to adequately protect the health and safety of all workers involved in the Project and any members of the public who may be affected by the Project. The Contractor remains solely responsible for the adequacy and completeness of the programs and work practices, and adherence to them.

Materials: The paint shall be one of the following **2-coat systems**:

Carbomastic 15	
Carbothane 133 LV, manufactured by:	Carboline 2150 Schuetz Road St. Louis, MO 63146 (800) 848-4645
Epoxy Mastic Aluminum II	
HA Poly 250, manufactured by:	Sherwin Williams 425 Benton Street Stratford, CT 06615 (203) 377-1711 (800) 474-3794
Carbomastic 90	
Carbothane 133 LV, manufactured by:	Carboline 2150 Schuetz Road St. Louis, MO 63146 (800) 848-4645

All materials for the complete coating system shall be furnished by the same coating material manufacturer with no subcontracted manufacturing allowed. Intermixing of materials within and between coating systems will not be permitted. Thinning of paint shall conform to the manufacturer's written recommendations. The coating thickness shall be in accordance with the Manufacturer's printed instructions. All components of the coating system and the mixed paint shall comply with the Volatile Organic Compounds (VOC) Content Limits and Emission Standards stated in the Connecticut Department of Energy and Environmental Protection's Administration Regulation for the Abatement of Air Pollution, Sections 22a-174-41 through 41a and 22a-174-20(s), respectively.

Control of Materials: A Materials Certificate will be required for the selected paint system in accordance with Article 1.06.07, confirming the conformance of the paint to the requirements set forth in these specifications. The selected Topcoat shall conform (as close as possible) in color to the existing topcoat.

Note: If any of the above and/or following stipulated Contract specifications differ from those of the manufacturer's recommended procedures or ranges, the more restrictive of the requirements shall be adhered to unless directed by the Engineer in writing.

Construction Methods:

Contractor - Subcontractor Qualifications: Contractors and subcontractors doing this work are required to be certified by the SSPC Painting Contractor Certification Program (PCCP) to QP 1 entitled "Standard Procedure for Evaluating Qualifications of Painting Contractors ("Field Application to Complex Structures"). When the work involves the disturbance of lead-containing paint, the Contractor and subcontractor are also required to be certified to SSPC-QP 2 "Standard Procedure for Evaluating the Qualifications of Painting Contractors to Remove Hazardous Paint." The certification(s) must be kept current for the duration of the work. If a Contractor's or subcontractor's certification expires, the firm will not be allowed to do any work related to this item until the certification is reissued. Requests for extension of time for delay to the completion of the Project due to an inactive certification will not be considered and liquidated damages will apply. In addition, if any recoat times are exceeded, the affected areas shall be cleaned to SSPC-SP 15 and coatings reapplied in accordance with these specifications at no additional cost to the State.

Contractors and subcontractors are required to have at least one (1) **Coating Application Specialist (CAS) (SSPC ACS/NACE No. 13)-**certified (Level II-Interim Status-Minimal) craft-worker. CAS-certified (Level II-Interim Status-Minimal) craft-worker(s) are required for all crews/craft-workers up to four (4) crew members. For each crew larger than four (4), an additional CAS-certified (Level II-Interim Status-Minimal) craft-worker shall be present on each surface preparation/painting crew during surface preparation cleaning/removal and spray application (Atmospheric and Immersion Service) operations. A crew-member is a person who is on the job performing hand/power tool cleaning and/or spray application of protective coatings on a steel structure. The certification(s) must be kept current for the duration of the Project work. If a Contractor's, subcontractor's or any craft-worker's certification expires, the firm will not be allowed to do any work on this item until the certification is reissued.

All Contractor activities associated with the work described and specified herein shall be conducted in accordance with all applicable Federal, State of Connecticut and local safety regulations and guidelines.

Quality Control Inspections: The Contractor shall perform first line, in process Quality Control (QC) inspections. The Contractor shall implement a Quality Control Program accepted by the Engineer, including written daily reports, that ensures that the work accomplished complies with these specifications. All Quality Control Reports must be reviewed and signed by either a NACE Coating Inspector Level 2 - Certified (must have completed sessions I, II and III) or SSPC – BCI Level I Inspector (Minimum qualifications). Copies of these reports shall be provided daily to the Engineer. Contractor QC inspections shall include, but not be limited to the following:

- Suitability of protective coverings and containments

- Ambient conditions
- Surface preparation (solvent cleaning or hand/power tool cleaning)
- Coating application (mixing, thinning, and wet/dry film thickness)
- Recoat times and cleanliness between coats
- Coating continuity (freedom from runs, sags, pinholes, shadow-through, skips, misses, etc.)
- Final film acceptance

Limits of Paint Removal and Field Painting: Prior to applying the heat of welding equipment to localized areas of existing steel superstructures, the existing paint shall be removed to a width of 6 inches from wherever the heat will be applied, or as directed by the Engineer. The locations of the paint removal and field painting shall be reviewed and accepted by the Engineer prior to commencement of the work. Such acceptance by the Engineer does not relieve the Contractor of his responsibility for complying with applicable OSHA and DEEP regulations.

Containment for Paint Removal and Collection of Debris: The containment(s) shall be designed and erected to contain, as well as facilitate the collection of debris from the paint removal operations. Drawings and details of the containment(s) shall be submitted to the Engineer for review and comments prior to any paint removal. Review of the containment by the Engineer shall in no way relieve the Contractor of his responsibility for the containment. The containment shall conform to the requirements found within the SSPC Guide 6. The class of the containment shall be a minimum of Class 3P, modified to include the following:

A. The containment materials shall be air and water impenetrable and fire resistant.
B. With the exception of the entryways, all seams in the containment enclosure shall be lapped a minimum of 24 inches and shall be tied off at intervals not to exceed 18 inches.
C. All attachments to bridge parapets or the underside of the bridge deck shall be sealed to prevent the escape of dust and debris.

The above specified containment must be used for **all** paint removal and collection of debris operations. The containment must remain in place until all associated debris has been collected.

Storage and Disposal of Collected Debris: All of the debris resulting from the paint removal operations shall be contained and collected. Debris within containment enclosures shall be removed by HEPA vacuum collection prior to disassembly of the enclosures. All the debris, rust and paint chips shall be stored in leak-proof storage containers at the Project site. Debris storage shall be in accordance with Connecticut Hazardous Waste Management Regulations. The storage containers and storage locations shall be reviewed by the Engineer and shall be located in areas not subject to ponding. Storage containers shall be placed on pallets and closed and covered with tarps at all times except during placement, sampling, and disposal of the debris.

Prior to generation of any hazardous waste, the Contractor shall notify the Engineer of its selected hazardous waste transporter and disposal facility. The Contractor must submit to the Engineer: (1) the transporter's current U.S DOT Certificate of Registration and (2) the transporter's current Hazardous Waste Transporter Permits for the State of Connecticut, the hazardous waste destination state and any other applicable states. The Engineer will then obtain an EPA ID number that will be

forwarded to the Contractor. Any changes in transporter or facility shall be immediately forwarded to the Engineer for review.

The Contractor shall conform to the latest requirements of the Hazardous Waste Management Regulations prepared by the DEEP's Hazardous Waste Management Section, subject to regulations of Section 22a-449(c) of the Connecticut General Statutes.

Disposal of the debris shall be in strict conformance with all Federal E.P.A. and DEEP regulations for hazardous materials.

All necessary forms, including the "Uniform Hazardous Waste Manifest" obtained from the Hazardous Waste Management Section of DEEP, must be filled out, approved and signed by the Department's Project Engineer (Construction), and appropriate copies returned to the Department's Division of Environmental Compliance.

A licensed hazardous waste transporter and a licensed hazardous waste treatment/disposal facility must be secured from lists available from the DEEP and approved by the Department's Division of Environmental Compliance.

The Contractor is liable for any fines, costs, or remediation costs incurred as a result of their failure to be in compliance with this special provision and all Federal, State and Local laws.

Paint Removal/Surface Preparation: The existing structural steel shall be power tool cleaned according to SSPC-SP 15 “Commercial Grade Power Tool Cleaning.” The power tools (needle guns, grinders, etc.) shall be equipped with HEPA vacuum attachments. Before the power tool cleaning, all dissolvable foreign matter, such as oil, grease, and dust shall be removed by wiping or scrubbing the surface with rags or brushes wetted with solvent in accordance with the provisions of SSPC-SP 1 “Solvent Cleaning.” Clean solvent and clean rags or brushes shall be used for the final wiping. The cleaned surface shall be accepted by the Engineer. If the surface is determined to meet the requirements of SSPC-SP 15, painting operations can commence.

Note: Chemical stripping and abrasive blast cleaning will not be permitted.

Existing Steel Surfaces to be Painted: After the designated areas have been inspected and accepted according to the surface preparation specification, SSPC SP 15, the steel surfaces which are to receive the field touch-up paint shall be cleaned immediately prior to coating operations by wiping or scrubbing the surface with rags or brushes wetted with solvent. Use clean solvent and clean rags for the final wiping.

- Solvent must be compatible with the specified coatings. Solvent cleaned surfaces shall be primed before any detrimental recontamination or corrosion occurs. Follow manufacturer’s safety recommendations when using any solvent.
- All foreign materials such as dirt, dust, loose rust scale, sand, bird droppings, and all materials loosened or deposited on the steel surface by cleaning operations shall also be completely removed by vacuuming before any painting operations commence.

- Failure by the Contractor to properly prepare and clean surfaces to be painted in accordance with the specifications shall be cause for rejection by the Engineer. All surfaces that are rejected shall be cleaned and painted to the satisfaction of the Engineer in accordance with the specifications, at no additional cost to the State.

Application of Field Paint: The method for coating application shall be by brush and roller equipment. The containment for paint application shall consist of drop cloths and a solid platform bottom.

Storage, opening, mixing, thinning and application of the paint shall be accomplished in strict accordance with the specified Contract requirements and procedures published by the paint manufacturer and supplier. The Contractor shall have at the Project site, at all times, the current copies of all technical data, recommendations and procedures published by the paint manufacturer. All coatings shall be supplied in sealed containers bearing the manufacturers name, product designation, batch number and mixing/thinning instructions. Leaking containers shall not be used. Paint shall be furnished in the manufacturer's original sealed and undamaged containers. For multiple component paints, only complete kits shall be mixed and used. Partial mixing is not allowed. The paint shall be applied to produce a uniform smooth coat without runs, streaks sags, wrinkles, or other defects.

The Contractor shall provide a suitable facility for the storage of paint, which is in accordance with the latest Federal and State regulations. This facility must provide protection from the elements and insure that the paint is not subjected to temperatures outside the manufacturer's recommended extremes. Storage for paint must be located in reasonable proximity to the painting locations. The Engineer shall be provided access to the stored paint at any time, for inspection and to witness removal of the materials. The Contractor's facility for the storage of paint is subject to the approval of the Engineer.

Ambient Conditions: Solvent cleaning just prior to coating application or coating application work shall be performed when the conditions are as follows:

- The relative humidity is at or below 80% and when there is no falling rain or dew present, or anticipated, before a prepared surface can be coated.
- The substrate is not damp or covered by frost or ice.
- The surface temperature and air temperature are between 50°F and 100°F.
- The surface temperatures of the steel and air are more than 5°F above the dew point temperature, as determined by a surface temperature thermometer and electric or sling psychrometer.

If the requirements of the coating manufacturer differ from the ranges provided above, comply with the most restrictive requirements unless directed otherwise by the Engineer in writing.

The Contractor is liable for any fines, costs, or remediation costs incurred as a result of his failure to be in compliance with this special provision and all federal, state, and local laws.

Method of Measurement: This work will be measured by the actual square foot of existing steel at designated areas where paint was removed, surfaces cleaned, re-painted and accepted. **Note:** In some instances when **new steel** is being added to the designated areas where the paint was removed, the removal area may not equal the area to be re-painted. Measurement in these cases will be by the actual square foot of existing steel where the paint was removed and accepted.

Basis of Payment: This work will be paid for at the Contract unit price per square foot for "Localized Paint Removal and Field Painting of Existing Steel," complete in place, which price shall include all materials, containments, containers, equipment, tools, labor, heating devices, services of the technical advisor and for any incidental work. No direct payment will be made for the cost of storage or hauling the paint and other materials, including paint chips and associated debris, to and/or from the bridge site, but the cost thereof shall be included in the Contract unit price.

Pay Item	Pay Unit
Localized Paint Removal and Field Painting Of Existing Steel	s.f.

ITEM #0603779A - TEMPORARY SUPPORT SYSTEM NO. 1

Description: Work under this item shall consist of the design, installation, maintenance and removal of a temporary support system used to maintain the structural integrity of the existing junction box during removal and re-construction of the top slab as indicated on the plans. Preparation of Working Drawings for the system is also included as part of this work.

Materials: All materials and components used shall be in good condition and appropriate for their intended use and shall match the sizes, grades and material designations shown on the approved Working Drawings.

If pre-engineered systems are used, the Contractor shall submit complete/comprehensive catalog cuts, design tables and certifications from the Supplier/Manufacture of the system.

Any materials or components that do not match the approved Working Drawings or Manufacture's literature or are deemed unacceptable by the Engineer shall be promptly removed from the work site.

Construction Methods: Working Drawings, Manufacture's literature and Materials Certificates and Certificates of Compliance, for pre-engineered systems, shall be submitted for review and approval prior to the start of work, in accordance with Articles 1.05.02 and 1.06.07 of Form 817. All Working Drawings shall have the design calculations and the drawings stamped by a Professional Engineer licensed in the State of Connecticut.

Working drawings must include a sequence of construction indicating when the full system or select portions of the system must be in place before any work or sequential portions of the work can begin. The Contractor cannot deviate from this sequence without the written approval of the Engineer. The installed system shall not impede the required construction/modification of the structure.

Connections to portions of the existing concrete to remain shall not cause any damage or modification that lowers its structural capacity or service life or creates an unacceptable visual appearance in its final condition, as determined by the Engineer.

Upon the satisfactory completion of the work, as shown on the plans and confirmed by the Engineer, the temporary system shall be removed in its entirety, in the sequence shown on the Working Drawings. Care shall be taken to not damage any of the existing or new structure elements or any of the adjacent new construction. Any other damage shall be repaired to the satisfaction of the Engineer at no cost to the State. All components of the temporary support system shall remain the property of the Contractor and shall be removed from the project site.

Method of Measurement: This work will not be measured for payment, as the work is being paid for on a Lump Sum basis at each site. All temporary support systems required at a specific bridge site shall be included in the Lump Sum price for that Contract Item.

Basis of Payment: This work will be paid for at the Contract Lump Sum price for "Temporary Support System No. 1" of the specific site where the work is complete and accepted. The Lump Sum price shall include all materials, equipment, tools and labor incidental thereto. The design and preparation of Working Drawings and any required revisions shall also be included in the Lump Sum price.

Pay Item	Pay Unit
Temporary Support System No. 1	L.S.

ITEM #0603802A - STRUCTURAL STEEL-SIGN SUPPORTS

Description: Work under this item shall consist of fabricating, furnishing, transporting, storing, handling and installing structural steel onto existing sign support structures, as indicated on the plans. The type and size of steel shall be as designated on the plans, as directed by the Engineer and in accordance with these specifications. Also included is the preparation of working drawings for erection of the supports.

Work under this item also includes removal and disposal of existing structural steel as required by the plans. To remove the steel, the existing welded or bolted connections shall be disassembled as required.

Work under this item shall also consist of obtaining field measurements as required to achieve proper fit of the final conditions.

Work under this item also includes furnishing and installing all high strength bolting hardware (bolts, nuts, washers, and plate washers), sign panel hooks, sign stops, and other miscellaneous steel shims and plates as required for the repairs to existing sign support structures. Except for installation of U-Bolts, and unless indicated otherwise in the plans, all steel attachments required under this item shall be made by high strength bolted connections.

Materials: Structural steel for vertical attachment members (VAMS), shim plates, and other miscellaneous steel indicated on the plans shall conform to the requirements of AASHTO M270 (ASTM A709), Grade 50. All new structural steel shall be hot dip galvanized in accordance with ASTM A123.

All high strength bolts shall conform to ASTM F3125, Grade A325, Type 1. Nuts shall conform to ASTM A563, Grade DH. Circular, flat, hardened steel washers shall conform to ASTM F436. The bolts, nuts and washers shall be galvanized in accordance with ASTM A153, Class C or ASTM B695, Class 50. Bolting materials and galvanizing shall also conform to all requirements of Subarticle M.06.02-3.

Compressible-washer-type direct tension indicators shall conform to ASTM F959, Type 325, and shall be galvanized in accordance with ASTM B695, Class 50.

U-bolts and threaded rods shall conform to ASTM A449. The nuts shall conform to ASTM A563, Grade DH. The washers shall conform to ASTM F436. The bolts, nuts and washers shall be galvanized in accordance with ASTM A153 or ASTM B695, Grade 50. The nuts shall be overtapped to the minimum amount required for the fastener assembly and all surfaces of the nuts shall be lubricated with a lubricant containing a visible dye of any color that contrasts with the color of the galvanizing. The threaded ends of all U-bolts and threaded rods shall be supplied with 1 washer and 2 nuts.

Neoprene gasket material, where called for, shall conform to ASTM D1056, Grade 2A2 or 2A3. Other grades of neoprene approved by the Engineer may be used.

Materials for this work shall be stored off the ground before, during, and after fabrication. Structural steel shall be kept free from dirt, grease and other contaminants and shall be reasonably protected from corrosion.

Construction Methods:

1. Removal of Existing Steel:

Miscellaneous steel, where called for in the plans, shall be cut out and removed from the site. All removals shall be done with minimal damage to all steel that is to remain in place.

Removal of weld material shall be done by machining, grinding, chipping, or air carbon-arc gouging and in such a manner that the remaining base metal is not undercut. A minimum of 1/4" of weld metal shall be left in place if arc gouging is the selected removal method and the remaining weld metal shall be removed by grinding. Welders who perform arc gouging shall be SMAW certified.

Bolts shall be removed by pneumatic or mechanical tools in a manner that will not damage the underlying, connected material. Flame cutting methods shall not be used without the prior written approval of the Engineer. Upon removal of each bolt, the base metal around the hole shall be examined for surface irregularities and deterioration. All oxidized material shall be removed.

Wherever hole diameters are increased by removal of oxidized material the diameter of the resultant hole must not be more than 1/16" larger than the mating bolt. If this condition is not met, provide a high strength bolt in a larger diameter as directed by the Engineer. A hardened washer shall be provided under each element of each bolt.

2. Pre-qualification:

(a) Fabricators producing material for Department projects under this item are required to have, as a minimum, an active AISC Certification for Simple Steel Bridges.

(b) Field Welders: All field welders, field welding operators, and field tackers shall possess a valid welder certification card issued by the Department's Division of Materials Testing. If such person has not been engaged in welding operations on a Department project or project acceptable to the Department within a period of six months, or if he cannot produce an approved welding certificate dated within the previous twelve months from a welding agency acceptable to the Engineer, he shall be required to re-qualify through examination. The Engineer may require re- qualification of anyone whose quality of work he questions.

3. Submittals:

(a) Shop Drawings: Before fabricating any materials the Contractor shall submit shop

drawings to the Engineer for approval in accordance with Article 1.05.02-3. These drawings shall include material lists, material designations, and all field measurements necessary for proper fabrication of the steel.

(b) Shop Schedule: The Contractor shall submit a detailed shop fabrication schedule to the Engineer for review within 30 days of the notice to proceed. At a minimum the schedule shall include the start date, milestone dates, and completion date.

(c) Welding Procedures: Prior to start of fabrication, all weld procedures shall be submitted to the Engineer for review and approval.

(d) Working Drawings: Prior to erection of supports, the Contractor shall submit working drawings which provide a detailed erection procedure for the supports. Working Drawings shall be prepared and submitted in accordance with Article 1.05.02.

The working drawings shall include as a minimum:

1. Plan of the work area
2. Maintenance and Protection of Traffic plan
3. Detailed narrative of erection sequence
4. List of equipment
5. Lifting capacities for any lifting or hoisting equipment and rigging
6. Bolting requirements

The Contractor shall submit these documents to the Engineer at least 30 calendar days in advance of their proposed use. If the proposed method of installation requires additional members or modifications to the existing members of the structure, such additions and modifications shall be made by the Contractor at no expense to the State.

4. Shop Fabrication: Unless otherwise shown on the plans or indicated in the Special Provisions, structural steel shall be fabricated in accordance with the AASHTO LRFD Bridge Construction Specifications, amended as follows:

(a) Notification: The Contractor shall submit written notification to both the Engineer and the Director of Research and Materials Testing not less than 7 calendar days prior to start of fabrication. No material shall be manufactured or worked in the shop before the Engineer has been so notified. The notification shall include the name and location of the fabrication shop where the work will be done so that arrangements can be made for an audit of the facility and the assignment of a Department Quality Assurance inspector.

(b) Welding: Unless otherwise indicated on the plans or specifications, all work shall be performed in accordance with the latest edition of the AWS D.1-1 Structural Welding Code – Steel.

(c) Inspection: The Contractor shall furnish facilities for the inspection of material and workmanship in the shop by the Engineer. The Engineer and his representative shall be allowed free access to the necessary parts of the premises.

The Engineer will provide Quality Assurance (QA) inspection at the fabrication shop to assure that all applicable Quality Control plans and inspections are adequately adhered to and maintained by the Contractor during all phases of the fabrication. A thorough inspection of a random selection of elements at the fabrication shop may serve as the basis of this assurance.

Prior to shipment to the project, each individual piece of structural steel shall be stamped or marked in a clear and permanent fashion by a representative of the fabricator's Quality Control(QC) Department to indicate complete final inspection by the fabricator and conformance to the project specifications for that piece. The stamp or mark must be dated. A Materials Certificate in accordance with Article 1.06.07 may be used in lieu of individual stamps or markings, for all material in a single shipment. The Materials Certificate must list each piece within the shipment and accompany the shipment to the project site.

Following the final inspection by the fabricator's QC personnel, the Engineer may select pieces of structural steel for re-inspection by the Department's QA inspector. Should non-conforming pieces be identified, all similar pieces must be re-inspected by the fabricator and repair procedure(s) submitted to the Engineer for approval. Repairs will be made at the Contractor's expense.

The pieces selected for re-inspection and found to be in conformance, or adequately repaired pieces, may be stamped or marked by the QA inspector. Such markings indicate the Engineer takes no exception to the pieces being sent to the project site. Such marking does not indicate acceptance or approval of the material by the Engineer.

Following delivery to the project site, the Engineer will perform a visual inspection of all material to verify shipping documents, fabricator markings, and that there was no damage to the material or coatings during transportation and handling.

The Engineer is not responsible for approving or accepting any fabricated materials prior to final erection and assembly at the project site.

(d) Nondestructive Testing: All nondestructive testing of structural steel and welding shall be performed as designated on the plans and in the project specifications. Such testing shall be performed by personnel approved by the Engineer.

Personnel performing Radiographic, Ultrasonic or Magnetic Particle testing shall be certified as a NDT Level II technician in accordance with the American Society for Non Destructive Testing (ASNT), Recommended Practice SNT-TC-1A.

Nondestructive testing shall be performed in accordance with the procedures and standards set forth in the AWS D.1-1 Structural Welding Code – Steel. The Department reserves the right to perform additional testing as determined by the Engineer.

All nondestructive testing shall be witnessed by an authorized representative of the

Department. Certified reports of all tests shall be submitted to the Assistant Director of Materials Testing for examination. Each certified report shall identify the structure, member, and location of weld or welds tested. Each report shall also list the length and location of any defective welds and include information on the corrective action taken and results of all retests of repaired welds.

Should the Engineer require nondestructive testing on welds not designated in the contract, the cost of such inspection shall be borne by the Contractor if the testing indicates that any weld(s) are defective. If the testing indicates the weld(s) to be satisfactory, the actual cost of such inspection will be paid by the Department.

(e) Marking: Each member shall be identified with an erection mark corresponding with the member identification mark on the approved shop drawings. Identification marks shall be impressed into the member with a low stress stamp in a location in accordance with standard industry practice.

(f) Shipping, Handling and Storage: The Contractor shall make all arrangements necessary to properly load, transport, unload, handle and store all material. The Contractor shall furnish to the Engineer copies of all shipping statements. The weight of the individual members shall be shown on the statements. All material shall be unloaded promptly upon delivery. The Contractor shall be responsible for any demurrage charges. Damage to any material during transportation, improper storage, faulty erection, or undocumented fabrication errors may be cause for rejection of said material at the project site. All costs associated with any corrective action will be borne by the Contractor.

5. Cleaning of Contact (Faying) Surfaces: All pack or laminar rust shall be removed from existing steel members that are to remain and will be attached to the new structural steel. Burrs or other irregularities that prevent solid seating of the adjoining surfaces shall be removed. At the time of assembly, all contact surfaces shall be free of loose paint, dirt, cutting oil (from drilling operations) and any other foreign material. The contact surfaces shall also be free of scale, except tight mill scale. Tightly adherent paint need not be removed. The purpose of this requirement is to insure that all contact surfaces between existing and new steel will be in firm contact without any deleterious materials interfering with the contact surfaces.

6. Installation of Steel: Structural steel shall be installed as shown on the plans, in accordance with Working Drawings, and any match marks shall be followed. The steel shall be carefully handled so it will not be bent, broken or otherwise damaged. Hammering which will injure or distort new or existing members is not permitted.

The Contractor shall provide the Engineer reasonable access and lighting to the work locations for the purpose of inspection whenever so requested.

Bolting: The high-strength bolts, including nuts and washers, shall be installed and tensioned in accordance with Subarticle 6.03.03-4 (f). A connection may be found acceptable by the Engineer if the faying surfaces of the connection plates are in firm, continuous contact after properly

tensioning the bolts. If a bolted connection is found not acceptable, the Contractor shall submit a procedure to the Engineer for review that details the repairs to the connection. Bolts, nuts and washers, if used for a trial shop fit-up, shall not be reused in the final field assembly

Field Touch-Up Painting: Existing steel surfaces that are left bare as a result of paint removal, bolting, or arc gouging operations shall be touched up after installation of the new steel with two coats of zinc paint conforming to M10.02-8. Damaged galvanizing or bare steel on all new steel shall also be touched up by application of two coats of said zinc paint. All surfaces designated for touch up painting shall be thoroughly cleaned and prepared in accordance with the Manufacturer's instructions prior to the touch-up painting.

Method of Measurement: The weight of the structural steel to be measured for payment under this item shall be computed on the basis of the net finished dimensions of the steel members based on field measurements determined by the Engineer, deducting for copes and cuts. Holes required for bolting materials will not be deducted from the weight calculations. The weight of weld metal, permanent bolting materials and temporary erection bolts, shop and field paint, boxes, crates, and other containers used for shipping, and materials used for supporting members during transportation and erection, shall not be measured for payment.

The weight of members designated for removal shall not be measured for payment.

The weight of steel shims, plate washers, and filler plates shall be measured for payment.

The weight of steel sign stops, sign hooks, and other miscellaneous steel plates that are installed or otherwise attached to vertical attachment members, when said VAMs are installed onto existing sign support structures, shall be measured for payment.

The weight of bolting hardware (bolts, nuts, washers) shall not be measured for payment.

The weight of threaded rods, when drilled and grouted into existing concrete bridge and wall parapets, shall be measured for payment.

Basis of Payment: The structural steel, incorporated in the completed and accepted structure, will be paid for at the contract unit price per hundredweight for "Structural Steel-Sign Supports."

Payment shall be for new structural steel, complete in place, which price shall include the cost of disassembling existing connections (bolts or welds); removal of the steel designated for replacement, obtaining field measurements, removing pack rust and other obstructions from surfaces of existing steel that will be in contact with the new structural steel; cleaning of contact (faying) surfaces; preparation of shop and working drawings; fabricating, furnishing, transporting, storing, erecting and installing new structural steel by bolting; providing the Engineer access to the work locations indicated on the plans, and all other materials, equipment, tools and labor incidental thereto.

Pay Item	**Unit**
Structural Steel-Sign Supports	cwt

ITEM #0603805.03A - TEMPORARY SUPPORT SYSTEM (SITE NO. 3)
ITEM #0603805.06A - TEMPORARY SUPPORT SYSTEM (SITE NO. 6)

Description: Work under this item shall consist of the design, installation, maintenance and removal of a temporary support system used to maintain the structural adequacy of existing pier elements during construction. Preparation of Working Drawings for the system is also included as part of this work. The Site Numbers are as indicated on the Contract plans.

Materials: All materials and components used shall be in good condition and appropriate for their intended use and shall match the sizes, grades and material designations shown on the approved Working Drawings.

If pre-engineered systems are used, the Contractor shall submit complete/comprehensive catalog cuts, design tables and certifications from the Supplier/Manufacture of the system.

Any materials or components that do not match the approved Working Drawings or Manufacture's literature or are deemed unacceptable by the Engineer shall be promptly removed from the work site.

Construction Methods: Working Drawings, Manufacture's literature and Materials Certificates and Certificates of Compliance, for pre-engineered systems, shall be submitted for review and approval prior to the start of work, in accordance with Articles 1.05.02 and 1.06.07 of Form 817. All Working Drawings shall have the design calculations and the drawings stamped by a Professional Engineer licensed in the State of Connecticut.

Working drawings must include a sequence of construction indicating when the full system or select portions of the system must be in place before any work or sequential portions of the work can begin on the existing pier. The Contractor cannot deviate from this sequence without the written approval of the Engineer. The designed systems shall include adequate adjustability to account for variability of the existing pier elements and other site conditions during installation and while in service. The installed system shall not impede the required construction/modification of the pier or other work in the vicinity of the pier.

The Contractor shall install the system, with the configurations and connections of components, shown on the approved Working Drawings. Deviations from the Working Drawings shall be cause for the stopping of work, if directed by the Engineer.

Connections to portions of the existing pier to remain shall not cause any damage or modification that lowers its structural capacity or service life or creates an unacceptable visual appearance in its final condition, as determined by the Engineer.

While in service, the system shall be periodically monitored for performance, in the presence of the Engineer. When necessary, adjustment to the system shall be made, through the means designed into the system for that specific purpose. Drastic changes in the performance or

configuration of the entire system or its components and connections will be immediately brought to the attention of the Engineer.

Upon the satisfactory completion of the work on the pier, as confirmed by the Engineer, the temporary system shall be removed in its entirety, in the sequence shown on the Working Drawings. Care shall be taken to not damage any of the pier elements remaining in service or any of the adjacent new construction. Specific attention shall be given to the locations where the temporary support system comes in contact with or was anchored to the pier element. Locations where planned temporary modifications were made to the pier, such as temporary anchorage connections, shall be permanently repaired as shown on the Working Drawings. Any other damage shall be repaired to the satisfaction of the Engineer at no cost to the State. All components of the temporary support system shall remain the property of the Contractor and shall be removed from the project site.

Method of Measurement: This work will not be measured for payment, as the work is being paid for on a Lump Sum basis at each site. All temporary support systems required at a specific bridge site shall be included in the Lump Sum price for that Contract Item.

Basis of Payment: This work will be paid for at the Contract Lump Sum price for "Temporary Support System (Site No. X)" of the specific site where the work is complete and accepted. The Lump Sum price shall include all materials, equipment, tools and labor incidental thereto. The design and preparation of Working Drawings and any required revisions shall also be included in the Lump Sum price.

Pay Item	Pay Unit
Temporary Support System (Site No. 3)	L.S.
Temporary Support System (Site No. 6)	L.S.

ITEM #0603870.03A - REMOVAL OF EXISTING STRUCTURAL STEEL (SITE NO. 3)

ITEM #0603870.15A - REMOVAL OF EXISTING STRUCTURAL STEEL (SITE NO. 15)

Description: Work under this item shall consist of the removal and satisfactory disposal of complete girders or portion of girders, diaphragms, stiffeners, and miscellaneous steel as shown on the plans or directed by the Engineer.

Work under this item shall also consist of designing, furnishing, installing, maintaining and removing any temporary shoring or bracing for the steel removal as required by the design or as shown on the plans.

Materials: Steel, timber or any other material or combination of materials may be used for the temporary shoring or bracing.

The materials used shall be of satisfactory quality, and capable of safely carrying the anticipated loads. All materials shall be approved by the Engineer before use.

Construction Methods: All work shall proceed as directed by and to the satisfaction of the Engineer in accordance with the details shown on the plans. The Contractor shall submit the procedure for removal of the existing structural steel to the Engineer for approval.

The Contractor shall prepare and submit to the Engineer working drawings and design computations for removal operations, including temporary shoring or bracing for review in accordance with Article 1.05.02. A Professional Engineer licensed in the State of Connecticut shall seal the working drawings and design calculations. Each page of the working drawings shall have the seal of the Professional Engineer. Only the first page of the design calculations need to have the seal of the Professional Engineer. No work shall begin until acceptance of the drawings has been obtained from the Engineer.

The temporary shoring tower shall be supported on firm bearing surface such as cribbing to ensure that the tower is able to support the design reaction without settlement.

The removal of existing structural steel shall not result in damage to any permanent construction (new or existing) or utilities. If any damage occurs it shall be repaired by the Contractor to the satisfaction of the Engineer, at no additional expense to the State.

During the removal of the existing structural steel, the Contractor must ensure that any existing girders are laterally supported until the new diaphragms and deck are installed.

Method of Measurement: This item being paid for on a lump sum basis will not be measured for payment.

Basis of Payment: This work will be paid for at the contract lump sum price for "Removal of Existing Structural Steel (Site No. x)" which price shall include all equipment, tools and labor necessary thereto, as well as the design, furnishing, installation, maintenance and removal of the temporary shoring tower.

There shall be no measurement or separate payment for the cost of removing lead paint. The final cleaning of members that are to remain or steel left bare as a result of modification shall be paid for under the item "Abrasive Blast Cleaning and Field Painting of Beam Ends (Site No. x)" as required.

Pay Item	Pay Unit
Removal of Existing Structural Steel (Site No. x)	L.S.

ITEM #0651649A - CURED IN PLACE PIPE LINER

Description:

This item shall consist of furnishing and installing a cured-in-place pipe (CIPP) liner necessary to rehabilitate storm drainage of the size specified on the plans. The work shall generally consist of design of the pipe liner, all required submittals, handling groundwater and stormwater, containment of rinse water, exposing the end of the pipe, storm drain cleaning, closed circuit television inspection throughout the operation, removal of obstructions and other pre-installation point repairs, service connection abandonment and rehabilitation, resin impregnation, inversion using hydrostatic head, curing using circulated heated water, sealing of ends and transitions, leak control, odor monitoring and mitigation, and all required testing for acceptance.

The CIPP lining shall be a resin-impregnated, flexible polyester felt tube inserted into the storm drain to be rehabilitated and cured-in-place by the use of circulating heated water.

When cured, the liner shall form a continuous, tight fitting, hard, impermeable liner that is resistant to contaminants, de-icing chemicals, trace amounts of gasoline and other oil products sometimes found in storm drain systems and soils adjacent to the pipe to be lined.

Point repairs authorized by the Engineer will be performed to repair sections of pipe through excavation from the ground surface.

Handling water necessary to satisfactorily perform the cured in place pipe lining and point repairs are included in the work under this item. Containment measures to ensure rinse waters do not discharge to the adjacent wetlands are also included in the work under this item. The Contractor shall submit working drawings for review for handling water and containment of rinse water.

Materials:

Tube: The tube supplied shall conform to the requirements of ASTM F 1216. The tube shall consist of one or more layers of flexible needled felt or an equivalent woven and/or non-woven material capable of carrying resin, withstanding installation pressures and curing temperatures. No single layer of the felt system shall be less than 1/16” in thickness. The material shall be able to stretch to fit irregular pipe sections and negotiate bends. The outside layer of the tube shall be constructed of an impermeable membrane with a material that is compatible with the resin used and which will isolate the curing water from the resin. The tube should be fabricated to a size that, when installed, will tightly fit the internal circumference and the length of the original conduit. Allowance should be made for circumferential stretching during inversion.

Resin: A general purpose, unsaturated, styrene-based, thermoset resin and catalyst system or an epoxy resin and hardener that is compatible with the inversion process shall be used. The resin must be able to cure in the presence of water and the initiation temperature for cure shall be less than 180 degrees F.

The CIPP system can be expected to have as a minimum, the following initial structural properties as determined by testing in accordance with ASTM D 790:

Flexural Strength	4500 psi
Flexural Modulus	250,000 psi

The Contractor shall submit a certificate of compliance and a material certification in conformance with Article 1.06.07 for the tube and resin.

Construction Methods:
The Contractor is responsible for the following work:

Design of Pipe Liner
a) Design Criteria: the cured in place pipe thickness shall be calculated and designed assuming a fully deteriorated existing pipe capable of carrying highway live loads in accordance with AASHTO HL-93 loading.

b) Shop Drawings: The contractor shall submit design calculations showing the thickness of the liner to be installed. This design shall be made in accordance with ASTM F-1216 and the project specifications. Designs shall indicate any assumptions made in addition to those specified, all calculations and inputs, and design output.

Measurements made by the Contractor to verify length and cross-section dimensions of the original storm drain pipe prior to ordering materials; the liner thickness to be provided for each segment to be rehabilitated; and information on the long-term flexural strength and long-term flexural modulus of the cured-in-place pipe lining system to be provided.

The Contractor shall submit a detailed procedure for installing the liner, including quantity calculations for tubing and resin, safety measures, odor control and monitoring, videotaping equipment and personnel, proposed storm drain cleaning equipment and containment methods, acceptance testing methods and personnel.

If any of the assumptions used in the design are found to be different than actual field conditions, the Contractor shall resubmit the design calculations with both the original and revised computations.

Design of Containment Measures
The Contractor shall design and submit a containment measure working drawing for review. The working drawing will include discharge capacity, handling methods, containment devices and disposal plan.

Bypass Flow Control Plan

The Contractor shall provide for bypass pumping of the flow of stormwater around the section designated for lining. Bypass pumping will be required for cleaning the pipe to be lined, televising the pipe, lining the pipe and final acceptance of the pipe. Bypass pumping will be included in the bid unit price of the item.

The Contractor shall protect the liner from the effects of stormwater and groundwater.

Storm Drain Cleaning

The Contractor shall clean storm drain segments designated for inspection and/or rehabilitation prior to performing the work and shall be solely responsible for his means and methods of cleaning. Cleaning of the storm drain shall consist of the removal of all contaminants, sand, silt, solids, roots, and other debris from each storm drain segment, including sags within any pipe segment and including manholes. Access for cleaning purposes shall only be via existing manhole openings or pipe outlet.

The Contractor shall be responsible for any material that flows downstream of the storm drain being rehabilitated during construction. The Contractor shall take necessary precautions and install temporary dams at the downstream end of the lining work to prevent material from leaving the work area. All temporary devices and construction debris shall be removed prior to reinstating flow through the storm drain.

The Contractor shall take satisfactory precautions to protect the storm drain segments and appurtenances from damage that might be inflicted upon them by the use of cleaning equipment. Any damage inflicted upon a storm drain segment or other property as a result of the Contractor's cleaning operations shall be repaired by the Contractor at no additional cost to the State.

Selection of cleaning equipment and the method for cleaning shall be based on the condition of pipe material of the storm drain segment at the time work commences, and shall comply with this specification. All equipment and devices shall be operated by experienced personnel so that storm drain lines are not damaged in the process of cleaning. If the Contractor's cleaning equipment becomes lodged in a storm drain, it shall be removed by the Contractor at no additional cost to the State. Effectiveness of equipment and operating method for cleaning shall be judged by the results obtained and subject to approval by the Engineer.

The flushing of any storm drain to facilitate the cleaning activities without the capture of sediments, solids and debris is specifically prohibited. When hydraulic or high velocity cleaning equipment is used, a suitable sand trap, weir, or dam shall be constructed in the downstream location in such a manner that all solids and debris are trapped and removed thereby preventing such material from passing into the next storm drain segment reach or outfall.

The Contractor shall remove all roots from the culvert walls and joints. Procedures may include the use of mechanical equipment such as rodding machines, winches using root cutters and porcupines, and equipment such as high-velocity jet cleaners. The Contractor shall seal voids in the culvert where the root was removed as directed by the Engineer.

If cleaning of an entire storm drain section cannot be successfully performed from one manhole, the Contractor shall immediately notify the Engineer. The Contractor shall then attempt cleaning on the other manhole or outfall. If successful cleaning cannot be performed on this reverse setup or the equipment fails to traverse entire storm drain section, it shall be assumed that a major blockage or defect exists. No additional payment allowance shall be made for reverse set-ups. The Contractor shall cease cleaning operations to avoid possible damage from continued operations.

The Contractor shall determine the location of major blockage(s) by measuring length of hose or rod inserted from manholes or outfall at each end and immediately report location of blockage(s) to the Engineer. The Contractor shall provide a written, detailed sketch of the blockage. The Contractor may be directed to proceed with the pre-inspection videotaping at this point to properly assess the obstruction. A repair assessment will be provided to the Engineer. Repairs requiring excavation will be included in the bid unit price of this item. The repair shall include excavation and repair of the storm drain, protection of underground utilities, backfilling, and surface restoration. No additional payment will be made for videotaping the obstruction. No rehabilitation work shall proceed until the Contractor receives direction from State regarding removal of the obstruction.

The Contractor shall remove all contaminants, dirt, sand, rocks, grease and other solid or semisolid material and debris resulting from the cleaning operations from the downstream manhole or outfall of the storm drain segment being cleaned. Passing material to another storm drain segment shall not be permitted. If sludge, dirt, sand, rocks, grease and other sediment or debris resulting from the cleaning operations passes to downstream storm drain, the Contractor shall clean such downstream storm drain at no additional cost to the State.

The Contractor shall be responsible for the proper handling, hauling and disposal of all debris, silt, and accumulated solids removed from the storm drain in accordance with the environmental specifications contained elsewhere in these documents.

Determination of acceptance of storm drain cleaning will be based on inspection at manholes and viewing of video tape completed following cleaning. When the depth of debris remaining after cleaning shall be less than or equal to ¼ inch and no blockages exist, the Contractor may request to continue with the Pre-Installation Television Inspection with the mutual understanding that acceptance of the cleaning cannot occur until the videotape has been created and viewed.

Pre-Installation Television Inspection

It shall be the responsibility of the Contractor to video (TV) inspect the storm drain pipe immediately before the insertion of the impregnated tube to assure that the pipe is clean and existing pipe conditions are acceptable for lining.

Television inspection equipment shall have an accurate footage counter that displays on a remote monitor the exact distance of the camera from the centerline of the starting manhole. The

camera shall be of the remotely operated pan and tilt type. The rotating camera and lighthead configuration shall provide 240 degrees of pan and tilt angle measuring centerline to centerline and 70 degree lens viewing angle.

The camera shall be color and shall provide a minimum of 460 lines of horizontal resolution and 400 lines of vertical resolution. The image pick-up device shall contain in excess of 379,000 picture elements (pixels). Geometrical distortion of the image shall not exceed one percent. The color camera shall be equipped with the necessary circuitry to allow for the remote adjustment of the optical focus and iris from the power control unit at the viewing station.

Inspection of pipelines shall be performed by experienced personnel trained in locating breaks, obstacles, and service connections by closed-circuit television inspection techniques. The interior of the pipeline shall be carefully inspected to determine the location and extent of all pipeline defects. The location of any conditions which may result in a limitation of rehabilitation techniques that could be used and/or prevent proper installation of designated rehabilitation materials in the pipelines shall be noted so that these conditions can be considered and, if necessary, corrected prior to actual rehabilitation.

The Contractor shall internally inspect, via closed circuit television inspection, the storm drain segments as required. Generally, inspection shall be completed one section at a time. Access for televising purposes shall only be via existing manholes. Should access to particular section be difficult and adjacent sections require television inspection, the Contractor may be allowed to complete inspection in multiple storm drain sections. When multiple storm drain sections are inspected using one setup, the Contractor shall zero the camera's footage metering device at each subsequent manhole to establish uniform starting location of Station 0+00 for each line section televised.

At all defects and service connections, the camera shall be stopped and the pan and tilt features shall be used to obtain a clear picture. The camera shall be panned to view up each lateral or point of connection.

The Contractor shall record these inspections on DVD and on a suitable electronic log. TV inspection software shall be furnished by WinCan America or approved equal. Video shall include a visual and audio narrative noting the date, time of day, and depth of flow; storm drain segment number (segment numbers designations shall be approved by the Engineer); upstream manhole number; downstream manhole or outlet number; type and size of storm drain; closest landmark and highway identification; beginning and ending tape counter numbers for each run (manhole to next manhole) of storm drain inspected; direction of movement of camera, heading, and direction of flow; location (start and end counter distances in feet from the beginning manhole's centerline) and description of obstructions, structural defects, missing pieces of pipe, longitudinal and/or circumferential cracking, joint deterioration including open and/or offset joints, ovality, leakage or evidence thereof, corrosion, erosion, break-in connections, protruding connections, mineral deposits, roots, previous repairs, deposits on pipe walls, sags, and other abnormalities with respect to the storm drain's condition with counter distance in feet from the beginning manhole's centerline. The Contractor's log shall contain the same information.

Video shall display at a minimum the date, pipe segment number (manhole number) and distance from the centerline of the upstream manhole. The distance between manholes shall be verified by measuring tape. If the counter distance and the taping distance differ by more than 2 feet per 100 feet, the run shall be re-televised by the Contractor at no additional cost to the State.

Video shall be maintained and delivered in a case, which shall display the project name, project number, date of inspection, manhole segment number(s) inspected, and crew ID number. The entire length of any one storm drain segment shall be on one DVD. No segment shall be split between two DVDs. A DVD may have multiple segments, so long as an entire section is on one DVD. Original DVDs of all sections will be provided to the Engineer along with the respective television inspection field logs.

The Contractor shall perform a pre-lining television inspection to verify the quality of the preparatory work and to document that the storm drain is clean of all dirt and debris prior to lining. The Contractor shall correct non-conforming preparatory work as directed by the Engineer during the pre-lining inspection. The Contractor shall re-televise or have still digital photographs taken to verify and document the quality of the corrective work prior to lining at no additional cost to the State. The Contractor shall confirm that the conditions are suitable for lining.

The Contractor shall present on DVD a continuous image in complete conformance with these Specifications of not less than ninety percent (90%) of the internal pipe surface at all times, including sags in storm drains. The video tape shall be accompanied by a complete log. Maximum acceptable speed of camera through storm drain shall be 9.2 feet per minute. Lighting system shall be adequate for quality color picture at least 1.5 feet in front of the camera's lens. The Contractor shall re-clean and televise any segment for which video tape does not present a clear image of at least 90% of the internal pipe surface at all times, and/or is accompanied by an incomplete log.

Pre-installation Point Repairs:

The Contractor shall clear the line of obstructions such as solids and roots that will prevent the insertion of CIPP. The Contractor shall perform all necessary repairs to the storm drain.

If pre-installation inspection reveals an obstruction that will prevent the installation process, such as a dropped joint or a collapse, and cannot be removed by conventional cleaning equipment or by entering the storm drain from the manhole, then the Contractor shall make a point repair excavation to uncover and remove or repair the obstruction. Such excavation shall be approved in writing by the Engineer prior to the commencement of the work. Excavation for the point repair will be included in the appropriate contract item for Trench Excavation of the depth specified.

The Contractor shall control active leaks to the extent required to install the liner in conformance with these specifications. If leaks are substantial enough to cause potential defects in the liner, they must be sealed with an acrylamide gel. The Contractor shall fill all void areas.

Where the storm drain to be lined changes size or shape, the Contractor shall furnish and install tapered liner to provide smooth transition. Contractor shall fill potential void areas at transition with grout or gunite prior to lining.

Repair mortar shall be a single component, high strength polymer modified cementitious patching mortar. Material supplied shall have a set time of 15 to 30 minutes. A bonding agent shall be added to the repair mortar to reinforce the bond to the existing surface.

The epoxy coating shall be a 100% solid, corrosion resistant epoxy, capable of being applied to brick by brush or roller. The epoxy should be quick setting and specifically designed for submergence in stormwater. The epoxy shall be capable of being applied and cured in an active storm drain environment.

Manholes and Liner Installation Access

Remove and replace sections of existing manholes for installation access as required for liner installation or as desired by Contractor to improve access to storm drain. The Contractor shall provide advance notice prior to the removal of brick manholes. The Contractor shall compile and submit a list of manholes that are to be modified for liner installation access well in advance of the lining work. The manholes shall be restored equal to or better than their original conditions as approved by the Engineer. The Contractor is responsible for verifying manhole dimensions.

Resin Impregnation

All dimensions shall be field verified by the Contractor prior to manufacture of the liner. The lining tube fabricator shall confirm all dimensions and installation parameters with the Contractor prior to fabricating the tube and certify that tube has been fabricated to tightly fit the internal circumference of the original storm drain based on the data provided.

The length of the liner shall be that deemed necessary by the Contractor to effectively carry out installation and seal the liner at each manhole. All lengths shall be verified by the Contractor prior to fabrication.

The Contractor shall designate a location where the felt tube will be impregnated. The quantity of resin used for tube impregnation shall be sufficient to fill the volume of air voids in the tube with additional allowances for polymerization shrinkage and the loss of resin through cracks and irregularities in the original pipe wall. A vacuum impregnation process and a roller system shall be used to uniformly distribute the resin throughout the tube.

The resin impregnated liner shall be transported and kept in a refrigerated truck until the time of installation. Transportation and storage of the resin impregnated liner shall be done so that the liner is not damaged, exposed to direct sunlight or creates a safety hazard.

Inversion using Hydrostatic Head

Furnish and install the liner in the full length of storm drain as shown on the plans. Intermediate and end manholes shall be lined through with CIPP liner whenever possible to provide continuous rehabilitation. The resin impregnated felt tube shall be inserted into the existing storm drain via water inversion method. Methods that utilize cables and winches to invert the liner shall not be used. The hydrostatic head used during the installation process shall be as specified by the manufacturer, and shall be sufficient to hold the liner tight to the pipe wall and flared ends at the two access manholes or outfall. The same head shall be great enough to overcome or prevent infiltration from entering the pipeline during the curing process.

Curing using Circulated Heated Water

After the inversion process is completed, the Contractor shall supply a suitable heat source and water recirculation equipment to uniformly raise the water temperature to effect a cure of the resin. The Contractor shall also supply adequate equipment to monitor the temperature of the incoming and outgoing water supply. Another gage should be placed between the impregnated tube and the pipe invert at the termination to determine the temperatures during cure. The curing temperature, period of curing and cool down period shall be determined by the resin/catalyst manufacturer. The use of steam as the external heat source will not be allowed.

Initial cure will occur during temperature heat-up and is completed when exposed portions of the new pipe appear to be hard and sound and the remote temperature sensor indicates that the temperature is adequate. After the initial cure is reached, the temperature should be raised to the post-cure temperature as recommended by the manufacturer.

Cool Down from Heated Water Cure

The new pipe should be cooled to a temperature below 100 degrees F (38 degrees C) before relieving the static head in the inversion standpipe. Cool-down may be accomplished by the introduction of cool water into the inversion standpipe to replace water being drained from a small hole made in the downstream end. Care should be taken in the release of static head so that a vacuum will not be developed that could damage the newly installed pipe.

Sealing at Ends

All cut edges of the cured liner shall be sealed with the same resin as was used with the liner. The catalyst or hardener used shall be compatible with the resin/catalyst used in the liner previously, but shall not require an external heat source to begin the exothermic reaction (curing). Cutting and sealing of the liner at manhole connections shall provide watertight pipe and manhole trough seals.

Any gap between installed liners in adjacent storm drain sections lined under this contract shall be filled with the epoxy-coated repair mortar as specified. The gap shall be entirely filled to a depth equal to the height of the liner such that a smooth, uniform transition between the liners is created. Where the epoxy-coated repair mortar is applied in intermediate manholes that were not continuously lined, the mortar shall be applied to the same thickness of the liner and to the springline of the storm drain.

The gap shall be filled using repair mortar. The preparation, installation, curing, and surface preparation of the repair mortar shall be in accordance with the manufacturer's instructions.

The repair mortar section shall be epoxy-coated using the epoxy compound. The epoxy coating application shall be in accordance with the instructions of the manufacturer of the epoxy. The minimum thickness of the epoxy coating shall be 20 mils.

In locations where liners have been overlapped, the top liner at the location of the overlap shall be beveled to provide a smooth transition and reduce the height of the lip caused by the overlap to the greatest extent possible.

Testing and Acceptance

Following installation of the liner, the liner shall be cleaned and debris removed. The Contractor shall then conduct a post-lining television inspection of the completed work. The post-lining television inspection shall verify the quality of the lining work, including the opening and sealing of manholes. The Contractor shall correct non-conforming lining work as noted from the post-lining inspections or otherwise noted by the Engineer. The Contractor shall re-televise or have still digital photographs taken to verify and document the quality of the corrective work at no additional cost to the State.

For each manhole-to-manhole segment, the Contractor shall prepare a written lateral log that documents accurate footages to the laterals, the date opened, and the reason for not opening laterals left closed. The lateral logs shall be signed by the Contractor's field supervisor. The post-lining lateral logs shall be prepared and submitted to the Engineer in the field following lining for each segment.

The liner shall be evaluated by the Engineer based on a review of post-installation television recordings and certified test data for the installed pipe samples and shall be deemed acceptable if the following criteria are met:

1. No observable water infiltration.
2. All manholes are open and clear. All manhole connections are made watertight using epoxy-coated mortar.
3. No observable evidence of splits, cracks, breaks, kinks, wrinkles larger than 1" perpendicular to storm drain flow that are not caused by the existing condition of the storm drain, delamination, or crazing in the liner.

If any defective liner is discovered after it has been installed, it shall be repaired to achieve the specified acceptance criteria or, if that is not achievable, removed and replaced with either a sound liner or a new pipe at no additional cost to the State.

Certification Testing:

The Contractor shall provide specimens from each length (inversion) of CIPP lining installed to allow an independent laboratory to conduct the tests specified below. CIPP samples shall be prepared and physical properties tested in accordance with ASTM F1216.

For each inversion, two CIPP samples shall be provided, using at least one of the following two methods. At least one of the samples shall be a clamped mold sample as described in paragraph "ii." below. The second sample may be taken per either paragraph "i." or paragraph "ii." below.

i. The sample shall be cut from a section of cured CIPP at an intermediate manhole or at the termination point that has been inverted through a like diameter pipe which has been held in place by a suitable heat sink, such as sandbags.

ii. The sample shall be fabricated from material taken from the tube and the resin/catalyst system used and cured in a clamped mold placed in the downtube.

The samples for each of these cases shall be large enough to provide a minimum of three specimens and a recommended five specimens. Each specimen shall be clearly marked to indicate the installed location of the liner, date of installation, pipe diameter, and the resin used.

For each specimen, the thickness shall be determined and the following test shall be performed:

Short-Term Flexural (Bending) Properties – The initial tangent flexural modulus of elasticity and flexural yield strength in accordance with ASTM D790.

Six (6) copies of the test results shall be sent directly to the Engineer by the Contractor's laboratory. The results shall report the actual test results for each of the properties being tested. The laboratory shall certify the reports as to the results and test method utilized.

Each individual reported value shall meet or exceed the value of that property as specified in this Section. Should the test results not meet the minimum strength requirements, the State will have the option of rejecting the CIPP sections found to be defective. If rejected, the CIPP shall be repaired or, if that is not feasible, removed and replaced at no additional cost to the State.

Method of Measurement:

This work will be measured for payment by the actual number of linear feet of cured in place pipe liner installed and accepted. Measurement shall be made along the invert from one sealed end of the cured-in-place pipe installation to the other.

There will be no measurement for payment for the point repairs, but the cost thereof shall be included in the contract unit price per feet for the type of cured in place pipe liner specified. Excavation necessary for such work will be considered as trench excavation and will be measured as such.

Basis of Payment:

Cured-in-Place Pipe Lining will be paid at the contract unit price per linear feet for the storm drain of the type and size specified, complete in place, which price shall include design of the pipe liner, all required submittals, bypass pumping, groundwater and storm water handling, storm drain cleaning, pre- and post-construction videotaping, installation, dust/erosion control, containment measures, protruding lateral cutting, point repairs, testing, repairing existing manholes impacted by the liner installation, odor control and mitigation, site restoration and all materials, equipment, tools and labor incidental to the installation and acceptance of the work.

ITEM #0653002A - CLEAN DRAINAGE SYSTEM

Description:

The work included in this item shall consist of furnishing all equipment, tools, labor, and materials and performing all work necessary for cleaning, removing and disposing of all sludge, dirt, sand, gravel, roots, grease, and other debris from the existing drainage system which includes: culverts; manholes; catch basins; and drop inlets, throughout the Project limits, as directed by the Engineer.

Materials:

Vacant

Construction Methods:

Selection of the equipment used shall be based on the condition of the drainage system at the time the cleaning operations commence and shall be approved by the Engineer. The sequence of the Contractor's work shall allow for the proper and adequate maintenance of all functional drainage systems.

Precautions shall be taken to protect the drainage systems at all times. All workmen shall be experienced and skilled in the use of the equipment used. The Engineer reserves the right to prohibit use of any equipment or method deemed inappropriate for the intended work.

Any and all debris resulting from the cleaning operations shall be removed from the job site and disposed of by the Contractor. The Contractor shall make every effort to remove all sludge, dirt, sand, gravel, roots, grease, and other debris from the existing drainage systems including discharge points. Washing sludge, dirt, sand, gravel, roots, grease, and other debris downstream shall not be permitted.

Method of Measurement:

Project wide cleaning of the drainage system under this item will be measured for payment on a lump sum basis.

Basis of Payment:

This work will be paid for at the contract lump sum price for “Clean Drainage System”, which price shall include all equipment, tools, and labor incidental to the completion of these items. All costs incidental to the disposal of sludge, dirt, sand, gravel, roots, grease, and other debris will be included in the price above.

Pay Item	**Pay Unit**
Clean Drainage System	LS

ITEM #0653102A - VIDEO AND DYE TEST DRAINAGE SYSTEM

Description:

The work under this item shall consist of examining existing drainage systems by means of remote video inspection or dye testing. The purpose is to confirm the size, location, material and condition of the existing drainage system outleting at I-91 NB Exit 27, Sta 19+75, 59R.

Methods:

Proper tools should be available on site for opening manholes or catch basin structures. Prior to beginning any tests or inspections.

The Contractor shall submit in writing his anticipated method of cleaning the conduit to the Engineer for approval prior to cleaning any conduit.

Video Inspection:

The Contractor shall remove all debris from the conduits prior to being inspected. Contractor shall perform a remote inspection by using a crawler mounted camera to record video. The crawler must be capable of inspecting conduits 12 to 120 inches, All-wheel drive or track mounted, adjustable camera height such that the camera can be centered in the conduit vertically and horizontally. The crawler does not obstruct the camera's view or interfere with proper recording of the conduit condition. Crawler speed is adjustable with an operating speed while recording not to exceed 30 feet per minute. The video camera must have a zoom ratio of at least 40:1, this can be achieved with a combination of optical and digital zoom; however, the optical zoom ratio must be at least 10:1. Camera should have a light source that allows all areas of concern to be readily observed. Finally the camera must have the capability of 360 degree rotation as well as a pan and tilt to a 90 degree angle to the axis of the conduit. Provide a recording device that is capable of recording video with the conduit identification, location and type shown on the video. Furnish the video recording in MPEG2 format at a resolution of 720x480 on one of the following media types: DVD, CD, or other media type approved by the Engineer.

Dye Testing:

Utilize available as-built information and utility drawings. Identify nearest exterior storm sewer manhole(s) and catch basins. Prepare the following materials prior to the test; Liquid tracing dye (2 colors minimum). All dyes must be non-toxic, biodegradable and NSF certified. Outfall observers must be able to communicate between upstream and downstream locations, by means of radio or cellular. Record the results in a Dye Test Log.

The dye test procedure is as follows: 1.) Station personnel at the identified manhole, sump, cleanout, outfall or other appropriate locations needed to watch for dye in the storm water flows. Provide personnel with the appropriate communication devices. 2.) Add about a tablespoon of

dye to each fixture drain connected to the storm drain to be tested. Make sure to record the time the dye was added on the Dye Testing Log. Mark the location on the record drawing of each fixture where dye was added. 3.) Flush each fixture with 20-30 gallons of water minimum or until dye is observed in a manhole, storm sewer outfall, or sump. The more water flushed will shorten the time it takes for the dye to be observed. 4.) Watch the storm drain discharge points until the dye is observed. Once dye is observed, note the time, and repeat steps 2 and 3 at each drain being tested.

Method of Measurement:

This work shall be measured for payment on a lump sum basis for each drainage system video inspected and dye tested.

Basis of Payment:

The work under the Item "Video and Dye Test Drainage System" shall be paid for at the contract on a lump sum basis, which price shall include all material, tools, equipment, all labor, and work incidental thereto. Cleaning and flushing drainage system shall be paid separately under item "Clean Drainage System".

Pay item:	Pay Unit:
Video and Dye Test Drainage System	EA.

ITEM #0686002.15A - 15” R.C. PIPE CLASS V (0-10’ DEEP)
ITEM #0686002.18A - 18” R.C. PIPE CLASS V (0-10’ DEEP)

Article 6.51.02 Add the following:

Materials:

Materials for this work shall conform to the current AASHTO specification M170, Class V, Wall C with the tongue-groove expansion joint sealed with continuous rubber gasket. Material requirements of Article M.08.01.6 of the standard specification, form 817 will apply.

ITEM #0686720.15A - 15” HIGH DENSITY POLYETHYLENE PIPE ELBOW - 0’ - 10’ DEEP

ITEM #0686720.18A - 18” HIGH DENSITY POLYETHYLENE PIPE ELBOW - 0’ - 10’ DEEP

ITEM #0686720.24A - 24” HIGH DENSITY POLYETHYLENE PIPE ELBOW - 0’ - 10’ DEEP

Description: This work shall consist of furnishing, preparing and installing new corrugated high density polyethylene (HPDE) pipe elbows of the size and type specified, bedding material, joint sealant, rubber gaskets, clamps, collars, grout, grout collars, drainage trench excavation, backfilling or satisfactory disposal of all materials, the removal of which is necessary for the proper completion of the work, connecting proposed drainage systems to existing systems, plugging or abandoning existing pipes and removal of existing pipe within trench limits, as shown on the plans or as directed by the Engineer.

This Section shall also include removal of drainage pipes outside of drainage trench excavation limits, as defined in 2.86.03-1.

Materials: Materials for this work shall be Type C (Interior Corrugated) Corrugated Polyethylene Pipe conforming to Form 817, Article M.08.01.18.

Bedding Material shall meet the requirements of M.08.03-1.

Granular Fill, if necessary, shall meet the requirements of M.02.01.

Brick Masonry shall meet the requirements of M.11.03 and Mortar shall meet the requirements of M.11.04.

Construction Methods: Unless otherwise directed by the Engineer, all HDPE pipe shall be installed in pipe bedding in accordance with the details as shown on the plans and in accordance with Form 817, Section 6.51.03.

Method of Measurement: This work shall be measured for payment by the actual number of pipe elbows of the various sizes, completed and accepted and measured in place along the invert. Coupling bands and fittings will not be measured for payment.

Removal of drainage pipe outside of drainage trench excavation limits, as defined in 2.86.03, will be measured for payment by the actual number of linear feet of drainage pipe removed. There will be no measurement for plugging existing pipes with cement masonry.

Basis of Payment: This work will be paid at the contract unit price per each HDPE pipe elbow of the size specified, complete in place, including all materials, equipment, tools, and labor incidental thereto.

Drainage Trench Excavation for the installation of drainage pipes will not be paid separately but shall be included in the Contract unit price for the respective drainage pipe or pipe end item(s), in accordance with the provisions of 2.86.05.

Rock in Drainage Trench Excavation will be paid for in accordance with the provisions of 2.86.05.

Bedding Material necessary for the installation of drainage items described herein will be included in the Contract unit price for the respective drainage pipe or pipe end item(s). Bedding material required to fill voids when rock in drainage trench is encountered will not be measured for payment but shall be included in the Contract unit price for "Rock in Drainage Trench Excavation," in accordance with 2.86.05.

Removal of drainage pipes of all types and sizes, outside of drainage trench excavation limits, as defined in 2.86.03-1, will be paid for at the Contract unit price per linear foot for "Remove Existing Pipe – 0' to 10' Deep," or "Remove Existing Pipe – 0' to 20' Deep," which price shall include excavation, temporary trench protection, backfill, and all equipment, tools and labor incidental thereto.

There will be no direct payment for the plugging of existing drainage pipes, but the cost thereof shall be included in the respective drainage Contract item(s).

Pay Item	Pay Unit
15” High Density Polyethylene Pipe Elbow 0-10’ Deep	l.f.
18” High Density Polyethylene Pipe Elbow 0-10’ Deep	l.f.
24” High Density Polyethylene Pipe Elbow 0-10’ Deep	l.f.

ITEM #0702081A - BITUMINOUS COATING FOR STEEL PILES

Description: Work under this item shall consist of furnishing and applying bituminous coating to steel piles. This work shall be performed as hereinafter specified, to the dimensions indicated on the plans, or as directed by the Engineer. This work shall also include field applied touch ups to coating damaged during shipping and handling.

Materials: Bituminous coating shall consist of canal liner bituminous in accordance with ASTM D 2521. It shall have a softening point of 190°F to 200°F, a penetration of 56 to 61 at 77°F and a ductility in excess of 1.38 in. at 77°F. Primer shall be in accordance with AASHTO M 116.

Submittals:

A. The Contractor shall submit cut sheets documenting the all proposed primer and bituminous coating materials for review prior to construction. The proposed materials shall meet all material requirements, and be appropriate for installation in accordance with project requirements.
B. The Contractor shall submit his proposed procedure for application of the primer and bituminous coating for review prior to construction.
C. The Contractor shall not proceed with the work before receiving authorization to proceed.

Construction Methods:

A. All surfaces to be coated with bituminous shall be dry and thoroughly cleaned of dust and loose materials prior to application.
B. Primer or bituminous shall not be applied in wet weather, nor when the ambient temperature is below 65°F.
C. Application of the prime coat shall be with a brush or other approved means and in a manner which thoroughly coats the surface of the piling with a continuous film of primer. The primer shall have set thoroughly before the bituminous coating is applied.
D. The bituminous shall be heated to 300°F and applied at a temperature between 200° and 300°F by means of one or more mop coats or other approved means. The average coating thickness shall be 3/8 inch.
E. Whitewashing of the coating may be required during hot weather as directed to prevent running or sagging of the asphalt coating prior to driving of the pile.
F. Bituminous coated piles shall be protected from sunlight or heat immediately after the coating is applied.
G. The bituminous coating shall not be exposed to damage or contamination during storage, hauling, or handling. Once the bituminous coating has been applied, dragging the piles on the ground or the use of cable wraps around the piles during handling will not be permitted. Padded eyes, or other suitable devices, shall be attached to the piles to be used for lifting and handling.

H. Where field splices are required the bituminous coating shall be removed in the splice area. After completing the field splice, the splice area shall be brush coated or mop coated with a minimum of one coat of bituminous material as directed.

Method of Measurement: The actual length of pile coated will be measured in linear feet along the centerline of the pile. Areas requiring touch up or recoating due to damage or splicing shall not be measured for payment.

Basis of Payment: Payment shall be made at the contract unit price, per linear foot, of pile coated and approved. This price shall be full compensation for furnishing all materials, for preparing and placing these materials, and for all labor, equipment tools, and incidentals necessary to complete the work.

Pay Item	Pay Unit
Bituminous Coating for Steel Piles	L.F.

ITEM #0702109A - PRE-AUGERING OF PILES

ITEM #0702111A - DRIVING STEEL PILES

Work under this item shall conform to the requirements of Section 7.02 of Form 817 amended as follows:

7.02.01- Description: Add the following:

Work under this Item includes pre-augering for piles as indicated on the plans, for all bituminous coated piles, or as directed.

7.02.03.2(a) - Construction Methods - Pile Driving Equipment - Hammers: Replace the second paragraph with the following:

The size of hammer shall be adapted to the type and size of piles and the driving conditions. The hammer model used for the driving of test piles shall be used for the driving of service or production piles, unless a change is authorized by the Engineer in writing. Hammers delivering an energy which the Engineer considers detrimental to the piles shall not be used.

7.02.03.2(c) (7) - Construction Methods - Pile Driving Equipment - Pre-Augering: Add the following:

The following apply when pre-auguring is done for piles with bituminous and epoxy coating:

The pre-augered hole is to continue to the top of the clay layer or to the depths shown on the plans or as directed by the Engineer. The pre-augered hole diameter shall be more than the diagonal dimension of the pile to permit pile installation, or as directed by the Engineer. All obstructions which could interfere with the driving of piles within the depth of pre-augering are to be removed as part of the pre-auguring work.

The Contractor shall provide temporary casing to maintain the pre-augured dimension of the hole. Upon completion of pile driving, the annulus between the pile and outer hole diameter shall be filled with clean sand and any temporary casing will be removed. As the casing is withdrawn, the Contractor shall ensure adequate sand is filled into the hole at all times to prevent the hole caving, excessive deformation or voids from developing. The casing may be advanced through the ground by twisting, driving or vibration before being cleaned out.

The Contractor shall control drilled pre-augering operations in a way that will prevent damage to existing structures and utilities, in accordance with 1.07.09 and 1.07.13. Preventive measures shall include, but are not limited to: selecting construction methods and procedures to prevent caving of the pre-augered excavation and casing removal; and that will include monitoring and controlling vibrations from construction activities such as the driving of casing or sheeting, drilling of the shaft, from any blasting that the Contractor or the Engineer may have permitted, or during extraction of the casing. If monitoring is called for in the Contract,

a preconstruction survey of existing facilities shall be performed prior to drilling or driving to establish baseline date, including ambient vibration levels and existing structural defects.

7.02.05.11 - Basis of Payment - Pre-Augering of Piles: Add the following:

This work shall also include obstruction removal within the pre-augered length, temporary casing installation and removal, and sand backfill.

ITEM #0707009A - MEMBRANE WATERPROOFING (COLD LIQUID ELASTOMERIC)

Description: Work under this item consists of furnishing and installing a seamless elastomeric waterproofing membrane system applied to a concrete or steel surface as shown on the plans, in accordance with this specification and as directed by the Engineer. Work shall also include conditioning of the surface to be coated and all quality-control testing noted herein.

The completed membrane system shall be comprised of a primer coat followed by the membrane coating which is applied in one or two layers for a minimum total thickness of 80 mil, an additional 40 mil membrane layer with aggregate broadcast into the material while still wet, and a bond coat of bitumen-based adhesive material.

Materials: The Contractor shall select a waterproofing membrane system from the Department's current Qualified Product List (QPL) for Spray-Applied Membrane Waterproofing System. All materials incorporated in the works shall meet the Manufacturer's specification for the chosen system. The Engineer will reject any system that is not on the QPL.

Materials Certificate: The Contractor shall submit to the Engineer a Materials Certificate for the primer and membrane and bond coat material in accordance with the requirements of Article 1.06.07.

Construction Methods: At least ten days prior to installation of the membrane system, the Contractor shall submit to the Engineer, the manufacturer's recommended procedure for preparing the deck surface, pre-treatment or preparing at cracks and gaps, treatment at curbs, vertical surfaces or discontinuities, applying the primer and membrane, and placing of aggregated coat. Procedures shall also include recommended repairs of system non-compliant issues identified during application. The system shall be applied to the prepared area(s) as defined in the plans strictly in accordance with the Manufacturer's recommendations.

A technical representative, in the direct employ of the manufacturer, shall be present on-site immediately prior to and during application of the membrane. The representative shall inspect and approve the surface prior to priming, and provide guidance on the handling, mixing and addition of components and observe application of the primer and membrane. The representative shall perform all required quality-control testing and remain on the Project site until the membrane has fully cured.
All quality-control testing, including verbal direction or observations on the day of the installation, shall be recorded and submitted to the Engineer for inclusion in the Project's records. A submittal of the quality-control testing data shall be received by project personnel prior to any paving over the finished membrane or within 24 hours following completion of any staged portion of the work.

1. Applicator Approval: The Contractor's membrane Applicator shall be fully trained and licensed by the membrane manufacturer and shall have successfully completed at least three spray membrane projects in the past five years. The Contractor shall furnish references from those projects, including names of contact persons and the names, addresses and phone numbers of persons who supervised the projects. This information shall be submitted to the Engineer prior to the start of construction. The Engineer shall have sole authority to determine the adequacy and compliance of the submitted information. Inadequate proof of ability to perform the work will be grounds to reject proposed applicators.

2. Job Conditions:

   (a) Environmental Requirements: Air and substrate temperatures shall be between 32°F and 104°F providing the substrate is above the dew point. Outside of this range, the Manufacturer shall be consulted.

   The Applicator shall be provided with adequate disposal facilities for non hazardous waste generated during installation of the membrane system. The applicator shall follow safety instructions regarding respirators and safety equipment.

   (b) Safety Requirements: All open flames and spark producing equipment shall be removed from the work area prior to commencement of application.

   "No Smoking" signs shall be visibly posted at the job site during application of the membrane waterproofing.

   Personnel not involved in membrane application shall be kept out of the work area.

3. Delivery, Storage and Handling:

   (a) Packaging and Shipping: All components of the membrane system shall be delivered to the site in the Manufacturer's packaging, clearly identified with the products type and batch number.

   (b) Storage and Protection: The Applicator shall be provided with a storage area for all components. The area shall be cool, dry and out of direct sunlight and shall be in accordance with the Manufacturer's recommendations and relevant health and safety regulations.

   Copies of Material Safety Data Sheets (MSDS) for all components shall be kept on site for review by the Engineer or other personnel.

   (c) Shelf Life - Membrane Components: Packaging of all membrane components shall include a shelf life date sealed by the Manufacturer. No membrane components whose shelf life has expired shall be used.

4. Surface Preparation:

   (a) Protection: The Applicator shall be responsible for the protection of equipment and adjacent areas from over spray or other contamination. Parapets and bridge joints shall be masked prior to application of the materials.

   (b) Surface Preparation: Sharp peaks and discontinuities shall be ground smooth. The surface profile of the prepared substrate is not to exceed 1/4 inch (peak to valley) and areas of minor surface deterioration of 1/2 inch and greater in depth shall also be repaired. The extent and location of the surface patches require the approval of the Engineer before the membrane system is applied.

   Surfaces shall be free of oil, grease, curing compounds, loose particles, moss, algae, growth, laitance, friable matter, dirt, bituminous products, and previous waterproofing materials. If required, degreasing shall be done by detergent washing in accordance with ASTM D4258.

   The surface shall be abrasively cleaned, in accordance with ASTM D4259, to provide a sound substrate free from laitance.

   Voids, honeycombed areas, and blow holes on vertical surfaces shall be repaired in the same manner.

   All steel components to receive membrane waterproofing shall be blast cleaned in accordance with SSPC SP6 and coated with the membrane waterproofing system within the same work shift.

5. Inspection and Testing: Prior to priming of the surface, the Engineer, Applicator and Manufacturer's technical representative shall inspect and approve the prepared substrate.

   (a) Random tests for deck moisture content shall be conducted on the substrate by the Applicator at the job site using a "Sovereign Portable Electronic Moisture Master Meter," a "Tramex CMEXpertII Concrete Moisture Meter" or approved equal. The minimum frequency shall be one test per 1000 s.f. but not less than three tests per day per bridge. Additional tests may be required if atmospheric conditions change and retest of the substrate moisture content is warranted.

   The membrane system shall not be installed on substrate with a moisture content greater than that recommended by the system's manufacturer, but shall not be greater than 6%, whichever is less.

   (b) Random tests for adequate tensile bond strength shall be conducted on the substrate using an adhesion tester in accordance with the requirements of ASTM D4541. The minimum frequency shall be one test per 5,000 s.f. but not less than three adhesion tests per bridge.

Adequate surface preparation will be indicated by tensile bond strengths of primer to the substrate greater than or equal to 150 psi or failure in a concrete surface and greater than or equal to 300 psi for steel surfaces.

If the tensile bond strength is lower than the minimum specified, the Engineer may request additional substrate preparation. Any primer not adequately applied shall be removed and a new primer applied at the Contractor's expense, as directed by Engineer.

(c) Cracks and grouted joints shall be treated in accordance with the Manufacturer's recommendations, as approved or directed by the Engineer.

6. Application:

(a) The System shall be applied in four distinct steps as follows:
1) Substrate preparation and gap/joint bridging preparation
2) Priming
3) Membrane application
4) Membrane with aggregate

(b) Immediately prior to the application of any components of the System, the surface shall be dry (see Section 5a of this specification) and any remaining dust or loose particles shall be removed using clean, dry oil-free compressed air or industrial vacuum.

(c) Where the area to be treated is bound by a vertical surface (e.g. curb or wall), the membrane system may be continued up the vertical, as shown on the plans or as directed by the Engineer.

(d) The handling, mixing and addition of components shall be performed in a safe manner to achieve the desired results, in accordance with the Manufacturer's recommendations or as approved or directed by the Engineer.

(e) A neat finish with well defined boundaries and straight edges shall be provided by the Applicator.

(f) Primer: The primer shall consist of one coat with an overall coverage rate of 125 to 175 s.f./gal unless otherwise recommended in the manufacturer's written instructions.

All components shall be measured and mixed in accordance with the Manufacturer's recommendations.

The primer shall be spray applied using a single component spray system approved for use by the Manufacturer. If required by site conditions and allowed by the manufacturer, brush or roller application will be allowed.

The primer shall be allowed to cure tack-free for a minimum of 30 minutes or as required by the Manufacturer's instructions, whichever time is greater, prior to application of the first lift of waterproofing membrane.

Porous concrete (brick) may require a second coat of primer should the first coat be absorbed.

(g) Membrane: The waterproofing membrane shall consist of one or two coats for a total dry film thickness of 80 mils. If applied in two coats, the second coat shall be of a contrasting color to aid in quality assurance and inspection.

The membrane shall be comprised of Components A and B and a hardener powder which is to be added to Component B in accordance with the Manufacturer's recommendations.

The substrate shall be coated in a methodical manner.

Thickness checks: For each layer, checks for wet film thickness using a gauge pin or standard comb-type thickness gauge shall be carried out typically once every 100 s.f. Where rapid set time of the membrane does not allow for wet film thickness checks, ultrasonic testing (steel surfaces only), calibrated point-penetrating (destructive) testing, in-situ sampling (cutout of small sections for measuring thicknesses), or other methods approved by the Engineer shall be employed for determination of dry film thickness. The measured thickness of each and every individual test of the membrane shall be greater than or equal to the required thickness.

Bond Strength: Random tests for adequate tensile bond strength shall be conducted on the membrane in accordance with the requirements of ASTM D4541. The minimum test frequency shall be one test per 5,000 s.f. but no less than three adhesion tests per bridge. Adequate adhesion will be indicated by tensile bond strengths of the membrane to the substrate of greater than or equal to 150 psi or failure in a concrete surface and greater than or equal to 300 psi for steel surfaces.

Spark Testing: Following application of the membrane, test for pin holes in the cured membrane system over the entire application area in accordance with ASTM D4787- "Continuity Verification of Liquid or Sheet Linings Applied to Concrete Substrates." Conduct the test at voltages recommended by the manufacturer to prevent damage to the membrane.

Repair the membrane system following destructive testing and correct any deficiencies in the membrane system or substrate noted during quality-control testing in accordance with the manufacturer's recommendations to the satisfaction of the Engineer at no additional cost to the State.

(h) Repairs: If an area is left untreated or the membrane becomes damaged, a patch repair shall be carried out to restore the integrity of the system. The damaged areas shall be cut back to sound materials and wiped with solvent (e.g. acetone) up to a width of at least four inches on the periphery, removing any contaminants unless otherwise recommended by the manufacturer. The substrate shall be primed as necessary, followed by the membrane. A continuous layer shall be obtained over the substrate with a four inches overlap onto existing membrane.

Where the membrane is to be joined to existing cured material, the new application shall overlap the existing by at least four inches. Cleaning and surface preparation on areas to be lapped shall be as recommended in the manufacturer's written instructions.

(i) Aggregated Finish:
1) Apply an additional 40 mil thick layer of the membrane material immediately followed by an aggregate coating, before the membrane cures, at a rate to fully cover the exposed area. The membrane and aggregate shall be fully integrated after the aggregate has been applied and the membrane cured.
2) Localized areas not fully coated shall be touched-up with additional membrane and aggregate as needed.
3) Remove loose and excess aggregate from the surface to the satisfaction of the Engineer and dispose of properly after application prior to allowing traffic onto finished surface or application of tack coat.

(j) Bond Coat:
Prior to application of a bituminous concrete overlay, the aggregated finish shall be coated with a bonding material. The bonding material shall be per the membrane waterproofing manufacturer's recommendations.

7. Final Review: The Engineer and the Applicator shall jointly review the area(s) over which the completed System has been installed. Any irregularities or other items that do not meet the requirements of the Engineer shall be addressed at this time.

Method of Measurement: The quantity to be paid for under this item shall be the number of square yards of waterproofed surface completed and accepted.

Basis of Payment: This item will be paid for at the contract unit price per square yard of "Membrane Waterproofing (Cold Liquid Elastomeric)," complete in place, which price shall include all surface preparation, furnishing, storing and applying the system, technical representative and quality control tests, and any necessary repairs and remediation work as well as all materials, equipment, tools, labor incidental to this work.

Pay Item	Pay Unit
Membrane Waterproofing (Cold Liquid Elastomeric)	s.y.

ITEM #0712018A - REINFORCED SOIL SLOPE

Description: This work shall consist of furnishing material for and constructing a reinforced soil slope, reinforced with geosynthetic soil reinforcement, in accordance with these specifications and in reasonable close conformity to the lines, grades, and dimensions shown on the plans or as directed by the Engineer. This work shall also consist of earth excavation, including benching of the existing slope, furnishing and installation of geosynthetic reinforcement, including appurtenance penetration overlaps, compacted granular fill, furnishing and placing topsoil, turf establishment and erosion control matting.

Materials: Materials shall conform to the following requirements

1 - Geosynthetic Reinforcement Material - The geosynthetic reinforcement shall consist of a geogrid or geotextile that can develop sufficient mechanical interaction with the surrounding soil or rock. The geosynthetic reinforcement structure shall be dimensionally stable, able to retain its geometry under construction stresses, and shall have high resistance to damage during construction, to ultraviolet degradation, and to all forms of chemical and biological degradation encountered in the soil being reinforced. The permeability of the geosynthetic reinforcement shall be greater than the permeability of the reinforced fill soil.

Geogrid used as geosynthetic reinforcement shall be a uniaxial geogrid consisting of a regular network of integrally connected polymer tensile elements consisting of either a polypropylene (PP), a polyethylene (HDPE), or a polyester (PET). The geogrid shall have certified properties as shown in Table 1.

Geotextile used as geosynthetic reinforcement may be woven or nonwoven but no "slit-film" woven fabrics will be permitted. The geotextile shall have certified properties as shown in Table 2. All property values represent Minimum Average Roll Value (MARV) in the weakest principal direction and shall meet or exceed the values stated below.

The Contractor shall submit a manufacturer's certification that the geosynthetic supplied meets the requirements as shown in the respective table, measured in full accordance with all test methods and standards specified, as set forth in these specifications, and in conformance with Article 1.06.07.

The geosynthetic reinforcement shall be manufactured with a high degree of quality control. The Manufacturer is responsible for establishing and maintaining a quality control (QC) program to ensure compliance with the requirements of the specification. The purpose of the QC testing program is to verify that the geosynthetic reinforcement being supplied to the project is representative of the material used for performance testing and approval by the department.

Conformance testing shall be performed as part of the manufacturing process and may vary for each type of product. As a minimum, the following index tests shall be considered as applicable for an acceptable QA/QC program: Wide Width Tensile (ASTM D-4595 for geotextiles and ASTM D-6637 for geogrids); Specific Gravity (HDPE only, ASTM D-1505); Melt Flow Index (HDPE and PP only, ASTM D-1238); Intrinsic Viscosity (PET only, ASTM D-4603); Carboxyl End Group (PET only, ASTM D-2455); and Single Rib Tensile (Geogrid only, ASTMD-6637). Sampling and conformance testing shall be in accordance with ASTM D-4354. Conformance testing procedures shall be established as noted in the specification. Geosynthetic product acceptance shall be based on ASTM D-4759.

The quality control certificate shall include roll number and identification, sampling procedures, and results of control test (including a description of test methods used).

Table 1

Geogrid Type	Property	Test Method	Criteria
Polyester	Geogrid Rib Tensile Strength (T_{ult})	ASTM D6637	Min. 2420 lbs./ft.
Polypropylene	Geogrid Rib Tensile Strength (T_{ult})	ASTM D6637	Min. 4840 lbs./ft.
Polyethylene	Geogrid Rib Tensile Strength (T_{ult})	ASTM D6637	Min. 3025 lbs./ft.
Polyester	Creep Reduction Factor (RF_{CR})	ASTM D 5262	Min. 2.0
Polypropylene	Creep Reduction Factor (RF_{CR})	ASTM D 5262	Min. 4.0
Polyethylene	Creep Reduction Factor (RF_{CR})	ASTM D 5262	Min. 2.5
All Polymers	Installation Damage Reduction Factor (RF_{ID})	ASTM D 5818	Min. 1.1
Polyester	Durability Reduction Factor (RF_D)	Hydrolysis Degradation Testing (extrapolated to 100yrs)	Min. 1.1
Polypropylene and Polyethylene	Durability Reduction Factor (RF_D)	Oxidation Degradation Testing (extrapolated to 100yrs)	Min. 1.1

Table 2

Property	Test Method	Elongation	
		<50%[A]	**≥50%[A]**
Grab Strength -lbs	ASTM D4632	315	202
Sewn Seam Stength[B] -lbs	ASTM D4632	283	182
Tear Strength -lbs	ASTM D4533	112	79
Puncture Strength - lbs	ASTM D6241	618	433
Ultimate Strength (Tult) –lbs/ft	ASTM D4595	Min. 3,970	
Long Term Allowable Tensile Strength (T_{all}) – lbs/ft	FHWA[C]	Min. 1,450	

[A] As determined in accordance with ASTM D4632. The strengths specified in the columns labeled "<50%" and "≥50%" refer to the elongation at which the geotextile material was tested. For example; if a fabric is tested at 15% elongation, then it must meet or exceed the minimum strength shown in the "<50%" column. Submittals must include the percent elongation at which the material was tested.
[B] When sewn seams are required.
[C]The Long Term Allowable Tensile Strength shall be determined by applying appropriate reduction factors to the Ultimate Tensile Strength of the geotextile to account for installation damage, survivability, creep, durability and degradation. A 100-year design life shall be used in determining the long term allowable tensile strength. The FHWA methodology (FHWA NHI-10-024 (Berg et al., 2009)) shall be used for this computation. Proposed strength and reduction factors are subject to approval. Minimum durability reduction factor is 1.15. Minimum installation damage factor is 1.10. The creep reduction factor should be developed from creep tests performed in accordance with ASTM D5262 and is subject to the minimums presented in Table 1 for the respective material.

2 - Compacted Granular Fill - Compacted Granular Fill shall conform to the requirements of Article M.02.01.

3 – Topsoil – The material shall meet the requirements of Subarticle M.13.01-1.

4 - Turf Establishment with Erosion Control Matting - The materials for this work shall conform to the requirements of Article M.13. The Erosion Control Matting shall be Class 1, Type D. Anchors for the Erosion Control Matting shall be a 9 guage-U Shaped Staple, with a minimum dimension of 12"x1"x12".

Construction Methods: The Contractor shall insure that during all periods of shipment and storage, the geosynthetic material is protected from mud, dirt, all deleterious materials that might become affixed to it, and temperatures greater than 140ºF. Follow manufacturer's recommendations with regards to protection from direct sunlight. At the time of installation, the geosynthetic shall be free of any defects, including, but not limited to tears, punctures, flaws, deterioration, or any damage due to manufacture, transportation, and storage.

All areas beneath the installation area for the geosynthetic reinforcement shall be properly prepared as detailed on the plans, specified within this specification, or as directed by the Engineer. All excavation required for construction of the slope shall conform to Article 2.02. Subgrade surfaces shall be level. The subgrade surface shall also be free from deleterious materials, loose soil, topsoil, organic soils, frozen soil, or any other unsuitable material. Prior to placement of geosynthetic reinforcement, subgrade shall be proof-rolled to provide a uniform and firm surface. Any soft areas, as determined by the Engineer, shall be excavated and replaced with suitable compacted soils. The foundation surface shall be inspected and approved by the Engineer prior to placement of geosynthetic and Compacted Granular Fill. Benching the backcut into competent soil shall be performed as shown on the plans or as directed by the Engineer and in conformance with Subarticle 2.02-5, paragraph 3, so as to ensure stability.

The geosynthetic shall be installed in accordance with the plans, specifications, and manufacturer's recommendation. The geosynthetic reinforcement shall be placed within the layers of the Compacted Granular Fill as shown on the plans, or as directed by the Engineer.

The primary geosynthetic reinforcement shall be placed in continuous, longitudinal strips in the direction of main reinforcement. . If the Contractor is unable to complete a required length with a single continuous length of geogrid, a joint may be made with the Engineer's approval. Only one joint per length of geogrid shall be allowed. This joint shall be made for the full width of the strip by using a similar material with similar strength. Joints in geogrid reinforcement shall be pulled and held taut during placement of Compacted Granular Fill. The minimum length of geogrid placed shall be 6 feet. For primary geogrids, joints shall not be placed within 6 feet of the slope face. Adjacent, overlying, and underlying rolls of geogrid shall not have a joint within 6 feet of each other. Joints shall not be permitted with geotextiles.

Horizontal coverage of less than 100% shall not be allowed. A 12 inch overlap shall be applied during geosynthetic (geogrid) installation in slopes where end of rolls or strips are adjacent to one another.

Place only that amount of geosynthetic reinforcement required for immediately pending work to prevent undue damage. After a layer of geosynthetic reinforcement has been placed, the next succeeding layer of soil shall be placed and compacted as appropriate. After the specified soil layer has been placed, the next geosynthetic reinforcing layer shall be installed. The process shall be repeated for each subsequent layer of geosynthetic reinforcement and soil.

Geosynthetic reinforcement shall be placed to lay flat and pulled tight prior to backfilling. After a layer of geosynthetic reinforcement has been placed, suitable means, such as pins or small piles of soil, shall be used to hold the geosynthetic reinforcement in position until the subsequent soil layer can be placed.

Incident Management System, Illumination, Guiderail and Drainage will be installed within the limits of the reinforced soil slopes and may impact the geosynthetic reinforcement. The Contractor shall incorporate horizontal and vertical penetration details as shown in the plans to avoid weakening the geosynthetic reinforcement.

During construction, the surface of the fill should be kept approximately horizontal. Geosynthetic reinforcement shall be placed directly on the Compacted Granular Fill surface. Geosynthetic reinforcements are to be placed within 3 inches of the design elevation view unless otherwise directed by the Engineer. The Contractor shall verify correct orientation of the geosynthetic reinforcement.

Compacted Granular Fill shall be placed and compacted as specified in Article 2.14, with the following amendments. The Contractor shall be allowed a maximum lift of 12 inches. In addition, the Compacted Granular Fill shall be placed, spread, and compacted in such a manner to minimize the development of wrinkles and/or displacement of the geosynthetic reinforcement. The Compacted Granular Fill shall be graded away from the slope crest and rolled at the end of each work day to prevent ponding of water or erosion on the surface of the reinforced soil mass.

Tracked construction equipment shall not be operated directly upon the geosynthetic reinforcement. A minimum fill thickness of 6 inches is required prior to operation of tracked vehicles over the geosynthetic reinforcement. Turning of tracked vehicles should be kept to a minimum to prevent tracks from displacing the fill and the geosynthetic reinforcement.

The Engineer may allow rubber tired equipment to pass over the geosynthetic reinforcement at speeds less than 10mph. Sudden braking and sharp turning shall be avoided.

Topsoil shall be furnished, placed and shaped in accordance with Article 9.44.

Turf Establishment with Erosion Control Matting shall be placed as specified in Article 9.50. Seeding and/or mulch shall be placed prior to placement of Erosion Control Matting. The Topsoil, Turf Establishment and Erosion Control Matting shall be placed immediately upon completion of each vertical steepened slope section of geosynthetic reinforcement and Compacted Granular Fill. In the event that the slope is not completed in a continuous operation, temporary erosion control matting shall be installed to prevent erosion of the slope.

Anchors and overlaps shall be placed and spaced in accordance with Manufacturer's recommendations. The Erosion Control Matting shall be placed horizontal along the face of the slope with the upper matting overlapping the lower matting.

The Contractor shall begin construction of the reinforced soil slope no earlier than March 15th, and have the reinforced slope constructed, seeded, and Erosion Control Matting installed by October 15th of the same calendar year. Out of season seeding will not be permitted.

Method of Measurement: This work will be measured for payment by the number of square feet of area of reinforced soil slope. The slope is considered to be the surface between the hinge point (top of slope) and the toe of slope.

Basis of Payment: This work will be paid for at the contract unit price per square feet for "Reinforced Soil Slope", complete in place, which price shall include all work performed, completed and accepted within the pay limits shown on the contract drawings for the reinforced soil slope including but not limited to the following: earth excavation, including benching of existing slopes, furnishing and installation of Geosynthetic Reinforcement and all labor and material necessary for incorporation of penetration details; Compacted Granular Fill; Furnishing and Placing Topsoil; Turf Establishment with Erosion Control Matting. The price shall also include all tools, labor, equipment, and material incidental thereto. If boulders in excess of 1 cubic yard are encountered in the excavation, the boulder(s) shall be removed and paid for in accordance with Article 2.02, "Rock Excavation".

ITEM #0714026A - TEMPORARY SHEET PILING (RAILROAD)

Work under this item shall conform to the requirements of Section 7.14, supplemented and amended as follows:

7.14.01-Description: Delete the article and replace with the following:

This specification covers only sheet piling systems shown on the plans to retain railroad facilities. This sheet piling system shall consist of any type of adequately braced sheet pile wall meeting these specifications, which the Contractor elects to build to satisfy, and which does satisfy, the condition that existing railroad facilities be properly retained during excavation for and placement of substructures.

The Contractor shall monitor the temporary excavation support system and the Railroad facilities being supported for movement in accordance with railroad requirements.

7.14.02-Materials: Delete the article and replace with the following:

Materials shall meet the following minimum requirements unless otherwise noted on the plans. Steel - Steel soldier piles, walers, bracing and fabrications shall conform to the requirements of AASHTO M 183 (ASTM A 36) or AASHTO M 223 (ASTM A 572). Sheet piling shall conform to the requirements of ASTM A 328.

Lagging - Timber lagging shall be construction grade, rough cut and shall be a minimum of 3" thick, and shall conform to AASHTO M168 “Standard Specification for Wood Products”. Where necessary, the Contractor shall provide certification that the timber conforms to the grade, species, and other specified requirements. If timber is to be treated with a preservative, a certificate of compliance shall be furnished.

Precast concrete lagging shall conform to Section 8.13 "Precast Concrete Members" of AASHTO "Standard Specifications for Highway Bridges." Concrete for the precast elements shall have a minimum 28-day compressive strength of 5000 psi.

7.14.03-Construction Methods: Delete the article and replace with the following:

The Contractor shall propose a sheet piling systems for approval that meet all project requirements including all requirements of the affected railroad. Sheet piling systems proposed by the Contractor shall be designed for all applicable loads including the live load effects of the railroad (Cooper E-80). Working drawings and design calculations for the systems shall be submitted in accordance with the requirements of Article 1.05.02(2). The working drawings and design calculations shall be prepared, sealed and signed by a Professional Engineer, licensed in the state of Connecticut. The furnishing of such plans shall not serve to relieve the Contractor of any part of his responsibility for the safety of the work or for the successful completion of the project.

Sections or elements of the sheet piling system shall be left in place to conform to the railroad requirements. All remaining sections or elements of the sheet piling system shall be removed from the site and disposed of by the Contractor. Removal shall be performed after the excavation has been backfilled and properly compacted or concrete has been placed against the sheeting.

The Contractor shall perform all work required for the furnishing of materials, fabrication, design, preparation of shop or working drawings, installation, maintenance, and removal of temporary excavation support systems in a manner that satisfies the operational requirements of the railroad as noted in the Contract documents.

7.14.04-Method of Measurement: Modify this article as follows:

Replace all references to "temporary sheet piling" with "Temporary Sheet Piling (Railroad)".

7.14.05-Basis of Payment: Modify this article as follows:

Replace all references to "temporary sheet piling" with "Temporary Sheet Piling (Railroad)". Delete the last sentence of the first paragraph.

ITEM #0821189A - CONCRETE BARRIER TRANSITION SECTION

Work under this item shall conform to the requirements of Section 8.21 of Form 817, amended as follows:

8.21.01 - Description: Delete and replace with the following:

Description: Under this item, the Contractor shall furnish and install precast concrete barrier transition sections along the roadway at the locations shown on the plans, or as directed by the Engineer.

Under this item the Contractor shall have the option of furnishing and installing cast in place concrete barrier sections or precast concrete barrier sections or any combination thereof, provided all units are properly anchored to other units or existing concrete in accordance with the Plans.

8.21.02-Materials: Add the following:

8. The threaded steel connection rod shall be manufactured in conformance with AASHTO M314, Grade 55. Threads shall be Unified National Coarse Series as specified in ANSI B1.1 and shall have Class 2A threaded tolerances before galvanizing.

   Plain steel washers shall be manufactured in accordance with ANSI B18.22.

   Heavy hex nuts shall be Grade A, manufactured in conformance with AASHTO M291 and tapped oversize for galvanizing.

   The threaded rod, washers and nuts shall be hot-dip galvanized in conformance with AASHTO M232, Class C.

   Connection loop bars shall be bent from smooth bars that conform to ASTM A36 and galvanized in accordance with ASTM A123.

8.21.03-Construction Methods: Add the following:

7. Holes shall be drilled in concrete, for installation of connecting steel dowels, where required by the plans.

8. If the Contractor elects to use cast-in-place concrete the work shall be done in accordance with Article 6.01.03.

8.21.05 - Basis of Payment: Delete and replace with the following:

Payment for this work will be made at the contract unit price per linear foot for "Concrete Barrier Transition Section" constructed to the dimensions shown in the plans, which price shall include all necessary excavation, backfill, materials, reinforcing steel, dowels, connecting rods, penetrating sealer protective compound, transportation, equipment, tools, labor and work incidental thereto and as required to achieve complete installation of the sections, including the cost of field measurements prior to fabrication of the units. No additional payment will be made for furnishing and placing anchorage materials necessary for attachment of concrete barrier sections to adjacent barriers or wingwalls.

Pay Item	Pay Unit
Concrete Barrier Transition Section	l.f.

ITEM #0822005A - TEMPORARY PRECAST CONCRETE BARRIER CURB (STRUCTURE)

ITEM #0822006A - RELOCATED TEMPORARY PRECAST CONCRETE BARRIER CURB (STRUCTURE)

Description: Work under this item shall consist of furnishing, installing, and removing temporary precast concrete barrier curb, suitable for attachment to bridge decks and concrete pavement, as shown on the plans or as directed by the Engineer. This work shall also include the drilling, grouting and later removal of anchor bolts, and the cleaning and subsequent grouting and sealing of anchor bolt holes after the barrier is removed.

Materials:

1. Concrete shall conform to the requirements of Subarticle M.14.01-1 amended as follows:

   (a) Concrete shall have a minimum 28 day strength (f'c) of 4000 psi.

   (b) Coarse Aggregate shall conform to the requirements of Subarticle M.03.01-1 and to the grading requirements of Class "F".

   (c) Fine Aggregate shall be Light in color and shall conform in color and type to the samples on file at the Laboratory of the Department of Transportation located in Rocky Hill, Connecticut.

   (d) Cement for light concrete shall be Type III or Type IIIA Portland cement or light colored cement approved by the Engineer.

   (e) The entrained air content shall not be less than 5% nor more than 7%.

   (f) Manufacturer identification and date of manufacture shall be permanently marked on the barrier curb in the location shown on the plans.

2. Reinforcing steel shall conform to the requirements of ASTM A615, Grade 60.

3. Lifting hooks, keys, bolts, devices and attachments shall be of the size indicated on the plans or of a design satisfactory for the purpose intended as approved by the Engineer.

4. Removable anchor bolts shall conform to "KELIBOND/KELIBOND ANCHORS coated with KELISLIP" as manufactured by Kelken-Gold. Inc., 3220 Bordentown Ave., Parlin, New Jersey 08859, or approved equal. Anchor bolts shall conform to the requirements of ASTM A325.

5. Galvanizing shall conform to the requirements of ASTM A123.

6. The grout used in patching the remaining holes in the concrete deck after the removal of the temporary barrier shall be non-shrink grout conforming to Subarticle M.03.05.

7. The pourable sealant used in patching the remaining holes in the overlay after the removal of the temporary barrier shall be a hot-poured bituminous sealer conforming to the requirements of Subarticle M.04.01-8.

8. The delineators shall be fabricated of aluminum, steel, plastic or of a material approved by the Engineer. The reflective sheeting shall be encapsulated lens sheeting conforming to Article M.18.09. Delineator fastening hardware or adhesive shall be suitable for the purpose intended.

Steel plates shall be ASTM M270, Grade 50W (weathering steel). U-bolts, washers and nuts shall be commercial grade, galvanized. Mesh shall be galvanized after welding.

Construction Methods:

1. Precast Units: Concrete barrier units shall be precast in an approved plant in conformance with the applicable requirements of Article 5.14.03, supplemented as follows:

Forms for precast concrete barrier units shall be of substantial construction, so as to produce a smooth dense surface with a uniform appearance. Form oil shall be a non-staining type. Pockets for anchor bolts shall be formed as shown on the plans. Air holes on exposed surfaces shall be filled immediately, after removal of the forms to the satisfaction of the Engineer.

2. Installation: Temporary precast concrete barrier units shall be placed as shown on the plans or as directed by the Engineer, on a firm even surface as to produce a smooth continuous barrier curb.

Anchor bolts shall be installed in properly drilled holes of the size and depth shown on the plans in strict accordance with the Manufacturer's directions. Care shall be taken not to drill holes into or through existing structural steel.

The Contractor shall submit the following to the Engineer for approval: type of drill, diameter of bit, method of cleaning holes, and method of placement of adhesive bonding material. Specifications and recommendations for the aforementioned may be obtained from the Manufacturer of the adhesive bonding material. The weight of the drill shall not exceed 20 pounds.

Drilling methods shall not cause spalling, cracking, or other damage to the concrete. Those areas damaged by the Contractor shall be repaired by him in a manner suitable to the Engineer and at no expense to the State.

The Contractor shall take necessary precautions to prevent any materials from falling onto the roadway or the waterway below.

For the adhesive bonding material, a Materials Certificate will be required in accordance with Article 1.06.07, confirming the conformance of the adhesive bonding material to the requirements set forth in these specifications.

The temporary concrete barrier shall be maintained by the Contractor during all stages of construction. Any damaged material shall be removed and replaced by the Contractor at his expense.

When the temporary barrier is no longer required, it shall be removed from the work site and become the property of the Contractor.

3. Patching Holes: After removal of the concrete barriers, the holes in the concrete deck shall be blown clean with an air jet. The grout shall then be mixed and placed as shown on the plans and in strict accordance with the Manufacturer's direction. Allow grout to cure for a minimum of 24 hours before placing the pourable sealant in the remaining hole in the bituminous wearing surface.

4. Delineators: The delineators shall be installed in the center on top of the barrier at the locations designated on the plans. They may be fastened by hardware or adhesive and must be maintained in good condition at all times.

DE-7 delineators shall be used when the barriers are on the right side of traffic or dividing traffic in the same direction. DE-7A delineators shall be used when the barriers are on the left side of traffic. DE-7B delineators shall be used when the barriers divide opposing traffic lanes. DE-7C delineators shall be used with the yellow side on the left side of traffic when traffic is alternated.

Method of Measurement:
Temporary Precast Concrete Barrier Curb (Structure): This work will be measured for payment along the centerline of the top of the concrete barrier. The measured length shall be the actual number of linear feet of temporary concrete barrier furnished and installed for the first time in its in-service position on site.

Relocated Temporary Precast Concrete Barrier Curb (Structure): This work shall be measured for payment along the centerline of the top of the concrete barrier. The measured length shall be the actual number of linear feet of temporary concrete barrier moved from an existing in-service position to a new in-service position on site.

Delineators will be measured in accordance with Article 12.05.04.

Basis of Payment: This work will be paid for at the contract unit price, per linear foot, for "Temporary Precast Concrete Barrier Curb (Structure)" and “Relocated Temporary Precast Concrete Barrier Curb (Structure)”, as applicable, complete in place, which price shall include all furnishing, transportation, storage, materials, including concrete, reinforcing steel connecting rods, removable anchor bolts conforming to the "KELIBOND/KELIBOND ANCHORS coated with KELISLIP" or approved equal, drilling holes in existing deck or concrete pavement, initial installation, removal, patching, hardware and incidental materials, equipment, tools, and labor incidental thereto. Any temporary barriers that become lost, damaged or defaced shall be replaced by the Contractor at no cost to the State.

There shall be no payment for the removal of temporary concrete barriers from the site when they are no longer needed.

Delineators will be paid for in accordance with Article 12.05.05.

Pay Item	Pay Unit
Temporary Precast Concrete Barrier Curb (Structure)	l.f.
Relocated Temporary Precast Concrete Barrier Curb (Structure)	l.f.

ITEM #0824052A - REMOVE EXISTING CONCRETE BARRIER CURB

Description:
This work shall include the removal and satisfactory disposal of existing concrete barrier curb as shown on the plans. The work shall also include the removal of concrete cap where it exists in the median or adjacent to substructure elements.

Construction Methods:
Existing concrete barrier curb and concrete cap shall be removed to the limits shown on the plans or as ordered by the Engineer.

Method of Measurement:
Existing concrete barrier curb removed under this item shall be measured for payment by the linear feet of barrier in place before removal. For existing barrier in the median, both sides will be measured for payment. Removal of backfill will be measured for payment under the contract item, "Earth Excavation."

Basis of Payment:
Payment for removing existing concrete barrier curb will be made at the contract unit price per linear foot for "Remove Existing Concrete Barrier Curb," which price shall include all equipment, tools and labor incidental to the removal of the barrier and concrete cap and the disposal thereof as directed by the Engineer.

Pay Item	Pay Unit
Remove Existing Concrete Barrier Curb	lf

ITEM #0901005A - BOLLARD

Description:
Work under this item shall consist of furnishing and installing steel concrete filled bollards at the locations called for on the plans, or as directed by the Engineer.

Materials:
Steel bollard: Schedule 80 galvanized steel pipe, 8 inch nominal size (8.625" O.D.), conforming to the requirements of ASTM-A53.

Concrete: Shall meet the requirements of CTDOT Standard Specifications Form 817, Section M.03 Portland Cement Concrete for Class "A" Concrete.

Construction Methods:
Bollards shall be installed in the locations shown on the plans. The steel pipe shall be securely set plumb in concrete and filled with concrete. The steel pipe shall be painted yellow.

Method of Measurement:
This work will be measured for Payment by the actual number of bollards installed, accepted and measured in place.

Basis of Payment:
This work will be paid for at the unit price for each "Bollard" complete in place, which shall include all material, tools and labor incidental thereto.

Pay Item	Pay Unit
Bollard	EA

ITEM #0904900A - METAL BRIDGE RAIL PROTECTIVE FENCE

Description: Work under this item shall consist of the fabrication, transportation and installation of a protective fence along the top of the parapet, as shown on the plans and as directed by the Engineer. Work under this item shall also include the replacement of existing damaged fence panels with new fence panels. Work under this item will also include the removal of existing portions of fence or railing which are in conflict with the installation of the new fence. Contractor shall take all necessary steps to ensure new fences visually matches into existing fence sections. Contractor to take detailed measurements of existing fence prior to fabrication to ensure plans match existing fence. If large discrepancies exist between the proposed plans and existing, Contractor to notify the Engineer.

All removed fence or railing components shall be salvaged if directed by the Engineer or shall be properly disposed of by the Contractor.

Materials: The Contractor shall provide Materials Certificates and Certificates of Compliance in accordance with Article 1.06.07.

Materials for this work shall conform to the following:

1. General: All fence components shall be aluminum unless otherwise specified.

2. Fence Panels, Connection Brackets and Rivets: Flat aluminum bar stock for the grille and connection plates shall be Alloy 6061-T6 conforming to the requirements of ASTM B221. Aluminum angles for the grille frames and brackets shall be Alloy 6061-T6 conforming to the requirements of ASTM B221. Aluminum rivets shall be Alloy 6061-T6 conforming to the requirements of ASTM B221.

3. Post, Rails and Splice Tubes: Square and rectangular tube shall be extruded aluminum (Alloy 6061-T6) conforming to the requirements of ASTM B221.

4. Base Plates, Cap Plates, Filler Plates and Splice Bars: Aluminum plate shall be Alloy 6061-T6 conforming to the requirements of ASTM B221.

5. Finish Coating: All aluminum components shall receive an anodized coating conforming to Aluminum Association Designation AA-M10C22A42. The anodic coating shall be Architectural Class I with a minimum thickness of 18 microns (0.7 mills) and a minimum weight of 35 mg/cm^2. The color of the finished coating shall be Medium Bronze, of a shade which matches the existing in place fence. Samples from production lots of finished materials as selected by the Engineer shall be tested in accordance with the following ASTM Specification:
    a. ASTM B137 - Coating Weight
    b. ASTM B244 - Coating Thickness
    c. ASTM B136 - Sealing

Color range samples shall be submitted by the selected finisher for the Engineer's approval before proceeding with production. All of the color shall be obtained from one source. These samples shall be used for comparison purposes during production, finishing, and shall consist of actual sections large enough so that good comparisons can be made to the existing fence and establish the limits of the allowable color shade range. Material outside of the allowable color shade range, as determined by the Engineer, will be rejected.

6. Hardware: All non-aluminum hardware for fastening together fence components shall be stainless steel conforming to the requirements of ASTM A193, Grade B8 and shall be of the shape and size shown on the plans. The stainless steel shall be made a medium bronze color by a thermo-chemical conversion process, to simulate the color of the anodizing process for aluminum. The finish shall not peel, chip or crack and shall be abrasion, fade and corrosion resistant. Color samples of the range of color shall be submitted to the Engineer prior to the start of production

7. Anchor Rods, Nuts, Washers and Anchor Plates: Anchor rods, nuts and washers shall be stainless steel conforming to the requirements of ASTM A276, (Type 430 MOD). Embedded anchor plates shall be stainless steel conforming to the requirements of ASTM A193, Grade B8.

8. Molded Pads: Molded pads shall be manufactured from new unvulcanized neoprene and used synthetic fibers, with a weight proportion of fiber content equal to approximately one-half of the total weight of the pad. The pads shall be formed into single sheets of 1/8" minimum thickness, with a tolerance of plus or minus 10 percent. Pads shall have a Shore A Durometer hardness within the range of 70 to 90, and shall have a minimum compressive breakdown of 6.5 ksi.

Construction Methods: Before fabricating any materials, the Contractor shall submit shop drawings to the Engineer for approval in accordance with Article 1.05.02(b). These drawings shall include but not be limited to the following information:

- A layout plan showing post spacing, rail splice locations, and connections points to existing fence, if required.
- Details for fence panels, rails, splices and connection hardware, posts and anchorage systems.
- Material designations for all components and finishes.

The protective fence shall be accurately fabricated and installed in accordance with the plans, approved shop drawings and as directed by the Engineer. The posts shall be oriented as shown on the plans. The fence panels shall be fabricated and installed such that the rails and top and bottom frames are aligned parallel to the top of the parapet, except where shown otherwise on the plans.

The protective fence shall be shop assembled in sections to ensure fit prior to shipping to the job site. The preassembly procedure shall consist of assembling a minimum of three contiguous

panels. Successive assemblies shall consist of at least one panel of the previous assembly and at least two new panels added to the advancing end.

Replacement fence panels shall be fabricated based on accurate field measurements to ensure proper fit and finish when the panel is in place. Field measurements shall be submitted with the shop drawings for use by the reviewer.

Aluminum welding shall be in accordance with the American Welding Society "Structural Welding Code-Aluminum", ANSI/AWS D1.2. All welding shall be done prior to any anodizing. All welding shall be done with 5356 welding wire or rods unless approved by the Engineer.

Rivets shall be installed as recommended by the Manufacturer and shall be sufficiently tight to provide a clamping force which does not allow any movement of the joined components.

The anchorage assemblies shall be preassembled as shown on the plans. Each assembly shall be accurately secured to the concrete formwork using a rigid top template to ensure that the anchor rods remain perpendicular to the top of the parapet and retain the correct spacing and configuration during the placement and curing of the concrete.

The Contractor shall place molded pads under each post base plate. Each pad shall be the same size and shape as the base plate it is to support, and the holes to accommodate the anchor rods shall be clearly and accurately punched before setting the pads in place.

Connection hardware shall be installed at all required locations and shall include proper washers and nuts. All nuts shall be fully tightened with a properly sized wrench such that they cannot be loosened by hand and will not become loose over time by in service vibrations.

When removing existing fence components, care shall be taken so as not to damage portions of the fence which are to remain in service or components which have been designated for salvage.

At locations where new runs of fence are to be connected to existing portions of fence, the Contractor shall take photos and accurate field measurements and shall create working and shop drawings showing how the new run of fence will connect to the existing portion remaining in place. The field information and working drawings shall be submitted to the Engineer for review and approval prior to modifying any existing components or fabricating any new components.

Method of Measurement: This work will be measured for payment as the actual length of fence installed and accepted, measured in linear feet along the in-place bottom rail of the fence. At terminal posts of individual runs of fence, the measured length shall continue to the face of the terminal post opposite of the rail element. No deduction in length shall be taken where the rail element is discontinuous and/or spliced at joints.

Portions of existing fence or rail which need to be removed prior to the installation of the new fence or replacement panels shall be salvaged and not be measured for payment.

Basis of Payment: This work will be paid for at the Contract unit price, per linear foot for "Metal Bridge Rail Protective Fence" complete in place and accepted, which price shall include all materials, equipment, tools and labor incidental thereto. There shall be no payment for the removal, disposal and/or salvage of existing components.

Pay Item	Pay Unit
Metal Bridge Rail Protective Fence	L.F.

ITEM #0910007A - ATTACHMENT ASSEMBLY

Description:
Work under this item shall consist of installing a temporary connection between a fixed barrier, such as a wingwall parapet and a temporary precast concrete barrier curb where called for on the plans or as directed by the Engineer. The beam rail attachment will consist of a W-Beam Terminal Connection with bolted chemical anchors. The attachment assembly can also be used for beam rail to temporary concrete barrier connections.

All work will be performed in accordance with the plan details and Section 9.10 and the Standard Drawings for beam rail barrier attachments.

Materials:
Materials shall conform to Article 9.01.02

Construction Methods:
Construction Methods shall conform to the details as shown in the plans and to Article 9.01.03.

Method of Measurement:
The number of Attachment Assemblies will be the actual number of beam rail attachments accepted and complete in place.

Basis of Payment:
The item "Attachment Assembly" will be paid at the contract unit price each in accordance with Standard Drawings and as directed by the Engineer. The cost shall include all hardware, the rail terminal connection, labor, materials and equipment required to attach a W-Beam Rail Terminal Connection with sufficient spanning length of rail element, including drilling holes and grouting bolted connections to concrete barrier.

Pay Item	Pay Unit
Attachment Assembly	ea

ITEM #0913014A - 5' CHAIN LINK FENCE (BRIDGE)

Description:

Work under this item shall consist of furnishing and installing chain link fencing as shown on the plans, or as directed by the Engineer, and in accordance with these specifications.

Materials:

Materials for this work shall conform to the following requirements:

Fabric: The fabric shall be galvanized (zinc) coated steel chain link fabric per ASTM A392. The wire shall be No. 9 gage Class 2 (2.0 oz./ft.^{2}) zinc coated wire woven to form a 2-inch mesh knuckled at both selvages.

Rails and Posts: All materials for rails and posts shall conform to the specifications of ASTM A53 Type E or S, Grade B. All rails and posts shall be hot-dip galvanized after fabrication in accordance with ASTM A123.

Fittings: All fittings shall be galvanized pressed steel, malleable iron, or aluminum alloy materials conforming to the specifications of ASTM F626. Galvanized steel wire for the attachment of the fabric to the post and rails shall not be less than #9 gauge.

Base Plates: Base plates shall conform to ASTM A36 or greater and shall be shop welded to the fence posts. All burrs and sharp edges shall be removed and smoothed before galvanizing in accordance with ASTM A123.

Anchor Bolts: Anchor bolts nuts and washers shall be stainless steel and shall conform to the requirements of ASTM F593.

Molded Pads: All molded pads shall be manufactured from new unvulcanized elastomer and unused synthetic fibers, with a weight proportion of fiber content equal to approximately one-half of the total weight of the pad. The pads shall be formed into single sheets of 1/8 inch minimum thickness with a tolerance of plus or minus 10 percent. The pads shall have a durometer hardness within the range of 70 to 90.

Materials Certification and Testing: The Contractor shall furnish a Materials Certificate in accordance with Article 1.06.07 for the fabric, posts, rails, fittings, bolts and washers.

Chemical Anchors: Chemical anchoring material for securing anchor bolts shall conform to the requirements of M.03.07.

Construction Methods:

The chain link fence shall be accurately fabricated and installed in accordance with ASTM F567, manufacturer's instructions, the design plans, and as directed by the Engineer.

Terminal posts shall be provided at each fence termination and any change in horizontal or vertical direction of 30° or more. All posts shall be set plumb unless otherwise directed by the Engineer.

Posts shall be located along the parapet or headwall as indicated on the approved shop drawings. A durable template shall be used to accurately position the drilled holes for the anchor bolts. The diameter of the holes shall be as specified by the chemical anchor Manufacturer.

Bridge or Headwall: Fence posts shall be attached perpendicular to the barrier curb top surface. The fence posts shall be securely bolted to the concrete headwall. The Contractor shall provide shop drawings for the method of attaching the chain link fence to the bridge or headwall and for the material and methods proposed to close gaps in the chain link fence between barrier curb sections. The final production shop drawings shall be signed by a licensed Professional Engineer registered in the State of Connecticut.

All base plates shall have full contact with the molded pad and concrete bearing surface and shall be caulked all around with a waterproof silicone rubber sealant.

All rails shall be erected to produce a smooth, continuous appearance parallel to the finished grade. The fabric shall be stretched tightly between end posts and securely fastened with stretcher bar bands. The fabric shall be attached to the posts and rails as shown on the plans. Dome caps shall be installed on top of all posts.

Chain Link Fabric Installation: Install fabric on roadway side, pull fabric taut; thread the tension bar through fabric and attach to terminal posts with tension bands spaced maximum of 15" on center and attach so that fabric remains in tension after pulling force is released. Install fabric so that it is 2" +/- 1" above finish grade. Secure fabric using wire ties to line posts at 15" on center and to rails and braces 24" on center, and to the tension wire using hog rings 24" on center. Tie wire shall be secured to the fabric by wrapping it two 360 degree turns around the chain link wire pickets. Cut off any excess wire and bend back so as not to protrude so as to avoid injury if a pedestrian may come in contact with the fence.

Before fabricating any materials, the Contractor shall submit shop drawings to the Engineer for approval in accordance with Article 1.05.02-3. These drawings shall include but not be limited to the following information: A layout plan showing all post and rail spacing, all baseplate grades, all fence and anchorage details, material lists and material designations and the name and telephone number of a person to contact who can answer questions about the shop drawings.

Areas where galvanizing has been damaged shall be repaired in accordance with ASTM A780 with two coats of galvanizing compound.

Method of Measurement:

This work will be measured for payment by the actual number of linear feet of completed and accepted fence, measured horizontally from centerline of terminal post to centerline of terminal post.

Basis of Payment:

This work will be paid for at the contract unit price per linear foot for "5' Protective Fence (Bridge)", complete and accepted in place, which price includes all materials, equipment, tools and work incidental thereto.

Pay Item	Pay Unit
5' Chain Link Fence (Bridge)	L.F.

ITEM #0913984A - TEMPORARY PROTECTIVE FENCE

Work under this item shall conform to the requirements of Section 9.13 amended as follows:

9.13.1 - Description:
Add the following paragraph:

Work under this item shall consist of furnishing, installing and maintaining a temporary protective chain link fence with a minimum height of 6' to restrict access to and secure the work area. The work shall also include the removal of all temporary fencing after the completion of construction.

9.13.2 - Materials:
Add the following paragraph:

The materials used shall be new or in good condition, if previously used.

9.13.3 - Construction Methods:
Add the following paragraph:

The fence shall be installed at the location shown on the plans or as ordered by the Engineer prior to commencement of construction activities. The Contractor shall maintain the fencing in good condition during the construction phase and shall immediately repair any damaged sections. The Contractor shall remove the temporary fencing when no longer required for the work, as directed by the Engineer.

9.13.4 - Method of Measurement:
Delete the article and replace with the following:

This work will be measured for payment by the number of linear feet of completed and accepted temporary chain link fence of the height specified, measured from outside to outside of terminal posts. No measurement will be made for temporary protective fence relocated for use at another location.

9.13.5 - Basis of Payment:
Delete the article and replace with the following:

This item will be paid for at the contract unit price per linear foot for "Temporary Protective Fence", which price shall include all materials, equipment, tools, disposal of surplus material and labor incidental thereto.

Pay Item	Pay Unit
Temporary Protective Fence	L.F.

ITEM #0916111A - NOISE BARRIER WALL (STRUCTURE)

ITEM #0916123A - NOISE BARRIER WALL – TRANSPARENT (STRUCTURE)

Description:

Work under this item shall consist of designing, fabricating, furnishing and erecting a Noise Barrier Wall (Structure) and Noise Barrier Wall – Transparent (Structure) to be supported by an appurtenant structure at the locations shown on the Contract Drawings, in this specification, or as directed by the Engineer.

Noise Barrier Wall (Structure) shall have a reinforced normal-weight concrete core and by virtue of its overall construction and composition, is impervious to the passage of light and has the ability to absorb noise.

Noise Barrier Wall – Transparent (Structure) shall be an acrylic and rigid monolithic sheet and by virtue of its overall construction and composition, is pervious to the passage of light and has the ability to reflect noise.

The structural support system of the Noise Barrier Wall (Structure) or Noise Barrier Wall – Transparent (Structure) may be attached, to either an existing structure or new construction, as indicated in the Contract Drawings. This specialized construction of a noise barrier wall shall be fully designed, detailed and manufactured taking into account its structural adequacy and integrity with the supporting structure.

Specific types of walls are indicated on the Contract Drawings and in this specification that are acceptable by the Connecticut Department of Transportation (Department) to be constructed on specific locations based on their conformance with the requirements in the project.

The Contractor is directed to verify at the site, all dimensions and information pertaining to the existing construction that are needed in the design, preparation of Working Drawings and in the overall execution of this project.

The Contract Drawings prepared by the Department for this project contain only conceptual and schematic interpretations for the general approach of design. The Contractor shall prepare its structural design calculations and Working Drawings based on the concept and scheme as presented in the Contract Drawings, and in conformance with this specification. **The structural design calculations and Working Drawings prepared by the Contractor shall be reviewed and approved by the Engineer prior to the start of fabrication of any element of the Noise Barrier Wall (Structure) and Noise Barrier Wall – Transparent (Structure).**

The Contractor is explicitly notified that no other types of Noise Barrier Wall (Structure) or Noise Barrier Wall – Transparent (Structure) shall be approved to be constructed at each specific site other than the types shown in the Contract Drawings.

Materials:

The materials to be used for the various components of the Noise Barrier Wall (Structure) and Noise Barrier Wall – Transparent (Structure), including all appurtenant support systems, shall be as specified in the Contract Drawings.

The Noise Barrier Wall (Structure) and Noise Barrier Wall – Transparent (Structure) chosen shall be as shown on the Contract Drawings and in this Specification. **The Contractor shall not commence with the production of its proposed system of Noise Barrier Wall (Structure) or Noise Barrier Wall – Transparent (Structure) without the Engineer's review and written approval.**

Noise Barrier Wall (Structure) shall be:

Acousta Crete
Faddis Concrete Products
2206 Horseshoe Pike
Downington, PA 19335
(610) 269-4685
www.faddis.com

Noise Barrier Wall – Transparent (Structure) shall be:

Acrylite Soundstop CT GSCC NBS
Armtec
8270 Greensboro Drive
McLean, VA 22102
(860) 615-2037
www.armtec.com

The materials used for the types of noise barrier walls shall be durable, and not be prone to developing openings, cracks or gaps from loading, warping, splitting, shrinkage, expansion, delamination, weathering and other weather-related and climactic-induced deterioration. The noise barrier wall panels shall be U.V.-resistant, flame-retardant, and could resist degradation from ozone, hydrocarbons and freeze-thaw cycling.

The Noise Barrier Wall (Structure) shall be able to provide a minimum Sound Transmission Class (S.T.C.) rating of 34 measured by ASTM E90. The Noise Reduction Coefficient (N.R.C.) shall have a minimum rating of 0.70, as measured by ASTM C423 and E 795. The sound-absorbing portions of the wall shall be durable and resistant against deterioration of material and damage from moderate scratch and abrasion and shall have a minimum of 20-year life cycle free from peeling, rotting or visible deterioration.

The Noise Barrier Wall (Structure) shall have a textured surface pattern as shown on the Contract drawings. The selected pattern for each wall location shall be as shown or noted on the Contract Drawings, and other patterns will not be acceptable. If both sides of the Noise Barrier Wall (Structure) contain a textured surface pattern, the side of the panels covered with the sound-absorbing material shall consistently face the roadway throughout the project. The

sound-absorbing material shall be installed on the entire wall face that is exposed to the roadway.

The color of the Noise Barrier Wall (Structure) exposed to traffic will be indicated on the Contract Plans, conforming to Federal Standard 595 Colors except if specified otherwise on the plans. Only one color may be used on the wall components to maintain uniformity, except where specified otherwise on the Contract plans.

Federal Standard 595 Color No.	Color
FS 36492	Gray
FS 34230	Green
FS 30215	Brown
FS 36622	Gray

The Noise Barrier Wall (Structure) panels shall be integrally-pigmented to a significant depth into its cross-section in conformance with the requirements of ASTM C979*,* in order to produce a uniform color should the panel become scratched, chipped or otherwise surface-damaged. Variation in color or shading from panel to panel shall not be acceptable. Field-staining or painting to achieve a uniform overall color is not allowed.

Individualized design panels may vary from standard wall colors, textures, and patterns, as depicted in the Contract Drawings.

The Noise Barrier Wall (Structure) shall have a suitable surface for repainting, staining, sandblasting or other acceptable method of returning the panels to their original color and texture should they become damaged after construction. Touching-up, re-staining, repainting, or sandblasting portions of the panels shall not result in visible color variation.

The manufacturer of the Noise Barrier Wall (Structure) and Noise Barrier Wall – Transparent (Structure) shall provide to the Department, an Aesthetic Coating Warranty of its product that covers a minimum of ten (10) years.

The Contractor shall also supply the Department with two (2) full-panel sections of Noise Barrier Wall (Structure) measuring 4 feet high, as well as two (2) full-panel sections of Noise Barrier Wall – Transparent (Structure) of similar length and width as the panels to be constructed. These panels of noise barrier walls shall be of the same color and pattern as the Noise Barrier Wall (Structure) and Noise Barrier Wall – Transparent (Structure) to be constructed. These noise barrier wall panels shall be delivered and unloaded at a recommended D.O.T. Maintenance Facility that will be ultimately responsible for the maintenance of the Noise Barrier Walls. These noise barrier panels are intended to be used by the Department for future repair of damaged panels.

Other:

All other materials shall conform to the requirements as indicated on the approved Working Drawings of the specific system of Noise Barrier Wall (Structure) and Noise

Barrier Wall – Transparent (Structure) selected for the project.

Construction Methods:

Design:

The Noise Barrier Wall (Structure) and Noise Barrier Wall – Transparent (Structure), including all structural supports such as but not limited to, reinforced concrete parapets or retaining walls, barrier curbs, columns, piles, caissons and footings, anchor bolts, and structural steel columns, beams, bolts and plates for the framing and support of the noise barrier wall, shall be designed for the most severe combination of gravity and lateral loads in accordance with the AASHTO LRFD Bridge Design Specifications, 7th edition (2014) with the interim specifications up to and including 2016.

The structural design of Noise Barrier Wall (Structure) and Noise Barrier Wall – Transparent (Structure) shall take into account any expansion and contraction movements of the various framing components and supporting structures due to changes in temperature, most especially at locations in proximity with expansion joints at the bridge deck and parapets. A thermal expansion and contraction of not less than 1 ½ inches of the bridge deck, bridge, wingwall or retaining wall parapets at all expansion joints must be accounted for in the design. Provisions to account for the localized and global effects of these temperature-induced movements in the design of the various framing components and supporting structures must be explicitly detailed in the Contractor's Working Drawings.

All steel components of the structural system supporting the Noise Barrier Wall (Structure), including but not limited to beams, columns, base plates and anchor bolts shall be galvanized after fabrication.

The visible sections of the Noise Barrier Wall (Structure) shall have the same color, pattern, texture and height of individual panels as that of the adjacent sections of Noise Barrier Wall in the Highway portions of the project, unless otherwise specified in the Contract Drawings or this Specification.

At a minimum, the top of the Noise Barrier Wall (Structure) and Noise Barrier Wall – Transparent (Structure) shall be at the Top of the Wall Elevations shown on the Contract Drawings.

The bottom panel of the Noise Barrier Wall (Structure) shall have a minimum height of 4 feet.

The Noise Barrier Wall (Structure) and Noise Barrier Wall – Transparent (Structure) shall also be designed in accordance with the manufacturer's requirements, details and specifications for the type of wall chosen if proved that such design parameters are consistent with, or more adequate and stringent than the design requirements established in this Specification or in the Contract Drawings, and if reviewed and approved by the Engineer.

The concrete Noise Barrier Wall (Structure) shall have an integral cap with a minimum height of 6" on the top panels. The caps shall not be cast with a sound-absorptive material.

The Noise Barrier Wall – Transparent (Structure) of reflective type shall have a consistent smoky-brown color and uniform bird warning stripes in all panels. The manufacturer shall provide facilities and qualified personnel to perform all specification tests and maintain an acceptable quality control program meeting the requirements of ISO/TS 16949. To ensure absolute quality, the manufacturer of Noise Barrier Wall – Transparent (Structure) shall provide **Proof of Compliance** for the production of panels.

The plastic sheet of the Noise Barrier Wall – Transparent (Structure) shall meet the following "**Performance Requirements**".

PERFORMANCE REQUIREMENTS

PROPERTY	REQUIREMENT	ASTM Method
Tensile Strength	>9,250 psi	D 638
Flexural Modulus	>445,000 psi	D 790
Rockwell Hardness	>M-90	D 785
STC	>34	E 90 / E 413

The plastic sheet of the Noise Barrier Wall – Transparent (Structure) shall meet the following:
"Transparent Sheet Optical Requirements":

TRANSPARENT SHEET OPTICAL REQUIREMENTS

PROPERTY	REQUIREMENT	ASTM Method
Light Transmission	>88%	D 1003
Haze	<1.5%	D 1003
Yellowness Index	<1	D 1003

After exposure to outdoor weathering for a period of 10 years or accelerated weathering in accordance with ASTM G 155, Cycle 1, for a period of 10,000 hours, the plastic sheet shall show no evidence of cracking or crazing and shall comply with the requirements for **"Resistance to Weathering"** as follows:

RESISTANCE TO WEATHERING

PROPERTY	REQUIREMENT	ASTM Test Method
Light Transmission	>88%	D 1003
Haze	<10%	D 1003
Yellowness Index	<5	D 1003
Tensile Strength	>75% of Initial Value	D 638
Flexural Strength	>75% of Initial Value	D 790

The plastic sheet shall meet the **"Flammability Requirements"** as follows:

FLAMMABILITY REQUIREMENTS

PROPERTY	REQUIREMENT	Test Method
Resistance to Brush Fire	Class 2	EN 1794-2
Horizontal Burn Rate	<2.5 in./min.	ASTM D 635
Smoke Density	<50%	ASTM D 2843
Self-Ignition	>650 Degrees Fahrenheit	ASTM D 1929

Shatter Resistance for Noise Barrier Wall – Transparent (Structure):
The panels shall have the capability to contain fragments in the event that the panel is broken during vehicle collision. The plastic sheet shall be secured in such a way that the fragments do not fall when they are deformed or broken. The acrylic sheets shall be secured in a 4-sided frame. The restraint system shall be designed to withstand the self-weight of the relevant parts multiplied by a factor of 4. There shall be a continuous upper crash rail that runs along the entire length of the Noise Barrier Wall-Transparent (Structure) to protect the noise barrier posts and panels from the cargo box of a truck. The centerline of the crash rail shall be set at elevation 10'-8" from the top of roadway at the gutter line. If not restricted by geometry or roadway profile, the crash rail shall be constructed parallel with the top of the panels throughout. The face of the crash rail facing the travel way shall be aligned with the vertical projection of the inside face of the existing traffic guard rail on the parapet. The inside face of the guardrail shall be its surface that faces the travel way. The crash rail shall be made of ASTM A500 Grade B steel. All ends of crash rails shall be transitioned within the framing system in such a way to eliminate any blunt end or protrusion that could be snagged by moving vehicles.

After an impact of 53 kips (6kJ), in accordance with EN 1974-1, Appendix C, fragments that are released from the plastic sheet shall meet the following requirements:

Pieces of test specimen that are released shall be no larger than 0.040 square inch (25 square millimeters) and shall weigh no more than 0.22 lbs. (0.10 kg.).

Pieces of specimens that are released shall be no longer than 6 inches (15 centimeters).

Rigid pieces or the test specimen that are released shall have angles of less than 15 degrees and shall weigh no more than 0.22 lbs. (0.10 kg.).

No pieces shall weigh more than 0.88 lbs. (0.40 kg.). These criteria shall apply only for one collision incident.

Impact Resistance for Noise Barrier Wall – Transparent (Structure): In order to withstand the impact of stones thrown up from the road surface, the plastic sheet shall meet the requirements of EN 1794-1, Appendix C.

After 10 years of outdoor exposure or 10,000 hours of xenon arc accelerated weathering, the plastic sheet shall retain at least 75% of its original impact strength when tested in accordance with ASTM D 4812, "Standard Test Method for Un-notched Cantilever Beam Impact Resistance of Plastics".

The plastic sheet shall retain at least 75% of its impact strength when tested over the temperature range of 73 degrees Fahrenheit to 0 degrees Fahrenheit, and tested in accordance with ASTM D 4812.

Required Glazing for Noise Barrier Wall – Transparent (Structure): As a safety glazing material, the plastic sheet shall comply with the requirements of ANSI Z 97.1.

Resistance to Roadside Chemicals for Noise Barrier Wall – Transparent (Structure): The plastic sheet shall be resistant to standard de-icing chemicals, such as calcium chloride, magnesium chloride, potassium acetate, calcium/magnesium acetate and sodium acetate.

Edge Conditioning for Noise Barrier Wall – Transparent (Structure): To avoid thermal and stress cracking, all edges of the acrylic must be cut smooth in straight line and without defects. The Contractor must observe all of the Manufacturer's instructions and guidelines in transporting, handling and storing the acrylic sheets at the jobsite, and in the eventual cleaning of the sheets after installation.

The horizontal joint lines between panels in Noise Barrier Wall (Structure) and Noise Barrier Wall – Transparent (Structure) shall match for a minimum distance of 60 feet. If steps-up are required in cases of significant changes in grade, the elevation difference between the horizontal joints of adjacent panels shall not be less than 3" or greater than 12". These requirements shall also apply to the top elevations of the walls. Strict adherence to these requirements may be waived at angle breaks greater than 30 degrees or as approved by the Engineer.

When a particular type of noise barrier wall transitions into a different type, or when a segment of noise barrier wall transitions onto an adjacent segment as necessitated by geometric offset on plan and/or elevation or by the differences in the support structures, or as indicated in the Contract Drawings, the Contractor shall be responsible for the design of the transition and connection components of the noise barrier wall systems.

All longitudinal gaps between the noise barrier wall panels and the top of parapets must be provided with auxiliary members to close such gaps and prevent the escape of noise. The system or mechanism to prevent the escape of noise through these gaps must be designed by the manufacturers of Noise Barrier Wall (Structure) and Noise Barrier Wall – Transparent (Structure), and be clearly detailed in the Contractor's Working Drawings. The design and detail drawings must take into account the relative movements between the noise barrier wall panels and parapets.

Submittals:

All panel units shall be installed in accordance with the Manufacturer's recommendations by an Installer who is duly qualified, approved and certified by the Manufacturer to perform the work, and who exhibits reasonable familiarity and experience for the type of work involved in the installation of Noise Barrier Wall (Structure) or Noise Barrier Wall – Transparent (Structure) described in this Specification and Contract Drawings.
The qualifications of the installer shall be submitted for approval.

The Contractor shall be fully responsible for the structural design, preparation of drawings and conformance to all additional specifications required for the selected Noise Barrier Wall (Structure) and Noise Barrier Wall – Transparent (Structure). The Designer or Responsible Engineer shall have at least Five (5) years of professional experience in the structural design of the afore-mentioned types of noise barrier walls.

The qualifications of proposed Professional Engineer shall be submitted for review and approval.

All drawings to be submitted by the Contractor shall conform to Article 1.05.02 of Form 817 regarding Working Drawings with the following additions:

Preliminary Submissions for Proprietary Noise Barrier Wall (Structure) and Noise Barrier Wall – Transparent (Structure): Prior to the start of fabrication or the construction of the Noise Barrier Wall (Structure) and Noise Barrier Wall – Transparent (Structure), the Contractor shall submit to the Engineer a design package for review and approval by the Engineer in accordance with Article 1.05.02. The design package shall include, but not be limited to the following:

Working Drawings and Structural Design Calculations:
For noise walls on proprietary retaining walls, working drawings for retaining walls and noise walls shall be submitted at the same time for review.

1. All Plans and Computations to be submitted to the Engineer shall be stamped by a licensed Professional Engineer in the State of Connecticut, who shall also be available for consultation in interpreting his computations and drawings, and in the resolution of any issues that may occur during the performance of his work.
2. Full Plan View, drawn to scale, of the Noise Barrier Wall. This view shall show:
   a. Beginning and end of the wall, as well as any angle points;
   b. Posts shall be identified, numbered and located with the proposed coordinates;
   c. Project roadway baselines with 100-ft stations labeled;
   d. Location of existing and/or proposed cantilever and truss sign supports, if any;
   e. Location of existing and/or proposed utilities. (Any existing utilities which are shown on the plans should be verified in the field.)
3. Full Elevation View (Roadway side), drawn to scale, of the Noise Barrier Wall, and including:
   a. Elevations of the finished top and bottom of the Noise Barrier Wall panels at all locations;
   b. Panel sizes;

c. Location of horizontal angle points;
d. Post lengths:
e. Transitions between different wall styles or types;
f. The approximate locations of 100-ft. baseline stations (perpendicular);
g. Location of access for fire hoses or other appurtenances as applicable.

4. Drawings shall include Plans, Details and Sections for the following:
   a. Representative wall panels showing the pattern, color, and texture of the proposed Noise Barrier Wall
   b. Any individualized design panel depicting pattern, dimensions, depth of pattern, textures, and colors
   c. Footings for all expected soil conditions (soil, rock, partial soil/rock)
   d. Attachment and anchorage of the Noise Barrier Wall gravity and lateral loads resisting systems onto the parapets of the existing bridge and wingwalls or onto new concrete columns, considering:
      i. Anchor bolts in sustained tension loading must not be installed in a chemical anchoring material.
      ii. Show arrangement of anchor bolts on plan and section.
      iii. Consideration of tolerances for the locations of Noise Barrier Wall posts relative to locations of expansion joints in the parapets.
      iv. Details and methods for eliminating gaps between the parapet top and side with the Noise Barrier Wall panels.
      v. Allowable installation tolerances for posts including allowable variations of horizontal spacing and from plumb.
   e. New columns and footings supporting the Noise Barrier Wall gravity and lateral loads resisting systems
   f. Transition between different wall styles or types
   g. Transition between walls at geometric offset on plan and elevation
   h. Transition between walls on different supporting structures
   i. Provisions for temperature expansion and contraction in the wall support systems.
   j. Methods of protection of any existing utilities, facilities and sub- structures during the construction of the Noise Barrier Wall
   k. Any false-work required to temporarily support the components during construction.
   l. Construction and installation procedures; including on proposed retaining walls
   m. Allowable fabrication tolerances for wall panels and posts

5. Calculations shall include:
   a. Computations shall clearly comply with and reference applicable AASTHO provisions.
   b. Structural design for the footings/foundations for the Noise Barrier Wall, modeling all expected soil conditions (soil, rock, partial soil/rock).
   c. Structural design for the support and framing systems of the Noise Barrier Wall for the combination of gravity and lateral loads (wind and seismic).
   d. Structural design for the attachment and anchorage of the support and framing systems of the Noise Barrier Wall for the combination of gravity and lateral loads

(wind and seismic).

e. Structural design for the gravity and lateral (wind and seismic) load resisting systems of the Noise Barrier Wall.
f. Documentation of computer programs utilized, including all design parameters.

Final Submissions of Noise Barrier Wall (Structure) and Noise Barrier Wall – Transparent (Structure) Drawings:

Once the Working Drawings for the Noise Barrier Wall (Structure) and Noise Barrier Wall – Transparent (Structure) have been reviewed and accepted by the Department, the Contractor shall submit the Final Plans. The final submission shall be made within 14 days of acceptance of the working drawing submittal by the Department. No fabrication shall be performed on the walls until the final submission has been received. Acceptance of the final design shall not relieve the Contractor of his responsibility under the Contract for the successful completion of the work.

Construction Specifications:

1) Construction tolerances, methods and material specifications specific to the noise barrier walls chosen shall be provided to the Department. Submittal requirements for materials such as certification, quality, and acceptance/rejection criteria should be included.

2) Any requirements from the Manufacturer specific to the noise barrier wall that are not stated herein shall also be included.
3) Tolerances:
   All noise barrier wall components shall conform to the following:
   Posts
   a) Post Dimension Tolerances:
      i) Post Height = $\pm$1/2”
         Post Vertical Sweep:
      ii) Posts $\leq$ 16’ long = $\pm$1/8” 2. Posts > 16’ long = $\pm$1/4”

   b) Post Installation:
      i) In horizontal plane from plan location = $\pm$1”
      ii) In horizontal plane from center of cylindrical footing = $\pm$1”
      iii) In horizontal plane from adjacent post = $\pm$1/2”
      iv) Post plumb = $\pm$1/8” per 10’ of wall height

   Panels
   c) Panel Dimension Tolerances:
      i) Panel Length and Height = $\pm$1/4”

ii) Panel Structural Thickness = ±1/4”
iii) Panel Absorptive Material Thickness = ±1/4”
iv) Panel Horizontal Sweep = ±1/8”
v) Panel Vertical Sweep = ±1/8”

d) Position of Lifting Inserts:
i) Along Panel Length = ±1”
ii) Along Panel Thickness = ±1/4”

e) Reinforcing Steel Tolerances:
i) Splice = +1” from Standard Lap Splice Requirement
ii) Concrete Cover = +2”
iii) Other

4) There shall be no openings in the wall or under the wall, which would allow sound transmission.

Fabrication of Panels:

Textured Surface Treatment: Formed surfaces other than the exposed face shall not require a textured finish. The textured surface finish shall be similar and consistent in material and construction with that of the Highway portion of Noise Barrier Wall in the project.

If the proposed noise barrier wall is being used to replace an existing noise barrier wall, the top of the proposed noise barrier wall shall be constructed to no lower than the top elevation of the existing wall or as shown on the Contract Plans, or unless specifically noted otherwise.

The Contractor shall provide two sample panels of the Noise Barrier Wall – Transparent (Structure), matching the proposed actual construction in material, texture and color prior to the start of actual production, as follows:

1. One (1) 24” x 24” x Full Thickness shall be provided for the Engineer’s approval as to the material, color and surface treatments. The production of panels may not commence without the Engineer’s approval.

2. One (1) Full Width x Full Thickness x 4 Feet High model panel, to be used as a guide, standard and for comparison purposes for the material, color and surface treatment of the production panels. This model panel shall be kept in the fabricator’s plant during the production of panels, and may be used in the project at the end of production operations with the permission of the Engineer.

Unexpected Obstructions:
If during construction, the avoidance of unexpected or unforeseen obstructions requires the revision of portions of the original design, the Contractor shall provide a revised design of the affected portions for review and written approval by the Engineer.

Construction:
The Contractor shall schedule its construction operations such that access to the areas behind the walls would not be required in the performance of the remainder of the work once access

has been rendered difficult or inexpedient. The Contractor, having caused its own access to be restricted or limited, as a result of prioritizing to finish grades, stabilize slopes or establish turf ahead of the other work, shall not be permitted to use any of these circumstances as a reason to not perform or finish the required work. Should the Contractor need access to these areas, the additional work to re-establish grades, re-establish slopes, re-establish turf or any work to restore the ground to a finished condition as shown in the Contract Drawings, shall be performed at the sole expense of the Contractor.

The Contractor shall restore all ground beyond the established Limits of Disturbance, if disturbed by the construction of the noise barrier walls. The ground restoration shall be in accordance with the proposed finished condition shown in the Contract Drawings. The Contractor shall remove all excess materials from the site.

Prior to any excavation, the Contractor shall field-verify the location of all existing utilities, sewers and culverts shown on the Contract Plans. Should a sewer, or culvert be damaged by the Contractor's omission or negligence, the Contractor shall replace the damaged sections at its own cost.

On-Site Representative:
A qualified and experienced representative from the manufacturer of noise barrier wall shall be present at the site during the start of construction to assist the Contractor and the Engineer. The representative shall also be available for consultation on an as- needed basis, if requested by the Contractor or the Engineer.

Installation:
All panel units shall be installed in accordance with the Manufacturer's recommendations by an Installer who is duly qualified, approved and certified by the Manufacturer to perform the work, and who exhibits reasonable familiarity and experience for the type of work involved in the installation of Noise Barrier Wall (Structure) or Noise Barrier Wall – Transparent (Structure) described in this Specification and Contract Drawings.

Special care shall be taken to properly set the bottom panel units true-to-line and grade.

The assembly of the various components shall be performed in such a manner that no undue strain or stress is placed on any of the members that constitute the completed structure.

Inspection and Rejection:
Marking: The date of manufacture, the production lot number, and the piece-mark shall be clearly marked on the side of each panel or module.

All panels shall be available for inspection by the Engineer prior to installation at the project site.

Panels with textured surface treatments shall be rejected if the exposed face deviates from the look of the approved model as to color or texture as determined by the Engineer.

Acceptance Criteria for Sound Barrier Wall (Structure) or Sound Barrier Wall – Transparent (Structure):

Precast components shall be accepted for use in wall construction provided the concrete strength meets or exceeds the minimum compressive strength requirement, and the panel or module dimensions are free from any chipping, cracks, honeycomb surface treatment, open texture concrete, broken corners or other defects as determined by the Engineer.

The Contractor shall be responsible for ensuring a completed sound barrier wall system free of discoloration, cracks or objectionable marks which may adversely affect the barrier's performance, aesthetics, or serviceability as determined by the Engineer. All panels that exhibit any form of structural damage, as determined by the Engineer, will be rejected without any cost to the Department, either at the fabrication shop or at the construction site, even after installation, but prior to acceptance of the job.

Panels with textured surface treatments shall be rejected if the color and texture on the exposed faces deviate, or show variations from the approved model, as determined by the Engineer.

Rejected panels deemed to require repair or replacement shall be replaced at the Contractor's expense. No payment shall be made for removing, temporarily storing, or re-installing panels to enable access to the panel to be replaced. Any panels that are damaged during panel replacement shall also be replaced or repaired per the direction of the Engineer. Any work to stabilize areas adjacent to the wall required due to replacement of cracked or damaged panels shall be done at the Contractor's own cost.

Method of Measurement:

Noise Barrier Wall (Structure) and Noise Barrier Wall – Transparent (Structure) shall be measured for payment by the number of square feet of Noise Barrier Wall (Structure) and Noise Barrier Wall – Transparent (Structure) completed and accepted within the limits indicated on the plans or as ordered by the Engineer and shall be measured from center to center distance between vertical columns supporting each wall panel. The vertical pay limit shall be measured from the bottom to the top of the barrier panel section. Each span between columns shall be measured for payment separately, as stepping may be required.

The two (2) full panel repair sections of Noise Barrier Wall (Structure) delivered to the D.O.T. Maintenance Facility shall be measured and paid for as Noise Barrier Wall (Structure) (sf.)

The two (2) full panel repair sections of Noise Barrier Wall – Transparent (Structure) delivered to the D.O.T. Maintenance Facility shall be measured and paid for as Noise Barrier Wall – Transparent (Structure) (sf.)

Basis of Payment:

Payment for this work will be made at the Contract unit price per square foot for Noise Barrier Wall (Structure) and Noise Barrier Wall – Transparent (Structure) complete in place, which price shall include engineering and design, on-call and on-site services of the representative from the wall manufacturers, all work and materials used for the fabrication, complete installation and construction of the walls, facing panels, excavation, grading, disposal of surplus material, equipment, tools, labor and work incidental to the installation of the wall.

No payment shall be made for survey, field-verification work and the preparation of working drawings.

PAY ITEM	PAY UNIT
Noise Barrier Wall - (Structure)	SF
Noise Barrier Wall – Transparent (Structure)	SF

ITEM #0916126A - NOISE BARRIER WALL

Description:

Work under this item shall consist of designing, fabricating, furnishing and erecting noise barrier wall systems in the locations, elevations, and dimensions shown on the plans, and in accordance with these specifications or as directed by the Engineer. Specific types of walls may be required by the Contract drawings; the Contractor may select any one of the types listed and detailed on the plans. The required foundations shall also be included in this item.

Noise Barrier Wall shall have a reinforced normal-weight concrete core and by virtue of its overall construction and composition, is impervious to the passage of light and has the ability to absorb noise.

The structural support system of the Noise Barrier Wall may be attached, to either an existing structure or new construction, as indicated in the Contract Drawings. This specialized construction of a noise barrier wall shall be fully designed, detailed and manufactured taking into account its structural adequacy and integrity with the supporting structure.

Specific types of walls are indicated on the Contract Drawings and in this specification that are acceptable by the Connecticut Department of Transportation (Department) to be constructed on specific locations based on their conformance with the requirements in the project. The Contractor shall select the appropriate wall type from a list in the Contract Drawings and in this specification.

The Contractor is directed to verify at the site, all dimensions and information pertaining to the existing construction that are needed in the design, preparation of Working Drawings and in the overall execution of this project.

The Contract Drawings prepared by the Department for this project contain only conceptual and schematic interpretations for the general approach of design. The Contractor shall prepare its structural design calculations and Working Drawings based on the concept and scheme as presented in the Contract Drawings, and in conformance with this specification. **The structural design calculations and Working Drawings prepared by the Contractor shall be reviewed and approved by the Engineer prior to the start of fabrication of any element of the Noise Barrier Wall.**

In its Bid Proposal, the Contractor shall identify by type, name and manufacturer, the specific type of noise barrier wall for each location upon which its bid is based. All noise barrier wall segments or panels selected for each location shall be furnished from the same manufacturer and shall be of the same type, pattern and color.

The Contractor is explicitly notified that no other types of Noise Barrier Wall shall be approved to be constructed at each specific site other than the types shown in the Contract Drawings.

Materials:

The materials to be used for the various components of the Noise Barrier Wall including all appurtenant support systems, shall be as specified in the Contract Drawings.

The Noise Barrier Wall chosen shall be selected from a list of manufacturers provided on the Contract Drawings and in this Specification. This list identifies various manufactured types of noise barrier wall systems that are considered appropriate and acceptable for each specific location in the project, but does not guarantee that all of the listed proprietary noise barrier wall systems can be designed to meet all of the dimensional, structural, or geotechnical constraints at each site. **The Contractor shall not commence with the production of its proposed system of Noise Barrier Wall without the Engineer's review and written approval.**

Noise Barrier Wall shall be:

Acousta Crete
Faddis Concrete Products
2206 Horseshoe Pike
Downington, PA 19335
(610) 269-4685
www.faddis.com

Not all of the above-listed walls are suited for use at specific locations due to structural requirements and concerns or, that the environment or locality warrants a certain type or style of wall to be used. Refer to the Contract Drawings for the specific types of Noise Barrier Wall that are acceptable for each specific location in the project.

The materials used for the types of noise barrier walls shall be durable, and not be prone to developing openings, cracks or gaps from loading, warping, splitting, shrinkage, expansion, delamination, weathering and other weather-related and climactic-induced deterioration. The noise barrier wall panels shall be U.V.-resistant, flame-retardant, and could resist degradation from ozone, hydrocarbons and freeze-thaw cycling.

The Noise Barrier Wall shall be able to provide a minimum Sound Transmission Class (S.T.C.) rating of 34 measured by ASTM E90. The Noise Reduction Coefficient (N.R.C.) shall have a minimum rating of 0.70, as measured by ASTM C423 and E 795. The sound- absorbing portions of the wall shall be durable and resistant against deterioration of material and damage from moderate scratch and abrasion and shall have a minimum of 20-year life cycle free from peeling, rotting or visible deterioration.

The Noise Barrier Wall shall have a textured surface pattern as shown on the Contract drawings. The selected pattern for each wall location shall be as shown or noted on the Contract Drawings, and other patterns will not be acceptable. If both sides of the Noise Barrier Wall contain a textured surface pattern, the side of the panels covered with the sound-absorbing

material shall consistently face the roadway throughout the project. The sound-absorbing material shall be installed on the entire wall face that is exposed to the roadway.

The color of the Noise Barrier Wall exposed to traffic will be indicated on the Contract Plans, conforming to Federal Standard 595 Colors except if specified otherwise on the plans. Only one color may be used on the wall components to maintain uniformity, except where specified otherwise on the Contract plans.

Federal Standard 595 Color No.	Color
FS 36492	Gray
FS 34230	Green
FS 30215	Brown
FS 36622	Gray

The Noise Barrier Wall panels shall be integrally-pigmented to a significant depth into its cross-section in conformance with the requirements of ASTM C979*,* in order to produce a uniform color should the panel become scratched, chipped or otherwise surface-damaged. Variation in color or shading from panel to panel shall not be acceptable. Field-staining or painting to achieve a uniform overall color is not allowed.

Individualized design panels may vary from standard wall colors, textures, and patterns, as depicted in the Contract Drawings.

The Noise Barrier Wall shall have a suitable surface for repainting, staining, sandblasting or other acceptable method of returning the panels to their original color and texture should they become damaged after construction. Touching-up, re-staining, repainting, or sandblasting portions of the panels shall not result in visible color variation.

The manufacturer of the Noise Barrier Wall shall provide to the Department, an Aesthetic Coating Warranty of its product that covers a minimum of ten (10) years.

The Contractor shall also supply the Department with two (2) full-panel sections of Noise Barrier Wall measuring 4 feet high, of similar length and width as the panels to be constructed. These panels of noise barrier walls shall be of the same color and pattern as the Noise Barrier Wall to be constructed. These noise barrier wall panels shall be delivered and unloaded at a recommended D.O.T. Maintenance Facility that will be ultimately responsible for the maintenance of the Noise Barrier Walls. These noise barrier panels are intended to be used by the Department for future repair of damaged panels.

Reinforcing steel shall conform to the requirements of Article M.06.01. Additionally, all steel components, including fasteners and anchor bolts shall be completely hot-dip galvanized, after fabrication, in accordance with ASTM A123 or ASTM A153, as applicable. Zinc-rich field primer for touch up shall conform to the requirements of ASTM A780. The use of aerosol spray cans shall not be permitted.

Concrete for footings shall have a minimum 28 day compressive strength f'c, of 3000 psi and conform to the requirements of Article M.03.01.

Other:

All other materials shall conform to the requirements as indicated on the approved Working Drawings of the specific system of Noise Barrier Wall selected for the project.

Construction Methods:

Design:

The Noise Barrier Wall, including all structural supports such as but not limited to, reinforced concrete foundations, barrier curbs, columns, piles, caissons and footings, anchor bolts, and structural steel columns, beams, bolts and plates for the framing and support of the noise barrier wall, shall be designed for the most severe combination of gravity and lateral loads in accordance with the AASHTO LRFD Bridge Design Specifications, 7th edition (2014) with the interim specifications up to and including 2016.

All steel components of the structural system supporting the Noise Barrier Wall, including but not limited to beams, columns, base plates and anchor bolts shall be galvanized after fabrication.

The visible sections of the Noise Barrier Wall shall have the same color, pattern, texture and height of individual panels as that of the adjacent sections of Noise Barrier Wall in the Highway portions of the project, unless otherwise specified in the Contract Drawings or this Specification.

At a minimum, the top of the Noise Barrier Wall shall be at the Top of the Wall Elevations shown on the Contract Drawings.

The bottom panel shall be a minimum height of 54 inches and shall be precast reinforced concrete. It shall be uncolored and without pattern or acoustic material on either face.

The Noise Barrier Wall shall also be designed in accordance with the manufacturer's requirements, details and specifications for the type of wall chosen if proved that such design parameters are consistent with, or more adequate and stringent than the design requirements established in this Specification or in the Contract Drawings, and if reviewed and approved by the Engineer.

The concrete Noise Barrier Wall shall have an integral cap with a minimum height of 6" on the top panels. The caps shall not be cast with a sound-absorptive material.

The horizontal joint lines between panels in Noise Barrier Wall shall match for a minimum distance of 60 feet. If steps-up are required in cases of significant changes in grade, the elevation difference between the horizontal joints of adjacent panels shall not be less than 3" or greater than 12". These requirements shall also apply to the top elevations of the walls. Strict adherence to these requirements may be waived at angle breaks greater than 30 degrees or as approved by the Engineer.

When a particular type of noise barrier wall transitions into a different type, or when a segment of noise barrier wall transitions onto an adjacent segment as necessitated by geometric offset on plan and/or elevation or by the differences in the support structures, or as indicated in the Contract Drawings, the Contractor shall be responsible for the design of the transition and connection components of the noise barrier wall systems.

All longitudinal gaps between the noise barrier wall panels and the top of parapets must be provided with auxiliary members to close such gaps and prevent the escape of noise. The system or mechanism to prevent the escape of noise through these gaps must be designed by the manufacturers of Noise Barrier Wall, and be clearly detailed in the Contractor's Working Drawings. The design and detail drawings must take into account the relative movements between the noise barrier wall panels and parapets or barrier curbs.

The structural design of Noise Barrier Wall shall take into account any expansion and contraction movements of the various framing components and supporting structures due to changes in temperature. Provisions to account for the localized and global effects of these temperature-induced movements in the design of the various framing components and supporting structures must be explicitly detailed in the Contractor's Working Drawings.

Crushed stone shall be placed adjacent/under the noise barrier wall as depicted in the Contract Drawings to allow for cross drainage from one side of the wall to the other, to prevent erosion, or to function as a splash pad.

Submittals:

All panel units shall be installed in accordance with the Manufacturer's recommendations by an Installer who is duly qualified, approved and certified by the Manufacturer to perform the work, and who exhibits reasonable familiarity and experience for the type of work involved in the installation of Noise Barrier Wall described in this Specification and Contract Drawings. The qualifications of the installer shall be submitted for approval.

The Contractor shall be fully responsible for the structural design, preparation of drawings and conformance to all additional specifications required for the selected Noise Barrier Wall. The Designer or Responsible Engineer shall have at least Five (5) years of professional experience in the structural design of the afore-mentioned types of noise barrier walls. The qualifications of proposed Professional Engineer shall be submitted for review and approval.

All drawings to be submitted by the Contractor shall conform to Article 1.05.02 of Form 817 regarding Working Drawings with the following additions:

Preliminary Submissions for Proprietary Noise Barrier Wall. Prior to the start of fabrication or the construction of the Noise Barrier Wall, the Contractor shall submit to the Engineer a design package for review and approval by the Engineer in accordance with Article 1.05.02. The design package shall include, but not be limited to the following:

Working Drawings and Structural Design Calculations:

1. All Plans and Computations to be submitted to the Engineer shall be stamped by a licensed Professional Engineer in the State of Connecticut, who shall also be available for consultation in interpreting his computations and drawings, and in the resolution of any issues that may occur during the performance of his work.

2. Full Plan View, drawn to scale, of the Noise Barrier Wall. This view shall show:
    a. Beginning and end of the wall, as well as any angle points;
    b. Posts shall be identified, numbered and located with the proposed coordinates;
    c. Roadway baseline with 100-ft stations labeled;
    d. Location of existing and/or proposed cantilever and truss sign supports, if any;
    e. Location of existing and/or proposed utilities. (Any existing utilities which are shown on the plans should be verified in the field.)
3. Full Elevation View (Roadway side), drawn to scale, of the Noise Barrier Wall, and including:
    a. Elevations of the finished top and bottom of the Noise Barrier Wall panels at all locations;
    b. Panel sizes;
    c. Location of horizontal angle points;
    d. Post lengths.
    e. Transitions between different wall styles or types;
    f. The approximate locations of 100-ft. baseline stations (perpendicular);
    g. Location of access for fire hoses or other appurtenances as applicable.

4. Drawings shall include Plans, Details and Sections for the following:
    a. Representative wall panels showing the pattern, color, and texture of the proposed Noise Barrier Wall
    b. Any individualized design panel depicting pattern, dimensions, depth of pattern, textures, and colors
    c. Footings for all expected soil conditions (soil, rock, partial soil/rock)
    d. Attachment and anchorage of the Noise Barrier Wall gravity and lateral loads resisting systems onto the new concrete columns, considering:
        i. Anchor bolts in sustained tension loading must not be installed in a chemical anchoring material.

ii. Show arrangement of anchor bolts on plan and section.
iii. Consideration of tolerances for the locations of Noise Barrier Wall posts relative to locations of expansion joints at the transitions between wall types.
iv. Details and methods for eliminating gaps between the barrier curb and top and side with the Noise Barrier Wall panels.
v. Allowable installation tolerances for posts including allowable variations of horizontal spacing and from plumb.

e. New columns and footings supporting the Noise Barrier Wall gravity and lateral loads resisting systems
f. Transition between different wall styles or types
g. Transition between walls at geometric offset on plan and elevation
h. Transition between walls on different supporting structures
i. Provisions for temperature expansion and contraction in the wall support systems.
j. Methods of protection of any existing utilities, facilities and sub-structures during the construction of the Noise Barrier Wall
k. Any false-work required to temporarily support the components during construction.
l. Construction and installation procedures
m. Allowable fabrication tolerances for wall panels and posts

5. Calculations shall include:
   a. Computations shall clearly comply with and reference applicable AASTHO provisions.
   b. Structural design for the footings/foundations for the Noise Barrier Wall, modeling all expected soil conditions (soil, rock, partial soil/rock).
   c. Structural design for the support and framing systems of the Noise Barrier Wall for the combination of gravity and lateral loads (wind and seismic).
   d. Structural design for the attachment and anchorage of the support and framing systems of the Noise Barrier Wall for the combination of gravity and lateral loads (wind and seismic).
   e. Post length and post embedment dimensions.
   f. Structural design for the gravity and lateral (wind and seismic) load resisting systems of the Noise Barrier Wall.
   g. Documentation of computer programs utilized, including all design parameters.

Final Submissions of Noise Barrier Wall Drawings:

Once the Working Drawings for the Noise Barrier Wall have been reviewed and accepted by the Department, the Contractor shall submit the Final Plans. The final submission shall be made within 14 days of acceptance of the working drawing submittal by the Department. No fabrication shall be performed on the walls until the final submission has been received. Acceptance of the final design shall not relieve the Contractor of his responsibility under the

Contract for the successful completion of the work.

Construction Specifications:

1. Construction tolerances, methods and material specifications specific to the noise barrier walls chosen shall be provided to the Department. Submittal requirements for materials such as certification, quality, and acceptance/rejection criteria should be included.

2. Any requirements from the Manufacturer specific to the noise barrier wall that are not stated herein shall also be included.

3. Tolerances:

   All noise barrier wall components shall conform to the following:

   Posts

   a. Post Dimension Tolerances:
      i. Post Height = $\pm$1/2”
      ii. Post Vertical Sweep:
         1. Posts $\leq$ 16’ long = $\pm$1/8”
         2. Posts > 16’ long = $\pm$1/4”

   b. Post Installation:
      i. In horizontal plane from plan location = $\pm$1”
      ii. In horizontal plane from center of cylindrical footing = $\pm$1”
      iii. In horizontal plane from adjacent post = $\pm$1/2”
      iv. Post plumb = $\pm{}^{1}/_{8}$” per 10’ of wall height

   Panels

   c. Panel Dimension Tolerances:
      i. Panel Length and Height = $\pm$1/4”
      ii. Panel Structural Thickness = $\pm$1/4”
      iii. Panel Absorptive Material Thickness = $\pm$1/4”
      iv. Panel Horizontal Sweep = $\pm$1/8”
      v. Panel Vertical Sweep = $\pm$1/8”

   d. Position of Lifting Inserts:
      i. Along Panel Length = $\pm$1”
      ii. Along Panel Thickness = $\pm$1/4”

   e. Reinforcing Steel Tolerances:
      i. Splice = +1” from Standard Lap Splice Requirement
      ii. Concrete Cover = +2”

   Other

4. There shall be no openings in the wall or under the wall, which would allow sound transmission.

Fabrication of Panels:

Textured Surface Treatment: Formed surfaces other than the exposed face shall not require a textured finish. The textured surface finish shall be similar and consistent in material and construction with that of the Highway portion of Noise Barrier Wall in the project.

If the proposed noise barrier wall is being used to replace an existing noise barrier wall, the top of the proposed noise barrier wall shall be constructed to no lower than the top elevation of the existing wall or as shown on the Contract Plans, or unless specifically noted otherwise.

The Contractor shall provide two sample panels of the Noise Barrier Wall, matching the proposed actual construction in material, texture and color prior to the start of actual production, as follows:

1. One (1) 24" x 24" x Full Thickness shall be provided for the Engineer's approval as to the material, color and surface treatments. The production of panels may not commence without the Engineer's approval.

2. One (1) Full Width x Full Thickness x 4 Feet High model panel, to be used as a guide, standard and for comparison purposes for the material, color and surface treatment of the production panels. This model panel shall be kept in the fabricator's plant during the production of panels, and may be used in the project at the end of production operations with the permission of the Engineer.

Construction:

Prior to any excavation, the Contractor shall field-verify the location of all existing utilities, sewers and culverts shown on the Contract Plans. Should a sewer, or culvert be damaged by the Contractor's omission or negligence, the Contractor shall replace the damaged sections at its own cost.

If during construction, the avoidance of unexpected utilities, drainage or other obstructions requires the use of closer post spacing than that shown on the Contract plans, the Contractor shall furnish additional foundations, posts, and panels as directed by the Engineer. The additional foundations, posts, and panels shall conform to the Contract documents and other approved drawings and specifications. Field cutting of posts or panels will not be accepted.

For noise barrier walls installed on grade, the posts shall be set in concrete in predrilled holes unless alternate methods are proposed by the noise barrier wall designer and approved by the Engineer. The concrete shall fill the bore to the full depth of the hole and shall be slightly crowned at the top for drainage. The drilled hole shall be reasonably true and plumb to the stated diameter and depth. Precautions shall be taken in the operational procedures to protect the hole from collapse. Should rock or other obstructions be encountered in making the hole, this material shall be removed and any space outside the designed pier diameter shall be replaced with concrete. The concrete shall be placed in the dry, against the existing soil or

rock. All disturbed material around the concrete shall be compacted.

The Contractor shall schedule its construction operations such that access to the areas behind the walls would not be required in the performance of the remainder of the work once access has been rendered difficult or inexpedient. The Contractor, having caused its own access to be restricted or limited, as a result of prioritizing to finish grades, stabilize slopes or establish turf ahead of the other work, shall not be permitted to use any of these circumstances as a reason to not perform or finish the required work. Should the Contractor need access to these areas, the additional work to re-establish grades, re-establish slopes, re-establish turf or any work to restore the ground to a finished condition as shown in the Contract Drawings, shall be performed at the sole expense of the Contractor.

The Contractor shall restore all ground beyond the established Limits of Disturbance, if disturbed by the construction of the noise barrier walls. The ground restoration shall be in accordance with the proposed finished condition shown in the Contract Drawings. The Contractor shall remove all excess materials from the site.

Prior to any excavation, the Contractor shall field-verify the location of all existing utilities, sewers and culverts shown on the Contract Plans. Should a sewer, or culvert be damaged by the Contractor's omission or negligence, the Contractor shall replace the damaged sections at its own cost.

On-Site Representative:

A qualified and experienced representative from the manufacturer of noise barrier wall shall be present at the site during the start of construction to assist the Contractor and the Engineer. The representative shall also be available for consultation on an as- needed basis, if requested by the Contractor or the Engineer.

Installation:

All panel units shall be installed in accordance with the Manufacturer's recommendations by an Installer who is duly qualified, approved and certified by the Manufacturer to perform the work, and who exhibits reasonable familiarity and experience for the type of work involved in the installation of Noise Barrier Wall described in this Specification and Contract Drawings.

Special care shall be taken to properly set the bottom panel units true-to-line and grade.

The assembly of the various components shall be performed in such a manner that no undue strain or stress is placed on any of the members that constitute the completed structure.

Inspection and Rejection:

Marking: The date of manufacture, the production lot number, and the piece-mark shall be clearly marked on the side of each panel or module.

All panels shall be available for inspection by the Engineer prior to installation at the project site.

Panels with textured surface treatments shall be rejected if the exposed face deviates from the look of the approved model as to color or texture as determined by the Engineer.

Acceptance Criteria for Sound Barrier Wall:

Precast components shall be accepted for use in wall construction provided the concrete strength meets or exceeds the minimum compressive strength requirement, and the panel or module dimensions are free from any chipping, cracks, honeycomb surface treatment, open texture concrete, broken corners or other defects as determined by the Engineer.

The Contractor shall be responsible for ensuring a completed sound barrier wall system free of discoloration, cracks or objectionable marks which may adversely affect the barriers performance, aesthetics, or serviceability as determined by the Engineer. All panels that exhibit any form of structural damage, as determined by the Engineer, will be rejected without any cost to the Department, either at the fabrication shop or at the construction site, even after installation, but prior to acceptance of the job.

Panels with textured surface treatments shall be rejected if the color and texture on the exposed faces deviate, or show variations from the approved model, as determined by the Engineer.

Rejected panels deemed to require repair or replacement shall be replaced at the Contractor's expense. No payment shall be made for removing, temporarily storing, or re-installing panels to enable access to the panel to be replaced. Any panels that are damaged during panel replacement shall also be replaced or repaired per the direction of the Engineer. Any work to stabilize areas adjacent to the wall required due to replacement of cracked or damaged panels shall be done at the Contractor's own cost.

Method of Measurement:

Noise Barrier Wall shall be measured for payment by the number of square feet of Noise Barrier Wall completed and accepted within the limits indicated on the plans or as ordered by the Engineer and shall be measured from center to center distance between vertical columns supporting each wall panel. The vertical pay limit shall be measured from the bottom to the top of the barrier panel section. Each span between columns shall be measured for payment separately, as stepping may be required.

The two (2) full panel sections of Noise Barrier Wall delivered to the D.O.T. Maintenance Facility shall be measured and paid for as Noise Barrier Wall (SF).

Basis of Payment:

Payment for this work will be made at the Contract unit price per square foot for Noise Barrier Wall complete in place, which price shall include engineering and design, on-call and on-site services of the representative from the wall manufacturers, all work and materials used for the fabrication, complete installation and construction of the walls, stone, foundation, facing panels, excavation, grading, disposal of surplus material, equipment, tools, labor and work incidental to the installation of the wall.

No payment shall be made for survey, field-verification work and the preparation of working drawings.

PAY ITEM	PAY UNIT
Noise Barrier Wall	SF

ITEM #0916301A - TIMBER NOISE BARRIER WALL

The work under the item Timber Noise Barrier Wall shall conform to Section 09.16 of the Standard Specifications, amended as follows:

09.16.01-Description: Add the following:

Work under this item shall also include modification of existing noise barrier wall, and installation of an access door and padlock. The access code for the padlock shall be provided to the Wethersfield Fire Department and Maintenance.

09.16.02-Materials: Add the following:

Materials for access door shall be as indicated on the Contract Drawings.

09.16.04-Method of Measurement: Add the following:

The access door shall not be measured for payment, but shall be included in the item 'Timber Noise Barrier Wall'.

ITEM #0916406A - REMOVE NOISE BARRIER WALL

Description: This work shall include the removal and satisfactory disposal of all existing noise barrier wall, including foundations, where shown on the plans or as directed by the Engineer, and in accordance with these specifications.

Construction Methods: Noise wall shall be removed in its entirety, due precaution being taken to avoid injury to new construction, public utility installations or abutting property. The material removed shall be disposed of offsite in accordance with all applicable local, state and federal regulations. Concrete foundations shall be removed according to the plans.

Method of Measurement: This work will be measured for payment by the number of linear feet of noise barrier wall removed and disposed of, measured horizontally between the outer limits of the noise barrier wall.

Basis of Payment: Payment for removing and disposing of noise barrier wall will be made at the contract unit price per linear foot for "Remove Noise Barrier Wall", which price shall include all equipment, tools and labor incidental for the removal and disposal of all elements.

Pay Item	Pay Unit
0916406A – Remove Noise Barrier Wall	l.f.

ITEM #0916408A - REMOVE NOISE BARRIER WALL (STRUCTURE)

Description: This work shall include the removal and satisfactory disposal of all structure mounted noise barrier wall where shown on the plans or as directed by the Engineer, and in accordance with these specifications.

Construction Methods: Structure mounted noise wall shall be removed in its entirety, due precaution being taken to avoid injury to new construction, public utility installations or abutting property. The material removed shall be disposed of offsite in accordance with all applicable local, state and federal regulations.

Method of Measurement: This work will be measured for payment by the number of linear feet of structure mounted noise wall removed and disposed of, measured horizontally between the extreme limits of the structure mounted noise barrier wall.

Basis of Payment: Payment for removing and disposing of structure mounted noise barrier wall will be made at the contract unit price per linear foot for "Remove Noise Barrier Wall (Structure)", which price shall include all equipment, tools and labor incidental thereto.

Pay Item	Pay Unit
Remove Noise Barrier Wall (Structure)	LF

ITEM #0917010A - REPAIR GUIDERAIL

Description: Work under this item shall consist of the repair of newly installed guiderail. It shall be repaired in the locations originally installed and fabricated in conformity with the lines, designations, dimensions, and details shown on the plans or as ordered by the Engineer.

Materials: The material for guiderail shall meet the requirements as specified within the original applicable contract items.

When repairing guiderail, the Contractor shall reuse any undamaged existing guiderail elements, timber rail, wire rope, appropriate posts, delineators, lap bolts, and other hardware within the project limits as approved by the Engineer to repair the guiderail. The Contractor shall use new materials when any components of the existing railing are damaged or missing and cannot be obtained from other guiderail systems being removed or converted within the Project limits.

Construction Methods: The repair of guiderail shall be in accordance with contraction methods as specified within the original applicable contract items.

Guiderail, including end anchors, which has been installed in final condition and accepted by the Engineer, shall be eligible for reimbursement for repairs subject to the conditions described below. If multiple runs are to be installed in a single stage as indicated in the contract documents, determination for reimbursement shall be made when all runs within the stage are complete and accepted as previously described. On projects without designated stages, guiderail installations must be complete and serving the intended function as determined by the Engineer.

When newly installed guiderail is damaged by public traffic, the following conditions must be satisfied prior to reimbursement for payment;

1. The damage must have been caused solely by the traveling public.

2. The contractor shall provide satisfactory evidence that such damage was caused by public traffic. Such as accident reports obtained from the Connecticut Department of Public Safety, police agencies or insurance companies; statements by reliable, unbiased eyewitnesses; or identification of the vehicle involved in the accident.

3. The contractor shall attempt to collect the costs from the person or persons responsible for the damage and provide documentation of those efforts to the satisfaction of the Engineer.

4. If such evidence cannot be obtained, the Engineer may determine that the damage was not caused by the Contractor and reimbursement for payment is warranted.

This repair provision does not relieve the Contractor of the requirements of Section 1.07, any other contractual requirements for maintenance and protection of traffic and final acceptance and relief of responsibility for the project.

The contractor shall remain responsible for the safety and integrity of the guiderail system for the duration of the project. In the event the guiderail is damaged, the Contractor shall provide sufficient cones, drums and other traffic control devices to provide safe passage by the public. When ordered by the Engineer, the Contractor shall furnish replacement parts and immediately repair the guiderail, but in no case more than 24 hours after notification from the Engineer. In non-emergency situations, the guiderail shall be repaired within 72 hours. The repaired guiderail or anchorages, when completed, shall conform to these specifications for a new system. The Contractor shall be responsible for the removal and the proper disposal of all damaged material and debris.

Method of Measurement: Guiderail damaged solely by the traveling public will be measured for payment. Damage caused by the Contractor's equipment or operations will not be measured for payment.

The sum of money shown on the estimate and in the itemized proposal as "Estimated Cost" for repair of guiderail will be considered the price bid even though payment will be made only for actual work performed. The estimated cost figure is not to be altered in any manner by the bidder. Should the bidder alter the amount shown, the altered figures will be disregarded and the original price will be used to determine the total amount bid for the contract.

Basis of Payment: Repair of guiderail will be paid for in accordance with Article 1.09.04 as required to restore the rail to its full working condition in conformance with these specifications for a new system. There will be no payment for maintenance and protection of traffic for work associated with this item unless, in the opinion of the Engineer, the sole purpose of the maintenance and protection of traffic is for repair of the guiderail.

Pay Item	Pay Unit
Repair Guiderail	est. (est.)

ITEM #0921160A - SIDEWALK SHED

Description:

Work under this item shall consist of furnishing, erecting, maintaining and removing structures over public sidewalks to protect pedestrians from falling objects from construction activities where shown on the plans or as directed by the Engineer.

Materials:

All materials used for the sidewalk sheds shall be suitable for the intended purpose and shall meet the minimum material requirements identified in the Contractor's Working Drawing submission and shall also meet the requirements of sections M.03, M.06, M.11 and M.15 as applicable. All material proposed for use shall be subject to inspection by the Engineer. Material deemed to be damaged or otherwise unsuitable for use shall be removed from the site by the Contractor.

Construction Methods:

The Contractor shall prepare a Working Drawing submission for the sidewalk sheds in accordance with Section 1.05.02. The submission shall include the details of the sheds, lighting, anchorage, material requirements, and construction and maintenance requirements. The working drawings shall be signed and sealed by an Engineer registered in the State of Connecticut and shall include the supporting design calculations.

Sidewalk sheds shall be erected in accordance with the manufacturer's recommendations for prefabricated pedestrian shelters or in accordance with any special construction requirements specified in the working drawing submission for Contractor designed systems.

Shed construction shall be performed in a workmanlike manner with care taken to provide a secure structure that satisfies the need to provide a roofed enclosure without introducing hazards including sharp edges, projections or other potential safety hazards. Sheds shall be in place prior to any construction or demolition on overpass structures and shall typically extend 10' beyond the limits of the overpass structure. Sheds shall be removed within one week of the completion of all construction or demolition activity on the overpass structure.

Sheds shall provide an unobstructed passageway with a minimum clear width of 5' and a clear height of 8' for pedestrian access and shall be lighted at all times by either natural or artificial light. The level of illumination shall have an intensity of not less than five foot-candles measured at the walkway level to ensure the safe movement of persons. Lighting shall be vandal proof fixtures mounted a minimum of 8' above the sidewalk level. Sheds shall have a solid roof deck designed for a minimum construction load of 150 psf. Edges of roof deck shall be detailed with debris guards that prevent miscellaneous construction debris from falling onto areas accessible to pedestrians. Sheds shall be designed with open sides facing the adjacent roadway. The side walls on the far side from the roadway may be designed as open or solid faced.

The Contractor shall not store materials on the shed or use the shed to support other construction activities unless the shed was specifically designed and detailed for such use.

The Contractor shall be responsible for the maintenance of sidewalk sheds including the lighting. Snow or construction debris accumulations on the roof of sheds shall be removed as a regular maintenance activity and the Contractor's design of the shed shall account for the loads associated with snow, construction debris and the removal of same.

The Contractor shall remove portions of the shed when construction access or a work area is required to perform adjacent construction on bridge substructures. Such removal and the subsequent reinstallation shall only take place when the section of sidewalk is closed to pedestrian traffic and an alternate pathway is open for pedestrians in accordance with the Item "Maintenance and Protection of Traffic".

Method of Measurement:

This work will be measured for payment by the actual number of linear feet of sidewalk sheds installed as shown on the plans or as ordered by the Engineer, measured along the centerline of the shed.

Basis of Payment:

This work will be paid for at the contract unit price per linear feet for "Sidewalk Shed" complete in place, which price shall include all materials, equipment, tools and labor incidental thereto, including the preparation of working drawings, the furnishing of lighting including the power source, maintenance of the sheds including lighting and removal of the sheds at the completion of the construction activity requiring the shed. Partial removal of sheds and reinstallation required for Contractor construction access or a work area is included in the unit price for this item with no additional payment for this work.

Temporary barrier required to protect shed structures from vehicles shall be paid under the item "Temporary Precast Concrete Barrier Curb".

Pay Item	Pay Unit
Sidewalk Shed	LF

ITEM #0945005A - WILDFLOWER ESTABLISHMENT

Description: The work included in this item shall consist of providing an accepted uniform stand of established wildflowers by furnishing and placing seed and mulch on all areas to be treated as shown on the plans, permits or as directed by the Engineer.

The work will also include the installation of bio-degradable erosion control matting, as shown on plans, permits or as directed by the Engineer, consisting of mulch and netting woven together as a unit.

Materials: All wildflower seed mixture sources shall be locally obtained within the Northeast USA including New England, New York, Pennsylvania, New Jersey, Delaware, or Maryland in order to preserve and enhance the diversity of native wildflower species.

Mulch shall meet the requirements of Article M.13.05.

Bio-degradable erosion control matting, if required, shall be from the Department's Qualified Products List and shall meet the requirements of Article M.13.09.

All seed mixture sources, mulch and erosion control matting shall be approved by Engineer prior to application.

Three approved seed mixtures are detailed below.

1. **New England Wildflower Seed Mix: (NEWP) New England WetMix**, New England Wetland Plants, Inc. 800 Main Street Amherst, MA 01002, or equal. Rate shall be 1 pound PLS per 1900 sq.ft.

2. **XERCES Northeastern Pollinator Mix:** Ernst Conservation Seeds Inc. 8884 Mercer Pike, Meadville, PA, 16335, or equal. Rate shall be 8 pound PLS per 1 acre.

3. **Wildflower & Grass Mix**, Vermont Wetland Plant Supply, LLC, P.O. Box 153, Orwell, VT, 05760, or equal. Rate shall be 1 pound PLS per 1600 sq.ft.

All seed mixtures must be approved by the Environmental Scientist from the Office of Environmental Planning in advance of purchase. The materials certification for any proposed mixture shall be submitted a minimum of thirty (30) days prior to delivery on site by the Contractor. All seed material certifications must have seed mixtures that shall not include any invasive species pursuant to Connecticut General Statute Sec. 22a-381d or any State Threatened or State Endangered species known pursuant to Connecticut General Statute Sec. 26-303 which would be a violation of the Connecticut Endangered Species Act. The seed tags from the bags are to be removed by the Engineer upon delivery and attached to the Material Certification. A copy of the seed tag is to be provided to the Environmental Scientist. No seeding shall occur if the requirements are not met.

All approved seed mixtures shall be obtained in sufficient quantities to meet the pure live seed (PLS) application rates as determined by the seed analysis of the mixture.

Construction Methods: Construction methods shall be those established as agronomically acceptable and feasible and approved by the Engineer.

Preparation of Seedbed Areas:

a. Level areas, median areas, interchanges and lawns: These areas shall be made friable and receptive for seeding by discing or by other approved methods to the satisfaction of the Engineer. The final prepared surface which has been seeded shall meet the lines and grades for such surface areas as shown on the plans, or as directed by the Engineer.
b. Slope and embankment areas: These areas shall be made friable and receptive to seeding by approved methods which will not disrupt the line and grade of the slope surface. In no event, will seeding be permitted on hard or crusted soil surface.

All areas to be seeded shall be reasonably free from weeds taller than 3 inches. Removal of weed growth for the slope areas shall be those methods which do not rut or scar the slope surface or cause excessive disruption of the slope line or grade as approved by the Engineer. Seeding on level areas shall not be permitted until substantial weed growth is removed and approved by the Engineer.

Seeding Season: The calendar dates for seeding shall be:

Spring – March 1 to June 15
Fall – September 15 to November 15

Seeding Methods: The wildflower seed mixture shall be applied by an agronomically acceptable procedure approved by Environmental Scientist. The rate of application shall be as shown on the plans or directed by the Engineer.

(Germination Percentage X Purity Percentage)/ 100 = Percentage PLS

The Engineer shall verify that the seed is applied at a rate which will allow for 100 percent PLS.

Method of Measurement: The work will be measured for payment by the number of pounds of each size and kind of wildflower seed counted, planted and accepted.

Basis of Payment: This work will be paid at the contract unit price per pound for "Wildflower Establishment," which price shall include all materials, maintenance, equipment tools, labor, transportation, operations, and all work incidental thereto. Partial payment of up to 50% may be

made for work completed, but not accepted. Full payment shall not be made until the area has been accepted by the Engineer.

Pay Item	**Pay Unit**
Wildflower Establishment	lb.

ITEM #0950040A - CONSERVATION SEEDING FOR SLOPES

Description: The work included in this item shall consist of providing an accepted stand of established meadow grasses by furnishing and placing seed as shown on the plans or as directed by the Engineer.

Materials: The materials for this work shall conform to the requirements of Section 9.50 of Standard Specification Form 817. The following mix shall be used for this item:

Conservation Seed Mix:
In order to preserve and enhance the diversity, the source for seed mixtures shall be locally obtained within the Northeast USA including New England, New York, Pennsylvania, New Jersey, Delaware, or Maryland. One approved seed mixture is detailed. Other proposed mixtures must be approved by the ConnDOT Landscape Design Unit.

Percentage	Common Name	Scientific Name
25	Creeping Red Fescue	Festuca rubra
10	Little Bluestem	Schizachyrium scoparium
10	Black Eyed Susan	Rudbeckia hirta
10	Kentucky Blue Grass	Poa pratensis
5	Arrowwood Viburnum	Viburnum dentatum
5	Flowering Dogwood	Cornus florida
5	Gray Dogwood	Cornus racemosa
5	Meadow Goldenrod	Solidago canadensis
5	Indian Grass	Sorghastrum nutans
5	Purple Coneflower	Echinacea purpurea
5	Butterfly Weed	Asclepias tuberosa
5	New England Aster	Aster novae-angliae
5	Common Milkweed	Asclepias syriaca

Construction Methods: Construction Methods shall be those established as agronomically acceptable and feasible and that are approved by the Engineer. Preparation of a clean weed free seed bed shall be provided. Rate of application shall be field determined in Pure Live Seed (PLS) based on the minimum purity and minimum germination of the seed obtained. Calculate the PLS for each seed species in the mix. Adjust the seeding rate for the above composite mix, based on 35 lbs. per acre (hectare). The mix may be applied by hydroseeding, by mechanical spreader, or on small sites by hand. Lightly rake, or roll to ensure proper seed to soil contact. Seeding dates are from March 15th – June 1st. The contractor may be directed by the Engineer to soak, scarify or perform other seed germination enhancement treatments. Fertilization is not recommended, unless topsoil testing indicates. An application of Plateau (imazapic) at a rate of .1 lb. per acre may be required right after seeding, or as directed by the Engineer. The seed shall be mulched in accordance with Article 9.50.03.

Method of Measurement: This work will be measured for payment by the number of Square Yards of surface area of accepted established grasses as specified or by the number of Square Yards of surface area of seeding actually covered and as specified.

Basis of Payment: This work will be paid for at the contract unit price per Square Yard for "Conservation Seeding for Slopes," which price shall include all materials maintenance, equipment, tools, labor, and work incidental thereto. Partial payment of up to 60% may be made for work completed, but not accepted.

Pay Item	Pay Unit
Conservation Seeding for Slopes	Square Yard

ITEM #0950043A - WETLAND GRASS ESTABLISHMENT

Description: The work included in this item shall consist of providing an accepted stand of established wetland grasses by furnishing and placing seed as shown on the plans, permits, or as directed by the Engineer within the Wetland Mitigation Area(s) or other areas when required.

Materials: All wetland grass mixture sources shall be locally obtained within the Northeast USA including New England, New York, Pennsylvania, New Jersey, Delaware, or Maryland in order to preserve and enhance the diversity of native wetland grass species.

The placement of fertilizer, mulch or bio-degradable erosion control matting will not be allowed within any wetland area.

All wetland seed mixture sources shall be approved by the Engineer prior to purchase.

Three (3) qualified wetland seed mixtures are as follows:

1. **New England Wet Mix (Wetland Seed Mix)**, New England Wetland Plants, Inc. 820 West Street Amherst, MA 01002, or equal. Rate shall be 1 pound PLS per 2,500 sq. ft.

2. **OBL Wetland Mix,** Ernst Conservation Seeds, Inc. 8884 Mercer Pike, Meadville, PA 16335, or equal. Rate shall be 1 pound PLS per 2,000 sq. ft.

3. **Vermont Wetland Shrub**, Vermont Wetland Plant Supply, LLC, P.O. Box 153, Orwell, VT 05760, or equal. Rate shall be 1 pound PLS per 2,420 sq. ft.

All seed mixtures must be reviewed and approved by the Engineer prior to application. All seed Materials Certificates must have seed mixtures that shall not include any invasive species pursuant to Connecticut General Statute Sec. 22a-381d, or any State Threatened or State Endangered species known pursuant to Connecticut General Statute Sec. 26-303 which would be a violation of the Connecticut Endangered Species Act. The seed tags from the bags are to be removed by the Engineer upon delivery and attached to the Materials Certificate. No seeding shall occur if the requirements are not met.

All approved seed mixtures shall be obtained in sufficient quantities to meet the pure live seed (PLS) application rates as determined by the seed analysis of the mixture.

Construction Methods: Construction methods shall be those established as agronomically acceptable and feasible and approved by the Engineer.

Wetland grass establishment seeding for Wetland Mitigation Site(s): Seeding shall occur during the fall season immediately following construction of the wetland site(s). Fall seeding must occur from August 15th to October 31th.

Wetland grass establishment seeding for areas other than the Wetland Mitigation Site(s), when required: Seeding dates shall adhere to Form 817 Section 9.50 – Turf Establishment.

Seeding shall be applied to wetland areas that will not be routinely inundated. If seed is purchased in bulk rather than by PLS, the rate of application must be adjusted to meet the required PLS seeding rate. This seeding rate shall be increased by the appropriate percentage based on the information provided on the seed tags at delivery, as determined by the following formula:

(Germination Percentage X Purity Percentage)/100 = Percentage PLS

The Engineer shall verify that the seed is applied at a rate that will allow for 100% PLS.

Method of Measurement: This work will be measured for payment by the number of square feet of surface area of established wetland seed mixture, planted, and accepted as specified or by the number of square feet of surface area of seeding actually covered as specified.

Basis of Payment: This work shall be paid at the Contract unit price per square foot for "Wetland Grass Establishment," which price shall include all materials maintenance, equipment, tools, labor, transportation, operations and all work incidental thereto. Partial payment of up to 50% may be made for work completed, but not accepted. Full payment shall not be made until the area has been accepted by the Engineer.

Pay Item	Pay Unit
Wetland Grass Establishment	s.f.

ITEM #0950044A - FLOODPLAIN ESTABLISHMENT SEED MIX

Description: The work included in this item shall consist of furnishing and placing a seed mixture to establish vegetation within the designated floodplain area(s), floodway area(s), wetland mitigation/enhancement Site(s), or other areas as shown on the plans, permits, or as directed by the Engineer.

Materials: All floodplain seed mixture sources shall be local to the northeast (New England, New York, Pennsylvania, New Jersey, Delaware, or Maryland).

Three qualified floodplain seed mixtures are detailed below. An equal seed mixture may be submitted to the Engineer for approval.

1. **New England Logging Road Mix,** New England Wetland Plants, Inc. 800 Main Street, Amherst, MA 01002. Rate shall be 1 pound PLS per 2,200 square feet.

2. **Floodplain Mix - ERNMX-154,** Ernst Conservation Seeds Inc. 8884 Mercer Pike, Meadville, PA, 16335. Rate shall be 1 pound PLS per 2,200 square feet.

3. **Flood Plain Wildlife Mix: #154,** Newsom Seed Warehouse. 11788 Scaggsville Road, Fulton, MD 20759. Rate shall be 1/2 pound PLS per 1,000 square feet.

The placement of fertilizer, mulch or erosion control matting will not be allowed within any floodplain area, floodway area or wetland mitigation/enhancement Site(s).

All floodplain seed mixture sources shall be approved by the Engineer prior to application.

The Materials Certificate for all seed mixtures shall state that the seed mixture does not include any invasive species pursuant to CGS Sec. 22a-381d or any State Threatened species, State Endangered species or State species of special concern pursuant to CGS Sec. 26-303 to Sec. 26-313. The seed tags from the bags are to be removed by the Engineer upon delivery and attached to the Materials Certificate. Seeding shall not occur if these requirements are not met.

All approved seed mixtures shall be obtained in sufficient quantities to meet the pure live seed (PLS) application rates as determined by the seed analysis of the mixture.

Construction Methods: Construction methods shall be those established as agronomically acceptable and feasible, and as approved by the Engineer.

Seeding for the establishment of a floodplain area associated with a wetland mitigation/enhancement Site(s) must occur between August 15th to October 31st.

For floodplain areas not associated with a wetland/enhancement Site(s), seeding shall occur during the dates specified in Article 9.50.03-2.

If seed is purchased in bulk rather than by PLS, the rate of application must be adjusted to meet the required PLS seeding rate. This seeding rate shall be increased by the appropriate percentage as determined by the following formula based from the information on the seed tags at delivery:

(Germination Percentage X Purity Percentage)/ 100 = PLS

The Engineer will verify that the seed is applied at a rate that will allow for 100 percent PLS.

Mowing will not be allowed within areas that are seeded with the floodplain establishment seed mix.

Method of Measurement: The work will be measured for payment by the number of square yards of surface area of accepted established floodplain grasses as specified or by the number of square yards surface area of seeding actually covered as specified.

Basis of Payment: This work will be paid for at the Contract unit price per square yard for "Floodplain Establishment Seed Mix," which price shall include all materials maintenance, equipment, tools, labor, and all work incidental thereto. Partial payment of up to 50% may be made for work completed, but not accepted. Full payment shall not be made until the area has been accepted by the Engineer.

Pay Item	Pay Unit
Floodplain Establishment Seed Mix	s.y.

ITEM #0952001A - SELECTIVE CLEARING AND THINNING

Description: This work shall conform to Section 9.52, supplemental as follows:

Construction Methods – Description is amended as follows:

Add the following:

Where the Contractor is directed by the Engineer or shown on the plans, materials to be cut, trimmed or removed shall be as follows:

Those items that restrict access to the CCTV or VMS installation location and would severely limit Contractor equipment maneuverability.

Those items that obstruct the sight lines of the CCTV or VMS locations. The Contractor shall refer to the plans for location of the sight line clearing for each site.

Those items that are necessary to be removed in order to install the controller foundation, pole foundation, sign support foundation and conduits to have a complete installation.

All trees scheduled to be removed shall be visibly marked or flagged by the Contractor at least five (5) business days prior to removal of such trees.

The Engineer will inspect the identified trees with the Contractor and the limits of the clearing and thinning prior to the Contractor proceeding with cutting operations.

ITEM #0952051A - CONTROL AND REMOVAL OF INVASIVE VEGETATION

Description: This work shall include the development and implementation of an Invasive Vegetation Removal Plan (IVRP) to outline the materials, labor, and equipment the Contractor plans to use for the complete eradication and treatment of the invasive vegetation. The work shall also include the identification, excavation, removal, and off-Site disposal of unwanted vegetation as indicated on the plan sheets, permits or as directed by the Engineer.

All invasive vegetation listed on the following websites will be subject to eradication:

- Connecticut Invasive Plant Working Group (CIPWG) Invasive Plants Council (http://cipwg.uconn.edu/invasive_plant_list/)
- US Army Corps of Engineers (ACOE) New England District Compensatory Mitigation Guidance Appendix K (http://www.nae.usace.army.mil/portals/74/docs/regulatory/Mitigation/2016_New_England_Compensatory_Mitigation_Guidance.pdf)

All vegetation designated for removal shall be eradicated in its entirety in accordance with the IVRP submitted by the Contractor and approved by the Engineer. Certain situations may require the full and complete mechanical excavation of invasive vegetation including its entire root system. The use of herbicides will not be permitted between the dates of October 1 and May 31.

Materials: All herbicides shall be registered for the species being treated and shall be formulated as applicable for target-species foliar treatment, cut surface, or injection applications. Where work in or immediately adjacent to wetlands is necessary, the product label(s) for any chemical/adjuvant formulation applied must indicate that the formulation is approved for aquatic environments.

Construction Methods:

1. IVRP: Prior to any ground disturbance within the Project limits, the Contractor shall submit an IVRP to the Engineer for review and approval. Within 30 days of receipt of the submittal, the Engineer will notify the Contractor whether the IVRP is approved, rejected or requires modifications by the Contractor. If any part of the plan is not approved, the Contractor shall promptly make any necessary changes and re-submit the entire plan for approval. The entire plan must be approved in writing prior to beginning any work on Site. In all cases, mechanical means shall be considered before the use of herbicides. If mechanical means is neither feasible nor recommended, an explanation must be provided in the IVRP. All removal methods shall prevent the spread of seeds – no mowing or "Brush Hog" equipment will be allowed. The approved methods must be capable of total removal and eradication of all identified invasive species in the designated areas throughout the Contract and the 1-Year Plant Establishment Period.

The IVRP shall include a schedule and outline with the following information:

1) The Contractor's methods of determining invasive vegetation surveyed limits, including:
    a. Stake out the limits prior to the initial treatment
    b. Maintain a record of the staked limits throughout the life of the Contract

2) Identification of the type(s) of invasive species present within the field surveyed limits
3) A marked up plan sheet outlining the invasive species limits and identifying the types of invasive species present within those limits and total square yards of proposed removal
4) For each species present on-Site, the following shall be described:
    a. Methods to eradicate specific invasive plant species for the life of the Contract (e.g. mechanical, herbicide, etc.) shall include any initial, intermediate and 1-Year Plant Establishment Period Treatment eradication methods for each plant species
    b. Types and concentrations of any herbicides to be used, including any adjuvants, SDS sheets, types of tools or machinery to be used
    c. Schedules showing dates and eradication methods for the initial, intermediate, and 1-Year Plant Establishment Period Treatments. This schedule must take into consideration stage construction, the time period required between herbicide application, and the physical removal of the target species wherever such methodology is employed
5) All invasive species are considered controlled materials and are to be taken off-Site to an approved disposal facility. For disposal methods:
    a. Provide address of location, current permits / letters from the town authorizing such activity and a Site map (complete with regulated areas)
    b. Wood chips from invasive species are not allowed to be stockpiled or reused on-Site
    c. Wood chipping on-Site will be allowed if temporarily stored in a properly contained enclosure and removed at the end of the treatment cycle
    d. Invasive plants shall not be buried on-Site
6) Proof of CT DEEP licensure for herbicide application
7) A description of safety equipment required
8) Procedures for handling chemical spills

Where certain species of invasive vegetation are present and identified on the plan sheets, permits, or as identified in the field by the Engineer, the removal via bulk mechanical excavation of such vegetation and the underlying soils may be required as directed. The approved method must be capable of the removal of all soil to a depth where invasive plant material and root system is no longer evident, or as directed by the Engineer.

Whether the Contractor's method of removal is by mechanical excavation or cutting and spraying of herbicides, invasive species must be removed separately from clearing and grubbing operations and disposed at an approved location as described in the Contractor's IVRP.

No equipment or vehicles other than that required to complete the work will be permitted in the areas designated for invasive vegetation removal. Any equipment used to process invasive vegetation, such as chippers and transport vehicles, must be cleaned prior to further use.

Any invasive species control and removal work performed throughout the duration of the Contract that causes damage or soil disturbance shall be repaired at the Contractor's expense within 7 days. It is the Contractor's responsibility to identify additional areas of concern for invasive vegetation within the limits of the Project, notify the Engineer, and to amend the IVRP.

The Contractor shall be responsible to identify invasive vegetation at all times of the year and to prepare a plan for its eradication without assistance.

All treatments, with the exception of an initial mechanical excavation of invasive species, will not be allowed outside of the optimal growing season between the dates of October 1 and May 31.

Herbicide applications will not be permitted during any rain event or during windy conditions. Broadcast or uncontrolled spray application will not be permitted and care must be taken to avoid contacting non-target native species. If any non-target native species to remain within the Project limits are inadvertently treated with herbicide and perish, the Contractor will be responsible to replace in-kind species at no cost to the State.

Remove all twining vines in treetops to the greatest extent possible without damaging the branches of the supporting desired vegetation. Cut and remove vines overtopping tree canopies to the extent practical. Climbing spikes will not be permitted for aerial work.

The Contractor shall also:

1) Maintain the labels for herbicides being used in his/her possession
2) Conduct all herbicide formulations and applications, including the addition of appropriate surfactants and other adjuvants, in strict conformance with the manufacturer's recommendation and per requirements of regulatory agencies
3) Maintain a written record of herbicide application, including the formulation, concentration, area treated, and date for each application. The records are to be provided by the commercial applicator and submitted to the Engineer following each treatment

Flush cut brush and trees shall not be more than 2 inches above the ground line. Prune out any branches on non-treatment plants that are damaged during removal of vegetation. All corrective pruning shall conform to the National Arborists Association Pruning Standards.

Wherever removal operations result in exposed soils, disturbed areas shall be vegetatively stabilized with the appropriate seed mix and protected with hay, cellulous fiber mulch, or erosion control matting.

Once the IVRP is approved, a field review shall be scheduled for the Contractor and Engineer to review the limits of invasive species removal (surveyed and flagged by the Contactor prior to the meeting), the specific species required to be removed, and the Contractor’s submitted invasive species removal plan. At this time, the Engineer may identify additional invasive species or designate additional areas for removal that are not included with the Contractor’s submitted IVRP.

If changes are required to the approved IVRP during the life of the Contract, these changes shall be documented by the Contractor and resubmitted to the Engineer for review and approval a minimum of 10 days prior to beginning of the additional work associated with the change. The Contractor shall provide a 10 day work notice to the Engineer prior to proceeding with each treatment.

2. Treatments: The treatment schedule below may be modified based on field conditions at the discretion of the Engineer. The Contractor shall provide a 10 day work notice to the Engineer prior to proceeding with each treatment. In all cases, each treatment must be reviewed once the work is performed, and accepted before payment is made for that treatment stage.

Initial Treatment: Shall commence at the beginning of the Contract time, prior to clearing and grubbing activities. Any invasive species found within a proposed cut slope shall be fully eradicated to the satisfaction of the Engineer prior to any earth work operations. After the completion of the initial treatment, the work must be reviewed and accepted by the Engineer prior to any earth excavation in that area. If herbicide is the initial treatment method, a minimum of 14 days is required prior to clearing and grubbing operations, so the herbicide application can take effect.

Intermediate Treatment(s): Shall be conducted during the optimal growing season between the dates of June 1 and September 30 for invasive species up to and including 10 days prior to plant installation or at the end of the Project if no landscaping plan is in the Contract. Optimal treatment times may be specific to the species being treated and this must be considered and documented when developing the Invasive Vegetation Removal Plan. Several treatments may be required to treat all species that are present.

1-Year Plant Establishment Period Treatment: Treatments as needed or as directed by the Engineer shall be conducted throughout the 1-Year Plant Establishment Period or when required under another Contract item.

Method of Measurement: This work will be measured for payment by the number of square yards of invasive vegetation identified, surveyed, treated and eradicated as required including any required re-treatment of any regrowth or new growth. No additional payment will be made for subsequent treatments. The area for removal will be surveyed and flagged prior to treatment and measured. After a review of the surveyed limits, the Engineer may designate additional areas for removal that are not shown on the plans. These additional areas will be measured for payment and included as part of the Contract work.

Where selective removal is required, the square yards of the drip line of the invasive vegetation will be measured for payment.

Basis of Payment: This work will be paid for at the Contract unit price per square yard for "Control and Removal of Invasive Vegetation." This payment shall include all labor, surveys, materials, tools, and equipment necessary for limits of the invasive area(s); maintenance of the limits throughout the Project; species identification; and cutting, excavation, treating, re-treating, removal, and off-Site disposal of designated invasive plant material. Off-Site disposal of residue shall include the loading, transport, dumping, and fees associated with legal off-site disposal.

- Upon approval of the required IVRP, the Contractor will receive a payment equal to 10% of the estimated Contract value

- Upon initial herbicide or mechanical removal treatment methods as it is described in the IVRP, the Contractor will receive a payment equal to 20% of all areas receiving treatment
- Upon successful completion of the initial treatment period, as determined during the review by the Engineer, the Contractor will receive a payment equal to 20%
- Upon successful completion of the intermediate treatment period as determined during the Site review by the Engineer, the Contractor will receive a payment equal to 20%
- Upon successful completion of the 1-Year Plant Establishment Period covering all treated areas on the Project (or the last treatment for those Projects which may not include a 1-Year Plant Establishment Period), the Contractor will receive final payment equal to the measured areas in place and treated, less any previous payments

Where bulk excavation is required for removal, this work shall be covered under the Contract Item "Earth Excavation" for all excavation in excess of 2 feet. All other vegetation not designated as invasive vegetation shall be removed in compliance with the Item "Clearing and Grubbing" in accordance with Section 2.01.

Vegetative stabilization of disturbed areas will be paid for under the respective Contract Items: "Turf Establishment," "Wetland Grass Establishment," or "Conservation Seeding for Slopes."

Pay Item	Pay Unit
Control and Removal of Invasive Vegetation	s.y.

ITEM #0969030A - PROJECT COORDINATOR (MINIMUM BID)

Article 1.05.08 – Schedules and Reports of the Standard Specifications is hereby amended by the following:

Add the following:

Description: Under this item the Contractor shall furnish the services of an administrative employee, entitled the Project Coordinator, for this Project, to coordinate and expedite all phases of the work required for the Project and to ensure that the construction schedule is maintained.

The minimum lump sum bid for this item shall be equal to 0.5% of the Contractor's total bid. Failure of the Contractor to bid at least the minimum amount will result in the Department adjusting the Contractor's bid to include the minimum bid amount for this item.

The Project Coordinator's resume shall be submitted for approval by name, in writing, within seven (7) calendar days of the award of the Contract, and shall not be changed without prior written notice to the Department.

This resume must demonstrate the Project Coordinator is experienced and versatile in the preparation, interpretation and modification of Critical Path Method (CPM) construction schedules. This must include successful completion of at least three (3) construction projects of similar complexity, where they served in a lead scheduling capacity. If the Contractor does not have a person in their company that has these skills, then the Contractor shall engage the services of a Consultant, subject to the approval of the Engineer, for the scheduling work required. If a Consultant is engaged, they shall be present at the first meeting, along with the Project Contractor, prepared to discuss, in detail, the methods and techniques they propose to use. Thereafter, the Project Coordinator or the Consultant responsible for updating the CPM Schedule shall attend all meetings between the Contractor, its Subcontractors, and any other meetings, which will affect the CPM schedule. The Contractor shall prepare CPM Schedules utilizing the latest version of Primavera Project Planner software.

When the Contract is administered under Section 1.20, the following requirement shall also apply:

The Project Coordinator shall have, in addition to the above noted requirements, a minimum of eight (8) years' experience related to commercial/industrial building construction as a Project Coordinator performing duties similar to those required herein. The Project Coordinator shall have knowledge of all trades involved in the construction, including civil/site work, environmental work, concrete work, masonry work, steel work, wood work, electrical work, and mechanical work. Other combinations of experience and education totaling ten (10) years in commercial building construction will be considered subject to the approval of the Engineer.

Computer Software and Printer: The Contractor shall provide the following equipment with all the required maintenance and repairs (to include labor and parts) throughout the Contract life. The Engineer reserves the right to expand or relax the specification to adapt to the software and hardware limitations and availability.

The Contractor shall provide the Engineer with a licensed copy registered in the Department's name of the latest versions of the software listed and maintain customer support services offered by the software producer for the duration of the project. The Contractor shall deliver to the Engineer all supporting documentation for the software and hardware including any instructions or manuals.

Software – Minimum Specification: The Contractor shall provide the Engineer with a licensed copy of the latest version of the Oracle Primavera Contractor – Deluxe Version scheduling software, registered in the Department's name, and maintain the Primavera customer support service contract over the duration of the project.

Printer: An addition printer shall be provided that meets the printer specifications noted under contract item for "Construction Field Office" and is compatible with the software.

The Contractor is responsible for service and repairs to all computer hardware. All repairs must be performed within 24 hours. If the repairs require more than a 24 hours then a replacement must be provided.

Construction Methods: The Project Coordinator shall attend all meetings between the Contractor and the Department, the Contractor and its Subcontractors, and any other meetings that affect the progress of the job. The Project Coordinator shall be knowledgeable of the status of all parts of the work throughout the length of the Contract.

Please delete any reference to Bar Chart under 1.05.08 – Schedule and Reports and replace with the following:

Critical Path Method (CPM)

Please add the following:

Proper relationship between all major activities shall be indicated. Node numbers shall be coded such that the major activities shown on the Critical Path Schedule shall be easily referenced to the Detailed Project Schedule when it is developed. Break down the work covered under each Special Provision, or Division and Section of Article 1.20 of the Standard Specifications, into individual activities required and logically group related activities together within the CPM.

All documents, which require approval by the Department, shall be clearly identified within the schedule. The Department and any outside agency shall be allocated a minimum number of calendar days in accordance with Article 1.20-1.05.02. If Article 1.20 does not apply, then the Department shall be allocated a minimum of thirty (30) calendar days (exclusive of weekends

and holidays) for review and approval of each submittal. Any submittals requiring approval by an outside Agency (ConnDEEP, Coast Guard, Army Corps of Engineers, etc.) shall be allocated a minimum of sixty (60) calendar days. The Department shall not be held responsible for any delay associated with the approval or rejection of any substitution or other revisions proposed by the Contractor.

The schedule shall indicate the logic of the work for the major elements and components of work under the Contract, such as the planned mobilization of plant and equipment, sequences of operations, procurement of materials and equipment, duration of activities, type of relationship, lag time (if any), and such other information as it is necessary to present a clear statement of the intended activities.

The schedules shall consist of a network technique of planning, scheduling and control, shall be a clear statement of the logical sequence of work to be done, and shall be prepared in such a manner that the Contractor's work sequence shall be optimized between early start and late start restraints. The Contractor shall use the same criteria in a consistent manner throughout the term of the project. If, at any time, the Contractor alters logic, original durations, and descriptions, adds activities or activity codes or in any way modifies the Baseline Schedule, they must notify the Engineer of the change, in writing, presenting in detail the reasons for the change. The Engineer reserves the right to approve or reject any such change.

The critical path of the project must be identified on the CPM schedule. The critical path is the longest-duration path through the network. The significance of the critical path is that the activities that lie on it cannot be delayed without delaying the project. Because of its impact on the entire project, critical path analysis is an important aspect of project planning.

The critical path can be identified by determining the following four parameters for each activity:

1. ES - Earliest Start Time: the earliest time at which the activity can start given that its precedent activities must be completed first.
2. EF - Earliest Finish Time: equal to the earliest start time for the activity plus the time required to complete the activity.
3. LF - Latest Finish Time: the latest time at which the activity can be completed without delaying the project.
4. LS - Latest Start Time: equal to the latest finish time minus the time required to complete the activity.

The *float time* for an activity is the time between its earliest and latest start time, or between its earliest and latest finish time. Float is the amount of time that an activity can be delayed past its earliest start or earliest finish without delaying the project. Delays to activities on the critical path through the project network in which no float exists, that is, where ES=LS and EF=LF will delay the project.

Float available in the schedule, at any time shall not be considered for the exclusive use of either the Department or the Contractor. During the course of Contract, any float generated due to the efficiencies of either party is not for the sole use of the party generating the float; rather it is a shared commodity to be reasonably used by either party. Project float will be a resource available to both the Department and the Contractor.

Each CPM Schedule submittal shall be in the form of an activity on node diagram (precedence diagramming method) and shall include at a minimum; an Early Start computer sort, a Total Float computer sort, an Activity Number computer sort, a Schedule Diagram in the Time Scaled Logic format and a backup data CD-ROM which includes all Primavera project files. The diagrams may be requested printed out by the Department and shall be on 22" x 34" sheets. Additional, more detailed diagrams for important aspects or phases of the work may be required on large or complex projects.

Activity I.D. numbers shall be keyed to the item numbers assigned on the detailed estimate sheet. The first three digits (four digits for highway illumination, signing, traffic signals and utility work) of the activity I.D. number shall be identical to the first three digits of the item number in the Contract. The remaining digits may be used to provide unique, orderly and sequential I.D. numbers for each activity.

Activity codes shall be added to the schedule dictionary at the direction of the Engineer. At a minimum, activity codes for responsibility (prime, subcontractor by name), location of work (bridge #, span #, sta. #, site, building, type of work, etc.) and stage or phase number should be included.

1. Recovery Schedules: If, in the opinion of the Engineer, the updated schedule indicates that the Project has fallen behind schedule, or that a revision in sequence of operations may be necessary for any other reason, absent a justifiable time extension, the Contractor shall immediately institute all necessary steps to improve the Project's progress and shall submit such revised network diagrams, tabulations and operational plans, as may be deemed necessary by the Engineer, to demonstrate the manner in which an acceptable rate of progress will be regained.

   Should the Contractor not demonstrate an ability to regain an acceptable rate of progress, the Engineer shall require the schedule to be resource loaded with the next monthly update. No additional compensation will be allowed for resource loading the schedule.

2. As-Built Schedules: Within thirty (30) days of completion of the project, including all corrective work, the Contractor shall submit an "As-Built Schedule" showing the actual progress of work. The Contractor shall submit three prints of this final CPM Schedule and one project backup data CD-ROM which include all Primavera project files for the Engineer's exclusive use.

   The following shall also apply to Contracts administered under Section 1.20:

3. Daily Construction Reports: The Project Coordinator shall assist the Engineer in the preparation of a daily construction report by ensuring that each of the Contractor's employees and subcontractors working on the Project Site on a given day signs the Engineer's sign-in sheet for that day; and by keeping and providing to the Engineer its own daily list of employees and subcontractors who worked on the Project Site on that day.

Method of Measurement: Within ten (10) calendar days of the award of the Contract, the Contractor shall submit to the Engineer for approval a breakdown of its lump sum bid price for this item detailing:

1. The development cost to prepare the Baseline Schedule in accordance with these specifications. Development costs shall not exceed 25% of the total cost of the item and shall include costs to furnish and install all specified hardware.

2. The cost to provide the services of the Project Coordinator, including costs to prepare and submit the Monthly Updates and Narrative; furnish and submit any Recovery Schedules; furnish and submit Two Week Look Ahead Schedules and maintenance of and supplies for the specified hardware noted above. A per month cost will be derived by taking this cost divided by the number of Contract months remaining from the date of acceptance of the Baseline Schedule.

3. The cost of submission and certification of the As-Built Schedule in accordance with these specifications. The submission and certification costs shall be no less than 2% of the total cost of the item.

4. Substantiation showing that the costs submitted are reasonable based on the Contractor's lump sum bid.

Upon approval of the payment schedule by the Engineer, payments for work performed will be made as follows:

1. Upon approval of the "Baseline" Schedule by the Engineer, the lump sum development cost will be certified for payment.

2. Upon receipt of each monthly narrative and update of the "Baseline" Schedule, the per month cost for the services of the Project Coordinator will be certified for payment.

3. Upon approval of the As-Built Schedule by the Engineer, the lump sum submission and certification cost will be certified for payment.

Basis of Payment: This service will be paid for at the Contract lump sum price for "Project Coordinator" complete, which price shall include the preparation and submission of all schedules, narratives, updates, reports and submittals. The lump sum price shall also include the

cost of providing a complete, licensed copy of the Primavera software which will remain the property of the Engineer, and all materials, equipment, labor and work incidental of this service.

The lump sum price will be certified for payment as described in "Method of Measurement" subject to the following conditions:

1. Any month where the monthly update of the "Baseline" CPM schedule is submitted late, without authorization from the Engineer, will result in the following actions:
    a. The monthly payment for the Project Coordinator item will be deferred to the next monthly payment estimate. If any monthly submittal is more than thirty (30) calendar days late, there will be no monthly payment for the services of the Project Coordinator.

    b. The greater of 5% of the monthly payment estimate or $25,000 will be retained from the monthly payment estimate until such time as the Contractor submits all required reports.

    c. If in the opinion of the Engineer, the Contractor is not in compliance with this specification, the Engineer may withhold all Contract payments.

2. In the event the Contract time extends beyond the original completion date by more than thirty (30) calendar days, and a time extension is granted to the Contractor, the Department may require additional CPM updates which will be paid for at the per month cost for the services of the Project Coordinator.

3. If the Contractor is not in compliance with this specification or has failed to submit a "Baseline" schedule, monthly update, or a Recovery Schedule for any portion of the work, the Engineer will withhold all Contract payments until the schedule is submitted to, and approved by, the Engineer.

Pay Item	Pay Unit
Project Coordinator	L.S.

ITEM #0969053A - CONTRACTOR QUALITY CONTROL PROGRAM LEVEL 2

Description: The Contractor shall establish, maintain, and implement a written Project-specific Quality Control (QC) Program tailored to the complexity and scope of the work. This Program shall detail the programmatic documentation of the Contractor's processes for delivering the level of construction quality required by the Contract.

The written QC Program shall provide a comprehensive description of the planning, monitoring and reporting program the Contractor shall implement to ensure and document the quality of the work as it progresses.

The QC Program shall address, as a minimum, the following elements: Organization; Document Control; Design Control; Procurement Control; Control of Subcontractors, Fabricators and Suppliers; Inspection; Special Process Control; Non-Conformance Resolution; Records; and Reporting.

The QC Program shall identify and list critical and routine work categories, which shall be used to differentiate the level of reporting, inspection and attention throughout the process.

The QC Program shall include a method to identify and resolve any deviations from the Contract while maintaining the Project schedule. The QC Program shall include a method to prevent recurring deviations once identified and resolved.

The Contractor shall modify the QC Program as needed to meet the requirements of this specification. The QC Program shall be recognized as a dynamic document, subject to revisions and amendments, as required, in response to actual Site conditions, work methods, and to address deviations encountered and corrected throughout the Project.

The Contractor shall furnish the services of a dedicated (sole responsibility), full-time, on-Site Quality Control Manager (QCM) for the Project. The QCM shall report directly to upper management and shall have the authority to issue stop work orders.

When the Contractor's schedule dictates simultaneous work operations, the Contractor is responsible for supplementing the QCM with additional QC personnel (independent of trade staff) to meet the requirements of this specification.

The additional Contractor Quality Control requirements described herein shall be used in conjunction with the Department's Standard Specifications Form 817. The QC Program is neither intended to relieve the Contractor from its responsibility under the Contract, nor to replace the external inspections of the work carried out by the Engineer.

The minimum lump sum bid for this item shall be **$1,280,000**. Failure of the Contractor to bid at least the minimum amount will result in the Department adjusting the Contractor's bid to the minimum bid amount for this item.

The Contractor Quality Control Program Level 2 should cover both projects 159-191 and 63-703 but will paid for in its entirety under Project 63-703.

Construction Methods:

Submittals

(1) QCM: Within thirty (30) days of Contract award, the Contractor shall submit, in writing, the name of their proposed QCM with a resume of their qualifications, submitted in accordance

with the requirements listed below, for concurrence by the Department. The QCM shall not be changed without prior written notification to the Department.

The submittal shall outline the credentials of the proposed QCM, who shall be an individual with a bachelor's degree in Engineering and demonstrated construction experience. This shall include at least 10 years of experience in any combination of the following areas:

- Field inspection experience
- Construction experience relevant to the type of work and the scope of the Project
- Previous experience as a Quality Control professional

The submittal shall also include documented certification or training in quality control principles (NETTCP Quality Assurance Technologist or approved equal) and two (2) letters of recommendation from previous clients.

(2) QC Program: Within forty-five (45) days of Contract award, the Contractor, with direct input from the QCM, shall prepare and submit to the Department, for review and approval, a written QC Program, including the Elements listed below, and in accordance with all requirements of this specification.

Sample forms and reports intended to be used to assure compliance with this specification shall be included in the initial submittal of the QC Program. Sample forms and reports shall include, but are not limited to:

- Sample document control tracking form
- Sample design control tracking form (for Contractor design-build items)
- Sample shop drawing/working drawing review
- Sample material receiving inspection report
- Sample inspection forms for critical work categories
- Sample special process control forms
- Sample non-conformance report
- Sample daily and monthly reports

The Contractor's QCM, Project Manager and a representative of their upper management shall sign the final QC Program submission and any revisions or amendments thereto. Any revisions or amendments made to the QC Program shall be submitted in writing to the Engineer for acceptance.

Subcontractors, fabricators and suppliers involved in critical work categories, as defined in the QC Program, shall have their own work-item specific QC Plan which shall be included as an addendum to the Contractor's QC Program, and shall comply with all conditions of this item.

(3) Additional QC Personnel: When additional QC personnel are required due to simultaneous work operations, the Contractor shall provide resume(s) of qualifications of the proposed personnel at least thirty (30) day in advance of the work. These individual(s) shall have demonstrated construction experience of at least 5 years in any combination of the following areas:

- Field inspection experience
- Construction experience relevant to the type of work and the scope of the Project
- Previous experience as a Quality Control professional

(4) Reports: The Contractor shall be required to produce and submit to the Engineer daily and monthly inspection reports as described in the Reporting Element of this specification.

Elements of the Contractor Quality Control Program:

1. **Organization:** This Element shall describe the Contractor's organization, including reporting relationships within and external to the Contractor's organization. The name of the QCM shall be clearly stated and this individual shall be responsible to upper management and have the authority to stop work. An organizational chart shall be included to graphically depict the Contractor's organizational structure and major reporting lines and relationships. The organizational chart shall clearly show the hierarchy between the QCM, upper management and additional QC personnel; and a narrative shall follow which shall define the roles, duties and responsibilities of each person in the implementation of the QC Program and in the resolution of QC issues. This Element shall also include the resumes of all QC personnel.
2. **Document Control:** This Element shall describe the methods used by the Contractor and the QCM to control the use of the various design documents, shop drawings, procedures, etc. to assure that only the most current, accepted documents are used and are distributed to the individuals performing the work. The process to recall documents which have been superseded or revised shall be addressed. This Element shall identify the submittals that are required by the Contract, the system used to track these submittals and their current status.

   A submittal status update spreadsheet shall be submitted with each monthly report, in accordance with the Reporting Element.
3. **Design Control:** This Element shall describe how the Contractor and the QCM control any design process (i.e. working and shop drawings) for which it is responsible. This shall include the selection of design input data, checking for correctness, completeness, compatibility and format, and reviewing and approving design output documents prior to submission to the Department. This Element shall provide guidance as to how the QCM or other personnel shall indicate that documents have been reviewed by the Contractor prior to submission, and that Department comments have been adequately addressed prior to any required resubmissions.
4. **Procurement Control:** This Element shall describe the methods used by the Contractor and the QCM to assure that all materials and specialized equipment provided for the work are as specified. Included shall be guidelines for documenting that purchase documents have been reviewed to assure that correct details have been ordered, including specification, grade, type, color, Buy America or other aspects as required by the Contract.

   This Element shall describe receiving inspection activities to be performed, and documentation required to confirm that the correct material or equipment has been delivered. A list of items requiring Materials Certificates and/or Certified Test Reports shall be developed by the Contractor and included in this Element. The Contractor shall prepare a "Material Receiving Inspection Report" which shall include records of inspections performed and reviews of material test reports or other documentation required by the Contract. It shall also include copies of Materials Certificates and/or Certified Test Reports for all these items.

   As a minimum, receiving inspections shall be performed on the following materials:
   - Materials requiring a Materials Certificate or Certified Test Report
   - Source-Controlled Materials (not inspected at the manufacturing plant)
   - Job-Controlled Materials (other than concrete, bituminous and soils)

   Following a receiving inspection, a copy of the "Material Receiving Inspection Report," along with associated documents, shall be submitted to the Engineer.
5. **Control of Subcontractors, Fabricators and Suppliers:** Subcontractors, fabricators and suppliers involved in critical work categories, as defined in 6(a) herein, shall develop their own

QC Plan to be added as an addendum to the Contractor's QC Program, which shall comply with all conditions of this item. The Contractor shall be responsible for reporting on QC activities performed by or for subcontractors, fabricators and suppliers.

It is the Contractor's responsibility to notify all subcontractors, fabricators, and suppliers of the requirements of the Contract. This Element shall describe the methods used by the Contractor and the QCM to assure that all the applicable requirements of the Contract are passed on to the subcontractors, fabricators and suppliers. This Element shall include the methods used by the Contractor and the QCM to monitor and control the quality of the work performed by subcontractors, fabricators and suppliers, and to obtain the required quality records.

This Element shall also describe how the Contractor will ensure that:

- The Engineer receives advance notice of:
  - The source of supply
  - The location of fabrication, including component parts
  - The schedule of fabrication, including the date of beginning of fabrication and the date the material is to be delivered to the Project
- Material fabricated specifically for the Project will be inspected and approved prior to being shipped or incorporated into the work
- Properly documented mill test reports are furnished by suppliers
- Subcontractors are approved prior to performing any work for or on the Project

6. Inspection: This Element shall describe how the Contractor and the QCM will assure that the specified quality of materials and workmanship will be achieved. The Contractor's QC Program is not related to any inspection carried out by the Engineer. Inspection will include the identification and tracking of the quality characteristics (metrics) used to verify that the level of quality of materials and workmanship conforms to the requirements of the Contract.

The QC Program shall identify the reporting requirements for each item based on its work category, and these reporting requirements will be approved by the Engineer. The work categories will be identified as **critical** or **routine**.

(a) Critical Work Categories: For this Project, critical work categories shall include, but are not limited to the following:

- Construction Staking
- Maintenance & Protection of Traffic
- Earthwork
- Subbase and Base Material
- Hot Mix Asphalt
- Drainage
- Bridge Demolition
- Earth Retaining Systems
- Geotechnical (Foundations, Piles, Drilled Shafts)
- Reinforcing Steel
- Structural Steel
- Structural Concrete
- Electrical
- Reinforced Slopes
- Concrete Pavement

- Incident management System
- Railroad at Grade Crossing
- Sign Support Foundations
- Landscaping
- Sign Support Foundation
- Precast Concrete Barrier Curb
- Environmental Compliance
- Permit Compliance

The QCM shall be familiar with all aspects of work related to critical work categories and no work shall be performed on these categories without the prior knowledge of the QCM. The QC Program shall define specific means and methods that shall be employed to minimize, identify, resolve and prevent recurrence of deviations from the Contract in regards to materials or workmanship for each of the critical work categories listed.

The QC Program shall identify hold points in the critical work categories beyond which work operations cannot proceed until the QCM has inspected the work in place and releases the hold.

When simultaneous critical work categories are required by the Contractor's schedule, additional QC personnel shall be required.

This Element shall describe the system(s) used to assure that all materials and workmanship for critical work categories are in conformance with the Contract, including but not limited to:

- visual inspection of the work, including frequency and hold points
- materials to be tested
- tests to be conducted
- frequency of testing
- locations of sampling
- checks
- intermittent or continuous inspections
- inspections of completed work
- or a combination of above methods

Quality control reporting forms shall be developed to document the work performed by the QCM and QC personnel, on each of these critical work categories. The forms shall be signed by Contractor supervisory field personnel, the QCM and QC personnel (if applicable), to document conformance of the work being performed. All work performed by the QCM and QC personnel on these critical work categories shall be documented and included in the QCM's daily and monthly reports.

(b) Routine Work Categories: All other work categories not covered by 6(a) will be defined as routine work categories and the general provisions of this specification shall apply.

7. Special Process Control: This Element shall describe the measures to be used to assure that any special processes (such as, but not limited to, welding, high-strength bolting, nondestructive examination, critical coatings, surveys, and control of critical tolerances) shall be controlled by procedures that are described in and comply with the Contractor's approved QC Program. The recording of results shall properly document that processes are in conformance

with the Contract. In addition, this Element shall describe the methods used to verify, document and track any pre-qualification of the processes, personnel and equipment where required by the Contract.

8. Non-Conformance Resolution: This Element shall describe the protocol(s) for correcting any material or workmanship found not to be in compliance with the Contract, the reporting requirements for documenting any non-compliance, subsequent corrective measures and issue resolution.

(a) Contractor-Issued Non-Conformance Reports: This Element shall outline the Contractor's use of self-issued non-conformance reports to document actions taken to identify, resolve and prevent recurring deviations. The non-conformance reports shall include signatures of the responsible persons for each process of the corrective action taken. Upon resolution of a non-conformance issue, the QC Program shall be revised to identify preventive measures that shall be taken to prevent similar deviations. Contractor supervisory field personnel involved in the work shall be informed of any changes implemented to avoid recurrence of deviations.

(b) Engineer-Issued Non-Compliance Notices (NCN): Non-compliance notices (NCNs) issued by the Engineer shall also be an indication of non-conformance and shall be addressed according to 1.05.11 and resolved to the satisfaction of the Engineer. Upon resolution, the QC Program shall be revised to identify preventive measures that shall be taken to prevent similar deviations. Contractor supervisory field personnel involved in the work shall be informed of any changes implemented to avoid recurrence of deviations.

9. Records: This Element shall describe how various records generated by the Contractor are originated, maintained, received, filed, protected and authenticated. Quality Control records required for submittal to the Engineer shall be described. This Element shall outline the Contractor's procedure for retaining records for a period of 3 years after acceptance of the Contract.

10. Reporting: QC Inspection Reports: The Contractor shall be required to produce and submit to the Engineer daily and monthly inspection reports in accordance with all requirements of this specification. The QC Program shall clearly define the information that shall be provided as part of the daily and monthly reports.

(a) Daily Reports: Daily reports shall include documentation of all activities, including inspection, material testing, and any work associated with the Elements of this specification, performed by the QCM and other QC personnel. The location of any forms relative to this specification shall be referenced in the daily reports.

For any week that a non-conformance report is issued, either by the Contractor or the Engineer, actions taken to resolve the non-conformance report shall be summarized and included with the submission of the daily reports. Updates on the status of the non-conformance shall continue in each submission of daily reports until the non-conformance issue is resolved. Once resolved, the next submission of daily reports shall document that supervisory field personnel involved in the work have been informed of any changes to be implemented to avoid recurrence of deviations. Any revisions or amendments made to the QC Program, once submitted and accepted by the Engineer, shall be documented in the next submission of daily reports.

Daily reports shall be submitted (as a package) to the Engineer by 12 PM on the Tuesday following the week of the inspection reports, or as agreed to by the Engineer. Except as otherwise authorized by the Engineer, submissions after that time will be considered late.

(b) Monthly Reports: Monthly reports shall include a summary of the work performed, including QC activities, in the previous month and also a one (1) month "look ahead" schedule with expected QC efforts and procedures for critical and routine work categories. Monthly reports shall also include a submittal status update spreadsheet.

Monthly reports shall be submitted to the Engineer by the fifth (5th) business day each month. Except as otherwise authorized by the Engineer, monthly submissions after that time will be considered late.

(c) Quality Assurance/Quality Control (QA/QC) Meetings: Meetings shall be held specific to the QC Program. The Contractor shall, at minimum, be represented by the QCM and shall meet with the Engineer every other week, or more frequently at the Engineer's request, to review reporting and all work related to this specification.

Method of Measurement: Within forty-five (45) calendar days of the award of the Contract, the Contractor shall submit to the Engineer for approval a schedule of values of its lump sum bid price for this item detailing the following:

1. The development costs to prepare the written QC Program. Development costs shall be ten percent (10%) of the total cost of the item.
2. The cost per-month to provide the services of the QC Program, including the QCM, QC activities, necessary QC personnel, preparing and submitting daily and monthly reports, and all other requirements of this specification. A per-month cost will be derived by taking the lump sum bid price, subtracting the development cost to prepare the written QC Program, and dividing the remainder by the number of Contract months remaining from the date of submission of the written QC Program.

Basis of Payment: This item will be paid for at the Contract lump sum price for "Contractor Quality Control Program Level 2" complete, which price shall include all submittals, QC Program revisions and amendments, inspections, monitoring, daily logs, reports, meetings, records, and all materials, equipment, labor and work incidental thereto.

Upon approval of the schedule of values by the Engineer, payments for work performed will be made as follows:

1. Upon acceptance of the written QC Program, the lump sum development cost from the payment schedule will be approved for payment.
2. Upon acceptable completion of the services of the QC Program for the month, the per-month cost will be approved for payment.

The Engineer reserves the right to apply the following reductions to the monthly payment portion, which cannot be recovered and will result in a reduction in the lump sum amount, should the Contractor fail to meet the requirements of this specification:

1. QCM: A five percent (5%) reduction to the monthly payment will be applied for each day that the services of an acceptable QCM is not provided as required by this specification. The total reduction for any calendar month could exceed the monthly payment for the item.

2. Reports: A five percent (5%) reduction to the monthly payment will be applied for each day that the required reports have been submitted late, up to a maximum of fifty percent (50%) of the monthly payment per report. This five percent (5%) reduction will apply to each independent report (each package of daily reports, described in 10(a) above, submitted on a weekly basis is considered one independent report). The total reduction for any calendar month could exceed the monthly payment for the item.
3. QA/QC Meetings: A twenty-five percent (25%) reduction to the monthly payment will be applied for each bi-weekly QA/QC meeting not attended by the QCM.

Should the Contractor fail to continuously provide an acceptable QC Program, as required by this specification, the Engineer may withhold the entire monthly estimate until such time as all requirements are met.

Should the QCM fail to comply with the requirements of this specification, they shall be replaced at the Engineer's request.

Only one monthly payment will be made for each calendar month regardless of the number of personnel required to complete the specified work.

Pay Item	Pay Unit
Contractor Quality Control Program Level 2	l.s.

ITEM #0969202A - CLASS B OFFICE

Description: Under this item, office quarters will be located, leased, built out and furnished by the Contractor, for the use of CTDOT and other personnel engaged in Project Nos. 0063-0703 / 0159-0191. The Class B Office shall be located convenient to the project at a location approved by the Engineer.

It shall be separated from any office occupied by the Contractor. The Class B Office shall conform to the standards for Class B office space and shall be approved by the Engineer. It shall provide a minimum of 6,000 square feet of floor space. Specific details and requirements of the office space, build out, furnishings, equipment, building services including security and maintenance shall be as specified by the Engineer.

Prior to leasing, build out and furnishing any office space under this Item, the Contractor shall obtain and submit to the Engineer a minimum of three quotes conforming to the requirements in Appendix A of this Special Provision. The Contractor shall submit quotes to the State within 14 days of Award of the Contract. The Engineer will review the quotes submitted and respond in writing within 14 days of receipt of the quotes.

Method of Measurement: The sum of the money shown on the estimate and in the itemized proposal as "Estimated Cost" for this work will be considered the bid price even though payment will be made only for the actual costs incurred for the Class B Office. The estimated cost figure is not to be altered in any manner by the bidder. Should the bidder alter the amount shown, the altered figures will be disregarded, and the original price will be used to determine the total bid for the contract.

Basis of Payment: The item "Furnish Class B Office" shall be paid for in accordance with Section 1.09. The Administrative Expense specified in subparagraph (e) shall be limited to 5% on the cost of the lease.

APPENDIX A

I. INTRODUCTION

The State of Connecticut, Department of Transportation (State) will accept lease proposals/site offerings from property owners (Owner) or their representative(s) to lease usable office space with on-site, reserved, paved and lighted parking for vehicles for use and occupancy by the Department of Transportation and it's consultants for a term of four (4) years, with up to two (2) six (6) month renewal options. The premises must be accessible to handicapped individuals.

II. SPACE REQUIREMENTS

A. Minimum Net Usable Office Space: The State will require the following minimum square feet of net usable office space as part of the lease. The space provided shall have a minimum ceiling height of 8 feet. The Owner shall describe in the proposal response how they will provide each of these requirements.

1. The State will require a base amount of 6,000 square feet of net usable office space.

B. Minimum Number of Parking Spaces: The State will require the following minimum number of on-site, paved and lighted parking spaces as part of the lease agreement. The owner shall describe in the proposal response how they will provide each of these requirements.

1. The State will require thirty (30) reserved parking spaces as described above plus parking capacity at the building for an additional twenty (20) visitors.

2. Handicapped accessible parking spaces, as required by State and local ordinances, shall not be included in the calculation of the number of parking spaces provided to the State under this requirement.

C. Location: The office space should be located within close proximity to the project. The office space should be located no more than one (1) mile from the Project Site.

III. OFFICE RENOVATIONS

As part of the lease agreement, and included in the square foot price, the owner shall improve the area to be occupied by the State to provide the following base requirements:

A. Suitable office space to a minimum of Class B Office standards, for the purpose of conducting consulting engineering practice.

B. The space shall be furnished with like new carpeting, paint, and window treatments acceptable to the Engineer.

C. The space shall provide a minimum of ten (10) offices. Offices shall be approximately 160 square feet each and each shall be provided with a door.

D. The space shall provide a minimum of two (2) common rooms suitable for a minimum of 10 cubicles per room with a minimum of 100 square feet per cubicle.

E. The space shall provide a minimum of two (2) conference rooms with one approximately 400 square feet and other approximately 200 square feet.

F. The space shall provide a kitchenette area with a countertop area including a sink, with outlets for microwave and refrigerator. Area shall be approximately 150 square feet.

The owner shall coordinate with appropriate individuals within the State to ensure desired work is in

accordance with State's needs. The owner will be responsible for preparing and furnishing drawings and specifications for the improvements, ensuring their compliance with all governing federal, state, and municipal laws, ordinances, rules, regulations, and orders relative to property, environmental, and health and safety matters as part of the improvements. The base renovations shall be completed no later than 4 weeks after the signing of the lease.

IV. ADDITIONAL LEASE CONDITIONS

A. Quotes: Quotes provided shall include a price per square foot for leasing the base space amount, including the base renovations listed herein. Additional prices shall be provided for the two options to lease additional space specified herein, including the base renovations listed herein.

B. Security Deposit: The owner shall not request a security deposit as a condition of the lease.

C. Increases: Any yearly percentage increases in the square foot price shall be specified as part of the proposal submitted.

D. Utility Costs: Utility costs shall be included in the square foot price.

V. SECURITY REQUIREMENTS

A. The office space provided shall be located within a building with a 24 hour, full-time security system. The space provided to the State shall be provided within a separate zone of this system so as to allow the zone to be activated/deactivated at the State's discretion.

B. The State and its consultants shall have access to the space 24 hours a day, 7 days a week, 365 day per year, including holidays.

VI. BUILDING MAINTENANCE/OPERATIONS

A. The owner shall provide all required building operation activities and services, including repairs and maintenance (including preventative).

B. The owner shall provide building custodial services and cleaning to include a high standard of cleanliness, including rubbish removal and recycling (in accordance with State regulations).

C. The owner shall provide parking allocation and control, as well as snow and ice removal.

D. The owner shall assure compliance with all health and safety related issues such as, but not necessarily limited to, building code requirements, fire code requirements, OSHA requirements, indoor air quality issues, and general building occupant safety, including conducting fire drills and developing, posting, and training occupants concerning building evacuation plans.

E. Restrooms made available to tenants under the lease shall meet current Americans with Disabilities Act (ADA) code requirements and not be grandfathered under the code.

F. Electrical service requirements: The office shall be equipped with an electric service panel, wiring, outlets, etc., to serve the electrical requirements of the office, including: lighting, general outlets, computer outlets, HVAC, etc. Electrical service shall be a minimum of 120/240 volt, 1 phase, 3 wire.

G. HVAC requirements: Heating, ventilation, and air conditioning ("HVAC") will be provided as required for the comfortable use and occupancy of the premises at all hours At all times when HVAC is to be provided under this lease, the HVAC system provided shall be sufficient to maintain conditions in the premises to not more than 25C (78 F) during warmer seasons nor less than 20C (69 F) in colder seasons.

H. Lighting: All lighting shall be in working order and shall be sufficient to provide a minimum of 1075 lux (107 foot-candles) at desk level height.

ITEM #0969205A - CLASS B OFFICE SUPPLIES (MONTH)

Description: Under this item, the Contractor will provide supplies and furnishings for the Class B Office quarters used by ConnDOT and other personnel engaged in Project Nos. 0063-0703 / 0159-0191.

Supplies and furnishings for the Class B Office shall be provided for the duration of the contract.

Materials: Materials shall be in like new condition for the purpose intended and shall be approved by the Engineer.

Office Requirements:

The Contractor shall provide the following additional new supplies, equipment, facilities, and/or services at the Class B Office on this contract to include at least the following to the satisfaction of the Engineer:

30 - Office desks (36" by 60") with L-shape return (2 4 " x 4 8 ") , with drawers, locks, and matching high-back desk chairs with arms that have pneumatic seat height adjustment and dual wheel casters on the legs or base.
60 - Office Chairs
2 - Standard secretarial type desk and matching desk chair that has pneumatic seat height adjustment and dual wheel casters on the legs or base.
1 - Conference table, 44in x 20 ft (nominal).
1 - Conference table, 44in x 12 ft (nominal).
30 - Conference table chairs, medium back padded, swiveling with casters.
6 - Fire resistant cabinets (letter size/4 drawer), locking.
6 - Non-fire resistant cabinets (letter size/4 drawer), locking.
4 - Drafting, type tables each 3 ft x 6 ft, self-supported.
4 - Drafters' stools.
2 - Heavy Duty Stapler, capable of 160 sheets, minimum
2 - Heavy Duty 3 hole-punch
2 - Large Multifunction Laser Printer/Copier/Scanner/Fax combination unit, network capable, as specified under Computer Hardware and Software. All supplies, paper and maintenance shall be provided by the Contractor.
2 - Hot and cold water dispensing unit and supply of cups and bottled water shall be supplied by the Contractor for the duration of the project.
4 - Electronic office type printing calculators capable of addition, subtraction, multiplication and division with memory and a supply of printing paper.
4 - Wi-Fi Printer and supplies as specified below under Computer Hardware and Software
1 - Video Projector as Specified below under Computer Related Hardware and Software.
1 - Projector screen (1-100" hanging screen complete with mounting hardware)
4 - 70" 4K resolution LED 120Hz Smart Television with Wall mounts and all cables necessary to accommodate video conferencing
5 - Digital Camera and supplies as specified below under Computer Hardware and Software.

34 - Wastebaskets - two (2) 30 gal and thirty-two (32) 5 gal including plastic waste bags.
2 - Recycling Bins. - two (2) 30 gal including plastic waste bags
1 - Cross-cut paper shredder, commercial grade.
4 - Electric pencil sharpeners.
6 - Wall clocks.
* - Fire extinguishers - provide and install type and number to meet applicable State and local codes for size of office indicated, including a fire extinguisher suitable for use on a computer terminal fire.
2 - First Aidkit.
10 - Tables - 3 ft x 6 ft.
20 - Cubicles - 6 ft height, soundproof type, portable and freestanding to provide a minimum of 10'x10' area per cubicle.
10 - Vertical plan racks for 2 sets of 2 ft x 3 ft plans for each rack. Inc all necessary plan clamps
2 - Double door supply cabinet with 4 shelves and a lock - 6 ft x 4 ft.
4 - White Dry-Erase Board, 36" x 48" min. with markers and eraser.
20 - Open bookcases - 4 shelves - 3 ft long.
5 - Infrared Thermometer, including certified calibration, case, cleaning wipes.
5 - Concrete Air Meter as specified below under Concrete TestingEquipment.
5 - Concrete Slump Cone as specified below under Concrete Testing Equipment.
2 - Concrete Curing Box as specified below under Concrete Testing Equipment.
10 - Case of cardboard banker boxes, Quick Set-Up Storage Boxes with Lift-Off Lid, Letter/Legal size, approx. dimensions of 15"L x 12"W x 10"H, min 450lb stacking strength (Min 10 boxes / case)
1 - Coat rack with 20 coat capacity.
20 - Desktop tape dispensers (with Tape)
50 - 8 Outlet Power Strip with Surge Protection
10 - Rain Gauge
1 - Large Refrigerator – 18 c.f. min.
2 - Microwave, 1.2 c.f. min, 1000W min.
1 - Field Office Wi-Fi Connection as specified below under Computer Related Hardware and Software.
1 - Business telephone system for four (4) lines with ten (10) handsets, intercom capability, and two (2) speaker phones, one for each conference table.

The furnishings and equipment required herein, except as noted above, shall remain the property of the Contractor. Any supplies required to maintain or operate the above listed equipment or furnishings shall be provided by the Contractor for the duration of the project.

Telephone Service: The Contractor shall provide telephone service with unlimited nation-wide calling plan. This shall consist of five (5) telephone lines: four (4) lines for phone/voice service and one (1) line dedicated for facsimile machine. The Contractor shall pay all charges.

Data Communications Facility Wiring: The Contractor shall install a Category 6 568B patch panel in a central wiring location and Cat 6 cable from the patch panel to each PC station,

Smart Board location, Multifunction Laser Printer/Copier/Scanner/Fax, terminating in a (Category 6 568B) wall or surface mount data jack. The central wiring location shall also house either the data circuit with appropriate power requirements or a category 5 cable run to the location of the installed data circuit.

The central wiring location will be determined by the CTDOT OIS staff in coordination with the designated office personnel as soon as the facility is in place.

The Contractor shall run CAT 6 LAN cables from workstations, install patch panel in data circuit demark area and terminate runs with RJ45 jacks at each device location. Terminate runs to patch panel in LAN switch area. Each run / jack shall be clearly labeled with an identifying Jack Number.

The Contractor shall supply cables to connect the Wi-Fi printer to the Contractor supplied internet router and to workstations/devices as needed. These cables shall be separate from the LAN cables and data Jacks detailed above for the CTDOT network.

The number of networked devices anticipated shall be at least equal to the number of personal desks, Multi-Function Laser Printer/Copier/Scanner/Fax, and smartboards listed in the Class B Office Supplies.

The installation of a data communication circuit between the office and the CTDOT OIS in Newington will be coordinated between the CTDOT District staff, CTDOT OIS staff and the local utility company once the Contractor supplies the field office phone numbers and anticipated installation date. The Contractor shall provide the field office telephone number(s) to the CTDOT Project Engineer within 10 calendar days after the signing of the Contract as required by Article 1.08.02. This is required to facilitate data line and computer installations.

Computer Related Hardware and Software: The CTDOT will supply by its own means the actual Personal Computers for the CTDOT representatives. The Contractor shall supply the Field Office Wi-Fi Connection, Wi-Fi Printer(s), Digital Camera(s), Flip Phones, Smart Phones, Multifunction Laser Printer/Copier/Scanner/Fax, Video Projectors, and Smart Board(s) as well as associated hardware and software, must meet the requirements of this specification as well as the latest minimum specifications posted, as of the project advertising date, at CTDOTs web site http://www.ct.gov/dot/cwp/view.asp?a=1410&q=563904

Within 10 calendar days after the signing of the Contract but before ordering/purchasing the Wi-Fi Printer (separate from the Multifunction Laser Printer/Copier/Scanner/Fax), Field Office Wi-Fi, Digital Camera(s), Flip Phones, Smart Phones, Multifunction Laser Printer/Copier/Scanner/Fax, Video Projector(s) and Smart Board(s) as well as associated hardware, the Contractor must submit a copy of their proposed order(s) with catalog cuts and specifications to the Administering CTDOT District for review and approval. The Wi-Fi Printer, Wi-Fi Router, Flip Phones, Smart Phones, digital cameras, Projector(s) and Smart Board(s) will be reviewed by CTDOT District personnel. The Multifunction Laser

Printer/Copier/Scanner/Fax will be reviewed by the CTDOT OIS. The Contractor shall not purchase the hardware, software, or services until the Administering CTDOT District informs them that the proposed equipment, software, and services are approved. The Contractor will be solely responsible for the costs of any hardware, software, or services purchased without approval.

The Contractor and/or their internet service provider shall be responsible for the installation and setup of the field office Wi-Fi, Wi-Fi printer, and the configuration of the wireless router as directed by the CTDOT. Installation will be coordinated with CTDOT District and Project personnel.

After the approval of the hardware and software, the Contractor shall contact the designated representatives of the CTDOT administering District, a minimum of 2 working days in advance of the proposed delivery or installation of the Field Office Wi-Fi Connection, Wi-Fi Printer, Digital Camera(s), Flip Phones, Smart Phones, Multifunction Laser Printer/Copier/Scanner/Fax, Video Projectors and Smart Board(s), as well as associated hardware, software, supplies, and support documentation.

The Contractor shall provide all supplies, paper, maintenance, service and repairs (including labor and parts) for the Wi-Fi printers, copiers, field office Wi-Fi, fax machines and other equipment and facilities required by this specification for the duration of the Contract. All repairs must be performed with-in 48 hours. If the repairs require more than a 48 hours then an equal or better replacement must be provided.

Once the Contract has been completed, the hardware and software will remain the property of the Contractor.

Concrete Testing Equipment: If the Contract includes items that require compressive strength cylinders for concrete, in accordance with the Schedule of Minimum Testing Requirements for Sampling Materials for Test, the Contractor shall provide the following. All testing equipment will remain the property of the Contractor at the completion of the project.

A) Concrete Cylinder Curing Box – meeting the requirements of Section 6.12 of the Standard Specifications.

B) Air Meter – The air meter provided shall be in good working order and will meet the requirements of AASHTO T 152.

C) Slump Cone Mold – Slump cone, base plate, and tamping rod shall be provided in like-new condition and meet the requirements of AASHTO T119, Standard Test Method for Slump of Hydraulic-Cement Concrete.

D) Concrete Cylinders –Ample supply of 4” and 6” Single –Use Cylinders

Insurance Policy: The Contractor shall provide a separate insurance policy, with no deductible, in the amount of one hundred thousand dollars ($100,000.00), in order to insure all State-owned data equipment and supplies used in the office, against all losses. The Contractor shall be named insured on that policy, and the Department shall be an additional named insured on the policy. These losses shall include, but not be limited to: theft, fire, and physical damage. The Department will be responsible for all maintenance costs of Department owned computer hardware. In the event of loss, the Contractor shall provide replacement equipment in accordance with current Department equipment specifications, within fourteen days of notice of the loss. If the Contractor is unable to provide the required replacement equipment within fourteen days, the Department may provide replacement equipment and deduct the cost of the equipment from monies due or which may become due the Contractor under the contract or under any other contract. The Contractor's financial liability under this paragraph shall be limited to the amount of the insurance coverage required by this paragraph. If the cost of equipment replacement required by this paragraph should exceed the required amount of the insurance coverage, the Department will reimburse the Contractor for replacement costs exceeding the amount of the required coverage.

Method of Measurement: The providing of supplies and furnishings for the Class B Office will be measured for payment by the number of calendar months that supplies and furnishing are provided to the Class B Office under this contract, measured to the nearest month.

Basis of Payment: The providing of supplies and furnishings for the Class B Office will be paid at the listed unit price per month for "Class B Office Supplies (Month)", which price shall include all material, equipment, labor, and work incidental thereto.

Any items not covered under this provision required for the operation of the Class B Office will be paid for as Extra Work as defined under Section 1.09.

Pay Item	Pay Unit
Class B Office Supplies (Month)	Month

ITEM #0971001A - MAINTENANCE AND PROTECTION OF TRAFFIC

Article 9.71.01 – Description is supplemented by the following:

The Contractor shall maintain and protect traffic as described by the following and as limited in the Special Provision "Prosecution and Progress":

Route I-91/Route 15/Route 2

The Contractor shall maintain and protect the minimum number of through lanes and shoulders as dictated in the Special Provision for Section 1.08 - Prosecution and Progress "Limitations of Operations - Minimum Number of Lanes to Remain Open" Chart, on a paved travel path not less than 11 feet in width per lane.

The Contractor shall be allowed to halt traffic for a period of time not to exceed 10 minutes for the purpose of erecting / removing overhead sign supports, structural steel, or blasting operations. If more than one 10-minute period is required, the Contractor shall allow all stored vehicles to proceed through the work area prior to the next stoppage.

Ramps and Turning Roadways

The Contractor shall maintain and protect existing traffic operations.

Excepted therefrom will be those periods, during the allowable periods, when the Contractor is actively working, at which time the Contractor shall be allowed to maintain and protect a minimum of one lane of traffic, on a paved travel path not less than 12 feet in width.

During Stages 1A, 1B, 1C, 1D and 2 when the Contractor is actively working in the southbound direction on Route 15 in the vicinity of the I-91 NB Exit 28 off-ramp the Contractor will be permitted to close the off-ramp to traffic and detour traffic as shown on the detour plan contained in the contract documents.

During Stages 2 and 4 when the Contractor is actively working in the vicinity of the Main Street on-ramp to Route 15 NB/I-84 EB the Contractor will be permitted to close the on-ramp to traffic and detour traffic as shown on the detour plan contained in the contract documents.

During Stage 1B when the Contractor is actively working in the vicinity of the Route 15 SB East River Drive off-ramp the Contractor will be permitted to close the off-ramp to traffic and detour traffic as shown on the detour plan contained in the contract documents. The East River Drive on-ramp and off-ramp closures shall not be on going at the same time.

During Stage 1B when the Contractor is actively working in the vicinity of the Route 15 SB East River Drive on-ramp the Contractor will be permitted to close the on-ramp to traffic and detour traffic as shown on the detour plan contained in the contract documents. The East River Drive on-ramp and off-ramp closures shall not be on going at the same time.

Airport Road/Main Street/Silver Lane/Reserve Road

The Contractor shall maintain and protect a minimum of two lanes of traffic in each direction, each lane on a paved travel path not less than 11 feet in width.

Excepted therefrom will be those periods, during the allowable periods, when the Contractor is actively working, at which time the Contractor will be allowed to maintain and protect a minimum of one lane of traffic in each direction on a paved travel path not less than 11 feet in width.

Where turn lanes exist, the Contractor shall provide an additional 10 feet of paved travel path to be used for turning vehicles only. This additional 10 feet of travel path shall be a minimum length of 150 feet. It shall be implemented so that sufficient storage, taper length, and turning radius are provided.

During Stage 2 when the Contractor is actively working in the vicinity of the Main Street under Route 15 Bridge the Contractor will be permitted to close Main Street to traffic and detour traffic as shown on the detour plans contained in the contract documents. These closures are to be short term for replacing overhead elements.

During Stage 2 when the Contractor is actively working in the vicinity of the Silver Lane under Route 15 Bridge the Contractor will be permitted to close Silver Lane to traffic and detour traffic as shown on the detour plans contained in the contract documents. These closures are to be short term for replacing overhead elements.

During Stage 2 when the Contractor is actively working in the vicinity of the Reserve Road the Contractor will be permitted to close Reserve Road to traffic and detour traffic as shown on the detour plan contained in the contract documents.

All Other Roadways

The Contractor shall maintain and protect a minimum of one lane of traffic in each direction, each lane on a paved travel path not less than 11 feet in width.

Excepted therefrom will be those periods, during the allowable periods, when the Contractor is actively working, at which time the Contractor shall maintain and protect at least an alternating one-way traffic operation, on a paved travel path not less than 11 feet in width. The length of the alternating one-way traffic operation shall not exceed 300 feet and there shall be no more than one alternating one-way traffic operation within the project limits without prior approval of the Engineer.

Commercial and Residential Driveways

The Contractor shall maintain access to and egress from all commercial and residential driveways throughout the project limits. The Contractor will be allowed to close said driveways to perform the required work during those periods when the businesses are closed, unless permission is granted from the business owner to close the driveway during business hours. If a temporary closure of a residential driveway is necessary, the Contractor shall coordinate with the owner to determine the time period of the closure.

Traffic Operations over Railroad – Highway Grade Crossing

The Contractor will not be allowed to queue traffic over the crossing at any point during the construction of the project. If, due to the nature of the Contractor's operations, queuing is unavoidable, the Contractor shall utilize Connecticut Southern Railroad (CSO) Protection to ensure that vehicles are kept clear of the crossing area. Subject to the approval of the Railroad and the Engineer, Uniformed Flaggers and/or Town Police Officers may be used in lieu of Railroad Protection. The Contractor shall coordinate its work with the Railroad's authorized representative.

Weekend Lane Closures

The Contractor shall be permitted to close one lane on I-91 for a total of four (4) weekends between the hours of 9:00 p.m. on Friday to 6:00 a.m. on Monday for the purpose of performing contract operations. During these 4 weekend periods all 3's called out on the I-91 Limitation of Operations Charts as the minimum number of lanes to remain open shall be replaced by 2's, however in no case is the Contractor permitted to close the highway to traffic. The Contractor shall always keep at least one lane of traffic through these weekend lane closures.

The Contractor shall propose weekend closures at least thirty-two (32) days in advance of the scheduled closure for review and approval. The proposal shall consist of a plan that details public relations strategy; highway operations and advance messaging; incorporation of Smart Work Zone applications; proposed detours, alternate routes and traffic control plans; nature of the work, including equipment and labor resources; specific locations of construction activity and length of the work zone; and specific proposed hours of operation. All work associated with organizing, coordinating and implementing weekend closures will be included in the lump sum price for Maintenance and Protection of Traffic.

Article 9.71.03 - Construction Method is supplemented as follows:

General

The Contractor is required to delineate any raised structures within the travel lanes, so that the structures are visible day and night, unless there are specific contract plans and provisions to temporarily lower these structures prior to the completion of work.

The Contractor shall schedule operations so that pavement removal and roadway resurfacing shall be completed full width across a roadway (bridge) section by the end of a workday (work night), or as directed by the Engineer.

When the installation of all intermediate courses of bituminous concrete pavement is completed for the entire roadway, the Contractor shall install the final course of bituminous concrete pavement.

When the Contractor is excavating adjacent to the roadway, the Contractor shall provide a 3-foot shoulder between the work area and travel lanes, with traffic drums spaced every 50 feet. At the end of the workday, if the vertical drop-off exceeds 3 inches, the Contractor shall provide a temporary traversable slope of 4:1 or flatter that is acceptable to the Engineer.

The Contractor, during the course of active construction work on overhead signs and structures, shall close the lanes directly below the work area for the entire length of time overhead work is being undertaken. At no time shall an overhead sign be left partially removed or installed.

If applicable, when an existing sign is removed, it shall be either relocated or replaced by a new sign during the same working day.

The Contractor shall not store any material on-site which would present a safety hazard to motorists or pedestrians (e.g. fixed object or obstruct sight lines).

The field installation of a signing pattern shall constitute interference with existing traffic operations and shall not be allowed, except during the allowable periods.

Construction vehicles entering travel lanes at speeds less than the posted speed are interfering with traffic, and shall not be allowed without a lane closure. The lane closure shall be of sufficient length to allow vehicles to enter or exit the work area at posted speeds, in order to merge with existing traffic.

Existing Signing

The Contractor shall maintain all existing overhead and side-mounted signs throughout the project limits during the duration of the project. The Contractor shall temporarily relocate signs and sign supports as many times as deemed necessary, and install temporary sign supports if necessary and as directed by the Engineer.

Requirements for Winter

The Contractor shall schedule a meeting with representatives from the Department including the offices of Maintenance and Traffic, and the Town/City to determine what interim traffic control measures the Contractor shall accomplish for the winter to provide safety to the motorists and permit adequate snow removal procedures. This meeting shall be held prior to October 31 of each year and will include, but not be limited to, discussion of the status and schedule of the following items: lane and shoulder widths, pavement restoration, traffic signal work, pavement markings, and signing.

Signing Patterns

The Contractor shall erect and maintain all signing patterns in accordance with the traffic control plans contained herein. Proper distances between advance warning signs and proper taper lengths are mandatory.

Pavement Markings

The Contractor will be responsible for the furnishing of all pavement markings, either temporary or permanent. The Contractor shall repaint roadways as directed by the engineer. This work will be paid for under the appropriate pavement marking items.

The Contractor is alerted that all pavement markings must be in place by the end of the work day for any roadway to be opened on that day.

Interim Pavement Markings

The Contractor shall install painted pavement markings, which shall include centerlines, shoulder edge lines, lane lines (broken lines), gore markings, lane-use arrows, and stop bars, on each intermediate course of bituminous concrete pavement and on any milled surface by the end of the work day/night. If the next course of bituminous concrete pavement will be placed within seven days, shoulder edge lines are not required. The painted pavement markings will be paid under the appropriate items.

If the Contractor will install another course of bituminous concrete pavement within 24 hours, the Contractor may install Temporary Plastic Pavement Marking Tape in place of the painted pavement markings by the end of the work day/night. These temporary pavement markings shall include centerlines, lane lines (broken lines) and stop bars; shoulder edge lines are not required. Centerlines shall consist of two 4 inch wide yellow markings, 2 feet in length, side by side, 4 to 6 inches apart, at 40-foot intervals. No passing zones should be posted with signs in those areas where the final centerlines have not been established on two-way roadways. Stop bars may consist of two 6 inch wide white markings or three 4 inch wide white markings placed side by side. The Contractor shall remove and dispose of the Temporary Plastic Pavement Marking Tape when another course of bituminous concrete pavement is installed. The cost of furnishing, installing and removing the Temporary Plastic Pavement Marking Tape shall be at the Contractor's expense.

If an intermediate course of bituminous concrete pavement will be exposed throughout the winter, then Epoxy Resin Pavement Markings should be installed unless directed otherwise by the Engineer.

Final Pavement Markings

The Contractor should install painted pavement markings on the final course of bituminous concrete pavement by the end of the work day/night. If the painted pavement markings are not installed by the end of the work day/night, then Temporary Plastic Pavement Marking Tape shall be installed as described above and the painted pavement markings shall be installed by the end of the work day/night on Friday of that week.

If Temporary Plastic Pavement Marking Tape is installed, the Contractor shall remove and dispose of these markings when the painted pavement markings are installed. The cost of furnishing, installing and removing the Temporary Plastic Pavement Marking Tape shall be at the Contractor's expense.

The Contractor shall install permanent Epoxy Resin Pavement Markings in accordance with Section 12.10 entitled "Epoxy Resin Pavement Markings, Symbols, and Legends" after such time as determined by the Engineer.

TRAFFIC CONTROL DURING CONSTRUCTION OPERATIONS

The following guidelines shall assist field personnel in determining when and what type of traffic control patterns to use for various situations. These guidelines shall provide for the safe and efficient movement of traffic through work zones and enhance the safety of work forces in the work area.

TRAFFIC CONTROL PATTERNS

Traffic control patterns shall be used when a work operation requires that all or part of any vehicle or work area protrudes onto any part of a travel lane or shoulder. For each situation, the installation of traffic control devices shall be based on the following:

Speed and volume of traffic
Duration of operation
Exposure to hazards

Traffic control patterns shall be uniform, neat and orderly so as to command respect from the motorist.

In the case of a horizontal or vertical sight restriction in advance of the work area, the traffic control pattern shall be extended to provide adequate sight distance for approaching traffic.

If a lane reduction taper is required to shift traffic, the entire length of the taper should be installed on a tangent section of roadway so that the entire taper area can be seen by the motorist.

Any existing signs that are in conflict with the traffic control patterns shall be removed, covered, or turned so that they are not readable by oncoming traffic.

When installing a traffic control pattern, a Buffer Area should be provided and this area shall be free of equipment, workers, materials and parked vehicles.

Typical traffic control plans 19 through 25 may be used for moving operations such as line striping, pot hole patching, mowing, or sweeping when it is necessary for equipment to occupy a travel lane.

Traffic control patterns will not be required when vehicles are on an emergency patrol type activity or when a short duration stop is made and the equipment can be contained within the shoulder. Flashing lights and appropriate trafficperson shall be used when required.

Although each situation must be dealt with individually, conformity with the typical traffic control plans contained herein is required. In a situation not adequately covered by the typical traffic control plans, the Contractor must contact the Engineer for assistance prior to setting up a traffic control pattern.

PLACEMENT OF SIGNS

Signs must be placed in such a position to allow motorists the opportunity to reduce their speed prior to the work area. Signs shall be installed on the same side of the roadway as the work area. On multi-lane divided highways, advance warning signs shall be installed on both sides of the highway. On directional roadways (on-ramps, off-ramps, one-way roads), where the sight distance to signs is restricted, these signs should be installed on both sides of the roadway.

ALLOWABLE ADJUSTMENT OF SIGNS AND DEVICES SHOWN ON THE TRAFFIC CONTROL PLANS

The traffic control plans contained herein show the location and spacing of signs and devices under ideal conditions. Signs and devices should be installed as shown on these plans whenever possible.

The proper application of the traffic control plans and installation of traffic control devices depends on actual field conditions.

Adjustments to the traffic control plans shall be made only at the direction of the Engineer to improve the visibility of the signs and devices and to better control traffic operations. Adjustments to the traffic control plans shall be based on safety of work forces and motorists, abutting property requirements, driveways, side roads, and the vertical and horizontal curvature of the roadway.

The Engineer may require that the traffic control pattern be located significantly in advance of the work area to provide better sight line to the signing and safer traffic operations through the work zone.

Table I indicates the minimum taper length required for a lane closure based on the posted speed limit of the roadway. These taper lengths shall only be used when the recommended taper lengths shown on the traffic control plans cannot be achieved.

TABLE I – MINIMUM TAPER LENGTHS

POSTED SPEED LIMIT MILES PER HOUR	MINIMUM TAPER LENGTH IN FEET FOR A SINGLE LANE CLOSURE
30 OR LESS	180
35	250
40	320
45	540
50	600
55	660
65	780

SECTION 1. WORK ZONE SAFETY MEETINGS

1.a) Prior to the commencement of work, a work zone safety meeting will be conducted with representatives of DOT Construction, Connecticut State Police (Local Barracks), Municipal Police, the Contractor (Project Superintendent) and the Traffic Control Subcontractor (if different than the prime Contractor) to review the traffic operations, lines of responsibility, and operating guidelines which will be used on the project. Other work zone safety meetings during the course of the project should be scheduled as needed.

1.b) A Work Zone Safety Meeting Agenda shall be developed and used at the meeting to outline the anticipated traffic control issues during the construction of this project. Any issues that can't be resolved at these meetings will be brought to the attention of the District Engineer and the Office of Construction. The agenda should include:

- Review Project scope of work and time
- Review Section 1.08, Prosecution and Progress
- Review Section 9.70, Trafficpersons
- Review Section 9.71, Maintenance and Protection of Traffic
- Review Contractor's schedule and method of operations.
- Review areas of special concern: ramps, turning roadways, medians, lane drops, etc.
- Open discussion of work zone questions and issues
- Discussion of review and approval process for changes in contract requirements as they relate to work zone areas

SECTION 2. GENERAL

2.a) If the required minimum number of signs and equipment (i.e. one High Mounted Internally Illuminated Flashing Arrow for each lane closed, two TMAs, Changeable Message Sign, etc.) are not available; the traffic control pattern shall not be installed.

2.b) The Contractor shall have back-up equipment (TMAs, High Mounted Internally Illuminated Flashing Arrow, Changeable Message Sign, construction signs, cones/drums, etc.) available at all times in case of mechanical failures, etc. The only exception to this is in the case of sudden equipment breakdowns in which the pattern may be installed but the Contractor must provide replacement equipment within 24 hours.

2.c) Failure of the Contractor to have the required minimum number of signs, personnel and equipment, which results in the pattern not being installed, shall not be a reason for a time extension or claim for loss time.

2.d) In cases of legitimate differences of opinion between the Contractor and the Inspection staff, the Inspection staff shall err on the side of safety. The matter shall be brought to

the District Office for resolution immediately or, in the case of work after regular business hours, on the next business day.

SECTION 3. INSTALLING AND REMOVING TRAFFIC CONTROL PATTERNS

3.a) Lane Closures shall be installed beginning with the advance warning signs and proceeding forward toward the work area.

3.b) Lane Closures shall be removed in the reverse order, beginning at the work area, or end of the traffic control pattern, and proceeding back toward the advance warning signs.

3.c) Stopping traffic may be allowed:

- As per the contract for such activities as blasting, steel erection, etc.
- During paving, milling operations, etc. where, in the middle of the operation, it is necessary to flip the pattern to complete the operation on the other half of the roadway and traffic should not travel across the longitudinal joint or difference in roadway elevation.
- To move slow moving equipment across live traffic lanes into the work area.

3.d) Temporary road closures using Rolling Road Blocks (RRB) may be allowed on limited access highways for operations associated with the installation and removal of temporary lane closures. RRB may be allowed for the installation and removal of lead signs and lane tapers only and shall meet the following requirements:

- RRB may not start prior to the time allowed in the contract Limitations of Operation for sign pattern installation. Sign pattern removal must be complete prior to the time indicated in the Limitations of Operation for restoring the lanes to traffic.
- On limited access highways with 4 lanes or more, a RRB may not start until the Limitations of Operation Chart allows a 2 lane closure. In areas with good sight lines and full shoulders, opposite side lead signs should be installed in a separate operation.
- Truck-Mounted Impact Attenuators (TMAs) equipped with arrow boards shall be used to slow traffic to implement the RRB. State Police Officers in marked vehicles may be used to support the implementation of the RRB. The RRB shall start by having all vehicles, including Truck-Mounted Impact Attenuators TMAs and police vehicles leave the shoulder or on-ramp and accelerate to a normal roadway speeds in each lane, then the vehicles will position themselves side by side and decelerate to the RRB speed on the highway.
- An additional Truck-Mounted Impact Attenuator TMAs equipped with a Portable Changeable Message Sign shall be utilized to advise the motorists that sign pattern installation / removal is underway. The Pre-Warning Vehicle (PWV) should be initially positioned in the right shoulder ½ mile prior to the RRB operation. If a traffic queue reaches the PWV's initial location, the contractor shall slowly reverse the PWV along the shoulder to position itself prior to the new back of queue. A Pre-Warning Vehicle, as specified elsewhere in the contract, shall be utilized to advise the motorists that sign pattern installation / removal is underway.

- The RRB duration shall not exceed 15 minutes from start of the traffic block until all lanes are opened as designated in the Limitation of Operation chart. If the RRB duration exceeds 15 minutes on 2 successive shifts, no further RRB will be allowed until the Contractor obtains approval for a revised installation procedure from the respective construction District.
- RRB should not be utilized to expand a lane closure pattern to an additional lane during the shift. The workers and equipment required to implement the additional lane closure should be staged from within the closed lane. Attenuator trucks (and State Police if available) should be used to protect the workers installing the taper in the additional lane.
- Exceptions to these work procedures may be submitted to the District Office for consideration. A minimum of 2 business days should be allowed for review and approval by the District.
- The RRB procedures (including any approved exceptions) will be reviewed and discussed by the inspection team and the Contractor in advance of the work. The implementation of the agreed upon plan will be reviewed with the State Police during the Work Zone Safety meeting held before each shift involving temporary lane closures. If the State Police determine that alternative procedures should be implemented for traffic control during the work shift, the Department and Contractor will attempt to resolve any discrepancies with the duty sergeant at the Troop. If the discrepancies are unable to be resolved prior to the start of the shift, the work will proceed as recommended by the Department Trooper. Any unresolved issues will be addressed the following day.

3.e) The Contractor must adhere to using the proper signs, placing the signs correctly, and ensuring the proper spacing of signs.

3.f) Additional devices are required on entrance ramps, exit ramps, and intersecting roads to warn and/or move traffic into the proper travelpath prior to merging/exiting with/from the main line traffic. This shall be completed before installing the mainline pattern past the ramp or intersecting roadway.

3.g) Prior to installing a pattern, any conflicting existing signs shall be covered with an opaque material. Once the pattern is removed, the existing signs shall be uncovered.

3.h) On limited access roadways, workers are prohibited from crossing the travel lanes to install and remove signs or other devices on the opposite side of the roadway. Any signs or devices on the opposite side of the roadway shall be installed and removed separately.

SECTION 4. USE OF HIGH MOUNTED INTERNALLY ILLUMINATED FLASHING ARROW

4.a) On limited access roadways, one Flashing Arrow shall be used for each lane that is closed. The Flashing Arrow shall be installed concurrently with the installation of the

traffic control pattern and its placement shall be as shown on the traffic control plan. For multiple lane closures, one Flashing Arrow is required for each lane closed. If conditions warrant, additional Flashing Arrows should be employed (i.e.: curves, major ramps, etc.).

4.b) On non-limited access roadways, the use of a Flashing Arrow for lane closures is optional. The roadway geometry, sight line distance, and traffic volume should be considered in the decision to use the Flashing Arrow.

4.c) The Flashing Arrow shall not be used on two lane, two-way roadways for temporary alternating one-way traffic operations.

4.d) The Flashing Arrow board display shall be in the "arrow" mode for lane closure tapers and in the "caution" mode (four corners) for shoulder work, blocking the shoulder, or roadside work near the shoulder. The Flashing Arrow shall be in the "caution" mode when it is positioned in the closed lane.

4.e) The Flashing Arrow shall not be used on a multi-lane roadway to laterally shift all lanes of traffic, because unnecessary lane changing may result.

SECTION 5. USE OF TRUCK MOUNTED IMPACT ATTENUATOR VEHICLES (TMAs)

5.a) For lane closures on limited access roadways, a minimum of two TMAs shall be used to install and remove traffic control patterns. If two TMAs are not available, the pattern shall not be installed.

5.b) On non-limited access roadways, the use of TMAs to install and remove patterns closing a lane(s) is optional. The roadway geometry, sight line distance, and traffic volume should be considered in the decision to utilize the TMAs.

5.c) Generally, to establish the advance and transition signing, one TMA shall be placed on the shoulder and the second TMA shall be approximately 1,000 feet ahead blocking the lane. The flashing arrow board mounted on the TMA should be in the "flashing arrow" mode when taking the lane. The sign truck and workers should be immediately ahead of the second TMA. In no case shall the TMA be used as the sign truck or a work truck. Once the transition is in place, the TMAs shall travel in the closed lane until all Changeable Message Signs, signs, Flashing Arrows, and cones/drums are installed. The flashing arrow board mounted on the TMA should be in the "caution" mode when traveling in the closed lane.

5.d) A TMA shall be placed prior to the first work area in the pattern. If there are multiple work areas within the same pattern, then additional TMAs shall be positioned at each additional work area as needed. The flashing arrow board mounted on the TMA should be in the "caution" mode when in the closed lane.

5.e) TMAs shall be positioned a sufficient distance prior to the workers or equipment being protected to allow for appropriate vehicle roll-ahead in the event that the TMA is hit, but not so far that an errant vehicle could travel around the TMA and into the work area. For additional placement and use details, refer to the specification entitled "Type 'D' Portable Impact Attenuation System". Some operations, such as paving and concrete repairs, do not allow for placement of the TMA(s) within the specified distances. In these situations, the TMA(s) should be placed at the beginning of the work area and shall be advanced as the paving or concrete operations proceed.

5.f) TMAs should be paid in accordance with how the unit is utilized. When it is used as a TMA and is in the proper location as specified, and then it should be paid at the specified hourly rate for "Type 'D' Portable Impact Attenuation System". When the TMA is used as a Flashing Arrow, it should be paid at the daily rate for "High Mounted Internally Illuminated Flashing Arrow". If a TMA is used to install and remove a pattern and then is used as a Flashing Arrow, the unit should be paid as a "Type 'D' Portable Impact Attenuation System" for the hours used to install and remove the pattern, typically 2 hours (1 hour to install and 1 hour to remove), and is also paid for the day as a "High Mounted Internally Illuminated Flashing Arrow".

SECTION 6. USE OF TRAFFIC DRUMS AND TRAFFIC CONES

6.a) Traffic drums shall be used for taper channelization on limited-access roadways, ramps, and turning roadways and to delineate raised catch basins and other hazards.

6.b) Traffic drums shall be used in place of traffic cones in traffic control patterns that are in effect for more than a 36-hour duration.

6.c) Traffic Cones less than 42 inches in height shall not be used on limited-access roadways or on non-limited access roadways with a posted speed limit of 45 mph and above.

6.d) Typical spacing of traffic drums and/or cones shown on the Traffic Control Plans in the Contract are maximum spacings and may be reduced to meet actual field conditions as required.

SECTION 7. USE OF (REMOTE CONTROLLED) CHANGEABLE MESSAGE SIGNS (CMS)

7.a) For lane closures on limited access roadways, one CMS shall be used in advance of the traffic control pattern. Prior to installing the pattern, the CMS shall be installed and in operation, displaying the appropriate lane closure information (i.e.: Left Lane Closed - Merge Right). The CMS shall be positioned ½ - 1 mile ahead of the lane closure taper. If the nearest Exit ramp is greater than the specified ½ - 1 mile distance, than an additional CMS shall be positioned a sufficient distance ahead of the Exit ramp to alert motorists to the work and therefore offer them an opportunity to take the exit.

7.b) CMS should not be installed within 1000 feet of an existing CMS.

7.c) On non-limited access roadways, the use of CMS for lane closures is optional. The roadway geometry, sight line distance, and traffic volume should be considered in the decision to use the CMS.

7.d) The advance CMS is typically placed off the right shoulder, 5 feet from the edge of pavement. In areas where the CMS cannot be placed beyond the edge of pavement, it may be placed on the paved shoulder with a minimum of five (5) traffic drums placed in a taper in front of it to delineate its position. The advance CMS shall be adequately protected if it is used for a continuous duration of 36 hours or more.

7.e) When the CMS are no longer required, they should be removed from the clear zone and have the display screen cleared and turned 90° away from the roadway.

7.f) The CMS generally should not be used for generic messages (ex: Road Work Ahead, Bump Ahead, Gravel Road, etc.).

7.g) The CMS should be used for specific situations that need to command the motorist's attention which cannot be conveyed with standard construction signs (Examples include: Exit 34 Closed Sat/Sun - Use Exit 35, All Lanes Closed - Use Shoulder, Workers on Road - Slow Down).

7.h) Messages that need to be displayed for long periods of time, such as during stage construction, should be displayed with construction signs. For special signs, please coordinate with the Office of Construction and the Division of Traffic Engineering for the proper layout/dimensions required.

7.i) The messages that are allowed on the CMS are as follows:

Message No.	Frame 1	Frame 2	Message No.	Frame 1	Frame 2
1	LEFT LANE CLOSED	MERGE RIGHT	9	LANES CLOSED AHEAD	REDUCE SPEED
2	2 LEFT LANES CLOSED	MERGE RIGHT	10	LANES CLOSED AHEAD	USE CAUTION
3	LEFT LANE CLOSED	REDUCE SPEED	11	WORKERS ON ROAD	REDUCE SPEED
4	2 LEFT LANES CLOSED	REDUCE SPEED	12	WORKERS ON ROAD	SLOW DOWN
5	RIGHT LANE CLOSED	MERGE LEFT	13	EXIT XX CLOSED	USE EXIT YY
6	2 RIGHT LANES CLOSED	MERGE LEFT	14	EXIT XX CLOSED USE YY	FOLLOW DETOUR
7	RIGHT LANE CLOSED	REDUCE SPEED	15	2 LANES SHIFT AHEAD	USE CAUTION
8	2 RIGHT LANES CLOSED	REDUCE SPEED	16	3 LANES SHIFT AHEAD	USE CAUTION

For any other message(s), approval must be received from the Office of Construction prior to their use. No more than two (2) displays shall be used within any message cycle.

SECTION 8. USE OF STATE POLICE OFFICERS

8.a) State Police may be utilized only on limited access highways and secondary roadways under their primary jurisdiction. One Officer may be used per critical sign pattern. Shoulder closures and right lane closures can generally be implemented without the presence of a State Police Officer. Likewise in areas with moderate traffic and wide, unobstructed medians, left lane closures can be implemented without State Police presence. Under some situations it may be desirable to have State Police presence, when one is available. Examples of this include: nighttime lane closures; left lane closures with minimal width for setting up advance signs and staging; lane and shoulder closures on turning roadways/ramps or mainline where sight distance is minimal; and closures where extensive turning movements or traffic congestion regularly occur, however they are not required.

8.b) Once the pattern is in place, the State Police Officer should be positioned in a non-hazardous location in advance of the pattern If traffic backs up beyond the beginning of the pattern, then the State Police Officer shall be repositioned prior to the backup to give warning to the oncoming motorists. The State Police Officer and TMA should not be in proximity to each other.

8.c) Other functions of the State Police Officer(s) may include:

- Assisting entering/exiting construction vehicles within the work area.
- Enforcement of speed and other motor vehicle laws within the work area, if specifically requested by the project.

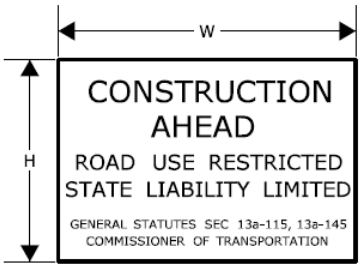
8.d) State Police Officers assigned to a work site are to only take direction from the Engineer.

Article 9.71.05 – Basis of Payment is supplemented by the following:

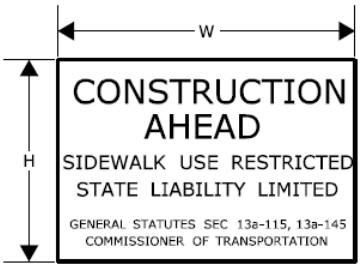
The temporary relocation of signs and supports, and the furnishing, installation and removal of any temporary supports shall be paid for under the item “Maintenance and Protection of Traffic”. Temporary overhead sign supports and foundations shall be paid for under the appropriate item(s).

The cost of furnishing, installing, and removing the material for the 4H:1V traversable slope shall be paid for under the item “Maintenance and Protection of Traffic.”

SERIES 16 SIGNS



		W H
16-E	80-1605	84" x 60"
16-H	80-1608	60" x 42"
16-M	80-1613	30" x 24"



		W H
16-S	80-1619	48" x 30"

THE 16-S SIGN SHALL BE USED ON ALL PROJECTS THAT REQUIRE SIDEWALK RECONSTRUCTION OR RESTRICT PEDESTRIAN TRAVEL ON AN EXISTING SIDEWALK.

SERIES 16 SIGNS SHALL BE INSTALLED IN ADVANCE OF THE TRAFFIC CONTROL PATTERNS TO ALLOW MOTORISTS THE OPPORTUNITY TO AVOID A WORK ZONE. SERIES 16 SIGNS SHALL BE INSTALLED ON ANY MAJOR INTERSECTING ROADWAYS THAT APPROACH THE WORK ZONE. ON LIMITED-ACCESS HIGHWAYS, THESE SIGNS SHALL BE LOCATED IN ADVANCE OF THE NEAREST UPSTREAM EXIT RAMP AND ON ANY ENTRANCE RAMPS PRIOR TO OR WITHIN THE WORK ZONE LIMITS.

THE LOCATION OF SERIES 16 SIGNS CAN BE FOUND ELSEWHERE IN THE PLANS OR INSTALLED AS DIRECTED BY THE ENGINEER.

SIGNS 16-E AND 16-H SHALL BE POST-MOUNTED.

SIGN 16-E SHALL BE USED ON ALL EXPRESSWAYS.

SIGN 16-H SHALL BE USED ON ALL RAMPS, OTHER STATE ROADWAYS, AND MAJOR TOWN/CITY ROADWAYS.

SIGN 16-M SHALL BE USED ON OTHER TOWN ROADWAYS.

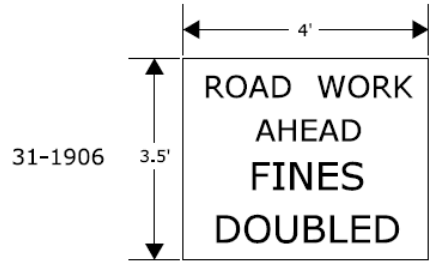
REGULATORY SIGN "ROAD WORK AHEAD, FINES DOUBLED"

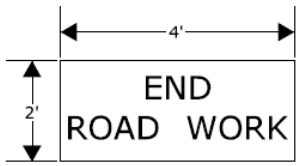
THE REGULATORY SIGN "ROAD WORK AHEAD FINES DOUBLED" SHALL BE INSTALLED FOR ALL WORK ZONES THAT OCCUR ON ANY STATE HIGHWAY IN CONNECTICUT WHERE THERE ARE WORKERS ON THE HIGHWAY OR WHEN THERE IS OTHER THAN EXISTING TRAFFIC OPERATIONS.

THE "ROAD WORK AHEAD FINES DOUBLED" REGULATORY SIGN SHALL BE PLACED AFTER THE SERIES 16 SIGN AND IN ADVANCE OF THE "ROAD WORK AHEAD" SIGN.

"END ROAD WORK" SIGN

THE LAST SIGN IN THE PATTERN MUST BE THE "END ROAD WORK" SIGN.





SCALE: NONE

CONSTRUCTION TRAFFIC CONTROL PLAN
REQUIRED SIGNS

CONNECTICUT DEPARTMENT OF TRANSPORTATION
BUREAU OF ENGINEERING & CONSTRUCTION

APPROVED Charles S. Harlow 2012.06.05 11:35:43-04'00'
PRINCIPAL ENGINEER

NOTES FOR TRAFFIC CONTROL PLANS

1. IF A TRAFFIC STOPPAGE OCCURS IN ADVANCE OF SIGN (A), THEN AN ADDITIONAL SIGN (A) SHALL BE INSTALLED IN ADVANCE OF THE STOPPAGE.

2. SIGNS (AA), (A), AND (D) SHOULD BE OMITTED WHEN THESE SIGNS HAVE ALREADY BEEN INSTALLED TO DESIGNATE A LARGER WORK ZONE THAN THE WORK ZONE THAT IS ENCOMPASSED ON THIS PLAN.

3. SEE TABLE 1 FOR ADJUSTMENT OF TAPERS IF NECESSARY.

4. IF THIS PLAN REMAINS IN CONTINUOUS OPERATION FOR MORE THAN 36 HOURS, THEN TRAFFIC DRUMS SHALL BE USED IN PLACE OF TRAFFIC CONES.

5. ANY LEGAL SPEED LIMIT SIGNS WITHIN THE LIMITS OF A ROADWAY / LANE CLOSURE AREA SHALL BE COVERED WITH AN OPAQUE MATERIAL WHILE THE CLOSURE IS IN EFFECT, AND UNCOVERED WHEN THE ROADWAY / LANE CLOSURE IS RE-OPENED TO ALL LANES OF TRAFFIC.

6. IF THIS PLAN REMAINS IN CONTINUOUS OPERATION FOR MORE THAN 36 HOURS, THEN ANY EXISTING CONFLICTING PAVEMENT MARKINGS SHALL BE ERADICATED OR COVERED, AND TEMPORARY PAVEMENT MARKINGS THAT DELINEATE THE PROPER TRAVELPATHS SHALL BE INSTALLED.

7. DISTANCES BETWEEN SIGNS IN THE ADVANCE WARNING AREA MAY BE REDUCED TO 100' ON LOW-SPEED URBAN ROADS (SPEED LIMIT < 40 MPH).

8. IF THIS PLAN IS TO REMAIN IN OPERATION DURING THE HOURS OF DARKNESS, INSTALL BARRICADE WARNING LIGHTS - HIGH INTENSITY ON ALL POST-MOUNTED DIAMOND SIGNS IN THE ADVANCE WARNING AREA.

9. A CHANGEABLE MESSAGE SIGN SHALL BE INSTALLED ONE HALF TO ONE MILE IN ADVANCE OF THE LANE CLOSURE TAPER.

10 SIGN (P) SHALL BE MOUNTED A MINIMUM OF 7 FEET FROM THE PAVEMENT SURFACE TO THE BOTTOM OF THE SIGN.

TABLE 1 - MINIMUM TAPER LENGTHS

POSTED SPEED LIMIT (MILES PER HOUR)	MINIMUM TAPER LENGTH FOR A SINGLE LANE CLOSURE
30 OR LESS	180' (55m)
35	250' (75m)
40	320' (100m)
45	540' (165m)
50	600' (180m)
55	660' (200m)
65	780' (240m)

METRIC CONVERSION CHART (1" = 25mm)

ENGLISH	METRIC	ENGLISH	METRIC	ENGLISH	METRIC
12"	300mm	42"	1050mm	72"	1800mm
18"	450mm	48"	1200mm	78"	1950mm
24"	600mm	54"	1350mm	84"	2100mm
30"	750mm	60"	1500mm	90"	2250mm
36"	900mm	66"	1650mm	96"	2400mm

SCALE: NONE

CONSTRUCTION TRAFFIC CONTROL PLAN

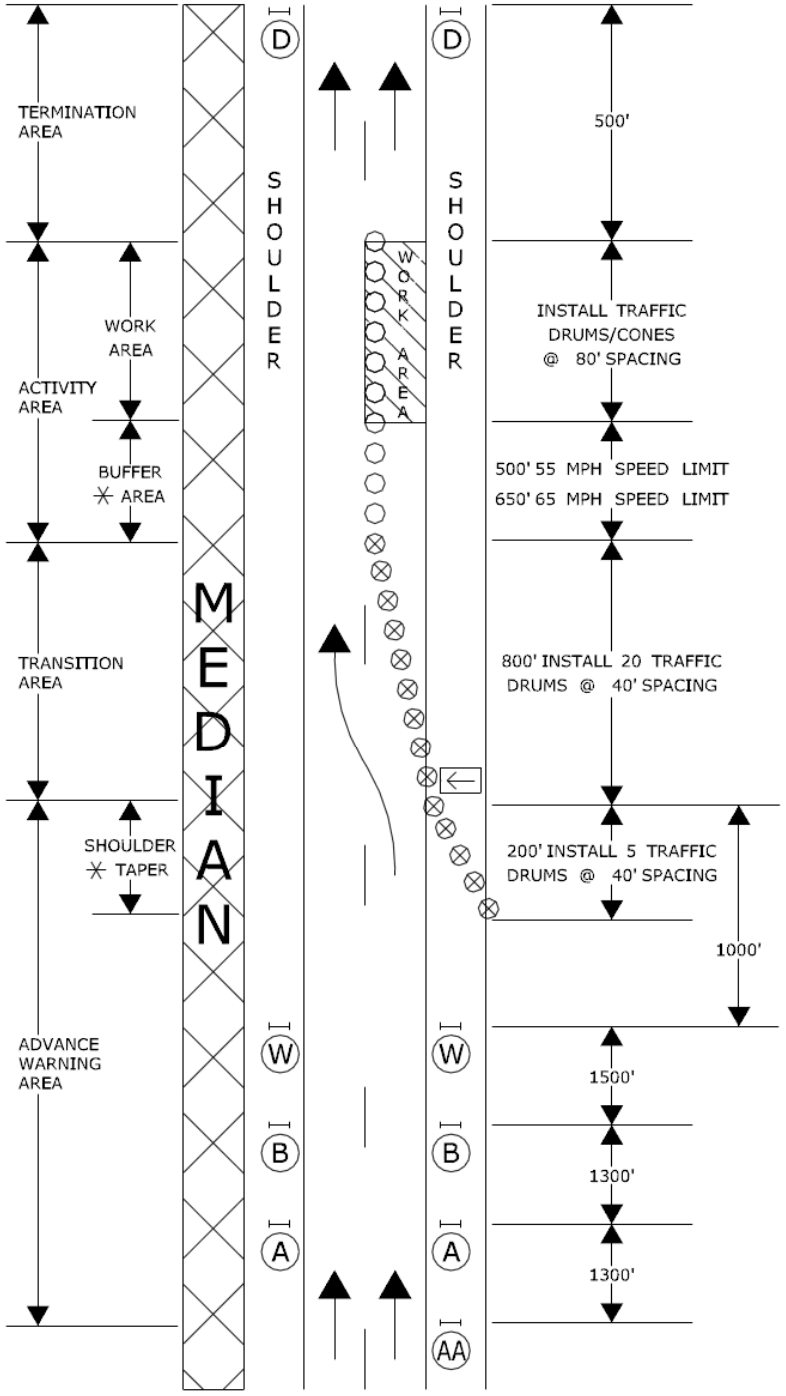
NOTES

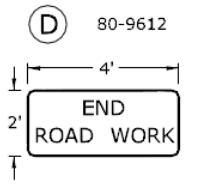
CONNECTICUT DEPARTMENT OF TRANSPORTATION
BUREAU OF ENGINEERING & CONSTRUCTION

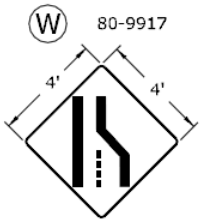
APPROVED Charles S. Harlow 2012.06.05 15:50:35-04'00'
PRINCIPAL ENGINEER

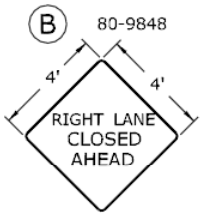
WORK IN RIGHT LANE - MULTILANE HIGHWAY

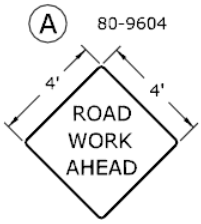
SIGN FACE
126 SQ. FT (MIN.)

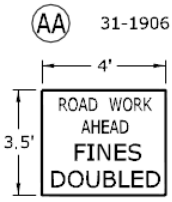












TRAFFIC CONE **OR** TRAFFIC DRUM
OPTIONAL TRAFFIC DRUM PORTABLE SIGN SUPPORT
HIGH MOUNTED INTERNALLY ILLUMINATED FLASHING ARROW

SCALE: NONE

CONSTRUCTION TRAFFIC CONTROL PLAN

PLAN 1

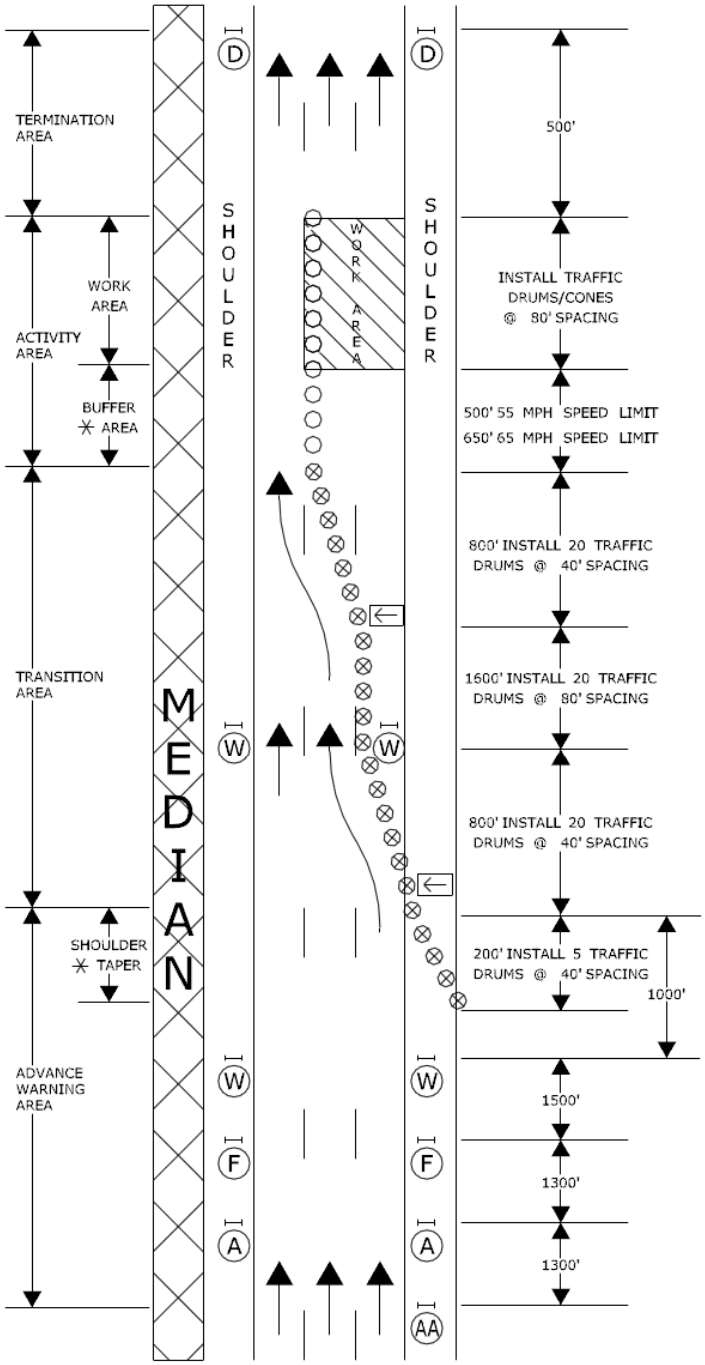
SEE NOTES 1, 2, 3, 4, 5, 6, 8, 9

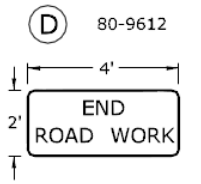
CONNECTICUT DEPARTMENT OF TRANSPORTATION
BUREAU OF ENGINEERING & CONSTRUCTION

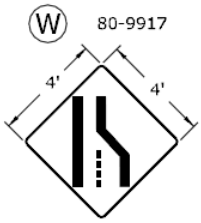
APPROVED Charles S. Harlow 2012.06.05 15:51:00-04'00'
PRINCIPAL ENGINEER

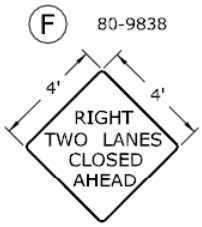
WORK IN RIGHT TWO LANES - MULTILANE HIGHWAY

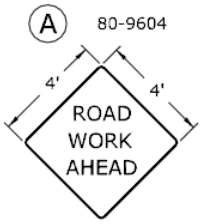
SIGN FACE
158 SQ. FT (MIN.)

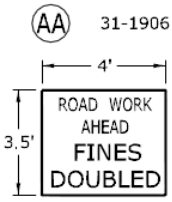












TRAFFIC CONE **OR** TRAFFIC DRUM
OPTIONAL TRAFFIC DRUM PORTABLE SIGN SUPPORT
HIGH MOUNTED INTERNALLY ILLUMINATED FLASHING ARROW

SCALE: NONE

CONSTRUCTION TRAFFIC CONTROL PLAN

PLAN 2

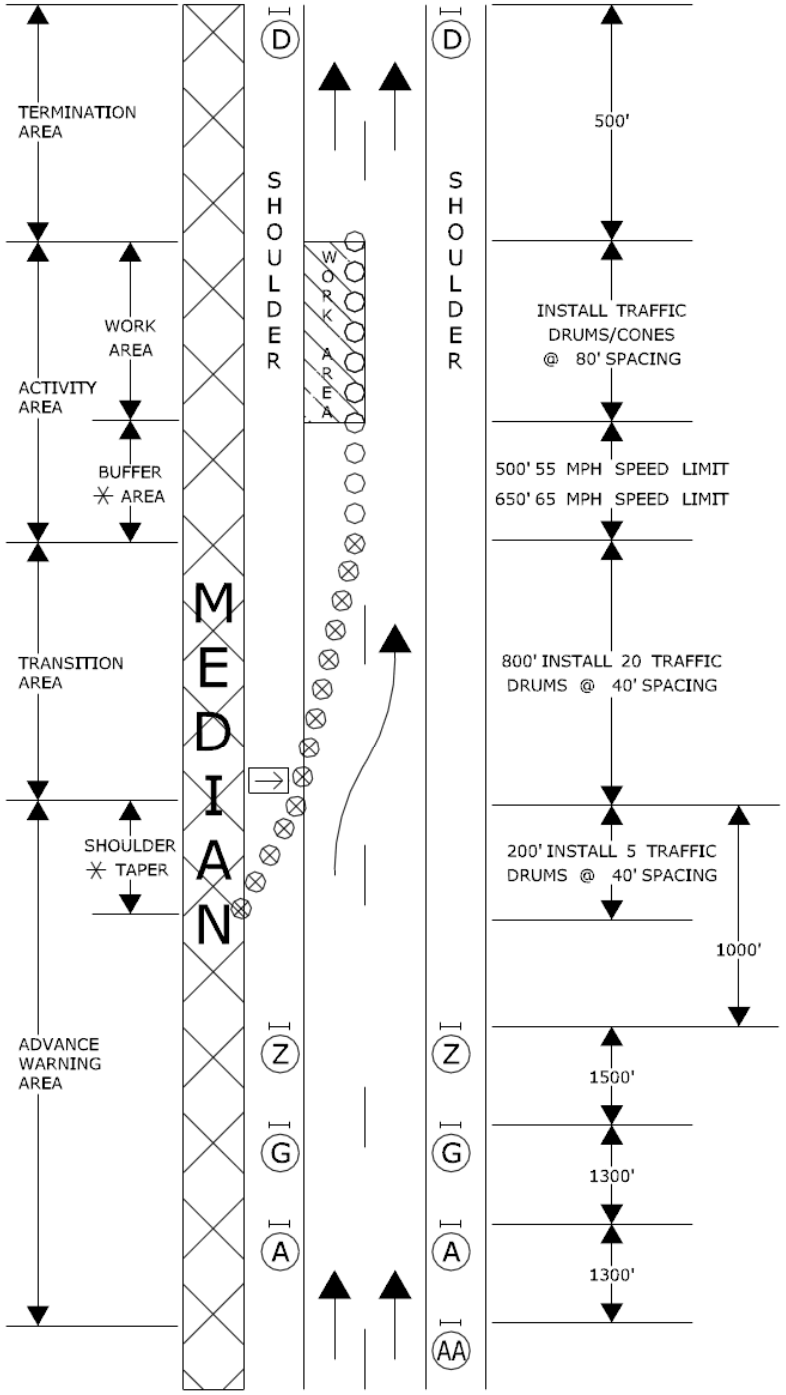
SEE NOTES 1, 2, 3, 4, 5, 6, 8, 9

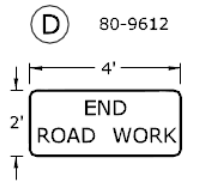
CONNECTICUT DEPARTMENT OF TRANSPORTATION
BUREAU OF ENGINEERING & CONSTRUCTION

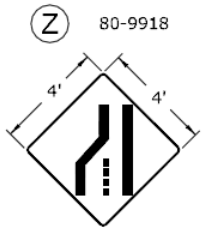
APPROVED Charles S. Harlow 2012.06.05 15:51:23-04'00'
PRINCIPAL ENGINEER

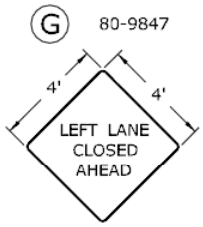
WORK IN LEFT LANE - MULTILANE HIGHWAY

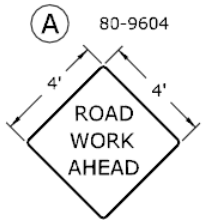
SIGN FACE
126 SQ. FT (MIN.)

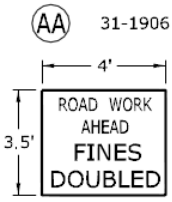












TRAFFIC CONE **OR** TRAFFIC DRUM
OPTIONAL TRAFFIC DRUM PORTABLE SIGN SUPPORT
HIGH MOUNTED INTERNALLY ILLUMINATED FLASHING ARROW

SCALE: NONE

CONSTRUCTION TRAFFIC CONTROL PLAN

PLAN 3

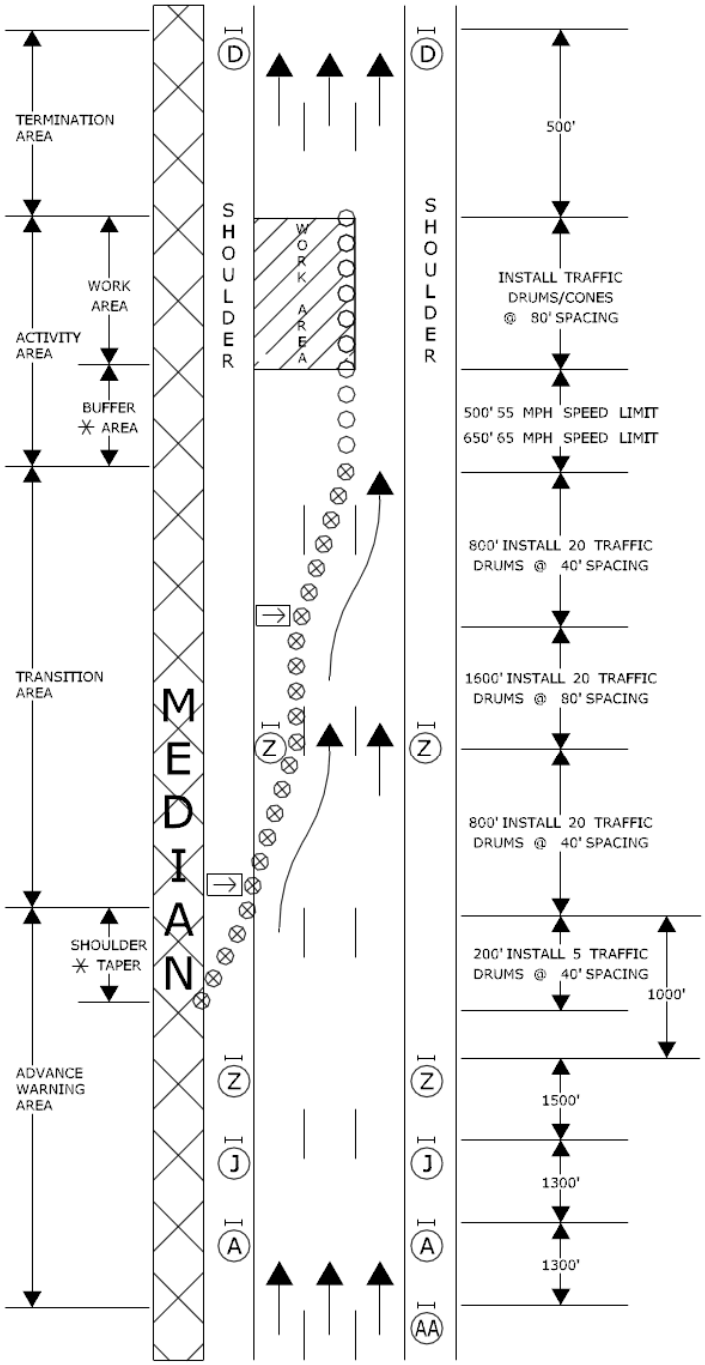
SEE NOTES 1, 2, 3, 4, 5, 6, 8, 9

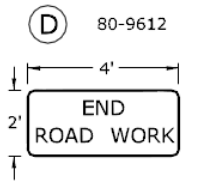
CONNECTICUT DEPARTMENT OF TRANSPORTATION
BUREAU OF ENGINEERING & CONSTRUCTION

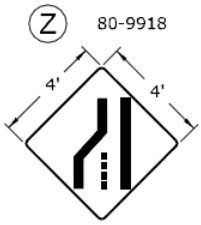
APPROVED Charles S. Harlow 2012.06.05 15:51:46-04'00'
PRINCIPAL ENGINEER

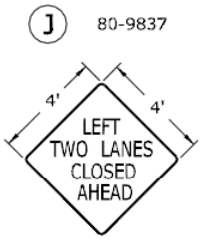
WORK IN LEFT TWO LANES - MULTILANE HIGHWAY

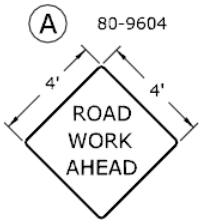
SIGN FACE
158 SQ. FT (MIN.)

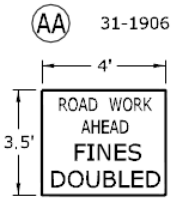












TRAFFIC CONE **OR** TRAFFIC DRUM
OPTIONAL TRAFFIC DRUM PORTABLE SIGN SUPPORT
HIGH MOUNTED INTERNALLY ILLUMINATED FLASHING ARROW

SCALE: NONE

CONSTRUCTION TRAFFIC CONTROL PLAN

PLAN 4

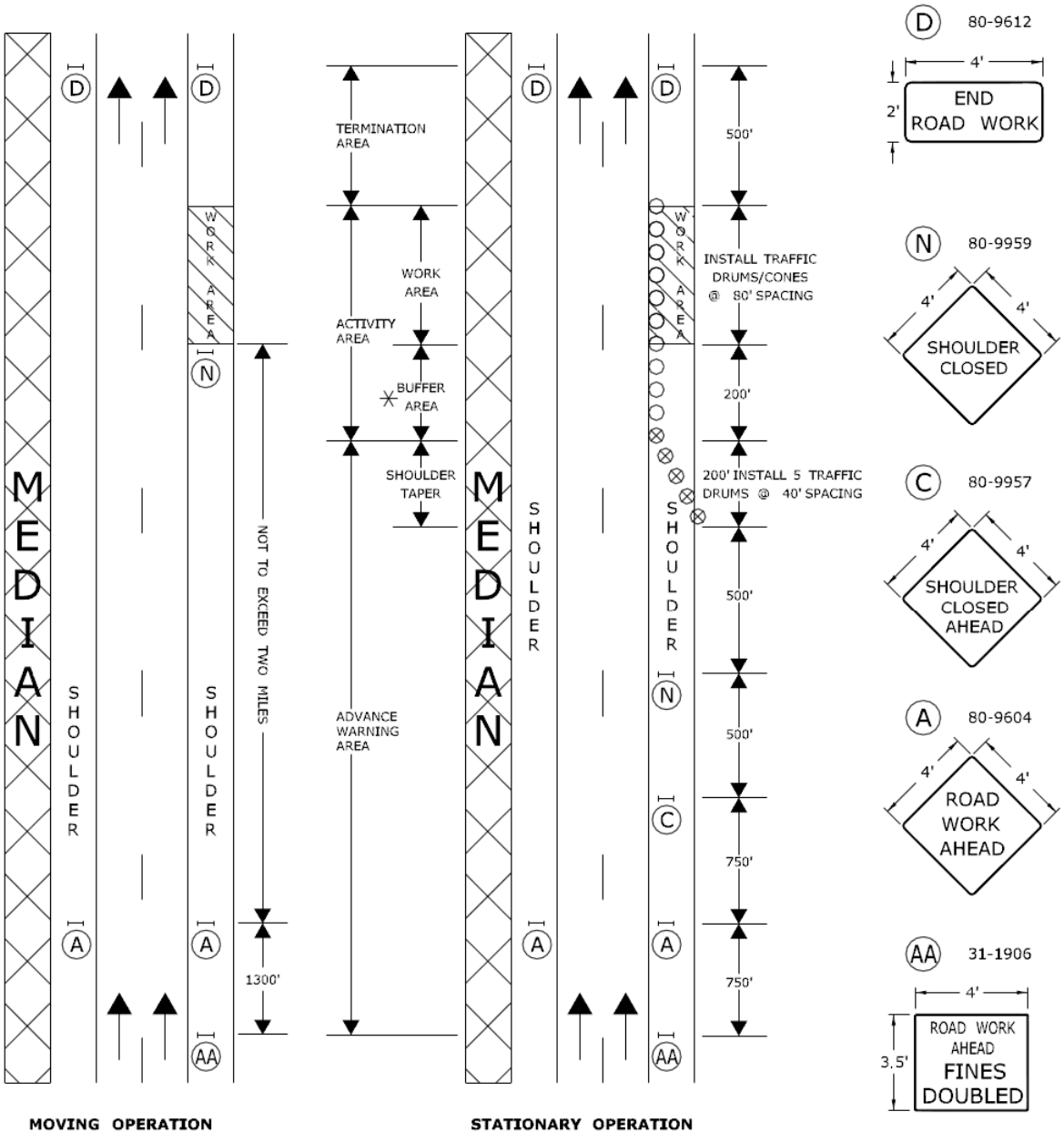
SEE NOTES 1, 2, 3, 4, 5, 6, 8, 9

CONNECTICUT DEPARTMENT OF TRANSPORTATION
BUREAU OF ENGINEERING & CONSTRUCTION

APPROVED Charles S. Harlow 2012.06.05 15:52:10-04'00'
PRINCIPAL ENGINEER

WORK IN SHOULDER AREA - MULTILANE HIGHWAY

SIGN FACE
94 SQ. FT (MIN.)



MOVING OPERATION **STATIONARY OPERATION**

TRAFFIC CONE **OR** TRAFFIC DRUM
OPTIONAL TRAFFIC DRUM PORTABLE SIGN SUPPORT
HIGH MOUNTED INTERNALLY ILLUMINATED FLASHING ARROW

SCALE: NONE

CONSTRUCTION TRAFFIC CONTROL PLAN

PLAN 6

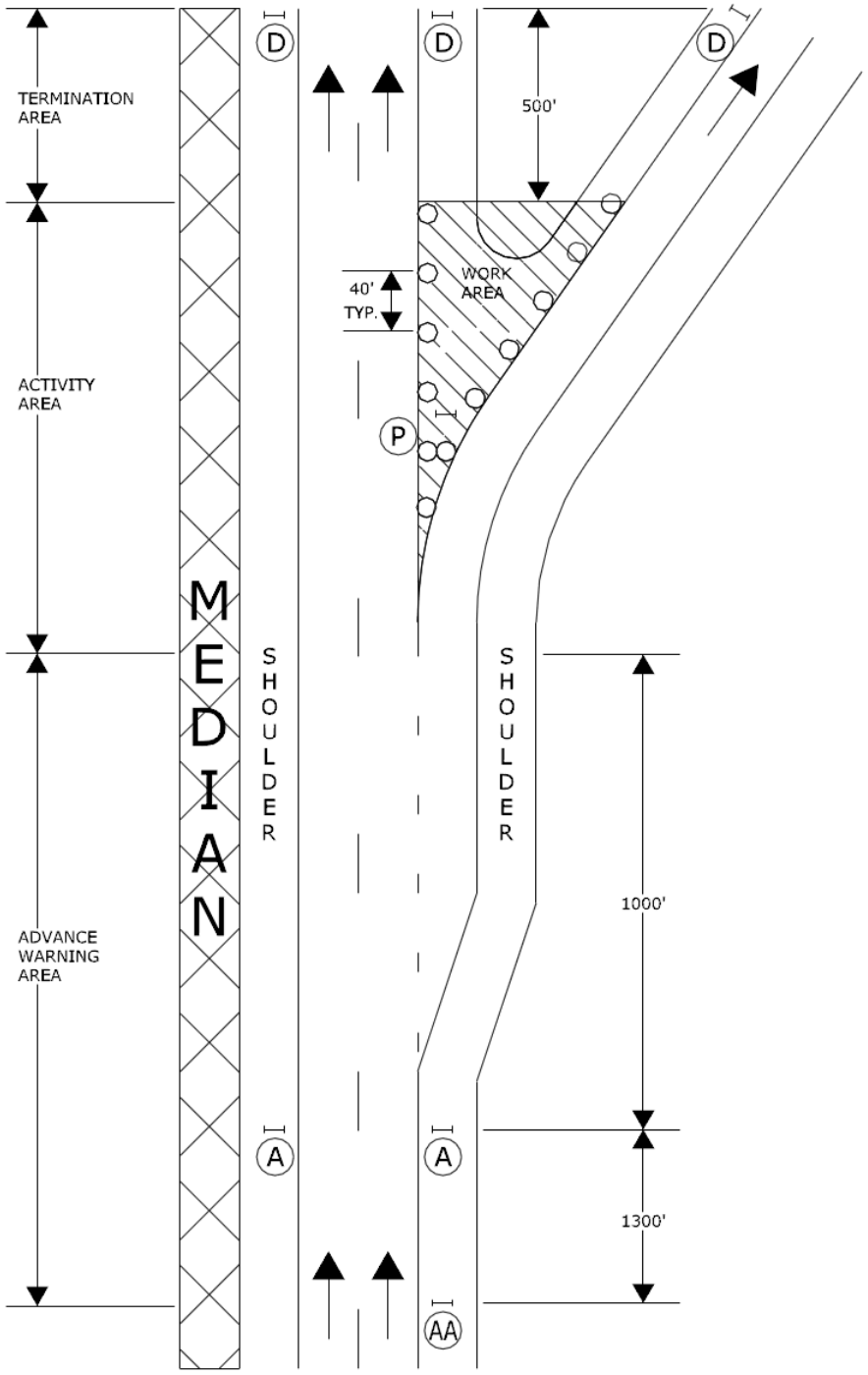
SEE NOTES 1, 2, 4, 8

CONNECTICUT DEPARTMENT OF TRANSPORTATION
BUREAU OF ENGINEERING & CONSTRUCTION

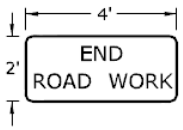
APPROVED Charles S. Harlow 2012.06.05 15:52:38-04'00'
PRINCIPAL ENGINEER

WORK IN RAMP GORE AREA

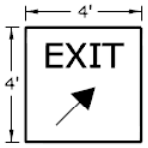
SIGN FACE
86 SQ. FT (MIN.)



D 80-9612

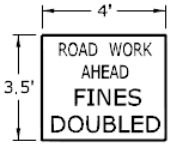


P 51-6147



A 80-9604

AA 31-1906



TRAFFIC CONE **OR** TRAFFIC DRUM
OPTIONAL TRAFFIC DRUM PORTABLE SIGN SUPPORT
HIGH MOUNTED INTERNALLY ILLUMINATED FLASHING ARROW

SCALE: NONE

CONSTRUCTION TRAFFIC CONTROL PLAN

PLAN 7

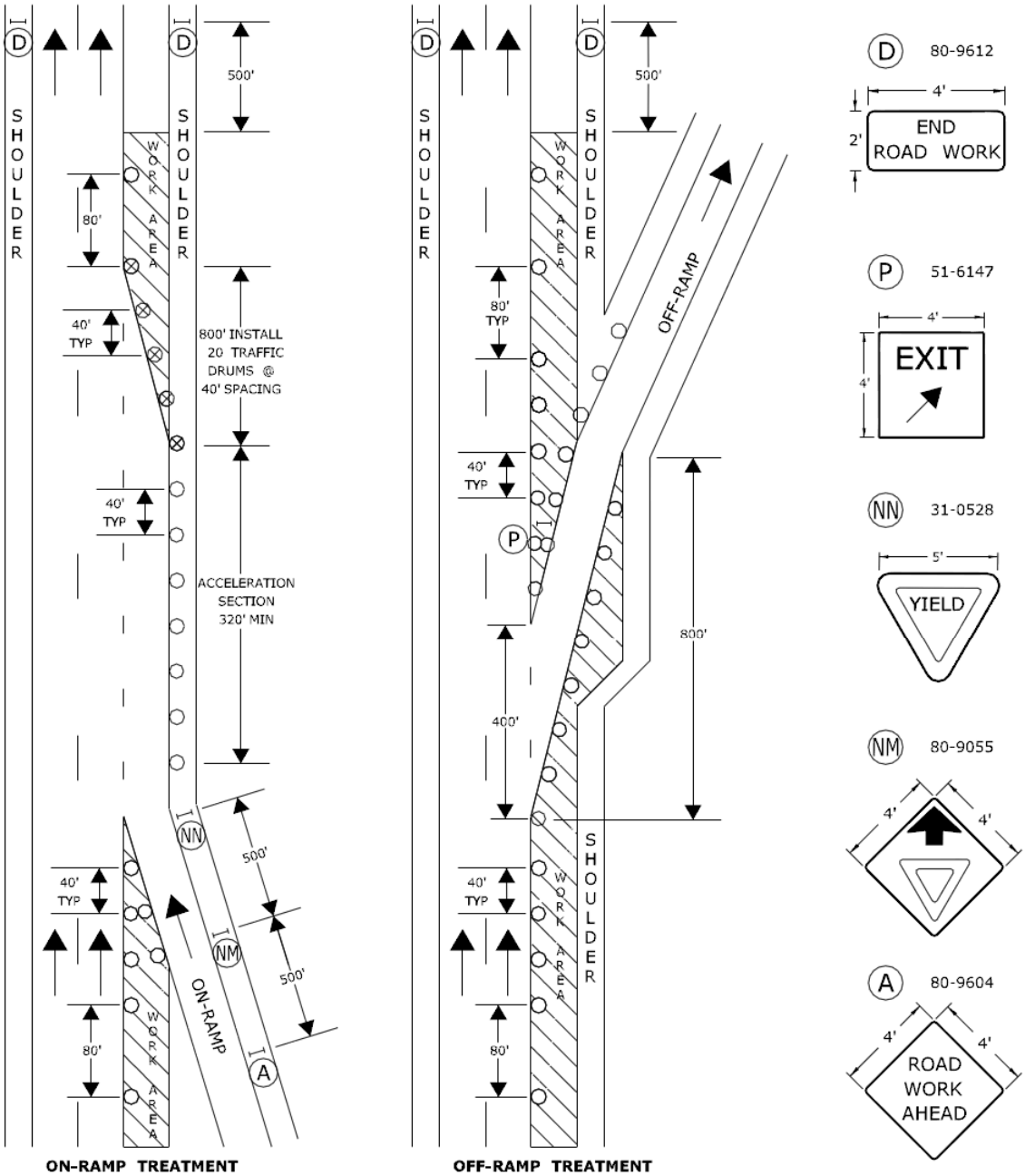
SEE NOTES 1, 2, 4, 8, 10

CONNECTICUT DEPARTMENT OF TRANSPORTATION
BUREAU OF ENGINEERING & CONSTRUCTION

APPROVED Charles S. Harlow 2012.06.05 15:53:03-04'00'
PRINCIPAL ENGINEER

TYPICAL RAMP TREATMENTS FOR MAINLINE LANE CLOSURE - MULTILANE HIGHWAY

SIGN FACE
SQ. FT VARIES



ON-RAMP TREATMENT **OFF-RAMP TREATMENT**

USE TRAFFIC CONTROL PLAN 1 TO CLOSE THE RIGHT LANE

TRAFFIC CONE **OR** TRAFFIC DRUM
OPTIONAL TRAFFIC DRUM PORTABLE SIGN SUPPORT
HIGH MOUNTED INTERNALLY ILLUMINATED FLASHING ARROW

SCALE: NONE

CONSTRUCTION TRAFFIC CONTROL PLAN

PLAN 8

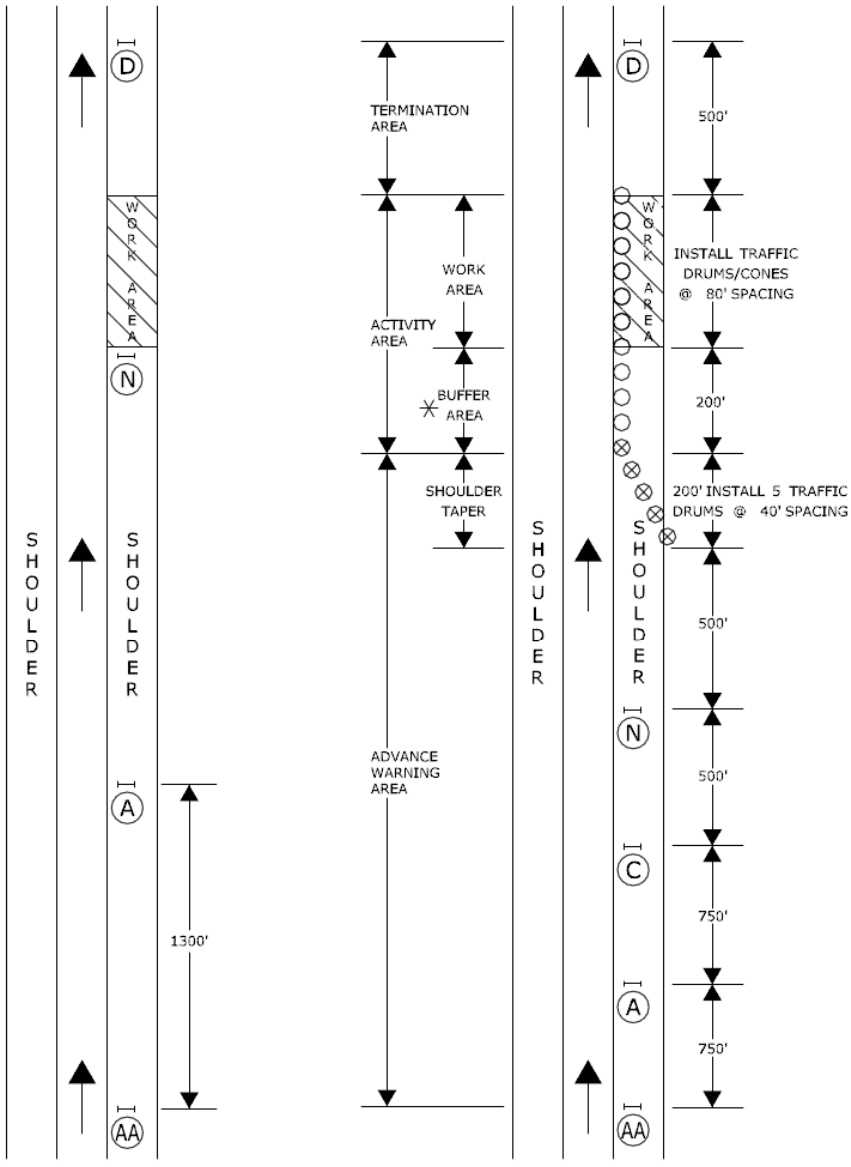
SEE NOTES 1, 2, 3, 4, 5, 6, 8, 9, 10

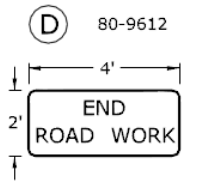
CONNECTICUT DEPARTMENT OF TRANSPORTATION
BUREAU OF ENGINEERING & CONSTRUCTION

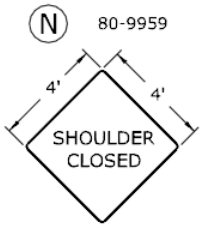
APPROVED Charles S. Harlow 2012.06.05 15:53:31-04'00'
PRINCIPAL ENGINEER

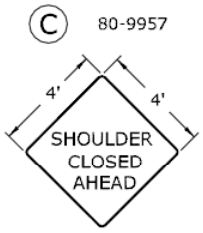
WORK IN SHOULDER AREA - TURNING ROADWAYS / RAMPS

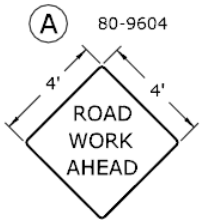
SIGN FACE
70 SQ. FT (MIN.)

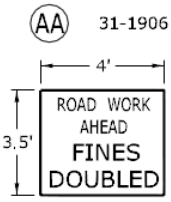












TRAFFIC CONE **OR** TRAFFIC DRUM
OPTIONAL TRAFFIC DRUM PORTABLE SIGN SUPPORT
HIGH MOUNTED INTERNALLY ILLUMINATED FLASHING ARROW

SCALE: NONE

CONSTRUCTION TRAFFIC CONTROL PLAN

PLAN 9

SEE NOTES 1, 2, 4, 8

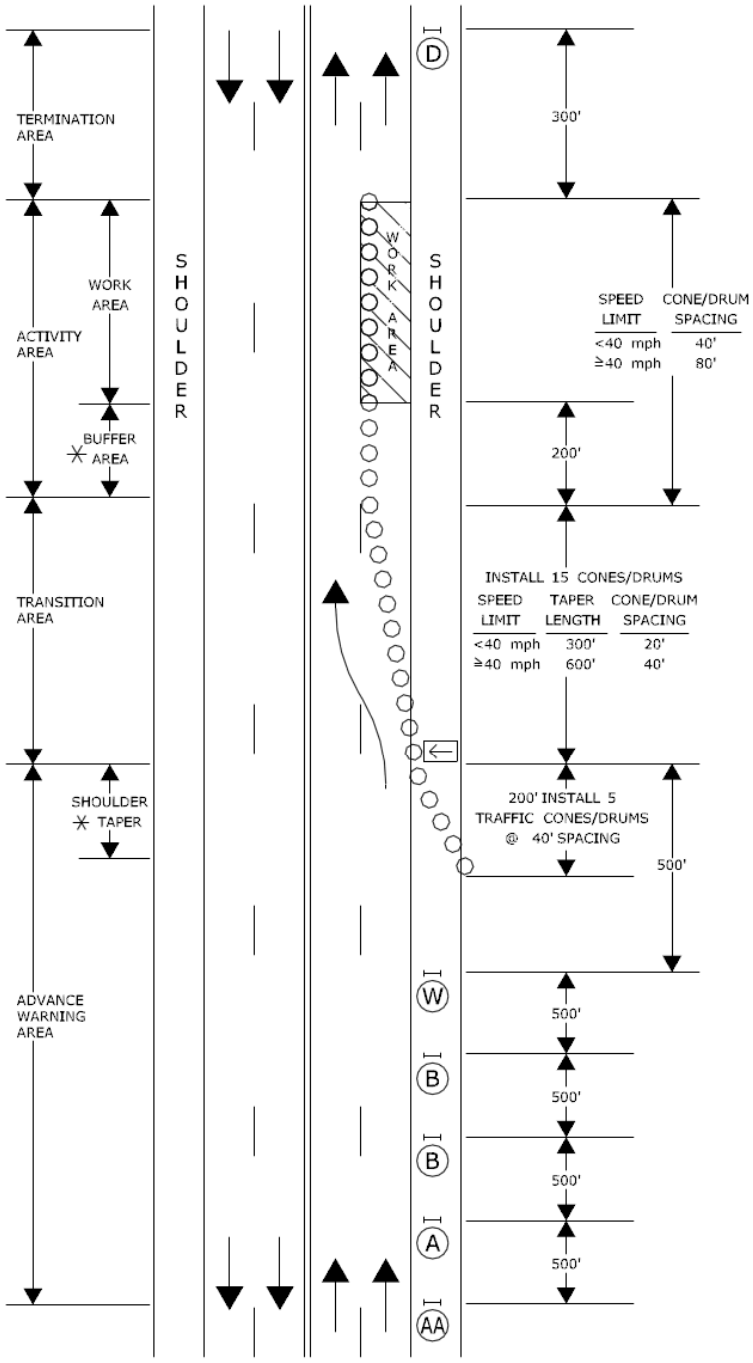
CONNECTICUT DEPARTMENT OF TRANSPORTATION
BUREAU OF ENGINEERING & CONSTRUCTION

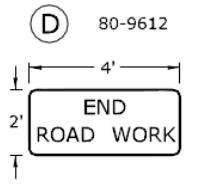
APPROVED _____ PRINCIPAL ENGINEER

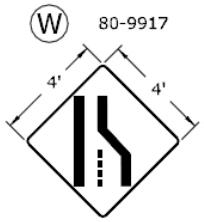
Charles S. Harlow
2012.06.05 15:53:53-04'00'

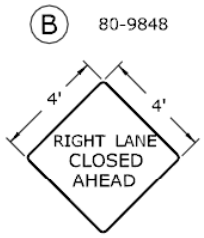
WORK IN RIGHT LANE - 4 LANE UNDIVIDED HIGHWAY

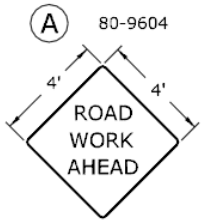
SIGN FACE
86 SQ. FT (MIN.)

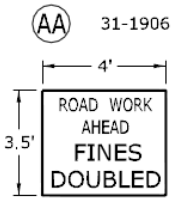












TRAFFIC CONE **OR** TRAFFIC DRUM
OPTIONAL TRAFFIC DRUM PORTABLE SIGN SUPPORT
HIGH MOUNTED INTERNALLY ILLUMINATED FLASHING ARROW

SCALE: NONE

CONSTRUCTION TRAFFIC CONTROL PLAN

PLAN 10

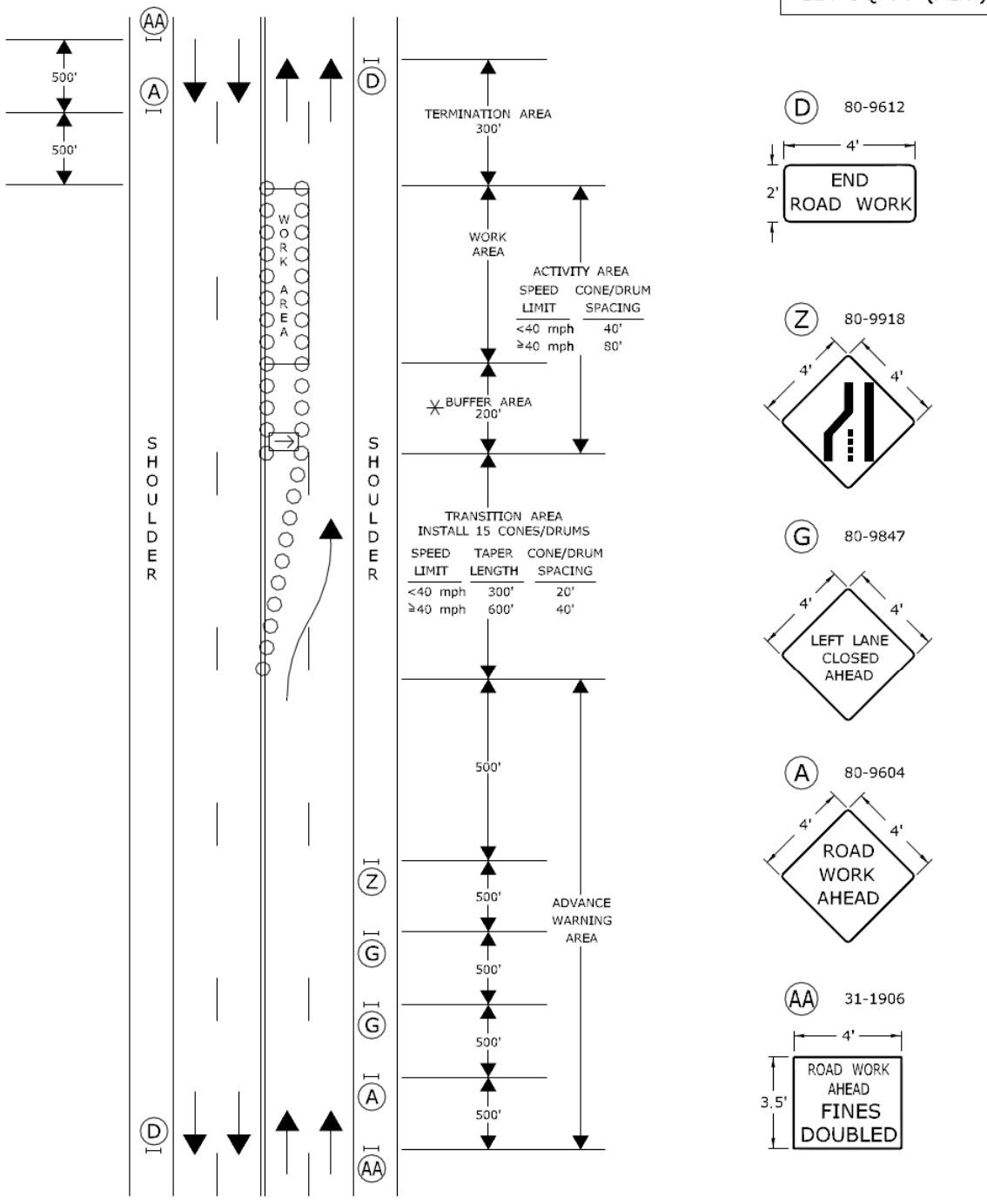
SEE NOTES 1, 2, 3, 4, 5, 6, 7, 8

CONNECTICUT DEPARTMENT OF TRANSPORTATION
BUREAU OF ENGINEERING & CONSTRUCTION

APPROVED Charles S. Harlow 2012.06.05 15:54:15-04'00'
PRINCIPAL ENGINEER

WORK IN LEFT LANE - 4 LANE UNDIVIDED HIGHWAY

SIGN FACE
124 SQ. FT (MIN.)



TRAFFIC CONE **OR** TRAFFIC DRUM
OPTIONAL TRAFFIC DRUM PORTABLE SIGN SUPPORT
HIGH MOUNTED INTERNALLY ILLUMINATED FLASHING ARROW

SCALE: NONE

CONSTRUCTION TRAFFIC CONTROL PLAN

PLAN 11

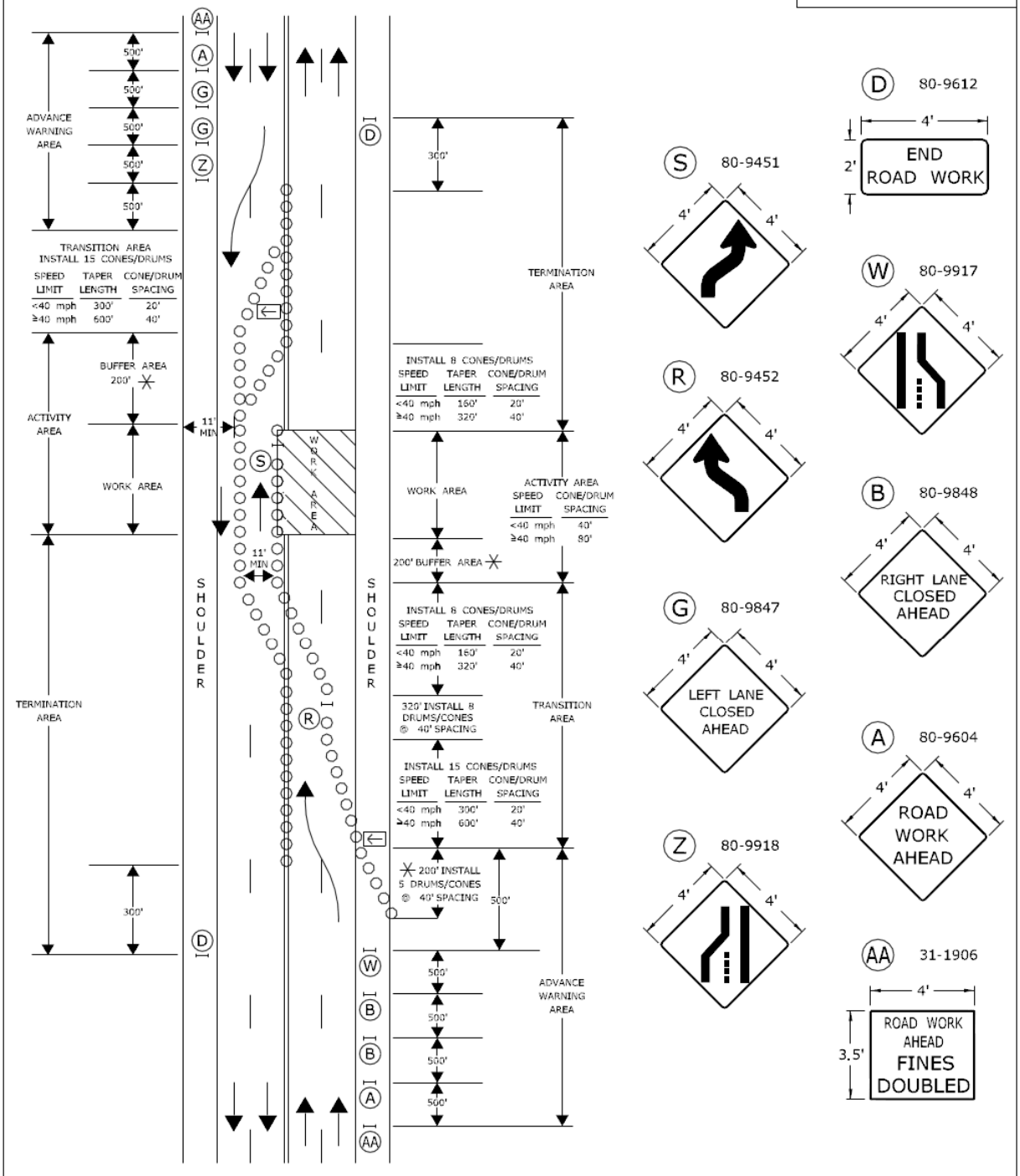
SEE NOTES 1, 2, 3, 4, 5, 6, 7, 8

CONNECTICUT DEPARTMENT OF TRANSPORTATION
BUREAU OF ENGINEERING & CONSTRUCTION

APPROVED _____ Charles S. Harlow 2012.06.05 15:54:36-04'00'
PRINCIPAL ENGINEER

WORK IN BOTH LANES - 4 LANE UNDIVIDED HIGHWAY

SIGN FACE
204 SQ. FT (MIN.)



◯ TRAFFIC CONE **OR** TRAFFIC DRUM
✳ OPTIONAL ⊗ TRAFFIC DRUM ⊢ PORTABLE SIGN SUPPORT
HIGH MOUNTED INTERNALLY ILLUMINATED FLASHING ARROW

SCALE: NONE

CONSTRUCTION TRAFFIC CONTROL PLAN

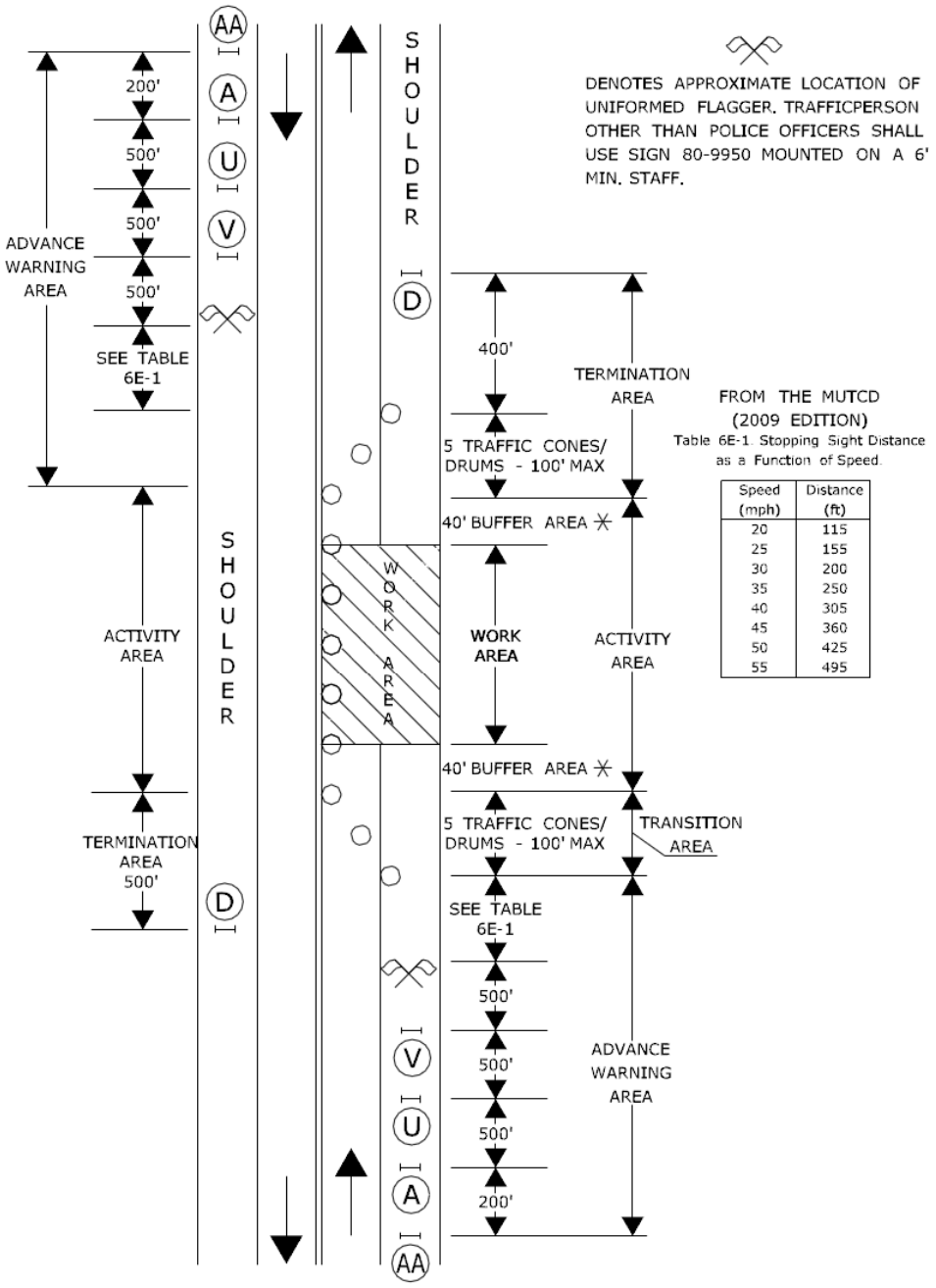
PLAN 12

SEE NOTES 1, 2, 3, 4, 5, 6, 7, 8

CONNECTICUT DEPARTMENT OF TRANSPORTATION
BUREAU OF ENGINEERING & CONSTRUCTION

APPROVED Charles S. Harlow 2012.06.05 15:55:01-04'00'
PRINCIPAL ENGINEER

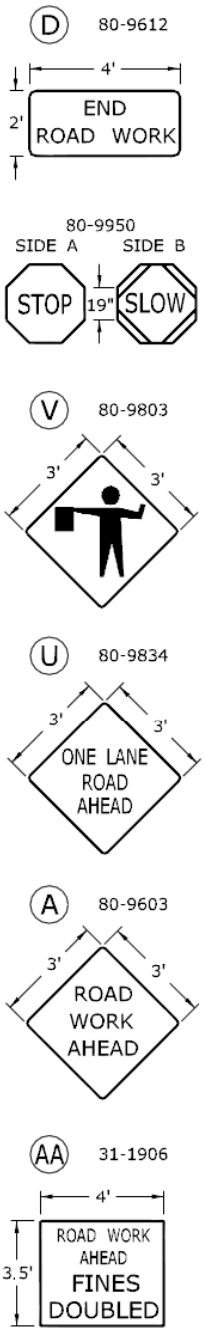
WORK IN TRAVEL LANE AND SHOULDER
TWO LANE HIGHWAY
ALTERNATING ONE-WAY TRAFFIC OPERATIONS



FROM THE MUTCD (2009 EDITION)
Table 6E-1 Stopping Sight Distance as a Function of Speed

Speed (mph)	Distance (ft)
20	115
25	155
30	200
35	250
40	305
45	360
50	425
55	495

SIGN FACE
108 SQ. FT (MIN.)



TRAFFIC CONE **OR** TRAFFIC DRUM
OPTIONAL TRAFFIC DRUM PORTABLE SIGN SUPPORT
HIGH MOUNTED INTERNALLY ILLUMINATED FLASHING ARROW

SCALE: NONE

CONSTRUCTION TRAFFIC CONTROL PLAN

PLAN 13 - SHEET 1 OF 2

SEE NOTES 1, 2, 4, 6, 7, 8

CONNECTICUT DEPARTMENT OF TRANSPORTATION
BUREAU OF ENGINEERING & CONSTRUCTION

APPROVED Charles S. Harlow 2012.06.05 15:55:23-04'00'
PRINCIPAL ENGINEER

WORK IN TRAVEL LANE AND SHOULDER
TWO LANE HIGHWAY
ALTERNATING ONE-WAY TRAFFIC OPERATIONS

SIGN FACE
108 SQ. FT (MIN.)

HAND SIGNAL METHODS TO BE USED BY UNIFORMED FLAGGERS

THE FOLLOWING METHODS FROM SECTION 6E.07, FLAGGER PROCEDURES, IN THE "MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES," SHALL BE USED BY UNIFORMED FLAGGERS WHEN DIRECTING TRAFFIC THROUGH A WORK AREA. THE STOP/SLOW SIGN PADDLE (SIGN NO. 80-9950) SHOWN ON THE TRAFFIC STANDARD SHEET TR-1220 01 ENTITLED, "SIGNS FOR CONSTRUCTION AND PERMIT OPERATIONS" SHALL BE USED.

A. TO STOP TRAFFIC

TO STOP ROAD USERS, THE FLAGGER SHALL FACE ROAD USERS AND AIM THE STOP PADDLE FACE TOWARD ROAD USERS IN A STATIONARY POSITION WITH THE ARM EXTENDED HORIZONTALLY AWAY FROM THE BODY. THE FREE ARM SHALL BE HELD WITH THE PALM OF THE HAND ABOVE SHOULDER LEVEL TOWARD APPROACHING TRAFFIC.

B. TO DIRECT TRAFFIC TO PROCEED

TO DIRECT STOPPED ROAD USERS TO PROCEED, THE FLAGGER SHALL FACE ROAD USERS WITH THE SLOW PADDLE FACE AIMED TOWARD ROAD USERS IN A STATIONARY POSITION WITH THE ARM EXTENDED HORIZONTALLY AWAY FROM THE BODY. THE FLAGGER SHALL MOTION WITH THE FREE HAND FOR ROAD USERS TO PROCEED.

C. TO ALERT OR SLOW TRAFFIC

TO ALERT OR SLOW TRAFFIC, THE FLAGGER SHALL FACE ROAD USERS WITH THE SLOW PADDLE FACE AIMED TOWARD ROAD USERS IN A STATIONARY POSITION WITH THE ARM EXTENDED HORIZONTALLY AWAY FROM THE BODY. TO FURTHER ALERT OR SLOW TRAFFIC, THE FLAGGER HOLDING THE SLOW PADDLE FACE TOWARD ROAD USERS MAY MOTION UP AND DOWN WITH THE FREE HAND, PALM DOWN.

◯ TRAFFIC CONE **OR** TRAFFIC DRUM
✳ OPTIONAL ⊗ TRAFFIC DRUM ⊢⊣ PORTABLE SIGN SUPPORT
⟵ HIGH MOUNTED INTERNALLY ILLUMINATED FLASHING ARROW

SCALE: NONE

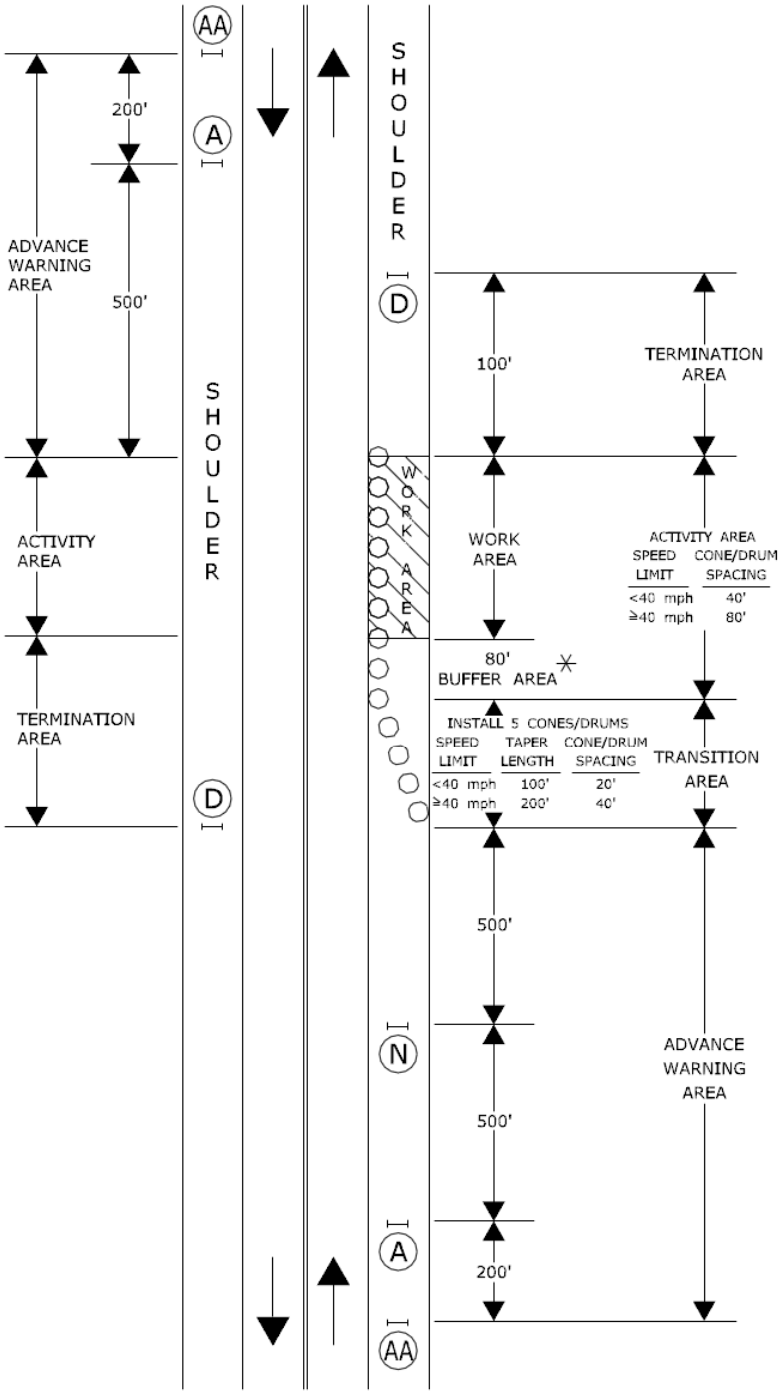
CONSTRUCTION TRAFFIC CONTROL PLAN
PLAN 13 - SHEET 2 OF 2
SEE NOTES 1, 2, 4, 6, 7, 8

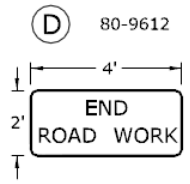
CONNECTICUT DEPARTMENT OF TRANSPORTATION
BUREAU OF ENGINEERING & CONSTRUCTION

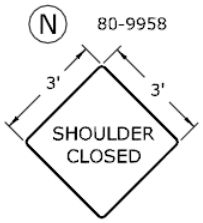
APPROVED Charles S. Harlow 2012.06.05 15:55:45-04'00'
PRINCIPAL ENGINEER

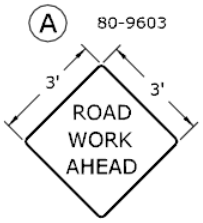
WORK IN SHOULDER - TWO LANE HIGHWAY

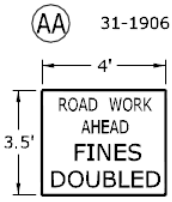
SIGN FACE
71 SQ. FT (MIN.)











TRAFFIC CONE **OR** TRAFFIC DRUM
OPTIONAL TRAFFIC DRUM PORTABLE SIGN SUPPORT
HIGH MOUNTED INTERNALLY ILLUMINATED FLASHING ARROW

SCALE: NONE

CONSTRUCTION TRAFFIC CONTROL PLAN

PLAN 14

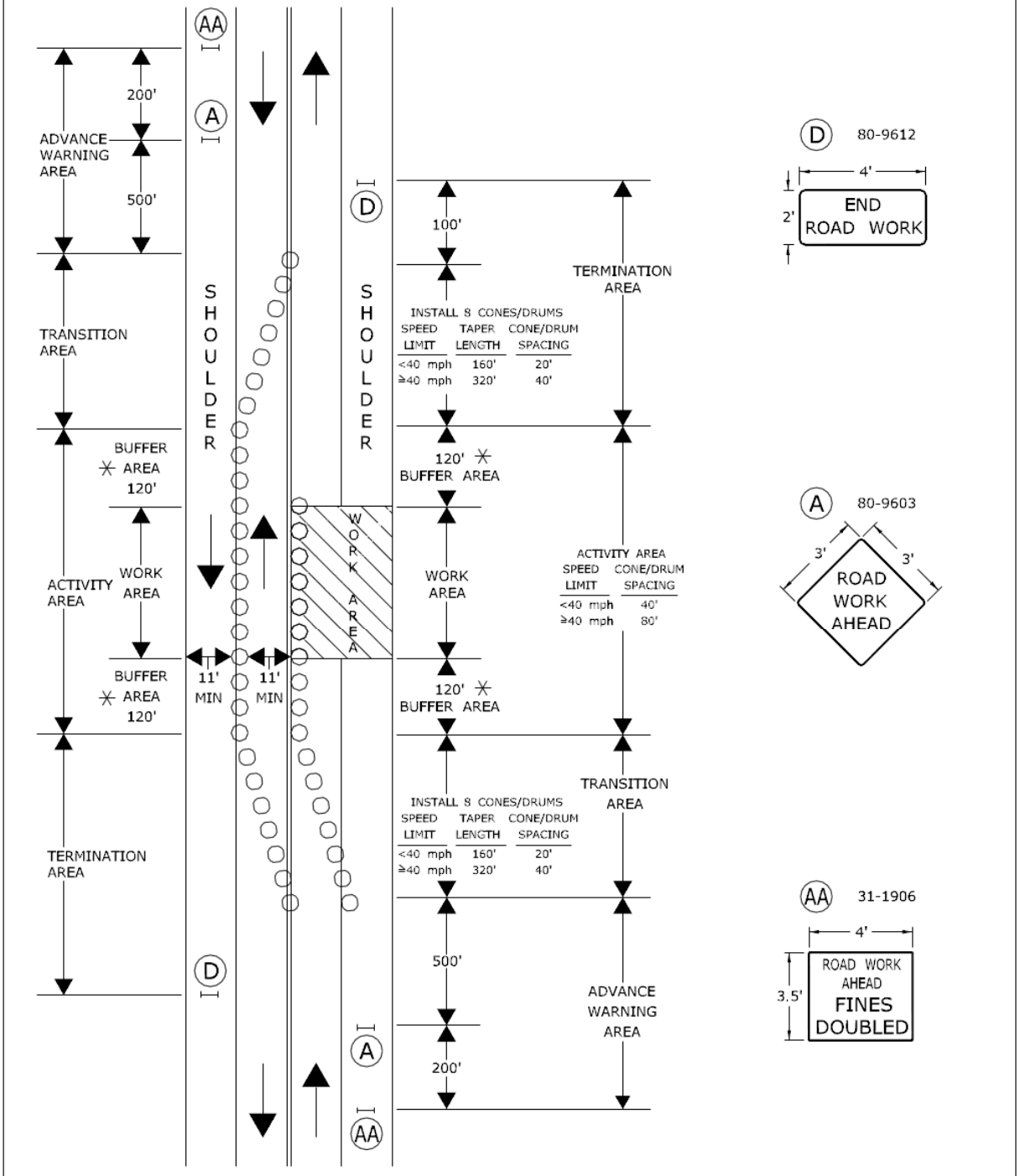
SEE NOTES 1, 2, 4, 7, 8

CONNECTICUT DEPARTMENT OF TRANSPORTATION
BUREAU OF ENGINEERING & CONSTRUCTION

APPROVED Charles S. Harlow 2012.06.05 15:56:09-04'00'
PRINCIPAL ENGINEER

WORK IN TRAVEL LANE AND SHOULDER
TWO LANE HIGHWAY

SIGN FACE
62 SQ. FT (MIN.)



TRAFFIC CONE **OR** TRAFFIC DRUM
OPTIONAL TRAFFIC DRUM PORTABLE SIGN SUPPORT
HIGH MOUNTED INTERNALLY ILLUMINATED FLASHING ARROW

SCALE: NONE

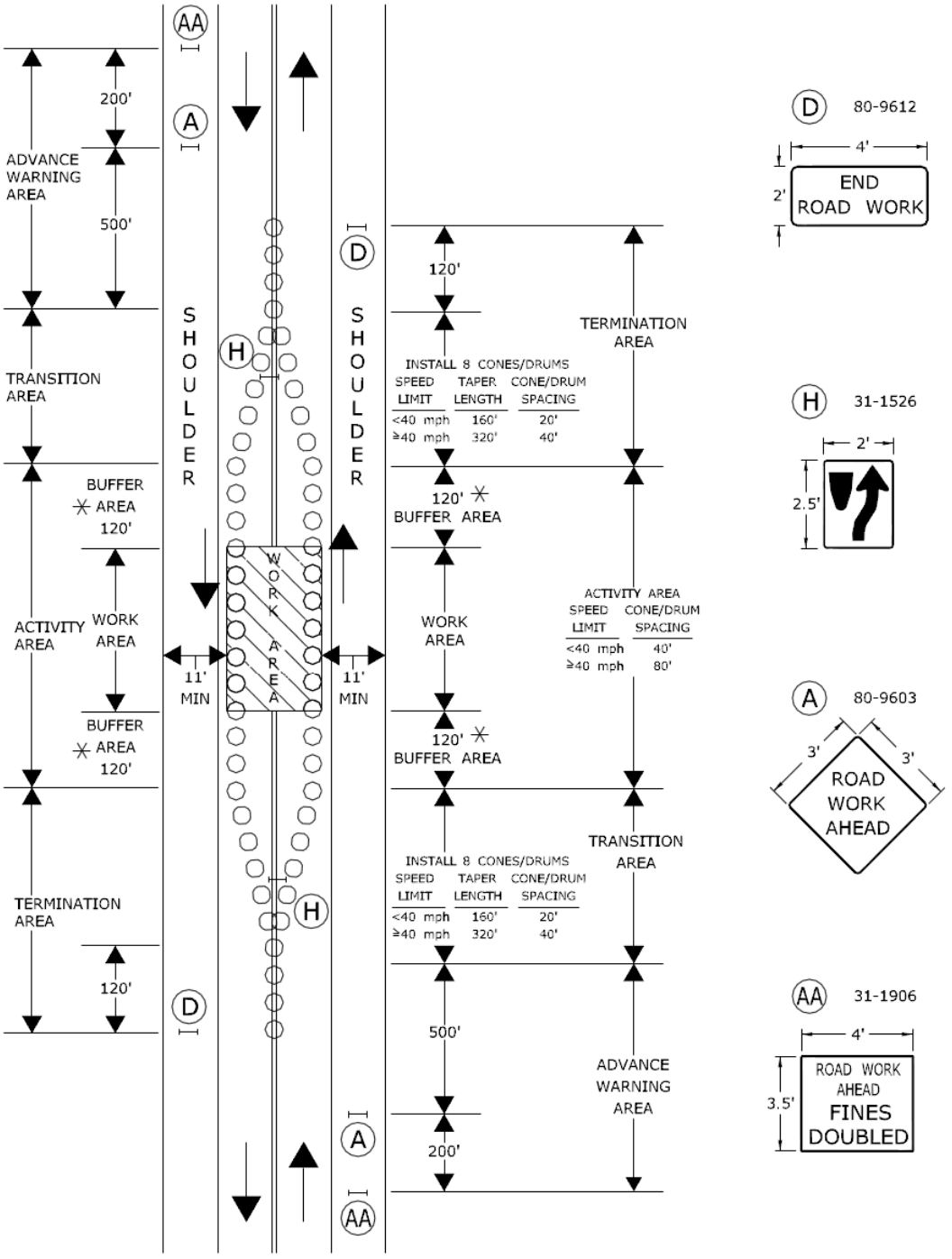
CONSTRUCTION TRAFFIC CONTROL PLAN
PLAN 15
SEE NOTES 1, 2, 4, 6, 7, 8

CONNECTICUT DEPARTMENT OF TRANSPORTATION
BUREAU OF ENGINEERING & CONSTRUCTION

APPROVED Charles S. Harlow 2012.06.05 15:56:29-04'00'
PRINCIPAL ENGINEER

WORK IN MIDDLE OF ROADWAY
TWO LANE HIGHWAY

SIGN FACE
72 SQ. FT (MIN.)



◯ TRAFFIC CONE **OR** TRAFFIC DRUM
✳ OPTIONAL ⊗ TRAFFIC DRUM ⊢ PORTABLE SIGN SUPPORT
⟸ HIGH MOUNTED INTERNALLY ILLUMINATED FLASHING ARROW

SCALE: NONE

CONSTRUCTION TRAFFIC CONTROL PLAN

PLAN 16

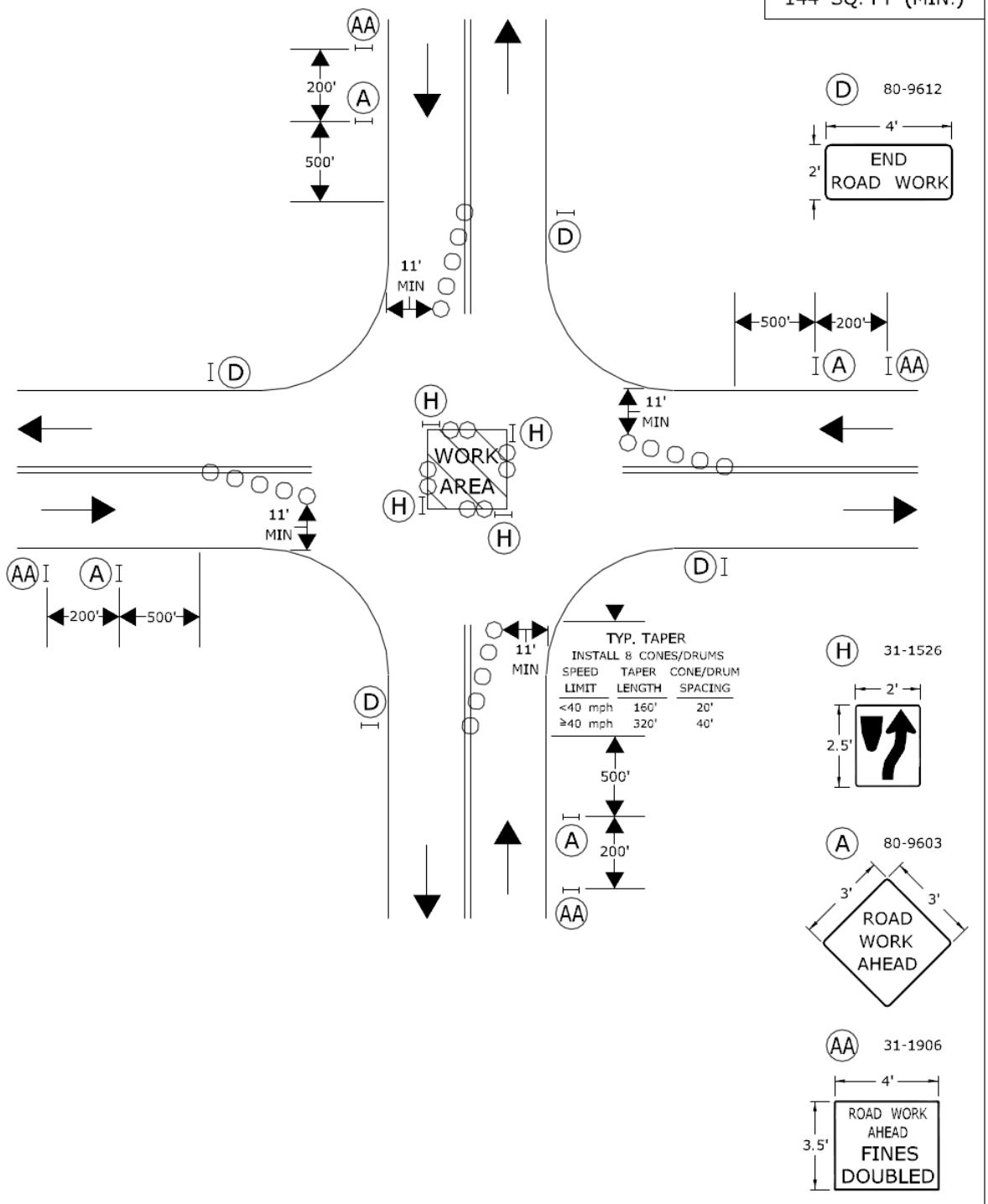
SEE NOTES 1, 2, 4, 6, 7, 8

CONNECTICUT DEPARTMENT OF TRANSPORTATION
BUREAU OF ENGINEERING & CONSTRUCTION

APPROVED _____ PRINCIPAL ENGINEER
Charles S. Harlow
2012.06.05 15:56:51-04'00'

WORK IN MIDDLE OF ROADWAY AT INTERSECTION

SIGN FACE
144 SQ. FT (MIN.)



TRAFFIC CONE **OR** TRAFFIC DRUM
OPTIONAL TRAFFIC DRUM PORTABLE SIGN SUPPORT
HIGH MOUNTED INTERNALLY ILLUMINATED FLASHING ARROW

SCALE: NONE

CONSTRUCTION TRAFFIC CONTROL PLAN

PLAN 17

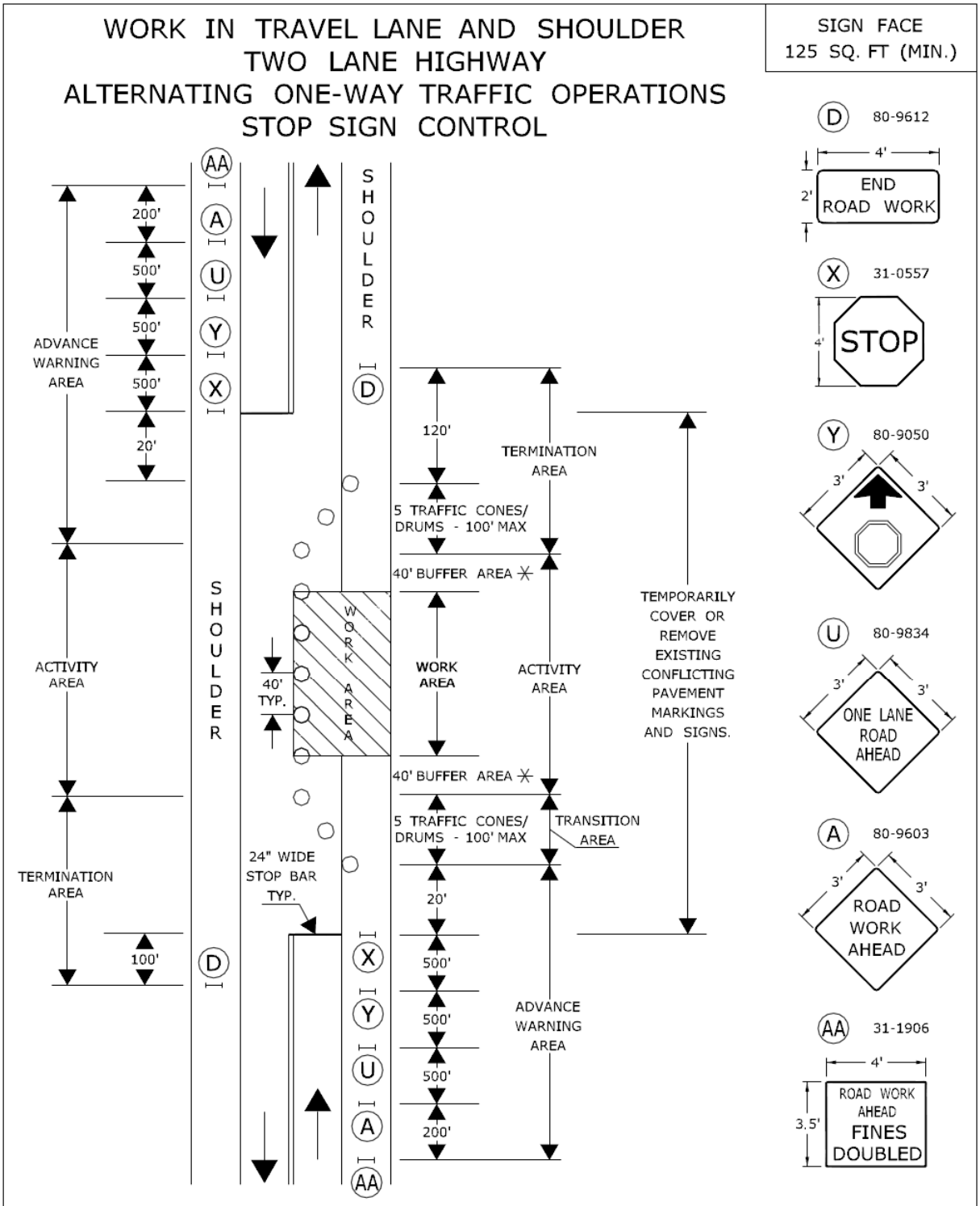
SEE NOTES 1, 2, 4, 6, 7, 8

CONNECTICUT DEPARTMENT OF TRANSPORTATION
BUREAU OF ENGINEERING & CONSTRUCTION

APPROVED _____ PRINCIPAL ENGINEER

Charles S. Harlow
2012.06.05 15:57:16-04'00'

WORK IN TRAVEL LANE AND SHOULDER
TWO LANE HIGHWAY
ALTERNATING ONE-WAY TRAFFIC OPERATIONS
STOP SIGN CONTROL



TRAFFIC CONE **OR** TRAFFIC DRUM
OPTIONAL TRAFFIC DRUM PORTABLE SIGN SUPPORT
HIGH MOUNTED INTERNALLY ILLUMINATED FLASHING ARROW

SCALE: NONE

CONSTRUCTION TRAFFIC CONTROL PLAN

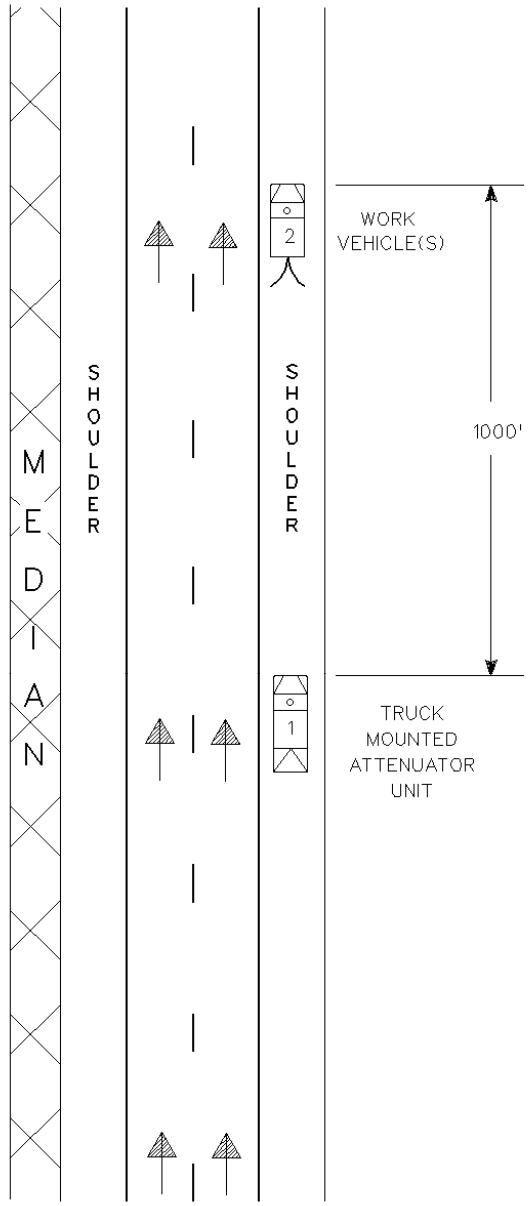
PLAN 18

SEE NOTES 1, 2, 4, 7, 8

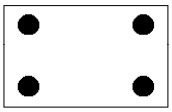
CONNECTICUT DEPARTMENT OF TRANSPORTATION
BUREAU OF ENGINEERING & CONSTRUCTION

APPROVED Charles S. Harlow 2012.06.05 15:57:37-04'00'
PRINCIPAL ENGINEER

MOVING OPERATION ON RIGHT SHOULDER
MULTILANE HIGHWAY & SECONDARY ROADWAYS



SIGN MOUNTED ON TRUCK 1



DEPARTMENT APPROVED
ARROW BOARD
(FLASHING YELLOW MODE)

REV'D 1-02

CONNECTICUT
DEPARTMENT OF TRANSPORTATION
BUREAU OF ENGINEERING &
HIGHWAY OPERATIONS
DIVISION OF TRAFFIC ENGINEERING

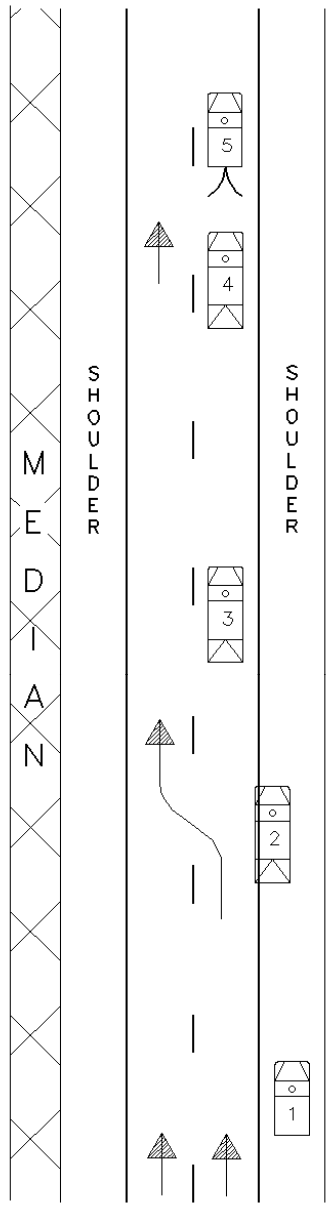
CONSTRUCTION
TRAFFIC CONTROL PLAN

PLAN 19

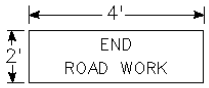
SCALE NONE

APPROVED J. Mccall PRINCIPAL ENGINEER DATE 1-30-02

MOVING OPERATION IN RIGHT LANE AND OUTSIDE SHOULDER AT THE SAME TIME MULTILANE HIGHWAY

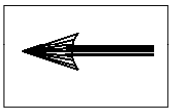


SIGN MOUNTED ON VEHICLE 5



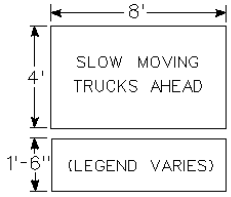
80-9612

SIGN MOUNTED ON TRUCKS 2, 3, & 4



DEPARTMENT APPROVED ARROW BOARD

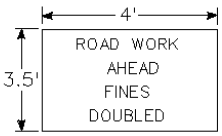
SIGNS MOUNTED ON VEHICLE 1



80-9815
THIS SIGN SHOULD BE COVERED WHEN NOT IN USE.

80-9914
USE APPROPRIATE MESSAGE FOR OPERATION.

SIGN MOUNTED ON VEHICLE 2



31-1906

REV'D 1-02

CONNECTICUT
DEPARTMENT OF TRANSPORTATION
BUREAU OF ENGINEERING & HIGHWAY OPERATIONS
DIVISION OF TRAFFIC ENGINEERING

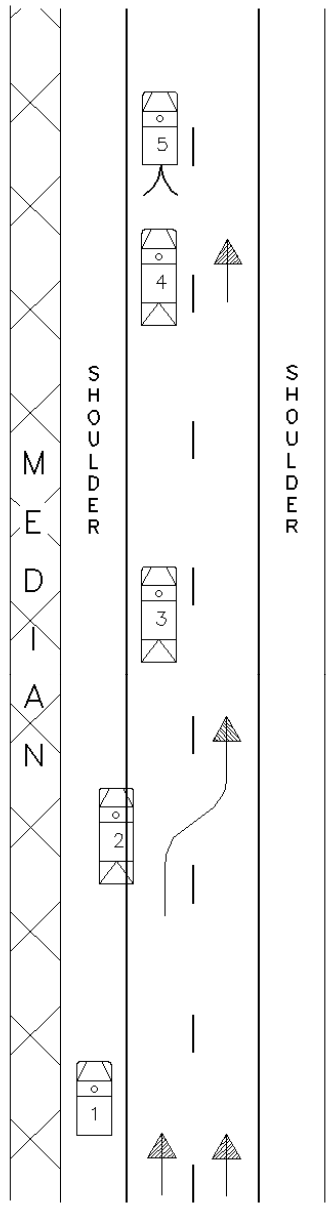
CONSTRUCTION
TRAFFIC CONTROL PLAN

PLAN 20

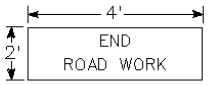
SCALE NONE

APPROVED John D. Micall
PRINCIPAL ENGINEER
DATE 1-30-02

MOVING OPERATION IN LEFT LANE AND INSIDE SHOULDER AT THE SAME TIME MULTILANE HIGHWAY

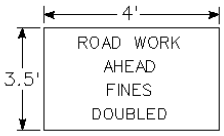


SIGN MOUNTED ON VEHICLE 5



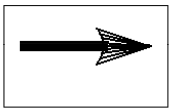
80-9612

SIGN MOUNTED ON VEHICLE 2



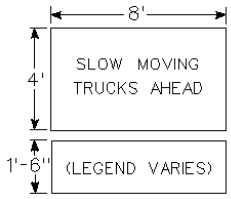
31-1906

SIGN MOUNTED ON TRUCKS 2, 3, & 4



DEPARTMENT APPROVED ARROW BOARD

SIGNS MOUNTED ON VEHICLE 1



80-9815
THIS SIGN SHOULD BE COVERED WHEN NOT IN USE.

80-9914
USE APPROPRIATE MESSAGE FOR OPERATION.

WHEN THE LEFT SHOULDER WIDTH CANNNOT ACCOMMODATE A VEHICLE, THEN ADVANCE WARNING VEHICLE 1 MAY DRIVE PARTIALLY IN THE LANE.

REV'D 1-02

CONNECTICUT
DEPARTMENT OF TRANSPORTATION
BUREAU OF ENGINEERING & HIGHWAY OPERATIONS
DIVISION OF TRAFFIC ENGINEERING

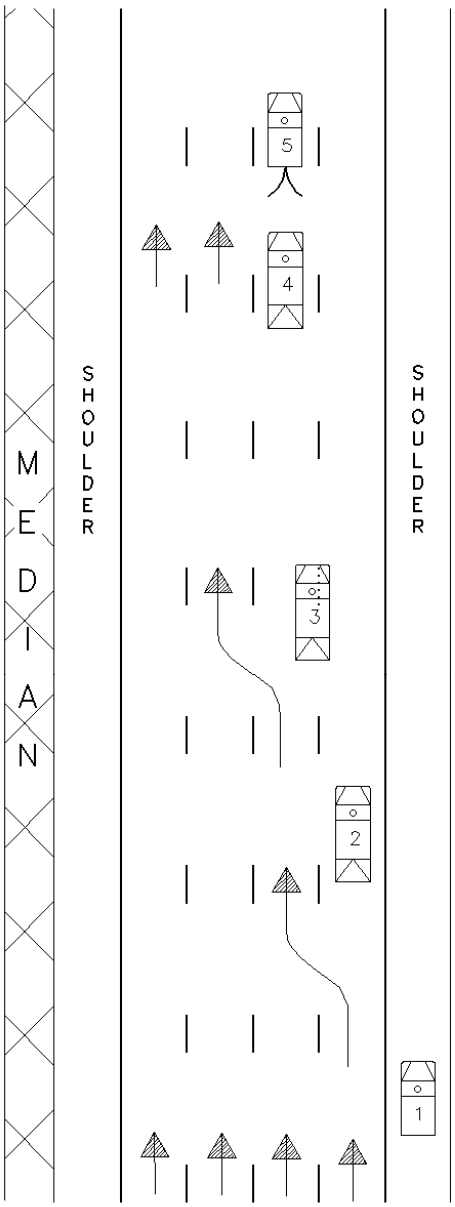
CONSTRUCTION
TRAFFIC CONTROL PLAN

PLAN 21

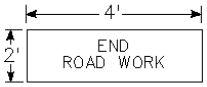
SCALE NONE

APPROVED John D. Micall
PRINCIPAL ENGINEER
DATE 1-30-02

MOVING OPERATION IN CENTER LANE
MULTILANE HIGHWAY

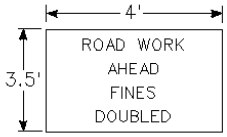


SIGN MOUNTED ON VEHICLE 5



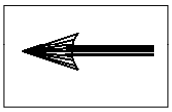
80-9612

SIGN MOUNTED ON VEHICLE 2



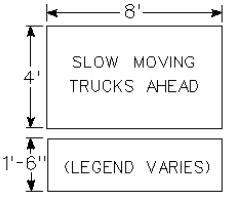
31-1906

SIGN MOUNTED ON TRUCKS 2, 3, & 4



DEPARTMENT APPROVED ARROW BOARD

SIGNS MOUNTED ON VEHICLE 1



80-9815
THIS SIGN SHOULD BE COVERED WHEN NOT IN USE.

80-9914
USE APPROPRIATE MESSAGE FOR OPERATION.

REV'D 1-02

CONNECTICUT
DEPARTMENT OF TRANSPORTATION
BUREAU OF ENGINEERING & HIGHWAY OPERATIONS
DIVISION OF TRAFFIC ENGINEERING

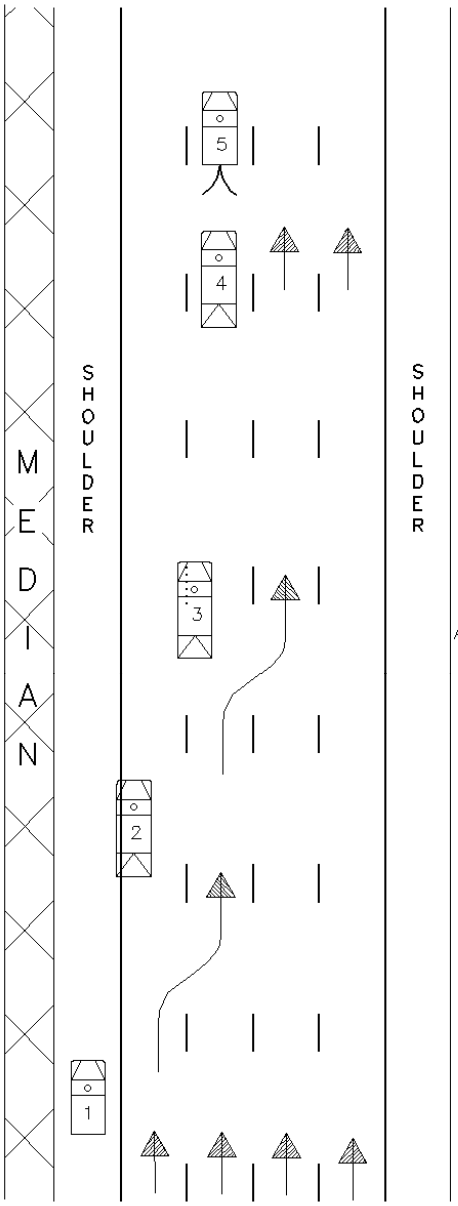
CONSTRUCTION
TRAFFIC CONTROL PLAN

PLAN 22

SCALE NONE

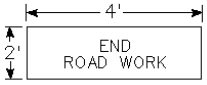
APPROVED John D. Micall
PRINCIPAL ENGINEER
DATE 1-30-02

MOVING OPERATION IN CENTER LANE
MULTILANE HIGHWAY



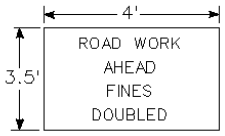
WORK VEHICLE(S)
150'
TRUCK MOUNTED ATTENUATOR UNIT
DISTANCE VARIES ACCORDING TO OPERATION
TRUCK MOUNTED ATTENUATOR UNIT
800'
TRUCK MOUNTED ATTENUATOR UNIT
1000'
ADVANCE WARNING VEHICLE

SIGN MOUNTED ON VEHICLE 5



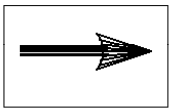
80-9612

SIGN MOUNTED ON VEHICLE 2



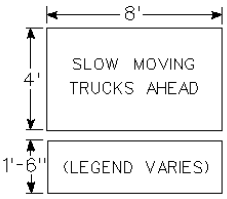
31-1906

SIGN MOUNTED ON TRUCKS 2, 3, & 4



DEPARTMENT APPROVED ARROW BOARD

SIGNS MOUNTED ON VEHICLE 1



80-9815
THIS SIGN SHOULD BE COVERED WHEN NOT IN USE.

80-9914
USE APPROPRIATE MESSAGE FOR OPERATION.

WHEN THE LEFT SHOULDER WIDTH CANNNOT ACCOMMODATE A VEHICLE, THEN ADVANCE WARNING VEHICLE 1 MAY DRIVE PARTIALLY IN THE LANE.

REV'D 1-02

CONNECTICUT
DEPARTMENT OF TRANSPORTATION
BUREAU OF ENGINEERING & HIGHWAY OPERATIONS
DIVISION OF TRAFFIC ENGINEERING

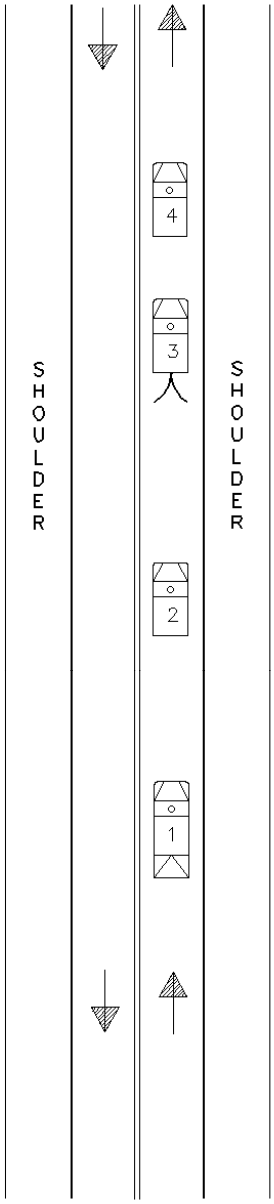
CONSTRUCTION
TRAFFIC CONTROL PLAN

PLAN 23

SCALE NONE

APPROVED John D. Micali
PRINCIPAL ENGINEER
DATE 1-30-02

MOVING OPERATION
TWO LANE HIGHWAY



LEAD VEHICLE

DISTANCE VARIES

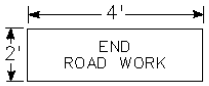
WORK VEHICLE(S)

DISTANCE VARIES ACCORDING TO OPERATION

WORK VEHICLE(S)

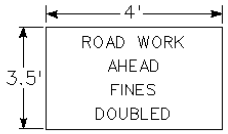
TRUCK MOUNTED ATTENUATOR UNIT

SIGN MOUNTED ON VEHICLE 4



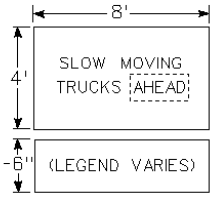
80-9612

SIGN MOUNTED ON VEHICLE 2



31-1906

SIGNS MOUNTED ON VEHICLE 1



80-9815
COVER THE WORD "AHEAD" WITH BLANK PANEL

80-9914
USE APPROPRIATE MESSAGE FOR OPERATION.

REV'D 1-02

CONNECTICUT
DEPARTMENT OF TRANSPORTATION
BUREAU OF ENGINEERING & HIGHWAY OPERATIONS
DIVISION OF TRAFFIC ENGINEERING

CONSTRUCTION
TRAFFIC CONTROL PLAN

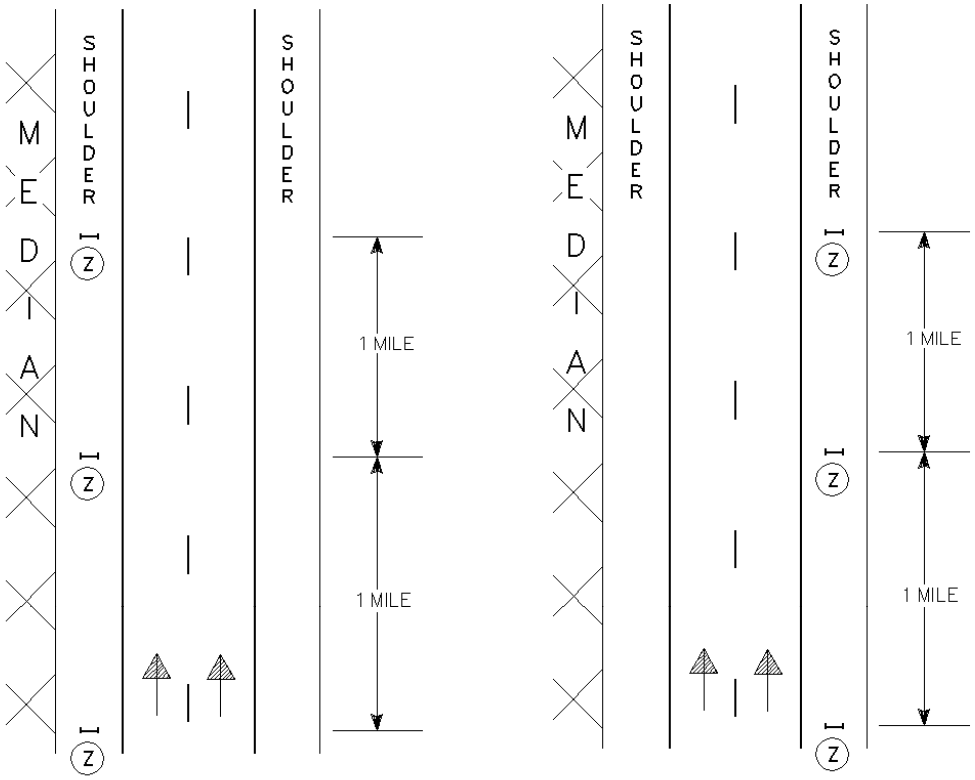
PLAN 24

SCALE NONE

APPROVED John D. Micall
PRINCIPAL ENGINEEER
DATE 1-30-02

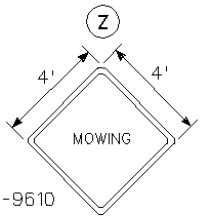
MOWING OPERATION - MULTILANE HIGHWAY

FOR EQUIPMENT ON THE ROADWAY, ROADSIDE
OR ON THE MEDIAN COMPLETELY OFF THE ROADWAY



MOWING IN MEDIAN
INSTALL "MOWING" SIGNS ON OPPOSITE TRAVELWAY MEDIAN SHOULDER AS SHOWN ABOVE.

MOWING RIGHT OF TRAVELWAY



80-9610

ERECT "MOWING" SIGNS AT 1 MILE INTERVAL AND IMMEDIATELY BEYOND THE ENTRANCE RAMPS.

WHEN MOWING FROM A TRAVEL LANE, USE BACK UP VEHICLES 1, 2 & 3 AS SHOWN ON PLANS 20 & 21 TO PROTECT MOWING OPERATIONS. WHEN MOWING EQUIPMENT MUST USE THE TRAVELWAY TO GET AROUND AN OBSTACLE, USE BACKUP VEHICLES 2 & 3 ONLY. THE BACKUP VEHICLES MUST REMAIN OFF THE ROADWAY UNTIL MOWING EQUIPMENT IS READY TO GET OUT ONTO THE TRAVELWAY. THE DISTANCE BETWEEN VEHICLE 3 AND THE MOWING EQUIPMENT IS TO BE 200 FEET.

REV'D 1-02

CONNECTICUT
DEPARTMENT OF TRANSPORTATION
BUREAU OF ENGINEERING & HIGHWAY OPERATIONS
DIVISION OF TRAFFIC ENGINEERING

CONSTRUCTION
TRAFFIC CONTROL PLAN

PLAN 25

SCALE NONE

APPROVED John D. Micall
PRINCIPAL ENGINEER
DATE 1-30-02

ITEM #0971999A - WRECKER SERVICE

Description:

Wrecker service for the purpose of towing disabled vehicles from the project area and approaches, as directed by the Engineer or the State Police, will be provided during the period of construction activities as follows:

From the hours of 6:00 AM – 9:00 AM and 3:00 PM – 7:00 PM, two wreckers will be stationed within the project limits, unless otherwise directed by the Engineer and/or State Police.

Materials:

The wrecker equipment shall be of sufficient size to remove passenger cars and light trucks. It shall be in good condition and well maintained at all times. It shall be equipped with dispatch radio and cellular telephone equipment. The wrecker shall have wheel lift capacity.

The wrecker equipment must be contracted for from a dealer or repairer company licensed by the Connecticut Motor Vehicle Department for Wrecker Service. The dealer or repairer company must also be on a State Police "Wrecker Rotation List".

A form letter will be provided to the Contractor by the Engineer on Department of Transportation letterhead for use by the wrecker service. Each operator will have on hand sufficient copies of the letter which will be provided to each motorist receiving the tow service. The letter will be addressed to the “Motorist” of the removed vehicle(s), describing the purpose and details of the wrecker service. The letter shall provide the name, address and phone number of the wrecker service garage facility to which the vehicle(s) will be towed to and from which the vehicle(s) can be recovered by the motorist(s). The letter shall also state that wrecker service will be provided free of charge and that the vehicle storage service will be provided free of charge for a maximum of twenty-four (24) hours, beyond which any additional charges will be the responsibility of the “Motorist(s)”.

Construction Methods:

Upon determining the need to remove a vehicle from the highway, the State Police shall notify the contracted wrecker service directly and shall not obtain the wrecker service from the “Wrecker Rotation List”.

The wrecker(s) shall tow the disabled vehicle(s) from the project limits and the transition areas preceding and following the project limits to a designated location established by the Contractor for each construction stage and approved by the Engineer.

Upon arrival at the towing scene, the wrecker operator shall transmit the vehicle's registration information to the State Police.

Upon delivery of the disable vehicle to the approved location, the wrecker shall be required to immediately return to its assigned duty station, thus providing maximum wrecker coverage during the specified duty hours.

In the event of an accident, no vehicle(s) is (are) to be moved until clearance is given by the investigating State Police Officer. Once clearance is received, the above procedure is to be utilized.

If it is determined that the vehicle to be towed is stolen, the wrecker company will make arrangements to have the vehicle immediately removed to the wrecker company's yard, unless otherwise directed by the State Police.

During the period when the wrecker service is required, the Contractor will maintain a towing log on a form acceptable to the Engineer. At the end of each period of wrecker service, a copy of the towing log will be submitted to the Engineer and the State Police. The towing log will indicate the vehicles towed, time and disposition at the end of each day. The wrecker company will be responsible for the vehicles that are towed until they are removed from the designated towing location by the Owner or wrecker company from the State Police "Wrecker Rotation List" for Wethersfield, Hartford and East Hartford.

Method of Measurement:

Wrecker services provided will be measured for payment by the number of hours for each wrecker that is made available for coverage and authorized by the Engineer.

Basis of Payment:

This work will be paid for at the contract unit price per hour for "Wrecker Service", which price shall include cost of furnishing, operating and maintaining the vehicles, as well as insurance costs or liabilities incidental to wrecker service.

No additional billing to the recipient of the wrecker service will be allowed for under this item of work.

Pay Item	Pay Unit
Wrecker Service	hr.

ITEM #0973723A - WORKSITE TRAFFIC SUPERVISOR

Description: The Contractor shall furnish the services of a certified person(s) to act as a Worksite Traffic Supervisor(s) on Site each workday that traffic control devices are being used. This individual(s) must be certified through the American Traffic Safety Services Association (ATSSA) as a Traffic Control Supervisor or a similar training course acceptable to CTDOT. The individual(s) must have taken the course, passed the exam and have certification or have applied for certification to be accepted or conditionally accepted for this position by the Department. If not already certified, certification must be obtained within 2 months of conditional acceptance by the Department. Certification must be maintained throughout the duration of the Project. The certified Worksite Traffic Supervisor(s) may be employee(s) of the Contractor or a subcontractor however, the Worksite Traffic Supervisor must be dedicated to this role with no other Project responsibilities.

The Worksite Traffic Supervisor(s) shall be designated by name, in writing, with a resume of their qualifications within fourteen (14) calendar days after award and shall not be changed without prior written notice to the Department.

The same Worksite Traffic Supervisor shall be used for projects 159-191 and 63-703, however will paid for entirely under Project 63-703.

Construction Methods: Worksite Traffic Supervisor(s) shall be present, on Site throughout each work shift where temporary traffic control signing is employed. During periods when no temporary traffic control signing is employed Worksite Traffic Supervisor(s) shall inspect the permanent traffic control signing a minimum of once each weekday (i.e. Monday through Friday).

The Worksite Traffic Supervisor's duties shall include, but are not limited to, the following:

Monitor installation, relocation, removal, cleaning and aligning of construction signing patterns, signs and sign supports, existing signs or signs required on the Project.

Assure all signing and pavement marking installation (both temporary and permanent) deficiencies caused by construction or vehicular traffic are corrected by the Contractor's forces.

Inspect all traffic control devices and pavement markings in use on a daily basis for proper installation in accordance with the Contract traffic control plans, CTDOT standards, and MUTCD requirements.

Monitor and enforce compliance by workers in the wearing of high visibility protective clothing and other safety related clothing.

Inspect and notify the Engineer of any deficiencies to traffic related mechanical devices located on the Project and the corrective actions to be taken.

Perform a monthly inventory of all construction signing, cones, drums and traffic control devices to assure compliance with the "Quality Standards for Work Zone Traffic Control Devices" as published by ATSSA. Assure removal from service of all "marginal" or "unacceptable" devices. Monitor work zone signing and safety practices of all subcontractors on the Project to ensure their

compliance with work zone safety requirements.

Recommend and implement enhancements to the Traffic Control Plan to meet Site conditions.

Monitor installed traffic control patterns and devices a minimum of four (4) times per shift and assure implementation of any necessary corrections.

Maintain a weekly log of all Worksite Traffic activities and provide to the Engineer by noon on Monday of the following week.

Conduct weekly inspections with the Engineer of all worksite traffic control signs, drums, pavement markings, Changeable Message Signs, arrow boards and other traffic control devices. Document all discussions in the Weekly Log.

Prior to the installation of any signing pattern on the Project, the Worksite Traffic Supervisor shall submit to the Engineer a copy of the proposed Weekly Worksite Traffic Safety Log to be used throughout the duration of the Project. The Weekly Log shall include at a minimum the following information:

- Date, weather conditions, temperature
- Worksite Traffic Safety Supervisor’s name
- Contractor's name
- Sign pattern information including type of sign patterns installed, time of installation, modifications to standard patterns, time of removal, and time of periodic reviews of patterns
- Status of all work zone traffic control signs, devices and systems
- Condition of pavement markings with deficiencies noted and corrective action taken
- Operational problems which may include traffic flow delays, accidents, incidents within Project
- Status report on Portable Work Zone Management System with deficiencies noted and corrective action taken

In addition, prior to installing any construction signing on the Project, the Worksite Traffic Supervisor shall develop and submit to the Engineer Site-specific installation and removal plans for all temporary signing patterns and construction sign installations to be used. Worksite Traffic Supervisor(s) shall conduct safety meetings with the sign installation crew prior to installing any signing patterns on the Project, and minimum of once a month thereafter, or more frequently if required due to staffing changes or installation and removal problems.

Worksite Traffic Supervisor(s) shall conduct monthly Traffic Safety "tailgate" sessions with all workers on the Project. A report of the safety "tailgate" sessions held along with a record of attendees shall be submitted to the Engineer by the tenth (10th) day of the following month.
If Worksite Traffic Supervisor(s) will not be available as required due to circumstances beyond the control of the Contractor (i.e. Illness, etc.) the Contractor shall notify the Engineer of the absence within one (1) hour of the start of the workday (work shift).

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Method of Measurement: This work will be measured on a monthly basis. Upon receipt of the monthly report, the per month cost for the services of the "Worksite Traffic Supervisor" will be certified for payment.

Basis of Payment: This service will be paid for at the Contract unit price per month for "Worksite Traffic Supervisor" complete, which price shall include all inspections, reports, meetings and handling of all traffic appurtenances, and all materials, equipment, labor and work incidental of this service. Only one monthly payment will be made for each calendar month regardless of the number of certified personnel required due to multiple shift operations.

Failure of the Contractor to provide Worksite Traffic Supervisor(s) as required by this specification will result in the following adjustment being applied:

A deduction of four hundred dollars ($400.00) for each work shift that is not covered as required by this specification. A work shift is defined as any eight (8) hour period, or portion thereof. The total deduction for any calendar month may exceed the monthly bid price for the item if the Contractor fails to provide the Worksite Traffic Supervisor (except where absence is beyond the Contractor's control).

Pay Item	Pay Unit
Worksite Traffic Supervisor	Month

ITEM #0973723A

ITEM #0974001A - REMOVAL OF EXISTING MASONRY

Work under this item shall be in accordance with Form 817 supplemented as follows:

9.74.01 - Description: Add the following:

Additional work under this item shall consist of the sawcuts and complete removal and disposal of the existing concrete substructure and wingwalls and metal bridge rail on wingwalls and retaining walls to the limits shown on the plans or as directed by the Engineer. All removed materials shall be disposed of at an approved site in a proper manner.

The work also includes maintaining the construction debris shield that is outlined in the special provisions for "Removal of Superstructure".

9.74.03 - Construction Methods: Add the following:

All work shall proceed as directed by and to the satisfaction of the Engineer and in accordance with the details shown on the Plans, or as approved by the Engineer.

When applicable, the Contractor's attention is drawn to the environmental sensitivity of the river and surrounding wetlands. The Contractor shall provide full debris shielding to prevent debris, tools, and/or other materials from entering into the waterway. All debris shall be promptly cleaned up and removed from the site. Any debris that does fall into the waterway shall be removed as soon as possible.

Wherever arc gouging or flame cutting will be used for removal of metal bridge rail on wingwalls or retaining walls, existing lead paint must first be removed from around the area to be affected. See the special provisions for "Localized Paint Removal and Field Painting of Existing Steel (Site No. X)" for the applicable description and construction methods.

The Contractor shall take necessary precautions to prevent damage to the portions of the existing abutments, wingwalls and retaining walls to remain. Any damage to these areas resulting from the Contractor's operations shall be repaired by the Contractor, as directed by the Engineer, at no cost to the State.

9.74.04 – Method of Measurement: Add the following:

Bridge rail components shall not be measured for payment.

9.74.05 – Basis of Payment: Add the following:

There shall be no separate payment for the cost of removing lead paint from the bridge rail and removing and properly disposing of the bridge rail. These cost shall be included in the contract unit price for "Removal of Existing Masonry".

ITEM #0974105A - CONCRETE HAUNCH REMOVAL

Description:

The work included under this item shall consist of removing the existing wide concrete haunches along beam flanges as shown on the Plans, and/or as directed by the Engineer and furnishing, fabricating, erecting, maintaining, removing and disposing of debris shields as described in this special provision. Work under this item shall conform to the requirements of Section 9.74 amended as follows:

Materials:

At the discretion of the Contractor and as called for in the Contractor's design, debris shields may be constructed from timber, steel, aluminum or any combination thereof.

Steel and aluminum shall conform to the requirements of Section M.06 Metals.

Timber and hardware shall be as required by the Contractor's design. Timber material shall be structural lumber in accordance with the National Design Specifications for stress graded lumber recommended by the National Forest Products Association (NFPA). Plywood shall be exterior grade as outlined in the latest edition of Voluntary Product Standard PS 1-95 for Construction and Industrial Plywood of the American Plywood Association.

Article 9.74.03 - Construction Methods: Add the following:

The concrete shall be removed to the extents and the limits shown on the Plans. The concrete shall be sawcut to delineate the removal limits, except at locations determined to be inaccessible as approved by the Engineer. Pneumatic hammers or any other method approved by the Engineer may be used to remove the concrete. Maximum 15 lb hammers shall be used near the existing steel. Pneumatic tools shall not be placed in direct contact with the steel to remain.

The Contractor shall take necessary precautions to prevent any damage to the portions of the structure to remain. Any damage shall be repaired by the Contractor, as directed by the Engineer, and at no cost to the State.

When removing the concrete, the Contractor shall take necessary precautions to prevent debris from dropping to areas below the structure onto adjacent walkways or traffic lanes.

All debris shall be disposed, from the site, by the Contractor.

The debris shields for concrete haunch removal shall meet or exceed the following requirements:

1. It shall be the Contractor's responsibility, as part of this item of work, to design and detail the debris shield to conform to all Federal, State, and Local laws and regulations, as well as the requirements contained here in this Specification.

2. The Contractor shall submit working drawings, stamped by a Professional Structural Engineer registered in the State of Connecticut, in accordance with Subsection 1.05.02; Plans, Working Drawings and Shop Drawings, of all proposed debris shielding to the Engineer for his review and approval prior to installation. The working drawings shall include design and details of the debris shield including all connections, brackets, and fasteners. The various components of the debris shield shall be designed for the anticipated weight of all personnel, material, equipment, and debris to be supported, based on the Contractor's method and sequence of work, but in no case shall be designed for less than 100 pounds per square foot. Vertical elements of the debris shield, along the fascia or below the beams, shall be designed for anticipated loads including wind, or a minimum of 30 pounds per square foot, whichever is higher.

3. The debris shields shall be placed and secured against all applicable loads, including wind. If, in the opinion of the Engineer, the shields are not secure, the Contractor shall remove and install them to the satisfaction of the Engineer.

4. Debris shields shall be placed so as to maintain the existing roadway width and vertical clearance. Traffic control for the work shall be performed during off-peak hours in accordance with Section 1.08 – Prosecution and Progress and shall be provided in accordance with the special provision "Maintenance and Protection of Traffic."

The debris shields shall not contain any gaps or openings that would allow debris to pass through, and shall be sufficiently strong to support any debris from falling onto the roadway or walkway below.

At the completion of the work, the debris shield shall be removed from the site by the Contractor.

If existing deck reinforcing bars are exposed during haunch removal, the reinforcing steel shall be coated with two coats of epoxy resin. Exposed edges of steel beam flanges shall also be cleaned and coated with epoxy resin if not being field painted. This work shall be performed in accordance with the special provision for "Clean and Coat Exposed Reinforcing Steel".

Article 9.74.04 - Method of Measurement: Delete in its entirety and replace with the following:

This work shall be measured for payment by the actual number of linear feet of "Concrete Haunch Removal", measured along the edge of the flange, accepted by the Engineer.

The debris shield shall not be measured separately for payment.

Article 9.74.05 - Basis of Payment: Delete in its entirety and replace with the following:

This work shall be paid for at the contract unit price per linear foot for "Concrete Haunch Removal" complete, removed, disposed and accepted, including debris shields, which price shall include all materials, equipment, tools and labor incidental thereto.

This price shall also include any coating of exposed deck reinforcing bars that may be required due to over-removal of concrete and the edge of the steel beam flange.

Pay Item	Pay Unit
Concrete Haunch Removal	L.F.

ITEM #0974106A - TIMBER SUPPORT MAT

Description:

Work under this item shall consist of the supplying, placement, relocation and removal of temporary timber support mats (commonly known as crane mats), as shown on the plans or as directed by the Engineer. In general, these mats shall be used when equipment needs to be located/operated within the edges of watercourses or on unsuitable ground where the ground will not support the weight of the equipment.

Materials:

Temporary timber support mats shall be constructed from untreated hardwood timbers connected together with durable metal fasteners. Their size shall be large enough to provide useable space to operate the equipment, while located completely within the edges of the mat or adjacent mats, and small enough to be easily transported, placed, relocated and removed from the site. Timber support mats shall not exceed 50 feet in length.

Construction Methods:

Prior to placing the timber support mats, the Contractor shall verify that the mats to be used are capable of supporting the equipment that will be operating on top of them.

Temporary support mats shall be used whenever necessary to prevent disturbance to streambeds and wetlands and prevent equipment for bearing directly in these surfaces. Small sections of timber matting shall be placed at the top of the stream banks on either side of the stream parallel to the flow of water to act as supports for a larger timber mat spanning the stream. At locations where the stream is too wide to be spanned by a single timber mat, a smaller section of timber matting can be placed in the stream to act as a pier supporting 2 or more adjacent timber mats. Timber support mats, bearing on the bottom of streams, shall not be placed immediately adjacent to each other, across the stream, preventing the flow of water.

The method of installing and removing timber mats shall minimize damage to the surface they are placed on. Installation, relocation and removal of timber mats shall be done in a progressive fashion such that the equipment moving them is always supported on a timber mat which is already in place or on suitable stable ground.

All timber support mats shall be removed from the site upon the completion of construction activities. Damage to the ground below them shall be repaired as directed by the Engineer.

Method of Measurement:

Work under this item, being paid for on a lump sum basis, will not be measured for payment.

Basis of Payment:

Payment for this work will be made at the contract lump sum price for "Timber Support Mat", when the use of the timber mats is complete and they have been removed from the site, which price shall include all materials, placement, relocation and removal of mats, tools, equipment and labor incidental thereto.

Pay Item	Pay Unit
Timber Support Mat	L.S.

ITEM #1001001A - TRENCHING AND BACKFILLING

The work under the item Trenching and Backfilling shall conform to Section 10.01 of the Standard Specifications amended as follows:

Materials: Article 10.01.02 – Materials, add the following:

Concrete fill for restoration of bituminous concrete overlayed concrete pavement shall conform to the requirements of Article M.03.01 and Article M.03.02 of the Standard Specifications and shall be capable of achieving 3,000 psi (21 MPa) within 12 hours. The Contractor shall submit a design mix to the Engineer for approval.

Processed Aggregate Base shall conform to the requirements of Article M.05.01 of the Standard Specifications.

Bituminous Concrete HMA S0.5 and HMA S1.0 shall conform to the requirements of Special Provision M.04 –Bituminous Concrete Materials.

Joint Seal shall conform to the requirements of Article M.04.01-8 – Joint Seal Material Requirements of the Standard Specifications.

Reinforcement shall conform to the requirements of ASTM A615, Grade 60.

Topsoil shall conform to the requirements of Article M.13.01 – Topsoil of the Standard Specifications. Turf Establishment materials shall conform to Article M.13 of the Standard Specifications.

Underground utility marking tape shall have a minimum tensile strength of 78 lbf (350 N) and a minimum elongation of 700 percent before breakage. The utility marking tape shall not delaminate nor smear when wet and shall be resistant to insects. The utility marking tape shall not degrade when exposed to alkalis, acids or other corrosive elements found in soil.

Construction Methods: Article 10.01.03 – Construction Methods, add the following:

All cuts in roadways shall be done in a neat and workmanlike manner, so as to cause the least possible injury to all other improvements. The Contractor should provide protection to all slopes, roadways, guide rails, drainage structures, illumination conduit and appurtenances, utilities, etc. as may be necessary or as required by the Engineer. Any property damage caused by excavation shall be repaired as directed by, and to the satisfaction of, the Engineer at no additional compensation. Excavating shall not be performed until immediately before installation of conduit and other appurtenances. The material from the excavation shall be placed where directed by the Engineer and in a position where the least damage and obstruction to vehicular traffic and the least interference with the surface drainage will occur.

All excavations shall be closed at the end of each day.

All pavement cutting required for this item, regardless of the type, shall be included as work under this item.

Where possible, communication conduit and electrical conduit shall be installed in the same trench and shall be paid for under this item as one. Payment shall not be made for separate trenching and backfilling where electrical and communication conduit may be installed in the same trench, but have been installed separately by the Contractor.

When trenching occurs in roadways, neat lines shall be drawn on the surface and the roadway shall be saw cut and removed to neat lines as indicated on the plans or as directed by the Engineer. The Contractor shall repair the pavement immediately upon completion of the trench backfilling and compaction in accordance with these specifications and to the dimensions on the contract drawings, or as directed by the Engineer. Where trenching occurs across bituminous concrete overlayed concrete pavement, repairs shall include filling the trench with high-early concrete fill and upon curing, permanent surface pavement repairs.

Unpaved areas disturbed during construction shall be restored with a minimum of 2 inches (50 mm) of topsoil and established turf.

Topsoil shall be provided in conformance to Section 9.44.03 of the standard specifications. Turf Establishment shall conform to Section 9.50.03 of the Standard Specifications.
The Contractor shall install utility marking tape above installed conduit as identified on the conduit installation details in the plans.

Method of Measurement: Article 10.01.04 – Method of Measurement: Add the following:

There shall be no separate measurement for sawcutting, temporary pavement repair, concrete fill, joint sealing, permanent pavement repair, sidewalk repair, cutting reinforcement, reinforcement, utility marking tape, topsoil and turf establishment.

Basis of Payment:

Article 10.01.05 -- Basis of Payment: Replace the second paragraph with the following:

It shall also include all sand encasement, backfilling, utility marking tape, grading, seeding, fertilizing, mulching, disposal of surplus material, sawcutting sidewalks and paved areas, as well as furnishing and installing curbing, riprap, crushed stone, processed aggregate subbase, gravel borrow, concrete fill, topsoil, sidewalk, pavement or structure, as the case may be.

Pay Item	Pay Unit
Trenching and Backfilling	l.f.

ITEM #1002214A - TRAFFIC CONTROL FOUNDATION – CONTROLLER - TYPE IV MODIFIED

All work shall conform to the requirements of Section 10.02 of the Standard Specifications with the following modifications:

Article 10.02.01 - Description:

Add the following:

This item will also include the installation of a traffic control foundation for a traffic management system cabinet.

Article 10.02.03 - Construction Methods:

Add the following paragraph:

The foundation dimensions will be as required to support the traffic management system cabinet and as shown on the approved foundation drawing.

The Contractor shall be responsible for the re-grading of the area surrounding the Traffic Control Foundation - Type IV Modified to allow for the adjacent concrete sidewalk pad installation to be installed level with a 2% (¼" per foot) pitch. See the Miscellaneous Details provided in the contract plans.

Article 10.02.05 - Basis of Payment:

In the first sentence insert the words "installation of borrow" after the words "disposal of surplus material".

ITEM #1002233A - TRAFFIC CONTROL FOUNDATION - SPAN POLE – TYPE D

Description:
This item consists of furnishing and installing a foundation of the type specified in accordance with the plans, as directed by the Engineer and in conformance with this specification.

Materials:
Concrete for the formed top of foundation shall conform to the requirements for Class "F" Concrete in Section 6.01 of the Standard Specifications and shall attain a 28-day compressive strength of 4,000 psi (27.6 MPa).

Concrete for the drilled shaft below the construction joint shall also conform to the requirements for Class "F" Concrete, except for the following:

- Entrained air will not be allowed
- Accelerators will not be allowed
- Slump shall be at least 6" to 8" (150mm to 200mm) for placement in dry shafts and 8" (200mm) when wet or casing methods are used. Slump shall not exceed 8" (200mm).
- A trial mix study for drilled shaft concrete should include the construction of a graph of slump loss versus time after batching. A proper mix design will maintain a slump of at least 4" (100mm) for at least 4 hours (the 4-inch (100mm) slump value is the minimum at which adequate fluid pressures can be assumed to develop against the sides of the drilled shaft hole). Testing shall be performed at the approximate temperature at which the concrete will exist in the field. An increase in temperature of 18 degrees F. (10 degrees C.) will increase the rate of slump loss by a factor of approximately 2.

Type III cement is prohibited.

Reinforcing steel shall conform to the requirements of Section 6.02 and Article M.06.01.

Anchor rods shall conform to ASTM F1554, Grade 105 (Grade 725). The leveling nuts shall conform to ASTM A563, Heavy Hex Grade DH (A563M, Heavy Hex Class 12). The internal threads of nuts shall be re-tapped after galvanizing to accommodate the increased diameter of the rods. The washers shall conform to ASTM F436 (F436M), Type 1. The rods, nuts and washers shall be galvanized in accordance with ASTM A153 (A153M), Class C. Hooked anchor rods are not permitted. Welding to anchor rods is not permitted.

Anchor plates shall conform to the requirements of AASHTO M270, Grade 50 (Grade 345), galvanized. The Contractor shall not drill holes or perform other operations on plates that are harmful to the galvanizing.

Rigid metal conduit, ground rod sleeves and related hardware and end caps shall be galvanized steel conduit and shall conform to Section M.15.09.

Bare copper grounding conductor shall be #8 AWG stranded bare copper wire conforming to M.15.13. The grounding bolt shall be stainless steel with a hex head.

Ground rods shall be 5/8-inch (16mm) in diameter by 12-feet (3660mm) long copper clad steel. The copper cladding shall be a minimum thickness of 0.128 inches (4mm). The ground rod clamp shall be a square-head bolt type listed for direct soil burial.

Zinc-rich field primer for touch up of galvanized hardware shall conform to the requirements of ASTM A780. The use of aerosol spray cans will not be permitted.

Granular Fill for backfill around formed foundation shall conform to Article M.02.01.

Bituminous concrete shall be as directed by the Engineer.

Topsoil shall conform to Article M.13.01.

Fertilizer shall conform to Article M.13.03.

Seed Mixture shall conform to Article M.13.04.

Mulch Materials shall conform to Article M.13.05.

Any admixtures proposed for use in a bentonite slurry, if used to construct a drilled shaft, shall be approved by the Engineer. Bentonite slurry properties may be adjusted to suit field conditions with the approval of the Engineer. Polymer or other slurry materials may be submitted to the Engineer for review.

Construction Methods:

Submittals:

The Contractor is required to submit the following:

1. Working Drawings
    - The Contractor shall obtain survey elevations of the ground surface at the foundation. He shall submit to the Engineer for approval an elevation view of the foundation showing:
        - The proposed foundation with elevations at the top and bottom of the proposed foundation
        - The proposed elevation at the mandatory construction joint
        - The existing ground elevations at the high and low side of the proposed foundation

The Contractor shall furnish the approved foundation elevations to the reinforcing bar detailer. These elevations shall be included with the foundation reinforcing shop drawings when submitted to the Designer for review.

- The Contractor shall submit a foundation constructability plan which includes the following:
  - Access to the area including the following, when applicable:
    - Temporary road
    - Removal of guide rails or concrete barriers
    - Utility locations and drainage installations that could obstruct construction
    - Clearing and grubbing (this shall be accomplished in accordance with Section 2.01)
  - Traffic Protection including the following applicable considerations:
    - Temporary guide rails and/or concrete barriers
    - Maintenance and Protection of Traffic Control Plans for work that cannot be accomplished using the Typical Traffic Control Plans (All work to install the camera pole foundation shall be accomplished in accordance with Article 1.08.04 – Prosecution & Progress and item 0971001A- Maintenance & Protection of Traffic unless otherwise approved in writing by the Engineer)
  - Drilling procedure including all calculations and specifications associated with the Contractor's proposed drilling procedure and tools and machinery used.
  - Fabrication drawings
    - The use of hooked anchor rods in not permitted
    - Welding of anchor rods is not permitted

2. Shop Drawings

- The Contractor shall submit shop drawings for the reinforcement including the following:
  - A note indicating that no welding of reinforcement will be allowed.
  - Supplemental cages or ties that will be used to lift the reinforcing cage and prevent distortion. Reinforcing cages shall be tied adequately for handling, but may need internal ties or cages, which shall be detailed for approval. The support bars or cage, if intended to remain in the finished foundation, shall be arranged so as not to interfere with concrete placement. Supplemental cages, if composed of weldable bars, may be welded, but may only be secured to the designed cage by ties.

- The Contractor shall submit shop drawings for the anchor rods and plates including the following:
  - Material designations
  - Length and diameter of anchor rods
  - Number of anchor rods
  - Thickness and dimensions of anchor plate

- Anchor rod hole diameters and locations, including bolt circle diameter and edge distance
- Angular orientation of the anchor rods around the bolt circle
- Galvanizing requirements

Constructing the Drilled Shaft Portion of the Foundation

The Contractor is responsible for properly locating the foundation. He shall notify the Engineer two weeks before beginning to drill the foundation. Should ledge, high ground water, or unsuitable materials be encountered, the Contractor shall notify the Engineer immediately so the Engineer may determine if relocation or alteration of the foundation is necessary.

The top of rock will be considered as the point where rock, defined as bedded deposits and conglomerate deposits exhibiting the physical characteristics and difficulty of rock removal as determined by the Engineer, is encountered which cannot be drilled with earth augers and/or underreaming tools configured to be effective in the soils indicated in the contract documents, and requires the use of special rock augers, core barrels, air tools, blasting, or other methods of hand excavation. Minimum required lengths of rock socket shall be determined from the table provided in the contract plans (refer to Camera Pole Foundation Details) based on the depth to the top of rock from the foundation grade level.

It is the Contractor's responsibility to utilize proper equipment and methodology to drill through the boulders. It should be noted that boulders may also be encountered at other structure locations.

Prior to drilled shaft construction, the grade in the vicinity of the shafts shall be constructed to the finished grade.

This work may require rock excavation, drilling rock or using slurry filled shafts through whatever materials are encountered to reach the depths indicated on the plans and specifications. The Contractor shall submit a sequence plan outlining drilling, casing, slurry, reinforcement and concrete placement procedures for the Engineer to review.

Temporary casing of the drilled shafts may be necessary to prevent sloughing of the granular soils. While the casing is being withdrawn, a sufficient head of concrete shall be maintained above the bottom of the casing, to prevent "necking" of the shaft due to sloughing soils. Concrete placed near the surface shall be in full contact with the undisturbed soil to provide lateral stability for the full length of the shaft.

Provisions shall be made to minimize surface water infiltration into the shaft excavations.

Construction of drilled shaft shall be in accordance with AASHTO Standard Specifications for Highway Bridges 2002 Division II, Section 5 and with U.S.D.O.T. Publication FHWA-IF-99-025, "Drilled Shafts: Construction Procedures and Design Methods."

The maximum allowable horizontal variation of the center of the top of the drilled shaft from the required location shall be 0.5% of the shaft diameter. The ground surface at each shaft location shall be re-compacted if disturbed during construction in order to minimize lateral deflection of the shafts.

The concrete shaft shall not be out of plumb by more than 1% of the total length.

Should the depth of drilled shaft extend below the depth shown on the plans, a minimum of one half of the longitudinal bars required in the upper portion of the shaft shall be extended the additional length by adding longitudinal reinforcing bars at the bottom of the cage. Tie or spiral bars shall be continued for the extra depth and the stiffener bars shall be extended to the final depth. All longitudinal and transverse bars shall be lap spliced or spliced with mechanical splices. Welding to the reinforcing steel will not be permitted.

Approved cylindrical concrete feet (bottom supports) shall be provided to ensure that the bottom of the reinforcing cage is maintained the proper distance above the base.

The drilled shaft concrete shall be placed as soon as possible after the placement of reinforcing steel. Concrete shall be placed to the level of the construction joint shown on the plans. Longitudinal reinforcing shall extend above the construction joint to within 3" (75mm) of the top of foundation.

Casings, if used in drilling operations, shall be removed from the hole. The casing may be removed as concrete is placed provided a 5 foot (1525mm) head of concrete is maintained, or the casing may be removed after the concrete has been poured, provided that the concrete has not been set. Separation of the concrete by hammering or otherwise vibrating the casing during withdrawal operations shall be avoided.

Concrete may be placed by free fall in dry holes if dropped vertically and concrete does not hit the reinforcing, supporting cage or the side walls of the shaft before it reaches the base. Smaller maximum-sized aggregate in the concrete mix will increase cohesion of the mix and discourage segregation. Concrete placement down the center of the shaft shall be directed by use of a hopper and drop chute.

Concrete may be placed in wet installations by tremie or concrete pump. Groundwater may be encountered during drilled shaft construction. So, concrete shall be placed using a concrete pump or tremie pipe in accordance with the specifications. Place concrete in the slurry filled shaft by the tremie method in such a manner that the concrete displaces the slurry from bottom and rises like a liquid and mixing of concrete with the slurry will not occur. The concrete shall be placed through a top metal hopper and into a rigid leak- proof elephant trunk tremie pipe sufficiently large enough to permit free flow of concrete. The tremie pipe shall be located so that it can be removed without disturbing the position of the reinforcing. Initially, there shall be a suitable plug at the bottom of the tremie pipe that will not discharge concrete until the concrete head has at least reached the top level of the slurry.

The intent is that bentonite slurry not be permitted to contaminate the concrete as the concrete is initially introduced to the tremie pipe. Thereafter, a positive concrete head shall be maintained throughout. The bottom of the tremie pipe shall be inside the concrete for at least a depth of 60 inches (1524mm), and this depth shall be maintained throughout. The concrete level shall be horizontal during the pouring operations. No horizontal movement of the tremie pipe will be permitted. The concreting of the shaft shall proceed continuously to 12 inches (305mm) above the final top of shaft elevation to produce a monolithic shaft foundation, with uncontaminated concrete for the design shaft length.

Concrete placement shall be continuous from the bottom of drilled shaft to the construction joint at the top. The elapsed time from the beginning of concrete placement in the shaft to the completion of the placement shall not exceed 2 hours. Admixtures such as water reducers, plasticizers, when approved for use, shall be adjusted for the conditions encountered on the job so the concrete remains in a workable plastic state throughout the 2-hour placement limit. Prior to concrete placement, the Contractor shall provide test results of both a trial mix and a slump loss test conducted by an approved testing laboratory using approved methods to demonstrate that the concrete will maintain a minimum slump of 4" (100mm) for 4 hours. Tests shall be conducted at temperatures comparable to those at which the concrete will be placed.

Cross-Hole Sonic Logging (CSL) tests are not required for the CCTV structures because the axial loads are light. Instead, careful records of concrete quantities placed shall be kept and compared with the theoretical quantities.

Constructing the Top of the Foundation

The top portion of the concrete foundation shall be formed and reinforced as shown on the plans. The top surface shall be level within ± 1/8" (± 3mm). The shape may be round or square as shown to facilitate forming. If a square shape is chosen, additional reinforcing is required to reinforce the corners and flat sides.

The number of conduits in the foundation shall be as shown on the plans. Electrical conduits of the size specified on the plans shall extend 2 feet (610mm) out from the side of the formed portion of the foundation. All conduit ends terminating below grade shall be capped with a malleable iron cap. All above grade conduit ends shall be terminated with an insulated bonding bushing with tinned insert. Conduit caps shall be installed before the concrete is placed and shall remain in place until the cable is installed.

Rigid metal conduit, drain pipe, anchor rods and the anchor plate shall be placed and secured in proper position in the formed portion of the top of foundation. A template shall be used to hold the required anchor rod assembly, ground rod sleeve and conduits in their correct positions. The orientation of the anchor rods on the bolt circle are important to the positioning of the handhole on the pole. The anchor rod locations shall be in accordance with approved shop drawings. Each anchor rod shall be fitted with two leveling nuts and double nuts above the base plate. Conduits shall extend up from the top of foundation to the height shown on the plans.

Concrete shall be placed in the forms in accordance with the applicable provisions of Subarticle 6.01.03-6.

Curing of the concrete shall be performed in accordance with Subarticle 6.01.03-9.

Forms shall not be removed until after the concrete has hardened properly and not less than 24 hours after the concrete has been placed.

The portions of the foundations that will remain exposed to view shall be finished to the satisfaction of the Engineer and in conformance with the pertinent requirements of Subarticle 6.01.03-10.

The Contractor may install the camera pole after a minimum of 7 days of proper curing of the concrete if he can show that the concrete has reached 3000 psi (21MPa) as confirmed by test cylinders. Concrete cylinders shall be cast, cured and tested in accordance with Subarticle 6.01.03-4. A sufficient number of cylinders shall be cast to enable further testing at a later date if the compressive strength is determined to be below the minimum strength specified.

Where a foundation is placed within or adjacent to a concrete sidewalk, the entire section of sidewalk between joints shall be replaced in accordance with Section 9.21, unless otherwise directed by the Engineer.

The disturbed ground along the access path to the shaft locations shall be restored and protected from erosion within 5 calendar days of the completion of the foundation construction.

Method of Measurement:
This work will be measured for payment by the number of foundations completely installed and accepted.

Basis of Payment:
The work will be paid for at the contract unit price each for "Traffic Control Foundation - Span Pole – Type D" complete in place, which price shall include layout, cutting and removing existing pavement, excavation, drilling, temporary casing, slurry, granular fill, backfill, concrete, reinforcing, anchor rods and plates, nuts and washers, rigid metal conduit sweeps, PVC weepholes, ground rod, ground wire, clamps, bonding bushings and grounding bolts. It shall include construction access path, topsoil, grading, seeding, fertilizing, mulching, riprap, restoration of bituminous concrete sidewalk and pavement surfaces treatments to be restored, as directed by the Engineer, and all materials, equipment, labor, tools and work incidental thereto.

No additional payment will be made for the Contractor to test the slurry when it is used to construct a drilled shaft foundation.

All concrete sidewalk replaced due to foundation installation shall be paid for at the Contract unit price for "Concrete Sidewalk."

When rock is encountered within the limits of excavation, its removal will be paid for at the Contract unit price per vertical foot (vertical meter) for "Rock-in-Foundation Excavation," which price includes any additional excavation to remove the rock and any additional concrete required to fill the excavation beyond the designed foundation hole dimensions. Rock-in-foundation excavation is defined as rock in definite ledge formation, boulders, or portions of boulders, cement masonry structures, concrete structures or Portland cement concrete pavement with a cross-sectional area that exceeds 50% of the cross-sectional area of the designed foundation hole.

The protection and restoration (if necessary) of existing underground wiring, conduits, drainage structures, pipes and underdrain systems within the excavation limits will not be paid for separately, but will be included as part of the work.

The removal of existing roadside barrier systems, installation and removal of temporary roadside barrier systems and resetting existing roadside barrier systems will not be paid for separately, but will be included as part of the work.

The restoration of existing surface treatments (pavement, access roads, slope protection, topsoil & seed, etc.) in all areas disturbed by the work will not be paid for separately, but will be included as part of the work. The Engineer will determine the type, thickness and horizontal limits of the surface treatments to be restored.

No direct payment will be made for the work of testing the concrete from the drilled shaft or formed top of foundation in accordance with Subarticle 6.01.05. Concrete cylinder curing boxes will be included under Item #0969066A – Construction Field Office, Extra Large.

Pay Item	Pay Unit
Traffic Control Foundation – Span Pole – Type D	ea.

ITEM #1002901A - REMOVE CONCRETE BASE

DESCRIPTION: Under this item the Contractor shall remove an existing precast concrete foundation for a base mounted traffic monitoring station cabinet where shown on the plans or as directed. The removed concrete foundation shall remain the property of the Contractor.

CONSTRUCTION METHODS: The Contractor shall remove a concrete foundation with associated equipment (conduit sweeps, ground rod, cables, etc.) where required, and shall be disposed of by the Contractor. The hole shall be backfilled and graded to match surroundings, unless otherwise noted on the plans.

METHOD OF MEASUREMENT: This work will be measured for payment by the number of concrete foundations removed and disposed of, complete and accepted.

BASIS OF PAYMENT: This work will be paid for at the contract unit price each for "Remove Concrete Base" which price shall include all materials, equipment and work incidental thereto including excavation, removal, backfill when necessary, hauling and disposal of the concrete foundation.

ITEM #1003540A - ALUMINUM POLE

DESCRIPTION: This item shall consist of furnishing and installing aluminum poles with removable transformer bases, dampers, grounding wire and connections, complete in place, at the locations and to the dimensions and details shown on the plans or as directed by the Engineer.

MATERIALS: Each pole with appurtenances attached thereto shall be fabricated of aluminum alloy, designed and constructed in accordance with the plans and current requirements of AASHTO "Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals." Poles with camera arms, junction boxes, and 360 degree cameras shall be designed to withstand a wind speed of 90 mph.

Base:

Pole with transformer base shall meet the breakaway requirements of the current AASHTO "Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals" and shall be identified with visible markings. The transformer base shall be approximately 17 inches high with a door having an approximate opening of 9" x 12".

A bonding lug shall be provided in each transformer base. All castings shall be clean and smooth with all details well-defined and true to pattern.

Shaft:

Shaft shall be fabricated of aluminum alloy 6063-T6 as specified under AASHTO, current edition. Each shaft shall be seamless, tapered, circular in cross section. The shaft shall be 1 piece.

Each shaft shall be provided with an aluminum pole cap with self-tapping screws and an internal vibration damper. The internal vibration damper shall be factory installed, location and size as determined by the pole manufacturer.

The shaft shall be finished with a uniform surface having the natural color of aluminum. The shaft shall have a smooth, uniform finish, free from disfiguring scratches, dents and similar markings.

Hardware:

All screws, nuts, bolts, washers, and miscellaneous hardware used to assemble the pole and base shall be stainless steel with the exception of washers and nuts for anchor bolts. Stainless steel bolts and washers shall conform to the requirements of ASTM A193, Grade B8. Stainless steel nuts shall conform to the requirements of ASTM A194, Grade 8.

Design Requirements:

The pole manufacturer shall certify on the catalog cuts or shop drawings that the pole, with appurtenances, conform to all pertinent requirements of AASHTO "Standard Specifications

for Structural Supports for Highway Signs, Luminaires, and Traffic Signals" including the latest AASHTO breakaway requirements and in accordance with definition given to the latest edition of AWS, as specified under AASHTO, Section 5, Article 1.5.5, Fabrication of Welded Aluminum Structure.

CONSTRUCTION METHODS: Aluminum poles shall be securely fastened to the anchor bolts in the concrete foundation. The completely assembled aluminum pole shall be erected plumb with the aid of aluminum shims, if necessary. The mounting height shall be as called for on the plans, measured from the center of the camera to the grade directly below.

The top of the shaft shall be drilled to accept three self-tapping screws. Pole caps shall be attached securely with three stainless steel set screws.

Each aluminum pole shall be effectively grounded with #8 AWG ground wire attached to the aluminum pole by an approved aluminum to copper lug and a stainless steel bolt, run to the ground rod, and connected with a square head bolt clamp.

METHOD OF MEASUREMENT: This work will be measured for payment by the number of aluminum poles complete and accepted in place.

BASIS OF PAYMENT: This work will be paid for at the contract unit price each for "Aluminum Pole" complete in place, which price shall include all materials, including dampers, shaft, transformer bases, washers, nuts, bolts, bolt covers, ground wire, connections, and all equipment, tools, labor incidental thereto, including pole certification.

ITEM #1003731A - BRIDGE INSPECTION RECEPTACLES (SITE NO. 1)

ITEM #1003732A - BRIDGE INSPECTION RECEPTACLES (SITE NO. 2)

DESCRIPTION: This item shall consist of furnishing and installing ground fault duplex receptacles, weatherproof boxes, conduit, conductors, and associated materials in each new box girder of structure No. 06947 (Site No. 1) and 06043A (Site No. 2) in accordance with the plans and specifications.

MATERIALS: Ground fault circuit interrupter duplex receptacles shall be 20 amp, 125 volt, 60 Hz Class A, approved by Underwriters Laboratory.

Conductors shall be THHN/THWN, rated for 600 volts. Conductors shall be No. 12 AWG and No. 10 AWG as called for on the plans. Conductor color coding shall be black, white, green.

The transformer shall be single phase, dry type, encapsulated, rated at 3.0 KVA, with a 240x480v primary and a 120/240 60 HZ secondary. The transformer shall be suitable for outdoor locations. The primary shall be fused with a 6 amp fuse and the secondary shall be fused for 20 amps. The transformer shall be U.L. listed.

Device boxes and junction boxes shall be sized as indicated on the plans and shall be constructed from hot compression molded fiberglass reinforced polyester or polyvinyl chloride. The enclosure shall be completely weatherproof and rated for outdoor use. Device boxes shall have hinged weatherproof covers.

Flexible conduit shall be LFNC-B (Liquidtight Flexible Nonmetallic Conduit) with a trade size diameter as indicated on the plans. LFNC shall be listed for UL Standard UL1660 and marked for outdoor applications. LFNC shall be flame resistant and UV/sunlight resistant. LFNC and fittings shall be wet location rated.

The 3/4" fiberglass conduit shall be standard wall type with a minimum wall thickness of 0.070 inches. The conduit shall be reinforced thermosetting resin conduit using the single circuit filament winding process and shall be free from defects including non-circularity and foreign inclusions. The conduit shall be nominally uniform (as commercially practical) in color, density, and physical properties and shall be straight with the ends cut square to the inside diameter. Each section of conduit shall be supplied with an overall length of 20'. The conduit color shall be black. The complete conduit system shall be UL listed and shall meet or exceed the requirements of UL 2515 Above Ground Standard. All conduit, elbows and fittings shall be durably and legibly marked in accordance with and Fittings and NEMA TC 14. All conduit joints shall feature tapered buttress threads which shall be permanently bonded using a joint adhesive supplied by the conduit manufacturer. The joint adhesive shall be applied to the conduit as specified by the manufacturer. The resin system shall be epoxy anhydride-cured with no fillers.
A complete line of fittings, adapters, expansion fittings and elbows shall be available and shall be manufactured from the same materials and manufacturing process as the conduit. Expansion

fittings shall be supplied by the conduit manufacturer and shall provide a minimum of 8" of lateral movement at all bridge expansion joints and 4" of lateral movement at all non-expansion locations. The conduit shall have an operating range of -40F to +250F and shall contain a ultra-violet (UV) inhibitor to meet the appropriate UL, CSA or NEMA specification.

Where the fiberglass conduit is connected to a non-metallic junction/device box the following connections can be utilized:

• Direct glued joint between the fiberglass conduit and a fiberglass reinforced polyester box.
• Use of a threaded box connector with locknuts.

Clamps for attaching the conduit to the steel bridge structure shall be beam-clamp type requiring no drilling into the bridge steel. Clamps for attaching the conduit to concrete bridge structure shall be two-hole type. All clamp materials shall be galvanized and rated for outdoor wet environments. Threaded rods, anchor bolts, nuts and washers shall be 316 stainless steel. When clamping the fiberglass conduit to the steel bridge structure, a slip collar shall be installed at the clamp location to allow the conduit to laterally expand within the clamp. When clamping the fiberglass conduit to the concrete bridge structure, the two-hole strap shall be oversized to allow the conduit to laterally expand within the strap. All attachment hardware including, mechanical anchors, slotted channel rail, bolts, hex-nuts, washers, etc. shall be stainless steel.

PVC conduit shall be ¾", schedule 40, and shall conform to Article M.15.09-3.

Fuse holders and fuses shall conform to Article M.15.05. Fuse ampere rating shall be as called for on the plans.

Wire nuts shall be gel filled, waterproof type, and shall be UL 486D listed.

CONSTRUCTION METHOD: The materials required for the bridge inspection receptacle system shall be installed in conformance with the plan details. The Contractor shall attach the 6"x6"x4" junction box over the conduit stub-down(s) in the ceiling of each new box girder. ¾" fiberglass conduit (FGC) shall be installed on the surface of the box girder ceiling from the surface mounted 6"x6"x4" junction box to each 4"x4"x4" junction box positioned at a GFCI duplex receptacle location. ¾" PVC conduit shall be run from each 4"x4"x4" junction box to the adjacent GFCI receptacle. There shall be a minimum of two receptacles per box girder; however, additional receptacles shall be installed in conformance with the following requirements: Spacing and placement of receptacles within the girder shall be dependent on the length of the girder. The receptacles located adjacent to the ends of the girder shall be installed at a minimum of 15' to a maximum of 50' from the girder end. A receptacle shall be located within 5' of the girder's access hatch. The spacing between adjacent receptacles shall not exceed 100'.

Holes for expansion anchors shall be drilled into the concrete at a depth not to exceed 1 ¼" to avoid damage to the reinforcing bars. Fiberglass conduit shall be securely clamped to the structure with clamp spacing as recommended by the NEC for reinforced thermosetting resin conduit (RTRC). Support spacing shall not exceed 3'-0" as specified in N.E.C. 355.30. Clamps

for attaching the conduit to the steel bridge structure shall be beam-clamp type requiring no drilling into the bridge steel. Clamps for attaching the conduit to the concrete bridge structure shall be two-hole type. When clamping the fiberglass conduit to the steel bridge structure, a slip collar shall be installed at the clamp location to allow the conduit to laterally expand within the clamp. When clamping the fiberglass conduit to the concrete bridge structure, the two-hole strap shall be oversized to allow the conduit to laterally expand within the strap. Expansion Joints and conduit shall be supplied by the same manufacturer. All expansion joints shall be installed using the manufacturers recommended guidelines. For conduit lengths under 50 feet no expansion joints will be required. For conduit lengths between 50 feet to 200 feet one expansion joint (4" movement) shall be installed at the mid-point of the conduit. For conduit lengths over 200 feet an expansion joint (4" movement) shall be installed every 200 feet. At bridge expansion joints, conduit expansion joints shall be "double" type with an overall lateral movement of 8". In areas where structural movement or expansion is anticipated and a standard conduit expansion coupling cannot be properly installed, the Contractor can install a sufficient length of LFNC to account for the anticipated movement. Surface mounted conduit shall be installed where indicated on the plans; using mounting brackets and/or clamps as approved by the Department. All joints shall be glued together using the Manufacturers recommended adhesive as well as the manufactures recommended procedure. The surface of the conduit shall be dry and clean, free of dust, moisture, oil, grease, or any other contaminant. Any field cuts shall be hand sanded to remove the resin glaze and to provide mechanical adhesion. The adhesive shall be applied only within the temperature range as specified by the manufacture. The Contractor shall ensure that no adhesive has formed on the interior wall of the conduit.

The receptacle boxes shall be installed on the side of the bridge girder or on the cross braces, and connected by PVC and where necessary Flexible conduit to the 4"x4"x4" junction boxes mounted to the girder ceiling. Wiring of the receptacles and transformer shall be as indicated on the plan details. The proposed method for mounting the boxes shall be submitted for approval.

The transformer shall be mounted to the underside of the bridge deck within the first box girder, and shall be electrically fed from the highway lighting circuit contained in the bridge parapet. The transformer shall be connected to the lighting circuit with in-line fusing. The transformer and GFCI receptacles shall be grounded as indicated on the plans and in conformance with NEC requirements.

Prior to beginning work and fabrication of any materials, the Contractor shall take all field measurements necessary to assure the proper fit of the finished structure mounted conduit and receptacle system. This shall include all supports, brackets and hangers, fixed and flexible sweep bends, expansion/contraction fittings, junction boxes, and other structure mounted appurtenances. The Contractor shall submit shop drawings to the Engineer for approval in accordance with Section 1.06.01. Submittals shall include the following information:

a. Layout plans and other pertinent information, including locations and type of supports, locations of receptacles, sweep-bends, expansion fittings, junction boxes, etc.

b. Commercial items shall be identified by manufacturer, trade name and catalog number. Catalog sheets, including pertinent specifications, shall be included with the submission.

c. Complete fabrication details, including material specifications, for all conduit supports, brackets and hangers, hardware, field fasteners including mechanical anchorages, etc. Where drilling into the structure is required the Contractor shall submit plans showing the location and diameter of all drill holes. Approval for drilling into the structure will be required.

d. All field measurements shall be submitted for reference to the reviewer.

Once installed the Contractor shall test and verify the functionality of the bridge inspection receptacle system.

METHOD OF MEASUREMENT: This work will be measured for payment as a lump sum complete and accepted per site.

BASIS OF PAYMENT: This work will be paid for at the contract lump sum price each for "Bridge Inspection Receptacles (Site No. 1)" and "Bridge Inspection Receptacles (Site No. 2)" complete and accepted in place, which price shall include all materials including junction boxes, device boxes, receptacles, covers, couplings, condulets, flexible conduit, expansion fittings, conduit, conductors, transformer, mounting hardware, clamps, anchors, slotted channel rail, straps, fuses, fuse holders, wire nuts, connections, drilling, grounding, and all materials, labor, tools, equipment and work incidental thereto.

ITEM #1003906A - REMOVE LIGHT STANDARD

DESCRIPTION: Under this item the Contractor shall remove an existing light standard with transformer base, bracket, and luminaire as indicated on the plans or as directed by the Engineer. The removed light standard, transformer base, bracket, and luminaire, shall remain the property of the Contractor.

CONSTRUCTION METHODS: The Contractor shall remove a light standard, transformer base, bracket, and luminaire, where required. The removed materials shall remain the property of the Contractor.

All removed materials shall be properly disposed of by the Contractor. The removed luminaire contains regulated materials. All regulated materials shall be as described and disposed of under Item No. 0101143A – Handling and Disposal of Regulated Items. Remote ballasts (where present), fuse kits, and wire shall be disposed of by the Contractor.

METHOD OF MEASUREMENT: This work will be measured for payment by the number of light standards with associated equipment removed and disposed of complete and accepted.

BASIS OF PAYMENT: This work will be paid for at the contract unit price each for "Remove Light Standard" complete, which price shall include the removal of a light standard with associated transformer base, bracket, luminaire, lamp, cable and hardware, delivering, disposing, hauling, and including all materials, tools, equipment, labor and work incidental thereto.

ITEM #1003912A - REMOVE CONCRETE LIGHT STANDARD BASE

DESCRIPTION: Under this item the Contractor shall remove an existing concrete light standard base where shown on the plans or as directed. The removed concrete base shall remain the property of the contractor.

CONSTRUCTION METHODS: The Contractor shall remove a concrete light standard base where required. The removed base shall be properly disposed of by the Contractor. The hole shall be backfilled and graded to match surroundings, unless otherwise noted on the plans.

METHOD OF MEASUREMENT: This work will be measured for payment by the number of concrete light standard bases removed and disposed of, complete and accepted.

BASIS OF PAYMENT: This work will be paid for at the contract unit price each for "Remove Concrete Light Standard Base", which price shall include all materials, equipment and work incidental thereto including excavation, removal, backfill when necessary, hauling and disposing of the concrete base.

ITEM #1003916A - REMOVE AND RELOCATE LIGHT STANDARD

DESCRIPTION: Under this item the Contractor shall remove, temporarily store as required, and install an existing light standard where shown on the plans, or as directed by the Engineer. The installation shall consist of erecting the light standard with bracket, ballast, luminaire and lamp on the new foundation, and making all necessary electrical connections for proper operation.

MATERIALS: The Contractor shall be responsible for damage to all equipment and materials incurred during removal and hauling to the specified area. All repairs or replacements due to damage or loss by the Contractor shall be made at the Contractor's expense.

Breakaway fuse connectors and fuses shall conform to Section M.15.05.

No. 10 single conductor shall be #10 AWG, THHN, rated for 600 volts. No. 8 bare grounding conductor shall conform to M.15.13.

CONSTRUCTION METHOD: The Contractor shall remove a light standard, bracket, luminaire and ballast where required, or as directed by the Engineer. The removed light standard, transformer base, bracket(s), luminaire(s), attachment hardware, shims, and load side conductors shall be properly stored as a unit at a location not to pose a hazard to motorists or cause damage to the unit. Upon installation of the new concrete foundation (paid for under a separate bid item), the completely assembled light standard shall be re-installed plumb with the aid of aluminum shims, if necessary. The bracket shall be securely attached to the light standard and the assembly shall be erected with the bracket placed perpendicular to the center line of the roadway.

The existing No. 10 tap conductors and fuse kits shall be removed and properly disposed of. New No. 10 conductors shall be installed between the luminaire and pole base or adjacent cast iron junction box. New breakaway fuse kits shall be installed in the pole base or adjacent cast iron junction box and connected to the lighting circuit. The luminaire shall be connected to the lighting circuit and proper operation shall be verified.The light standard shall be connected to the grounding system and ground rod with a No. 8 bare copper grounding conductor.

The Contractor shall make all necessary arrangements with the District Electrical Maintenance Supervisor, for locking and unlocking of the circuits on which any work is to be done, through the Engineer.

All work shall be in strict conformance with the National Electric Code.

METHOD OF MEASUREMENT: This work will be measured for payment by the number of light standards removed and relocated, complete and accepted.

BASIS OF PAYMENT: This work will be paid for at the contract unit price each for "Remove and Relocate Light Standard" as specified, which price shall include removal, storage, delivery, and installation of the light standard with bracket and luminaire, breakaway fuse holders, fuses, conductors, connections, disposal, and all work, materials, tools and equipment incidental thereto.

ITEM #1003925A - REMOVE EXISTING LUMINAIRE

DESCRIPTION: Under this item the Contractor shall remove an existing luminaire, and associated equipment as indicated on the plans or as directed and in accordance with these specifications. The removed luminaire and lamp shall be properly disposed of by the Contractor.

CONSTRUCTION METHOD: The Contractor shall remove an existing luminaire, and associated equipment where required. The removed luminaire and lamp shall be properly disposed of by the Contractor.

All removed materials shall be properly disposed of by the Contractor. The removed luminaire contains regulated materials. All regulated materials shall be as described and disposed of under Item No. 0101143A – Handling and Disposal of Regulated Items.

METHOD OF MEASUREMENT: This work will be measured for payment by the number of luminaires with associated equipment, removed and disposed of complete and accepted.

BASIS OF PAYMENT: This work will be paid for at the contract unit price each for "Remove Existing Luminaire", which price shall include removal of luminaire and associated equipment, hauling and unloading, disposal, and all materials, tools, equipment and labor incidental thereto.

ITEM #1005600A - LED LUMINAIRE

DESCRIPTION: This item shall consist of furnishing and installing a light emitting diode (LED) luminaire of the wattage, distribution, and voltage as specified, completely wired and attached to the arm or bracket of the pole in accordance with the plans and specifications.

MATERIALS: The LED luminaire shall be one of the following:

American Electric, Autobahn, catalog number: **ATB0-20BLEDE53-480-R2-NR,** with the following characteristics: 36 watts, 4,638 lumens, 525mA, 4000 CCT, 480 volt, type 2 light distribution, and 10kV surge suppression.

Philips, RoadFocus, catalog number: **RFM-35W32LED4K-G2-R2M-HVU-GY3**, with the following characteristics: 37 watts, 4,670 lumens, 350mA, 4000 CCT, 480 volt, type 2 medium light distribution, and 10kV surge suppression.

Eaton, Streetworks, Archeon Small, catalog number: **ARCH-AF16-30-8-T2R-10K-AP**, with the following characteristics: 32 watts, 3,803 lumens, 4000 CCT, 480 volt, type 2 medium light distribution, and 10kV surge suppression.

No alternate luminaires will be accepted. A catalog cut will be required.

The luminaire housing shall be powder coated grey in color.

The luminaire housing shall not have a photocontrol receptacle.

The luminaire's onboard circuitry shall include a surge protection device (SPD) to withstand high repetition noise transients as a result of utility line switching, nearby lightning strikes, and other interference. The LED luminaire shall be provided with integral 10kV surge protection which shall conform and be labeled as UL 1449 compliant. The SPD protects the luminaire from damage and failure for common and differential mode transient peak currents up to 5kA (minimum). SPD performance shall have been tested per procedures in ANSI C136.2/IEEE C62.41-2:2002 category C high exposure. The SPD shall fail in such a way as the Luminaire will no longer operate and the driver will be isolated from additional spikes. The SPD shall be field replaceable.

The LED luminaire shall carry a limited 5 year warranty on the LEDs and the Driver.

Conductors shall be #10 AWG in accordance with Article M.15.11 of the Standard Specifications. Insulation shall be THHN/THWN and rated for 600 volts. The equipment grounding conductor shall be No. 10 AWG, THHN/THWN, rated for 600 volts. The ground wire shall be green in color.

Fuses and fuse holders shall conform to the requirements of Article M.15.05 and shall be “slow blow” type.

CONSTRUCTION METHOD: The LED luminaire shall be installed at the end of the bracket and shall be securely fastened, properly oriented, connected to the power supply conductors, cleaned, and ready for operation. The luminaire shall be leveled by placing an electronic (digital) level along the flat bottom face of the luminaire. All luminaires suspected of not being leveled shall be re-leveled by the Contractor at the discretion of the Engineer.

For installation on an existing light standard: The Contractor shall remove and replace the existing no. 10 AWG conductors and existing fuses/fuse kits. Three No. 10 AWG conductors shall be installed from the fuse holders to the luminaire. Fuse holders and fuses shall be installed in the pole base or in the adjacent cast iron junction box for bridge mounted poles. The luminaire shall be properly grounded with a No. 10 AWG equipment ground connected between the ground rod/wire in the light pole base (or junction box) and the grounding lug in the luminaire. Existing tap conductors and fuse kits which are removed shall be properly disposed of by the Contractor.

The Contractor shall ensure that once installed the LED luminaire functions properly.

Luminaires classified as “spare” on the plans shall not be installed but shall be delivered to ConnDOT District 1 Electrical Maintenance. The Contractor shall contact the Electrical Maintenance Supervisor at telephone: 860-566-3156 to coordinate the transfer of the spare luminaire to ConnDOT. The Contractor shall contact the Electrical Maintenance Supervisor at least 48 hours in advance to coordinate the transfer of materials.

METHOD OF MEASUREMENT: This work will be measured for payment by the number of LED luminaires installed, complete and accepted.

BASIS OF PAYMENT: This work will be paid for at the contract unit price each for "LED Luminaire" of the type and size specified, complete and accepted in place, which price shall include all materials including luminaire, LEDs, driver, surge suppressor, conductors, fuses, fuse holders, connections, leveling, grounding, delivery, and all labor, tools, equipment and work incidental thereto.

ITEM #1005601A - LED LUMINAIRE – TYPE 1

DESCRIPTION: This item shall consist of furnishing and installing a light emitting diode (LED) luminaire of the wattage, distribution, and voltage as specified, completely wired and attached to the arm or bracket of the pole in accordance with the plans and specifications.

MATERIALS: The LED luminaire shall be one of the following:

For luminaires with a Type II light distribution:

Philips Road Focus, catalog number: **RFM-108W48LED4K-G2-R2M-HVU-API-SP2-GY3**, with the following characteristics: 106 watts, 12,757 lumens, 700mA, 4000 CCT, 480 volt, Type II light distribution, and 20kV surge suppression.

American Electric, Autobahn, catalog number: **ATB0-30BLEDE10-480-R2-NR-20K-NL,** with the following characteristics: 105 watts, 12,414 lumens, 1000mA, 4000 CCT, 480 volt, Type II light distribution, and 20kV surge suppression.

Cooper Lighting, Navion, catalog number: **NVN-AF-02-E-8-SL2-1000-20K-AP**, with the following characteristics: 113 watts, 11,941 lumens, 1000mA, 4000 CCT, 480 volt, Type II medium light distribution, and 20kV surge suppression.

For luminaires with a Type III light distribution:

Philips Road Focus, catalog number: **RFM-108W48LED4K-G2-R3M-HVU-API-SP2-GY3**, with the following characteristics: 106 watts, 12,771 lumens, 700mA, 4000 CCT, 480 volt, Type III light distribution, and 20kV surge suppression.

American Electric, Autobahn, catalog number: **ATB0-30BLEDE10-480-R3-NR-20K-NL,** with the following characteristics: 105 watts, 12,748 lumens, 1000mA, 4000 CCT, 480 volt, Type III light distribution, and 20kV surge suppression.

Cooper Lighting, Navion, catalog number: **NVN-AF-02-E-8-SL3-1000-20K-AP**, with the following characteristics: 113 watts, 12,165 lumens, 1000mA, 4000 CCT, 480 volt, Type III medium light distribution, and 20kV surge suppression.

No alternate luminaires will be accepted. A catalog cut will be required.

The luminaire housing shall be powder coated grey in color.

The luminaire housing shall not have a photocontrol receptacle.

The luminaire's onboard circuitry shall include a surge protection device (SPD) to withstand high repetition noise transients as a result of utility line switching, nearby lightning strikes, and

other interference. The LED luminaire shall be provided with integral 20kV surge protection which shall conform and be labeled as UL 1449 compliant. The SPD protects the luminaire from damage and failure for common and differential mode transient peak currents up to 10 kA (minimum). SPD performance shall have been tested per procedures in ANSI C136.2/IEEE C62.41-2:2002 category C high exposure. The SPD shall be connected so that in the event of catastrophic failure the luminaire will no longer operate and the driver and light engine will be isolated from additional spikes. The SPD shall be field replaceable.

The LED luminaire shall carry a limited 5 year warranty on the LEDs and the Driver, and shall be ARRA compliant.

Conductors shall be #10 AWG in accordance with Article M.15.11 of the Standard specifications. Insulation shall be THHN/THWN and rated for 600 volts. The equipment grounding conductor shall be No. 10 AWG, THHN/THWN, rated for 600 volts. The ground wire shall be green in color.

Fuses and fuse holders shall conform to the requirements of Article M.15.05. Fuses shall be "slow-blow" type rated at 10 amps.

CONSTRUCTION METHOD: The LED luminaire shall be installed at the end of the bracket and shall be securely fastened, properly oriented, connected to the power supply conductors, cleaned, and ready for operation. The luminaire shall be leveled by placing an electronic (digital) level along the flat bottom face of the luminaire. All luminaires suspected of not being leveled shall be re-leveled by the Contractor at the discretion of the Engineer. The Contractor shall ensure that once installed the LED luminaire functions properly.

For installation on a new light standard: Fuse holders and fuses shall be installed in the pole base or in the adjacent cast iron junction box for bridge parapet mounted poles. Three No. 10 AWG conductors shall be installed from the fuse holders to the luminaire. The luminaire shall be properly grounded with a No. 10 AWG equipment ground connected between the ground rod/system in the light pole base and the grounding lug in the luminaire.

For installation on an existing light standard: The Contractor shall remove and replace the existing no. 10 AWG conductors and existing fuses/fuse kits. Three No. 10 AWG conductors shall be installed from the fuse holders to the luminaire. The luminaire shall be properly grounded with a No. 10 AWG equipment ground connected between the ground rod/system in the light pole base and the grounding lug in the luminaire. Existing tap conductors and fuse kits which are removed shall be properly disposed of by the Contractor.

Luminaires classified as "spare" on the plans shall not be installed but shall be delivered to ConnDOT District 1 Electrical Maintenance. The Contractor shall contact the Electrical Maintenance Supervisor at telephone: 860-566-3156 to coordinate the transfer of the spare luminaire to ConnDOT. The Contractor shall contact the Electrical Maintenance Supervisor at least 48 hours in advance to coordinate the transfer of materials.

METHOD OF MEASUREMENT: This work will be measured for payment by the number of LED luminaires installed, complete and accepted.

BASIS OF PAYMENT: This work will be paid for at the contract unit price each for "LED Luminaire – Type 1" of the type and size specified, complete and accepted in place, which price shall include all materials including luminaire, LEDs, driver, surge suppressor, conductors, fuses, fuse holders, connections, leveling, grounding, delivery of spares, removal and disposal of existing conductors and fuse kits, and all labor, tools, equipment and work incidental thereto.

ITEM #1005602A - LED LUMINAIRE – TYPE 2

DESCRIPTION: This item shall consist of furnishing and installing a light emitting diode (LED) luminaire of the wattage, distribution, and voltage as specified, completely wired and attached to the arm or bracket of the pole in accordance with the plans and specifications.

MATERIALS: The LED luminaire shall be one of the following:

For luminaires with a Type II light distribution:

Philips Lumec, Road Focus, catalog number: **RFL-145W64LED4K-G2-R2M-HVU-SP2-GY3**, with the following characteristics: 137 watts, 17,444 lumens, 700mA, 4000 CCT, 480 volt, Type II medium light distribution, and 20kV surge suppression.

American Electric, Autobahn, catalog number: **ATB2-60BLEDE70-480-R2-NR-20K,** with the following characteristics: 130 watts, 18,193 lumens, 700mA, 4000 CCT, 480 volt, Type II light distribution, and 20kV surge suppression.

Cooper Lighting, Navion, catalog number: **NVN-AF-04-E-8-SL2-20K-600-AP**, with the following characteristics: 129 watts, 15,759 lumens, 600mA, 4000 CCT, 480 volt, Type II medium light distribution, and 20kV surge suppression.

No alternate luminaires will be accepted. A catalog cut will be required.

Required light distribution shall be as indicated on the plans.

The luminaire housing shall be powder coated grey in color.

The luminaire housing shall not have a photocontrol receptacle.

The luminaire's onboard circuitry shall include a surge protection device (SPD) to withstand high repetition noise transients as a result of utility line switching, nearby lightning strikes, and other interference. The LED luminaire shall be provided with integral 20kV surge protection which shall conform and be labeled as UL 1449 compliant. The SPD protects the luminaire from damage and failure for common and differential mode transient peak currents up to 10 kA (minimum). SPD performance shall have been tested per procedures in ANSI C136.2/IEEE C62.41-2:2002 category C high exposure. The SPD shall fail in such a way as the Luminaire will no longer operate and the driver will be isolated from additional spikes. The SPD shall be field replaceable.

The LED luminaire shall carry a limited 5 year warranty on the LEDs and the Driver.

Conductors shall be #10 AWG in accordance with Article M.15.11 of the Standard Specifications. Insulation shall be THHN/THWN and rated for 600 volts. The equipment grounding conductor shall be No. 10 AWG, THHN/THWN, rated for 600 volts. The ground wire shall be green in color.

Fuses and fuse holders shall conform to the requirements of Article M.15.05. Fuses shall be "slow blow" type.

CONSTRUCTION METHOD: The LED luminaire shall be installed at the end of the bracket and shall be securely fastened, properly oriented, connected to the power supply conductors, cleaned, and ready for operation. The luminaire shall be leveled by placing an electronic (digital) level along the flat bottom face of the luminaire. All luminaires suspected of not being leveled shall be re-leveled by the Contractor at the discretion of the Engineer. The Contractor shall ensure that once installed the LED luminaire functions properly.

For installation on a new light standard: Fuse holders and fuses shall be installed in the pole base or in the adjacent cast iron junction box for bridge parapet mounted poles. Three No. 10 AWG conductors shall be installed from the fuse holders to the luminaire. The luminaire shall be properly grounded with a No. 10 AWG equipment ground connected between the ground rod/system in the light pole base and the grounding lug in the luminaire.

For installation on an existing light standard: The Contractor shall remove and replace the existing no. 10 AWG conductors and existing fuses/fuse kits. Three No. 10 AWG conductors shall be installed from the fuse holders to the luminaire. The luminaire shall be properly grounded with a No. 10 AWG equipment ground connected between the ground rod/system in the light pole base and the grounding lug in the luminaire. Existing tap conductors and fuse kits which are removed shall be properly disposed of by the Contractor.

Luminaires classified as "spare" on the plans shall not be installed but shall be delivered to ConnDOT District 1 Electrical Maintenance. The Contractor shall contact the Electrical Maintenance Supervisor at telephone: 860-566-3156 to coordinate the transfer of the spare luminaire to ConnDOT. The Contractor shall contact the Electrical Maintenance Supervisor at least 48 hours in advance to coordinate the transfer of materials.

METHOD OF MEASUREMENT: This work will be measured for payment by the number of LED luminaires installed, complete and accepted.

BASIS OF PAYMENT: This work will be paid for at the contract unit price each for "LED Luminaire – Type 1" of the type and size specified, complete and accepted in place, which price shall include all materials including luminaire, LEDs, driver, surge suppressor, conductors, fuses, fuse holders, connections, leveling, grounding, delivery of spares, removal and disposal of existing conductors and fuse kits, and all labor, tools, equipment and work incidental thereto.

ITEM #1005603A - LED LUMINAIRE – TYPE 3

DESCRIPTION: This item shall consist of furnishing and installing a light emitting diode (LED) luminaire of the wattage, distribution, and voltage as specified, completely wired and attached to the arm or bracket of the pole in accordance with the plans and specifications.

MATERIALS: The LED luminaire shall be one of the following:

Philips Lumec, Road Focus, catalog number: **RFL-180W80LED4K-G2-R2M-HVU-SP2-GY3**, with the following characteristics: 174 watts, 21,805 lumens, 700mA, 4000 CCT, 480 volt, type 2 light distribution, and 20kV surge suppression.

American Electric, Autobahn, catalog number: **ATB2-60BLEDE85-480-R2-NR-20K-NL,** with the following characteristics: 165 watts, 21,436 lumens, 850mA, 4000 CCT, 480 volt, type 2 light distribution, and 20kV surge suppression.

Cooper Lighting, Navion, catalog number: **NVN-AF-04-E-8-SL2-20K-800-AP**, with the following characteristics: 171 watts, 19,324 lumens, 800mA, 4000 CCT, 480 volt, type 2 medium light distribution, and 20kV surge suppression.

No alternate luminaires will be accepted. A catalog cut will be required.

The luminaire housing shall be powder coated grey in color.

The luminaire housing shall not have a photocontrol receptacle.

The luminaire's onboard circuitry shall include a surge protection device (SPD) to withstand high repetition noise transients as a result of utility line switching, nearby lightning strikes, and other interference. The LED luminaire shall be provided with integral 20kV surge protection which shall conform and be labeled as UL 1449 compliant. The SPD protects the luminaire from damage and failure for common and differential mode transient peak currents up to 10 kA (minimum). SPD performance shall have been tested per procedures in ANSI C136.2/IEEE C62.41-2:2002 category C high exposure. The SPD shall fail in such a way as the Luminaire will no longer operate and the driver will be isolated from additional spikes. The SPD shall be field replaceable.

The LED luminaire shall carry a limited 5 year warranty on the LEDs and the Driver.

Conductors shall be #10 AWG in accordance with Article M.15.11 of the Standard Specifications. Insulation shall be THHN/THWN and rated for 600 volts. The equipment grounding conductor shall be No. 10 AWG, THHN/THWN, rated for 600 volts. The ground wire shall be green in color.

Fuses and fuse holders shall conform to the requirements of Article M.15.05 and shall be “slow blow” type.

CONSTRUCTION METHOD: The LED luminaire shall be installed at the end of the bracket and shall be securely fastened, properly oriented, connected to the power supply conductors, cleaned, and ready for operation. The luminaire shall be leveled by placing an electronic (digital) level along the flat bottom face of the luminaire. All luminaires suspected of not being leveled shall be re-leveled by the Contractor at the discretion of the Engineer.

For installation on a new light standard: Fuse holders and fuses shall be installed in the pole base or in the adjacent cast iron junction box for bridge parapet mounted poles. Three No. 10 AWG conductors shall be installed from the fuse holders to the luminaire. The luminaire shall be properly grounded with a No. 10 AWG equipment ground connected between the ground rod/system in the light pole base and the grounding lug in the luminaire.

For installation on an existing light standard: The Contractor shall remove and replace the existing no. 10 AWG conductors and existing fuses/fuse kits. Three No. 10 AWG conductors shall be installed from the fuse holders to the luminaire. The luminaire shall be properly grounded with a No. 10 AWG equipment ground connected between the ground rod/system in the light pole base and the grounding lug in the luminaire. Existing tap conductors and fuse kits which are removed shall be properly disposed of by the Contractor.

The Contractor shall ensure that once installed the LED luminaire functions properly.

Luminaires classified as “spare” on the plans shall not be installed but shall be delivered to ConnDOT District 1 Electrical Maintenance. The Contractor shall contact the Electrical Maintenance Supervisor at telephone: 860-566-3156 to coordinate the transfer of the spare luminaire to ConnDOT. The Contractor shall contact the Electrical Maintenance Supervisor at least 48 hours in advance to coordinate the transfer of materials.

METHOD OF MEASUREMENT: This work will be measured for payment by the number of LED luminaires installed, complete and accepted.

BASIS OF PAYMENT: This work will be paid for at the contract unit price each for "LED Luminaire – Type 4" of the type and size specified, complete and accepted in place, which price shall include all materials including luminaire, LEDs, driver, surge suppressor, conductors, fuses, fuse holders, connections, leveling, grounding, disposal, delivery of spare luminaires, and all labor, tools, equipment and work incidental thereto.

ITEM #1005604A - LED LUMINAIRE – TYPE 4

DESCRIPTION: This item shall consist of furnishing and installing a pendant mounted light emitting diode (LED) luminaire to be used for underbridge lighting as specified, with pendant bracket and flexible conduit, completely wired and attached to the bridge structure in accordance with the plans and details. This item shall also include the removal of the existing HPS underbridge luminaire, pendant bracket, and flexible conduit from the bridge structure.

MATERIALS: The LED underbridge luminaire shall be one of the following:

Holophane, Parkpak LED, catalog number: **PPSQL2-P70-40K-48-GL-T5W-STM-GYSDP-SPD,** with the following characteristics: 80 watts, 8,366 lumens, 4000k CCT, 480 volt, and Type 5 wide light distribution.

Lithonia Lighting, D-Series LED Parking Garage fixture, catalog number: **DSXPG-LED-30C-700-40K-T5W-480-SPD-DNAXD** with the following characteristics: 67 watts, 8,019 lumens, 700mA, 4000k CCT, 480 volt, and Type 5 wide light distribution.

Philips Gardco, G3 LED Garage and Canopy fixture, catalog number: **G3-5-32L-800-NW-G2-480-MGY-NP**, with the following characteristics: 85 watts, 10,020 lumens, 800mA, 4000k CCT, 480 volt, and Type 5 symmetrical light distribution.

No alternate luminaires will be accepted. A catalog cut will be required.

The luminaire housing shall be powder coated grey or natural aluminum in color.

The luminaire housing shall not have a photocontrol receptacle.

The luminaire's onboard circuitry shall include a surge protection device (SPD) to withstand high repetition noise transients as a result of utility line switching, nearby lightning strikes, and other interference. The LED luminaire shall be provided with integral 10kV surge protection which shall conform and be labeled as UL 1449 compliant. The SPD protects the luminaire from damage and failure for common and differential mode transient peak currents up to 5kA (minimum). SPD performance shall have been tested per procedures in ANSI C136.2/IEEE C62.41-2:2002 category C high exposure. The SPD shall be field replaceable.

A spare surge suppressor shall be supplied with the luminaire and turned over to the Engineer for delivery to ConnDOT District Electrical Maintenance personnel.

The LED luminaire shall carry a limited 5 year warranty on the LEDs and the Driver.

Flexible conduit shall be ¾" Liquidtight Flexible Metallic Conduit and shall conform to Article M.15.09.

The galvanized steel pendant mounting bracket, mechanical anchors, and mounting hardware, shall be as detailed on the plans. Mechanical anchor bolts, nuts and washers shall conform to ASTM A449 and shall be stainless steel.

CONSTRUCTION METHOD: The Contractor shall remove the existing HPS underbridge luminaire from the existing pendant bracket. The Contractor shall remove the existing pendant bracket and ¾" flexible conduit back to the existing surface mounted rigid metal conduit. Removal of the pendant and flexible conduit shall be such that the existing 3 #10 conductors to the luminaire are retained for connection to the new luminaire. The LED underbridge luminaire with associated pendant bracket and flexible conduit shall be installed in conformance with Section 10.06. The luminaire shall be installed at the end of the pendant mount bracket and shall be securely fastened, properly oriented, leveled, re-connected to the existing power supply conductors, cleaned, and ready for operation. A waterproof thread sealer shall be applied to the threaded joint between the pendant and the luminaire. The exact method of attaching the luminaire to the pendant will be luminaire specific and shall maintain the luminaire's IP66/U.L. wet location rating. The Contractor shall contact the luminaire manufacturer to determine the required mounting method to maintain the IP66/U.L. wet location rating of the fixture. Mounting methods may include:

- Direct mount to 1 ¼" pendant with a ¾" NPT threaded reducer.

- Mount to 4"x4"x2" galvanized cast iron junction box with ¾" threaded backwall conduit hub threaded onto pendant with a ¾" reducer.

It is the Contractor's responsibility to verify that the mounting method retains the IP66/U.L. wet location rating of the fixture and that all connections to the pendant are watertight and suitable for outdoor locations. The mounting method shall be submitted for approval as part of the shop drawing submittal process. A waterproof thread sealer shall be applied to all threaded pendent connections including the threaded joint between the pendant and the luminaire.

The Contractor shall ensure that once installed the LED luminaire functions properly.

All removed materials shall be properly disposed of by the Contractor. The removed luminaire contains regulated materials. All regulated materials shall be as described and disposed of under Item No. 0101143A – Handling and Disposal of Regulated Items.

METHOD OF MEASUREMENT: This work will be measured for payment by the number of LED luminaires installed, complete and accepted.

BASIS OF PAYMENT: This work will be paid for at the contract unit price each for "LED Luminaire – Type 4" of the type and size specified, complete and accepted in place, which price shall include all materials including luminaire, LEDs, driver, surge suppressor (with spare), pendant bracket including conduit, conduit fittings, condulets and junction box, flexible conduit, anchors, hardware, connections, thread sealer, leveling, mounting, grounding, drilling, removal and disposal of materials, and all labor, tools, equipment and work incidental thereto.

ITEM #1006000A - UNDERBRIDGE LUMINAIRE – LED (WALL MOUNTED)

DESCRIPTION: This item shall consist of furnishing and installing a light emitting diode (LED) wall mounted underbridge luminaire as specified with necessary mountings, conduit, conductors, fuses, and fuseholders, completely wired and attached to the bridge wall in accordance with the plans and details.

MATERIALS: The LED luminaire shall be one of the following, or approved equal:

Holophane Lighting, model **W4GLED-20C-1000-40K-T3M-480-GYSDP-W4GWGU**.
Lithonia Lighting, model **TWHLED-20C-1000-40K-T3M-480-DNAXD-WG**.

For LED luminaires other than the specified luminaires, the Contractor shall submit a sample fixture (if requested by the Engineer) and a manufacturer's shop drawing. A shop drawing will be required for all submitted luminaires. The Department reserves the right to disapprove any alternate luminaire based solely on photometric performance, lumen maintenance, and construction. Alternate luminaires are required to meet average illuminance and uniformity ratio as recommended by the Illuminating Engineering Society of North America (RP-8-00) for the given roadway application as calculated by the Department.

The housing of the luminaire shall be heavy-duty die-cast aluminum with an impact resistant tempered glass lens that is fully gasketed. The housing shall be completely sealed against moisture and environmental contaminants. The LED luminaire shall be IP-55 rated. The housing shall feature standard grey thermal-setting polyester powder coat paint. The fixture shall be designed for wall mounting and shall have a threaded top and back knock-out for ¾" conduit attachment.

LED optics shall consist of sealed LED "light bars" with an IP66 rating. The luminaire optics shall provide warm white light at a standard 4000K CCT. The LEDs shall operate at a drive current of 1000mA. The luminaire shall provide an initial delivered lumen output of 7,000 lumens or greater, and shall provide an IESNA type III distribution. The luminaire shall produce a minimum of 95 lumens per watt. Integral aluminum heat sinks shall transfer heat rapidly away from the LED circuit boards.

The LED luminaire shall draw approximately 72 watts or less. The LED luminaire shall be provided with integral surge suppression protection meeting a minimum Category C low for 120-277 volts (per ANSI/IEEE C62.41.2). The LED luminaire electronic driver shall be Class 1 with a power factor >90% and THD <20%, and expected life of 100,000 hours. The luminaire shall operate at 480 volts. The luminaire shall be rated for -40°C minimum ambient. The luminaire's LM87 rating shall be greater than 100,000 hours at 25°C. The luminaire shall be supplied with a spare surge suppressor.

The LED luminaire shall carry a limited 5 year warranty on the LEDs and the Driver.

Conductors shall be #10 AWG in accordance with Article M.15.11 of the Standard Specifications. Insulation shall be THHN/THWN.

Mechanical anchors shall be stainless steel, 3/8" in diameter, with length as recommend by the manufacturer for the application and the expected load.

Flexible conduit shall be LFNC-B (Liquidtight Flexible Nonmetallic Conduit) with a trade size diameter as indicated on the plans. LFNC shall be listed for UL Standard UL1660 and marked for outdoor applications. LFNC shall be flame resistant and UV/sunlight resistant. LFNC and fittings shall be wet location rated.

The 3/4" fiberglass conduit shall be standard wall type with a minimum wall thickness of 0.070 inches. The conduit shall be reinforced thermosetting resin conduit using the single circuit filament winding process and shall be free from defects including non-circularity and foreign inclusions. The conduit shall be nominally uniform (as commercially practical) in color, density, and physical properties and shall be straight with the ends cut square to the inside diameter. Each section of conduit shall be supplied with an overall length of 20'. The conduit color shall be grey. The complete conduit system shall be UL listed and shall meet or exceed the requirements of UL 2515 Above Ground Standard. All conduit, elbows and fittings shall be durably and legibly marked in accordance with and Fittings and NEMA TC 14. All conduit joints shall feature tapered buttress threads which shall be permanently bonded using a joint adhesive supplied by the conduit manufacturer. The joint adhesive shall be applied to the conduit as specified by the manufacturer. The resin system shall be epoxy anhydride-cured with no fillers.
A complete line of fittings, adapters, expansion fittings and elbows shall be available and shall be manufactured from the same materials and manufacturing process as the conduit. Expansion fittings shall be supplied by the conduit manufacturer and shall provide a minimum of 8" of lateral movement at all bridge expansion joints and 4" of lateral movement at all non-expansion locations. The conduit shall have an operating range of -40F to +250F and shall contain a ultra-violet (UV) inhibitor to meet the appropriate UL, CSA or NEMA specification. Clamps for attaching the conduit to the steel bridge structure shall be single hole type. Clamps for attaching the conduit to concrete bridge structure shall be two hole type. All clamp materials shall be rated for outdoor wet environments. Threaded rods, anchor bolts, nuts and washers shall be 316 stainless steel. When clamping the fiberglass conduit to the steel bridge structure, a slip collar shall be installed at the clamp location to allow the conduit to laterally expand within the clamp. When clamping the fiberglass conduit to the concrete bridge structure, the two hole strap shall be sized to allow the conduit to laterally expand within the strap.

CONSTRUCTION METHOD: The LED luminaire with associated conduit and conductors shall be installed in conformance with Section 10.06. The LED underbridge luminaire shall be surface mounted to the bridge pier or abutment wall at the location and to the dimensions as indicated on the plans. The luminaire shall be leveled, securely fastened, properly oriented, connected to the power supply conductors, cleaned, and ready for operation.

The luminaire shall be properly grounded with a No. 10 AWG equipment ground connected to the system ground wire.

Fuse holders and fuses shall be installed in the cast iron junction box surface mounted to the bridge abutment. The cast iron Junction box shall be furnished and installed under a separate bid item.

Surface conduit and conductors shall be installed in conformance with section 10.08.03-1.
Fiberglass conduit shall be securely clamped to the structure with a clamp spacing as recommended by the NEC for reinforced thermosetting resin conduit (RTRC). Support spacing shall not exceed 3'-0" as specified in N.E.C. 355.30 or as listed by the conduit manufacturer.
Clamps for attaching the conduit to the steel bridge structure shall be single hole type. Clamps for attaching the conduit to the concrete bridge structure shall be two hole type. When clamping the fiberglass conduit to the steel bridge structure, a slip collar shall be installed at the clamp location to allow the conduit to laterally expand within the clamp. When clamping the fiberglass conduit to the concrete bridge structure, the two hole strap shall be sized to allow the conduit to laterally expand within the strap. Expansion Joints and conduit shall be supplied by the same manufacturer. All expansion joints shall be installed using the manufacturers recommended guidelines. For conduit lengths under 50 feet no expansion joints will be required. For conduit lengths between 50 feet to 200 feet one expansion joint (4" movement) shall be installed at the mid-point of the conduit. For conduit lengths over 200 feet an expansion joint (4" movement) shall be installed every 200 feet. At bridge expansion joints, conduit expansion joints shall be "double" type with an overall lateral movement of 8". In areas where structural movement or expansion is anticipated and a standard conduit expansion coupling cannot be properly installed, the Contractor can install a sufficient length of LFNC to account for the anticipated movement.
Surface mounted conduit shall be installed where indicated on the plans; using mounting brackets and/or clamps as approved by the Department. All joints shall be glued together using the Manufacturers recommended adhesive as well as the manufactures recommended procedure. The surface of the conduit shall be dry and clean, free of dust, moisture, oil, grease, or any other contaminant. Any field cuts shall be hand sanded to remove the resin glaze and to provide mechanical adhesion. The adhesive shall be applied only within the temperature range as specified by the manufacture. The Contractor shall ensure that no adhesive has formed on the interior wall of the conduit.

The Contractor shall ensure that once installed the LED luminaire functions properly.

The spare surge suppressor shall be turned over to the project inspector for transfer to District Electrical Maintenance personnel.

METHOD OF MEASUREMENT: This work will be measured for payment by the number of underbridge luminaires installed, complete and accepted.

BASIS OF PAYMENT: This work will be paid for at the contract unit price each for "Underbridge Luminaire – LED (Wall Mounted)" of the type and size specified, complete and accepted in place, which price shall include all materials including luminaire, LEDs, driver, surge suppressor, spare surge suppressor, conductors, conduit, liquid tight flexible conduit, reducers, conduit nipples, fuses, anchors, drilling, mounting, connections, and all labor, tools, equipment and work incidental thereto.

ITEM #1006001A - UNDERBRIDGE LUMINAIRE – LED (PENDANT MOUNTED)

DESCRIPTION: This item shall consist of furnishing and installing a light emitting diode (LED) luminaire to be used for underbridge lighting as specified with necessary mountings, conduit, conductors, pendant bracket, fuses, and fuseholders, completely wired and attached to the mounting pendant in accordance with the plans and details.

MATERIALS: The LED underbridge luminaire shall be one of the following or approved equal:

- Holophane, Parkpak LED, catalog number: **PPSQL2-P70-40K-48-GL-T5R-STM-GYSDP-SPD,** with the following characteristics: 80 watt, 8,020 lumen, 4000k CCT, 480 volt, glass lens, ¾" threaded top pendant attachment, type 5 rectangular light distribution.

- Holophane, Petrolux LED, catalog number: **PLED2-08L-4K-48-UN-NA-G-L1-09189-3**, with the following characteristics: 74 watt, 7,263 lumen, 4000k CCT, 480 volt, glass lens, ¾" threaded top pendant attachment, long and narrow light distribution.

For alternate fixtures, the Contractor shall submit a complete set of manufacturer shop drawings for the luminaire in conformance with Article 1.06.01 - Source of Supply and Quality. If requested, the Contractor shall submit a sample fixture for review by the Department. The Department reserves the right to disapprove any luminaire based solely on photometric performance, lumen maintenance, and construction. LED underbridge luminaires submitted for approval are required to meet average illuminance and uniformity ratio as recommended by the Illuminating Engineering Society of North America (RP-8-00) for the given roadway application as calculated by the Department.

The LED underbridge luminaire shall feature heavy duty construction for harsh/hostile outdoor environments (tunnels, wastewater treatment facilities, petroleum refineries, chemical plants, power plants, parking garages, etc.) where dust, dirt, and moisture are a concern. The luminaire housing shall be constructed of rugged die cast, low copper content aluminum (0.6% CU content) with integral heat dissipation fins. The housing, with heat dissipation fins, shall achieve up to a 40°C ambient rating. The overall fixture shall have an ambient rating of -40°C to 40°C when operated at 480 volts. The luminaire shall be IP66 rated and UL 1598 listed for use in wet locations. The luminaire shall have a ¾" threaded NPT mounting hole in the top center of the aluminum housing. The electrical and optical housing shall be polyester powder coated with super durable corrosion-resistant paint. The luminaire housing shall be gray in color. The luminaire shall be equipped with a prismatic borosilicate "sag lens" glass refractor which will create a "long and narrow" light distribution. The luminaire shall be specifically designed for demanding wet location environments, and as such, standard parking garage type pendant fixtures will not be approved for this item.

The LED underbridge luminaire shall produce a minimum of 7,500 lumens at an input power of 80 watts or less at 4,000K CCT, CRI>70. Lumen depreciation shall be 0.91 or better at 60,000 hours (25°C). Lumen depreciation shall be 0.88 or better at 100,000 hours (25°C). The LED light engine shall be fault-tolerant and shall provide light even with the failure of one LED.

The luminaire's on board circuitry shall include a surge protection device (SPD) to withstand high repetition noise transients as a result of utility line switching, nearby lightning strikes, and other interference. The LED luminaire shall be provided with integral 10kV/5kA surge protection which shall conform and be labeled as UL 1449 compliant. The SPD protects the luminaire from damage and failure for common and differential mode transient peak currents up to 10kA (minimum). SPD performance shall have been tested per procedures in ANSI C136.2/IEEE C62.41-2:2002 category C high exposure. The electronic driver shall operate at 480 volts.

The pendant luminaire shall be supplied and installed with a safety chain kit.

The LED luminaire shall carry a limited 5 year warranty on the LEDs and the Driver. The LED luminaire shall be Design Lights Consortium (DLC) qualified.

Threaded rods, anchor bolts, nuts and washers shall conform to ASTM A449 and shall be stainless steel. Clamps shall be stainless steel and shall be supplied with stainless steel hardware.

The galvanized steel pendant mounting bracket, support bracing, mechanical anchors, mounting hardware, threaded rod, nuts, and washers shall be as detailed on the plans.

Fuses and fuse holders shall conform to the requirements of Article M.15.05.

A spare surge suppressor shall be supplied with the luminaire and turned over to the Engineer for delivery to ConnDOT District Electrical Maintenance personnel.

The LED luminaire shall carry a limited 5 year warranty on the LEDs and the Driver.

The pendant bracket shall be as detailed on the plans.

Conductors shall be #10 AWG in accordance with Article M.15.11 of the Standard Specifications. Insulation shall be THHN/THWN and rated for 600 volts. The equipment grounding conductor shall be No. 10 AWG, THHN/THWN, rated for 600 volts. The ground wire shall be green in color.

Flexible conduit shall be LFNC-B (Liquidtight Flexible Nonmetallic Conduit) with a trade size diameter as indicated on the plans. LFNC shall be listed for UL Standard UL1660 and marked for outdoor applications. LFNC shall be flame resistant and UV/sunlight resistant. LFNC and fittings shall be wet location rated.

Fiberglass conduit shall be standard wall type with a minimum wall thickness of 0.070 inches for conduit ¾" in diameter. For fiberglass conduit 2" in diameter, the conduit shall be extra-heavy wall type with a minimum wall thickness of 0.250 inches. The conduit shall be reinforced thermosetting resin conduit using the single circuit filament winding process and shall be free from defects including non-circularity and foreign inclusions. The conduit shall be nominally uniform (as commercially practical) in color, density, circularity, and physical properties and shall be straight with the ends cut square to the inside diameter. The conduit shall have an operating range of -40F to +250F and shall contain a ultra-violet (UV) inhibitor to meet the appropriate UL, CSA or NEMA specification. The conduit color shall be grey. The complete conduit system shall be UL listed and shall meet or exceed the requirements of UL 2515 Above Ground Standard. All conduit, elbows and fittings shall be durably and legibly marked in accordance with and Fittings and NEMA TC 14. All ¾" conduit joints shall be straight socket type and shall be permanently bonded using a joint adhesive supplied by the conduit manufacturer. The joint adhesive shall be applied to the conduit as specified by the manufacturer. The resin system shall be epoxy anhydride-cured with no fillers. A complete line of fittings, adapters, expansion fittings and elbows shall be available and shall be manufactured from the same materials and manufacturing process as the conduit. Expansion fittings shall be supplied by the conduit manufacturer and shall provide a minimum of 4" of lateral movement. An expansion fitting shall be installed in all conduit runs of 50' or greater and shall be installed in complete conformance with the manufacturer's guidelines.

Threaded rods, anchor bolts, nuts and washers shall conform to ASTM A449 and shall be stainless steel. Conduit clamps/straps shall be stainless steel and shall be supplied with stainless steel hardware. Beam clamps shall be galvanized. Fuses and fuse holders shall conform to the requirements of Article M.15.05.

CONSTRUCTION METHOD: The LED underbridge luminaire with associated conduit and conductors shall be installed in conformance with Section 10.06. The luminaire shall be installed at the end of the pendant mount bracket and shall be securely fastened, properly oriented, leveled, connected to the power supply conductors, cleaned, and ready for operation. The longitudinal light distribution of the underbridge luminaire shall be oriented parallel to the centerline of the roadway.

It is the Contractor's responsibility to verify that the mounting method retains the IP66/U.L. wet location rating of the fixture and that all connections to the pendant are watertight and are suitable for outdoor locations. A thread sealant shall be applied to all threaded pendant mount joints and in particular to the threaded joint between the pendant and the luminaire housing.

The luminaire shall be properly grounded with a No. 10 AWG equipment ground connected between the system ground wire in the adjacent junction box and the grounding lug in the luminaire.

Surface mounted conduit shall be installed where indicated on the plans; using mounting brackets and/or clamps as approved by the Department. For 3/4" fiberglass conduit, support spacing shall not exceed 3'-0" as specified in N.E.C. 355.30. Conduit expansion joints and

conduit shall be supplied by the same manufacturer and shall be installed in conformance with the manufacturers recommended guidelines. A conduit expansion joint shall be installed at all bridge joints subject to movement. Except as noted above, for conduit lengths under 50 feet no expansion joints will be required. For conduit lengths between 50 feet to 200 feet one expansion joint shall be installed at the mid-point of the conduit. For conduit lengths over 200 feet an expansion joint shall be installed every 200 feet. Clamps for attaching the conduit to the steel bridge structure shall be single hole or beam-clamp type. Clamps for attaching the conduit to concrete bridge structure shall be two hole type. All clamp materials shall be rated for outdoor wet environments. Threaded rods, anchor bolts, nuts and washers shall be 316 stainless steel. When clamping the fiberglass conduit to the steel bridge structure, a slip collar shall be installed at the clamp location to allow the conduit to laterally expand within the clamp. When clamping the fiberglass conduit to the concrete bridge structure, the two hole strap shall be sized to allow the conduit to laterally expand within the strap.

Fuse holders and fuses shall be installed in the cast iron junction box surface mounted to the bridge abutment or in the adjacent concrete handhole. The cast iron Junction box shall be furnished and installed under a separate bid item.

The Contractor shall ensure that once installed the LED luminaire functions properly.

METHOD OF MEASUREMENT: This work will be measured for payment by the number of LED luminaires installed, complete and accepted.

BASIS OF PAYMENT: This work will be paid for at the contract unit price each for "Underbridge Luminaire - LED (Pendant Mounted)" of the type and size specified, complete and accepted in place, which price shall include all materials including luminaire, LEDs, driver, surge suppressor (with spare), pendant bracket, conductors, fuses, conduit, flexible conduit, fuse holders, anchors, hardware, connections, thread sealant, leveling, mounting, grounding, drilling, and all labor, tools, equipment and work incidental thereto.

ITEM #1006151A - REMOVE UNDERBRIDGE LUMINAIRE

DESCRIPTION: Work under this item shall consist of removal of an existing underbridge luminaire at the location shown on the plans or as directed. All removed underbridge luminaires, lamps, mountings, conduits, conductors, fuses and fuse holders shall be disposed of by the Contractor.

CONSTRUCTION METHODS: The Contractor shall remove an underbridge luminaire where required. All removed underbridge luminaires, lamps, mountings, conduits, conductors, fuses and fuse holders shall be disposed of by the Contractor.

All removed materials shall be properly disposed of by the Contractor. The removed luminaire contains regulated materials. All regulated materials shall be as described and disposed of under Item No. 0101143A – Handling and Disposal of Regulated Items.

METHOD OF MEASUREMENT: This work will be measured for payment by the number of underbridge luminaires with associated equipment, removed and disposed of, complete and accepted.

BASIS OF PAYMENT: This work will be paid for at the contract unit price each for "Remove Underbridge Luminaire" complete, which price shall include removal of materials, disposing, delivering, hauling, including all materials, tools, equipment, labor and work incidental thereto.

ITEM #1008015A - 2 INCH (50 MM) RIGID METAL CONDUIT – SURFACE

ITEM #1008115A - 2 INCH (50 MM) RIGID METAL CONDUIT IN TRENCH

ITEM #1008117A - 3 INCH (75 MM) RIGID METAL CONDUIT IN TRENCH

ITEM #1008215A - 2 INCH (50 MM) RIGID METAL CONDUIT UNDER ROADWAY

ITEM #1008700A - 4" (100 MM) RIGID METAL MULTI DUCT CONDUIT - SURFACE

ITEM #1008720A - 4" (100 MM) RIGID METAL MULTI DUCT CONDUIT - UNDER ROADWAY

ITEM #1008770A - 4" (100 MM) PVC MULTI DUCT CONDUIT - IN TRENCH

Description:

The mainline conduit shall be a 4" (100 mm) multiduct conduit system designed and engineered for direct burial and protection of optical fiber cable. The multiduct concept shall maximize duct usage by compartmentalization of cables for current requirements and for future expansion.

For the 4" (100 mm) PVC conduit, the Contractor shall be required to install the conduit **simultaneously** with the pullboxes to ensure that the conduit innerduct on each side of the pullbox is at exactly a 90-degree angle to the side of the pullbox. For Rigid Metal Conduit under Roadway, the Contractor shall be required to install the conduit **simultaneously** with the installation of the pullboxes. For Rigid Metal Conduit under Roadway, the Contractor shall be required to install a minimum of 10 feet (3.0 meters) of Flexible Conduit on each side of the pullbox to ensure that the innerduct enters the pullbox at exactly a 90-degree angle to the side of the pullbox. **The cost of the Flexible Metal Conduit shall be included in the cost of the appropriate conduit item; it shall not be paid for separately. The required installation is shown on the IMS details. The required length of Flexible Metal Conduit on each side of a structure shall be as shown on the appropriate detail.**
The mainline conduit shall contain four (4) factory installed 1.25" (30 mm) PVC or HDPE inner-ducts within a 4" (100 mm) outer-duct.

The 2" (50 mm) RMC conduit shall be used for mainline optical fiber cable, branches off the mainline conduit, telephone service and electrical service as indicated on the plans. The 2" (50 mm) RMC – Surface used as risers on utility poles shall include an entrance fitting (weatherhead) at the top termination of the conduit run as indicated on the plans. The 3" (75 mm) conduit shall be used for utility service for CCTV cameras and variable message signs as indicated on the plans.

As part of this item, the Contractor will be required to test the integrity of the conduit with a poly-line and to install a pull tape in each and separate innerduct as required in the specification.

Work under the above items shall conform to Public Utility Commission Rules and Regulations, where applicable, and to Section 10.08 of the standard specifications, supplemented and amended as follows:

Materials:

A. General:

The multi-cell conduit system shall be a pre-assembled conduit manufactured from a 4" (100 mm) round outerduct containing four (4) factory installed 1.25" (30 mm) PVC or HDPE innerducts. The innerducts shall be held together in a square configuration by a system of spacers, bands, or other mechanism. The coupling system shall be resistant to water infiltration, air loss during cable installation, and shall be capable of locking the system tightly together to not allow free twisting of the innerducts.

The conduit shall be free from defects including non-circularity and foreign inclusions. It shall be nominally uniform (as commercially practical) in color, density, and physical properties. It shall be straight and the ends shall be cut square to the inside diameter. Polyvinyl Chloride (PVC) conduit shall be Type 40 grade conforming to Section M.15.09 of the standard specifications. Rigid Metal Conduit shall be galvanized steel also conforming to Section M.15.09 of the standard specifications.

B. PVC Outerduct:

The complete PVC Type 40 Multi-cell conduit system shall be UL Listed, designed and engineered for direct burial or encased underground applications. Protective outer-duct shall be 4" (100 mm) PVC Type 40 with extended 6" (150 mm) integral bell end and have a lay length of 20 feet (6.1 m). The outer-duct shall have a longitudinal running print line to assure proper innerduct orientation and alignment. This line shall consist of the following wording: "INSTALL THIS SIDE UP – Connecticut D.O.T. Cable – For Assistance Call 860-594-3447". The outer-duct shall be marked with data traceable to plant location, date, shift, and machine of manufacture.

The outer-duct shall have a circumferential ring on the spigot end of the ducts so as to provide a reference point for ensuring the proper insertion depth when connecting conduit ends. Both ends of the conduit shall be capped to protect inner-duct during shipment and job site storage.

The PVC conduit system to be utilized shall be a complete system and the Contractor shall provide the following fittings:

- Coupling Kits
- Terminator Kits

- Lubrication Fittings
- Repair Kits
- Installation Accessories

A complete line of fittings, adapters, and elbows shall be available and shall be manufactured from the same materials and manufacturing process as the conduit. The multi-cell conduit shall be joined by use of a coupling system that effectively seals the outerducts and innerducts but allows for expansion or contraction in the system. A silicone non-petroleum base lubricant may be used for assembly of the multi-cell conduit.

All conduit entering and exiting conduit termination points shall have a terminator installed that is made of PVC with an anti-reversing gasket that prevents ingress of water and debris into the outer conduit and the innerduct.

C. Couplings:

The PVC coupling body shall allow for transitions from PVC conduit to RMC conduit to Flexible Sweeps and any combination thereof. The coupling body shall have a factory assembled, multi-stage gasket that is anti-reversing for sealing both the outer and inner-duct. A secondary, mid-body gasket shall be seated at the shoulder of the bell to assure 100psi (690 kPa) air pressure (in accordance with Bellcore GR-2884 Issue 1) and watertight integrity with minimum joint infiltration of 6 psi (41 kPa). This will allow for the use of Air-Jet technology to be used in the placing of cables. The PVC conduit system shall be designed so that both straight sections and fittings will assemble without the need for cement or glue.

The coupling body shall be designed so that when the conduit is joined, the outer walls of the innerducts and the inner walls of the outerduct shall be sealed, providing an airtight seal from within the innerduct system and a watertight seal from the outside of the outerduct. The coupling body shall be tested for water tightness and air-tightness in accordance with Bellcore GR-2884-CORE Issue 1, July 1995 (R3-41 for water-tightness and R3-43 for air-tightness). The coupling body shall conform to the following requirements:

Watertightness: 6 psi (41 kPa) minimum
Air Tightness: no significant leakage at 100 psi (690 kPa)

The system shall be designed so that expansion and contraction of the inner-duct shall take place in the coupling body, and the fittings shall allow going from steel to PVC without compromising air/water tightness, or pulling capabilities. The coupling body shall be factory assembled in the bell end of the outer duct and shall be manufactured from high impact engineered thermoplastic. The coupling body face shall be supplied with lead-ins to facilitate assembly. The coupling body shall have each conduit entrance identified with a raised number and the white inner duct locator conduit entrance shall have raised ribs that can be felt through a glove.

The PVC system shall be designed so that the assembly of components can be accomplished by inserting the spigot end into the male bell end to the marked insertion depth. (The insertion depth is marked on the spigot end)

D. Sweeps:

The PVC conduit system shall offer a complete line of fixed and flexible sweep-bends with system compatible bell and spigot ends. The PVC conduit system shall offer and the Contractor shall utilize the following standard fixed sweep-bends:

Radius	Bend	System
4 ft & 3 ft. (1200mm & 900mm)	11.25°, 22.5°, 45°, 90°	4-way

Note: Direction changes shall not exceed 90 degrees.

The flexible sweep-bend shall be supplied in two lengths to meet field requirements. They shall have a PVC outer jacket and be acceptable for exposed and direct burial installation. The inner-duct shall extend 6" out of the spigot end of the flexible elbow. Once the elbow is bent to the proper angle, the innerducts shall be trimmed to the proper length for insertion to the bell end. PVC inner ducts shall not be allowed in bend and sweeps.

Length Feet (Meters)	**Radius** Feet (Meters)	**Bend** degrees (°)	**System**
10 (3.2)	4 (1.2) min	0-90	4-way
10 (3.2)	6 (1.8)	0-70	4-way
10 (3.2)	9 (2.7)	0-55	4-way
16 (4.9)	4 (1.2) min	0-90	4-way
16 (4.9)	6 (1.8)	0-70	4-way
16 (4.9)	9 (2.7)	0-55	4-way

All bends, including flexible sweeps, shall have a minimum radius of 3 ft. (900 mm). The inner-duct system shall be solvent welded to the coupling body; supported by a moveable spacer every 4 ft. (1.32 m). The bends shall not violate the minimum bending radius of the fiber optic cable.

All bends shall have nylon inner ducts, or approved equivalent, installed to prevent burn-through in accordance with test procedure outlined in Bellcore GR-2884 Issue 1 Section R3-35 and R3-36.

E. Shop Drawings

Prior to beginning work and fabrication of any materials, the Contractor shall take all field measurements necessary to assure the proper fit of the finished structure mounted conduit. This shall include all supports, brackets and hangers, fixed and flexible sweep bends,

expansion/contraction fittings, junction boxes, and other structure mounted appurtenances. The Contractor shall submit shop drawings to the Engineer for approval in accordance with Article 1.05.02(b).

a. Layout plans and other pertinent information, including conduit lengths, locations and type of supports, sweep-bends, expansion fittings, junction boxes, etc. for each bridge or sign support that has structure mounted conduit and appurtenances.

b. Commercial items shall be identified by manufacturer, trade name and catalog number. Catalog sheets, including pertinent specifications, shall be included with the submission.

c. Complete fabrication details, including material and galvanizing specifications, for all conduit supports, brackets and hangers, hardware, field fasteners including chemical anchorages, etc.

d. All field measurements shall be submitted for reference to the reviewer.

F. Innerduct:

The inner-duct in straight lengths shall be manufactured from PVC or high density polyethylene (HDPE). Innerducts shall be factory treated with atomized silicone or manufactured in a manner to reduce friction during pulling of fiber optic cable.

Innerduct to be used in bends and sweeps shall have a minimum burn through time of 90 minutes when tested in accordance with Telcordia (formerly Bellcore) GR-2884 Issue 1 Section R3-35, and R3-36.

PVC inner ducts shall not be allowed in bends and sweeps.

The innerducts shall have a permanent dry lubricant extruded within the inner wall and shall incorporate longitudinal ribs within the inner wall. The innerducts shall have a nominal size of 1.25” (30 mm) and shall consist of 4 unique colors: white, red, orange, and yellow. Innerduct colors shall be oriented in a clockwise direction as specified above, looking at the spigot end of the multi-cell conduit system. The white innerduct shall be located directly under the print line on the outerduct.

Each inner-duct shall be sealed with an expanding Neoprene Plug that withstands 22 psi (150 kPa) and seals the inner-duct from water and debris infiltration, and a provision for tying off a pull line.

G. Rigid Metal Outerduct:

All components of the conduit system shall meet or exceed the following specifications and standards:

1. ASTM A 36. Standard Specification for Structural Steel.
2. ASTM A 53. Standard Specification for Steel Pipe.
3. ASTM A 570 Standard specification for Steel.
4. ASTM A 479 Standard Specification For Stainless Steel.

In addition, the steel outer duct shall conform to the following industry standards:
NEC Article 346
ANSI C80.1
U.L. 6

The conduit system shall be a complete system with all the following fittings:
Manhole Terminator Kits
Deflection Fittings
Offset Fittings
Expansion/Contraction Fittings
Lubrication Fittings
Repair Kits
Installation Accessories
Steel to PVC Sched. 40
Steel PVC-Coated Flexible Elbows
Stand Off Fittings
Entrance Fittings

Galvanized outer-duct shall be hot dipped galvanized inside and out; conduit shall be smooth and free from burrs and coated with rust inhibitor.

Rigid steel shall be supplied in 10 foot (3-meter) lengths with a length tolerance of +/- ½" (10mm) and shall be Schedule 40 minimum. Conduit shall be supplied with thread protectors.

Each section of steel conduit shall be supplied with one reversing spin coupling that allows straight sections and fittings to be joined without spinning the conduit. The reversing coupling shall be galvanized and have three set screws to lock the coupling in place.

The Steel Outerduct system shall be designed so that the assembly of components can be accomplished in the following steps:

a. Loosen set screws on coupling spin back to allow for insertion
b. Insert male into female and spin coupling forward to bottom
c. Once the spin coupling is installed, there shall be no threads visible on the 4" (100 mm) steel conduits.
d. Tighten set screws

The Steel conduit system shall offer a complete line of fixed and flexible sweep-bends with system compatible bell and spigot ends. The Steel conduit system shall offer and the Contractor shall utilize the following standard fixed sweep-bends:

Radius	Bend	System
4 ft & 3 ft. (1200mm & 900mm)	11.25°, 22.5°, 45°, 90°	4-way

Note: Direction changes shall not exceed 90 degrees.

The flexible sweep-bend shall be supplied in two lengths to meet field requirements. They shall have a steel core with a PVC outer jacket and be UL Listed for exposed and direct burial installation. The inner-duct shall always remain flush to the end of the flexible elbow, even when bending. PVC inner ducts shall not be allowed in bend and sweeps.

Length Feet (Meters)	**Radius** Feet (Meters)	**Bend** degrees (°)	**System**
10 (3.2)	4 (1.2) min	0-90	4-way
10 (3.2)	6 (1.8)	0-70	4-way
10 (3.2)	9 (2.7)	0-55	4-way
16 (4.9)	4 (1.2) min	0-90	4-way
16 (4.9)	6 (1.8)	0-70	4-way
16 (4.9)	9 (2.7)	0-55	4-way

All bends, including flexible sweeps, shall have a minimum radius of 3 ft. (900 mm). The inner-duct system shall be solvent welded to the coupling body; supported by a moveable spacer every 4 ft. (1.32 m). The bends shall not violate the minimum bending radius of the fiber optic cable.

All bends shall have nylon inner ducts, or approved equivalent, installed to prevent burn-through in accordance with test procedure outlined in GR-2884 Issue 1 Section R3-35 and R3-36.

The following performance requirements shall be met:

Yield	30,000 psi (200 MPa)
Tensile	50,000 psi (345 MPa)
Hardness	Rockwell “B” 55-65

All conduit entering and exiting conduit terminal points shall have a terminator installed that is made of PVC with an anti-reversing gasket that prevents ingress of water and debris into the outer conduit and inner-duct.

The rigid steel conduit system shall offer expansion/contraction fittings with system compatible threads and reversing couplings. The inner-duct of the expansion/contraction fittings shall also

be system compatible. The capacity of the fitting shall be 8" (200 mm) total stroke with 4" (100 mm) expansion and 4" (100 mm) contraction capacities.

H. Structure Mounted Conduit Supports

For applications in which the multi-cell conduit system is specified on the plans and/or by the Engineer to be attached to a bridge or other structure, bridge hanger assemblies and conduit support devices shall be required as shown on the details for these attachments. These hanger assemblies and support devices shall be designed for application to the specific bridge or structure for which they will be used, and their materials and design shall be approved by the Department prior to their use.

Threaded rods, anchor bolts, nuts and washers shall conform to ASTM A449 and shall be galvanized in accordance with ASTM A153.

All hex nuts shall be "Prevailing Torque Reusable Type Lock Nuts."

I. Conduit Testing:

The poly-line installed to verify the integrity of the conduit system shall be ¼" (6 mm) polypropylene.

The detectable pull tape shall consist of a single 24 AWG copper wire with polyethylene or PVC jacket woven into the polyester tape. The pull tape shall be NEPTCO Part No. DP1250P, or approved equal, for cable sizes of less than 97 fibers. NEPTCO Part No. DP1800P, or approved equal, shall be used for cable size of 97-288 fibers.

The detectable pull tape shall have the following properties:

- 1250 lb (5.56 kN) tensile strength
- flat, not round, construction
- printed foot markings
- pre-lubricated for reduced pulling tension at start of cable pull
- low susceptibility to absorption of moisture; moisture resistant

Underground utility marking tape shall have a minimum tensile strength of 78 lbf (350 N) and a minimum elongation of 700 percent before breakage. The detectable tape shall not delaminate nor smear when wet and shall be resistant to insects. The tape shall not degrade when exposed to alkalis, acids or other corrosive elements found in soil.

Pressure treated wood for Identification Posts shall conform to Article M.12.13 of the Standard Specifications. Signs on Identification Posts shall conform to Article M.18.13 of the Standard Specifications.

J. Bedding Material:

Bedding material for all conduit shall be No. 100 fine aggregate as defined in Section M.03 of the standard specifications and backfill for the pits shall be pervious structure backfill conforming to Article 2.16.02.

Construction Methods:

A. General:

Construction methods shall conform to Article 10.08.03 of the Standard Specifications and to the manufacturer's instructions.

The Contractor shall layout the trench for the conduit in conjunction with the installation of pullboxes, vaults, or manholes. When installing the conduit, the Contractor shall be aware of the location of the proposed conduit terminal point when they are at a sufficient distance from the terminal point to allow for adjustment of the trench so that the conduit will line up flush with the applicable entry point. Flexible conduit will not be used indiscriminately.

A silicon, non-petroleum based lubricant on the coupling body may be used to facilitate installation.

PVC conduits entering conduit terminal points shall terminate flush with the inside wall. The inner-duct shall extend 6" (150 mm) from the inside face.
Galvanized rigid steel conduit shall extend 2" (50 mm) into the manhole/vault/pull box for installation of grounded end bushings.

Conduits and inner-duct entering conduit terminal points or where terminated in trench, shall be capped or sealed to prevent ingress of water and debris into the conduit. Conduits containing inner-duct shall be plugged using a quadplex expansion plug inside the conduit around the inner-duct. Inner-duct containing one cable shall be plugged using an expandable cable seal off. Conduits terminating in a trench shall be clearly marked and flagged, both in trench and above trench for future locating.

At each conduit terminal point, a PVC coupling body with anti-reversing gasket that seals between the conduit and inner-duct shall be used as follows:

In places where the field installed inner-duct enters and exits existing conduit, the space between the conduit and the inner-duct, as well as the space between the inner-duct and the cable shall be sealed by means of a split internal expansion plug. Bushing sleeves shall be equipped to suit varying cable sizes. Sealing capacity shall withstand 22 psi (150 kPa).

All inner-duct shall be sealed by means of a polypropylene duct plug equipped with a neoprene or polyurethane gasket. Plugs shall be equipped with an attachment to secure the pull rope in the inner-duct.

When PVC cannot be installed at the required depth, such as where ledge or rock is encountered, the Contractor shall install Rigid Metal conduit at the maximum depth possible. In areas where the conduit is installed in the shoulder and the required depth cannot be obtained, the conduit shall be installed at a minimum depth of 18" (450 mm) and capped in concrete. If the Contractor is unable to obtain a minimum depth of 18" (450 mm), the Contractor shall install the conduit as directed by the Engineer.

Warning Tape shall be placed in trench over conduit as shown on the details. Identification Posts shall be carefully placed adjacent to conduit in trench at intervals not to exceed 1200 ft. (365 meters) in length, except at long span bridges and paved areas.

B. Conduit Under Roadway:

For Rigid Metal Conduit under Roadway, the Contractor shall be required to install the conduit **simultaneously** with the installation of the pullboxes and shall be required to install a minimum of 10 feet (3.0 meters) of Flexible Conduit on each side of the pullbox to insure that the innerduct enters the pullbox at exactly a 90 degree angle to the side of the pullbox. The required installation is shown on the IMS details. The required length of Flexible Metal Conduit on each side of a structure shall be as shown on the appropriate detail.

The preferred method of installing steel casing under roadway shall be by veneering or cutting. In areas where the conduit is installed under live traffic, such as a ramp crossing, the conduit will be capped in concrete. In areas where the conduit is installed in the shoulder and the required depth cannot be obtained, the conduit shall be installed at a minimum depth of 18" (0.45 meters) and capped in concrete.

Where veneering or cutting is not possible, and under the direction of the Engineer, steel casing may be furnished and installed by jacking. The casing shall be designed to withstand all the loads that it will be subject to, including the loads during installation and the in-service highway loads. The casing shall be designed by and bear the seal and signature of a Connecticut Licensed Professional Engineer and the computations shall be submitted with the Jacking Plan. The pipe shall be installed to preclude interference with highway traffic or damage to traveled lanes or shoulders. Jacking operations shall be conducted so as to prevent caving ahead or to cause voids outside of the pipe.

The auger head shall not proceed more than 4" (100 mm) ahead of the pipe being jacked. Removal of the material from the jacking pits by washing or sluicing will not be permitted.

A shoring and jacking pit plan shall be prepared by and bear the seal and signature of a Connecticut licensed Professional Engineer.

After the casing pipe is jacked in place, the inside shall be thoroughly cleaned free from grease, dirt, rust, moisture or other deleterious contaminants. All welding on the steel casing pipe shall

be done by a certified welder. The galvanized steel conduit shall be inserted with skids securely attached to maintain full support of the conduit and to prevent damage.

The space between the conduit and the casing shall be grout sealed for at least 1 foot (300 mm) from each end of the casing. Grout shall attain a minimum of 400 psi (2.76 MPa) compressive strength after 7 days. Pits shall be back-filled with pervious structure backfill as prescribed in Article 2.16.03 of the Standard Specifications.

For Jacking operations, the Contractor shall provide the following:

A. A jacking pit plan depicting:
   (1) Protection of traffic and pedestrians
   (2) The dimension of pit
   (3) Shoring, bracing struts, walers, or sheet pile
   (4) Size and type of casing
   (5) Conduit skids and means of attachment

B. The proposed method of jacking including:
   (1) The jacking system
   (2) A detail of the separator-cushion at the end of casing against which the jacking force
   will be applied.
   (3) The support system behind the jack
   (4) The support system under the jack and at the bottom of the pit.

C. Structure Mounted Conduit Supports

The Contractor will be required to submit to the Engineer for approval a proposal detailing the proposed installation method of the surface mounted conduit including the spacing between the conduit supports. The Contractor shall support the conduit as recommended by the manufacturer and approved by the Engineer.

Surface mounted conduit shall be installed where indicated on the plans; using mounting brackets and/or clamps as detailed on the plans or as directed by the Engineer.

Anchor bolts for conduit supports shall be drilled and anchored into sound concrete only. The anchorage system shall be installed per the manufacturers' recommendations. If existing reinforcement is encountered during drilling, the hole shall be abandoned, filled with non-shrink grout and relocated as directed by the Engineer. After installation of the conduit support, tighten all chemical anchor bolts to the torque as recommended by the anchorage system manufacturer.

D. Conduit Testing:

The Contractor shall test each cell of the multicell conduit after the conduit is installed. All testing shall be performed using the procedures and mandrel size recommended by the multicell

or conduit manufacturer. The Contractor will be required to install a poly-line within each cell of the conduit. The intention of the conduit testing is to verify the integrity of the completed system; therefore, this testing will only be allowed to commence once the conduit system has been completely installed. Testing shall be performed in the presence of the Engineer. The Engineer will document the date, time, and the results of the testing and shall submit this information to Highway Operations for record keeping purposes.

E. Detectable Pull Tape:

The Contractor shall install detectable pull tape, by hand pulling, blowing, or via vacuum method, into each empty conduit and empty cell within a multi-cell conduit during conduit installation. The Contractor shall install the detectable pull tape after conduit testing has been completed. The Contractor shall neatly coil and secure 10 ft (3 meters) of slacked pull tape in each vault location.

The detectable pull tape shall be field installed within each innerduct for the purpose of attaching to, and pulling of, the fiber optic cable. The Detectable Pulling Tape shall be tied off to an expanding Neoprene Plug.

F. As -Built Plans:

The Contractor shall advise the Engineer of any change of measurement of layout of the Plans submitted to them. Upon completion of construction but prior to acceptance of the contract, the Contractor shall furnish as-built plans on 2 ft. by 3 ft. (55 cm by 91 cm) standard plan sheets (hard copy) form or in an electronic portable document format (.pdf). All construction changes, with the final location and depth of the conduits, etc. shall be shown in sepia or other reproducible format. These plans shall include all field installations. One sepia or other reproducible of the Project Plans will be provided to the Contractor for their use. Any other base maps that may be necessary for the Contractor to comply with this requirement shall be the Contractor's responsibility.

Method of Measurement:

The conduit shall be measured for payment by the actual number of feet (meters) of the type and size installed and accepted**. Expansion fittings, fixed and flexible sweep-bends, flexible metal conduit, and conduit fittings will not be measured for payment but shall be included in the pay item for the conduit of the type and size specified.** The measured length shall be from end to end along the centerline through all fittings.

The warning tape, identification posts with signs, pull tape, and the poly-line conduit testing will not be measured for payment but shall be included in the pay item for the conduit of the type and size specified.

Basis of Payment:

Article 10.08.05 – Basis of Payment shall be amended as follows:
In the second paragraph, after the words "bonding bushings", add the words "bonding wire,".

This work shall be paid for at the contract unit price per foot (meter) for conduit of the size and type indicated, within the limits shown on the plans and in the details. This price shall include all materials required including expansion fittings, fixed and flexible sweep-bends, conduit fittings, pervious structure backfill, boxes, caps, entrance fittings, detectable pull tape, poly-line, inserts, warning tape, ground wire, identification posts with signs, bridge hanger assemblies and conduit support devices, chemical anchors, equipment, tools, labor and work incidental thereto.

Trenching and backfilling shall be paid separately under Item #1001001A, Trenching and Backfilling, and as specified in Section 10.01 of the Standard Specifications.

Pay Item	Pay Unit
(Size) (Kind) Conduit (Type)	l.f.

ITEM #1008309A - 2½" FIBERGLASS CONDUIT IN STRUCTURE

ITEM #1008644A - 2½" FIBERGLASS CONDUIT - SURFACE

ITEM #1008665A - 2½" FIBERGLASS CONDUIT IN TRENCH

ITEM #1008682A - 2½" FIBERGLASS CONDUIT UNDER ROADWAY

DESCRIPTION: This item shall consist of furnishing and installing fiberglass conduit of the size and type specified with necessary fittings within a trench, under roadway, surface mounted, or cast in concrete, at the locations shown on the plans or as directed by the Engineer and in accordance with this specification.

Work under the above items shall conform to Section 10.08 of the standard specifications, supplemented and amended as follows:

MATERIALS: The 2½" fiberglass conduit shall be extra heavy wall type with a minimum wall thickness of 0.250 inches. The conduit shall be reinforced thermosetting resin conduit using the single circuit filament winding process and shall be free from defects including non-circularity and foreign inclusions. The conduit shall be nominally uniform (as commercially practical) in color, density, circularity, and physical properties and shall be straight with the ends cut square to the inside diameter. Each section of conduit shall be supplied with an overall length of 20'. The conduit color shall be black.

The complete conduit system shall be UL listed. For buried conduit applications the conduit shall meet or exceed the requirements of UL 2420 below ground standard. For surface mounted applications the conduit shall meet or exceed the requirements of UL 2515 Above Ground Standard. All conduit, elbows and fittings shall be durably and legibly marked in accordance with NEMA TC 14-2002.

All conduit joints shall be straight socket type and shall be permanently bonded using a joint adhesive supplied by the conduit manufacturer. The joint adhesive shall be applied to the conduit as specified by the manufacturer. The resin system shall be epoxy anhydride-cured with no fillers.

A complete line of fittings, adapters, and elbows shall be available and shall be manufactured from the same materials and manufacturing process as the conduit.

The conduit shall have an operating range of -40F to +250F and shall contain a ultra-violet (UV) inhibitor to meet the appropriate UL, CSA or NEMA specification.

Clamps for surface mounting fiberglass conduit to steel bridge members shall be J-type beam-clamps. Beam clamps shall be hot-dip galvanized. Clamps for surface mounting fiberglass conduit to concrete bridge walls/deck shall be two hole strap type. Two hole straps shall be

stainless steel. All clamp materials shall be rated for outdoor wet environments. Threaded rods, anchor bolts, concrete anchors, nuts and washers shall be 316 stainless steel.

LFNC shall be listed for UL Standard UL1660 and marked for outdoor applications. LFNC shall be flame resistant and UV/sunlight resistant. LFNC and fittings shall be wet location rated.

The Contractor shall submit shop drawings to the Engineer for approval in accordance with Section 1.06.01.

CONSTRUCTION METHODS: All conduit joints shall be glued together using the Manufacturer's recommended adhesive as well as the Manufacturer's recommended procedure. The surface of the conduit shall be dry and clean, free of dust, moisture, oil, grease, or any other contaminant. Any field cuts in the conduit shall be hand sanded to remove the resin glaze and to ensure proper mechanical adhesion. The adhesive shall be applied only within the temperature range as specified by the Manufacture. The adhesive shall be applied in conformance with the Manufacturer's recommendations and in such a manner as to avoid "ponding" and voids which will result in weak joints. The Contractor shall ensure that no adhesive forms on the interior wall of the conduit. Once the adhesive has set, the Contractor shall hand test the joint for proper connection. Any joints which are loose, cracked, or exhibit poor adhesion shall be cut out and re-made.

For conduit in trench: Trenches shall be of the depth and cross section shown on the plans with a minimum covering of 24". Trenching and backfilling shall be paid for under a separate bid item.

For conduit under roadway: Trenches shall be of the depth and cross section shown on the plans with a minimum covering of 24". No payment for trenching and backfilling will be made for conduit installed during construction under new pavement. Where fiberglass conduit is installed under roadway above the moment slab of a retaining wall, the conduit shall be supported throughout its entire length with suitable backfill. Particular attention shall be given to locations where the conduit is connected to conduit stub-outs exiting the concrete retaining wall or where the conduit passes over steps in the moment slab. Full support of the conduit shall be achieved prior to final backfilling and application of the roadway surface. Conduit shall have a minimum cover of 24". The Contractor shall coordinate the placement of the conduit prior to the placement of the pavement.

For conduit in structure: It shall be the Contractor's responsibility to coordinate the setting of the conduit in the structure wall prior to pouring the concrete. Proper rodding/compaction of the concrete around the conduit where it connects to a junction box shall be carried out to prevent voids and honeycombing. The fiberglass conduit shall be securely attached to the cast iron junction box using a threaded box connector and galvanized locknuts. The free end of the fiberglass conduit sweep shall be directed into the fill area behind the adjacent guide railing and shall terminate at a depth of 24" below finished grade. The end of the conduit sweep shall be temporarily capped with a conduit cap (non-glued) to prevent entry of dirt and debris into the conduit sweep.

For surface mounted conduit: Construction methods shall conform to Section 10.08.03-1 of the Standard Specifications and to the manufacturer's instructions**.**

Fiberglass conduit shall be clamped to the structure with a clamp spacing as recommended by the NEC for reinforced thermosetting resin conduit (RTRC). Support spacing shall not exceed 5'-0" as specified in N.E.C. 355.30.

Expansion Joints and conduit shall be supplied by the same manufacturer. All expansion joints shall be installed using the manufacturers recommended guidelines. For conduit lengths under 50 feet no expansion joints will be required. For conduit lengths between 50 feet to 200 feet one expansion joint shall be installed at the mid-point of the conduit. For conduit lengths over 200 feet an expansion joint shall be installed every 200 feet. In areas where structural movement or expansion is anticipated and a standard conduit expansion coupling cannot be properly installed, the Contractor can install a sufficient length of LFNC to account for the anticipated movement. Flexible conduit shall be LFNC-B (Liquidtight Flexible Nonmetallic Conduit) with a trade size diameter equal to the fiberglass conduit it is connect to.

When clamping the fiberglass conduit to steel bridge members, a slip collar shall be installed at the clamp location to allow the conduit to laterally expand within the clamp. When clamping the fiberglass conduit to the concrete bridge structure, the two hole strap shall be oversized to allow the conduit to laterally expand within the strap. Surface mounted fiberglass conduit shall be installed in such a manner as to allow thermal expansion of the conduit independent of the bridge structure.

Surface mounted conduit shall be installed where indicated on the plans; using mounting brackets and/or clamps as approved by the Department.

Prior to beginning work and fabrication of any materials, the Contractor shall take all field measurements necessary to assure the proper fit of the finished structure mounted conduit. This shall include all supports, brackets and hangers, fixed and flexible sweep bends, expansion/contraction fittings, junction boxes, and other structure mounted appurtenances. The Contractor shall submit shop drawings to the Engineer for approval in accordance with Section 1.06.01.

METHOD OF MEASUREMENT: The conduit shall be measured for payment by the actual number of linear feet of the type and size installed, complete and accepted. Fixed sweep-bends and assorted fittings will not be measured for payment but shall be included in the pay item for the conduit of the type and size specified. The measured length shall be from end to end along the centerline through all fittings.

The pull tape and conduit testing will not be measured for payment but shall be included in the pay item for the conduit of the type and size specified.

BASIS OF PAYMENT: This work shall be paid for at the contract unit price per foot for "2½" Fiberglass Conduit in Structure", "2½" Fiberglass Conduit - Surface", "2½" Fiberglass Conduit in Trench", or "2½" Fiberglass Conduit Under Roadway" within the limits shown on the plans and in the details. This price shall include all materials required including conduit, couplings, threaded connectors, elbows, expansion fittings, fixed sweep-bends, flexible conduit, conduit fittings, clamps, straps, brackets, hangers, hardware, drilling, anchoring, caps, pull-rope, adhesive, sanding, equipment, tools, labor, and all work incidental thereto.

ITEM #1008671A - 2 ½" FIBERGLASS CONDUIT IN MEDIAN BARRIER

DESCRIPTION: This item shall consist of furnishing and installing conduit of the size and type specified with necessary fittings within the granular fill of the raised concrete median barrier, at locations shown on the plans or as directed by the Engineer and in accordance with these specifications.

Work under the above items shall conform to Section 10.08 of the standard specifications, supplemented and amended as follows:

MATERIALS: The 2-1/2" fiberglass conduit shall be standard wall type with a minimum wall thickness of 0.070 inches. The conduit shall be reinforced thermosetting resin conduit using the single circuit filament winding process and shall be free from defects including non-circularity and foreign inclusions. The conduit shall be nominally uniform (as commercially practical) in color, density, circularity, and physical properties and shall be straight with the ends cut square to the inside diameter. Each section of conduit shall be supplied with an overall length of 20'. The conduit color shall be black.

The complete conduit system shall be UL listed and shall meet or exceed the requirements of UL 2515 Above Ground Standard. All conduit, elbows and fittings shall be durably and legibly marked in accordance with and Fittings and NEMA TC 14.

All conduit joints shall be interference type and shall be permanently bonded using a joint adhesive supplied by the conduit manufacturer. The joint adhesive shall be applied to the conduit as specified by the manufacturer. The resin system shall be epoxy anhydride-cured with no fillers.

A complete line of fittings, adapters, and elbows shall be available and shall be manufactured from the same materials and manufacturing process as the conduit.

The conduit shall have an operating range of -40F to +250F and shall contain a ultra-violet (UV) inhibitor to meet the appropriate UL, CSA or NEMA specification.

CONSTRUCTION METHODS: The 2-1/2" fiberglass conduit shall be installed within the granular fill of the raised concrete median barrier, at locations shown on the plans and in conformance with the details.

All conduit joints shall be glued together using the Manufacturer's recommended adhesive as well as the Manufacturer's recommended procedure. The surface of the conduit shall be dry and clean, free of dust, moisture, oil, grease, or any other contaminant. Any field cuts in the conduit shall be hand sanded to remove the resin glaze and to ensure proper mechanical adhesion. The adhesive shall be applied only within the temperature range as specified by the Manufacture. The adhesive shall be applied in conformance with the Manufacturer's recommendations and in such a manner as to avoid "ponding" and voids which will result in weak joints. The Contractor

shall ensure that no adhesive has formed on the interior wall of the conduit. Once the adhesive has set, the Contractor shall hand test the joint for proper connection. Any joints which are loose, cracked, or exhibit poor adhesion shall be cut out and re-made.

The Contractor shall submit shop drawings to the Engineer for approval in accordance with Section 1.06.01.

METHOD OF MEASUREMENT: The conduit shall be measured for payment by the actual number of linear feet of the type and size installed and accepted. Fixed sweep-bends and assorted fittings will not be measured for payment but shall be included in the pay item for the conduit of the type and size specified. The measured length shall be from end to end along the centerline through all fittings.

The pull tape and conduit testing will not be measured for payment but shall be included in the pay item for the conduit of the type and size specified.

BASIS OF PAYMENT: This work shall be paid for at the contract unit price per foot for 2-1/2" Fiberglass Conduit in Median Barrier, within the limits shown on the plans and in the details. This price shall include all materials required including conduit, couplings, threaded connectors, elbows, fixed sweep-bends, conduit fittings, caps, pull-rope, adhesive, equipment, tools, labor, drilling and all work incidental thereto.

ITEM #1008860A - 4" (100 MM) FIBERGLASS MULTIDUCT CONDUIT – EXTRA HEAVY WALL

DESCRIPTION:

The mainline fiberglass conduit shall be a 4" multi-duct conduit system designed and engineered for installation underneath or on the outside of the parapet or beam of a structure terminated by ground mounted pullboxes, vaults or manholes. The multiduct concept shall maximize duct usage by compartmentalization of cables for current requirements and for future expansion.

The mainline conduit shall contain four (4) factory installed 30 mm innerducts within a 4" outer duct. As part of this item, the Contractor will be required to test the integrity of the conduit with a poly-line and to install pull tape as required in the specification.

Work under the above items shall conform to Public Utility Commission Rules and Regulations, where applicable, and to Section 10.08 of the standard specifications, supplemented and amended as follows:

MATERIALS:

The multi-cell conduit system shall be a pre-assembled conduit manufactured from a 100 mm round outerduct containing 4 factory installed innerducts. The innerducts shall be held together in a square configuration by a system of spacers, bands, or other mechanism. The coupling system shall be resistant to water infiltration, air loss during cable installation, and shall be capable of locking the system tightly together to not allow free twisting of the innerducts.

Outerduct:
The conduit shall be free from defects including non-circularity and foreign inclusions. It shall be nominally uniform (as commercially practical) in color, density, and physical properties. It shall be straight and the ends shall be cut square to the inside diameter. Fiberglass conduit and fittings shall be supplied with an ultraviolet inhibitor. The color of the outerduct shall be a gray that matches as close as possible the color of the parapets of the structures. The Contractor will be required to submit a color swatch for approval.

The complete conduit system shall be UL listed, designed and engineered for an outdoor plant application. Protective outer duct shall be filament wound fiberglass reinforced epoxy as manufactured to comply with the specifications outlined in NEMA TC-14 and UL 1684 as noted.

The extra heavy wall fiberglass conduit shall have a minimum wall thickness of ¼ in. (6.35 mm). The extra heavy wall conduit shall prevent the penetration of a .45 caliber slug fired from a distance of 20 ft. (6.1 meters). The protective outer duct shall have extended 6 in. (150 mm) integrally wound bell ends and shall be shipped in a minimum lay length of 20 ft. (6.1 meters). The outer duct shall have a longitudinal running print line to assure proper innerduct orientation and alignment. This line shall consist of the following wording: "Install This Side Up –

Connecticut D.O.T. Cable – For Assistance Call 860-594-3447". The outer duct shall be marked with data traceable to plant location, date, shift, and machine of manufacture.

PHYSICAL AND MECHANICAL PROPERTIES	TEST METHODS
Ultimate Tensile Strength – 11,000 PSI Min.	ASTM D 2105
Dielectric Strength – 500 Volts/Mil.	ASTM D 149
Water Absorption – 1% Max.	ASTM D 570
Specific Gravity – 1.9-2.0	ASTM D 792
Glass Content – 68 ± 2 %	API SPEC 15 LR
Barcol Hardness – 58-52	ASTM D 2583

The outer duct shall have a circumferential ring on the spigot end of the ducts so as to provide a reference point for ensuring the proper insertion depth when connecting conduit ends. Both ends of the conduit shall be capped to protect inner-duct during shipment and job site storage.

The fiberglass conduit system to be utilized shall be a complete system and the Contractor shall provide the following fittings:

- Coupling Kits
- Terminator Kits
- Lubrication Fittings
- Repair Kits
- Installation Accessories

A complete line of fittings, adapters, and elbows shall be available and shall be manufactured from the same materials and manufacturing process as the conduit. The multi-cell conduit shall be joined by use of a coupling system that effectively seals the outerducts and innerducts but allows for expansion or contraction in the system.

All multicell conduit entering and exiting conduit termination points shall have a terminator installed that is made of PVC with an anti-reversing gasket that prevents ingress of water and debris into the outer conduit and the innerduct.

Couplings:

The couplings shall allow for transitions from fiberglass conduit to rigid metal conduit to flexible sweeps to PVC conduit and any combination thereof. The coupling body shall have a factory assembled, multi-stage gasket that is anti-reversing for sealing both the outer and innerduct. A secondary, mid-body gasket shall be seated at the shoulder of the bell to assure 100psi (690 kPa) air pressure (in accordance with Bellcore GR 2884 Issue 1) and watertight integrity with minimum joint infiltration of 6 psi (41 kPa). This will allow for the use of Air-Jet technology to be used in the placing of cables.

The coupling body shall be designed so that when the conduit is joined, the outer walls of the innerducts and the inner walls of the outerduct shall be sealed, providing an airtight seal from within the innerduct system and a watertight seal from the outside of the outerduct. The coupling body shall be tested for water tightness and air-tightness in accordance with Bellcore

GR-2884-CORE Issue 1, July 1995 (R3-41 for water-tightness and R3-43 for air-tightness). The coupling body shall conform to the following requirements:

Watertightness: 6 psi(41 kPa) minimum
Air Tightness: no significant leakage at 100 psi (690 kPa).

The system shall be designed so that expansion and contraction of the inner-duct shall take place in the coupling body, and the fittings shall allow going from steel to PVC without compromising air/water tightness, or pulling capabilities. The coupling body shall be factory assembled in the bell end of the outer duct and shall be manufactured from high impact engineered thermoplastic. The coupling body face shall be supplied with lead-ins to facilitate assembly. The coupling body shall have each conduit entrance identified with a raised number and the white inner duct locator conduit entrance shall have raised ribs that can be felt through a glove.

The conduit system shall be designed so that the assembly of components can be accomplished in the following steps:

a. Loosen set screws on coupling spin back to allow for insertion
b. Insert male into female and spin coupling forward to bottom
c. Tighten set screws

Flexible Sweeps:
The conduit system shall offer a complete line of fixed and flexible sweep bends with system compatible bell and spigot ends. The conduit system shall offer and the Contractor shall utilize the following standard fixed sweep bends:

Radius	Bend	System
4 ft & 3 ft. (1200mm & 900mm)	11.25°,22.5°,45°,90°	4-way

Note: Direction changes shall not exceed 90 degrees.

The flexible sweep bend shall be supplied in two lengths to meet field requirements. They shall have a steel core with a PVC outer jacket and be UL listed for exposed and direct burial installation. The inner duct shall always remain flush to the end of the flexible elbow, even when bending.

Length Feet (Meters)	Radius Feet (Meters)	Bend degrees (°)	System
10 (3.2)	4 (1.2) min	0-90	4-way
10 (3.2)	6 (1.8)	0-70	4-way
10 (3.2)	9 (2.7)	0-55	4-way
16 (4.9)	4 (1.2) min	0-90	4-way
16 (4.9)	6 (1.8)	0-70	4-way
16 (4.9)	9 (2.7)	0-55	4-way

All bends, including flexible sweeps, shall have a minimum radius of 3 ft. (900 mm). The inner duct system shall be solvent welded to the coupling body; supported by a movable spacer every 4 ft. (1.32 m). The bends shall not violate the minimum bend radius of the fiber optic cable to be installed.

All bends shall have nylon inner ducts, or approved equivalent, installed to prevent burn-through in accordance with test procedure outlined in Bellcore GR-2884 Issue 1 Section R3-35 and R3-36.

Innerduct:
The innerducts in straight lengths shall be manufactured from PVC or high density polyethylene (HDPE). Innerducts shall be factory treated with atomized silicone or manufactured in a manner to reduce friction during pulling of fiber optic cable.

Innerduct to be used in bends and sweeps shall have a minimum burn through time of 90 minutes when tested in accordance with Bellcore GR-2884 Issue 1 Section R3-35, and R3-36.
PVC inner ducts shall not be allowed in bends and sweeps.

The innerducts shall have a permanent dry lubricant extruded within the inner wall and shall incorporate longitudinal ribs within the inner wall. The innerducts shall have a nominal size of 1.25" (30 mm) and shall consist of 4 unique colors: white, red, orange, and yellow. Innerduct colors shall be oriented in a clockwise direction as specified above, looking at the spigot end of the multi-cell conduit system. The white innerduct shall be located directly under the print line on the outerduct.

Each inner-duct shall be sealed with an expanding Neoprene Plug that withstands 22 psi (150 kPa) and seals the inner-duct from water and debris infiltration, and a provision for tying off a pull line.

Conduit Testing:

The poly-line installed to verify the integrity of the conduit system shall be ¼" (6 mm) polypropylene. The pull tape shall consist of polyethylene or PVC jacket woven into the polyester tape. The pull tape shall be NEPTCO Part No. WP1250P, or approved equal, for cable sizes of less than 97 fibers. NEPTCO Part No. WP1800P, or approved equal, shall be used for cable size of 97-288 fibers.

The pull tape shall have the following properties:

- Proper tensile strength for the required fiber installation, or 1250 lbs. minimum
- flat, not round, construction
- printed foot markings
- Pre-lubricated for reduced pulling tension at start of cable pull
- Low susceptibility to absorption of moisture; moisture resistant

Structure Mounted Conduit Supports

For applications in which the multi-cell conduit system is specified on the plans and/or by the Engineer to be attached to a bridge or other structure, bridge hanger assemblies and conduit support devices shall be required as shown on the details for these attachments. These hanger assemblies and support devices shall be designed for application to the specific bridge or structure for which they will be used, and their materials and design shall be approved by the Department prior to their use.

Threaded rods, anchor bolts, nuts and washers shall conform to ASTM A449 and shall be galvanized in accordance with ASTM A153.

All hex nuts shall be "Prevailing Torque Reusable Type Lock Nuts."

Bedding material for all conduits shall be No. 100 fine aggregate as defined in Section M.03 of the standard specification and backfill for the pits shall be pervious structure backfill conforming to Article 2.16.02.

When the Contractor core drills through abutment back walls, wing walls and retaining walls, the conduit within the wall shall be Rigid Metal. Fiberglass conduit will only be installed underneath the structure, not within the walls.

Construction Methods

Construction methods shall conform to Article 10.08.03 of the Standard Specifications and to the manufacturer's instructions.

The Contractor shall layout the trench for the conduit in conjunction with the installation of pullboxes, vaults, or manholes. When installing the conduit, the Contractor shall be aware of the location of the proposed conduit terminal point when they are at a sufficient distance from the terminal point to allow for adjustment of the trench so that the conduit will line up flush with the applicable entry point. Flexible conduit will not be used indiscriminately.

Fiberglass conduit shall extend 2" (50 mm) into the manhole/vault/pullbox for installation of grounded end bushings.

Conduits and innerduct entering conduit terminal points or where terminated in trench, shall be capped or sealed to prevent ingress of water and debris into the conduit. At each conduit terminal point, a PVC coupling body with an anti-reversing gasket that seals between the innerduct and the conduit shall be used. Conduits containing innerduct shall be plugged using a quadplex expansion plug inside the conduit around the innerduct. Each innerduct shall be sealed with an expanding Neoprene Plug that withstands 22 psi (150 kPa) and seals the innerduct from water and debris infiltration, and a provision for tying off a pull line. Innerduct containing one cable shall be plugged using an expandable cable seal off.

Structure Mounted Conduit Supports

The Contractor will be required to submit to the Engineer for approval a proposal detailing the proposed installation method of the surface mounted conduit including the spacing between the conduit supports. The Contractor shall support the conduit as recommended by the manufacturer and approved by the Engineer.

Surface mounted conduit shall be installed where indicated on the plans; using mounting brackets and/or clamps as detailed on the plans or as directed by the Engineer.

Anchor bolts for conduit supports shall be drilled and anchored into sound concrete only. The anchorage system shall be installed per the manufacturers' recommendations. If existing reinforcement is encountered during drilling, the hole shall be abandoned, filled with non-shrink grout and relocated as directed by the Engineer. After installation of the conduit support, tighten all chemical anchor bolts to the torque as recommended by the anchorage system manufacturer.

Shop Drawings:
Prior to beginning work and fabrication of any materials, the Contractor shall take all field measurements necessary to assure the proper fit of the finished structure mounted conduit. This shall include all supports, brackets and hangers, fixed and flexible sweep bends, expansion/contraction fittings, junction boxes, and other structure mounted appurtenances. The Contractor shall submit shop drawings to the Engineer for approval in accordance with Article 1.05.02(b).

a. Layout plans and other pertinent information, including conduit lengths, locations and type of supports, sweep-bends, expansion fittings, junction boxes, etc. for each bridge or sign support that has structure mounted conduit and appurtenances.
b. Commercial items shall be identified by manufacturer, trade name and catalog number. Catalog sheets, including pertinent specifications, shall be included with the submission.
c. Complete fabrication details, including material and galvanizing specifications, for all conduit supports, brackets and hangers, hardware, field fasteners including chemical anchorages, etc.
d. All field measurements shall be submitted for reference to the reviewer.

Pull Tape

The Contractor shall install pull tape, by hand pulling, blowing, or via vacuum method, into each empty conduit and empty cell within the multi-cell conduit. The intention of this installation is to verify the integrity of the completed system; therefore, this testing will only be allowed to commence once the conduit system has been completely installed. Testing shall be performed in the presence of the Engineer. The Engineer will document the date, time, and the results of the testing and shall submit this information to Highway Operations for record keeping purposes. The Contractor shall neatly coil and secure 10 ft. (3 meters) of slacked pull tape in each vault location. The pull tape shall be field installed within each innerduct for the purpose of attaching to, and pulling of, the fiber optic cable.

As -Built Plans:

The Contractor shall advise the Engineer of any change of measurement of layout of the Plans submitted to them. Upon completion of construction but prior to acceptance of the contract, the Contractor shall furnish as-built plans on 2' X 3' (55 cm by 91 cm) standard plan sheets. All construction changes, with the final location and depth of the conduits, etc. shall be shown in sepia or other reproducible format. These plans shall include all field installations. One sepia or other reproducible of the Project Plans will be provided to the Contractor for their use. Any other base maps that may be necessary for the Contractor to comply with this requirement shall be the Contractor's responsibility.

Method Of Measurement:

The conduit shall be measured for payment by the actual number of feet (meters) of the type and size installed and accepted. Expansion fittings, fixed and flexible sweep-bends, conduit fittings, will not be measured for payment but shall be included in the pay item for the conduit of the type and size specified. The measured length shall be from end to end along the centerline through all fittings.

Core drilling through abutment back walls, wing walls and retaining walls, including the placement of the joint seal around the conduit at the front and rear face of the walls shall be included in the cost of the Fiberglass conduit of the type and size specified. The Rigid Metal conduit within the walls shall be measured for payment by the actual number of feet (meters) of the type and size installed and accepted.

All work necessary to complete the attachment of the conduit, including but not limited to mounting brackets, clamps, hangers, anchors, bolts, etc. to the structures, will not be measured for payment but shall be included in the pay item for the conduit.

The pull tape and conduit testing will not be measured for payment but shall be included in the pay item for the conduit of the type and size specified.

Basis Of Payment:

This work shall be paid for at the contract unit price per foot (meter) for conduit of the size and type indicated, within the limits shown on the plans and in the details. This price shall include all materials required including expansion fittings, fixed and flexible sweep-bends, conduit fittings, pervious structure backfill, bedding material, boxes, caps, pull-rope, inserts, warning tape, ground wire, identification posts with signs, structural supports, equipment, tools, labor and work incidental thereto. Trenching and backfilling shall be paid as specified in Section 10.01 of the Standard Specifications.

Pay Item	Pay Unit
4" Fiberglass Multiduct conduit – Extra Heavy Wall	l.f.

ITEM #1008907A - CLEAN EXISTING CONDUIT

Description:

The work under this item shall consist of cleaning existing conduit, as required, as shown on the plans or as directed by the Engineer to facilitate installation of new cable.

Construction Methods:

The Contractor shall remove all existing cable from conduit that will be reused. The contractor will be directed to clean the conduit which has obstructions or is found to be impassable. This cleaning process shall be by one of the following methods:

1) Rodding
2) A high pressure jet spray, or air pressure
3) By pulling a mandral or ball through the conduit.

The Contractor shall submit in writing his anticipated method of cleaning the conduit to the Engineer for approval prior to cleaning any conduit.

If the conduit is found to be damaged to any extent that the cleaning process will not clear the obstruction, it will be the judgment of the Engineer whether to replace the entire conduit run or excavate the damaged section for repair.

Method Of Measurement:

This work shall be measured for payment on an hourly basis based on the actual number of hours for the Contractor's forces, regardless of the number of employees, rendering services in accordance with these specifications. Payment will be made only for those hours when the Contractor's employee(s) is performing work. No travel time will be paid.

Basis Of Payment:

The work under the Item "Clean Existing Conduit" shall be paid for at the contract unit price per hourly basis, which price shall include all cleaning, material, tools, equipment, all labor, and work incidental thereto.

When it is determined by the Engineer to repair or replace damaged sections of existing conduit, the work involved in the replacement of the conduit will be paid separately under the appropriate contract item(s) for Repair Multiduct Conduit, Rigid Metal Conduit, RMC Multiduct Conduit, PVC Conduit, Trenching and Backfilling, and the applicable restoration items.

Pay Item	Pay Unit
Clean Existing Conduit	hr.

ITEM #1008910A - MULTIDUCT CONDUIT REPAIR

Description:

The work under this item shall consist of repairing damaged sections of existing multiduct conduit or innerduct as directed by the Engineer to facilitate installation of new fiber optic cable in the duct system.

Materials:

Materials used for backfilling excavations around conduit repairs shall conform to the requirements of Section 10.01.02.

Construction Methods:

Prior to the installation of new fiber optic cable in spare innerducts of existing multiduct conduit, the Contractor shall verify the condition of the spare innerduct in which the fiber optic cable is to be installed and identify any possible obstructions. This work shall be performed in accordance with the requirements of the respective items for Optical Fiber Cable, Single Mode, Loose Buffer Tube Cable.

If the conduit innerduct is found to be damaged or impassable to any extent that the cleaning process will not clear the obstruction, the Engineer will determine whether the conduit is to be repaired or replaced. Where the Engineer determines that the conduit should be replaced, work will be performed under separate items.

When directed by the Engineer to repair the damaged or impassable section of multiduct conduit or innerduct, the Contractor shall submit in writing to the Engineer a detailed procedure for the multiduct conduit repairs, identifying all procedures, equipment and materials that will be utilized for his work.

The Contractor shall excavate below the existing conduit and to a sufficient distance to either side of the damage so as to expose the obstructed portion and determine the length of the multiduct conduit that will need to be removed for the repair. The Contractor shall remove the damaged segment of multiduct conduit taking care not to damage the existing innerducts. As necessary, damaged segments of innerduct for the proposed fiber optic cable shall be cut-out and removed and repaired utilizing a split duct system, or other approved method as detailed in the Contractor's approved procedure.

Prior to making repairs to innerduct, the Contractor shall take steps to verify the integrity of remaining multiduct conduit to either side of the damaged section.

Following the repairs to the innerduct, the section of multiduct conduit that was removed shall be repaired utilizing a split duct system, or other approved method as outlined in the Contractor's approved procedure.

The excavation shall be backfilled in conformance with the requirements of Section 10.01.03 of the Standard Specifications. Topsoil shall be provided in conformance to Section 9.44.03 of the Standard Specifications. Turf Establishment shall conform to Section 9.50.03 of the Standard Specifications.

Method of Measurement:

This item shall be measured for payment as provided under Article 1.09.04 – Extra and Cost Plus Work.

The sum of money shown on the estimate and in the itemized proposal as "Estimated Cost" for Repair Multiduct Conduit will be considered the price bid even though payment will be made only for actual work performed. The estimated cost figure is not to be altered in any manner by the bidder. Should the bidder alter the amount shown, the altered figures will be disregarded and the original price will be used to determine the total amount bid for the contract.

Basis of Payment:

This work will be paid on a cost-plus basis according to Article 1.09.04 – Extra and Cost Plus Work. There will be no payment for maintenance and protection of traffic for work associated with this item unless, in the opinion of the Engineer, the sole purpose of the maintenance and protection of traffic is for repair of the multiduct conduit.

The cleaning of the existing innerduct and identification of any damaged or impassable sections will be paid under Item #1008907A - Cleaning Existing Conduit.

When it is determined by the Engineer to replace entire damaged sections of existing multiduct conduit, the work involved in the replacement of the conduit will be paid separately under the appropriate contract item(s) for RMC Multiduct Conduit, Trenching and Backfilling, and any applicable restoration items.

Pay Item	Pay Unit
Multiduct Conduit Repair	est. (est.)

ITEM #1009016A - 18" X 12" X 8" (450 MM X 300 MM X 200 MM) CAST IRON JUNCTION BOX

Description:

This item shall consist of furnishing and installing cast iron junction boxes at locations shown on the plans or as directed by the Engineer and in accordance with these specifications.

Materials:

Cast Iron Junction Boxes shall conform to the material requirements of Article M.15.10. The junction boxes shall be 18" (450 mm) high X 12" (300 mm) wide X 8" (200 mm) deep and shall include a screened ¾" (19 mm) drain hole located at the bottom of the box along the 12" (300 mm) wide dimension. The drain hole shall include woven insect screen to prevent insects and bees from entering the box. The screen shall be fastened inside the box.

The junction box cover shall be attached with approved stainless steel bolts, sealing washers and lock washers. The cover shall be equipped with a neoprene or rubber cover gasket and shall include a minimum of eight (8) ¼" X 1" (6 mm x 25 mm) bolted connections securing the cover to the junction box. All stainless steel hardware shall conform to the requirements of ASTM 304.

Construction Methods:

The junction boxes shall be mounted as shown on the plans or as directed by the Engineer. All hardware used in conjunction with mounting of these boxes shall be rust and corrosion resistant.

The junction box shall be installed at a higher elevation than its conduit connected handhole or pullbox to prevent the ingress of water into the junction box.

Conduit knockouts shall be made in the junction box by an approved method recommended by the manufacturer. Diameter of the knockouts shall be no larger than the minimum diameter required to accept the size conduit specified on the plans.

All conduits are to be secured to the junction box using the washers, locknuts, and bushings as detailed on the plans or as recommended by the manufacturer.

The junction box shall be installed where as the drain hole is at the bottom of the box facing the ground.

All excess concrete shall be removed from the junction box cover, recessed bolt holes, and bolt heads.

Method of Measurement:

The work for this item will be measured for payment by the number of cast iron junction boxes of the size specified, complete and accepted in place.

Basis of Payment:

This work will be paid for at the Contract unit price each for "Cast Iron Junction Box" of the size specified, complete in place, which price shall include all materials, box, cover, gasket, drain pipe, drain hole screen, cover bolts, necessary fittings and hardware, including that necessary for mounting, removal of excess concrete, all equipment, tools and labor incidental thereto.

Pay Item	Pay Unit
18” X 12” X 8” Cast Iron Junction Box	ea.

ITEM #1009501A - 10” X 10” X 6” NEMA 4X NON-METALLIC JUNCTION BOX

ITEM #1009503A - 16" X 14" X 6" NEMA 4X NON-METALLIC JUNCTION BOX

Description:
This item shall consist of furnishing and installing a surface mounted thermoplastic 10”x10”x6” NEMA 4X non-metallic junction box or 16”x14”x6” NEMA 4X non-metallic junction box at the location(s) as shown on the plans or as directed by the Engineer.

Materials:
Junction boxes and covers shall be constructed of hot compression molded fiberglass reinforced polyester, manufactured from a thermoset non-halogenated material. The enclosure shall be completely weatherproof, rated for outdoor use, and shall meet NEMA Standard 250, as well as UL/cUL 50 File E64358. The box shall be rated NEMA 4X and be supplied with stainless steel hardware. The enclosure shall have a molded in flange in order to secure the enclosure to the structural concrete.

The enclosure shall meet ASTM D1435 – *Standard Method of Outdoor Weathering of Plastics* and ASTM D4364 - *Standard Method of Accelerated Outdoor Weathering of Plastics using Concentrated Natural Sunlight*. The integral urethane gasket attached to the cover shall be constructed of elastomeric material that will meet the environmental construction and performance requirements. The cover shall be supplied with a stainless steel beaded chain attached to the enclosure in order to secure the cover after the cover bolts have been removed. All cover bolts shall be stainless steel. The enclosure shall have threaded brass inserts which shall be sized to accept the stainless steel cover bolts.

The Non-Metallic Junction box shall be warrantied to be free from defects in workmanship for a period of 10 years.

Construction Methods:
The Contractor shall install the junction box at the location and to the dimensions as detailed on the plans. Conduit entrance holes shall be drilled into the junction box at the required locations using a hole-saw of the minimum diameter required to accommodate the conduit connector. All conduit connections shall be glued. The non-metallic enclosure shall be attached to the structural concrete using stainless steel mechanical anchors with flat washers, lock washers, and hex nuts. The location of the junction box shall be installed between the median barrier walls of a bridge structure as indicated on the plans and details. All conduit attachments shall utilize a weatherproof sealing ring to ensure that the installation is watertight.

Method of Measurement:
Each junction box of the size specified shall be measured as a unit, complete and accepted in place.

Basis of Payment:
This work will be paid for at the contract unit price each for "10"x10"x6" NEMA 4X Non-Metallic Junction Box" and "16"x14"x6" NEMA 4X Non-Metallic Junction Box", complete in place, which price shall include junction box, cover, attachment hardware, mechanical anchors, flat washers, lock washers, hex nuts, drilling, anchoring, and all materials, equipment, tools and labor incidental thereto.

Pay Item	**Pay Unit**
10" x 10" x 6" NEMA 4X Non-Metallic Junction Box	EA
16" x 14" x 6" NEMA 4X Non-Metallic Junction Box	EA

ITEM #1010060A - CLEAN EXISTING CONCRETE HANDHOLE

DESCRIPTION:
Clean all debris from an existing concrete handhole where shown on the plans or as directed.

MATERIAL:

Insulated Bonding Bushings: Specification Grade Threaded Malleable Iron or Steel Galvanized UL listed

Bonding Wire: M.15.13

Grout: M.03.05

CONSTRUCTION METHODS:

Remove to a level even with the bottom of the handhole all sand, silt and other debris. Remove any material that is accessible from the ends of conduit. Additional conduit cleaning will be paid for under Item 1008908A-Clean Existing Conduit. Place approximately 4" (100) of ¾" (19) crushed stone in bottom of handhole using care not to allow crushed stone to enter conduits. Grout around conduits to prevent future entrance of dirt and silt. Properly dispose all removed debris. Inspect bonding bushings. Tighten loose bushings. Secure loose bond connections. Install new bonding bushings on spare conduits and bond to other conduits.

METHOD OF MEASUREMENT:

This work will be measured for payment by the number of concrete handholes cleaned, complete and accepted.

BASES OF PAYMENT:

This work will be paid for at the contract unit price each for "Clean Existing Concrete Handhole", which price shall include the removal and disposal of debris from handhole and associated conduit, crushed stone, grout, bonding bushings, bonding wire, and all equipment and work incidental thereto.

Pay Item	Pay Unit
Clean Existing Concrete Handhole	Each (Ea)

ITEM #1010902A - REMOVE CONCRETE HANDHOLE

DESCRIPTION: Under this item the Contractor shall remove an existing concrete handhole where shown on the plans or as directed. The removed concrete handhole shall be disposed of by the Contractor.

CONSTRUCTION METHODS: The Contractor shall remove and dispose of a concrete handhole where shown on the plans or as directed. The hole shall be backfilled and graded to match surroundings, unless otherwise noted on the plans.

METHOD OF MEASUREMENT: This work will be measured for payment by the number of concrete handholes removed and disposed of, complete and accepted.

BASES OF PAYMENT: This work will be paid for at the contract unit price each for "Remove Concrete Handhole", which price shall include all materials, equipment and work incidental thereto including excavation, backfill when necessary, hauling and disposing of concrete handholes.

ITEM #1014503A - TRANSFORMER 5 KVA 240V - 120V

Description:

The work under this item shall consist of furnishing and installing a transformer of the type specified herein, on the outside of the proposed Traffic Management System Cabinets (TMSC) as shown on the plans or as directed by the Engineer.

Materials:

The transformer shall be the type and size required to provide for the necessary functions listed herein. The Contractor shall submit for approval the specifications for the transformer to be used, prior to the start of work for the installation of the cabinets. The transformer shall be a one-piece, dry type, 5 KVA, single phase, with a 2:1 voltage step down, from 240 volt to 120 volt. The transformer shall be UL listed for outdoor use and shall be suitable for salt-spray conditions prevalent along the expressway. The transformer shall be housed in a weatherproof, corrosion resistant enclosure capable of mounting on the TMSC and have an approved thermal installation system to minimize heat transmitted to the cabinet. Conduit knockouts shall be provided as required. The transformer shall be equipped with ANSI standard leads. The transformer ratings shall meet the applicable ANSI/NEMA Standards for specialty transformers.

Construction Methods:

The transformer shall be mounted on the TMSC per the manufacturer's specifications and as directed by the Engineer. The Contractor is to verify the requirements of the system for the transformer to be utilized.

The transformer shall be mounted on the side of the TMSC which is away from the traffic flow of the adjacent roadway to minimize vehicle spray during wet conditions. The transformer shall be mounted such that the mounting brackets, bolts or hardware do not conflict with the internal hardware of the cabinets.

The transformer shall have rigid metal conduit and all associated fittings, and couplings for the service cable.

Method of Measurement:

This work will be measured for payment by the number of transformers of the type specified, installed, completed, operating and accepted in place.

Basis of Payment:

This work will be paid for at the contract unit price for each "Transformer 5 KVA 240V - 120V" complete and accepted in place which price shall include the transformer, enclosure, all required conduit, fittings, couplings, internal wiring, mounting brackets, mounting hardware, drilling for mounting brackets, material, equipment, tools, labor and incidental thereto.

Pay Item	Pay Unit
Transformer 5 KVA 240V - 120V	ea.

ITEM #1014901A - REMOVE CABLE

DESCRIPTION:

The work under this item shall include the removal and legal disposal of Incident Management System (IMS) fiber optic cable, copper communications cable and electric service cable and conductors where shown on the plans or as directed by the Engineer.

MATERIALS:

The Contractor shall be responsible for damage to all equipment and materials incurred during removal, hauling and disposal. All repairs or replacements due to damage or loss by the Contractor shall be made at the Contractor's expense.

A 1/4" (6 mm) polyester rope (pull line) shall be installed in all abandoned conduits for future pulling purposes.

A detectable pull tape, NEPTCO Part No. DP1250P, shall be installed in all abandoned innerducts of multiduct conduit installations.

CONSTRUCTION METHOD:

Removal of existing IMS fiber optic cable, copper communications cable and electrical service cable/conductors shall be performed in a manner and sequence not to damage portions of the cable that shall remain or other adjacent or nearby appurtenances. The Contractor shall install a ¼-inch (6 mm) poly pull line for future use within any and all conduit where the IMS fiber optic cable has been removed. A pull rope shall be installed in communications and electrical service conduits only where noted on the plans. The pull line shall have sufficient length at each end and be neatly tied off within the nearest manhole, handhole, or pullbox.

METHOD OF MEASUREMENT:

This work will be measured for payment by the actual number of linear feet (meters) of IMS cables removed. For communications cable and electrical service cable/conductors where more than one cable or conductor is to be removed from within the same conduit, measurement shall be based on the length of conduit (and any manholes, pullboxes, handholes, etc.) from which the cables/conductors are removed.

BASIS OF PAYMENT:

This work will be paid for at the contract unit price per linear foot (meter) for "Remove Cable" as specified, which price shall include removal, storage, disposal, installation of polyester pull line, and all work, materials, tools and equipment incidental thereto.

Pay Item	Pay Unit
Remove Cable	ft (m)

ITEM #1015041A - PULLBOX

Description:

Vaults and Pullboxes for IMS are defined as structures implemented to facilitate cable installation, splicing and excess cable storage. Vaults and Pullboxes are generally located at intermediate locations to facilitate cable installation. This item shall consist of furnishing and installing concrete structures of the design and dimensions indicated in the details or as ordered by the Engineer, and in conformity with these specifications. Vaults and Pullboxes installed underground may be precast or cast-in-place.

Materials:

All vaults, pullboxes and associated components shall comply with industry standards for communications applications and be of suitable construction for installation in an off-highway environment. Work in this section shall meet or exceed the applicable provisions of the following documents:

1. AASHTO HS 20-44 rating
2. AASHTO M-199.
3. ASTM C857-83, Minimum Structural Design Loading for Underground Precast Concrete Utility Structures.
4. ASTM C858-83, Underground Precast Concrete Utility Structures.

All vaults shall include the following provisions:

1. A sump 12” (300 mm) in diameter.
2. Four ¾” (19mm) diameter pulling inserts in the floor.
3. 8 Unistruts of the length indicated on the plans.
4. Knockouts located on each wall, aligned to as close to the center of the vault as possible, to facilitate cable pull-through or change in direction.
5. The galvanized steel cover with frame shall conform to Article M.08.02 of the Standard Specifications. The assembled steel covers shall include a locking mechanism that will not allow the covers to open more than 120 deg. from the closed position.
6. The steel covers shall be installed flush with the top of the concrete structure.
7. The minimum thickness of the vault walls shall be 6” (150 mm).

All pullboxes shall include the following provisions:

1. "C" Channel of length indicated.
2. Four ¾” (19mm) diameter pulling inserts in the floor.

3. Knockouts, located on each wall, aligned as close to the center of the pullbox as possible, to facilitate cable pull through or direction change.
4. The galvanized steel cover with frame shall conform to Article M.08.02 of the Standard Specifications. The assembled steel covers shall include a locking mechanism that will not allow the covers to open more than 120 deg. from the closed position.
5. The steel covers shall be installed flush with the top of the concrete structure.
6. The minimum thickness of the pullbox walls shall be 4" (100mm).

Vaults, Pullboxes and covers shall have a vertical proof-load strength of 25,000 lbf (110,000 Newtons) in accordance with Federal Specification RR-F-621e. The vaults and pullboxes shall be reinforced with a galvanized Z-bar welded frame and cover. Frames shall be anchored to the boxes by means of ¼" x 2" (6.25 mm x 51-mm) long concrete anchors. Hold down screws shall be 3/8" (9.5-mm) hex flange cap screws of Type 316 stainless steel. The nut shall be zinc plated carbon steel and shall be made vibration resistant with a wedge ramp at the root of the thread. The nut shall be spot welded to the underside of, or fabricated with, the galvanized Z-bar pull box frame.

Steel covers shall be countersunk approximately ¼" (6.35 mm) to accommodate the bolt head. The bolt head shall not extend more than 1/8" (3.2 mm) above the top of the cover when tightened down. A ¼" (6.35- mm) tapped hole and brass-bonding screw shall be provided.

After the installation of the precast units, the steel covers shall be installed and kept bolted down during periods when work is not actively in progress. When placing the steel cover for the final time, the cover and the Z-bar frame shall be cleaned of all debris and securely tightened down. Each pullbox supplied shall be secured with two bolt down locking hex bolts.

Construction Methods:

The Contractor shall contact Mr. James Gannon of D.O.T. Highway Operations at (203)–696–2685 to conduct a walk through of the project limits and to stake out the proposed locations of vaults, or pullboxes prior to installation.

All dimensions and exact locations of existing underground substructures and utilities shall be field verified by the Contractor prior to committing any materials or any excavation. Following are the parameters required for the execution of work in this section:

1. Excavation shall be performed in accordance with Article 2.02 of the Standard Specifications.
2. All pre-cast units shall be installed on a level foundation of granular fill, compacted.
3. All pre-cast units shall be installed at grade in paved areas, and one (1) inch (25 mm) above grade in unpaved areas.

4. Backfill shall consist of good compactable material as prescribed in Section M.02 of the Standard Specifications. In no case shall the material be saturated soil, or contain large rocks, or chunks.
5. All pre-cast units shall be free of debris and ready for cable installation.

The Contractor shall provide the excavation into which the individual components shall be lowered. The excavation shall allow for overall assembled height plus added height of risers, manhole castings, etc., and bedding material consisting of a minimum of 6" (150 mm) of granular fill, compacted conforming to Article 2.13 of the Standard Specifications. A minimum clearance of 6" (150 mm) around the sidewalls of the manhole shall be provided. The excavation hole shall not contain water during the installation. Where found during excavation, unsuitable material shall be excavated as directed by the Engineer and replaced with granular fill, compacted.

All spare conduits and innerducts shall be sealed by means of reusable mechanical plugs. The Contractor shall use extreme care with the cables especially with regard to the minimum bending limitations.

When all cables at each pre-cast unit are securely racked, the void areas around the conduits or innerducts containing cables shall be sealed using reusable mechanical plugs.

Method of Measurement:

This work shall be measured for payment by the number of electric vaults (IMS) or pullboxes of the type specified, complete and accepted in-place.

Basis of Payment:

This work shall be paid for at the contract unit price each for "Electric Vault (IMS)" or "Pullbox", complete in-place, which price shall include all materials, concrete, steel cover, locks, pulling irons, conduit plugs, appurtenances, dewatering, any excavation, granular fill, backfilling, replacement of pavement, including grading and placing topsoil, seeding, fertilizing, mulching and all equipment, tools, labor and work incidental thereto.

Pay Item	Pay Unit
Pullbox	ea.

ITEM #1017030A - SERVICE

DESCRIPTION: Work under this item shall consist of equipping a base mounted traffic controller cabinet with electric service, which shall include all electrical equipment in the cabinet and conductors as detailed on the plans or as directed by the Engineer, and in accordance with these specifications. This item shall also consist of removing existing 14/2 loop cables, piezo sensor cables, and terminal blocks from the cabinet.

MATERIALS:

Duplex outlet shall be 15 amp, 125 volt, 60 HZ Class A, and shall be UL listed.

A light fixture with porcelain base, pull chain, and lamp shall be mounted in the cabinet.

A surge protector shall be mounted in the cabinet.

A neutral bus bar shall be mounted in the cabinet.

A portable cord and plug connected power strip with six outlets shall be located in the cabinet.

Conductors shall conform to the requirements of Article M.15.11.

Circuit breaker shall be single pole, 15 amp, 120 volt, and shall be thermal magnetic type, non-enclosed, front-connecting.

CONSTRUCTION METHODS: The existing 14/2 loop cables, piezo sensor cables, and terminal blocks located in the cabinet shall be removed and properly disposed of by the Contractor. Electrical equipment shall be installed and wired as detailed on the plans or as directed by the Engineer. All wiring within the cabinet shall be neat and firm.

METHOD OF MEASUREMENT: This work will be measured for payment by the number of electric services installed, complete and accepted.

BASIS OF PAYMENT: The electric service in the cabinet will be paid for at the contract unit price each for "Service" complete and accepted in place, which price shall include the removal of 14/2 loop cables, piezo sensor cables, and terminal blocks, the installation of circuit breaker, surge protector, duplex outlet, light fixture, lamp, neutral bus bar, power strip, conductors, wiring, grounding, and all equipment, tools, labor and work incidental thereto.

ITEM #1017050A - SERVICE RELOCATION

DESCRIPTION: Work under this item shall consist of the removal of an existing base mounted service cabinet for traffic monitoring station and relocation of the cabinet onto a new foundation at the location shown on the plans or as directed by the Engineer, and in accordance with these specifications.

MATERIALS: Bare copper grounding conductor shall be No. 8 and shall conform to the requirements of article M.15.13.

The Contractor shall be responsible for the repair of damage to the cabinet and internal equipment (backboard and shelves) caused by the Contractor in performing the work specified herein. All repairs or replacements due to damage or loss by the Contractor shall be made by the Contractor at the Contractor's expense, as directed by the Engineer.

CONSTRUCTION METHODS: The existing service cabinet with internal equipment (backboard and shelves) shall be removed, temporarily stored by the Contractor as required and relocated onto a new foundation at the location shown on the plan. The cabinet shall be mounted on the foundation and leveled before the cabinet is bolted down. A waterproof caulking compound shall be used to seal the cabinet to the foundation. The cabinet and conduit sweeps shall be bonded to the ground rod in the foundation using No. 8 bare copper grounding conductor. The grounding conductor shall be attached to the cabinet using a bonding lug.

The Contractor shall follow standard lockout/tagout procedures. All work shall be in accordance with the National Electrical Code.

METHOD OF MEASUREMENT: This work will be measured for payment by the number of service cabinets removed and relocated, complete and accepted in place.

BASIS OF PAYMENT: This work will be paid for at the contract unit price each for "Service Relocation" complete and accepted, which price shall include removal, storage, delivery and installation of the cabinet, lugs, grounding conductor, caulk, connections and all materials, tools, equipment and labor incidental thereto.

ITEM #1017051A - SERVICE REVISION

Description:

The work under this item shall consist of revisions to an existing pedestal mounted service cabinet to install new locking mechanisms and circuit breakers of the type specified at the locations shown on the plans or as directed by the Engineer and in accordance with these specifications.

Materials:

Deadbolt-type lock to work with the standard pedestal mounted three-point door latching mechanism. The lock shall manufactured from brass and be keyed with a CONN #1 lock with two keys.

Conductors shall conform to Section 10.12 and Article M.15.11 shall be type XHHW-2 rated for 600 volts. Conductors shall be sized as indicated on the plans.

The circuit breakers shall be thermal magnetic type. The number of poles, voltage rating and current ratings shall be as shown on the plans. See Drawing Title Typical Electrical and ATC Details.

Construction Methods:

The Contractor shall replace the existing deadbolt-type lock on the existing service cabinets with a new deadbolt-style lock. The Contractor may be required to drill out the existing deadbolt-style lock if the lock cylinder is corroded.

At existing service cabinets where the existing metered service shall be retained, the Contractor shall install a new Single pole (120V) circuit breaker for CCTV Traffic Management System Cabinets (TMSC) shall be rated for 50 Amps and a two pole (240V) circuit breakers for CCTV TMSC's shall be rated for 25 Amps.

At existing service cabinets where the new metered service for combined CCTV/VMS shall be installed the Contractor shall install a new 150 Amp two pole (240V) circuit breaker lateral, a 100 Amp 2 two pole (240V) circuit breaker for VMS and 50 Amp single pole (120V) or 25 Amp two pole (240V) circuit breaker for CCTV TMSC.

The circuit breakers and service cables shall be clearly marked in the cabinet for their use and future identification.

Method of Measurement:

This work will be measured for payment by the number of existing pedestal mounted service cabinets revised, complete and accepted. Each service cabinet will be measured for payment regardless of single or multiple services.

Basis of Payment:

This work will be paid for at the contract unit price each for "Service Revision" complete, which price shall include all locks, conductors, circuit breakers and all materials, tools, equipment, labor and work incidental thereto.

Pay Item	Pay Unit
Service Revision	ea.

ITEM #1017052A - REMOVE SERVICE

DESCRIPTION: Work under this item shall consist of removal of an existing base mounted traffic controller cabinet for traffic monitoring station as indicated on the plans.

MATERIALS: The Contractor shall be responsible for damage to all equipment and material incurred during removal and hauling to a specified area. All repairs or replacements due to damage or loss by the Contractor shall be made at the Contractor's expense.

CONSTRUCTION METHODS: The existing traffic controller cabinet with all components and foundation shall be removed by the Contractor. The traffic controller cabinet with all components excluding the battery shall be salvaged by the Contractor and turned over to the State, while the foundation shall be properly disposed of by the Contractor. The excavation for foundation shall be backfilled and graded to match surroundings.

After removal of the existing traffic controller cabinet, the construction inspector shall contact Mr. Zoltan Rigo of the Office of Policy and Planning at telephone 860-594-2780 to make arrangements for the retrieval of the cabinet.

METHOD OF MEASUREMENT: This work will be measured for payment by the number of traffic controller cabinets removed and salvaged, and the associated foundations removed and disposed of, complete and accepted.

BASIS OF PAYMENT: This work will be paid for at the contract unit price each for "Remove Service" which price shall include excavation, grading, backfill when necessary, removal and temporary storage of the cabinet with all components excluding the battery, removal, hauling and disposal of the foundation, and all materials, tools, equipment and labor incidental thereto.

ITEM #1018008A - NAVIGATION LIGHT (PIVOT TYPE CENTER OF CHANNEL)

DESCRIPTION: This item shall consist of furnishing and installing a pivot arm mounted light emitting diode (LED) 360 degree green navigation light of the wattage, distribution, and voltage as specified, completely wired and attached to the bridge structure in accordance with the plans and specifications.

MATERIALS: The navigation light shall have LED optics and shall produce a 360° green light output. The navigation light shall be U.S. Coast Guard approved and shall carry the following certifications:

CE (European Conformity)	EN61000-6-3:1997, EN61000-6-1:1997
IALA	E-200-1
USCG	33 CFR Part 66
Quality Assurance	ISO9001:2008
IP	IP67

The LED navigation light shall have a visible range of up to 4NM and shall operate at 120 volts AC. The navigation light body and lens material shall be LEXAN polycarbonate which shall be UV stabilized. The LED light source shall be integral to the light fixture. A light fixture utilizing an Edison base type LED light bulb will not be accepted. The following characteristics shall apply:

Visible Range:	AT@0.74: 2 NM (nominal) AT@0.85: 2.3 NM (nominal)
Vertical Divergence:	9°
LED Life Expectancy:	>100,000 hours
Temperature Range:	-40 to 80°C
Lens Diameter:	4.25”
Mounting:	2” O.D. slip-fitter
Height:	4”
Width	4.25”
Mass:	2.625 lbs.
Warranty:	3 Years

The LED navigation light shall feature an aluminum slip fitter type post mount fabricated of aluminum and powder coated green. All hardware used in the construction of the light shall be stainless steel. The navigation light shall feature a factory connected, 3 conductor, outdoor rated, flexible power cable. The Contractor shall take field measurements to determine the required length of the power cable allowing enough slack in the cable to accommodate the 180° degree rotation of the pivot arm bracket, create a suitable drip loop, and allow for conductor splicing in the parapet junction box as indicated on the plans.

The pivot arm bracket shall be manufactured from 2" stainless steel tubing and shall be supplied by the same manufacturer as the navigation light. The pivot arm shall allow full 180° rotation of the navigation light from the "down" position to the "service" position and shall feature a locking plate which when engaged will lock the pivot arm in the downward position. The Contractor shall take field measurements to determine the required length of the pivot arm. The length of the arm shall be such that the navigation light is positioned at the same elevation as the existing light (to be removed) or as called for on the plans.

Concrete anchors shall be mechanical type and shall be furnished with flat washers, hex nuts, and lock washers or lock nuts. All hardware used to mount the pivot arm to the bridge structure shall be Type 316 stainless steel and shall be sized per the manufacturer's recommendations for the given loads.

The pendant mounted navigation light shall be equipped with an articulated stainless steel chain which will allow retrieval of the navigation light up to a maintenance position above the safety parapet of the bridge.

All cable connectors/connections shall be watertight.

The fuse and fuse holders shall conform to the requirements set forth in Article M.15.05. Fuses shall be sized as indicated on the plans.

The step-down transformer shall be 316 stainless steel, dry type, encapsulated, housed in a NEMA 3R enclosure and rated for outdoor locations. Transformer shall be single phase, 60 Hz, 1kVA, with a 240 x 480v primary and a 120/240v secondary. The approximate transformer dimensions shall be 10.5" x 5.5" x 5.25". The transformer shall be UL listed and CSA certified. UL-3R enclosure shall meet or exceed all listing criteria including NEMA, ANSI and OSHA.

CONSTRUCTION METHOD: The Pivot type 360° green navigation light shall be used to light the center of the navigable channel and shall be installed in conformance with Section 10.18 and the plans and details.

The navigation light swivel pendant shall be attached to the structural concrete at the center channel point. The swivel pendant shall be installed at the same position relative to the maritime channel as the existing navigation light pendant. Minor positional adjustments to the location of the pendant will be allowed as follows: The vertical position of the mounting plate on the back face of the concrete parapet can be adjusted to position the new mechanical anchors in virgin concrete; however, the stem length of the swivel pendant shall be adjusted to position the navigation light below "low steel" as indicated in the details. If necessary, a minor lateral adjustment to the position of the mounting plate of 6" or less will be allowed to avoid installing the new mechanical anchors in close proximity to the existing anchors.

The navigation light shall be installed at the end of the pivot arm and the swivel assembly shall be securely bolted to the structural concrete. Mounting hardware shall include lock washers or lock nuts to eliminate the possibility of vibration induced loosening.

The Contractor shall ensure that the installed navigation light is completely accessible, including access to the lift chain and latch plate. The Contractor shall demonstrate that when raised, the navigation light is accessible from roadway surface.

The manufacturer supplied power cable shall be connected to the navigation lighting circuit through the transformer as indicated in the plan details. The navigation light shall be properly connected to the equipment ground. Fuse holders and fuses (brass slug for neutral) shall be installed in the parapet cast iron junction box to protect the power cord conductors to the navigation light.

The step-down transformer shall be installed in the parapet cast iron junction box and connected to the lighting circuit conductors as indicated on the plans. The step down transformer shall feed the center channel navigation light along with the two channel margin navigation lights (paid for under a separate bid item) installed on the same side (parapet) of the bridge.

The navigation light shall be tested for proper operation.

The installation of the navigation light shall be carried out during daylight hours and the installation shall be completed prior to sunset. Under no circumstances shall the proper nighttime demarcation of the channel center be disrupted.

METHOD OF MEASUREMENT: This work will be measured for payment by the number of navigation lights installed, complete and accepted.

BASIS OF PAYMENT: This work will be paid for at the contract unit price each for "Navigation Light (Pivot Type Center of Channel)" of the type and size specified, complete and accepted in place, which price shall include all materials including navigation light, stainless steel pivot arm, latch plate, lift chain, lift chain eye bolt, power cable, transformer, fuses, fuse holders, connections, mounting hardware, drilling, mounting, testing, measuring, grounding, and all labor, tools, equipment and work incidental thereto.

ITEM #1018009A - NAVIGATION LIGHT (PIVOT TYPE CHANNEL MARGIN)

DESCRIPTION: This item shall consist of furnishing and installing a pivot arm mounted light emitting diode (LED) 180 degree red navigation light of the wattage, distribution, and voltage as specified, completely wired and attached to the bridge structure in accordance with the plans and specifications.

MATERIALS: The navigation light shall have LED optics and shall produce a 180° sectored red light output. The navigation light shall be U.S. Coast Guard approved and shall carry the following certifications:

CE (European Conformity)	EN61000-6-3:1997, EN61000-6-1:1997
IALA	E-200-1
USCG	33 CFR Part 66
Quality Assurance	ISO9001:2008
IP	IP67

The LED navigation light shall have a visible range of up to 4NM and shall operate at 120 volts AC. The navigation light body and lens material shall be LEXAN polycarbonate which shall be UV stabilized. The LED light source shall be integral to the light fixture. A light fixture utilizing an Edison base type LED light bulb will not be accepted. The following characteristics shall apply:

Visible Range:	AT@0.74: 2 NM (nominal) AT@0.85: 2.3 NM (nominal)
Vertical Divergence:	9°
LED Life Expectancy:	>100,000 hours
Temperature Range:	-40 to 80°C
Lens Diameter:	4.25”
Mounting:	2” O.D. slip-fitter
Height:	4”
Width	4.25”
Mass:	2.625 lbs.
Warranty:	3 Years

The LED navigation light shall feature an aluminum slip fitter type post mount fabricated of aluminum and powder coated red. All hardware used in the construction of the light shall be stainless steel. The navigation light shall feature a factory connected, 3 conductor, outdoor rated, flexible power cable. The Contractor shall take field measurements to determine the required length of the power cable allowing enough slack in the cable to accommodate the 180° degree rotation of the pivot arm bracket, create a suitable drip loop, and allow for conductor splicing in the parapet junction box as indicated on the plans.

The pivot arm bracket shall be manufactured from 2" stainless steel tubing and shall be supplied by the same manufacturer as the navigation light. The pivot arm shall allow full 180° rotation of the navigation light from the "down" position to the "service" position and shall feature a locking plate which when engaged will lock the pivot arm in the downward position. The Contractor shall take field measurements to determine the required length of the pivot arm. The length of the arm shall be such that the navigation light is positioned at the same elevation as the existing light (to be removed) or as called for on the plans.

Concrete anchors shall be mechanical type and shall be furnished with flat washers, hex nuts, and lock washers or lock nuts. All hardware used to mount the pivot arm to the bridge structure shall be Type 316 stainless steel and shall be sized per the manufacturer's recommendations for the given loads.

The pendant mounted navigation light shall be equipped with an articulated stainless steel chain which will allow retrieval of the navigation light up to a maintenance position above the concrete bridge parapet.

All cable connectors/connections shall be watertight.

The fuse and fuse holders shall conform to the requirements set forth in Article M.15.05. Fuses shall be sized as indicated on the plans.

CONSTRUCTION METHOD: The Pivot type 180° red navigation light shall be used to light the channel margin and shall be installed in conformance with Section 10.18 and the plans and details.

The navigation light swivel pendant shall be attached to the structural concrete at the channel margin point. The swivel pendant shall be installed at the same position relative to the maritime channel as the existing navigation light pendant. Minor positional adjustments to the location of the pendant will be allowed as follows: The vertical position of the mounting plate on the back face of the concrete parapet can be adjusted to position the new mechanical anchors in virgin concrete; however, the stem length of the swivel pendant shall be adjusted to position the navigation light below "low steel" as indicated in the details. If necessary, a minor lateral adjustment to the position of the mounting plate of 6" or less towards the center of the channel will be allowed to avoid installing the new mechanical anchors in close proximity to the existing anchors.

The navigation light shall be installed at the end of the pivot arm and the swivel assembly shall be securely bolted to the structural concrete. Mounting hardware shall include lock washers or lock nuts to eliminate the possibility of vibration induced loosening.

The Contractor shall ensure that the installed navigation light is completely accessible, including access to the lift chain and latch plate. The Contractor shall demonstrate that when raised, the navigation light is accessible from roadway surface.

The manufacturer supplied power cable shall be connected to the navigation lighting circuit through the transformer (paid for under separate bid item) as indicated in the plan details. The navigation light shall be properly connected to the equipment ground. Fuse holders and fuses (brass slug for neutral) shall be installed in the parapet cast iron junction box to protect the power cable to the navigation light.

The navigation light shall be tested for proper operation.

The installation of the navigation light shall be carried out during daylight hours and the installation shall be completed prior to sunset. Under no circumstances shall the proper nighttime demarcation of the channel margin be disrupted.

METHOD OF MEASUREMENT: This work will be measured for payment by the number of navigation lights installed, complete and accepted.

BASIS OF PAYMENT: This work will be paid for at the contract unit price each for "Navigation Light (Pivot Type Channel Margin)" of the type and size specified, complete and accepted in place, which price shall include all materials including navigation light, stainless steel pivot arm, latch plate, lift chain, lift chain eye bolt, power cable, fuses, fuse holders, connections, mounting hardware, drilling, mounting, measuring, testing, grounding, and all labor, tools, equipment and work incidental thereto.

ITEM #1018101A - REMOVE NAVIGATION LIGHTS

DESCRIPTION: Under this item the Contractor shall remove a complete navigation lighting system consisting of navigation lights, step-down transformers, surface conduit and junction boxes, cables, where shown on the plans or as directed by the Engineer. The removed navigation lights and associated equipment shall be properly disposed of by the Contractor.

CONSTRUCTION METHODS: The Contractor shall remove a complete navigation lighting system consisting of two pendant type green navigation lights, four pendant type red navigation lights, step-down transformers, brackets, surface conduit, junction boxes, and cables. The removed navigation lights and associated equipment shall be properly disposed of by the Contractor.

The removal of the existing navigation lighting equipment shall be coordinated with the installation of the temporary or new navigation lighting equipment (paid for under separate bid items) so that proper nighttime navigation lighting of the river channel is maintained at all times. Nighttime navigation lighting of the maritime channel shall be maintained throughout all stages of construction.

Removed materials shall be properly disposed of by the Contractor.

The Contractor shall operate and maintain the complete navigation lighting system (existing, temporary, and new) once construction begins and throughout all stages of construction.

METHOD OF MEASUREMENT: This work will be measured for payment as an each item for the removal of the complete existing navigation light system as described.

BASES OF PAYMENT: This work will be paid for at the contract unit price each for "Remove Navigation Lights", which price shall include removal of lights, pendants, step-down transformers, brackets, conduit, cables, disconnection, disposal, hauling, and all work, materials, and equipment incidental thereto.

ITEM #1019053A - AERIAL CABLE (3 NO. 2)

DESCRIPTION: This work shall consist of furnishing and installing aerial cable, with insulators and brackets, on proposed poles at the location indicated on the plans.

MATERIALS: Aerial cable shall be 7 strand aluminum containing a No. 2 AWG bare messenger with three No. 2 AWG cross-linked polyethylene insulated conductors rated at 600 volts.

CONSTRUCTION METHOD: The aerial cable shall be used as temporary circuitry to maintain nighttime roadway lighting, on the roadways within the project limits open to vehicular traffic. Aerial cable shall be attached to proposed fiberglass poles or aluminum light standards (with insulators), including all connections as indicated on the plans or as directed by the engineer. When necessary, the aerial cable shall be relocated to maintain different illumination circuits as dictated by the construction stages. Aerial cable used for temporary lighting shall be removed once the permanent lighting is installed and operational. Removed aerial cable shall remain the property of the Contractor.

Aerial Cable (3 No. 2) shall be used for mainline circuit connections where voltage drop considerations require a cable with a large circular mil value.

METHOD OF MEASUREMENT: This work will be measured for payment by the actual number of linear feet of aerial cable installed and accepted, including attachments.

BASIS OF PAYMENT: This work will be paid for at the contract unit price per linear foot for "Aerial Cable (3 No. 2)" of the size and voltage specified, complete in place, which price shall include, insulators, entrance cap and attachment, bracket, all materials, tools, connections, equipment, labor, and work incidental thereto. The unit cost for this item is a one time only cost. The cost of removing and relocating the aerial cable to maintain different illumination circuits shall be included in the unit cost.

ITEM #1020030A - TEMPORARY ILLUMINATION UNIT

DESCRIPTION: Under this item the Contractor shall furnish and install a fiberglass light pole, bracket, luminaire, and associated hardware, to be used for temporary lighting during construction, as indicated on the plans or as directed by the Engineer. At the end of the project the temporary illumination unit shall become the property of the Contractor.

MATERIALS: The pole shaft shall be fiberglass reinforced composite (FRC). The pole shaft shall be constructed by the filament winding process from thermosetting polyester resin and contain a minimum of 65 percent of "E" type fiberglass by weight. The filament windings shall be continuously applied with uniform tension and shall be placed on the pole helically at low angles to provide axial strength. Additional windings shall be placed on the pole in a circular manner to provide compressive strength. The pole is to be round, tapered, hollow, and reinforced in the support arm and hardware attachment areas. The pole is to be non-conductive and chemically inert. The pole shall meet the current AASHTO LTS-2 *Street Lighting Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals*, and shall be approved by FHWA for use on Federal Aid projects. A 2 ½" x 5" handhole shall be provided at the base of the pole shaft at approximately 18" above the finished grade line.

The pole exterior surface is to be grey with a natural (textured) finish. The surface of the pole will be uniform for the entire length of the pole. The laminate shall contain colored pigment, the color of the final coating, and be of uniform color throughout the entire wall thickness of the pole. A coating shall be applied to the pole to maintain surface integrity against the damaging effects of sunlight and extremes in weather. The coating is to be highly weather resistant pigmented polyurethane. The coating thickness shall have minimum dry film thickness of 1-1/2 mils.

The surface shall be tested for a minimum of 5000 hours of accelerated testing in accordance with ASTM G154 (UV-A lamp 340 NM wave length, 130° F, cycle lamp 4 hours on 4 hours off) with the following results: Fiber exposure: none, Crazing: none, Checking: none, Chalking: none, Color: may dull slightly.

Anchorage mounted poles: The pole shaft shall be equipped with an anchor base of heavy duty A356-T6 aluminum which shall be permanently bonded to the outside of the fiberglass shaft. The anchor base pole shall be installed on a concrete foundation, parapet anchorage, temporary bracket, or other fixed anchorage as called for on the plans. The anchor base pole shall be non-breakaway, but shall be attached to the anchorage using breakaway couplings as indicated on the plans or as directed by the Engineer. The pole shall provide a 35' luminaire mounting height when measured from the top of the pole anchorage. The luminaire bracket arm shall be 6' in length (single member) of an upsweep design fabricated from tubular aluminum. The luminaire end shall have a 2-3/8" outside diameter.

Direct buried poles: The pole shall be suitable for direct burial and shall conform to the breakaway requirements of the current AASHTO *Standard Specification for Structural Supports for Highway Signs, Luminaires and Traffic Signals*. For direct buried break-away poles the butt end shall be enlarged so as to provide resistance to rotation and pull out. The pole shall provide a 35’ luminaire mounting height when measured from the roadway surface. The luminaire bracket arm shall be 12' in length (single member) of an upsweep design fabricated from tubular aluminum. The luminaire end shall have a 2-3/8" outside diameter.

Each pole is to be permanently marked in characters 3/16” minimum high on a brass or stainless steel plate with the manufacturer's identification symbol, month and year of manufacture. Each pole shall be individually packaged for protection during shipping and storage. The pole shall be warranted to be free of defects in materials and workmanship for a period of three years from the date of purchase.

The top of the pole is to be pre-drilled for two 5/8" thru bolts on 9-1/2" centers starting 4” below the top of the pole. A 1-1/2" wire exit hole shall be centered 1/2 the distance between the two holes.

A cast aluminum removable cap shall be securely mounted to the top of the pole. The cap shall be corrosion resistant and must remain in place when subjected to the maximum wind loading for which the pole is designed.

The luminaire shall conform to the pertinent requirements of Article M.15.05, and shall be high pressure sodium. The luminaire wattage shall be 250 watt or as called for on the plans. The socket shall be adjustable to provide I.E.S. light distribution type M-S-II (sag glass type). The ballast shall be under guarantee of the manufacturer for a period of one year commencing when the unit is installed and accepted

CONSTRUCTION METHOD: The fiberglass pole shall be securely bolted to the anchor bolts of the fixed anchorage or installed in an augured hole where indicated on the plans. The bracket and luminaire assembly shall be installed perpendicular to the center line of the roadway. When necessary, the temporary light pole and luminaire shall be relocated to maintain different illumination circuits as dictated by the construction stages.

Upon completion of the project the temporary illumination unit shall be removed and shall remain the property of the Contractor.

Upon removal of the pole, the resulting excavation shall be properly backfilled to match the surrounding area.

METHOD OF MEASUREMENT: This work will be measured for payment by the number of temporary illumination units installed and accepted.

BASIS OF PAYMENT: This work will be paid for at the contract unit price each for "TEMPORARY ILLUMINATION UNIT" complete in place, which price shall include all materials, fiberglass poles, anchor base bracket, luminaire, lamps, ballast, hardware, breakaway couplings, breakaway base section, connections, hauling, and all equipment, tools, labor and all work incidental thereto including removal, hauling, relocation, and disposal. The unit cost for this item is a one-time only cost. The cost of removing and relocating the temporary illumination unit to maintain different illumination circuits shall be included in the unit cost.

ITEM #1020998A - TEMPORARY LIGHT STANDARD ATTACHMENT BRACKET

DESCRIPTION: Work under this item shall consist of furnishing, installing and removing temporary brackets to support temporary illumination units on bridge parapets and temporary precast concrete barrier curbs in order to maintain proper illumination of all roadways within the project limits during all construction stages. The temporary support brackets shall be any type which the Contractor elects to build which adequately support the temporary light standard units. Holes and anchorages installed in bridge parapets for the purpose of anchoring or supporting the brackets and light standards shall be repaired as part of this work.

MATERIALS: Steel plate used for temporary support brackets shall conform to the requirements of ASTM A36.

Expansion anchors shall be Hilti HSL Expansion Anchor, Rawl-Bolt or other similar type of expansion anchor which uses a hexagon headed bolt for expanding the anchor.

The chemical anchoring material shall be a resin compound specially formulated to anchor steel bolts in holes drilled in concrete. The chemical anchoring material shall be from the Department of Transportation's approved list.

Anchor bolts shall conform to the requirements of Subarticle M.15.02.

Non-shrink grout shall conform to Subarticle M.03.01-12.

Class "A" Concrete shall conform to the requirements of Article M.03.01.

Reinforcing steel shall conform to ASTM A615, and shall be deformed Grade 420.

CONSTRUCTION METHODS: Temporary support brackets to support temporary illumination units shall be designed by the Contractor to support the temporary light standard under design loadings called out in the AASHTO publication “Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals”, 1994.

The Contractor shall submit working drawings and design calculations for temporary light standard attachment brackets in accordance with the requirements of Article 1.05.02(2). The working drawings and design calculations shall be prepared, sealed and signed by a Professional Engineer, licensed in the state of Connecticut. These drawings shall be submitted for approval in accordance with Article 1.05.02(3).

Temporary light standard attachment bracket shall be secured to the non-traffic side of concrete barrier curbs and parapets. No part of the support bracket shall extend into or beyond the traffic side face of the concrete barrier curb or parapet.

The temporary attachment brackets are the property of the Contractor and shall be removed from the project site when no longer required. Temporary anchors, threaded rods and hardware fastened to concrete barrier curbs and parapets shall be removed and disposed of off site. All holes in the concrete barrier curbs and parapets shall be filled with non-shrink grout after the temporary attachment brackets have been removed.

The unit cost for this item is a one-time only cost. The cost of removing and relocating the temporary light standard attachment bracket to maintain different illumination circuits shall be included in the unit cost.

METHOD OF MEASUREMENT: This work will be measured for payment by the number of temporary light standard support bracket units installed and accepted.

BASIS OF PAYMENT: This work will be paid for at the contract unit price per each for "Temporary Light Standard Attachment Bracket", complete in place, which price shall include all materials, anchors, guys, hardware, and all equipment, tools, labor and all work incidental thereto and the removal of these materials at the end of the project. The unit cost for this item is a one-time only cost. The cost of removing and relocating the temporary light standard attachment bracket to maintain different illumination circuits shall be included in the unit cost.

ITEM #1108164A - MODIFY EXISTING MAIN FIBER HUB

Description:

This item consists of modifications to the communications equipment installed at the Connecticut DOT Main Fiber Hub (MFH). The MFH is an existing communications shelter located in Hartford, CT at the I-84/I-91 interchange. The MFH houses equipment racks containing video and data communications equipment that links a number of field equipment sites to various agency operations centers (including the DOT Newington Operations Center).

MATERIALS:

1.0 Baseband Video Cable – RG-6U Type

1.1 The cable shall have a polyethylene jacket.

1.2 The outer conductor shall be tinned copper double braid 98% shield coverage.

1.3 The center conductor shall be 20 AWG solid bare copper

1.4 The dielectric shall be polyethylene.

1.5 The nominal impedance shall be 75 ohms, plus or minus 2%.

1.6 The nominal DC loop resistance of the center conductor shall be 32.5 ohms/km.

1.7 The nominal DC loop resistance of the shield shall be 3.6 ohms/km.

1.8 The cable shall be 100% sweep tested.

2.0 Connectors for Baseband Video Cable

2.1 Connectors shall be BNC type, manufactured specifically for the baseband video coaxial cable to which they will be attached.

2.2 The BNC connectors shall meet or exceed the following specifications:

- Characteristic Impedance 75 ohms (true)
- Return Loss less than – 35dB to 1 GHz
- Mechanical Durability 500 Cycles Minimum
- Corrosion Resistance MIL-STD-202, Method 101

- Solvent Resistance MIL-STD-202, Method 215

2.2.1 The center conductor of the BNC connector shall be 1.25 micrometers (50 millionths of an inch) gold plating over copper plate.

3.0 Data Cable

3.1 Data cables shall be TIA/EIA 568A Category 6, characterized up to 350 MHz, suitable for 1000Base-T local area network applications.

3.2 All cabling to be installed in outdoor equipment cabinets shall maintain specified electrical properties over the entire operating temperature range, specified below

3.3 Data cables shall be terminated with 8 pin Category 6 RJ-45 connectors, or other approved connectors as required by the communications equipment.

3.4 Data cables used for horizontal wiring and patching between equipment shall be 4 pair Category 6 shielded Cable as required by the application and as directed by the Engineer and shall comply with the following requirements:

- Conductor: 23 AWG (solid bare copper)
- Nominal Capacitance: 14 pF/ft
- Characteristic Impedance: 100Ω±15%
- Maximum DC Resistance: 9.4/100m
- Velocity of Propagation: 71% (minimum)
- Performance 350 MHz

3.5 Equipment located within environmentally controlled rooms shall conform to the following requirements:

- Storage Temperature: -40° to + 70° Celsius
- Operating Temperature Range: 0° to + 50° Celsius
- Relative Humidity: 5 to 90%, non-condensing
- Fire Resistance Complies with TR-NWT-000063, Issue 3.

3.6 Fiber Optic Patch Cords

3.6.1 Fiber Optic Patch Cords shall be furnished in sufficient length, connector type, and quantity, and installed in the Main Fiber Hub to connect the

newly utilized strands of an existing field fiber optic cable (terminated at an existing patch panel) to the optical equipment in the equipment racks.

3.6.2 All optical fibers, coatings, tubes, metals and jackets shall be free of roughness, porosity, blisters, splits and voids in accordance with good manufacturing practice.

3.6.3 The color coding and position of fibers / buffer tubes within the cable shall be in accordance with TIA/EIA–598-A "Optical Fiber Cable Color Coding".

3.6.4 The cable shall be suitable for operation over a temperature range of -20ºC to +60ºC.

3.6.5 The cable shall provide mechanical support and protection for the specified number of fibers. The outer jacket of the cable shall be constructed of medium or high density polyethylene. The cable jacket shall be marked with the manufacturer's name, sequential meter or foot markings, month, year or quarter year of manufacture, and a telecommunications handset symbol, as required by Section 350G of the National Electrical Safety Code.

3.6.6 The cable shall be suitable for installation in plenums and risers.

3.6.7 At a minimum, the cable shall be UL-listed OFNR/OFNP.

3.6.8 The cable shall be composed of materials that are fully compliant with the State of Connecticut, NEC, and all other applicable local codes that pertain to wiring and cabling within a plenum air space or riser shaft.

3.6.9 Materials used in the cable shall not produce hydrogen in a concentration large enough to cause any degradation in the transmission performance of the optical fibers.

3.6.10 Materials used in the cable shall not support galvanic action.

3.7 Fiber-optic Cable Connectors

3.7.1 ST connectors shall have a ceramic ferrule with a nickel plated nut and body. SC connectors shall have a ceramic insert.

3.7.2 The connector shall be of the ST-type (for fiber optic demultiplexer and fiber direction couplers) or SC-type (for patch panel connections and

10/100 Ethernet Switch) and fully compatible with the fiber optic cable utilized and the mating jacks to which they will be attached.

3.7.3 The connector shall be compatible with an ultra physical contact (UPC) finish. All connectors shall be polished to a UPC finish such that the return loss per mated pair of connectors is at least 25 dB. The return loss when the connector is mated with previously installed connectors shall be at least 18 dB.

3.7.4 The connector mean loss shall not be greater than 0.2 dB with a standard deviation of not greater than 0.1 dB.

3.7.5 The connector loss shall not vary more than 0.1 dB after 500 repeated matings.

3.7.6 The connector shall withstand an axial load of 135 N.

3.7.7 The connectors shall be attached in accordance with the manufacturer's recommended materials, equipment and practices.

3.7.8 The connector shall be suitable for the intended environment and shall meet the following environmental conditions.

- Operating Temperature: -20 to +50^{o} C
- Storage Temperature: -30 to +60^{o} C

3.7.9 The connector loss shall not vary more than 0.2 dB over the operating temperature range.

3.7.10 When not in use, connectors shall be protected by a suitably installed waterproof protection cap.

4.0 Warranty:

4.1 All equipment shall be warranted for parts and labor by the vendor against defects and failures, which may occur through normal use for a minimum of one (1) year from the date of installation. A copy of the warranty must be presented to the Engineer prior to the approval of use of the equipment.

Construction Methods:

1.0 Fiber-Optic Patch Cables:

1.1 The Contractor shall contact the Engineer to coordinate the installation of the equipment and cables in the Main Fiber Hub. All cables, connectors and power supplies shall be installed as per the state and local electrical codes. The Engineer shall direct the Contractor where the equipment is to be installed in the Main Fiber Hub. The contractor shall route all fiber optic patch cables in the existing fiber optic cable management.

1.2 The Contractor shall furnish and install a single duplex fiber-optic patch cord and connectors from the existing fiber optic patch panel to the optical video data receiver.

1.3 All wires and cables to and from connectors shall be labeled using a cable labeling and identification system approved by the Engineer.

2.0 Baseband Video Cables and Connectors – RG-6U Type

2.1 The Contractor shall furnish and install RG-6U cables from the optical video data receiver to the existing multidyne video distribution amplifier. From the existing multidyne video distribution amplifier the contractor shall furnish and install RG-6U cables to the existing American dynamics video matrix switcher and existing Optelecom video multiplexer.

2.2 BNC connectors shall be attached to video coaxial cable only with the connector manufacturer's recommended installation and crimping tools.

2.3 All wires and cables to and from connectors shall be labeled using a cable labeling and identification system approved by the Engineer.

3.0 Existing Video Matrix Switch:

3.1 The Contractor shall reprogram the existing video matrix switch to include the new CCTV from this project. The Contractor shall request matrix switch assignments from the Engineer.

4.0 Data Cables

4.1 Four-pair category 6 patch cables shall be installed within equipment racks and in the existing overhead wire ladder for PTZ and TFM data connections. Data wiring for the new CCTV coming from the optical video data receiver shall be connected

to an existing Digi terminal server as directed by the engineer. Data wiring for the new TFM coming from the optical video data receiver shall be connecterized with a DB-25 and connected to an existing Hullspeed port sharing device.

4.2 All wires and cables to and from connectors shall be labeled using a cable labeling and identification system approved by the Engineer.

5.0 Work Area Requirements

5.1 All debris from demolition and/or construction activities shall be cleaned daily, removed and disposed by the Contractor from the premises. Disposal of the debris is the sole responsibility of the Contractor. The Contractor shall comply with all prevailing local laws, rules, and ordinances with regard to disposal.

5.2 The Contractor shall protect walls, floor, door frames, doors, ceilings and stairs from construction activities, including overloading.

6.0 Testing:

6.1 All BNC coaxial cable and Data cables shall be tested prior to installation for compliance with requirements specified in this section

7.0 Submittals:

7.1 As part of Section 1.06 (Control of Materials) for this project, the Contractor shall submit the following documentation:

7.2 Detailed shop drawings, wiring diagrams, equipment cabinet front elevation drawings, and equipment installation drawings indicating supports and appurtenances required for proper installation in Visio 2010 format

7.3 Schematic showing wiring panel assembly including panel dimensions, locations of terminal blocks, surge suppression, transformers, cables, including wiring labels, etc. in Visio 2010 format.

8.0 As-built Documentation:

As part of the project-built documentation, the Contractor shall provide the following information:

8.1 Test procedures and test results.

8.2 The Contractor shall submit with the documentation wiring diagrams and schematics, hookup prints, and rack elevation diagrams in Visio 2010 format.

9.0 Delivery, Storage, and Handling

9.1 The Contractor shall deliver, store, handle and install all materials and equipment in such a manner as not to degrade quality, serviceability or appearance.

9.2 The Contractor shall be responsible for storage of the materials and equipment prior to installation in a clean, dry location free from construction dust, precipitation and excess moisture.

9.3 The Contractor shall be required to replace any damaged materials and equipment, as determined by the Engineer, at no additional cost to the Department

Method of Measurement:

This item shall be measured for payment at the contract lump sum price for "Modify Existing Main Fiber Hub", installed, tested and accepted in place.

Basis of Payment:

This work will be paid for at the contract lump sum price for "Modify Existing Main Fiber Hub", which price shall include all materials, hardware, chassis, card units, cables, connectors, labor, tools, test equipment, and incidentals necessary to complete the work.

Pay Item	Pay Unit
Modify Existing Main Fiber Hub	l.s.

ITEM #1108539A - MODIFY EXISTING OPERATIONS CENTER CONTROL SYSTEM

Description:

The Existing operations center control system is located in the Department of Transportation Administration building located at 2800 Berlin Turnpike Newington. The Operations Center control room is located on the ground floor in Room G316. The work in this specification will be conducted in room G322 (Computer Room). This item shall consist of connecting the video and data equipment within this project at the Operations Center.

Materials:

1.0 Baseband Video Cable – RG-6U Type

1.1 Precision video coaxial cable shall be utilized to transmit baseband NTSC video signals between communications equipment as described herein and elsewhere in these specifications and as shown on the drawings.

1.2 BNC-type connectors shall be utilized to terminate segments of the baseband video cable installed between communications equipment as shown on the Drawings.

1.3 The outer conductor shall be tinned copper double braid 98% shield coverage.

1.4 The center conductor shall be 20 AWG solid bare copper

1.5 The nominal impedance shall be 75 ohms, plus or minus 2%.

1.6 The nominal DC loop resistance of the center conductor shall be 32.5 ohms/km.

1.7 The nominal DC loop resistance of the shield shall be 3.6 ohms/km.

1.8 The cable shall be 100% sweep tested.

2.0 Connectors for Baseband Video Cable

2.1 Connectors shall be BNC type, manufactured specifically for the baseband video coaxial cable to which they will be attached.

2.2 The BNC connectors shall meet or exceed the following specifications:

- Characteristic Impedance 75 ohms (true)
- Return Loss less than – 35dB to 1 GHz
- Mechanical Durability 500 Cycles Minimum
- Corrosion Resistance MIL-STD-202, Method 101
- Solvent Resistance MIL-STD-202, Method 215

2.3 The center conductor of the BNC connector shall be 1.25 micrometers (50 millionths of an inch) gold plating over copper plate.

3.0 Warranty:

3.1 All equipment shall be warranted for parts and labor by the vendor against defects and failures, which may occur through normal use for a minimum of one (1) year from the date of installation. A copy of the warranty must be presented to the Engineer prior to the approval of use of the equipment.

Construction Methods:

1.0 Baseband Video Cables and Connectors – RG-6U Type

1.1 The Contractor shall furnish and install RG-6U cables from the existing optelecom video multiplexer to the existing American dynamics video switcher.

1.2 BNC connectors shall be attached to video coaxial cable only with the connector manufacturer's recommended installation and crimping tools.

1.3 All wires and cables to and from connectors shall be labeled using a cable labeling and identification system approved by the Engineer.

2.0 Existing Video Matrix Switch:

2.1 The Contractor shall reprogram the existing video matrix switch to include the new CCTV from this project. The Contractor shall request matrix switch assignments from the Engineer.

3.0 Existing Terminal Server

3.1 The contractor shall configure the existing terminal server to allow connection of the PTZ into the existing Video switcher.

4.0 Work Area Requirements

4.1 All debris from demolition and/or construction activities shall be cleaned daily, removed and disposed by the Contractor from the premises. Disposal of the debris is the sole responsibility of the Contractor. The Contractor shall comply with all prevailing local laws, rules, and ordinances with regard to disposal.

4.2 The Contractor shall protect walls, floor, door frames, doors, ceilings and stairs from construction activities, including overloading.

5.0 Testing:

5.1 All BNC coaxial cable and Data cables shall be tested prior to installation for compliance with requirements specified in this section

6.0 Submittals:

6.1 As part of Section 1.06 (Control of Materials) for this project, the Contractor shall submit the following documentation:

6.2 Detailed shop drawings, wiring diagrams, equipment cabinet front elevation drawings, and equipment installation drawings indicating supports and appurtenances required for proper installation in Visio 2010 format

6.3 Schematic showing wiring panel assembly including panel dimensions, locations of terminal blocks, surge suppression, transformers, cables, including wiring labels, etc. in Visio 2010 format.

7.0 As-built Documentation:

As part of the project as-built documentation, the Contractor shall provide the following information:

7.1 Test procedures and test results.

7.2 The Contractor shall submit with the documentation updated wiring diagrams and schematics, hookup prints, and rack elevation diagrams in Visio 2010 format.

8.0 Delivery, Storage, and Handling

8.1 The Contractor shall deliver, store, handle and install all materials and equipment in such a manner as not to degrade quality, serviceability or appearance.

8.2 The Contractor shall be responsible for storage of the materials and equipment prior to installation in a clean, dry location free from construction dust, precipitation and excess moisture.

8.3 The Contractor shall be required to replace any damaged materials and equipment, as determined by the Engineer, at no additional cost to the Department

Method of Measurement:

This item shall be measured for payment at the contract lump sum price for "Modify Existing Operations Center Control System" of the type specified, installed, tested and accepted in place.

Basis of Payment:

This work will be paid for at the contract lump sum price for "Modify Existing Operations Center Control System" of the type specified, which price shall include all materials, hardware, cables, connectors, labor, tools, test equipment, and incidentals necessary to complete the work.

Pay Item	Pay Unit
Modify Existing Operations Center Control System	l.s.

ITEM #1108644A - TRAFFIC MANAGEMENT SYSTEM CABINET

Description:

This work includes the furnishing and installing of outdoor equipment cabinets as shown on the Drawings and detailed in this specification.

Materials:

1. General:

1.1. The Traffic Management System Cabinet (TMSC) shall serve as an environmental enclosure for the field equipment. The TMSC shall be installed at camera sites as shown on the plans.

- Rack mounted input wiring panel with all appropriate surge suppression devices, terminal blocks and power supplies.
- Rack mounted power distribution panel.
- Heating and ventilation system

1.2. Publications listed below form a part of these Specifications to the extent referenced. The publications are referred to in the text by the basic designation only.

- National Electrical Manufacturers Association (NEMA Standard 250)
- Underwriters Laboratories UL50 and UL508
- National Electrical Code – Most recent edition
- 170 Traffic Signal Control Hardware Specification FHWA-1 P:-78-6

2. Traffic Management System Cabinet (TMSC):

2.1. The TMSC shall meet the NEMA 3R standard. The TMSC shall be 24”W x 30”D x 67”H with 19” rack rails mounted inside the cabinet. The TMSC shall be fabricated with “S” flanges in the top ventilation to prevent forced snow, ice and road salt from entering the enclosure.

2.2. The TMSC shall operate from an 115VAC +/- 10%, 60 Hz power source.

2.3. The TMSC shall be an enclosure suitable for outdoor mounting on a concrete foundation.

2.4. The TMSC shall meet the requirements as specified in Chapter 12 of the Type 170 Traffic Signal Control Hardware Specification FHWA-1 P-78-6 as modified by this

Specification.

2.5. The TMSC shall be furnished with front and rear doors possessing securing brackets, each door equipped with a Conn-2 lock (tumbler-type). One (1) key shall be furnished for each cabinet installed. When closed, both doors shall fit tightly to a neoprene gasketing material. The door hinge pins shall be made of stainless steel. The hinge pins shall be the length of the door. The door hinges and securing brackets shall be made of stainless steel and bolted so doors may be changed without the need to cut welds.

2.6. The TMSC shall be supplied with internal EIA standard 19" racks as specified in the Drawings. The 19" racks shall be installed on both the front and rear door access points.

2.7. The TMSC shall have one rack mounted shelf that extends the complete width and depth of the cabinet. The shelf shall be adjustable in height and shall have rails to extend outwards The shelf must be able to support a laptop computer when fully extended outward.

2.8. The TMSC shall be equipped with adequate heating as required for cabinet components and ventilating system to maintain inside temperature between +5 to +60 degrees C at any time. The heating and ventilating system shall include an electric heater, fan and replaceable filter mounted on the intake vent. The ventilation fan assembly shall be of adequate size to circulate air in the cabinet and controlled by an adjustable thermostat. The fan and cabinet are to be located so as to direct the bulk of the airflow throughout the entire cabinet. The fan motor shall have a suppresser across it equal to or better than 0.1 μf/47 ohm protection @ 600v. All points on the thermostat and fan at which 110 VAC are present shall be insulated to prevent electric shock.

2.9. The TMSC shall be equipped with an enclosed, 19" rack mounted electric strip heater and blower with a rating of approximately 800 watts at 120 VAC. The enclosure shall house the strip heater and blower in which air shall be drawn in across the strip heater and exhausted out from the blower. The enclosure shall feature an internal thermal cut-off that will shut off the heater should the exhaust area become obstructed. The ventilation fan and strip heater with blower shall be controlled by a high-low adjustable thermostat which can be set to ensure the cabinet interior temperature remains between +5° C and +60° C under average weather conditions. The strip heater with blower thermostat shall have an adjustable low temperature range down to at least 0°C. The heater shall be wired directly to the AC circuit breaker reserved for the heaters.

2.10. The TMSC shall be equipped with an outdoor rated LED lamp with 100 watt equavalent output rating. The LED lamp shall be wired such that the lamp comes on when either front or rear door is opened. The lamp shall be directly wired to an AC breaker.

2.11. The following electrical devices shall be provided on a hinged 19" EIA power

distribution rack-mounted assembly in the TMSC. The hinged power distribution assembly shall be rack mounted on the opposite side of the ITS equipment. The hinged rack assembly chassis shall be constructed of aluminum and have a clear anodized finish. The hinged power assembly shall be able to swing out to provide clear access to rack mounted equipment for servicablity. A catalog cut of the power distribution assembly must be submitted for review and approval of the Engineer as part of the shop drawing review process.

2.11.1. One (1) 40 Amp main service input circuit breaker

2.11.2. Eight (8) 15 Amp load circuit breakers

2.11.3. Power bus

2.11.4. Ground bus

2.11.5. Neutral bus

2.11.6. Three (2) 20 Amp duplex 120 VAC power receptacles. In addition, one (1) GFCI duplex receptacle shall be included for tools and test equipment purposes. The electronic equipment to remain in the cabinet shall not be connected to the GFCI receptacles unless directed by the Engineer.

2.11.7. An EDCO ACP-340 surge suppression device shall be provided on the load side of the main circuit breaker. The protector shall be installed on the rack/panel mounted power assembly.

2.12. The TMSC shall have a heavy plastic envelope which will contain cabinet wiring diagrams, schematics, etc. The envelope shall be securely fastened to the inside of the front cabinet door. The envelope shall be 12” (300 mm) x 18” (455 mm) or larger.

2.13. The TMSC shall be fabricated from sheet aluminum providing it is rigid and has a minimum thickness of 3.17 mm. All outside surfaces shall be cleaned and finished. The outside surface appearance shall be brushed aluminum.

2.14. The TMSC shall be suitable for an outdoor installation on a concrete foundation and provide adequate environmental protection for the devices housed in the cabinets for year-round operation.

3.0 Input Wiring Assembly and Surge Suppression:

3.1 An rack mounted input wiring assembly measuring approximately 16”x19” shall be

provided for each traffic management system cabinet. The assembly shall serve as the termination point for all communication and low-voltage power wiring to the CCTV cameras, traffic flow monitors (if required), variable message signs (if required) and other field equipment specified in the contract and shown on the plans. In addition, the assembly shall serve as a mounting location for surge suppression devices, low-voltage AC and DC transformers, and equipment cables that connect to devices in the traffic management system cabinet such as OVDT's, Ethernet port-sharing devices, fiber-optic media converters, etc.

3.2 The input wiring assembly shall be rack mounted on the backside of the TMSC above the power distribution panel. The assembly shall be hinged to provide access to rack mounted equipment.. All cables shall be securely trained and fastened to allow free swinging of the wiring assembly and prevent fraying or damage. The panel shall swing out to provide access to rack mounted equipment for servicabilty.

3.3 All terminal positions and devices on the wiring panel assembly shall be clearly marked and identified

3.4 The following types of voltage transient/surge suppression shall be provided and installed on the wiring panel assembly. Each surge suppression device shall be supplied and installed in an appropriate socket that is fastened to the wiring panel assembly.

- Coaxial CCTV cable input – EDCO CX-06-BNCY-I
- Traffic Flow Monitor power – EDCO PHC060 (one unit for every two (2) TFM's)
- Traffic Flow Monitor data communications – EDCO LCDP-030 (one unit for every TFM). This is only needed for TFM's that are connected to the cabinet using category 6 cable.(Ethernet circuit)
- Variable Message Sign with direct connect communications – EDCO LCDP-030 (one unit for every VMS) This is only needed for VMS's that are connected to the cabinet using category 6 cable (Ethernet circuit)
- CCTV camera data communications – EDCO PC642C-008 LC Two (2) EDCO devices may be required if Manchester data communications is used for local camera control. (RS-422 circuits)
- CCTV camera power – EDCO PHC060.
- Digital CCTV communications (For future use) – EDCO CAT6-POE

3.5 All field terminations, interconnections and wiring cable connections shall be made using terminal block strips except for Ethernet communications. Crimp-on spade lugs shall be installed on all cabling for easy connection and removal. All wiring connections shall be as short as possible to minimize signal loss and reduce transients.

3.6 Cables installed between surge suppression devices and cabinet equipment (such as OVDT's, CICU, etc.) may be made directly from the output terminals of the EDCO surge suppression units.

3.7 Transformers that supply low-voltage power shall be rack mounted on the wiring assembly panel.

4.0 Manufacturer's Qualifications:

4.1 The Manufacturer shall have a minimum of five (5) year's experience in the design, manufacture, and testing of TMSC of the type and size specified here in. The cabinets shall be manufactured according to world class quality standards. The manufacturer shall be ISO 9001 certified.

5.0 Warranty:

5.1. All equipment supplied under these items shall be warranted for parts by the vendor against defects and failures, which may occur through normal use for a period of one (1) year from the date of installation. A copy of the warranty shall be presented to the Engineer before installation of the equipment.

Construction Methods:

1. Submittals:

As part of Section 1.06 (Control of Materials) for this project, the Contractor shall submit the following documentation:

1.1. Detailed shop drawings, wiring diagrams, equipment cabinet front elevation drawings, and equipment installation drawings indicating supports and appurtenances required for proper installation in Visio 2010 format

1.2. Schematic showing wiring panel assembly including panel dimensions, locations of terminal blocks, surge suppression, transformers, cables, including wiring labels, etc in Visio 2010 format.

1.3. Product data and cut sheets, operating and maintenance manuals. Information regarding materials, finishes and accessories.

2. As-built Documentation:

2.1. As part of the project as-builts, the Contractor shall provide the following information:

2.1.1. Test procedures and test results.

2.1.2. The Contractor shall submit with the documentation for the TMSC item four (4) copies of the "as-built" equipment manuals. The equipment manuals shall include technical information, wiring diagrams and schematics, hookup prints, parts list and a troubleshooting guide.

3. Delivery, Storage, and Handling:

3.1. The Contractor shall deliver, store, handle and install all materials and equipment in such a manner as not to degrade quality, serviceability or appearance.

3.2. The Contractor shall be responsible for storage of the materials and equipment prior to installation in a clean, dry location free from construction dust, precipitation and excess moisture.

3.3. The Contractor shall be required to replace any damaged materials and equipment, as determined by the Engineer, at no additional cost to the Department.

3.4. All materials shall be delivered in the manufacturer's original unopened protective packages. All materials shall be stored in their original protective packaging and protected against soiling, physical damage, or wetting, before installation. All equipment shall be protected during transportation and until installation against damage and stains.

4. Installation:

4.1. The Contractor shall install the TMSC on the foundation per the manufacturer's requirements. Connect all cables for power and fiber. Install all equipment listed in this specification and other equipment as required to power and communications cables/connectors. All communication cables must be terminated by the approved ITS integrator.

4.2. Install the rack mounted optical video/data transmitters, Ethernet port sharing devices and fiber-optic media converters in the field equipment cabinets in accordance with the equipment manufacturer's recommendations.

4.3. Install and connect field fiber optic cable and all other inter-equipment cabling required

to fully interconnect the equipment as shown on the Drawings.

4.4. Install and connect the video/data transmitter, Ethernet port sharing device, fiber optic data media converter power supplies to the existing 120 VAC receptacles reserved for the equipment in the cabinet.

4.5. The optical fiber path for each video link shall have been tested and verified in accordance with the plans prior to the equipment installation.

4.6. Power distribution assembly components shall be mounted such that they are readily accessible. All hazardous voltage points shall be covered to prevent inadvertent contact. The circuit breakers shall be labeled.

4.7. Install and connect equipment on wiring panel assembly such as equipment transformers, surge suppression, cabling with spade lugs and/or connectors, surge suppression, etc.

4.8. Install and connect the hinged wiring panel assembly inside traffic management system cabinet. All wiring shall be neat and firm and in conformance with the current National Electrical Code. Any work performed by the Contractor for the utility installation shall be in accordance with P.U.C.A and State of Connecticut Department of Transportation Form 816. The Contractor shall obtain the necessary utility specifications prior to any service work.

4.9. All wiring to the hinged power distribution assembly shall be harnessed so that the panel may be moved to facilitate field repairs on the panel. AC+ signal power shall be brought to an accessible terminal. Logic Ground, AC-, and Chassis Ground must be tied to a common point in the cabinet and grounded. The cabinet shall be wired such that the removal of two jumper wires will completely isolate all said grounds from one another. The AC+ service wire shall be wired direct to the line side of the main circuit breaker.

4.10. All power cables and communication cables connected within the TMSC shall be neatly trained along the rail racks.

4.11. The Contractor shall neatly train all optical patch cords and pigtails together when routing them along the same path and shall neatly train them along the support rails in the camera control equipment cabinet. The contractor will provide rack mounted cable management when needed or as directed by the engineer.

4.12. The fibers shall be carefully managed and connected to a 19” rack mounted patch panel with six SC fiber connectors. The fiber cable sheath shall be sealed to provide a moisture barrier at the termination point.

4.13. No cables shall be installed with a sweep-bend radius less than the manufacturer’s

minimum recommended bending radius.

5. Testing:

5.1. The Contractor shall be responsible for all testing and documentation required to establish approval and acceptance of this Item.

5.2. Pre-Installation Testing:

5.2.1. The Contractor shall be required to perform quality control testing on one (1) of the cabinets and all of the thermostats and heating/cooling assemblies prior to delivery.

5.2.2. The Contractor shall submit test procedures and documented test results to the Engineer. The test procedures shall document the nature of test activities to be performed.

5.2.3. The test procedures shall be submitted to the Engineer prior to initiation of the testing. The procedures will be returned to the Contractor within two (2) weeks indicating either “accepted” or “make corrections noted”.

5.2.4. In the case that corrections are required, the Contractor shall submit revisions within one (1) week.

5.2.5. Four (4) copies of the final test procedures shall be submitted to the Engineer prior to commencement of testing. The testing and test procedures shall include, but not be limited, to the following:

- Visual Inspection: The Contractor shall perform detailed visual inspection to confirm that the following aspects of the cabinet are in compliance with the requirements of this specification:

- General appearance: cabinet dimensions, finish, locks and door handles, door frames, latching mechanism, door hinges, bolts, louvered vents and filters, gaskets, and lifting eyes.

- Interior insulation, side panels, equipment rack.

- Electrical components: power distribution assembly, conductors, color coding, terminal blocks, heater operation and mounting, fan ventilation area, trouble lamp.

5.2.6. The Contractor shall perform visual test of the following components: service light, power distribution assembly, fan, heater, main power disconnect and thermostat.

5.2.7. The Contractor shall refer to the testing and documentation of the materials and equipment listed under these items to the testing and documentation for other pertinent items contained in this contract.

5.3. Proof-of-Performance Testing – The contractor shall energize each cabinet and confirm proper operation of heaters, fans, thermostats and service lights.

5.4. Installation Testing - Upon complete installation of all field equipment (including camera assemblies, TMSC, OVDT's, PSD's, media converter - VMS) an operational test shall be performed by the Contractor and demonstrated to the Engineer to verify proper installation and operation. The test shall verify the proper operation of the field equipment installation.

5.5. 30-day Operational Testing - Upon successful completion of the installation test and approval by the Engineer, a 30-day System Operational Test for each TMSC site shall commence. During the course of this test, the system must function continuously in accordance with the specifications for the duration of the test. If a malfunction occurs within the stated time frame, the Contractor shall make all necessary repairs to the system and re-establish proper operation. Upon approval of the Engineer, the 30-day test will begin anew. The system must operate for a full thirty (30) consecutive days without malfunction before the system will be accepted by the Engineer. The Contractor shall refer to "Notice To Contractor – 30 Day System Operational Test" for additional testing requirements. The Contractor shall coordinate the 30-day System Operational Test with other pertinent items in this contract.

5.6 Ground Test

5.6.1 All cabinet grounding systems when completed in place shall have a resistance to ground of not more than that shown in the table below as determined in the following manner:

1. Temporarily connect a 10 ampere load between the AC+ side of the equipment cabinet fuse and the ground system. It should be assured that the applied power voltage is 120 volts AC at the time of the test.
2. Disconnect the power company AC neutral from the ground system.
3. Connect a voltmeter between the power company AC neutral and the ground system.

Cabinet Insulated	Voltmeter Reading (Volts)	Equivalent Resistance (Ohms)

Model 170 Type	20	2.0

4. If the voltmeter reading is higher than the appropriate voltage shown in the above table under the 10 ampere load, the grounding system has an unacceptable resistance to ground. Additional grounding including electrical bonding of underground metallic conduit, may be necessary in order to meet the requirements of this test.
5. The results of this test shall be recorded and provided to the Engineer for each cabinet installed prior to acceptance and 30-test operational testing.

5.6.2 Insulation Resistance Testing – An insulation resistance test at 500 volts DC shall be made on each circuit between the circuit and ground. The insulation resistance shall not be less than 10 megohms on each circuit.

Method of Measurement:

This item shall be measured for payment by the actual number of equipped Traffic Management System Cabinets supplied.

Basis of Payment:

The work to be done under this item shall be paid for at the Contract unit price each for Traffic Management System Cabinet of the type specified, which price shall include all materials, devices, hardware, termination panels, rack-mounted fiber patch panel, rack-mounted power assembly, rack-mounted wiring panels, surge suppression/transient protection, terminal strips, cable management, cables, connectors, tools, equipment, labor and incidentals necessary to complete this work.

Pay Item	Pay Unit
Traffic Management System Cabinet	ea.

ITEM #1108704A - OPTICAL VIDEO/DATA TRANSMITTER

Description:

This work includes the furnishing and installing optical video/data transmitters (OVDT's) as shown on the Drawings and detailed in this specification. This Item specifies the requirements for the video and data fiber-optic communications system to be furnished and installed at a Traffic Management System Cabinet (TMSC) or the Traffic Management System Mini-Hub Cabinet (TMSMHC) as shown on the Drawings and detailed in this Specification Section.

Optical Video/Data Transceivers (OVDT) are used in the TMSC for transmission of combined video, pan-tilt-zoom (PTZ) control, and two RS232, RS422, or RS485 data channels. A matching Optical Video/Data Transceiver is installed in the Main Fiber Hub located in Hartford.

Materials:

1.0 Optical Video/Data Transmitter (OVDT):

1.1. The OVDT shall transmit one (1) video signal and three (3) full duplex asynchronous data signals from the Traffic Management System Cabinet (TMSC) to the Main Fiber Hub using one (1) single mode optical fiber. The OVDT shall be the 9245DT (BB)/SM-ST manufactured by Optelecom**.**

1.2. The OVDT shall be from the same manufacturer as item 1108707A (Rack Mount Optical Video/Data Receiver), designed by the manufacturer to operate with each other.

1.3. The video signal transmission shall employ digital transmission technology.

1.4. The OVDT shall employ automatic gain control (AGC) circuits, cable equalization and other features to minimize or eliminate any required field electrical or optical adjustments.

1.5. OVDT optical fiber connections shall be compatible with the single mode fiber-optic cable connectors and the fiber-optic interconnect panel connectors. Adapters will not be allowed by the Department. The OVDT shall interface to the single mode fiber cable using an ST connector.

1.7. All circuit boards shall be conformally coated.

1.8. Video Transmission Specifications:

- Video Input: 1 Volt peak-to-peak, 75 ohm
- Video Bandwidth: 5 Hz to 6.5 MHz minimum, -3 dB
- Video Signal-to-Noise Ratio: Equal to or greater than 63 dB at maximum optical attenuation
- Differential Gain: 1% maximum
- Differential Phase: 0.7 ° typical
- Wavelength: 1310/1550 nm
- Optical Loss Budget: 23 dB
- Operating Temperature: -40 to +74 degrees C
- Operating Humidity (Relative): 0 to 95% non-condensing
- Encoding: 9 bit

1.9. The data transmission channels shall be fully compliant with the data format and transmission speed requirements of the field devices to which they are to be connected. This includes the data signals required for existing CCTV camera pan-tilt-zoom (PTZ) control, RS232 for existing traffic flow monitors, and RS232 for existing Variable message signs direct connect.

1.10. Data Transmission Specifications:

- Data Circuits Available: 3 full duplex
- Aggregate Data Rate: 115 Kbps
- Data Format: RS-232, RS-422, or RS-485 (NRZ, RZI, Manchester, bi-phase); fully compliant with the terminal equipment and intended application

1.11. Data port 1 shall be designated for Pan-Tilt-Zoom (PTZ) control signals (RS-422), data port 2 shall be designated for Traffic flow monitors use, and data port 3 shall be designated for Variable message sign direct connect.

1.12. OVDT's shall be hot-swappable, with LED status monitoring, BNC video connector, and power indicator.

1.13. Transient suppression equipment shall have no adverse effect upon the video or data transmission performance.

2. Installation and Environmental Requirements:

2.1. Optical Video/Data Transmitter:

2.1.1. The OVDT shall be configured for rack-mounting in traffic management system cabinets.

2.1.2. All modules and assemblies shall be clearly identified with name, model number, serial number and any other pertinent information required to facilitate equipment maintenance.

2.1.3. All external connections shall be made by means of connectors attached to a wiring harness or cable. The connectors shall be keyed to preclude improper hookups.

2.1.4. Connectors for copper data cable shall be screw type connectors compatible with the video and data fiber-optic transmission equipment.

2.1.5. All wires and cables to and from the connectors shall be color-coded and/or appropriately marked.

2.1.6. Equipment shall operate from 115 VAC plus/minus 10 percent, 60 Hz power. The equipment operations shall not be adversely affected by transient voltages, voltage harmonic distortion, voltage unbalance, surges and sags normally experienced on commercial power lines.

2.1.7. All equipment including the stand alone power supply shall be certified to operate over a temperature range of -10° Celsius to +60° Celsius with a relative humidity of 10% to 95%, without the need for additional cooling or heating equipment.

3. Manufacturer's Qualifications:

3.1. Optical Video/Data Transmitter:

3.1.1. The Manufacturer shall have a minimum of five (5) year's experience in the design, manufacture, and testing of Video and Data Fiber Optic Transmission Equipment is required. The system shall be designed and manufactured according to world class quality standards. The manufacturer shall be ISO 9001 certified.

4. Warranty:

4.1. All equipment supplied under these items shall be warranted for parts by the manufacturer against defects and failures, which may occur through normal use for a period of five (5) years from the date of installation. A copy of the warranty shall be presented to the Engineer before installation of the equipment.

5. Spare parts:

5.1. As part of this item the Contractor shall supply 1 standalone OVDT's with power supplies, model **9245DT (BB)/SM-ST**

Construction Methods:

1. Submittals:

As part of Section 1.06 (Control of Materials) for this project, the Contractor shall submit the following documentation:

1.1. Detailed shop drawings, wiring diagrams, equipment cabinet front elevation drawings, and equipment installation drawings indicating supports and appurtenances required for proper installation.

1.2. Schematic showing wiring panel assembly including panel dimensions, locations of terminal blocks, surge suppression, transformers, cables, etc. in Visio 2010 format

1.3. Product data and cut sheets, operating and maintenance manuals. Information regarding materials, finishes and accessories.

2. As-built Documentation:

2.1. As part of the project as-builts, the Contractor shall provide the following information:

2.1.1. Test procedures and test results.

2.1.2. The Contractor shall submit with the documentation for the TMSC item four (4) copies of the "as-built" equipment manuals. The equipment manuals shall include technical information, wiring diagrams and schematics, hookup prints, parts list and a troubleshooting guide.

3. Delivery, Storage, and Handling:

3.1. The Contractor shall deliver, store, handle and install all materials and equipment in such a manner as not to degrade quality, serviceability or appearance.

3.2. The Contractor shall be responsible for storage of the materials and equipment prior to installation in a clean, dry location free from construction dust, precipitation and excess moisture.

3.3. The Contractor shall be required to replace any damaged materials and equipment, as

determined by the Engineer, at no additional cost to the Department.

3.4. All materials shall be delivered in the manufacturer's original unopened protective packages. All materials shall be stored in their original protective packaging and protected against soiling, physical damage, or wetting, before installation. All equipment shall be protected during transportation and until installation against damage and stains.

4. Installation:

4.1. Install the rack mounted optical video/data transmitters in the TMSC in accordance with the equipment manufacturer's recommendations.

4.2. Install any needed fiber optic patch cable, coax cable, or data cable required to fully interconnect the equipment as shown on the Drawings.

4.3. Install and connect the video/data transmitter power supply to one of the existing 120 VAC receptacles reserved for communications in the cabinet.

4.4. The optical fiber path for each video link shall have been tested and verified in accordance with the plans prior to the OVDT installation.

4.5. All power cables and communication cables connected shall be neatly trained along the rail racks.

4.6. The Contractor shall neatly train all optical patch cords and pigtails together when routing them along the same path and shall neatly train them along the support rails in the camera control equipment cabinet.

4.7. No cables shall be installed with a sweep-bend radius less than the manufacturer's minimum recommended bending radius.

5. Testing:

5.1. The Contractor shall be responsible for all testing and documentation required for establishing approval and acceptance of this Item.

5.2. Pre-Installation Testing:

5.2.1. The Contractor shall submit test procedures and documented test results to the Engineer. The test procedures shall document the nature of test activities to be performed.

5.2.2. The test procedures shall be submitted to the Engineer prior to initiation of the

testing. The procedures will be returned to the Contractor within two (2) weeks indicating either "accepted" or "make corrections noted".

5.2.3. In the case that corrections are required, the Contractor shall submit revisions within one (1) week.

5.2.4. Four (4) copies of the final test procedures shall be submitted to the Engineer prior to commencement of testing.

5.2.5. The Contractor shall refer to the testing and documentation of the materials and equipment listed under these items to the testing and documentation for other pertinent items contained in this contract.

5.3. Proof-of-Performance Testing – The contractor shall connect each OVDT to the corresponding OVDR back at the TMSMHC. The OVDT link light must illuminate and video must transmit successfully without drops to the OVDR.

5.4. Installation Testing - Upon complete installation of the OVDT an operational test shall be performed by the Contractor and demonstrated to the Engineer to verify proper installation and operation. The test shall verify the proper operation of the communications between the OVDT and rack mount OVDR.

5.5. 30-day Operational Testing - Upon successful completion of the installation test and approval by the Engineer, a 30-day System Operational Test for each TMSC site shall commence. During the course of this test, the system must function continuously in accordance with the specifications for the duration of the test. If a malfunction occurs within the stated time frame, the Contractor shall make all necessary repairs to the system and re-establish proper operation. Upon approval of the Engineer, the 30-day test will begin anew. The system must operate for a full thirty (30) consecutive days without malfunction before the system will be accepted by the Engineer. The Contractor shall refer to "Notice To Contractor – 30 Day System Operational Test" for additional testing requirements. The Contractor shall coordinate the 30-day System Operational Test with other pertinent items in this contract.

Method of Measurement:

This item shall be measured for payment by the actual number of equipped Optical Video/Data Transmitter units.

Basis of Payment:

The work to be done under this item shall be paid for at the Contract unit price each for Optical Video/Data Transmitter of the type specified, which price shall include all materials, OVDT,

hardware, termination panels, Power supply, wiring panels, surge suppression/transient protection, terminal strips, cables, connectors, tools, warranties, spare equipment, labor and incidentals necessary to complete this work.

Pay Item	Pay Unit
Optical Video/Data Transmitter	ea.

ITEM #1108707A - RACK MOUNT OPTICAL VIDEO/DATA RECEIVER

Description:

This item shall consist of furnishing, installing, connecting and configuring the Rack Mount Optical Video Data Receiver (RMOVDR) at the mini-hub cabinets at the locations shown on the plans. The work shall include cabling and connecting the RMOVDR

Materials:

1.0 Rack Mount Optical Video/Data Receiver

1.1. The RMOVDR shall consist of one 1-slot receiver card. **The RMOVDR shall be the 9241DR (BB)-SM-ST.** The receiver card will be installed in an existing optelecom 9002 chassis located at the Main Fiber Hub in Hartford.

1.2. Each RMOVDR card shall receive one (1) video signal and a minimum of three (3) full duplex asynchronous data signals transmitted from the traffic management system cabinet to the to the existing Main Fiber Hub, using one (1) single mode optical fiber.

1.3. The video signal transmission shall employ digital transmission technology.

1.4. The RMOVDR shall employ automatic gain control (AGC) circuits, cable equalization and other features to minimize or eliminate any required field electrical or optical adjustments.

1.5. Optical fiber connections to the receiver cards shall be compatible with the single mode fiber-optic cable connectors and the fiber-optic interconnect panel connectors. Adapters will not be allowed by the Department.

1.6. All video and data communications circuits shall include transient suppression equipment for both common and transverse mode noise.

1.7. The video signal performance specification for the transmission and reception is measured from the transmission input to the transmission output as per the testing criteria defined in EIA/TIA-250-C.

1.8. Video Transmission Specifications:

- Video Input: 1 Volt peak-to-peak, 75 ohm
- Video Bandwidth: 5 Hz to 6.5 MHz minimum, -3dB
- Video Signal-to-Noise Ratio: Equal to or greater than 63 dB at maximum optical attenuation
- Differential Gain: 1% maximum
- Differential Phase: 0.7 ° typical
- Wavelength: 1310/1550 nm
- Optical Loss Budget: 23 dB
- Operating Temperature: -40 to +74 degrees C
- Operating Humidity (Relative): 0 to 95% non-condensing
- Encoding: 9 bit

1.9. The data transmission channels shall be fully compliant with the data format and transmission speed requirements of the field devices to which they are to be connected. This includes the data signals required for existing CCTV camera pan-tilt-zoom (PTZ) control, RS232 for existing traffic flow monitors, and RS232 for existing Variable message signs direct connect.

1.10. Data Transmission Specifications

- Data Circuits Available 3 full duplex
- Aggregate Data Rate 115 Kbps
- Data Format RS-232, RS-422, or RS-485 (NRZ, RZI, Manchester, bi-phase); fully compliant with the terminal equipment and intended application

1.11. Data port 1 shall be designated for Pan-Tilt-Zoom (PTZ) control signals, data port 2 shall be designated for future use, and data port 3 shall be designated for future use.

1.12. The RMOVDR shall interface to the single mode fiber cable using an ST connector.

1.13. The RMOVDR shall be hot-swappable, with LED status monitoring, BNC video connector, and power indicator.

1.14. All modules and assemblies shall be clearly identified with name, model number, serial number and any other pertinent information required to facilitate equipment maintenance.

1.15. All external connections shall be made by means of connectors attached to a wiring harness or cable. The connectors shall be keyed to preclude improper hookups.

1.16. Connectors for copper data cable shall be screw type connectors compatible with the video and data fiber-optic transmission equipment.

1.17. All wires and cables to and from the connectors shall be color-coded and/or appropriately marked.

1.18. Equipment shall operate from 115 VAC plus/minus 10 percent, 60 Hz power. The equipment operation shall not be adversely affected by transient voltages, voltage harmonic distortion, voltage unbalance, surges and sags normally experienced on commercial power lines.

1.19. All video and data communications circuits shall include transient suppression for both common and transverse mode noise to minimize the effects of power surges or transients. Transient suppression equipment shall have no adverse effect upon the video or data transmission performance.

1.20. All equipment shall be certified to operate over a temperature range of -10° Celsius to +60° Celsius with a relative humidity of 10% to 95%, without the need for additional cooling or heating equipment.

1.21. All circuit boards shall be conformally coated.

1.22. All materials shall be delivered in the manufacturer's original unopened protective packages. All materials shall be stored in their original protective packaging and protected against soiling, physical damage, or wetting, before installation. All equipment shall be protected during transportation and until installation against damage and stains.

1.23. Store materials and equipment in a clean, dry location free from construction dust, precipitation and excess moisture. Replace damaged materials and equipment, as determined by the Engineer, at no additional cost to the Department.

2.0 Fiber Optic Patch Cords

2.1 Fiber Optic Patch Cords shall be furnished in sufficient length and quantity and installed in the mini hub cabinet to connect the optical fiber termination patch panel to the optical equipment in the equipment racks.

2.2 All optical fibers, coatings, tubes, metals and jackets shall be free of roughness, porosity, blisters, splits and voids in accordance with good manufacturing practice.

2.3 The cable shall be suitable for operation over a temperature range of -20ºC to +60ºC.

2.4 The cable shall provide mechanical support and protection for the specified number of fibers. The outer jacket of the cable shall be constructed of medium or high-density polyethylene. The cable jacket shall be marked with the manufacturer's name, sequential meter or foot markings, month, year or quarter year of manufacture, and a telecommunications handset symbol, as required by Section 350G of the National Electrical Safety Code.

2.5 At a minimum, the cable shall be UL-listed OFNR/OFNP.

2.6 Materials used in the cable shall not produce hydrogen in a concentration large enough to cause any degradation in the transmission performance of the optical fibers.

2.7 Materials used in the cable shall not support galvanic action.

3.0 ST Connectors

3.1 The connector shall have a ceramic ferrule with a nickel-plated nut and body.

3.2 The connector shall be of the ST-type and fully compatible with the fiber optic cable utilized and the mating jacks to which they will be attached.

3.3 The connector shall be compatible with a physical contact (PC) finish. All connectors shall be polished to a PC finish such that the return loss per mated pair of connectors is at least 25 dB. The return loss when the connector is mated with previously installed connectors shall be at least 18 dB.

3.4 The connector mean loss shall not be greater than 0.2 dB with a standard deviation of not greater than 0.1 dB.

3.5 The connector loss shall not vary more than 0.1 dB after 500 repeated matings.

3.6 The connector shall withstand an axial load of 135 N.

3.7 The connectors shall be attached in accordance with the manufacturer's recommended materials, equipment and practices.

3.8 The connector shall be suitable for the intended environment and shall meet the following environmental conditions.

3.9 Operating Temperature: -20 to +50^{o} C, Storage Temperature: -30 to +60^{o} C

3.10 The connector loss shall not vary more than 0.2 dB over the operating temperature range.

3.11 Connectors shall be protected before installation by a suitably installed waterproof protection cap.

4.0 Data Cables

4.1 Data cables shall be TIA/EIA 568A Category 6, characterized up to 350 MHz, suitable for 1000Base-T local area network applications.

4.2 Category 6 cable shall be used for T-1, Ethernet, and serial data communications connections between communications equipment as shown on the Drawings.

4.3 All data cables installed in indoor equipment racks or on cable tray shall be plenum rated.

4.4 Data cables installed in outdoor equipment racks shall be rated for outdoor installations. All cabling to be installed in outdoor equipment cabinets shall maintain specified electrical properties over the entire operating temperature range, specified below

4.5 Data cables shall be terminated with RJ-11, RJ-45, RJ48, DB-25F, 44 Pin D-Type connector or other approved connectors as required by the communications equipment.

4.6 Data cables used for horizontal wiring shall be either 4 pair or 24 pair cable as required by the application and as directed by the Engineer and shall comply with the following requirements:

- Conductor: 24 AWG (solid bare copper)
- Nominal Capacitance: 14 pF/ft
- Characteristic Impedance: 100Ω±15%
- Maximum DC Resistance: 9.4/100m
- Velocity of Propagation: 71% (minimum)

4.7 Data cables used for patching between equipment in equipment racks shall be 4 pair cable and shall comply with the following requirements:

- Conductor: 24 AWG (stranded tinned copper)
- Nominal Capacitance: 14 pF/ft
- Characteristic Impedance: 100Ω±15%
- Maximum DC Resistance: 9.4/100m
- Velocity of Propagation: 71% (minimum)

4.8 Equipment located within environmentally controlled rooms shall be capable of meeting the following requirements:

- Storage Temperature: -40° to + 70° Celsius
- Operating Temperature Range: 0° to + 50° Celsius

- Relative Humidity: 5 to 90%, non-condensing
- Fire Resistance Complies with TR-NWT-000063, Issue 3.

5.0 Copper Coax Cables and Connectors:

5.1 The coax cable shall be Belden Part Number 7915A or approved equal. The conductor shall be a Series 6 conductor with a solid stranding. The cable shall be 18 AWG with the conductor material being made of BC – Bare Copper. The conductor diameter shall be 0.040 in. The insulation shall be a gas injected Foam Polyethylene with an insulator diameter of 0.180 in. The outer shield shall be Duobond Plus™). The outer shield type shall be Tape/Braid/Tape. The tape shall be bonded aluminum foil-polyester tape – aluminum foil. The braid shall be aluminum. The tape shall cover 100% of the cable. The braid shall cover 77% of the cable. The outer jacket material shall be PVC – polyvinyl chloride. The overall nominal diameter shall be 0.275 in. The cable shall meet operating temperature of –40 C to + 80 C with a maximum pulling tension of 91lbs. with a min. bending radius of 5.75 in. The cable shall meet NEC/UL CM, with UL flame test UL 1685 UL Loading.

5.2 Precision video coaxial cable shall be utilized to transmit baseband NTSC video signals between communications equipment as described herein and elsewhere in these specifications and as shown on the drawings.

5.3 BNC-type connectors shall be utilized to terminate segments of the baseband video cable installed between communications equipment as shown on the Drawings.

5.4 The outer conductor shall be tinned copper double braid 98% shield coverage.

5.5 The cable shall be 100% sweep tested.

5.6 Connectors shall be BNC type, manufactured specifically for the baseband video coaxial cable to which they will be attached.

5.7 The BNC connectors shall meet or exceed the following specifications:

- Characteristic Impedance 75 ohms (true)
- Return Loss less than – 35dB to 1 GHz
- Mechanical Durability 500 Cycles Minimum
- Corrosion Resistance MIL-STD-202, Method 101
- Solvent Resistance MIL-STD-202, Method 215

5.8 The center conductor of the BNC connector shall be 1.25 micrometers (50 millionths of an inch) gold plating over copper plate.

6.0 Manufacturer's Qualifications

6.1 The Manufacturer shall have a minimum of five (5) year's experience in the design, manufacture, and testing of Video and Data Fiber Optic Transmission Equipment is required. The system shall be designed and manufactured according to world class quality standards. The manufacturer shall be ISO 9001 certified.

7.0 Warranty

7.1 All equipment supplied under these items shall be warranted for parts by the manufacturer against defects and failures, which may occur through normal use for a period of five (5) years from the date of installation. A copy of the warranty shall be presented to the Engineer before installation of the equipment.

8.0 Spare Parts

8.1 As part of this item the Contractor shall supply one 1-slot receiver card model 9241DR(BB)-SM-ST.

Construction Methods:

1.0 Connections to existing Optical Fiber Termination Patch Panel (OFTPP):

1.1. The Contractor shall provide and install all interconnection fiber optic patch cords between the RMOVDR and the OFTPP in the Main Fiber Hub. The Contractor shall match the fibers from the field to connect to the camera sites to the RMOVDR.

1.2. The optical fiber path for each video link shall have been tested and verified in accordance with this Contract prior to the connection to the OVDR.

1.3. The Contractor shall provide to the Engineer a copy of all the planned port assignment for both video and data to and from the RMOVDR two weeks prior to installation. The planned assignments shall include assignments for the OFTPP, Optelecom OVDR, Optelecom multiplexer, and terminal servers.

2.0 Rack Mount Optical Video/Data Receiver:

2.1 The RMOVDR card shall be configured and installed in the existing Main Fiber Hub 9002 chassis. The configuration shall meet the requirements to successfully connect the video and PTZ data from the camera site to the Main Fiber Hub.

2.2 The Contractor shall connect the connect coax cables from video out ports on the RMOVDR fiber optic card units to an existing Multidyne Video Distribution

Amplifier. The Contractor shall connect the correct PTZ data connectors from the RMOVDR data ports to the existing Digi Terminal Server.

2.3 The Contractor shall neatly train all optical patch cords together when routing them along the same path and shall neatly train them along the support rails in the camera control equipment cabinet. The Contractor shall neatly train all coax and data cables along the support rails in the camera control equipment cabinet.

2.4 No cables shall be installed with a sweep-bend radius less than the manufacturer's minimum recommended bending radius.

2.5 The contractor shall label all coax, data, and fiber cables which shall correspond to the As-built wiring diagrams. The contractor will be provided existing Visio wiring diagrams which will need to be updated to include the newly installed equipment, wiring, and rack elevation diagrams.

3.0 Testing:

3.1 The Contractor shall be responsible for all testing and documentation required in establishing approval and acceptance of this Item.

3.2 The Contractor shall submit test procedures and documented test results to the Engineer. The test procedures shall document the nature of test activities to be performed.

3.3 The test procedures shall be submitted to the Engineer prior to initiation of the testing. The procedures will be returned to the contractor within two (2) weeks indicating either "accepted" or "make corrections noted".

3.4 In the case that corrections are required, the Contractor shall submit revisions within one (1) week.

3.5 Four (4) copies of the final test procedures shall be submitted to the Engineer prior to commencement of testing.

3.6 The Contractor shall refer to the testing and documentation of the materials and equipment listed under this item to the testing and documentation for other pertinent items contained in this contract.

3.7 Installation Testing - Upon complete installation of all field equipment (including OVDT, multiplexer/demultiplexer, terminal server, etc.), an operational test shall be performed by the Contractor and demonstrated to the Engineer to verify proper installation and operation. The test shall verify the proper operation of the field equipment installation.

3.8 30-day Operational Testing - The Contractor shall refer to "Notice To Contractor – 30 Day System Operational Test" for additional testing requirements. The Contractor shall coordinate the 30-day System Operational Test with other pertinent items in this contract.

4.0 Delivery, Storage, and Handling

4.1 The Contractor shall deliver, store, handle and install all materials and equipment in such a manner as not to degrade quality, serviceability or appearance.

4.2 All material shall be new and delivered in unopened packaging.

4.3 The Contractor shall be responsible for storage of the materials and equipment prior to installation in a clean, dry location free from construction dust, precipitation and excess moisture.

4.4 The Contractor shall be required to replace any damaged materials and equipment, as determined by the Engineer, at no additional cost to the Department.

5.0 Submittals:

As part of Section 1.06 "Control of Materials", the Contractor shall provide the following information as part of the shop drawing/catalog cut submittal:

5.1 Functional block diagrams, wiring diagrams, and point-to point wiring details. Wiring diagrams shall be supplied in Visio 2010 format.

5.2 Detailed shop drawings, wiring diagrams, equipment cabinet front elevation drawings, and equipment installation drawings indicating supports and appurtenances required for proper installation.

5.3 Product data, Operations and Maintenance manuals. Information regarding materials, finishes and accessories.

Method of Measurement:

These items shall be measured for payment by the number of Rack Mount Optical Video/Data Receiver card of the type specified, installed, completed, tested and accepted. This item shall include 1 receiver card and spare equipment.

Basis of Payment:

The work to be done under this Item shall be paid at the Contract Price each for the Rack Mount Optical Video/Data Receiver which price shall include all equipment, materials, cables, connectors, spare equipment, fiber patch cords, splicing, tools, installation, labor, warranties, shipping and incidental items required to satisfy these Specifications.

Pay Item	Pay Unit
Rack Mount Optical Video/Data Receiver	ea.

ITEM #1111201A - TEMPORARY DETECTION (SITE NO. 1)

ITEM #1111202A - TEMPORARY DETECTION (SITE NO. 2)

Description:

Provide a Temporary Detection (TD) system at signalized intersections throughout the duration of construction, as noted on the contract plans or directed by the Engineer. TD is intended to provide an efficient traffic-responsive operation which will reduce unused time for motorists travelling through the intersection. A TD system shall consist of all material, such as pedestrian pushbutton, accessible pedestrian signal, conduit, handholes, cable, messenger, sawcut, loop amplifier, microwave detector, Video Image Detection System (VIDS), Self-Powered Vehicle Detector (SPVD), and any additional components needed to achieve an actuated traffic signal operation.

- Site No. 1 is Great Meadow Road at Ramp E (Intersection #159-239)
- Site No. 2 is Airport Road at I-91 SB exit (Intersection #063-290).

Materials:

Material used for TD is either owned by the Contractor and in good working condition, or existing material that will be removed upon completion of the contract. Approval by the Engineer is needed prior to using existing material that will be incorporated into the permanent installation. New material that will become part of the permanent installation is not included or paid for under TD.

Construction Methods:

The work for this item includes furnishing, installation, relocating, realigning, and maintaining the necessary detection systems as to provide vehicle and pedestrian detection during each phase of construction. If not shown on the plan, program the TD modes (pulse or presence) as the existing detectors or as directed by the Engineer. If the TD method (loops, SPVD, microwave, VIDS, pushbutton, or other) it may be the Contractor's choice. The method chosen for TD must be indicated on the TD Plan submission.

The traffic signal plan-of-record, if not in the controller cabinet will be provided upon request. Ensure the controller phase mode (recall, lock, non-lock) and phase timing are correct for the TD. Adjust these settings as needed or as directed by the Engineer.

At least 30 days prior to implementation of each phase of construction submit a TD proposal to the Engineer for approval. Submit the TD proposal at the same time as the Temporary Signalization plan. Indicate the following information for each intersection approach:

- Phase Mode
- Temporary Detection Method
- Area of Detection
- Detector Mode

Submit the proposed temporary phase timing settings and the TD installation schedule with the TD proposal. See the example below.

Example Proposed Temporary Detection and Timing

Site 1

Warren, Rt. 45 at Rt. 341, Location #149-201

Approach	Phase	Phase Mode	TD Method	Area of Detection	Det Mode
Rt. 45 NB	***2***	***Min Recall***	***VIDS***	***150' from Stop Bar***	***Pulse***
Rt. 45 SB	***2***	***Min Recall***	***SPVD***	***150' from Stop Bar***	***Pulse***
Rt. 341	***4***	***Lock***	***Microwave***	***30' from Stop Bar***	***Pulse***
Rt. 341	***4***	***Lock***	***Pushbutton***	***At SE & SW corners***	***n/a***

Temporary Phase Timing Settings:

Phase	Min	Ped	Ped Clr	Ext	Max 1	Max2	Yel	Red
2	***20***	***0***	***0***	***6***	***45***	***60***	***4***	***1***
4	***14***	***7***	***9***	***3***	***27***	***35***	***3***	***1***

Scheduled TD: ***July 4, 2011***

Site 2

Scotland, Rt. 14 at Rt. 97, Location #123-201

Approach	Phase	Phase Mode	TD Method	Area of Detection	Det Mode
Rt. 15 WB Left Turn	***1***	***Non-Lock***	***VIDS***	***5' in front to 10' Behind Stop Bar***	***Presence***
Rt. 14 EB	***2***	***Min Recall***	***Existing Loop***	***150' from Stop Bar***	***Pulse***
Ped Phase	***3***	***Non-Lock***	***Pushbutton***	***At all corners***	***n/a***
Rt. 14 WB	***6***	***Min Recall***	***VIDS***	***150' from Stop Bar***	***Pulse***
Rt. 97	***4***	***Lock***	***Loop, Pre-formed***	***20' from Stop Bar***	***Pulse***

Temporary Phase Timing Settings:

Phase	Min	Ped	Ped Clr	Ext	Max 1	Max2	Yel	Red
1	***5***	***0***	***0***	***2***	***12***	***18***	***3***	***0***
2 & 6	***24***	***0***	***4***	***4***	***26***	***36***	***4***	***1***
3	***16***	***7***	***9***	***0***	***16***	***16***	***4***	***1***
4	***14***	***7***	***9***	***3***	***27***	***35***	***3***	***1***

Scheduled TD: ***July 4, 2011***

When at any time during construction the existing vehicle or pushbutton detection becomes damaged, removed, or disconnected, install TD to actuate the affected approaches. Install and make TD operational prior to removing existing detection. TD must be operational throughout all construction phases.

Provide a list of telephone numbers of personnel who will be responsible for the TD to the Engineer. If the TD malfunctions or is damaged, notify the Engineer and place the associated phase on max recall. Respond to TD malfunctions by having a qualified representative at the site within three (3) hours. Restore detection to the condition prior to the malfunction within twenty-four (24) hours.

If the Engineer determines that the nature of a malfunction requires immediate attention and the Contractor does not respond within three (3) hours following the initial contact, then an alternative maintenance service will be called to restore TD. Expenses incurred by the State for alternative service will be deducted from monies due to the Contractor with a minimum deduction of $500.00 for each service call. The alternate maintenance service may be the traffic signal owner or another qualified Contractor.

TD shall be terminated when the detection is no longer required. This may be either when the temporary signal is taken out of service or when the permanent detectors are in place and fully operational.

Any material and equipment supplied by the Contractor specifically for TD shall remain the Contractor's property. Existing material not designated as scrap shall become the property of the Contractor.

Method of Measurement:

Temporary Detection will be paid only once per site as a percentage of the contract Lump Sum price. Fifty percent (50%) will be paid when Temporary Detection is initially set up, approved, and becomes fully operational, and fifty percent (50%) will be paid when Temporary Detection terminates and all temporary equipment is removed to the satisfaction of the Engineer.

Basis of Payment:

This work will be paid at the contract Lump Sum price for "Temporary Detection (Site No.)". The price includes furnishing, installing, relocating, realigning, maintaining, and removing, the necessary detection systems and all incidental material, labor, tools, and equipment. This price also includes any detector mode setting changes, timing or program modifications to the controller that are associated with TD. All Contractor supplied material that will remain the Contractor's property will be included in the contract Lump Sum price for "Temporary Detection (Site No.)." Any items installed for TD that will become part of the permanent installation will not be paid for under this item but are paid for under the bid item for that work.

Pay Item	Pay Unit
Temporary Detection (Site No.)	L. S.

ITEM #1111401A - LOOP VEHICLE DETECTOR

Replace Section 11.11.02, Article M16.12, with the following:
11.11.02 – Materials:
Article M.16.12

M.16.12 - LOOP VEHICLE DETECTOR AND SAWCUT

1. Loop Vehicle Detector:
- Comply with National Electrical Manufacturers Association (NEMA) standards, Section 6.5, Inductive Loop Detectors.
- Comply with the current CT DOT Functional Specifications for Traffic Control Equipment, Section 3 B, Loop Vehicle Detector with Delay/Extend Option.

Replace Section 11.11.03, Article 1. Loop Vehicle Detector, with the following:
11.11.3 - Construction methods:
1. Loop Vehicle Detector
- Shelf-mount the detector amplifier in the controller cabinet.
- Terminate the harness conductors with crimped spade connectors. Connect conductors to appropriate terminals, eg, black wire to 110vac, white wire to 110vac neutral.
- Tie loop harness and conductors to controller cabinet wiring harness. Leave enough slack in loop harness so that amplifier may be moved around on cabinet shelf; ± 2 feet (0.6 meter) slack.
- Attach a loop identification tag to the harness. Record pertinent detector information on the tag with indelible ink. See example below.
  - Loop No.: D4
  - Phase Call: Phase 4
  - Field Location: Rt. 411 (West St.)
  - Eastbound, Left Lane
  - Detector No.: 4
  - Cabinet Terminals: 234, 235

Replace Section 11.11.04, Article 1. Loop Vehicle Detector, with the following:
11.11.4 – Method of Measurement:
1. Loop Vehicle Detector is measured by the number of installed, operating, tested, and accepted vehicle detector amplifiers of the type specified.

Replace Section 11.11.05, Article 1. Loop Vehicle Detector, with the following:
11.11.5 – Basis of Payment:
1. Loop Vehicle Detector is paid at the contract unit price each of the type specified.

Pay Item	Pay Unit
Loop Vehicle Detector	ea. (ea.)

ITEM #1111451A - LOOP DETECTOR SAWCUT

11.11.02 – Materials:

Replace Article M.16.12 with the following:

Sawcut:

(a) Wire in sawcut:

- International Municipal Signal Association (IMSA) Specification 51-7, single conductor cross-linked polyethylene insulation inside polyethylene tube.
- # 14 AWG

(b) Sealant:

(1) Polyester Resin Compound

- Two part polyester which to cure, requires a liquid hardener.
- Use of a respirator not necessary when applied in an open air environment.
- Cure time dependent on amount of hardener mixed.
- Flow characteristics to guarantee encapsulation of loop wires.
- Viscosity: 4000 CPS to 7000 CPS at 77 degrees Fahrenheit (25º C).
- Form a tack-free skin within 25 minutes and full-cure within 60 minutes at 77 degrees Fahrenheit (25º C).
- When cured, resist effects of weather, vehicular abrasion, motor oil, gasoline, antifreeze, brake fluid, de-icing chemicals, salt, acid, hydrocarbons, and normal roadway encounters.
- When cured, maintain physical characteristics throughout the ambient temperature ranges experienced within the State of Connecticut.
- When cured, bonds (adheres) to all types of road surfaces.
- Weight per Gallon (3.8 l): 11 lbs ±1 lb (5kg ± .45kg)
- Show no visible signs of shrinkage after curing.
- 12 month shelf life of unopened containers when stored under manufacturers specified conditions.
- Cured testing requirements:
  - Gel time at 77 degrees F (25° C): 15 - 20 minutes, ASTM C881, D-2471
  - Shore D Hardness at 24 hours: 55-78, ASTM D-2240
  - Tensile Strength: > 1000 psi (6895 kPa), ASTM D-638
  - Elongation: 18 - 20 %, ASTM D-638
  - Adhesion to steel: 700 - 900 psi (4826 - 6205 kPa), ASTM D-3163
  - Absorption of water, sodium chloride, oil, and gasoline: < 0.2%, ASTM D-570
- Include in the Certificate of Compliance:
  - Manufacturer's confirmation of the uncured and cured physical properties stated above.
  - Material Safety Data Sheet (MSDS) stating sealant may be applied without a respirator in an open air environment.
- Designed to allow clean-up without the use of solvent that is harmful to the workers and the environment.

(2) Elasotmeric Urethane Compound:

- One part urethane which to cure, does not require a reactor initiator, or a source of thermal energy prior to or during its installation.
- Use of a respirator not necessary when applied in an open air environment.

- Cure only in the presence of moisture.
- Flow characteristics to guarantee encapsulation of loop wires.
- Viscosity such that it does not run out of the sawcut in sloped pavement during installation; 5000 CPS to 85,000 CPS.
- Form a tack-free skin within 24 hours and 0.125 inch (0.33mm) cure within 30 hours at 75 degrees Fahrenheit (24º C).
- When cured, resist effects of weather, vehicular abrasion, motor oil, gasoline, antifreeze, brake fluid, de-icing chemicals, salt, acid, hydrocarbons, and normal roadway encounters.
- When cured, maintain physical characteristics throughout the ambient temperature ranges experienced within the State of Connecticut.
- Show no visible signs of shrinkage after curing.
- Shelf life when stored under manufacturers specified conditions:
    - Caulk type cartridges: minimum 9 months
    - Five gallon containers: minimum 12 months
- Designed for application when the pavement surface temperature is between 40 and 100 degrees Fahrenheit (4º and 38º C).
- Uncured testing requirements:
    - Weight/Gallon: ASTM D-1875
    - Determination of Non-volatile Content: ASTM D-2834
    - Viscosity: ASTM D-1048B
    - Tack-free Time: ASTM D-1640
- Cured testing requirements:
    - Hardness: ASTM D-2240
    - Tensile Strength & Elongation: ASTM D-412A
- Include in the Certificate of Compliance:
    - Manufacturer's confirmation of the uncured and cured physical properties stated above.
    - Material Safety Data Sheet (MSDS) stating sealant may be applied without a respirator in an open air environment.
- Designed to allow clean-up without the use of solvent that is harmful to the workers and the environment.

3. Miscellaneous:

(a) Liquidtight Flexible Nonmetallic Conduit

- UL listed for direct burial
- UL 1660
- Smooth polyvinyl chloride inner surface

(b) Water Resistant Pressure Type Wire Connector

- Ul listed for direct burial and wet locations
- UL 486D

11.11.03 - Construction methods:

2. Loop Detector Sawcut

- Loop size, number of turns, and location is shown on the intersection plan.
- Do not cut through a patched trench, damaged or poor quality pavement without the approval of the Engineer.
- Wet-cut pavement with a power saw using a diamond blade ⅜ inch (9.5mm) wide. Dry-cut is not allowed.
- Ensure slot depth is between 1 ¾ inch to 2.0 inch (45mm to 50mm).
- Overlap corners to ensure full depth of cut.

- To prevent wire kinking and insulation damage, chamfer inside of corners that are ≤ 120 degrees.
- Clean all cutting residue and moisture from slot with oil-free compressed air. Ensure slot is dry before inserting wire and sealing sawcut.
- Cut home-run, from loop to curb or edge-of-road, as shown on the typical installation sheet.
- To prevent cross-talk and minimize electrical interference, twist home-run wires, from edge of road to handhole, with at least 5 turns per foot (16 turns per meter). Tape together twisted home-run wires at 2 foot (0.6 meter) ± intervals.
- In new or resurfaced pavement, install loops in the wearing course. If the wearing course is not scheduled for immediate placement (within 24 hours) after the base course, provide temporary detection when directed by the Engineer. Temporary detection may be sawcut loops, preformed loops, microwave sensor, video, or other method approved by the Engineer.
- Splice(s) not allowed anywhere in loop wire either in loop or in home-run.
- Ensure wires are held in place at bottom of slot by inserting at 2 foot (0.6 m) intervals, 1 inch sections of foam backer rod or wedges formed from 1 inch (25mm) sections of the polyethylene tubing. Loop detectors with wires that have floated to the top of the sealant will not be accepted.
- To create a uniform magnetic field in the detection zone, wind adjacent loops in opposite directions.
- Use **polyester compound** as the sealant unless another type is allowed by the Engineer.
- Mix hardening agent into polyester resin with a power mixer or in an application machine designed for this type of sealant in accordance with the manufacturer's instructions.
- Apply the loop sealant in accordance with the manufacturer's instructions and the typical installation sheet. Do not apply sealant when pavement temperature is outside the manufacturers recommended application range.
- Solder splice the loop wires to the lead-in cable and install water resistant connector as shown on the typical installation sheet.
- Test the loop circuit resistance, inductance, and amplifier power-interruption as shown on the typical installation sheet. Document all test results.

3. Damaged, Patched, or Excessively Worn Pavement
- Where the existing pavement is damaged, patched or excessively worn and is found to be not suitable for reliable loop detection, notify the Engineer.
- When directed by the Engineer, remove and replace an area of pavement to allow the proper installation of the loop.
- Remove a minimum of 3 inches (75mm) depth.
- Comply with the applicable construction methods of Section 2.02 Roadway Excavation, Formation Of Embankment and Disposal of Surplus Material, and Section 4.06 Bituminous Concrete, such as:
    - Cut Bituminous Concrete
    - Material for Tack Coat
    - Bituminous Concrete Class 1

4. Re-surface/Overlay Project
- Prior to disconnecting the existing loop confirm that the amplifier is operating properly and is programmed according to plan. Document loop operation. Report any discrepancies and malfunctions to Engineer.
- Remove all abandoned sawcut home-run wire from handhole.
- Sawcut new loop according to plan.

- Solder splice new loop wires to the existing lead-in cable and install new water resistant twist connectors as shown on the typical installation sheet. Do not re-use the removed connectors.
- Test the loop circuit resistance and inductance. Document results.
- Ensure the existing loop amplifier has re-tuned to the new loop and is operating according to plan.

11.11.04 – Method of Measurement:

Loop Detector Sawcut is measured by the number of linear feet (meters) of installed, tested, operating, and accepted sawcut only where there is loop wire. Over-cuts at corners that do not contain wire are not measured.

11.11.05 – Basis of Payment:

Loop Detector Sawcut is paid at the contract unit price per linear foot (meter). The price includes sawcut, loop wire, sealant, liquidtight flexible nonmetallic conduit, duct seal, water resistant splice connectors, testing, incidental material, equipment, and labor.

Pay Item	Pay Unit
Loop Detector Sawcut	l.f. (m)

S:\traffic\1406\SIGNAL SPECS\SPECS\1111451A-LOOP DETECTOR SAWCUT only, rev 1-11, polyester compound

ITEM #1112210A - CAMERA ASSEMBLY

DESCRIPTION:

The "camera assembly" item shall consist of furnishing and installing an outdoor dome assembly with integral CCTV color camera and motorized lens, receiver/driver (if required), local camera control at the TMSC/TMSMHC appropriate interconnect wiring, at the locations shown on the plans. The equipment to be provided shall include any ancillary or incidental items including any code-translators, code-distributors, data converter units, camera controller units, cables, connectors and power supplies required at each video switcher site or camera location to make a complete and fully operating video surveillance system with the approved camera manufacturer.

MATERIALS:

Manufacturer Requirements:

The Contractor shall ensure that all specified camera features, functions and performance requirements are supported by the American Dynamics 1024 video switcher and American Dynamics 2089 keyboard without loss of camera features, functions, performance and response time (except alarm returns). The camera assembly shall be a unit that has been tested and working with the American Dynamics 1024 video switcher at the Department's Operation Center at 2800 Berlin Turnpike Newington CT. The Contractor will not be allowed to submit a camera manufacturer other than the manufacturers listed herein. **All camera assemblies shall be manufactured by Sensormatic - SpeedDome Ultra 8E day/night or latest equivalent model.** The catalog cut submittal shall clearly document any camera functions that do not meet the item specifications.

1.0 Materials

- High-speed, programmable dome with a high-resolution DSP7 camera incorporating programmable Day and Night camera modes
- Day and Night mode control by removal of an infrared (IR) cut filter
- Wide Dynamic Range (WDR) for viewing of detailed images when observing scenes with widely varying degrees of light
- Digital Slow Shutter (DSS) allowing more light accumulation within the CCD imager
- Electronic Image Stabilization (EIS) to compensate for physical movement and vibration of the dome with a user-selectable bandwidth of 5 or 10Hz
- Dome to conform to RoHS initiative standards.
- Outdoor enclosure
- Local camera controller
- Camera power, video and data cables.
- Code Distributors, Code Translators and Date Converters
- Spare equipment
- Power supply transformer

2.0 Performance Specifications

- The dome assembly must be comprised of a high-speed, pan/tilt assembly and a high-resolution Day or Night mode camera with 35X optical zoom, 12X digital zoom permitting up to 420X total zoom, and a horizontal resolution of 540TVL. The camera/lens assembly must provide continuous, full-time, auto focus capabilities.
- The pan/tilt mechanism must incorporate a sealed, precision slip-ring to provide 360° of continuous rotation.
- The tilt mechanism must provide for 110° of travel.
- Precise manual panning and tilting must be achievable through a combination of variable-speed operator control (speed ranges) and automatic adjustment of these speed ranges dependent upon zoom factor. Manual pan and tilt speeds must range from 0.25° to 100° per second. Preset pan speeds must range from 1° to 360° per second, and preset tilt operating speeds must be from 1° to 220° per second. Pan and tilt speeds will be automatically adjusted by the zoom factor to allow the user the same ease of control, regardless of the field of view.
- High-speed, DC direct-drive motors must be used to maintain high torque through the entire operating range. These motors must use pulse-width modulation and encoder feedback to control the acceleration, speed, and deceleration of the motors to ensure smooth, precise, accurate, and fluid movement. The design shall use DC direct-drive motors and no belt to ensure long-term, reliable operation.
- The dome assembly shall contain a built-in, multi-protocol receiver/driver for use with matrix switching systems using one or more of the following protocols:
- AD Manchester control code and a single 18AWG shielded twisted pair (STP) to support up to three daisy-chained domes a maximum of 1500m (5000ft)
- SensorNet control code and a single 22AWG unshielded twisted pair (UTP) to support up to 32 daisy-chained domes a maximum of 1000m (3000ft)
- RS-422/RS-485 control code and two pairs of 22AWG STP cabling to support up to 10 daisy-chained domes a maximum of 1000m (3000ft)
- AD-UTC and a 20AWG RG–59U video cable to control a dome a maximum of 700m (2,300ft)
- The receiver/driver will provide all voltages for camera controls, pan and tilt functions, and all motorized lens functions. In addition, the dome shall support selected third-party protocols for integration to other systems without the need for optional translator boards.
- The dome must natively support the National Transportation Communications for ITS Protocol (NTCIP) version 1205:2001 v01.08, implemented via the RS–422 communication interface.
- The dome must include standard support for UTP dome connections, which allow the use of separate cabling for transmission of video and dome control signals up to 300m (1000ft).
- The dome shall support 96 Presets, 16 Patterns, and 16 Preset Sequences depending upon protocol and controller used. The dome shall also support a Home Position that automatically returns the dome to a Preset, Pattern or Preset Sequence after a specified period of inactivity: 1-60 minutes. A freeze frame function must be available that maintains a static image on-screen during dome movement and lens adjustment when

presets and patterns are called. This freeze frame function helps to preserve hard-drive space when a digital video recorder is used.

- The dome must support a minimum of eight privacy zones to prevent users from viewing sensitive or secured areas. So as not to interfere with normal surveillance operations, these on-screen "shields" must block out only the area that has been defined as sensitive. The privacy zones should not cause the screen to blank out when the sensitive area is within the camera's field of view. On the monitor, the privacy zones should appear larger or smaller depending on the camera's zoom factor.
- The dome must support on-screen programming of dome parameters, including proportional flip, direction indicators and azimuth, maximum zoom stop, line-lock or internal crystal synchronization, AGC, white balance, Wide Dynamic Range selection, alarm actions and default states, infrared filter removal threshold, and home position. On-screen programming of dome name, 16 Area names, 96 Preset names, 16 Pattern names and four alarm names must also be provided. All of this on-screen programming, as well as the rest of the on-screen displays, must be available in the following languages: English, French, Italian, German, Spanish, and Portuguese.
- A DirectSet menu must be used to provide easy access to common dome settings when installed with compatible controllers. This DirectSet menu must provide access to the following features:
    a. dome configuration menu
    b. auto iris/autofocus resume
    c. flip
    d. default apple peel pattern
    e. set North position
    f. line lock off
    g. line lock on
    h. night mode, day mode
    i. auto day/night mode
    j. WDR on
    k. WDR off
    l. enable/disable wide dynamic range
    m. activate smooth scan
    n. activate stepped scan
    o. activate random scan
    p. activate a preset sequence
    q. display the dome information screen
    r. Password protection must be provided to prevent unauthorized access.

- Dome direction indicators and azimuth reading; Dome, Area, Preset, Pattern, Preset Sequence and alarm names; and zoom, focus, and iris status must be displayable on the monitor. All on-screen text character attributes must be user-selectable solid or translucent white, with or without black outline.
- On-screen display of dome usage statistics must be available. This usage information must provide a record of the number of pan, tilt, and zoom commands issued by the dome; operating time, time from last reset in seconds, and total reset count.

- The dome assembly design shall contain four alarm inputs and be field programmable to receive “normally open” or “normally closed” contacts. If operating on a SensorNet or RS–422 network, the dome shall be capable of receiving the alarm and transmitting the alarm back to the switching system and/or reacting to the alarm event independent of the switching system. If operating on a Manchester network, the dome must be able to process the alarm internally and automatically activate a Preset, Pattern or Preset Sequence.
- The dome assembly shall contain a single auxiliary output (outdoor dome) or three independent auxiliary outputs (indoor dome). The outdoor dome single auxiliary output shall be a form C relay contact. Each open collector auxiliary output must respond as momentary or latching (depending on system capability).
- The open collector of each auxiliary shall be required to handle +12Vdc at a maximum of 40mA.
- The complete dome assembly must be capable of operating to full specification with an applied voltage of 18 to 30Vac at a frequency of 50 or 60Hz and meet Class 2 standards. The power consumption cannot exceed 11W with all functions operating. The dome assembly shall have surge protection for the video, communications, power, and alarm connections.
- The camera shall have a 35X optical zoom and be a ¼-inch CCD interline transfer device. Day mode shall provide a minimum horizontal resolution of 540 lines with a usable video signal with a scene illumination of better than 0.24 Lux (20 IRE with AGC on) and 0.028 Lux (with an open shutter selection of 1/4sec).
- Night mode shall provide a minimum horizontal resolution of 540 lines with a usable video signal with a scene illumination of 0.021 Lux (20 IRE with AGC on) and 0.00041 Lux (IR mode with an open shutter selection of 1/2sec).
- The video output synchronization shall be 2:1 interlace and will observe the NTSC or PAL standards. Line-lock with an adjustable vertical phase must also be provided.
- The lens must be color-corrected, 3.4-119mm, f1.4, and must have continuous autofocus with manual override. The lens must also have auto-iris with manual iris override. The autofocus and auto-iris resume settings shall be configurable via on-screen menu settings.
- The dome shall incorporate a twist-lock release base for ease of installation and service. This base enables the installer to wire the appropriate cables onto an I/O board contained within the twist-lock base. The I/O base enables wiring to be completed once and for the housing/eyeball assembly to be connected and disconnected to the twist-lock base without disturbing the wires or connections. This I/O base option shall support four alarm inputs and three auxiliary outputs. In the event that the camera assembly must be replaced, the I/O base shall store presets, patterns, and other selected programming information. Each base will include diagnostic LEDs to indicate power and proper communications to and from the matrix.
- An installation tool that enables service personnel to connect and disconnect the housing/eyeball assembly without the use of a ladder or lift must be available. The dome and base must be available separately so installation of the base can be accomplished by qualified personnel prior to the purchase of the dome or housing/eyeball assembly. An outdoor housing must also be available and shall provide for the same ease of installation and service.

- Upon initial power up and after dome resets, diagnostic tests must be run, including communication loopback, camera loopback, and motor circuit tests. The results of these tests must be displayable on the monitor. After initialization, the dome shall automatically pan, tilt, and zoom to its previous position.

3.0 Camera Assembly

3.1 Each camera assembly shall include, but not be limited to, the following equipment:

- Pendant mounted dome camera housing, mountings, pan and tilt unit, and other camera accessories as specified.
- ¼" CCD Integral color television camera with motorized lens.
- Integral receiver/driver installed in the dome housing.
- Local camera controller capabilities located in the traffic management system cabinet or portable variable message sign cabinet.
- Data Transmission RS-422. Data transmission shall use a dedicated data cable. The selected data transmission protocol shall require prior approval by the Engineer.
- All required wiring and connections to related equipment.

3.2 The dome camera, zoom lens, domed pressurized enclosure and control receiver shall be assembled and tested in accordance with these Technical Special Provisions prior to delivery to the job site. All equipment shall be UL listed. These assemblies shall be delivered to the job site as complete units, and installed on poles and camera lowering devices as shown on the plans and specified herein.

3.3 The operation of CCTV equipment dome type shall not be affected by transient voltages, surges, and sags normally experienced on commercial power lines. CCTV field hardware and related electronic components shall not be adversely affected by wind driven rain, salt in the air or ice buildup. <u>The camera assembly shall have the capability to turn on or off the heater and blower systems by manual override from the operations center as specified and elsewhere in these provisions</u>.

4.0 Camera Assembly Items

4.1 The camera shall be capable of automatically reestablishing video and data communications upon the restoration of communications or power to the cameras. The maximum lux level requirements shall be considered using a resulting image on the video monitors at the Department's Newington Operations Center. The cameras shall meet or exceed the following requirements:

Note: Due to the market changes in the CCTV industry, the Contractor should contact the Department to verify camera features and performance.

Operational

Manual Pan/Tilt Speed:	0.25° to 100° per second (based on zoom position)
Preset Pan/Tilt Speed:	360° per second maximum (Pan) 220° per second maximum (Tilt)
Pan Travel:	360° continuous
Tilt Travel:	110°
Pan/Tilt Accuracy:	± 0.5°
Zoom/Focus Accuracy:	± 0.5%
Programmable Patterns/Sequences/Areas/ Privacy Zones:	16/16/16/8
Direction Indicators:	Yes
Presets:	96 max, system-capability dependent
Auto Synchronization:	
Line-Locked:	Remote V-phase adjustment
Internal:	Built-in sync generator
Address Range:	
RS-422/RS-485:	1 to 99
Manchester:	1 to 64
SensorNet:	1 to 255
AD-UTC:	Based on number of inputs
Alarm Inputs with I/O board (indoor only):	4 dry contacts with optical isolation/3.5mA sink
Alarm Outputs with I/O board (indoor only):	3 open collector drivers at 12Vdc, 40mA

Integral Receiver / Driver

Control Code:	AD Manchester, SensorNet, RS-422, or UTC
Maximum Daisy-Chain Devices:	
RS-422/RS-485:	10 Domes up to 1000m (3000ft)
SensorNet:	32 Devices up to 1000m (3000ft)
AD Manchester:	3 Domes, up to 1500m (5000ft)
Controllable Functions:	Pan, Tilt, Zoom, Focus (Manual/Auto), Iris (Manual/Auto)

Camera

Imager:	Interline transfer ¼-inch CCD array
Scanning System:	.2:1 interlace

Optical Zoom:	35X
Digital Zoom:	12X
Maximum Zoom:	420X
Video Output:	1.0Vp-p, 75Ω composite
S/N Ratio:	–50dB (typical)
Horizontal Resolution:	540 lines at center
Minimum Illumination (20 IRE, AGC on):	0.24 Lux (color) 0.028 Lux (color with 1/4sec open shutter) 0.021 Lux (B/W IR mode) 0.00041 Lux (B/W IR mode with 1/2sec open shutter)
Gain Control:	Automatic (AGC)
White Balance:	Through-the-Lens (TTL) Automatic Tracing White Balance (ATW)
Day/Night	Auto (Med., Low, High) On, or Off
Wide Dynamic Range (WDR)	On or Off
Electronic Image Stabilization (EIS)	On (5 or 10Hz) or Off
NTSC:	
Effective Pixels:	768 (H) x 494 (V)
Scanning:	525 lines, 60 fields, 30 frames
Horizontal:	15.734kHz
Vertical:	59.94Hz
Shutter Speed (Auto/Manual):	1/2 to 1/30,000

Lens

Design:	Aspherical
Aperture:	f1.4
Focal Length:	3.4 to 119mm
3.4mm field of view:	55.8° (H) x 41.8° (V)
119mm field of view:	1.7° (H) x 1.3° (V)

Features

Automatic Gain Control:	Off, On with adjustable max. dB, Open Shutter
White Balance:	Auto, Manual
Line Lock:	Off, On with adjustable vertical phase
Freeze Frame:	Maintains static image on-screen during call up of Preset or Pattern
Home Position:	Dome assumes a specified Preset or Pattern after a time-out period (1 to 60 minutes)

Alarm Processing: ..... External (by controller)
Alarm Input States:..... Normally Open or Normally Closed
Alarm Input: ..... 4 Normally Open (NO) or Normally Closed (NC)
Auxiliary Output: ..... 3 Normally Open (NO) or Normally Closed (NC)
Diagnostic LEDs: ..... Power, communication, network type, and failure mode

On-Screen Text:

Appearance: ..... Choice of outline or no outline for text overlay; solid, or translucent white characters

Language:..... English, French, German, Italian, Portuguese, and Spanish

Password Protection: ..... 3 to 8 character, user-programmable, to prevent unauthorized access to programmable features

DirectSet Menu: ..... provides access to commonly used dome features when used with compatible controllers

Overexposure Protection — The camera shall have built-in circuitry to signal the lens to appropriately adjust the iris opening to prevent any damage to the camera when pointed directly at strong light sources, including the sun.

Electrical

Input Voltage:..... 18 to 30Vac, Class 2 LPS
Design Tolerance:..... 16 to 36Vac
Line Frequency:..... 50/60Hz
Power Consumption: ..... 11W maximum

Power-on In-rush current: 1.5A

Allowable Drop-out: 100µs

Surge Protection:

Video: ..... Low-capacitance Zener suppressor of 6.5V, 1500W

SensorNet/Manchester:..... Isolation transformer coupled, 2000Vrms; PTC resettable fuse protects transformer; 9.8V, 1A, 500W; 8/20µs impulse

RS–422/RS–485: ..... 10kA impulse rated gas tube

Alarm Input/ Auxiliary Output:..... TVS rated at 9.8V, 1A, 500W, 8/20µs impulse

Power Line: ..... TVS rated at 60V, 250A, 1.5 joules; 8/20µs impulse

Data and video shall utilize separate cables

Mechanical

Dimensions (includes base) (H x D): ..... 205mm x 120mm (8in x 4.7in)
Mounting : ..... pendant mounts for outdoor housing
Bubble (for Top Hat Mount): ..... Clear (f0)

Weight (Housing and Eyeball): ..... 1.09kg (2.40 lbs)
Weight (Base with I/O board): ..... 0.16kg (0.35 lbs)

Pan – Tilt Drive

Pan-Tilt Drive……Internal, powered by DC servo motors Or AC micro stepping motors

Environmental

Operating Temperature..... -10° to 50°C (14° to 122°F)
Humidity..... 0 to 95% RH (non-condensing)
Storage Temperature ..... -20° to 65°C (-4° to 149°F)

Regulatory

Emissions ..... FCC: 47 CFR Part 15, Subpart B Class A
CE: EN55022 Class B
CE: EN61000-3-2
CE: EN61000-3-3
AS/NZS 3548, Class A
CISPR22
ICES-003
Immunity ..... CE: EN50130-4
Safety..... UL: UL1950
CUL: CSA 22.2.950
CE: EN60950-1
IEC 60950-1

5.0 Camera Assembly Dome Enclosure

A dome enclosure supplied and produced by the same manufacturer of the camera assemblies shall be supplied as part of each item. The enclosure shall be an American Dynamics SpeedDome Ultra Outdoor Dome Housing Model ADSDUHOC. The enclosure shall be rated for outdoor environment use and meet or exceed NEMA 4 rating. The dome enclosure shall meet or exceed IP66 rating. Each camera assembly shall be installed within the dome enclosure. The enclosure shall be pendant mounted

and provided with a 1 ½" (38mm) diameter pipe fitting with NPT threads and all hardware required for attachment to the camera lower device and as shown on the plans. The dome housing shall be suitable for use in outdoor locations subject to extreme temperatures and wet conditions. The housing will incorporate a "twist-lock" mounting base to facilitate quick connection and disconnection of the dome housing/eyeball assembly.

5.1 Performance Specifications

- The outdoor dome housing will protect against water and dust intrusion and meet a minimum of NEMA-4 and IP66 ratings.
- The housing must include an outer sunshade and an inner aluminum housing with thermostat, heater, and fans to ensure protection and safe operation of the dome in temperatures of -40 °C to 50 °C (-40 °F to 122 °F) with a humidity range of 0–95% (non-condensing). The housing shall be constructed of reinforced fiberglass high impact polycarbonate material along with a UV stabilized sun shade trim ring and top cover.
- The housing must prevent the buildup of ice on the exterior bubble and be able to melt ice that has formed on the bubble during a power outage or other event within one hour of power being restored. The heater must be controllable via auxiliary outputs to aid in the clearing of moisture accumulation. The heater must be of a modular design, easily removable for servicing.
- The housing shall operate in sustained winds of up to 240 kph (150 mph) when properly mounted and installed on the pole.
- The housing and bubble shall have an Effective Projected Area (EPA) of approximately 125 square inches.
- The entire dome and housing will operate from a Class 2 power source requiring no more than 80 VA of power. The dome and housing shall be tolerant of 24 VAC supply voltages from 20 VAC to 36 VAC at 50/60Hz and be installed in accordance with Class 2 requirements.
- The housing must include an integral twist-lock I/O board to facilitate quick connect/disconnect of the dome from the housing. The housing shall incorporate "Euro-style" terminal screw connectors for ease of connection, and internal LEDs to verify proper power and communication status. The housing must provide four alarm inputs for use as alarm contacts and a Form C output rated at 30 volts AC or DC, 1 amp. The housing must provide for lightning and surge protection of the video, power, and communication lines.
- The housing shall include a clear bubble with no light loss. The bubble must be sealed with a gasket and secured with tamperproof screws. The appropriate security screwdriver bit must be provided with the housing.

<u>Mechanical</u>

Construction:

Enclosure .....Aluminum

Sun Shade/

Trim Ring/Top Cover	UV stabilized, polycarbonate
Color	Light gray
Height:	321 mm (12.64 in)
Diameter:	244 mm (9.61 in)
Bubble:	Acrylic
Bubble Diameter:	75.3 mm (6.93 in)
Weight:	
Without Dome	2.6 kg (5.72 lbs)
With Dome	3.8 kg (8.36 lbs)
Shipping Weight:	3.3 kg (7.26 lbs)
Mechanical Connection	1.5 in NPT
Mounting :	Outdoor Pole Mount

Electrical

Voltage	20–36 VAC, 50/60 Hz
Power	80 watts, maximum
Power-on In-rush Current	3 A
Surge Protection:	
Video	Series resistor of 3.9 Ω; low-capacitance Zener suppressor of 6.5 V, 1500 watts, 500 watts, 8/20 µsec impulse, 500 watts, 10 kA impulse rated gas tube
Manchester/SensorNet	Isolation transformer coupled, 2000 Vrms; PTC resettable fuse protects transformer; TVS rated at 5.6 V, 40 A, 0.1 joules, 8/20 µsec impulse, 500 watts, 10 kA impulse rated gas tube
RS-422	Series resistors of 33 Ω; TVS rated at 5.6 V, 40 A, 0.1 joules, 8/20 µsec impulse, 500 watts, 10 kA impulse rated gas tube
Alarm Inputs (4)	series resistors of 33 Ω; TVS rated at 5.6 V, 40 A, 0.1 joules, 8/20 µsec impulse, 500 watts, 10 kA impulse rated gas tube
Power Line	TVS rated at 60 V, 250 A, 1.5 joules, 8/20 µsec impulse, 500 watts, 10 kA impulse rated gas tube
Auxiliary Output	1000 V isolation Form 1-C relay
Allowable drop out:	150 ms

Environmental

Weatherproof Standard	NEMA 4/IP66
Operating Temperature	-40 °C to 50 °C (-40 °F to 122 °F)
Humidity	0–95% RH (non-condensing)
Storage Temperature	-10 °C to 50 °C (14 °F to 122 °F)
Wind Loading	Sustained winds of 240 km/hour (150 miles/hour) when properly installed and mounted (wall, pole, ceiling, and over-the-roof mount with proper support)
Effective Projected Area (EPA)	~125 square in (~317.5 square cm)

Regulatory

Emissions	FCC: 47 CFR Part 15, Subpart B Class A CE: EN55022 Class B CE: EN61000-3-2 CE: EN61000-3-3 AS/NZS 3548, Class A CISPR22 ICES-003
Immunity	CE: EN50130-4
Safety	UL: UL1950 cUL: CSA 22.2 No. 950 CE: EN60950 IEC950

5.2 The dome environmental enclosure shall be manufactured from high-quality acrylic substrate, aluminum, cell-cast or an approved equal. The enclosure shall be coated with an off-white, beige or gray finish, and outfitted with a sunshield to reflect direct rays from the sun from the control equipment within the housing without adversely effecting the optical qualities of the camera and lens. The sunshield shall have a means for dissipating heat to protect the camera from failing due to excessive sun exposure. The enclosure shall not allow external moisture to intrude the bubble of camera.

5.3 The bubble shall be constructed from high quality, clear, optically graded, thermoformed acrylic or approved equal. The bubbles shall be free of imperfections, scratches and blemishes. Tamper-proof hardware and a safety strap or lanyard shall be provided to attach the bubble assembly to the dome enclosure. A gasket seal shall be provided between the bubble and dome enclosure to prevent water and dust entry. All external connections shall be environmentally sealed. The dome and bubble enclosure shall not exceed 380

mm. in height. Sufficient protective packing material shall be provided by the manufacturer to prevent damage to any enclosure surfaces during shipping and handling.

5.4 A thermostatically controlled heater/defroster and blower circulation system shall be provided to maintain the temperature in the specified range and ensure clear viewing during cold weather operation. The heater shall turn on at a minimum 4°C and off at a maximum of 15°C (+ or -2.8°C) to maintain the specified range defined in Section 2.0. The blower shall operate continuously. The blower shall be rated for continuous operation. All heater and blowers shall be mounted to the non-rotating housing of the dome. The enclosure shall prevent ice formation on the exterior of the enclosure. The camera assembly shall capabilities to turn on or off the heater and blower systems by manual override from the operations center.

5.5 The enclosure shall provide easy access to the camera and pan-tilt unit and a quick release option to allow removal of the assembly.

5.6 The dome enclosure shall automatically restart camera operation upon restoration of power, video and data communications.

5.7 The camera and enclosure shall not experience any adverse operation during power fluctuations within the specified range.

6.0 Local Camera Controller

6.1 Means shall be provided to perform all camera control functions locally within the field equipment cabinet for each dome camera. Activation of local camera control shall disable remote camera control. The following shall be included to provide local camera control:

- A special purpose, RJ45 jack located in the input wiring panel within the traffic controller cabinet. The jack shall be wired for a minimum of three 3 pairs to provide for local control within the cabinet.

7.0 Camera Cable Assemblies

7.1 The Contractor shall furnish and install all cable and connectors, and make all connections between equipment as required to provide the specified operation. A camera cable assembly shall consist of a camera control cable carrying power for

the camera and control lines for the lens and pan-tilt operations, and a video cable that carries the video signal generated by the camera. Specifications of all cable assemblies, including connectors, shall be submitted to the Engineer as part of the shop drawings for review and approval.

7.2 The Contractor shall supply and install interconnection wiring between the camera assembly/Lowering Device and the equipment installed at the termination point in the traffic management system cabinet and Mini-hub.

7.3 The Contractor shall supply and install interconnection wiring between the camera assembly and the wiring panel assembly installed in the traffic management system cabinet. The twisted pair cable shall be Belden Part Number 9734. The twisted pair cable shall be an eleven- (11) pair 7x32 stranded conductor. The conductor shall be a 24 AWG with the wires made of TC – Tinned Copper. The insulation shall be Foam Polyethylene with an insulator diameter of 0.061 in. The cable shall meet operating temperature of –20 C to + 80 C with a maximum pulling tension of 180lbs. and a min. bending radius of 5.75 in. The cable shall meet NEC/UL CM, with UL flame test UL 1685 UL Loading.

7.3 The coax cable shall be Belden Part Number 7915A. The conductor shall be a Series 6 conductor with a solid stranding. The cable shall be 18 AWG with the conductor material being made of BC – Bare Copper. The conductor diameter shall be 0.040 in. The insulation shall be a gas injected Foam Polyethylene with an insulator diameter of 0.180 in. The outer shield shall be Duobond Plus™). The outer shield type shall be Tape/Braid/Tape. The tape shall be bonded aluminum foil-polyester tape – aluminum foil. The braid shall be aluminum. The tape shall cover 100% of the cable. The braid shall cover 77% of the cable. The outer jacket material shall be PVC – polyvinyl chloride. The overall nominal diameter shall be 0.275 in. The cable shall meet operating temperature of –40 C to + 80 C with a maximum pulling tension of 91lbs. with a min. bending radius of 5.75 in. The cable shall meet NEC/UL CM, with UL flame test UL 1685 UL Loading.

7.4 The Category 6 cable shall be an OSP Broadband branded cable part number BBDN6. The cable shall be 23 AWG with a Aluminum tape shield. The cable shall be suitable for direct buried applications. The Category 6 cable shall be run between the traffic management System cabinet to the camera lowering device.

7.5 The Camera assembly power cable shall be Belden Part Number 8628 7 conductor 14 AWG. The power cable shall be run between the Traffic management system cabinet to the camera lowering device.

7.5 All wiring shall conform to the camera assembly manufacturer's requirements. All DC logic control conductors shall be shielded from conductors carrying AC power to prevent electrical noise from interfering with control. The interconnect wiring shall be protected with surge suppression.

8.0 Spare Equipment

9.1 A minimum of one spare camera assembly shall be included for every three (3) camera assemblies provided. For example: If 3 cameras are installed, one (1) spare is provided. If 6 cameras are installed, two (2) spares are provided, etc.

9.2 The spare camera assembly shall be the same manufacturer and model provided for the camera assemblies installed on the poles.

9.3 The spare camera assembly shall include all necessary materials including but not limited to camera, enclosure, code converters, cables, power supply transformer etc. to replace any camera assembly requiring service.

9.4 The Contractor is allowed to use the spare camera assembly to replace defective camera assemblies during the equipment operations period. The Contractor shall replace the defective camera assembly at no additional cost to the Department.

9.5 The Contractor shall provide to the Department a properly operating spare camera assembly(ies) at the end of the equipment operations item.

10. Power Supply

10.1 The Contractor shall furnish and install power supply transformer for each camera assembly in the traffic management system cabinet and or traffic management system mini-hub cabinet rated for outdoor use and environmental.

10.2 Each power supply transformer shall be from the same manufacturer for each camera assembly item and certified by the manufacturer for compatibility with the camera assembly.

10.3 The power supply transformer shall be a variable voltage power supply providing a range between 18 VAC and 36 VAC to provide the correct operating voltage for each camera assembly installed to meet the camera manufacturer's specifications, camera assembly cabling and voltage drop from the camera assembly and the input wiring panel. The Contractor shall be responsible for adjusting the voltage output of the power supply transformer to each camera assembly to meet the camera manufacturer's operating voltage specifications.

10.4 The power supply transformer shall be UL rated and capable of being install in the wiring panel assembly in the traffic management system cabinet or traffic management system mini-hub cabinet as shown on the plans.

10.5 The power supply transformer shall be manufactured to prevent incidental shock in the event contact is made while installed and fully powered in the traffic management system cabinet or traffic management system mini-hub cabinet.

CONSTRUCTION METHODS:

1.0 Camera Assembly

1.1 All assemblies, including camera, lens, pan-tilt unit, enclosures and receiver/drivers, shall be assembled and factory tested prior to delivery to the job site.

1.2 The assemblies shall be delivered to the job site as complete units, and installed on the lowering device mount as shown on the plans or as directed by the Engineer. The camera assembly shall be mounted in such a way that all designated areas are available for viewing by operating the pan, tilt and zoom functions. The Contractor shall contact the Engineer to confirm mount for maximum or preferred view.

1.3 The Contractor shall provide the required mounting adapters and hardware required to attach the camera assembly to the lowering device. Pole-mounted adapters shall be electrically bonded to the support bracket and pole. Camera assemblies shall be electrically bonded to the mounting adapter.

1.4 The Contractor shall pay particular attention to protection of the camera assembly dome enclosure glass face during installation. It is important that any clear surfaces not be scratched or marred. If any damage is observed by the Engineer, the Contractor will be required to replace the affected equipment at no cost to the State.

1.5 The qualified integrator shall furnish and install the camera cables between the camera lowering device through the camera pole to the traffic management system cabinet.

1.6 The Contractor shall connect cables for each camera assembly to the appropriate power and data connections as shown on the plans and as required by the camera manufacturer.

1.7 The Contractor shall clean all equipment during installation as required by the manufacturer. This is especially important for clear surfaces which must be free of any static electricity that can attract dust. The Contractor shall coat the exterior side of any clear surfaces with a water-resistant chemical, if use of such chemical is approved by the manufacturer.

1.8 All programming for all camera assemblies shall be conducted by an Integrator that is certified by the camera manufacturer**.** The Contractor shall submit certified

integrator qualifications, including contact names and previous experience, to the Engineer as part of the catalog cut submittal.

1.9 The Integrator shall program each camera to fully utilize the capabilities of all programmable features to the satisfaction of the Engineer, including night time and other varying light conditions. The Integrator shall be responsible for coordinating the integration dates and times with the Engineer. The Integrator shall demonstrate to the Engineer that all programming features are included as specified.

1.10 The Contractor shall complete all camera programming at least two working days after the successful establishment of video and data communications between the camera site and the DOT Newington Highway Operations Center. The Contractor/Integrator shall contact the Engineer to coordinate the completion of all programmable features. Upon completion of the program features, the Contractor/Integrator shall record the program settings for each camera assembly and submit two copies to the Engineer for review and approval.

2.0 Local Camera Controller Installation

3.1 If a shelf-mounted local camera controller is used, the Contractor shall install the controller in the traffic cabinet and furnish and install all necessary cables to interface the camera controller with the junction box, video camera output signal and power source.

3.2 If a manufacturer's keyboard is used for local camera control, the Contractor shall be responsible for purchasing a keyboard that is utilized for programming and configuring camera operation. Use of the keyboards provided as part of this contract item will not be allowed.

3.3 The Contractor is responsible for the purchase and supply of a video monitor and any other equipment required for on-site programming, configuration and testing at no additional cost to the Department.

3.0 Camera Cable Assembly Installation

3.1 The Contractor shall supply and install all required interface cables between the camera assembly, lowering device, local camera controller, input panel and the power source. All cables shall be routed between the camera assembly via the inside of the camera pole or in a conduit as described in the lowering device and pole specifications. A ground wire shall be provided between the camera assembly and the traffic controller cabinet.

3.2 Wiring shall run continuous from source to destination. No splices will be allowed. Coaxial cables shall be installed without damaging the connectors, insulation or jacket. The coaxial cables shall not be kinked or bent tighter than the manufacturer's recommended bending radius. Sufficient slack cable shall be provided for equipment movement. All cabling shall be secured with tie-wraps and protected from physical damage. All interconnecting wiring and connectors shall meet all necessary standards with regard to voltage, current and environmental ratings. All electrical cable shall meet the requirements of the National Electrical Code. All communication terminations shall be terminated by the approved ITS integrator. A coax pigtail with copper conductors on one end and a BNC connector on the opposite end shall be supplied for connection to the camera lowering device.

4.0 Camera Assembly Tests

4.1 The Contractor shall be responsible for the provision of all testing and documentation required to obtain approval and acceptance of the production, installation and operation of these materials, equipment and the overall system. The Contractor shall test each camera assembly as shown on the plans as described herein or as directed by the Engineer.

4.2 The Contractor shall test all cables for continuity, short circuits or grounds. Tests on cables with connectors attached (connectorized) shall be performed after installation. The Contractor shall perform system integration testing to ensure that the video interface and camera interconnect wiring functions properly and complies with all relevant standards when used in operation with all other devices installed under this contract or the procurement contract.

- Verification of installation of specified cables and connections between camera assembly and the traffic controller cabinet.
- Local operation of all CCTV equipment, exercising the pan, tilt, zoom, focus, iris opening, shutter control, power on/off and all other functions described herein this specification while observing the video picture on a portable monitor.

- Demonstration of camera sensitivity at low light levels to meet the specified requirements.
- Demonstration of pan/tilt speed and extent of movement to meet the specified requirements.
- Measurement of video signal level at the field equipment cabinet with VM700 video testing equipment.
- Verify that video output from the camera is a 1-volt peak-to-peak, composite NTSC signal.
- Random test of at least two installed camera to verify camera enclosure environmental resistance.
- Preset test to ensure camera consistently goes to the proper preset position.

4.3 The integrator shall provide test reports for the category 6 cable and RG-6 coax cable installed to the top of the camera pole. The tests shall be done through the lowering device connections down to the TMSC or TMSMHC. Category 6 cable tests shall include length, Attenuation, Crosstalk (NEXT), Delay Skew, and Return Loss. RG-6 coax tests shall include HDTDR, Resistance, Length, Impedance, and insertion Loss. Any tests found to be outside RG-6 and CAT 6 standards will need to be remediated. Test results shall be submitted to the department before the start of the 30 day operational test.

4.4 Whenever any unit of equipment fails to pass the assembly tests, the Contractor shall correct the deficiencies, either by repair or replacement, at his expense (including freight costs) as required to comply with the testing requirements. Upon notification by the Contractor that the deficiencies have been corrected, the equipment shall be re-tested. All camera assembly testing and any re-testing shall be performed in the presence of the Engineer or his designated representative. The Contractor shall provide all test results to the Engineer in writing seven working days after the completion of each individual camera assembly test.

5.0 Factory Tests

5.1 All camera equipment furnished by the Contractor shall be tested and subjected to a nominal 72-hour burn-in period at the factory. The factory tests shall be in accordance with the manufacturer's standard procedures and quality assurance program.

5.2 The Contractor shall provide the Engineer with a copy of the manufacturer's test procedures and quality assurance procedures for information. If the Engineer determines that these procedures are not adequate, the Engineer may require that the Contractor conduct additional tests prior to installation. The Contractor shall provide documentation certifying and showing that each item supplied has passed factory inspection, burn-in and testing.

6.0 Central Control Tests

6.1 The central control tests shall demonstrate that all equipment furnished by the Contractor has been installed properly and operates as a fully functional CCTV surveillance system using the existing ConnDOT video camera control system. Prior to initiating the central control tests, all camera assembly tests specified in (a) herein shall have been successfully conducted by the Contractor in the presence of the Engineer or his designated representative.

6.2 In the event that any Contractor-provided component of the CCTV surveillance system malfunctions or operates below the level specified, the Contractor shall be required to determine and correct the problems, including repair or replacement of equipment, at no cost to the Department. The Contractor shall respond with a qualified technical representative on site to determine and correct any problems within 24 hours following notification by the Engineer. The central control tests shall resume upon correction of the problem. In the event a malfunction is the result of equipment not installed by the Contractor (e.g., power service, etc.), the central control tests will be suspended until these problems are corrected by others.

7.0 Daytime Tests

7.1 All central control and monitoring equipment shall be tested from the ConnDOT Newington Highway Operations Center facility during daytime hours. The Contractor shall contact the Engineer to arrange and coordinate the testing procedure. The tests shall include, but not be limited to the following:

- Operation of all newly installed camera assemblies from the central controller, exercising the pan, tilt, zoom, focus, presets, iris opening and all other functions and features described herein this specification while observing the video picture on the local monitor.

- Display of each camera on a designated video monitor to verify proper operation and picture quality from each camera.

7.2 The Contractor shall correct any operational problems encountered with the video camera system during this test.

8.0 Nighttime Tests

8.1 A second central control test shall be performed during the hours of darkness to verify proper operation of the auto iris lenses, shutter control and the absence of video signal noise. This test shall be conducted in the presence of the Engineer or

his designated representative at the Highway Operations Center. The test shall include the following as a minimum:

- Operation of all newly installed camera assemblies from the central controller, exercising the pan, tilt, zoom, focus, presets, iris opening and shutter control functions while observing the video picture on the local monitor.

- Display of each camera on a designated video monitor to observe both the brightest and darkest scenes available from each camera location.

8.2 The Contractor shall correct any operational problems encountered with the video camera system during this test.

9.0 Additional Tests

9.1 Upon successful completion of the installation test and approval by the Engineer, a 30-day System Operational Test for each TMSC site shall commence. During the course of this test, the system must function continuously in accordance with the specifications for the duration of the test. If a malfunction occurs within the stated time frame, the Contractor shall make all necessary repairs to the system and re-establish proper operation. Upon approval of the Engineer, the 30-day test will begin anew. The system must operate for a full thirty (30) consecutive days without malfunction before the system will be accepted by the Engineer. The Contractor shall refer to "Notice To Contractor – 30 Day System Operational Test" for additional testing requirements. The Contractor shall coordinate the 30-day System Operational Test with other pertinent items in this contract.

10.0 Warranty

10.1 All equipment supplied under these items shall be warranted for parts by the manufacturer against defects and failures, which may occur through normal use for a period of one (1) year from the date of installation. A copy of the warranty shall be presented to the Engineer before installation of the equipment.

METHOD OF MEASUREMENT:

The work to be measured for payment under this item shall be the number of Camera Assemblies of the type specified, installed, completed, tested and accepted.

BASIS OF PAYMENT:

This work shall be paid for at the contract unit price for each "Camera Assembly" of the type specified, which price shall include all equipment including camera, lens, dome pan-tilt mechanism, enclosures, receiver/drivers, local camera controller, power supply, spare camera equipment, interconnect wiring, mountings, cabling and connectors, testing, testing equipment and all labor, materials, tools, equipment, transportation, storage and other incidentals necessary to complete the work.

Pay Item	Pay Unit
Camera Assembly	ea.

ITEM #1112216A - CAMERA LOWERING DEVICE ASSEMBLY – TYPE A

Description:

Work under this item shall consist of furnishing and installing a camera lowering system on a steel pole of the height specified on the plans. The camera lowering device and camera pole shall be fabricated in accordance with the details shown on the plans, in accordance with these specifications and as ordered by the Engineer and shall be mounted on a prepared foundation.

Materials:

The camera lowering system shall be designed to support and lower a simultaneous Dual analog and IP closed circuit television camera, lens, housing, PTZ mechanism, cabling, connectors and other supporting field components without damage or causing degradation of camera operations. The lowering system shall consist of a 85' camera pole, suspension contact unit, divided support arm, and a pole adapter for attachment to a pole top tenon, conduit mount adapter, pole top junction box, and camera connection box. **The construction of the camera lowering device shall be the [MG]² Model CLDMG2-HYPIP6+7-XXX(ST)**

CAMERA POLE

The pole may be round or may have 16 or more sides. It shall be of the diameter specified on the plans. If a multi-sided pole is chosen, the distance between outside faces of parallel sides shall be the same dimension as the specified outside diameter of the round pole. Both shall be tapered from top to bottom as shown on the plans.

The pole, base plate, top plate, tenon, tenon plate and handhole frames and covers shall be made of steel with minimum yield strength of 36,000 psi. All steel pole sections shall be of the same grade. The yield strengths of the plates welded to the pole at the top and bottom may be different than the yield strength of the pole.

Charpy V-notch sampling is required for the pole and base plate regardless of material thickness. The testing shall conform to AASHTO T 266 (ASTM E23). The minimum energy absorbed shall be as follows:

- 15 ft-lb at +40 degrees F for steel with a specified yield strength of 50 ksi and lower
- 15 ft-lb at -20 degrees F for steel with a specified yield strength greater than 50 ksi and equal to or less than 70 ksi.

High strength bolts shall conform to ASTM A325, Type 1. Nuts shall conform to ASTM A563-DH, zinc coated or ASTM A194, Grade 2H, zinc coated as specified in ASTM A325. Washers shall conform to ASTM F436, zinc coated. Compressible washer-type direct tension indicators may be used and shall conform to ASTM F959 Type 325.

Stainless steel bolts shall conform to ASTM A193, series 300.

Chain for connecting the handhole cover to the handhole shall be stainless steel of sufficient strength to support the weight of the cover.

Where "Silicone Joint Sealant" is specified on the plans, a primer will also be required for proper adhesion of the joint sealant to the steel. The following Primer and Silicone Joint Sealant or approved equals shall be used:

> Dow Corning 1200 Prime Coat and Dow Corning 790 Silicone Building Sealant, manufactured by the Dow Corning Corporation, Midland, Michigan 48686-0994.

All steel components shall be completely hot-dip galvanized, after fabrication, in accordance with AASHTO M111 (ASTM A123) and AASHTO M232 (ASTM A153) as applicable.

Mechanical galvanizing of bolts shall conform to ASTM B695, Class 50.

Zinc-rich field primer for touch up shall conform to the requirements of ASTM A780. The use of aerosol spray cans will not be permitted. The color of the primer shall match the color of the galvanized surface as nearly as possible. Areas that do not match shall be recoated with the correct color primer at no additional expense to the State. Aluminum paint will not be allowed.

Closed cell elastomer for sealing handhole covers and for sealing the space between the foundation and base plate shall conform to ASTM D1056, Grade 2A2 or 2A3 and shall have a pressure-sensitive adhesive backing on one side for adhesion to steel. Closed cell elastomer contained within the anchor bolt pattern shall not interfere with the anchor rod leveling nuts and shall not block the opening in the base plate.

Certified test reports and Material Certificates will be required in accordance with Article 1.03.07 for hot-dip galvanizing to specify galvanizing has been tested and performed in accordance with AASHTO M111 (ASTM A123). Certified test reports and Material Certificates will be required for all structural steel components.

Tenon Design Requirements:

The Contractor is responsible for the design and details of the tenon and tenon plate at the top of the camera pole, the connection of the tenon plate to the pole top plate and all connections and openings required to attach and operate the lowering device. He shall coordinate the design of the tenon and tenon plate with Section - 2 Camera Lowering Device Assembly, of this specification. Dimensions and details shown on the plans are for the purpose of establishing a detailing concept for the connection of the tenon plate to the pole.

The design and fabrication of the tenon and tenon plate, shall conform to the requirements of AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals – 2001 (Fourth Edition), including the latest interim specifications. The Contractor shall incorporate the following information into the design:

- The design wind speed shall be 120 mph. The computation of wind pressures in accordance with Appendix C is not permitted.
- The minimum design life shall be 50 years.
- The structure shall be designed for fatigue category I and for the wind load effects due to natural wind gusts. Vibration mitigation devices are not permitted.
- The minimum thickness of the pole tenon shall be ¼".
- The minimum thickness of the tenon plate shall be 3/8".

Shop Drawings:
Prior to fabrication, the Contractor shall submit shop drawings to the Engineer for review in accordance with Article 1.05.02. Drawings shall be submitted for each camera pole to be installed. **Data for multiple sites may not be presented in a table and submitted along with "typical" details.** An identifier for each pole is noted on Site Plans or Location Plans and shall be used to identify each set of drawings and computations.

Shop drawings shall be submitted on 11" x 17" (Ledger/Tabloid) sheets with an appropriate border and title block. Procedures and other supporting data shall be submitted on 8 ½" x 11" (Letter) sheets. Electronic submissions of portable document files (.pdf) are acceptable.

Deviations from any criteria noted on the plans or in this specification will not be considered for approval unless a request for change is submitted in writing to the District Engineer. Requests for change should be submitted and approved before preparing shop drawings. The request should include a reason for the proposed change. Shop drawings that do not conform to the contract plans and special provisions and prepared without written permission for the change may be rejected. Such a rejection gives no cause for a delay claim.

The shop drawings for each site shall contain the following information:

- The project number, town and camera pole identification number or Site Number
- Overall pole height and height of each pole section
- Cross sectional shape of pole (round or specify number of sides)
- Outside distance between parallel faces and width of flats at the top and bottom of each pole section (if member is multi-sided)
- Inside bend radius at angle points, if multi-sided member
- Wall thickness of each pole section
- Connection of pole to base plate (fillet welded socket connection or full penetration groove weld with a continuously welded backer bar). The following criteria shall be addressed:
    - The fabricator shall cut inside the specified opening in the base plate and grind to match the outside dimension of the pole.
    - The separation between the base plate and the pole within the socket shall not exceed 1/16" in order to assure sufficient fillet weld as specified in AWS D1.1, Section 5.22, "Tolerance of Joint Dimensions."

- Groove welds at the base of poles less than 5/16" thick shall be ultrasonically tested in accordance with AWS D1.1, Annex K, as specified in Article 6.20.1. A 5/16" thick wall thickness may be substituted at no extra charge to avoid the need to use Annex K for full penetration weld inspection procedures
- Details and location(s) of the longitudinal seam welds in the pole, including designation of the penetration depth of the welds at the pole ends and within the length of the pole
- Welding process, electrodes, weld designations and non-destructive testing requirements
- Length of slip type field splice
- Diameter or distance across flats at the top and bottom of each pole section. Adequate tolerance should be allowed for the thickness of galvanizing, so the slip type field splice is adequate.
- Details of reinforced handholes and covers and their location on the pole (both vertical and angular orientation)
- Locations and diameters of holes in the pole wall for traffic flow monitor cables
- Tie-offs, grounding lug hole and other attachments
- Base plate details, including length, width and thickness, as well as anchor rod holes and other openings.
- A plan view of the pole and base plate showing the orientation of the anchor rod holes in relation to the hand hole at the base of the pole
- Pole top plate details, including length, width and thickness, as well as bolt holes and other openings
- Tenon and tenon plate, including length, width and thickness of tenon plate, as well as tie-offs, bolt holes and other openings. Coordinate dimensions with the manufacturer of the lowering device
- A copy of camera lowering device assembly support arm and pole connection details (to show compatibility with tenon)
- Material specifications for all components
- Minimum Charpy impact values for the steel pole and base plate
- Fabrication details of all components, including method of fabrication, when applicable
- Galvanizing requirements

Working Drawings:
Prior to fabrication, the Contractor shall submit erection drawings to the Engineer for review in accordance with Article 1.05.02. An individual set of drawings shall be prepared for each height camera pole.

Working drawings shall be submitted on 11" x 17" (Ledger/Tabloid) sheets with an appropriate border and title block. Design computations, procedures and other supporting data shall be submitted on 8 ½" x 11" (Letter) sheets.

The working drawings and design computations shall be sealed by a Professional Engineer, licensed in the State of Connecticut, who shall also be available for consultation in interpreting his computations and drawings, and in the resolution of any problems which may occur during the performance of the work. Please note that each working drawing must be sealed.

Erection drawings shall include the following:

- The project number, town and camera pole identification number
- Overall pole height and location of slip type field splice
- Pole installation and erection procedure, including
  - lifting weight
  - crane size and placement
  - location where pole will be assembled
  - method of pulling pole sections together
  - proposed sequence of conduit and cable installation in pole, cable tie-off, etc.
  - method of lifting pole (including strongbacks, if required)
  - method of securing the base during tilt-up
  - proposed orientation of arm and handhole relative to traffic
  - method of turning pole to the proposed orientation
  - placement of elastomeric seal inside anchor rod circle
  - method of positioning leveling nuts in preparation for setting the pole (include minimum and maximum clear space between leveling nuts and foundation)
  - anchor rod and nut lubrication requirements
  - anchor rod nut tightening sequence, including degree of tightening

Bolting pole sections together to secure them during erection and lifting holes in the steel pole will not be permitted and may be cause for rejection of the pole. A suggested pole erection sequence is included in the camera pole plans.

CAMERA LOWERING DEVICE ASSEMBLY

The lowering system shall consist of a suspension contact unit, divided support arm, and a pole adapter for attachment to a pole top tenon, conduit mount adapter, pole top junction box, and camera connection box. **The construction of the camera lowering device shall be the [MG]² Model CLDMG2-HYP**IP6+7-XXX(ST)

The divided support arm and receiver brackets shall be designed to self-align the contact unit with the pole centerline during installation and ensure that the contact unit cannot twist under design wind conditions.

Round support arms are not acceptable.

The camera lowering device shall be designed in accordance with AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals – 2009 (Fifth Edition), including the latest interim specifications.

The lowering device manufacturer shall furnish independent laboratory testing documents certifying adherence to the stated wind force criteria identified in the CAMERA POLE section below utilizing, as a minimum, the effective projected area (EPA), the actual EPA or an EPA greater than that of the camera system to be attached.

The camera lowering device to be furnished shall be the product of the manufacturers with a minimum of two (2) years of experience in the successful manufacturing of such systems. The lowering device provider shall be able to identify a minimum of three (3) previous projects where the proposed system has been installed successfully for over a one-year period of time each.

Suspension Contact Unit

The suspension contact unit shall have a load capacity 600 lbs. with a 4 to 1 safety factor.

There shall be a locking mechanism between the fixed and moveable components of the lowering device. The movable assembly shall have a minimum of 2 latches. This latching mechanism shall securely hold the device and its mounted equipment. The latching mechanism shall operate by alternately raising and lowering the assembly using a winch and lowering cable. When latched, all weight shall be removed from the lowering cable. The fixed unit shall have a heavy duty cast tracking guide and means to allow latching in the same position each time. The contact unit housing shall be weatherproof with a gasket provided to seal the interior from dust and moisture.

The prefabricated components of the lift unit support system shall be designed to preclude the lifting cable from contacting the power or video cabling. The lowering device manufacturer shall provide a conduit mount adapter for housing the lowering cable. This adapter shall have an interface to allow the connection of a contractor-provided 1.25 inch PVC conduit and be located just below the cable stop block at the back of the lowering device. The Contractor shall supply and install the internal conduit in the pole as required by the Engineer and/or lowering device provider. **The only cable permitted to move within the pole or lowering device during lowering or raising shall be the stainless steel lowering cable. All other cables must remain stable and secure during lowering and raising operations.**

The female and male socket contact halves of the connector block shall be made of a UL94, V-0 rated thermosetting synthetic rubber. The female barrel contacts and the male pin contacts shall be permanently and integrally encased in this rubber material to ensure optimum protection from moisture and the environment.

All current carrying male pin and female socket/barrel contacts shall be Gold-plated per ASTM B-488 over Nickel plated CA 360 per QQ-N-290m.

The DUAL Analog/Ethernet configuration contact connector shall include:

(7) specifically designed Male contacts sized a minimum of 0.125 inches while the female contacts shall be at least 0.125 inches I.D. at the contact area. All (7) contacts shall be soldered to #18/1 UL lead wire and affixed with numbered tags. Two of these wires shall be equipped with a factory installed BNC connector for video transmission/connection from the CCTV.

(13) specifically designed Male contacts sized a minimum of 0.09 inches while the female contacts shall be at least 0.09 inches I.D. at the contact area. Eight of the thirteen contacts shall be soldered to CAT5e Wire end terminated with an RJ45-Male connector. Five of the thirteen contacts shall be soldered to #18/1 UL lead wire and affixed with numbered tags, which may be used for additional camera requirements including but not limited to power, control, alarms or grounds.

All current carrying male pin and female socket/barrel contacts shall be Gold-plated per ASTM B-488 over Nickel plated CA 360 per QQ-N-290m. Each individual female barrel contact shall have a Nickel plated CA 360 sleeve which prevents foreign matter from entering the contact area as well as preclude the possibility of the leaves of the female contact from opening beyond allowable limits and ensure a snug fit around the respective male pins. There shall be at least one contact that is positioned in a manner which will allow it to make first and break last providing optimum grounding performance.

All soldering shall be per IPC J STD-001E. Each individual contact shall be rated for up to 600v and 7A but de-rated according to the wire used in the application. For optimum weatherproofing, each male shall be self-wiping with a shoulder at the base of each male contact so that it will recess into the female block, thereby giving a rain-tight seal to each individual contact when mated. Further, the wire leads from both the male and female rubber contact blocks shall be permanently and integrally molded in the synthetic rubber body. The facility manufacturing the electrical contact connector must comply with Mil Spec Q-9858 and Mil Spec I-45208.

Spare Equipment

A minimum of one spare camera lowering device assembly without camera pole shall be supplied .

The spare camera lowering device assembly shall be the same manufacturer and model provided for the camera lowering device assembly installed within the project limits.

The spare camera lowering device assembly shall include all necessary materials including but not limited to camera lowering device, camera junction box, cables, etc. to provide a complete working lowering device assembly.

The spare camera lowering device assembly shall be delivered to Newington Headquarters, 2800 Berlin Tpke, Newington, CT. Delivery to be coordinated with Robert Kennedy, Highway Operations (860-594-3458) at least 48 hours prior to delivery.

Camera Junction Box

The camera junction box shall be of two piece clamshell design with one hinge side and one latch side to facilitate easy opening. The general shape of the box shall be cylindrical to minimize the EPA. The Camera Junction Box shall be cast aluminum with stabilizing weights

on the outside of the box to increase room on the interior. The box shall be capable of having up to 40 pounds of stabilizing weights. The bottom of the Camera Junction Box shall be drilled and tapped with a 1-1/2" NPT thread to accept industry standard dome housings and be able to be modified to accept a wide variety of other camera mountings. The junction box shall be gasketed to prevent water intrusion. The bottom of the box shall incorporate a screened and vented hole to allow airflow and reduce internal condensation. If utilizing a CCTV dome housing, it must be furnished from the camera factory with an epoxy sealed connection flange at the point of connection of the dome to the CLD junction box to ensure that there is no moisture migration from the CLD junction box into the dome.

Pulleys

All pulleys for the camera lowering device and portable lowering tool shall have sealed, self-lubricated bearings, oil tight bronze bearings, or sintered bronze bushings.

Cables and Connectors

The lowering cable shall be a minimum 1/8" diameter stainless steel aircraft cable with a minimum breaking strength of 1740 pounds with (7) strands of #19 wire each.

All electrical and video coaxial connections between the fixed and lowerable portion of the contact block shall be protected from exposure to the weather by a waterproof seal to prevent degradation of the electrical contacts. The electrical connections between the fixed and movable lowering device components shall be designed to conduct high frequency data bits and one (1) volt peak-to-peak video signals as well as the power requirements for operation of dome environmental controls.

The Power/Signal cable provided by the contractor/camera provider per the requirements of the camera shall be in the lengths as noted on the plans for each camera site. See Item No. 1112210A Camera Assembly for requirements pertaining to the camera power/signal cables. Further, the power signal cable shall be delivered to the lowering device manufacturer and prewired to the lowering device at the lowering device manufacturer prior to arrival at the jobsite. The coaxial video connection for the CCTV Camera shall be made from twisted pair to BNC with a manufactured off-the-shelf connector.

Other Materials

The interface and locking components shall be made of stainless steel and or aluminum. All external components of the lowering device shall be made of corrosion resistant materials, powder coated, galvanized, or otherwise protected from the environment by industry-accepted coatings to withstand exposure to a corrosive environment.

The Camera Manufacturer shall provide weights and /or counterweights as necessary to assure that the alignment of pins and connectors are proper for the camera support to be raised into position without binding. The lowering unit will have sufficient weight to disengage the camera and its control components in order that it can be lowered properly.

The Camera Manufacturer shall provide the power and signal connectors for attachment to the bare leads in the camera junction box.

The Camera Manufacturer shall provide a mounting flange sufficient for mounting their respective camera assembly to a standard 1.5 inch NPT female, or other suitable method approved by the Engineer, at the bottom of the Camera connection box.

Lowering Tool

The camera-lowering device shall be operated by use of a portable lowering tool. The tool shall consist of a lightweight metal frame and winch assembly with cable as described herein, a quick release cable connector, an adjustable safety clutch and a variable speed industrial duty electric drill motor.

This tool shall be compatible with accessing the support cable through the hand hole of the camera pole. The lowering tool shall attach to the pole with one single bolt. The tool will support itself and the load assuring lowering operations and provide a means to prevent freewheeling when loaded.

The lowering tool shall have a reduction gear to reduce the manual effort required to operate the lifting handle to raise and lower a capacity load. The lowering tool shall be equipped with a positive locking mechanism to secure the cable reel during raising and lowering operations. The lowering tool shall be provided with an adapter for operating the lowering device by a portable drill using a clutch mechanism.

The lowering tool should be capable of lowering and raising the camera assembly for a 70’ pole within a five-minute time period.

Construction Methods:

CAMERA POLE

The Contractor is responsible for reviewing the site conditions at each pole location as soon as possible. The Contractor shall immediately notify the Engineer of concerns such as conflicts with overhead utilities, trees, the presence of drainage swales, buried facilities, etc. that could make installation undesirable, extremely difficult or even impossible.

Pole Fabrication

A maximum of one telescopic, slip-type field splice is permitted in the pole. The minimum length of this splice shall be 1.5 times the inside diameter of the exposed end of the female section.

Poles shall be fabricated in accordance with the dimensions and tolerances listed in ASTM A595. Each pole will be inspected for straightness at the fabrication shop and again upon delivery to the site where it will be installed. Deviations from the allowable tolerance are cause for rejection.

The pole top plate shall have slotted holes that allow field adjustment of the arm/camera orientation up to 360 degrees. A tenon shall be welded to a separate tenon plate - NOT to the pole top plate. The tenon plate shall be bolted to the pole top plate. The tenon shall have standard size mounting holes as shown on the plans for the mounting of the camera-lowering device assembly. The tenon shall be of dimensions necessary to facilitate camera lowering device component installation. A slot in the tenon shall be parallel to the pole centerline as shown on the plans for mounting the lowering device.

Traffic appurtenances shall be located and mounted on the pole as shown on the Traffic Flow Monitor (TFM) plans. A ½" diameter hole shall be located on the traffic side of the pole 12" above the detector, whose height is noted on the TFM plans. A rubber grommet shall be installed in the hole to protect the wire from chafing and to prevent moisture from entering.

A handhole of the size detailed on the plans shall be placed at the level of the ½" diameter TFM monitor cable hole facing away from oncoming traffic.

Handhole Requirements:

- The camera pole shall have handholes that are detailed and located as shown on the plans.
- The handhole shall be provided with a cover connected to the frame with stainless steel bolts.
- A neoprene gasket shall be adhered to the inside of the handhole cover such that the gasket makes contact with the frame and seals the opening against intrusion of water.
- The cover shall be attached to the frame with stainless steel bolts as shown on the plans. Coupling nuts shall be welded to the inside face of the handhole frame to receive the handhole cover bolts. The cover shall be trial-fitted in the shop before being galvanized. All bolts shall be threaded into the coupling nuts simultaneously and the cover shall fit tightly to the handhole frame with the elastomeric seal in place.
- A stainless steel chain shall connect the handhole cover and the handhole frame.
- The handhole frame shall accommodate a winch-anchoring bolt to secure the lowering device attachment. A drilled and tapped hole is specified on the plans. The female threads shall be re-tapped after galvanizing, if necessary, for compatibility with the bolt.
- The exposed edges of the handhole shall be ground smooth and rounded by grinding.

Welding Requirements:

All welding shall conform to the following requirements:

- Department Welding Inspector shall be present during welding. At no time will welding of the pole and base plate and welding of the handhole frame to the pole be permitted without oversight by the Department Welding Inspector.
- AWS D1.1 Structural Welding Code - Steel as supplemented by Section 12 of AASHTO/ANSI/AWS D1.5 Bridge Welding Code.
- The pole members may be fabricated with no more than 2 longitudinal seam welds.
- The longitudinal seam welds for the pole members shall have 60% minimum penetration, except longitudinal seam welds within 6" of the member ends shall be complete joint penetration groove welds. At the slip-type splice, the longitudinal seam welds on the female section of telescopic splices shall be complete penetration groove welds for a length equal to 1.5 times the inside diameter of the exposed end of the female section plus 6".
- A minimum of 25% of the partial joint penetration seam welds and 100% of the complete joint penetration seam welds shall be non-destructively tested.
- Partial joint penetration seam welds shall be non-destructively tested in accordance with the magnetic particle method.
- Complete joint penetration seam welds shall be non-destructively tested in accordance with the ultrasonic method.
- Poles: the pole-to-transverse base plate connection may be made with a fillet welded socket connection with two fillet welds or a complete joint penetration groove weld with a backing ring attached to the plate with a continuous fillet weld.
- If a complete joint penetration groove weld is chosen for tube walls less than 5/16" thick, ultrasonic testing of the weld shall be performed in accordance with Annex K of AWS D1.1, as specified in Article 6.20.1.
- 100% of complete joint penetration groove welds shall be non-destructively tested by the ultrasonic method.
- 100% of fillet welds shall be non-destructively tested by the magnetic particle method.
- The joint between the backing ring and tubular member shall be sealed with silicone sealant at the top of the backing ring.

All welding, drilling of holes and any other fabrication practices that would damage the galvanized coating shall be completed prior to galvanizing the post.

After the post has been completely fabricated, welds ground smooth, flux and spatter removed, they shall be hot-dip galvanized in accordance with AASHTO M111 (ASTM A123). All pieces shall be galvanized in a single dip. Double-dipping will not be accepted.

All damaged areas of the galvanizing shall be properly prepared and touched-up. "Damaged" does not include mishandling or deliberate welding or drilling. Such deliberate destruction of the galvanized finish may be cause for rejection of the member. Damaged zinc shall be touched-up in accordance with ASTM A780. Spray aerosol cans of zinc rich primer will not be permitted.

Zinc paint shall match the color of the galvanizing as nearly as possible. The Engineer may order additional touch-up if he deems it appropriate. Aluminum paint will not be permitted.

Fabricated materials shall be packed with sufficient dunnage and padding to protect finished surfaces. Poles shall be stored in a manner that does not dent or permanently bend the wall of the pole or permanently bend the pole along its axis.

Pole Installation

See the camera pole drawings for a suggested erection procedure. The Contractor is fully responsible for developing a workable erection procedure.

The Contractor is responsible for the proper orientation of the camera pole and arm. The station and offset of the pole shall be as shown on the CCTV\TFM plans or as directed by the Engineer.

The camera pole shall be electrically grounded by attaching one end of a bare copper grounding conductor to the ½“ ground tap using an exothermic weld. The rigid metal conduit shall be electrically grounded by passing the ground conductor through an insulated bonding bushing attached to the conduit. The conductor shall terminate at the ground lug connection at the handhole.

Ensure that the handhole covers are securely installed before leaving the pole unattended.

In the void between the top of the concrete foundation and underside of the base plate a ring of closed cell elastomer shall be placed to seal the opening in the base plate completely. Closed cell elastomer shall fit inside the anchor bolts, but allow clearance for tightening. The elastomer shall be compressed approximately 10% to 20% when the base plate is in its final position.

The following installation procedure is critical to preventing fatigue failure of the anchor rods with UNC threads:

1. The anchor rod double leveling nuts shall be pre-set to expose as few threads as possible below the nuts, while forming a level line in all directions across the top of the top leveling nuts. A sufficient number of threads should be exposed below the leveling nuts to allow the nuts to be adjusted when plumbing the installed pole. The installation will be considered unacceptable if 1 ½” or more of threads are exposed below the bottom nut.
2. The anchor rod leveling nuts and washers shall be in full contact with the bottom surface of the base plate when the centerline of the pole is plumb.
3. Once the leveling nuts have all been brought into full contact with the bottom of the base plate, the nuts above the base plate may be tightened to snug-tight. Snug tight is equivalent to the full effort of a workman on a 12” wrench.
4. The nuts shall then be turned an additional one-third turn beyond snug-tight.
5. The leveling nuts shall be retightened to ensure that full contact has been made.
6. Bring all double nuts in contact with the tightened nuts and turn until snug-tight.

Note: Nut rotation is relative to the anchor rod. The tolerance is plus 20 degrees.

The camera lowering device assembly shall be installed according to the manufacturer’s specifications. The camera will be installed after the pole has been erected. To facilitate the

camera installation, lower the control cable to the ground, attach the camera and raise it into position.

CAMERA LOWERING DEVICE ASSEMBLY

The Contractor shall install the lowering device and pole on the span pole foundation in the location(s) as shown on the plans.

The Contractor shall utilize an authorized representative from the lowering device manufacturer to assist with the assembly and testing of the first lowering system onto the pole assembly. The manufacturer shall furnish the Engineer documentation certifying that the electrical contractor has been instructed on the installation, operation and safety features of the lowering device. The contractor shall be responsible for providing applicable maintenance personnel "on site" operational instructions.

The Contractor shall install two (2) - 1.25 inch PVC conduits inside the camera pole between the tenon assembly and camera pole handhole. One conduit will be installed to contain the stainless steel aircraft lowering device control cable. The second conduit will be used to contain the twisted pair camera control, category 6 cable, and coax video cable. The camera control cable shall be contained inside of the 1.25 inch PVC conduit and the camera coax video cable shall be secured with plastic cable ties to the outside the PVC conduit. The TFM communication cable shall not be contained inside a PVC conduit.

The Contractor shall be responsible for installing and coordinating the CCTV and TFM cables between the lowering device and the pole installation per the manufacturer's recommendations. All Contractor personnel involved in terminating communication cables for the above listed items shall meet or exceed the above referenced installation qualifications and shall be approved by the Office of Highway Operations. See the special provision "Notice to Contractor – Installation Qualifications".

The Contractor shall contact the Engineer prior to installation of each lowering device assembly to determine the appropriate pole top tenon angle to use for optimum camera visibility. The Contractor shall then adjust the angle of the lowering device and pole top tenon as required.

The Contractor shall connect all power, video and data cables as required to fully operate the lowering device and camera assembly.

The camera lowering device assembly shall be mounted on the Camera Pole as dictated by the camera lowering device installation manual and the onsite representative. The lowering device assembly components, wiring and cabling shall be tested for proper signal continuity prior to installation of the pole on the foundation supports and anchor bolts.

Upon completion of the pole installation on the foundation, the unit shall be tested with a replica of the actual CCTV unit for the lowering device system functionality. The system shall be tested in the presence of the manufacturer's representative and Engineer.

Method of Measurement:

This work will be measured for payment by the number of camera lowering device and steel camera pole assemblies of the height specified, furnished, installed, tested, completed and accepted in place.

Basis of Payment:

This work will be paid for at the contract unit price each for "Camera Lowering Device Assembly – Type A", complete in place, which price includes the steel camera pole, tenon, base plate and all attachments, camera lowering device assembly, PVC conduit, suspension contact unit, pulleys, cables, connectors, lowering tool, spare equipment, and all equipment, materials, coordination, design, fabrication, tools, labor testing, manufacturer representation and incidentals thereto.

Anchor rods, nuts, and washers and anchor plates will be included for payment in the item "Traffic Control Foundation Span Pole – (Type D)." The foundation type shall be as indicated on the plans.

Pay Item	Pay Unit
Camera Lowering Device Assembly – Type A	ea.

ITEM #1112241A - FIBER OPTIC CABLE SPLICE ENCLOSURE

Description:

This Item shall consist of furnishing and installing splice enclosures to interconnect optical fibers between two or more fiber optic cable segments.

Materials:

A. Applicable Publications

1. Publications listed below form a part of these specifications to the extent referenced. The publications are referred to in the text by basic designation. All Fiber Optic Communication System hardware shall be compliant with the following specifications: Electronics Industries Association (EIA):

   a. TIA-526-3-89 Fiber Optic Terminal Equipment Receiver Sensitivity and Maximum Receiver Input.
   b. TIA-455-32A-90/Fiber Optic Circuit Discontinuity.
   c. EIA-310-C Racks, Panels, and Associated Equipment.
   d. EIA-359-A Colors for Color Identification and Coding.
   e. EIA-TIA-455-A Standard Test Procedures for Fiber Optic Fibers, Cable Transducer Sensors, Connecting and Terminating Devices and Other Fiber Optic Components.
   f. EIA-455-6B Cable Retention Test Procedure for Fiber Optic Cable Interconnecting Devices.
   g. TIA/EIA–598–A Optical Fiber Cable Color Coding.

B. Fiber Optic Splice Enclosure

1. The Splice Enclosures shall accommodate from 60 to 168 fiber splices. Each splice enclosure shall have a splice tray organizer capable of holding 12 to 18 splice trays. The organizer shall provide access to and removal of individual splice trays and permit selective splicing to allow one or more fibers to be cut and spliced to branch cable(s) without disrupting other fibers.

2. The Contractor shall install Splice Enclosures of a capacity that they are capable of handling of 24 fibers more than the current fiber count at any given splice location as shown on the Drawings.

3. The Splice Enclosure shall fit within the space allocated for it as shown on the plans and to operate within the environment in which it is to be installed.

4. The Splice Enclosure shall protect the fiber optic cable splices from mechanical damage, shall provide strain relief for the cable, and shall be resistant to salt corrosion. The enclosure shall be waterproof and airtight, and shall be manufactured of non-corroding materials.

5. The Splice Enclosure shall be designed for a temperature range of -30° C (-22° F) to +70° C (158° F). The splice enclosure shall be capable of performing in a cable vault or pull box, environment where total and continuous submersion in water is to be expected.

6. All materials in the enclosures shall be non-reactive and shall not support galvanic cell action. The outer enclosure shall be compatible with the other enclosure components, splice trays, and cables. The end plate shall consist of two sections and shall have the capacity for a minimum of two cable entries on each end.

7. All Splice Enclosures shall employ re-usable sealing materials allowing multiple re-entrances without replacing any component. Access to the splice enclosures shall be accomplished without the use of special tools or devices. The splice enclosure shall employ a latching mechanism for entrance to the internal components of the enclosure.

8. All environmentally exposed components of the Splice Enclosures shall be UV light resistant.

9. All splice trays shall be lined to provide a contrasting a contrasting background for splicing colored fibers or as approved by the Engineer. The splice trays shall include clear snap-on covers and tie wraps to secure the buffer or transport tubes to the tray. The splice trays shall be of adequate size to prevent induced attenuation due to fiber bending.

10. Each splice tray shall be capable of accommodating a minimum of 12 fusion splices for the single mode fiber cable of the type selected.

11. The splice tray shall have features that retain the fiber loops and control the bend radius. The splice tray cover shall be clear plastic to allow for inspection of the fibers without opening the tray.

12. Vinyl markers shall be supplied to identify each fiber to be spliced within the enclosure. Each splice shall be individually mounted and mechanically protected on the splice tray.

C. Cable Racking Hardware

1. Cable racking hardware shall be made of a high-performance polymer: Each splice enclosure shall be supported in the pullbox by a medium duty rack capable

of supporting a minimum load of 100 lbs (445 N). Racks shall not be less than 6 inches (150mm) in length. Medium duty racks shall have 4 inch (100mm) arms minimum. At splice points, the pullbox shall have a horizontal rack capable of supporting, and holding securely in place, a splice closure.

D. Warranty

1. All equipment supplied for this shall be warranted for parts by the vendor against defects and failures, which may occur through normal use for a period of one (1) year from the date of installation. A copy of the warranty must be presented to the Engineer before installation of the equipment.

Construction Methods:

A. Installation

1. Splice Enclosures shall be installed as shown in the Drawings or as directed by the Engineer. Unless otherwise specified, outdoor type Splice Enclosures shall be installed within vaults or pull boxes located adjacent to CCTV cameras and at fiber optic cable reel-end splice locations as shown on the Drawings.

2. The installations shall include all required components including sealing kits, cable racking hardware and mounting hardware to achieve an environmentally secure permanent installation.

3. The Contractor shall supply all materials, tools, equipment and labor including but not limited to fan out kits, connectors, trays, splice enclosures, and any other incidentals necessary to complete the installation of the fiber optic cable splice enclosure.

4. The Splice Enclosure shall be secured to the interior of the cavity of the vault or pullbox on cable racking hardware using tie-wraps.

5. The Outdoor Splice Enclosure shall be mounted in such position to allow the cable to enter and exit the enclosure without exceeding the cables minimum bending radius. Sufficient cable shall be coiled in the vault or pull box to allow the Splice Enclosure to be removed from the vault for current and future splicing and cable repairs. The Contractor shall install mounting hardware within the pullbox or splice location to support the splice enclosure and the splice enclosure shall be securely fastened in place. In no cases shall the splice Enclosure be allowed to rest on the bottom of the pullbox or vault.

6. After the splice trays are placed inside the enclosure, the enclosure shall be sealed using a procedure recommended by the manufacturer that will provide a waterproof environment for the splices. Encapsulant shall be used to ensure water

resistance. The individual fibers shall be looped one full turn within the Splice Enclosure to avoid micro bending.

7. Care shall be taken at the cable entry points to ensure a tight salt resistant and waterproof seal is made which will not leak upon aging. It is acceptable to have multiple cables enter the fiber optic cable Splice Enclosure through one port as long as all spaces between the cables are adequately sealed.

8. All splices shall be protected with a thermal shrink sleeve and shall be labeled in the splice tray with permanent vinyl markers. Butt ends shall also be labeled to identify the destination of the fiber.

9. The splices shall be fabricated using modern, high quality fusion type splicing equipment. All splicing equipment shall be in good working order, properly calibrated, and meeting all industry standards and safety regulations. Cable preparation, Enclosure installation, and splicing shall be accomplished in accordance with accepted and approved industry standards.

10. Optical fibers shall be spliced as noted on the plans using the fusion type and the maximum splice loss shall not exceed 0.10 dB per splice in each direction. The Contractor shall test all splices for signal loss.

11. Each splice shall be tested for tensile strength by applying a force of not less than 7 oz. (200 grams).

12. All splices shall be arranged neatly in splice trays, supported and protected with a suitable splice protector.

13. Only the fibers required to be spliced to Drop Cables at the CCTV Camera and Mini-Hub locations shall be severed and spliced. Where required, the buffer tube splitting tool recommended by the manufacturer shall be used to open the correct buffer tube. Unsevered fibers in an open buffer tube shall be coiled in the splice tray. When buffer tubes do not need to be opened, at least 4.0 m of unopened buffer tubes shall be coiled in the fiber optic Splice Enclosure.

14. Drop cable entrances to the splice enclosures shall adhere to the manufacturer's recommendations for the type of cable.

15. In order to reduce the overall number of splices required, the cable shall be installed in the maximum continuous reel length provided by the manufacturer, or as shown on the plans, or as approved by the Engineer. Factory splices will not be permitted. Prior to ordering the fiber optic cable, the Contractor shall be required to submit a detailed cable layout plan showing the proposed reel lengths and splice points.

16. Fiber identification shall be in accordance with the tables and schedules provided in the Contract Drawings.

17. Upon completion of the splicing operation, all waste material shall be deposited in suitable containers, removed from the job site, and disposed of in an environmentally acceptable manner.

B. Submittals

1. Submit:

a. Functional block diagrams, cable diagrams, and point to point cabling details.
b. Product data, installation manuals, materials, system configuration options and features, and accessories.
c. Shop Drawings shall be completely dimensioned and shall indicate the intended installation method and details.
d. Specifications for all assemblies and subassemblies (eg. High Density Frames, Splice Housings, Connector Panels, Underground Splice Enclosures and associated Splice Trays).
e. Installation and maintenance manuals for all equipment.

C. Testing

1. Testing shall be performed to demonstrate that all furnished and installed equipment complies with the requirements of each item, and shall be conducted using Manufacturer recommended procedures, materials and test equipment.

D. Delivery, Storage, and Handling

1. The Contractor shall deliver, store, handle and install all materials and equipment in such a manner as not to degrade quality, serviceability or appearance.

2. The Contractor shall be responsible for storage of the materials and equipment prior to installation in a clean, dry location free from construction dust, precipitation and excess moisture.
3. Contractor shall be required to replace any damaged materials and equipment, as determined by the Engineer, at no additional cost to the owner.

Method of Measurement:

Work under these items shall be measured for payment by the actual number of "Fiber Optic Splice Enclosures" of the type specified, installed, tested, operating and accepted in place.

Basis of Payment:

The work to be done under this item shall be paid at the Contract Price each for "Fiber Optic Splice Enclosure" which price shall include all materials, hardware, termination panels, labor, cables, connectors, tools, equipment and incidentals necessary to complete this work.

The Contractor shall note that the required racking in the pullboxes and the vaults is included in the splice enclosure item.

Pay Item	Pay Unit
Fiber Optic Splice Enclosure	ea.

ITEM #1112252A - EQUIPMENT OPERATIONS (ESTIMATED COST)

Description:
The purpose of this item is to provide the necessary services required to maintain the Incident Management System (IMS) equipment existing and newly installed, operating to the manufacturer's specifications, so as to provide a means to monitor, detect and manage incidents as they occur on the highway. The work included in this item for the existing IMS equipment will commence upon receiving the Notice to Proceed for this contract. The work included in this item for newly installed IMS equipment will commence upon completion of the 30 Day Operational Test

Materials:
All materials utilized to maintain and repair the Incident Management System (IMS) shall be in conformance with the specifications of this project or shall be in conformance with the specifications of the Procurement Contract, or as recommended by the manufacturer. The existing or newly installed IMS equipment shall include but not be limited to the operation of the CCTV Cameras, Traffic Management System Cabinets (TMSC), Traffic Flow Monitors (TFM) and Variable Message Signs (VMS).

The Contractor shall provide all the cables, connectors, tools, replacement equipment and labor necessary to successfully maintain the equipment.

The Contractor shall be able to use replacement parts available from the State of Connecticut inventory in order to expedite the repair process. As soon as possible and to the State's satisfaction, the Contractor shall provide replacement equipment to be re-entered into the State's inventory.

The Contractor shall provide documentation certifying the manufacturer's repair or replacement of the spare equipment upon return of the equipment to the Department.

Construction Methods:
Certification:
The Contractor shall provide the State with evidence satisfactory to the State that they fully understand the purpose for which the equipment is intended, and they are qualified and capable of fulfilling all provisions of this item. The Contractor as well as individual personnel performing this work shall be certified by all manufacturers of the equipment to be maintained as being capable of maintaining the equipment and also capable of obtaining and installing the necessary spare parts to keep the system on-line. The Contractor, prior to the commencement of the start of the equipment operations, shall be required to submit training certificates for all of the pertinent equipment.

Response Time:
The Contractor shall service and maintain the newly installed IMS equipment at the conclusion of the 30 Day Operational Test for each installation and the existing IMS equipment from the contract Notice to Proceed as allowed by the Engineer. All IMS equipment shall be serviced and

maintained on a twenty-four (24) hour a day, seven days a week basis. The Contractor shall provide a suitable means of communication between them and the Highway Operations Center (HOC). This shall include a twenty-four (24) hour telephone number, a fax number for emergency purposes and a fax number for daily communications and log activities. Repairs shall commence not more than 8 hours after notification and shall be completed within 24 hours of notification.

The Contractor shall keep a neat and accurate log book of all the malfunctions reported with the date and time that the information was received and the nature of the problem. The log book shall be submitted to the Engineer monthly or upon request by the Engineer. The Contractor shall include in the log book the time that each unit is checked for proper operation, the condition of each unit checked, and the date and time each unit was restored to proper operation or replaced.

Work performed under this item shall conform to the latest National Electrical Code standards, local electrical codes, and Department of Transportation installation requirements. The Contractor shall conform to these requirements as specified herein.

Any IMS equipment that has been damaged through the Contractors own actions shall be repaired and/or replaced by the Contractor at no cost to the State.

Method of Measurement:
This item shall be measured for payment as provided under Article 1.09.04 – Extra and Cost Plus Work.

The sum of money shown on the estimate and in the itemized proposal as "Estimated Costs" for this work will be considered the price bid even though payment will be made only for actual work performed. The estimated cost figure is not to be altered in any manner by the bidder. Should the bidder alter the amount shown, the altered figures will be disregarded and the original price will be used to determine the total amount bid for the contract.

Basis of Payment:
This work will be paid on a cost-plus basis according to Article 1.09.04 – Extra and Cost Plus Work. Warranties in effect for newly installed equipment associated with CCTV Cameras, Traffic Management System Cabinets (TMSC), Traffic Flow Monitors (TFM) and Variable Message Signs (VMS) operation shall be honored by the suppliers of the equipment. Contractor or sub-contractor will be responsible for securing warranted equipment and installation. There will be no payment for materials included under a manufacturers warrantee. Labor costs only will be reimbursed on a cost plus basis.

If warranties have expired, any equipment and labor that must be repaired will be paid on a cost plus basis.

ITEM #1112284A - VEHICLE DETECTION MONITOR

Description:

Furnish and install a Vehicle Detection Monitor with stand in the Controller Cabinet.

Materials:

All hardware shall be new, corrosion resistant. All equipment shall be current production.

Physical:

- Compact and easily accessible stand-mounted LCD/LED Flat Panel Display.
- Diagonal screen size minimum 10 inches and maximum 15 inches.
- Withstand temperatures ranging from -4 to 140°F (-20 to 60°C).
- Operating humidity: 10-90% non-condensing.

Functional:

- Compatible with Color or Monochrome Detection systems.
- Industrial-grade video panel.
- ANSI contrast ratio of 300:1 minimum.
- Minimum brightness level: 400 candelas per square meter (400 lux).
- Native resolutions: 1024 (horizontal) x 768 (vertical).
- Support both National Television Standards Committee (NTSC) and Phase Alternating Line (PAL) video formats with auto-sensing.
- Minimum viewing angle: 140 degrees horizontally, 120 degrees vertically.
- On-Screen Display (OSD) controls brightness, contrast, color, as well as horizontal and vertical positioning.
- Compatible with video detection processor output. Use appropriate converters/adapters if necessary.
- Operable on 110 VAC or 220 VAC, 50 or 60 Hz.
- FCC, Voluntary Control Council for Interference (VCCI), Electromagnetic Compatibility (EMC), Consumer Electronics (CE) approved, UL listed and Energy Star efficient.
- MTBF Rating: 50,000 hours minimum.

Warranties and Guarantees:

Provide warranties and guarantees to the **Department of Transportation Office of Maintenance** in accordance with Article 1.06.08 of the Standard Specifications. Warranties for all equipment furnished as part of this Contract are to cover a period of 24 months following successful completion of the entire site acceptance test.

Method of Measurement:

The Vehicle Detection Monitor will be measured for payment as the number of units furnished, installed, operational, and accepted.

Basis of Payment:

This work will be paid at the Contract unit price for each accepted "Vehicle Detection Monitor," which price shall include the Vehicle Detection Monitor, stand, documentation, warranty, labor, tools, and equipment incidental thereto.

Pay Item	Pay Unit
Vehicle Detection Monitor	ea.

ITEM #1112286A - 360 DEGREE CAMERA ASSEMBLY

ITEM #1112289A - 360 DEGREE CLOSED LOOP SYSTEM VIDEO DETECTION PROCESSOR

ITEM #1113901A - CAMERA CABLE

Description:

Furnish and install a 360 Degree Video Image Detection System (360VIDS) as shown on the plans or as directed by the Engineer. The 360VIDS consists of a 360 Degree Camera Assembly (360CA), 360 Degree Closed Loop System Video Detection Processor (360CLSVDP), and 23 AWG 4 Twisted Pair Category 5E Cable.

Materials:

All hardware shall be new, corrosion resistant. All equipment shall be current production.

360 Degree Camera Assembly:

Camera:

- No-aim, no-focus camera
- Downward facing lens and camera shroud
- Single Power Over Ethernet (POE) connection for power and data collection.
- Color image camera with 360 degree point of view (POV)
- Active picture elements (pixels): 2560 (H) x 1920 (V), minimum.
- Signal to noise ratio: 55dB
- Heated camera
- IP addressable

Camera Enclosure:

- Tamper proof constructed of painted or powder coated aluminum of at least 0.25 inch (6.35 mm) thickness.
- IP66-rated camera housing.

Camera Mounting Hardware:

- Swivel bracket for dual plane adjustment for leveling
- Quick connect junction box
- Hybrid terminal junction box with surge.
- Astro-Brac banded bracket
- 34 inch to 78 inch 90 degree mounting arm pole.

360 Degree Closed Loop System Video Detection Processor:

Functional:

- Connectivity: Local Area Network (LAN), Wide Area Network (WAN), Camera interfaces.
- NEMA TS1/TS2, Type 170 and 2070 ATC compatible
- Four (4) USB 3.0 expansion ports.
- Front panel LED indicators displays calls and light states.
- Twenty-four (24) optically isolated I/O interface.
- Two (2) camera ports – Up to two (2) 360 Degree Camera Assembly; or one (1) 360 Degree Camera Assembly and four (4) IP video detection camera assembly (IPVDCA) or thermal cameras; or eight (8) IPVDCA or thermal cameras.
- Phase and detection display.
- Wi-Fi capable
- Power – 110/220 VAC 50/60 Hz
- Point and click zone drawing feature
- Digital flattening of image
- Omni-directional vehicle tracking
- Virtual pan-tilt-zoom
- Zone level visibility monitoring.
- Monitor phases and loops, generates calls to controllers.
- Support MJPEG video output
- Environmental: -29°F to +165°F (-34°C to +74°C), 0-95% non-condensing
- Fail-safe in the event of loss of video from 360CA or loss of power to 360CLSVDP.
- Shall be capable of configuring and adjusting the detection zone with the cabinet mounted Vehicle Detection Monitor (VDM).
- Shall collect traffic data such as volume, vehicle classification, speed, turning movements, and lane occupancy.
- Storage required to support collection of data.
- Support ability to transmit collected traffic data and alarm events from field devices to remote desktop PC.

Application Software:

- Shall be provided at no additional cost.
- Shall be capable of searching the network for other 360CLSVDP.
- Shall be compatible with Windows operating system supported by the Department.
- Shall maintain a historical log of all configurations when site is modified.
- Shall be capable of point-and-click zone drawing.
- Shall feature digital flattening of image.
- Shall feature the ability to digitally pan, tilt, and zoom within the camera assembly's field of view without movement of the camera.

- Detection zone data stored in non-volatile memory so that after recovery from power interruption, all parameters are returned to latest settings.
- Shall support the import and export of program database from notebook PC or remote desktop PC. The program database shall also be allowed to be transferred through a USB flash drive.
- Shall be capable of superimposing detection zone on real time video image from selected camera with time stamping capabilities.
- Shall be capable of monitoring real time video and adjusting zones in field or remotely while 360CLSVDP is actuating the traffic controller.
- Shall provide visual confirmation of detection by highlighting detection zone symbols.
- Shall support quad view video monitoring.
- Shall be capable of syncing with a cloud network resource to allow for program database and collected traffic data backup.
- Shall maintain a database of current and historical traffic data, and allow users to run reports against the data to include traffic volume, vehicle classification, speed, turning movements, lane occupancy, red/green occupancy, and cycle lengths.
- Shall be capable of displaying data in a graph or chart format.
- Shall be capable of selecting data collection resolution in at least 15, 30, and 60-minute intervals through software.
- Shall provide a means by which alerts can be configured to be delivered to different individuals via email.
- Report output formats shall include at minimum PDF, rich text format, and Microsoft Excel formats.

Physical:

- Either shelf mounted, stand-alone design, or modular card rack design.
- Aluminum card rack frame capable of accepting four (4) 360CLSVDP modules.
- TS1 harness cable.
- Standard Ethernet and USB connectors for video input and video output.
- Female metal shell connector with latching clamp for NEMA TS1 detector outputs and inputs.
- LED indications to monitor all detector outputs.
- Side or rear mounted connectors and controls are not allowed on stand-alone units.
- NEMA FR-4 glass epoxy or equivalent circuit boards.

Ethernet Repeater:

- Utilize Ethernet repeater if CAT5E cable distance is over 328'.

Ethernet Switch:

- Power Over Ethernet (POE) switch
- Ports for up to four (4) IPVDCA or thermal cameras.
- Powder coated aluminum.

- Dual purpose LED port lights.
- RJ-45 CAT5E connectivity.
- Environmental: -29°F to +165°F (-34°C to +74°C).
- NEMA TS2 compliant.

Video Encoder:

- Power Over Ethernet (POE)
- Video: H.264 (MPEG-4 Part 10/AVC) Baseline and Main Profile
- Compression: Motion JPEG
- Resolutions: 176x120 to 720x576, 176x120 to 1536x1152 for quad view.
- Frame rate:
    - H.264: 25/30 (50/60 Hz) fps,
    - 15fps in quad view in full resolution,
    - Motion JPEG: 25/30 (50/60 Hz) fps,
    - 15fps in quad view in full resolution.
- Video Streaming: Multi-stream H.264 and Motion JPEG: One H.264 and one JPEG stream on each channel (8 streams in total) in full frame rate individually configured streams in maximum resolution at 25/30 fps; more streams if identical or limited in frame rate/resolution. Controllable frame rate and bandwidth; VBR/CBR H.264.
- Environmental: -40°F to +167°F (-40°C to +75°C), 10-95% non-condensing.
- NEMA TS2 compliant.

Ethernet Protection Module:

- Either shelf mounted or stand-alone design.
- Protect 360CA, IPVDCA, thermal cameras, and 360CLSVDP in the event of a surge or lightning.

Peripherals:

- Separable Keypad & Joystick or Computer Mouse including all necessary cables for connectivity to 360CLSVDP.

Environmental:

- Comply with NEMA TS2, Section 2 requirements for Controller Assembly.
- Pass following NEMA TS2 tests and applicable test procedures.
    - Vibration: Section 3.13.3, Section 3.13.8.
    - Shock: Section 3.13.4, Section 3.13.9.
    - Transients, Temperature, Voltage, and Humidity: Section 3.13.7.
    - Power Interruption: Section 3.13.10.

23 AWG 4 Twisted Pair Category 5E Cable:

- Supply the 360CA power and return the video signal to the 360CLSVDP.
- Outdoor Aerial CAT5E cable with UV insulation.
- Rated for 48VDC

- 250MHZ, shielded, gel-filled (flooded core) direct burial grade.
- Polyethylene insulation.
- Shall be installed continuous between the 360CA and 360CLSVDP.
- Cable shall be installed according to TIA/EIA-568-B.
- Other type cable may be substituted at the request of the 360CLSVDP manufacturer.

Documentation (360CA and 360CLSVDP):

Provide to the **Department of Transportation Office of Maintenance** three (3) copies of equipment manuals furnished by the manufacturer, which includes the following:

- Installation and operation procedures.
- Performance specifications (functions, electrical, mechanical, and environmental) of the unit.
- Schematic diagrams (point to point wiring).
- Pictorial of component layout on circuit board.
- List of replaceable parts including names of vendors for parts not identified by universal part numbers such as JEDEC/RETMA or EIA.
- Troubleshooting, diagnostic, and maintenance procedures.

Site Survey:

Perform a site survey with the 360CLSVDP manufacturer representative at all 360VIDS locations prior to installation. The purpose of the survey is to optimize the performance from the 360VIDS equipment when it is installed and insure that it will meet the accuracy requirements specified previously. Prior to installation, submit the results of this survey to the Engineer in a report, which lists all 360VIDS locations with any recommended changes to camera locations, mounting adjustments, camera lens adjustments, and desired detection zone locations.

Warranties and Guarantees (360CA and 360CLSVDP):

Provide warranties and guarantees to the **Department of Transportation Office of Maintenance** in accordance with Article 1.06.08 of the Standard Specifications. Warranties for all equipment furnished as part of this Contract are to cover a period of 36 months following successful completion of the entire site acceptance test.

Construction Methods:

Install 360VIDS equipment in accordance with the manufacturer instructions and recommendations to achieve the detection zones as shown in the plans and accuracy as described in these specifications. The location of the 360CA shown on the plan may be revised as a result of the Site Survey. Peripherals are to be furnished and fully installed in an easily accessible position within the controller cabinet. Leave proper clearance(s) surrounding video monitor to allow for accessible connections and space to utilize surrounding equipment.

Method of Measurement:

The 360 degree Camera Assembly will be measured for payment as the number of 360 degree cameras furnished, installed, operational, and accepted.

The 360 degree Closed Loop System Video Detection Processor will be measured for payment as the number of units including all additional work and materials listed in Basis of Payment, furnished, installed, operational, and accepted.

Camera Cable will be measured for payment as linear feet, furnished, installed, and accepted.

Basis of Payment:

The unit bid price for 360 degree Camera Assembly includes the 360 degree camera, enclosure, brackets used to attach the 360CA to a support structure, documentation, warrantee, labor, tools, and equipment necessary to provide the specified video signal to the 360CLSVDP.

The unit bid price for 360 degree Closed Loop System Video Detection Processor includes the manufacturers' site survey, unlimited number of any necessary 360VIDS configuration software and license, card rack frame, power supply, all miscellaneous hardware such as PC interface cable with connectors, necessary peripherals such as Ethernet repeater, Ethernet switch, video encoder, Ethernet protection module, documentation, warrantee, labor, tools, and equipment necessary to make the 360VIDS fully operational.

The unit bid price for Camera Cable includes all connectors, labor, tools, and equipment necessary to install the cable between the 360CA and the 360CLSVDP.

Pay Item	Pay Unit
360 Degree Camera Assembly	ea.
360 Degree Closed Loop System Video Detection Processor	ea.
Camera Cable	l.f.

ITEM #1113059A - TRAFFIC FLOW MONITOR

Description:

This special provision covers the requirements for the installation, calibration, and testing of the Traffic Flow Monitors (TFM) at the locations shown on the plans. The components shall include:

1. Detector unit and Enclosure

2. Fully regulated power supply, to be installed in the Traffic Management System Cabinet or Traffic Management System Mini-hub Cabinet to supply power to a minimum of two Traffic Flow Monitors.

3. Traffic Flow monitor manufacturer approved external Serial to Ethernet converter.

4. Cable between the detector unit and the adjacent traffic management system cabinet (TMSC) or traffic management system mini-hub cabinet (TMSMHC), including the cables and connectors necessary at the locations where an auxiliary connection cabinet is specified.

5. Supporting bracket and banding for the TFM unit.

6. Pole-mounted Auxiliary Detector connection cabinet provided and installed when a traffic flow monitor is installed on opposite side of highway from the camera or (TMSC) or when a dedicated TFM pole is installed.

7. All other miscellaneous hardware required for the installation of the TFM

8. Menu Driven Windows 7 compatible or greater Set-up Software

The TFM will be used for traffic flow monitoring within the project limits. The TFM will be mounted on Camera Poles, Overhead Sign Supports, or steel poles as shown on the plans.

All traffic flow monitors and brackets installed as part of this item shall be manufactured by Image Sensing Systems (ISS). The equipment model number shall be an RTMS Sx-300.

The Traffic Flow Monitor shall be a true presence microwave radar detector which can provide presence, volume, lane occupancy and speed information in up to twelve discreet zones. The detector shall identify vehicle presence within each detection zone with a 95% accuracy or greater, independent of the vehicle's direction of travel through the detection zone. This information shall be available to existing controllers via contact closure pairs serial communication lines and Ethernet communication lines. The flow monitor shall operate thru a Frequency Modulated Continuous Wave Operation. The flow monitor shall be able to detect stationary vehicles within the beam path. Flow monitors that utilize the "Doppler Effect" for detection will not be accepted. The flow monitor shall detect the presence of vehicles in 6½ foot

(2m) wide radial range slices in the path of the microwave beam. The Traffic Flow Monitor shall be capable of being installed in either a side-mounted or a forward-looking configuration.

The mean time between failures (MTBF) of the unit in its operating environment shall be 90000 hours (10 years).

Materials:

The approximate size of the unit shall be 8 x 8 x 6 in (210 x 210 x 160 mm) and the approximate weight shall be 3.5 pounds (1.4 kg). The enclosure shall be rugged and shall meet the requirements of NEMA-4X and IP-65. The enclosure shall be sealed to protect the unit from wind, dust and airborne particles, and exposure to moisture. The operating limits of the unit shall be as follows:

Temperature Range: -35 to 165° F (-37 to 74° C)

Humidity: Up to 95% Relative Humidity

Wind: Winds up to 90 mph (145 km/h)

The performance of the unit shall not be degraded by precipitation.

The unit shall operate within a range of 12-24V AC. The unit shall contain a sensor that will shut down the unit if the maximum peak voltage is exceeded. The maximum power consumption for the individual unit shall be approximately 3 watts. The unit shall be capable of automatically recovering from power failure within 5 seconds.

An AC regulated power supply with fuse and surge suppression shall be provided for each traffic flow monitor and installed on the wiring panel assembly in the TMSC or TMSMHC. The AC supply output shall provide the required operating voltage to the traffic flow monitor, and conform to the temperature range noted above. The Contractor shall consider the voltage drop of the TFM cable wiring and other voltage drops when determining the type and size of power supply provided for use. At sites that require more than one (1) traffic flow monitor, a single power supply that can power the required number of traffic flow monitors may be substituted as long as the proper operating voltage is obtained at the TFM unit.

The interface at the unit consists of a single MS connector which provides power to the unit, output contact closure wire pairs for each of the required detection zones rated at 350V AC/DC 100 mA, serial communication lines for interface setup and testing at 9600 baud rate. The TFM shall be optically isolated that will protect the internal circuits against surges of up to 6KV. Data format of the serial port shall be standard binary NRZ 8 bits data, 1 stop bit, no parity which will be used for field setup and connection at the Traffic Management system mini-hub cabinet or Main Fiber Hub. A second optional RS-485 port must be supplied with the unit for future communication back to the Newington Operations Center. The second RS-485 shall be connected to a terminal server. The terminal server shall be configured and setup for future

connectivity. The unit must communicate using the X2/X3 protocol and be 100 percent compatible with Newington operations existing Crescent ATMS software.

The MS3476W18-32S cable connector pin assignment is shown in the table below:

Function	MS Connector
USB D+	A
USB VBUS	B
USB D-	C
Ethernet RX+	W
Ethernet RX-	Z
Standard Power 12-24 AC/DC	f and g
Serial Transmit Tx	V
Serial Receive Rx	T
Signal GND	U
Ethernet TX-	e
Ethernet TX+	d

Bracket: The mounting assembly shall be stainless steel and shall support a load of 18 pounds (8 kg). The bracket support shall be steel material as detailed on the plans and supplied by the manufacturer of the detector unit. The bracket shall allow limited freedom of rotation on three axes.

The brackets shall be attached with manufacturer approved ¾ inch (19 mm) wide, 0.30 inch (7.6mm) thick, stainless steel bands or to a concrete wall/bridge using 2 stainless steel expansion bolts of sufficient length and diameter to support 100 pounds (45 kg).

Cables: The power, RS-232, and RS-485 communication cable between the flow monitor and the camera cabinet TMSC shall consist of multiple twisted pairs of stranded AWG #22 to #12 wires with a common shield rated at 300V with a temperature rating of 105° C (Belden #9516 or approved equal) and shall be UV-resistant. The contractor will be responsible for determining and supplying the proper power cable size for the TFM and remote media converter based upon the distance from the TMSC or TMSMHC to the remote cabinet. For distances of 40 feet (12 m) or less the Belden 9516 will provide both serial communications and power to the TFM but at

distances longer than 40 feet (12 m) the contractor will need to provide separate power cables to overcome voltage drop.

Construction Methods:

Installation of the Traffic Flow monitor consists of the following steps:

1. The Contractor shall calculate the required AC power supply required for installation in the traffic management system cabinet. A copy of the calculations and selected power supply shall be recorded and supplied to the Engineer for review. It is the Contractor's responsibility to ensure that the proper operating voltage is provided to the traffic flow monitor unit.
2. Secure mounting bracket to the pole or other designated location (bolts or banding supplies required) facing the required detection zones as shown on the site plans with the ball joint pointed downwards.
3. Insert the flow monitor unit into the ball joint, taking care not to kink the rubber grommet. Lubrication is recommended.
4. Align the bracket and the unit's pin holes and insert the lynch pin. Secure lynch pin ring around the ball joint.
5. Release the ball-joint bolt and aim the unit. The unit needs to be kept level side to side. In side-fired configuration tilt the unit to point to the center (up to 4 lanes) or the first 1/3 (for 5 or more lanes) of the entire detection width. Aiming may have to be corrected during the set-up process. Tighten locking bolt securely.
6. Install the cable from the cabinet to the unit.
7. Connect the cable supplying power and delivering the Flow monitor outputs. The wide connector key is pointing forward. Twist the outer ring of the MS connector clockwise until it locks.
8. Installation of the power supply, cabling and connectors within the TMSC or TMSMHC. The Contractor shall properly connect the power and data communications surge suppression devices (supplied as part of the cabinet item) to the traffic flow monitor cables.
9. Measurement and recording of the operating voltage measured at the traffic flow monitor unit. Verify that the operating voltage is within the manufacturer's specified range.
10. Installation of the auxiliary detector cabinet (where required)
11. Connect a PC, at either the cabinet or the auxiliary detection cabinet, and perform set-up as recommended by the manufacturer.

The MS connector pins must be crimped to the cable conductors and assembled and tested prior to installation and pulling of cable on-site. Pins must be crimped, not soldered, onto the cable conductors. Cable strain relief measures should be provided as recommended by manufacturer.

Connections at the Existing Auxiliary Detector Cabinet:

At the existing auxiliary detector cabinet the Contractor will loop an RS-232 test cable within the enclosure and tie up so that the cable is not touching the bottom of the cabinet. The contractor will then furnish and install an edco surge protector model PC642-020LC. The contractor shall run power and communication back to the TMSC and tie into the optical video data transmitter with the RS-232 communication. The RS-485 cables shall be connected to the terminal server and setup with the IP address assignments provided by the department.

Cables shall be installed neatly between adjoining equipment and shall be secured to rigid structures using appropriate fastening devices. Cable and connectors shall not be stressed during or after installation. A written procedure for cable preparation and connectorization shall be provided to the Engineer for approval. Manufacturer descriptions of all equipment required to do the work shall be included. The ITS integrator will be required to make all communication terminations for this item.

The Contractor will be responsible for setting up the Traffic Flow Monitor Unit at the various locations. **The manufacturer will be available and will conduct on-site visits as necessary to provide technical expertise.** The Contractor will be responsible for mounting, calibrating, and setting up the units to detect the required number of lanes as shown on the site plans. The ITS integrator will perform the set-up process at all of the locations and have the unit configured to detect vehicles in the specified lanes.

Anchor bolts for conduit supports and bracket supports shall be drilled and anchored into sound concrete only. The anchorage system shall be installed per the manufacturer's recommendations. If existing reinforcement is encountered during drilling, the hole shall be abandoned, filled with non-shrink grout and relocated as directed by the Engineer. After installation of the supports, tighten all chemical anchor bolts to the torque as recommended by the anchorage system manufacturer.

The TFM units shall be calibrated upon installation to provide accurate volume, speed and occupancy traffic data using software provided by the manufacturer. The Contractor shall provide a laptop computer for calibration and testing. The configurations at each site shall be saved on a digital storage device and provided to the Department for future use. The filenames used at the various sites shall be in a format agreeable to the Department.

The Contractor shall have the manufacturer's representatives on-site to oversee the installation, testing and calibration of the TFM to ensure all manufacturer requirements are satisfied.

<u>Testing:</u>

The Contractor shall carry out proof of performance testing to ensure that the TFM units provide adequate quality of the traffic data according to the manufacturers stated accuracy levels. The contractor shall submit test procedures detailing the methodology of the test activities to be

performed. Two copies of the test procedure shall be submitted to the Department for review three weeks prior to commencing testing.

The Contractor is required to perform manual validation of traffic volumes and traffic speeds for 100% of TFM units installed under this contract. The validation shall include two 15 minute periods performed during peak and off-peak periods. The Contractor shall document the test results in accordance with the quality control test procedures and submit the results to the Department. If the unit's accuracy for speed and volume counts are not found to not be within manufactuerers stated accuracy then the contractor will be required to recalibrate or readjust the mounting height to meet the manfuacturers stated accuracy and then rerun all manual validation tests.

Upon successful completion of the installation test and approval by the Engineer, a 30-day System Operational Test for each TMSC or TMSMHC site shall commence. During the course of this test, the system must function continuously in accordance with the specifications for the duration of the test. If a malfunction occurs within the stated time frame, the Contractor shall make all necessary repairs to the system and re-establish proper operation. Upon approval of the Engineer, the 30-day test will begin anew. The system must operate for a full thirty (30) consecutive days without malfunction before the system will be accepted by the Engineer. The Contractor shall refer to "Notice To Contractor – 30 Day System Operational Test" for additional testing requirements. The Contractor shall coordinate the 30-day System Operational Test with other pertinent items in this contract.

Warranty:

The manufacturer shall warranty the product to be free from defects in material and workmanship for a period of three years from the date of acceptance. The manufacturer shall also warranty the operation of the firmware and software provided with the units.

Method of Measurement:

This item will be measured for payment by the actual number of complete Traffic Flow Monitor units installed, configured, tested, and accepted.

Basis of Payment:

This work will be paid for at the contract unit price each for "Traffic Flow Monitor" complete-in-place, which price shall include all materials, and all equipment, tools, labor and work incidental thereto. The price shall also include all necessary auxiliary detector cabinets, brackets, power supplies, terminal server, surge protectors, and all cabling and connectors. This price shall also include furnishing, set-up, installing, warranty, testing, of the traffic flow monitor.

Pay Item	Pay Unit
Traffic Flow Monitor	ea.

ITEM #1113604A - OPTICAL FIBER CABLE – SINGLE MODE, LOOSE BUFFER TUBE CABLE, 6 FIBER

ITEM #1113620A - OPTICAL FIBER CABLE – SINGLE MODE, LOOSE BUFFER TUBE CABLE, 60 FIBER

ITEM #1113621A - OPTICAL FIBER CABLE – SINGLE MODE, LOOSE BUFFER TUBE CABLE, 72 FIBER

Description: This Item specifies the requirements for furnishing, installing in conduit, splicing, and terminating fiber optic cables. As part of this item, the Contractor shall install a pull tape in all innerducts within the contract limits of work, as necessary to install the fiber optic cable and future fiber optic cable.

Materials:

A. General

1. The fiber optic cable supplied in this project shall be manufactured by corning in order to be completely compatible with the existing fiber cable supplied under Project 63-548/42-288. The cable shall be compatible with Fitel/Lucent single jacket loose tube fiber optic cable with DryBlock Core. The Contractor shall provide proof of compatibility to the Department with the appropriate shop drawings and catalog cut submittals.

2. Outdoor fiber optic cable shall be installed in conduit, spliced as required and terminated in Camera-Hub Cabinets and Mini-Hub Cabinets, as shown on the Drawings.

3. Plenum-rated indoor fiber optic cable shall be installed inside the State Transportation Building within existing conduits, spliced as required and terminated at the fiber optic patch panel, as shown on the Drawings.

4. The fiber optic cable, splices, connectors and interconnect panels shall meet all requirements stated in this Specification.

5. All optical fiber cables used in this project shall be from the same manufacturer. That manufacturer shall be regularly engaged in the production of fiber optic cables. Each optical fiber cable for this project shall be dielectric, loose tube, duct-type.

B. Applicable Publications

1. Publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation. All Fiber Optic Communication System hardware shall be compliant with the following specifications:

   Electronics Industries Association (EIA):

   a. EIA-310-C Racks, Panels, and Associated Equipment.
   b. EIA-359-A Colors for Color Identification and Coding.
   c. EIA-422-A Electrical Characteristics of Balanced Voltage Digital Interface Circuits.
   d. EIA-TIA-455-A Standard Test Procedures for Fiber Optic Fibers, Cable Transducer Sensors, Connecting and Terminating Devices and Other Fiber Optic Components.
   e. EIA-455-6B Cable Retention Test Procedure for Fiber Optic Cable Interconnecting Devices.
   f. EIA-485 Standard for Electrical Characteristics of Generators and Receivers for use in Balanced Digital Multipoint Systems.
   g. TIA/EIA-598-A Optical Fiber Cable Color Coding.

2. USDA Rural Utilities Service (RUS) 7 CFR 1755.900.

3. ANSI/ICEA Standard for Fiber Optic Outside Plant Communications Cable, ANSI/ICEA S-87-640-1992.

4. UL-listed OFNR

5. CSA-listed FT-4

C. Outdoor Fiber Optic Cable Requirements

1. The cable shall be an accepted product of the United States Department of Agriculture Rural Utilities Service (RUS) 7 CFR 1755.900 and meet the requirements of the ANSI-ICEA Standard for Fiber Optic Outside Plant Communications Cable, ANSI/ICEA S-87-640-1992.

2. The Outdoor Fiber Optic Cable shall be stranded loose tube cable with the required number of fibers as shown in the Contract Drawings. The buffer tubes shall contain 12 fibers per tube unless otherwise noted in the Contract.

3. The Contractor shall provide manufacturer's documentation certifying that the Outdoor Fiber Optic Cable complies with the following performance requirements:

a. When tested in accordance with FOTP-3, "Procedure to Measure Temperature Cycling Effects on Optical Fibers, Optical Cable, and Other Passive Fiber Optic Components," the change in attenuation at extreme operational temperatures -40°F and +158°F (-40°C and +70°C) shall not exceed 0.2 dB/km at 1550 nm for single-mode fiber.

b. When tested in accordance with FOTP-82, "Fluid Penetration Test for Fluid-Blocked Fiber Optic Cable." a one meter length of unaged cable shall withstand a one meter static head or equivalent continuous pressure of water for cable end.

c. When tested in accordance with FOTP-81, "Compound Flow (Drip) Test for Filled Fiber Optic Cable", the cable shall exhibit no flow (drip or leak) of filling and/or flooding material at 149°F (65°C).

d. When tested in accordance with FOTP-41, "Compressive Loading Resistance of Fiber Optic Cables," the cable shall withstand a minimum compressive load of 220 N/cm (125 lbf/in) applied uniformly over the length of the sample. The load shall be applied at the rate of 1/10 in to ¾ in (3 mm to 20 mm) per minute and maintained for ten minutes. The change in attenuation shall not exceed 0.4 dB during loading and 0.2 dB after loading at 1550 nm for single-mode fiber.

e. When tested in accordance with FOTP-104, "Fiber Optic Cable Cyclic Flexing Test," the cable shall withstand 25 mechanical flexing cycles around a sheave diameter not greater than 20 times the cable diameter. The change in attenuation shall not exceed 0.1 dB at 1550 nm for single-mode fiber.

f. When tested in accordance with FOTP-25, "Repeated Impact Testing of Fiber Optic Cables and Cable Assemblies," the cable shall withstand 25 impact cycles. The change in attenuation shall not exceed 0.2 dB at 1550 nm for single-mode fiber.

g. When tested in accordance with FOTP-33, "Fiber Optic Cable Tensile Loading and Bending Test," using a maximum mandrel and sheave diameter of 22 in (560 mm), the cable shall withstand a tensile load of 608 lbf (2700 N). The change in attenuation shall not exceed 0.2 dB during loading and 0.1 dB after loading at 1550 nm for single-mode fiber.

h. When tested in accordance with FOTP-85, "Fiber Optic Cable Twist Test," a length of cable no greater than 13 feet (4 meters) shall withstand 10 cycles of mechanical twisting. The change in attenuation shall not exceed 0.1 dB at 1550 nm for single-mode fiber.

i. When tested in accordance with FOTP-181, "Lightning Damage Susceptibility Test for Optic Cables with Metallic Components," the cable shall withstand a simulated lightning strike with a peak value of the current pulse equal to 105 kA without loss of fiber continuity. A damped oscillatory test current shall be used with a maximum time-to-peak value of 15 μs (which corresponds to a minimum frequency of 16.7 kHz) and a maximum frequency of 1800000 rpm (30 kHz). The time to half-value of the waveform envelope shall be from 40 - 70 μs.

j. When tested in accordance with FOTP-37, "Low or High Temperature Bend Test for Fiber Optic Cable", the cable shall withstand four full turns around a mandrel of ≤ 10 times the cable diameter for non-armored cables and ≤ 20 times the cable diameter for armored cables after conditioning for four hours at test temperatures of -22°F and +140°F (-30°C and +60°C). Neither the inner or outer surfaces of the jacket shall exhibit visible cracks, splits, tears or other openings. Optical continuity shall be maintained throughout the test.

4. All optical fibers, coatings, tubes, metals and jackets shall be free of roughness, porosity, blisters, splits and voids in accordance with good manufacturing practice.

5. The color coding and position of fibers / buffer tubes within the cable shall be in accordance with TIA/EIA–598-A "Optical Fiber Cable Color Coding". Fibers shall be colored with ultraviolet curable ink. In buffer tubes containing multiple fibers, the colors shall be stable across the specified storage and operating temperature range and not subject to fading or smearing onto adjacent fibers or into the gel filing material. Color materials shall not cause fibers to stick together.

6. The buffer tubes shall be resistant to external forces and shall meet the buffer tube cold bend and shrinkback requirements of 7 CFR 1755.900.

7. The cable shall be suitable for operation over a temperature range of -22°F to +158°F (-30°C to +70°C) and shall be suitable for installation in outdoor ducts.

8. The cable shall provide mechanical support and protection for the specified number of fibers.

9. The central anti-buckling member shall consist of a dielectric, glass reinforced plastic (GRP) rod. The GRP rod shall be coated with a black colored thermoplastic when required to achieve dimensional sizing to accommodate buffer tubes/fillers.

10. All interstices within the cable outer jacket and within each buffer tube shall be filled with a compound to prevent the ingress and migration of water. The compound shall be a non-hygroscopic, non-nutritive to fungus, electrically non-conductive, homogeneous gel that is nontoxic and dermatologically safe. The gel shall be free from dirt and foreign matter. Some leakage of the compound is permitted, however, there shall be no bulk flow of compound out of the cable over the specified operating

temperature range which could impact on the waterproofness of the cable. The gel shall be readily removable with conventional nontoxic solvents.

11. Buffer tubes shall be stranded around the dielectric central member using the reverse oscillation, or "S-Z", stranding process. Water blocking yarn(s) shall be applied longitudinally along the central member during stranding.

12. A water blocking tape shall be applied longitudinally around the outside of the stranded tubes/fillers. The tape shall be held in place by a single polyester binder yarn. The water blocking tape shall be non-nutritive to fungus and electrically non-conductive.

13. The cable shall be able to withstand a maximum pulling tension of 607lbf (2700 N) during installation without any resulting damage. Tensile strength shall be provided by dielectric yarns. The high tensile strength dielectric yarns shall be helically stranded evenly around the cable core.

14. The outer jacket of the cable shall be constructed of medium or high density polyethylene. The minimum nominal jacket thickness shall be 1/20 inch (1.4 mm). Jacketing material shall be applied directly over the tensile strength members and water blocking tape. The polyethylene shall contain carbon black to provide ultraviolet light protection and shall not promote the growth of fungus. MDPE jacket material shall be as defined by ASTM D1248, Type II, Class C and Grades J4, E7 and E8.

15. The cable shall contain at least one ripcord under the sheath (outer cable jacket) for easy sheath removal of all-dielectric cable.

16. The cable jacket shall be marked with manufacturer's name, sequential meter or foot markings, month, year or quarter year of manufacture, and a telecommunications handset symbol, as required by Section 350G of the National Electrical Safety Code. The actual length of the cable shall be within 1% of the length markings.

17. Materials used in the cable shall not produce hydrogen in a concentration large enough to cause any degradation in the transmission performance of the optical fibers.

18. Materials used in the cable shall not support galvanic action.

D. Single Mode Optical Fibers

1. The Single Mode fiber shall consist of a doped silica core surrounded by a concentric silica cladding. The fiber shall be matched clad design.

2. The dispersion un-shifted or dispersion flattened single mode fiber shall conform to the following specifications:

   a. The Single Mode fiber core shall have a diameter of between 8.3 to 9 μm inclusive with a tolerance of ± 1.3 μm.

   b. The Single Mode fiber cladding shall have an outer diameter of 125 μm with a tolerance of ±1.0 μm.

   c. The core-to-cladding offset shall not be greater than 0.6 μm.

   d. The cladding Non-Circularity shall not be greater than 1.0% defined as: (1- Minimum Cladding Diameter/Maximum Cladding Diameter) x 100

   e. The Single Mode fiber shall be coated with a protective polymer to preserve the strength of the fiber. The coating shall be removable by mechanical or chemical means. The coating shall retain its color when subject to the manufacturer's recommended fiber cleaning and splicing preparation methods.

   f. The SM fiber shall have attenuation and bandwidth specified at two wavelength windows.

      i. The first wavelength window shall be at and around 1310 nm.
      ii. The second wavelength window shall be at and around 1550 nm.

3. The mean optical attenuation at 1310 nm shall not be greater than 0.4 dB/km with a standard deviation not greater than 0.05 dB/km. The maximum attenuation of any continuous length of SM fiber at 1310 nm shall not exceed 0.45 dB/km.

4. The mean optical attenuation at 1550 nm shall not be greater than 0.3 dB/km with a standard deviation not greater than 0.06 dB/km. The maximum attenuation of any continuous length of SM fiber shall not exceed 0.36 dB/km.

5. The fiber attenuation shall not vary more than 0.2 dB/km over the specified cable operational temperature range.

6. The fiber optical bandwidth at 1310 nm or 1550 nm shall be equal to or greater than 1000 MHz-Km.

7. The zero dispersion wavelength shall be at a wavelength of 1310 ± 10 nm.

8. The maximum dispersion at 1550 nm shall not exceed 18 ps / (nm-km).

9. The maximum dispersion in the wavelength range of 1285 to 1330 nm shall not exceed 3.2 ps / (nm-km).

E. Fiber Optic Distribution Cable

1. This item consists of furnishing and installing optical fiber cables and connectors of the size and type specified at the locations shown on the Drawings or as indicated by the Engineer, in accordance with these Specifications.

2. The Contractor shall provide multiple fiber, stranded, loose tube cable with single mode fiber that shall be suitable for placement in an underground environment as shown in the Drawings.

3. The optical fiber capacity of the fiber optic distribution cables to be supplied and installed under this Contract will vary in capacity according to network topology and traffic requirements. The current minimum requirements are for distribution cable to be of the following capacities: 72 SM **Refer to Drawing**, Fiber Optic Cable Plant. (Note SM refers to the number of Single Mode fibers within a cable segment.)

4. The Contractor shall provide a manufacturer's certification that the offered cable complies with all optical and mechanical requirements set forth in this Specification. Any deviation of the offered cable from the specifications set forth herein shall be clearly noted in the Contractor's proposal.

5. All optical fiber distribution cable used on this project shall be from the same manufacturer. Each optical fiber cable shall be all dielectric, duct type, loose tube and shall conform to these Specifications.

F. Fiber Optic Drop Cables

1. Drop cables are used for connecting Traffic management system cabinets, Traffic management system Mini-Hub cabinets and Variable Message Sign (VMS) cabinets to the fiber optic distribution (trunk) cable or between cabinets.

2. The Drop Cable shall consist of single mode fibers housed in a protective jacket. The end of the fiber installed at the Traffic Management system cabinet, Traffic Management system Mini-Hub cabinet, or VMS cabinet shall be terminated in a patch panel. The other end of the drop cable shall be spliced into a fiber optic distribution cable at an underground Splice Closure within an adjacent pull box. When drop cables are run between two cabinets the cable shall be terminated in a patch panel at both ends.

3. For drop cables landing in each traffic management system cabinet, VMS cabinet or any Incident management system (IMS) cabinet with a fiber count of 12 or less, the contractor shall furnish a 19" rack mounted patch panel with six SC fiber connectors.

4. The exact number of Drop Cables at each Splice Closure shall be in accordance with the Contract. The Contractor shall employ the most efficient means of meeting the Drop Cable requirements, as approved by the Engineer.

5. The attenuation of Drop Cable after installation, not including the connector loss, shall not exceed 0.1 dB measured at 1310 nm and 1550 nm.

G. Fiber Optic Connectors

1. The ST connector shall have a ceramic ferrule with a nickel plated nut and body. SC connectors shall have a ceramic insert.

2. The connector shall be of the ST-type or SC-type and fully compatible with the fiber optic cable utilized and the mating jacks to which they will be attached.

3. The connector shall be compatible with an ultra physical contact (UPC) finish. All connectors shall be polished to a UPC finish such that the return loss per mated pair of connectors is at least 25 dB. The return loss when the connector is mated with previously installed connectors shall be at least 18 dB.

4. The connector mean loss shall not be greater than 0.2 dB with a standard deviation of not greater than 0.1 dB.

5. Index matching fluids or gels shall not be used.

6. The connector loss shall not vary more than 0.1 dB after 500 repeated matings.

7. The connector shall withstand an axial load of 30 lb (135 N).

8. The connectors shall be attached in accordance with the manufacturer's recommended materials, equipment and practices.

9. The connector shall be suitable for the intended environment and shall meet the following environmental conditions.

   a. Operating Temperature: -4°F to +122°F (-20 to +50o C)

   b. Storage Temperature: -22°F to +140°F (-30 to +60o C)

   c. The connector loss shall not vary more than 0.2 dB over the operating temperature range.

   d. Connectors shall be protected by a suitably installed waterproof protection cap.

H. Conduit Testing and Pull Tape

1. The poly-line installed to verify the integrity of the conduit system shall be ¼" (6 mm) polypropylene.

2. The detectable pull tape shall consist of a single 24 AWG copper wire with polyethylene or PVC jacket woven into the polyester tape. The pull tape shall be NEPTCO Part No. WP1250PDP1250P, or approved equal, for cable sizes of less than 97 fibers. NEPTCO Part No. WP1800PDP1800P, or approved equal, shall be used for cable size of 97-288 fibers.

3. The pull tape shall have the following properties:
   a. 1250 lb (5560 N) tensile strength
   b. flat, not round construction
   c. printed foot markings
   d. Pre-lubricated for reduced pulling tension at start of cable pull
   e. low susceptibility to absorption of moisture; moisture resistant

I. Fiber Optic Cable Fabrication

1. Packing and Shipment

   a. The cable shall be supplied on reels. Top and bottom end of the cable shall be available for testing. Both ends of the cable shall be sealed to prevent ingress of moisture.

   b. The optical cable shall be in one continuous length per reel with no factory splices in the fiber. Each reel shall be marked to indicate the direction the reel should be rolled to prevent loosening of the cable. Installation procedures and technical support shall be furnished upon request.

   c. Each reel shall have the following information clearly labeled on it:

      i. Customer
      ii. Customer order number
      iii. Reel number
      iv. Destination
      v. Ship date
      vi. Manufactured date
      vii. Manufacturer's name
      viii. Cable code
      ix. Length of cable

J. Warranty

1. All equipment supplied for this shall be warranted for parts and labor by the vendor certified by the manufacturer against defects and failures, which may occur through normal use for a minimum period of one (1) year from the date of installation. A copy of the warranty must be presented to the Engineer after installation of the cable and equipment.

K. Quality Assurance

1. The Contractor shall have a Quality Assurance Program in place.

2. A minimum of ten (10) year's experience in the design, manufacture, and testing of Fiber Optic Cable and Connectors is required. The cable and connectors shall be designed and manufactured according to world class quality standards. The manufacturer shall be ISO 9001 certified.

Construction Methods:

A. Submittals

1. Submit:

a. Functional block diagrams, cabling diagrams, and point to point cabling details, including locations of all distribution cable splice points (both drop cable splices and reel-end splices.
b. As built drawings including a cable route diagram indicating the actual cable route and "foot marks" for all interchanges, intersections, directional change points in the cable routing, and all termination points. The Contractor shall record these points during cable installation. Cable system "as-built" drawings showing the exact cable route shall be provided by the Contractor to ConnDOT. Information such as the location of slack cable and its quantity shall also be recorded in the cable route diagram.
c. Product data, manufacturer's test certifications, installation manuals, materials, system configuration options and features, and accessories.
d. Shop Drawings shall be completely dimensioned and shall indicate the intended installation method and details.
e. Specifications of cable, connectors, and fiber splice kits.
f. Operating and maintenance manuals for all equipment.
g. Vendor Optical Time Domain Reflectometer (OTDR) certification for each reel of fiber optic cable listing each specification compliant fiber by fiber color code and group color code.

B. Delivery, Storage, and Handling

1. The Contractor shall deliver, store, handle and install all materials and equipment in such a manner as not to degrade quality, serviceability or appearance.

2. The Contractor shall be responsible for storage of the materials and equipment prior to installation in a clean, dry location free from construction dust, precipitation and excess moisture.

3. Contractor shall be required to replace any damaged materials and equipment, as determined by the Engineer, at no additional cost to the owner.

4. Cable shall be transported to site using cable reel trailers.

5. Care shall be taken at all times to avoid scraping, denting, or otherwise damaging the cable before, during or after installation. Damaged cable shall be replaced by the Contractor without additional compensation.

6. Sufficient slack shall be pulled to allow cable cutting and connection to communications equipment.

C. Installation in Ducts

1. Cable shall be installed in innerduct, duct or conduit in the field in accordance with the Contract Drawings.

2. Fiber Optic Distribution Cable shall be installed in the lowest innerduct (relative to ground level). Where more than one cable is to be installed in a conduit, the mid-level innerduct shall be used, and the highest level innerduct shall be reserved.

3. The Contractor shall install pull tape in the existing innerducts as necessary to install the fiber optic cable. A 6.5 ft (2.0 m) length of pull tape shall be left coiled, tied, and accessible in each cabinet, vault, maintenance hole and junction box. The pull tape shall be installed according to manufacturer recommendations and shall be “free” and NOT helical about communications cables.

4. The Contractor shall install cables in innerducts consistently throughout the project; crossover of a cable from one innerduct to another is not allowed.

5. Duct ends shall have all rough ends smoothed to prevent scraping the cable.

6. Where cable will be installed directly in conduit with no innerduct, a stiff bristle brush shall be pulled through each section of duct before pulling cable.

7. The Contractor shall not exceed the manufacturer's recommended safe pulling tension and minimum bending radius during delivery and installation.

8. A manufacturer's recommended lubricant shall be applied to the cable to reduce friction between the cable and the duct.

9. A cable grip shall be attached to the cables so that no direct force is applied to the optical fiber. The cable grip shall have a ball bearing swivel to prevent the cable from twisting during pulling.

10. Cable rollers and feeders and winch cable blocks shall be used to guide the cable freely into the duct and at maintenance hole locations.

11. Mechanical aids and pulling cable or ropes shall be used as required.

12. The Contractor shall employ personnel at as many pull points as need be to achieve the longest continuous cable segment as possible to reduce the need for excessive main-line splices.

13. Personnel equipped with two-way radios shall be stationed at each maintenance hole, cabinet and communications vault at which the cable is to be pulled to observe and lubricate the cable.

14. Where mechanical pulling is required (i.e. all runs greater than 164 ft (50 m)), a dynamometer shall be used to record installation tension and a tension limiting device shall be used to prevent exceeding the maximum pulling tension as defined by the cable manufacturer. The maximum pulling tension shall be recorded for each run of cable. The cable shall be taken up at intermediate pulling points with an intermediate cable take-up device as approved by the Engineer to prevent over tension on the cable. Cable pulls shall be continuous and steady between pull points and shall not be interrupted until the entire run of cable has been pulled.

15. Trunk fiber cable segment lengths shall be the maximum tolerable length within the maximum pulling tension defined by the manufacturer. The number of trunk cable reel-end splices shall be minimized. The Contractor shall provide a plan to the Engineer showing the reel-end splice point locations following a field investigation of the conduit and shall not install cable until receiving the Engineer's approval of the reel-end splice location plan. The Contractor shall obtain the Engineer's approval for all required changes to the reel-end splice point location plans. Cable segments installed with reel-end splices not approved by the Engineer will be replaced by the Contractor at no additional cost to the Department.

16. The Contractor shall be responsible for ensuring the cable length is sufficient to allow for connection between the communication equipment and the splice enclosures

including provision for slack, vertical runs, cable necessary for splicing, wastage and cable to allow for the removal of the splice enclosure for future splicing.

17. Drop Cables shall be of length suitably long to be connected to the rack mounted patch panel within the Traffic management system cabinet, VMS cabinet, or IMS cabinet. Sufficient slack shall be left at each end to allow removal of the rack mounted patch panel for relocation anywhere within the cabinet.

18. Drop Cable fibers in the Mini-Hub Cabinet shall be spliced to pig-tails in a rack-mounted patch panel/splice closure provided by others. Splicing shall be in accordance with the requirements specified elsewhere in these Specifications and as shown on the Drawings. All unused fibers shall be properly terminated in accordance with manufacturer recommendations.

19. All cable ends, connectors, and fiber optic jacks shall be protected from moisture ingress by using properly sealed caps.

20. Following installation of the cable in the ducts, all duct entrances at pedestals and cabinets shall be sealed with duct sealing compound to prevent the ingress of moisture, foreign materials, and rodents.

21. 20 feet (6 m) of cable going to and coming from each Splice Closure shall be coiled in the first pull box on each side of each closure. In addition, 50 feet (15 m) of cable shall be left coiled in the first pull box on each side of all surface mounted conduit systems.

22. Where trunk cable terminations are left “dead ended”, 100 feet (25 m) of cable shall be left coiled.

23. All coiled cables shall be securely fastened in place with a minimum of four galvanized steel conduit straps.

24. Fish line shall be installed in all communications ducts or conduits along with fiber optic communication cables. A 6ft. 6 in (2.0 m) length of fish line shall be left coiled, tied and accessible in each cabinet, vault, maintenance hole and junction box. The fish line shall be installed according to manufacturer specifications and shall be "free" and NOT helical about communications cables.

25. At intermediate pulling points, to prevent over tension on the cable, the cable shall be either taken up with an intermediate cable take up device as approved by the Engineer, or all excess cable shall be laid out on the ground in a figure eight configuration before subsequent installation.

26. Following installation in duct, a label shall be affixed to each cable end in a pull box or cable vault and the label shall contain the following information:

27. Customer order number
    x. Reel number
    xi. Ship date
    xii. Manufactured date
    xiii. Manufacturer's name
    xiv. Cable designation as shown on the Drawings
    xv. Length of cable to next reel-end splice point
    xvi. Location of other end of cable (reel-end splice point)
    xvii. Cable test data

D. Splicing

1. Splicing of the cable shall only be permitted at splice closure or field fiber optic interconnect panel locations as indicated in the Drawings, unless authorized by the Engineer.

2. The Contractor shall prepare for splicing the designated fibers of the cable to the Drop Cables connecting the communications equipment located in the traffic management system cabinet and traffic management system minihub cabinet. Sufficient cable shall be coiled in the vault/cabinet to allow for consumption during the splicing and to permit the splice closure to be removed from the vault/cabinet for future splicing.

3. At least 1.0m of each fiber shall be stored in the splice trays. The Contractor shall further splice all additional fibers provided in order to meet the fiber requirements specified in the Contract and including any fibers provided which are additional to the Contract requirements.

E. Testing

1. Test Documentation

   a. The Contractor shall be responsible for all testing and documentation required to establish approval and acceptance of this Item.

   b. The Contractor shall submit test procedures and documented test results to the Engineer. The test procedures shall document the nature of test activities to be performed.

   c. The test procedures shall be submitted to the Engineer prior to initiation of the testing. The procedures will be returned to the Contractor within two week

indicating either “accepted” or “make corrections noted”. If corrections are required, the Contractor shall submit revisions within 1 week.

d. Four copies of the final test procedures shall be submitted to the Engineer prior to commencement of testing.

2. Pre-Installation Testing

a. Reels of cable shall be tested for attenuation prior to installation in ducts. The Contractor shall measure and record the attenuation of 100% of the total single mode fibers on each reel. Attenuation shall meet or exceed the specified performance requirements in accordance with the Contract.

b. The Contractor shall ensure that specifications for the fiber optic cable are met prior to installation.

3. Proof of Performance Testing

a. The Contractor shall measure the attenuation per kilometer of fiber in each length of cable after installation.

b. The Contractor shall measure the attenuation of a randomly selected minimum of 10% of the total single mode fibers, which will be connected to equipment.

c. All (100%) of optical fibers assigned to be spare or reserved shall be individually tested for optical attenuation.

d. The Contractor shall sequence the fibers which are to be measured after each pull, such that the same fibers are not measured on consecutive lengths.

e. The Contractor shall record the reel number from which the cable came, the identification of the fibers measured and the attenuation in dB/km of the fibers measured.

f. The Contractor shall measure and record the splice quality of each fusion splice performed. The Engineer shall be provided with access to interim results.

4. Optical Time Domain Reflectometer (OTDR) Testing

   a. The Contractor shall perform single mode Fiber OTDR testing after each cable has been installed.

   b. The Contractor shall provide the Engineer with information regarding OTDR test equipment make and model with the equipment calibration procedures and certification dates prior to conducting the test routine.

   c. An OTDR shall be used for backscattered light measurements. The OTDR shall operate at a nominal wavelength of 1310 nm and 1550 nm and shall include all necessary hardware required to couple it with single mode fiber.

   d. The backscatter light measurement of each single mode fiber and each single mode optical link shall be measured in both directions and at both 1310 nm and 1550 nm wavelengths. Each single mode optical link shall be defined as being the total length of interconnected single mode fibers and the splices which form a continuous end-to-end optical link.

   e. The Contractor shall maintain a test result record of each single mode optical link and each single mode fiber by means of printer copy of the OTDR measured cable attenuation profile. All single mode optical links shall be identified in the test results by identifying the cabinet site and patch panel fiber at which the OTDR was connected.

   f. The test results shall include the following measurements:

      i. Total length of the single mode link
      ii. Total attenuation of the single mode link
      iii. Attenuation of each splice in the link under test
      iv. Attenuation per kilometer of each interconnected fiber in the link under test
      v. Identification of each fiber including location, patch panel, and labeled fiber designator.

   g. Attenuation shall be measured in decibels referencing optical power.

   h. Each single mode fiber and splice tested shall be tested to meet the performance requirements in accordance with the Contract. Fiber strands failing this test shall be re-terminated and re-tested.

Method of Measurement: Work under this item shall be measured for payment by the number of linear feet of Fiber Optic Cable furnished and installed, as specified and shown on the Drawings.

Basis of Payment: The work to be done under this item shall be paid at the Contract unit price for each foot of the Fiber Optic Cable furnished and installed as described in this Specification. This work shall include all cable, connectors, rack mounted patch panels, equipment, materials and incidental items required to satisfy these Specifications.

Pay Item	**Pay Unit**
Optical Fiber Cable – Single Mode, Loose Buffer Tube Cable, 6 Fiber	LF
Optical Fiber Cable – Single Mode, Loose Buffer Tube Cable, 60 Fiber	LF
Optical Fiber Cable – Single Mode, Loose Buffer Tube Cable, 72 Fiber	LF

ITEM #1113814A - REMOVAL AND/OR RELOCATION OF ATMS

Description:

This Item includes the work for removal and relocation of the existing ConnDOT Advanced Traffic Management System (ATMS) VMS 91N-033 Cabinet, IMS Splice Cabinet, Relocation of 96 & 60 Fiber Optic Cable I-91 NB Exit 29, Removal of Existing Conduit and Removal of Existing Traffic Flow Monitor (TFM), TFM Pole and foundation.

Materials:

There are no specific material requirements for the work under this item, as the work entails turn-off of the existing system for the removal and relocation of the existing VMS 91N-033 Cabinet, IMS Splice Cabinet, Relocation 60 Fiber Optic Cable I-91 NB Exit 29 and Removal of Existing Conduit. If the use of any materials is required for the removal and/or relocation then said equipment shall be in conformance with the Standard Specifications, Form 817.

Construction Methods:

The Contractor shall maintain an uninterrupted service to the existing Incident Management System at all times. The scheduled downtime of the Incident Management System shall conform to the requirements of Notice to Contractor – Installation Qualifications and Section 1.08.04 Prosecution and Progress, Limitations of Operations - Incident Management System.

VMS 91N-033 Cabinet Relocation:

The removal and relocation of the existing VMS 91N-033 Cabinet and associated fiber optic and electric service cables shall be completed as defined on the Intelligent Transportation Systems Subset 1.05 and Temporary IMS Plans Subset 1.08.13.

The Contractor shall be permitted to remove VMS 91N-033 from operation to relocate the cabinet for a period not to exceed one (1) work day, eight (8) hours.

The Contractor shall not be permitted to begin cabinet relocation without written permission from the Highway Operations Engineer. To minimize the period that the VMS Cabinet is not operational, all infrastructure, including but not limited to, cabinet foundation, conduit, handholes, junction boxes, and cables shall be installed as identified on the Intelligent Transportation Systems Subset 1.05 and Temporary IMS Plans Subset 1.08.13.

Prior to the removal of the VMS 91N-033 Cabinet, the Contractor shall contact Robert Kennedy, Highway Operations at 860-594-3458 to perform an operational test on the existing VMS. The Contractor will again contact Robert Kennedy at the completion of the VMS Cabinet relocation to perform an operation test on the relocated VMS. The Contractor shall be responsible to perform any repairs necessary caused by the cabinet relocation.

IMS Splice Cabinet:

The IMS Splice Cabinet contains the connection of the IMS trunkline fiber cables that connect the DOT Newington Operations Center to all of the IMS infrastructure installed on I-91, I-84, I-291, I-691 and Route 2 in the Greater Hartford and Waterbury areas.

The maintenance and protection of the IMS Splice Cabinet is critical to the operation of the Incident Management System and shall remain operational at all times.

The Contractor shall complete the following tasks prior to the relocation of the existing IMS Splice Cabinet in order to minimize downtime of the IMS Operation in the Greater Hartford and Waterbury areas:

- Installation of Traffic Control Foundation Type IV Modified
- Installation of 2-4" Multiduct RMC between the existing IMS Vault and the new IMS Splice Cabinet Foundation.

Relocation 96 & 60 Fiber Optic Cable I-91 NB Exit 29

The 96 & 60 fiber optic cable installed along I-91 NB requiring removal and relocation between approx. Sta. 310+00 and approx. Sta. 327+25 is critical to the operation of the Incident Management System and shall remain operational at all times.

In order to minimize the downtime of the Incident Management System, the Contractor shall install a complete conduit system including 4" Multiduct RMC, Cast Iron Junction Box and Pullbox as identified on the IMS plans. The Contractor shall also complete the Splice Cabinet foundation and conduit installation.

The Contractor shall contact Robert Kennedy, the Highway Operations Engineer (860-594-3458) at least 2 weeks prior to the removal and relocation of the 96 & 60 fiber optic trunkline cable. The Highway Operations Engineer shall, coordinate the fiber outage with the DOT Newington Operations Center. The Contractor shall not be permitted to perform the 96 & 60 fiber optic trunkline cable removal and relocation work without written permission from the Division of Highway Operations.

The Contractor shall schedule the removal and relocation of the 96 & 60 fiber optic cable trunkline during an approved non-holiday weekend and shall be completed in a fifteen (15) hour work window as described in the special provision Notice to Contractor – Installation Qualifications.

Relocation of the 96 & 60 fiber optic cable shall comply with the following:

A. Installation in Ducts

1. Cable shall be installed in innerduct, duct or conduit in the field in accordance with the Contract Drawings.
2. The Contractor shall install pull tape in the existing innerducts as necessary to install the fiber optic cable. A 6.5 ft (2.0 m) length of pull tape shall be left coiled, tied, and accessible in each cabinet, vault, maintenance hole and junction box. The pull tape shall be installed according to manufacturer recommendations and shall be "free" and NOT helical about communications cables.
3. The Contractor shall install cables in innerducts consistently throughout the project; crossover of a cable from one innerduct to another is not allowed.
4. Duct ends shall have all rough ends smoothed to prevent scraping the cable.
5. Where cable will be installed directly in conduit with no innerduct, a stiff bristle brush shall be pulled through each section of duct before pulling cable.
6. The Contractor shall not exceed the manufacturer's recommended safe pulling tension and minimum bending radius during delivery and installation.
7. A manufacturer's recommended lubricant shall be applied to the cable to reduce friction between the cable and the duct.
8. A cable grip shall be attached to the cables so that no direct force is applied to the optical fiber. The cable grip shall have a ball bearing swivel to prevent the cable from twisting during pulling.
9. Cable rollers and feeders and winch cable blocks shall be used to guide the cable freely into the duct and at maintenance hole locations.
10. Mechanical aids and pulling cable or ropes shall be used as required.
11. The Contractor shall employ personnel at as many pull points as need be to achieve the longest continuous cable segment as possible to reduce the need for excessive main-line splices.
12. Personnel equipped with two-way radios shall be stationed at each maintenance hole, cabinet and communications vault at which the cable is to be pulled to observe and lubricate the cable.
13. Where mechanical pulling is required (i.e. all runs greater than 164 ft (50 m)), a dynamometer shall be used to record installation tension and a tension limiting device shall be used to prevent exceeding the maximum pulling tension as defined by the cable manufacturer. The maximum pulling tension shall be recorded for each run of cable. The cable shall be taken up at intermediate pulling points with an intermediate cable take-up device as approved by the Engineer to prevent over tension on the cable. Cable pulls shall be continuous and steady between pull points and shall not be interrupted until the entire run of cable has been pulled.
14. The Contractor shall be responsible for ensuring the cable length is sufficient to allow for connection between the communication equipment and the splice enclosures including provision for slack, vertical runs, cable necessary for splicing, wastage and cable to allow for the removal of the splice enclosure for future splicing.

15. Drop Cables shall be of length suitably long to be connected to the rack mounted patch panel within the Traffic management system cabinet, VMS cabinet, or IMS cabinet. Sufficient slack shall be left at each end to allow removal of the rack mounted patch panel for relocation anywhere within the cabinet.
16. Drop Cable fibers in the Mini-Hub Cabinet shall be spliced to pig-tails in a rack-mounted patch panel/splice closure provided by others. Splicing shall be in accordance with the requirements specified elsewhere in these Specifications and as shown on the Drawings. All unused fibers shall be properly terminated in accordance with manufacturer recommendations.
17. All cable ends, connectors, and fiber optic jacks shall be protected from moisture ingress by using properly sealed caps.
18. Following installation of the cable in the ducts, all duct entrances at pedestals and cabinets shall be sealed with duct sealing compound to prevent the ingress of moisture, foreign materials, and rodents.
19. 20 feet (6 m) of cable going to and coming from each Splice Closure shall be coiled in the first pull box on each side of each closure. In addition, 50 feet (15 m) of cable shall be left coiled in the first pull box on each side of all surface mounted conduit systems.
20. Where trunk cable terminations are left “dead ended”, 100 feet (25 m) of cable shall be left coiled.
21. All coiled cables shall be securely fastened in place with a minimum of four galvanized steel conduit straps.
22. Fish line shall be installed in all communications ducts or conduits along with fiber optic communication cables. A 6ft. 6 in (2.0 m) length of fish line shall be left coiled, tied and accessible in each cabinet, vault, maintenance hole and junction box. The fish line shall be installed according to manufacturer specifications and shall be "free" and NOT helical about communications cables.
23. At intermediate pulling points, to prevent over tension on the cable, the cable shall be either taken up with an intermediate cable take up device as approved by the Engineer, or all excess cable shall be laid out on the ground in a figure eight configuration before subsequent installation.
24. Following installation in duct, a label shall be affixed to each cable end in a pull box or cable vault and the label shall contain the following information:
    - Customer order number
    - Reel number
    - Ship date
    - Manufactured date
    - Manufacturer's name
    - Cable designation as shown on the Drawings
    - Length of cable to next reel-end splice point
    - Location of other end of cable (reel-end splice point)
    - Cable test data

B. Splicing

1. Splicing of the cable shall only be permitted at splice closure or field fiber optic interconnect panel locations as indicated in the Drawings, unless authorized by the Engineer.

2. The Contractor shall prepare for splicing the designated fibers of the cable to the Drop Cables connecting the communications equipment located in the traffic management system cabinet and traffic management system minihub cabinet. Sufficient cable shall be coiled in the vault/cabinet to allow for consumption during the splicing and to permit the splice closure to be removed from the vault/cabinet for future splicing.

3. At least 1.0m of each fiber shall be stored in the splice trays. The Contractor shall further splice all additional fibers provided in order to meet the fiber requirements specified in the Contract and including any fibers provided which are additional to the Contract requirements.

C. Testing

1. Test Documentation

   a. The Contractor shall be responsible for all testing and documentation required to establish approval and acceptance of this Item.
   b. The Contractor shall submit test procedures and documented test results to the Engineer. The test procedures shall document the nature of test activities to be performed.
   c. The test procedures shall be submitted to the Engineer prior to initiation of the testing. The procedures will be returned to the Contractor within two week indicating either “accepted” or “make corrections noted”. If corrections are required, the Contractor shall submit revisions within 1 week.
   d. Four copies of the final test procedures shall be submitted to the Engineer prior to commencement of testing.

2. Pre-Installation Testing

   a. The Contractor shall test the existing fiber cable attenuation prior to removal from the existing Splice Cabinet multiduct conduit. The Contractor shall measure and record the attenuation of 100% of the total 96 & 60 fiber optic cable trunkline single mode fibers.
   b. The Contractor shall ensure that specifications for the fiber optic cable are met prior to removal.

3. Proof of Performance Testing

    a. The Contractor shall measure the attenuation of the existing 96 & 60 fiber optic cable trunkline after relocated installation. The Contractor shall measure and record the attenuation of 100% of the total 60 fiber optic cable trunkline single mode fibers.
    b. The attenuation results of the relocated existing 96 & 60 fiber optic cable shall be compared to the Pre-Installation attenuation results.
    c. The Contractor shall be responsible for repair of any damaged single mode fibers caused by the fiber cable relocation work at no cost to the State.
    d. The Contractor shall measure and record the splice quality of each fusion splice performed, if necessary. The Engineer shall be provided with access to interim results.

4. Optical Time Domain Reflectometer (OTDR) Testing

    a. The Contractor shall perform single mode Fiber OTDR testing after each cable has been installed.
    b. The Contractor shall provide the Engineer with information regarding OTDR test equipment make and model with the equipment calibration procedures and certification dates prior to conducting the test routine.
    c. An OTDR shall be used for backscattered light measurements. The OTDR shall operate at a nominal wavelength of 1310 nm and 1550 nm and shall include all necessary hardware required to couple it with single mode fiber.
    d. The backscatter light measurement of each single mode fiber and each single mode optical link shall be measured in both directions and at both 1310 nm and 1550 nm wavelengths. Each single mode optical link shall be defined as being the total length of interconnected single mode fibers and the splices which form a continuous end-to-end optical link.
    e. The Contractor shall maintain a test result record of each single mode optical link and each single mode fiber by means of printer copy of the OTDR measured cable attenuation profile. All single mode optical links shall be identified in the test results by identifying the cabinet site and patch panel fiber at which the OTDR was connected.
    f. The test results shall include the following measurements:
        - Total length of the single mode link
        - Total attenuation of the single mode link
        - Attenuation of each splice in the link under test
        - Attenuation per kilometer of each interconnected fiber in the link under test
        - Identification of each fiber including location, patch panel, and labeled fiber designator.

g. Attenuation shall be measured in decibels referencing optical power.
h. Each single mode fiber and splice tested shall be tested to meet the performance requirements in accordance with the Contract. Fiber strands failing this test shall be re-terminated and re-tested.

D. Fiber Optic Connectors

1. The ST connector shall have a ceramic ferrule with a nickel plated nut and body. SC connectors shall have a ceramic insert.
2. The connector shall be of the ST-type or SC-type and fully compatible with the fiber optic cable utilized and the mating jacks to which they will be attached.
3. The connector shall be compatible with an ultra physical contact (UPC) finish. All connectors shall be polished to a UPC finish such that the return loss per mated pair of connectors is at least 25 dB. The return loss when the connector is mated with previously installed connectors shall be at least 18 dB.
4. The connector mean loss shall not be greater than 0.2 dB with a standard deviation of not greater than 0.1 dB.
5. Index matching fluids or gels shall not be used.
6. The connector loss shall not vary more than 0.1 dB after 500 repeated matings.
7. The connector shall withstand an axial load of 30 lb (135 N).
8. The connectors shall be attached in accordance with the manufacturer's recommended materials, equipment and practices.
9. The connector shall be suitable for the intended environment and shall meet the following environmental conditions.

    a. Operating Temperature: -4°F to +122°F (-20 to +50o C)
    b. Storage Temperature: -22°F to +140°F (-30 to +60o C)
    c. The connector loss shall not vary more than 0.2 dB over the operating temperature range.
    d. Connectors shall be protected by a suitably installed waterproof protection cap.

Removal of Existing Conduit

The removal of existing conduit as identified on the plans shall be the responsibility of the contractor to remove and dispose of. The contractor shall be responsible for the turn off and disconnection of the cable inside the conduit scheduled for removal. The Contractor shall not be permitted to remove any conduit without written permission from the Highway Operations Engineer.

Removal of Existing Traffic Flow Monitor (TFM), TFM Pole and Foundation

The removal of existing Traffic Flow Monitor (TFM) and TFM Pole as identified on the plans shall be removed and salvaged. The TFM Pole Foundation shall be removed and disposed of by the Contractor. The contractor shall be responsible for the turn off and disconnection of the TFM scheduled for removal. The Contractor shall not be permitted to remove any conduit without written permission from the Highway Operations Engineer.

The salvaged TFM and TFM Pole shall be delivered to (See special Provision Notice to Contractor – Salvaged Material):

Rocky Hill Maintenance Garage
1107 Cromwell Avenue
Rocky Hill, CT 06067
Contact: Special Services Manager
Phone: 860-258-4516

Method of Measurement:

Work under this item shall not be measured for payment. A lump sum fee will be provided for the total removal work under this item, "Removal and/or Relocation of Existing ATMS".

Basis of Payment:

The work to be done under this item shall be paid for at the Contract lump sum price for "Removal and/or Relocation of Existing ATMS", which price shall include all removal, relocation, salvage, materials, hardware, labor, tools, equipment, testing and incidentals necessary to complete this work.

Pay Item	Pay Unit
Removal and/or Relocation of Existing ATMS	l.s.

ITEM #1118012A - REMOVAL AND/OR RELOCATION OF TRAFFIC SIGNAL EQUIPMENT

Section 11.18: *Replace the entire section with the following:*

Description:
Work under this item shall consist of removal of all abandon traffic signal equipment. Where indicated on the plans or as directed by the Engineer remove, relocate and reinstall existing traffic signal equipment to the location(s) shown. Work under this item shall also consist of the relocation of a Pedestrian Push Button/Signal Face, pedestal and foundation at I-91 SB Exit 27 at Airport Road as shown in the plans, including excavation and backfill for foundation and restoration of areas affected by the removals or relocations, including grading.

Materials:
The related sections of the following specifications apply to all incidental and additional material required for the proper relocation of existing equipment and the restoration of any area affected by this work.

- Division III, "Materials Section" of the Standard Specifications.
- Current Supplemental Specifications to the Standard Specifications.
- Applicable Special Provisions to the Standard Specifications.
- Current Department of Transportation, Functional Specifications for Traffic Control Equipment.

Construction Methods:
Schedule/coordinate the removal and/or relocation of existing traffic signal equipment with the installation of new equipment to maintain uninterrupted traffic signal control. This includes but is not limited to vehicle signals and detectors, pedestrian signals and pushbuttons, coordination, and pre-emption.

Abandoned Equipment

The contract traffic signal plan does not show existing equipment that will be abandoned. Material found to be abandoned shall be removed from the site and disposed by the Contractor. Unless shown on the plans it is not necessary to remove abandoned conduit in-trench and conduit under-roadway

When a traffic signal support strand, rigid metal conduit, down guy, or other traffic signal equipment is attached to a utility pole, secure from the pole custodian permission to work on the pole. All applicable Public Utility Regulatory Authority (PURA) regulations and utility company requirements govern. Keep utility company apprised of the schedule and the nature of the work. Remove all abandoned hardware, conduit risers, and down guys, Remove anchor rods, to 6" below grade.

When underground material is removed, backfill the excavation with clean fill material. Compact the fill to eliminate settling. Remove entirely the following material: pedestal foundation; controller foundation; handhole; pressure sensitive vehicle detector complete with concrete base. Restore the excavated area to a grade and condition compatible with the surrounding area.

- If in an unpaved area apply topsoil and establish turf in accordance with Section 9.44 and Section 9.50 of the Standard Specifications.
- If in pavement or sidewalk, restore the excavated area in compliance with the applicable Sections of Division II, "Construction Details" of the Standard Specifications.

Relocated Equipment

In the presence of the Engineer, verify the condition and operations of all material that will be relocated and reused at the site. The Contractor shall remove all material, fittings, and attachments in a manner to safeguard parts from damage or loss. The Contractor shall furnish at no additional cost, all material which becomes damaged or lost during removal, storage, or reinstallation.

Method of Measurement:
This work will be measured for payment as Lump Sum for the completion of all work specified.

Basis of Payment:
This work will be paid for at the contract lump sum price for "Removal and/or Relocation of Traffic Signal Equipment" which price shall include relocating signal equipment and associated hardware, all equipment, material, tools and labor incidental thereto. This price shall also include removing, loading, transporting, and unloading of signal equipment/materials designated for scrap, and all equipment, material, tools and labor incidental thereto. This price shall also include removing and disposing of traffic signal equipment and all equipment, material, transportation, tools and labor incidental thereto. Payment for temporary relocations will be included in the bid item "Temporary Signalization (Site No. X)."

Payment is at the contract lump sum price for "Removal and/or Relocation of Traffic Signal Equipment" inclusive of all labor, equipment, transportation, connections, storage, excavation, backfill, installation and incidental material necessary for the complete removal of abandoned equipment/material and/or relocation of existing traffic signal equipment/material. Payment will also include the necessary labor, equipment, and material for the complete restoration of all affected areas.

Pay Item	**Pay Unit**
Removal and/or Relocation of Traffic Signal Equipment	L.S.

ITEM #1118051A - TEMPORARY SIGNALIZATION (SITE NO. 1)

ITEM #1118052A - TEMPORARY SIGNALIZATION (SITE NO. 2)

Description:

Provide Temporary Signalization (TS) at the intersections shown on the plans or as directed by the Engineer.

- **Site No. 1 (Intersection #159-239)** Great Meadow Road at Ramp E - Existing Signalized Intersection: Keep each traffic signal completely operational at all times during construction through the use of existing signal equipment, temporary signal equipment, new signal equipment, or any combination thereof once TS has started as noted in the section labeled Duration.
- **Site No. 2 (Intersection #063-290)** Airport Road at I-91 SB Exit Terminus – Existing Signalized Intersection: Provide TS during construction activities and convert the temporary condition to a permanent traffic signal upon project completion. Furnish, install, maintain, and relocate equipment to provide a complete temporary traffic signal, including but not limited to the temporary relocation of the pedestal and foundation, necessary support structures, electrical energy, vehicle and pedestrian indications, vehicle and pedestrian detection, pavement markings, and signing.

Materials:

- Pertinent articles of the Standard Specifications
- Supplemental Specifications and Special Provisions contained in this contract

Construction Methods:

Preliminary Inspection

In the presence of the Engineer and a representative from the DOT Electrical Maintenance Office (Town representative for a Town owned signal), inspect and document the existing traffic signal's physical and operational condition prior to Temporary Signalization. Include but do not limit the inspection to the following:

- Controller Assembly (CA)
  - Controller Unit (CU)
  - Detection Equipment
  - Pre-emption Equipment
  - Coordination Equipment
- Vehicle and Pedestrian Signals
- Vehicle and Pedestrian Detectors
- Emergency Vehicle Pre-emption System (EVPS) *
- Interconnect Cable and Splice Enclosures
- Support Structures
- Handholes, Conduit and Cable

It may be necessary to repair or replace equipment that is missing, damaged, or malfunctioning. Develop a checklist of items for replacement or repair after the inspection. If authorized by the Engineer, this work will be considered "Extra Work" under Article 1.09.04.

* At a State owned signal the EVPS equipment is usually owned by the municipality. It is recommended to apprise the municipality of the inspection schedule and results.

TS Plan

At least 30 days prior to implementation of each stage, submit a 1:40 (1:500 metric) scale TS plan for each location to the Engineer for review and comment. Include but do not limit the plan to the following:

- Survey Ties
- Dimensions of Lanes, Shoulders, and Islands
- Slope Limits
- Clearing and Grubbing Limits
- Signal Phasing and Timing
- Location of Signal Appurtenances such as Supports, Signal Heads, Pedestrian Push buttons, Pedestrian Signals
- Location of Signing and Pavement Markings (stop bars, lane lines, etc.)
- Location, method, and mode of Temporary Detection

Review of the TS plan does not relieve the Contractor of ensuring the TS meets the requirements of the MUTCD. A copy of the existing traffic signal plan for State-owned traffic signals is available from the Division of Traffic Engineering upon request. Request existing traffic signal plans for Town-owned traffic signals from the Town. Do not implement the TS plan until all review comments have been addressed.

Earthwork

Perform the necessary clearing and grubbing and the grading of slopes required for the installation, maintenance, and removal of the TS equipment. For the temporary relocation of the pedestal and foundation at Site No. 2, work shall include excavation and backfill for the foundation. After TS terminates restore the affected area to the prior condition and to the satisfaction of the Engineer.

Maintenance and Protection of Traffic

Furnish, install, maintain, relocate, and remove signal-related signing (lane-use, signal ahead, NTOR, etc.) and pavement markings as needed. Install, relocate, and/or remove equipment in a manner to cause no hazard to pedestrians, traffic or property. Maintain traffic as specified in the Special Provisions "Prosecution and Progress" and "Maintenance and Protection of Traffic."

Electrical Service and Telephone Service at Existing Signalized Intersections

If the electrical service or the telephone service source must be changed or relocated make all arrangements with the utility company and assume all charges. The party previously responsible for the monthly payment of service shall continue to be responsible during TS.

Electrical Service at Unsignalized Intersections

Assume all charges and make all arrangements with the power company, including service requests, scheduling, and monthly bills in accordance with Section 10.00.12 and Section 10.00.13 of the Standard Specifications. A metered service is recommended where TS equipment will be removed when no longer needed.

Temporary Signalization

Furnish, install, maintain, relocate, and remove existing, temporary, and proposed traffic signal equipment and all necessary hardware; modify or furnish a new CA; reprogram the CU phasing and timing; as many times as necessary for each stage/phase of construction to maintain and protect traffic and pedestrian movements as shown on the plans or as directed by the Engineer.

Inspection

When requested by the Engineer, the TS will be subject to a field review by a representative of the Division of Traffic Engineering and/or the Town, which may generate additional comments requiring revisions to the temporary signal.

Detection

Provide vehicle detection on the existing, temporary, and/or new roadway alignment for all intersection approaches that have existing detection, that have detection in the final condition as shown on the signal plan, or as directed by the Engineer. Keep existing pedestrian pushbuttons accessible and operational at all times during TS. Temporary Detection is described and is paid for under Item # 111120XA - Temporary Detection (Site No. X)

Emergency Vehicle Pre-emption System (EVPS)

Furnish, install, maintain, relocate, and remove the equipment necessary to keep the existing EVPS operational as shown on the plan. Do not disconnect or alter the EVPS without the knowledge and concurrence of the Engineer and the EVPS owner. Schedule all EVPS relocations so that the system is out of service only when the Contractor is actively working. Ensure EVPS is returned to service and is completely operational at the end of the work day. Keep the EVPS owner apprised of all changes to the EVPS.

Coordination

Furnish, install, maintain, relocate, and remove the equipment necessary to keep the intersection coordinated to adjacent signals as shown on the plan. Do not disconnect the interconnect without the approval of the Engineer.

- Closed Loop System: If it is necessary to disconnect the communication cable, notify the Engineer and the Bridgeport Operation Center (BOC) or the Newington Operation Center (NOC) prior to disconnect and also after it is reconnected.
- Time Base System: Program and synchronize all Time Clock/Time Base Coordination (TC/TBC) units as necessary.

Maintenance

Once TS is in effect, assume maintenance responsibilities of the entire installation in accordance with Section 1.07.12 of the Standard Specifications. Notify the Engineer for the project records the date that Temporary Signalization begins. Notify the following parties that maintenance responsibility has been transferred to the Contractor:

Signal Owner

CT DOT Electrical Maintenance Office or
Town Representative

Local Police Department

Provide the Engineer a list of telephone numbers of personnel who will be on-call during TS. Respond to traffic signal malfunctions by having a representative at the site within three hours from the initial contact. Within twenty-four (24) hours have the traffic signal operating according to plan.

If the Engineer determines that the nature of a malfunction requires immediate attention and/or the Contractor does not respond within three (3) hours, then an alternate maintenance service will be called to repair the signal. Expenses incurred by the alternate maintenance service for each call will be deducted from monies due to the Contractor with a minimum deduction of $1,000. The alternate maintenance service may be the owner of the signal or another qualified electrical contractor.

Duration

Temporary Signalization shall commence when any existing signal equipment is disturbed, relocated, or altered based on the inspection checklist in any way for the TS.

For intersections with a State furnished controller, TS terminates when the inspection of the permanent signal is complete and operational and is accepted by the Engineer. For intersections with a Contractor furnished controller, Temporary Signalization terminates at the beginning of the 30 day test period for the permanent signal.

Ownership

Temporary equipment supplied by the Contractor remains the Contractor's property unless noted otherwise.

Method of Measurement:

Temporary Signalization shall be paid only once per site on a percentage of the contract Lump Sum price. Fifty percent (50%) shall be paid when TS is operational as shown on the plan or to the satisfaction of the Engineer. Fifty percent (50%) shall be paid when TS terminates.

Basis of Payment:

This work shall be paid at the contract Lump Sum price for "Temporary Signalization (Site No.)" for each site. This price includes the preliminary inspection, TS plan for each stage/phase, furnishing, installing, maintaining, relocating and revising traffic signal equipment, controller assembly modifications, controller unit program changes such as phasing and timing,

removing existing, temporary, and proposed traffic signal equipment, arrangements with utility companies, towns or cities including the fees necessary for electric and telephone service, clearing and grubbing, grading, area restoration and all necessary hardware, materials, labor, and work incidental thereto.

For the temporary relocation of the pedestal and foundation at Site No. 2 as shown in the SPN 63-703 plans, the price shall also include excavation and backfill for the foundation. Payment for the relocation of the pedestal and foundation to the final location as shown in the SPN 159-191 plans shall be paid under the Item 1118012A – Removal and/or Relocation of Traffic Signal Equipment.

All material and work for signing and pavement markings is paid under the appropriate Contract items.

All material and work necessary for vehicle and pedestrian detection for TS is paid for under item 111120XA - Temporary Detection (Site No. X).

All Contractor supplied items that will remain the Contractor's property shall be included in the contract Lump Sum price for "Temporary Signalization."

Any items installed as part of the permanent installation are not paid for under this item but are paid for under the bid item for that work.

Pay Item	**Pay Unit**
Temporary Signalization (Site No. X)	L.S.

ITEM #1131016A - SMART WORK ZONE MOBILE VIDEO CAMERA/QUEUE SENSOR TRAILER (SVQS)

ITEM #1131017A - SMART WORK ZONE MOBILE VIDEO CAMERA/QUEUE SENSOR TRAILER (SVQS) SERVICE

ITEM #1131018A - SMART WORK ZONE VARIABLE MESSAGE SIGN/QUEUE SENSOR TRAILER (SVMQ)

ITEM #1131019A - SMART WORK ZONE VARIABLE MESSAGE SIGN/QUEUE SENSOR TRAILER (SVMQ) SERVICE

ITEM #1131020A - SMART WORK ZONE DEPLOYMENT

ITEM #1131021A - SMART WORK ZONE OPERATIONS

ITEM #1131022A - SMART WORK ZONE TRAILER RELOCATION

ITEM #1131023A - SMART WORK ZONE QUEUE TRAILER/SENSOR (SQT)

ITEM #1131024A - SMART WORK ZONE QUEUE TRAILER/SENSOR (SQT) SERVICE

Description: This work shall consist of furnishing, installing, operating, servicing, maintaining, relocating and removing an automated Smart Work Zone (SWZ) of the complete system for the duration of the Project.

These items shall include vehicle trailers, sensors, cameras, variable message signs, cloud hosted third party traffic speed data, processed rock for leveling trailers, website, communications equipment, relocation, service and maintenance. Included in the operational responsibilities is the assumption of all trailer license plates, communication costs such as FCC licensing, cellular telephone, wireless data networks, satellite and internet subscription charges, solar system support, battery charging and maintenance. In addition to these requirements, the Contractor shall assume all responsibility for any damaged equipment included in the system due to crashes, vandalism, adverse weather, etc. that may occur during system deployment and operation.

This system shall monitor the areas in advance of the project work zone and project's work zone area. The SWZ shall provide Connecticut Department of Transportation (CTDOT) operators control of the cameras to disseminate real-time information to the traveling public and other stakeholders. The system shall be completely operational fourteen (14) days prior to the start of roadwork to allow for traffic data accumulation by the system. The SWZ shall consist of an automated system using trailer-mounted microwave sensors that transmit vehicle speed and related data through cellular communications to a Contractor-hosted central computer system. The camera shall be used to verify traffic conditions within the viewable area of the camera. The central computer system shall send automated and operator manual commands to variable message signs through cellular communications to display travel time, delay and stopped traffic

information. The speed data, video images, and variable message sign content shall be hosted on a Contractor-supplied website.

The SWZ shall be capable of detecting the presence of queued traffic in the segments identified on the plans and reporting via the queue warning Smart Work Zone Variable Message Sign/Queue Sensor Trailer (SVMQ). The distance from the SVMQ to the detected back of queue shall be reported within one-half (1/2) mile accuracy on the system, but reported on the SVMQ at one (1) mile accuracy rounded up to the nearest mile. This "real-time" queue location information shall be calculated and displayed on the applicable SVMQ to the nearest minute.

The SWZ shall have the capability to notify the construction field office, Contractor or others, as determined by the Engineer, of travel times and when the speed through the work zone decreases below thirty (30) mph. The system shall be capable of transferring real-time data in a file format compatible with Oracle®. "Motion" video feeds updated once per one (1) second shall be available for the CTDOT to display on the Contractor-provided website. In addition, any number of CTDOT or Contractor employees shall be notified via email or text message for these speed changes. Contact information will be furnished by the Engineer at the start of the SMZ deployment.

All the required components of the SWZ shall be fully operational within forty-five (45) days of notice to deploy from the Engineer. If not fully operational within said forty-five (45) days, a payment reduction of five percent (5%) for each day the entire system is not operating will apply, as determined by the Engineer.

Once operations begin, the SWZ shall perform with no major malfunctions throughout the Contract, unless the Engineer requests the system or portions of the system be removed. Malfunctions include, but are not limited to, the inability of the equipment to provide accurate real-time video feeds, delay, or travel time information, inability to withstand the construction roadside environment or normal weather conditions. The Engineer reserves the right to terminate this item at any time if it is determined the SWZ is not performing in accordance with this specification.

Construction Methods:

Submittals:

1. At least twenty (20) days prior to beginning installation, the Contractor shall submit to the Engineer for review and approval, in consultation with the CTDOT's Subject Matter Expert, evidence that the proposed supplier has successfully completed at least five (5) SWZ projects similar in concept and scope to the proposed system in the past five (5) years. The proposed supplier shall also provide the credentials of a qualified technician who shall install and operate the system. Include names, addresses, and telephone numbers of the similar project's owner's representatives for verification.
2. Also, at least twenty (20) days prior to beginning installation, submit brochures and cut sheets on all units of the SWZ, with details of how and which communications systems shall be used, and the technical specifications for the website.
3. The Contractor shall demonstrate to the Engineer an operating SWZ.
4. At least fourteen (14) days prior to installation, the Contractor shall propose the actual device layout to the CTDOT for review and approval.

5. Prior to public viewing, the website map showing device locations and other interactive elements shall be submitted for the Engineer's review.
6. The Engineer reserves the right to add or remove locations as needed.

Equipment:

1. The SWZ shall consist of the following equipment.
   a) Fourteen (14) SVQS with camera with pan-tilt-zoom (PTZ). The computer hardware and software must meet the manufacturer's requirements to operate and monitor the system. The camera response time to web commands for PTZ shall be reviewed and approved by the Engineer. The PTZ response time shall follow the operator's manual commands to move the camera to the desired position.
   b) One (1) SQT shall provide real time speed, volumes, occupancy and other necessary data to the SWZ to activate messaging on the variable message signs and provide historical data.
   c) Fifteen (15) SVMQ shall display real-time travel time messaging and back of queue warning to the traveling public.
   d) Communication equipment including wireless data networks, base stations, cell phone data interfaces, Ethernet network interfaces, and internet interfaces.
   e) Customized Webpage integrated with the SWZ to include traveling public and Project staff accessibility; SWZ website shall be allowed to "link" to the CTDOT's website
   f) Software package customized for this particular Project's needs.

2. The following shall be provided for each SQT, SVMQ and SVQS with PTZ:
   a) Approximate locations of variable message signs and traffic sensors shown on the figures below may be adjusted to ensure sightlines and safety are adequate
   b) Clean stone or processed rock to provide a level area for trailers and provide for sufficient height for sensors to operate correctly.
   c) Individually mounted on trailer units with solar power.
   d) Equipped with digital wireless cellular modems as required.
   e) Linked to the Contractor's central computer server.
   f) Maintained as needed to remain operational, including cleaning and inspecting components, snow and ice removal from solar panels and keeping batteries charged.
   g) Extra set of programming instructions stored in the units for emergency use.

3. The SVQS, SQT, and SVMQ shall collect and process traffic data as programmed within the software provided with the sensors. This data shall be transmitted over a digital cellular network to access and store the respective data remotely. The remote monitoring and data collection shall be placed in areas where wireless communication is available. The SVQS, SQT, and SVMQ shall use both solar power and deep cycle batteries to provide a self-contained completely autonomous system.

The SVQS mobile camera(s) shall provide a mobile, self-contained, all-weather, trailer-mounted equipment platform. The mobile camera system shall use wireless communication. The mobile camera shall provide a rapidly-deployable real-time video system viewable from a remote location. The mobile camera shall be capable as a stand-alone camera system.

   a) Trailer and power requirements:
      i. 2-wheel industrial grade trailer with stabilizer legs
      ii. Available as a mobile unit or permanent mount

iii. Adjustable solar array for maximum exposure to sun
iv. Removable trailer tongue
v. Battery bank sized for thirty (30) day autonomy

b) SVQS requirements:
i. Microwave detection (Wavetronix Smart Sensor HD) with Dual Radar that reliably detects up to twenty-two (22) lanes of traffic, auto configuration
ii. Provide data including speed, volume and occupancy
iii. Digital cellular communications
iv. Dome camera with day/night adjustable pan/tilt/zoom IP addressable
v. Mobile camera system shall provide camera operating software to use camera manufacturer's operating system.
vi. Minimum thirty (30) ft extendable mast with 360 degree lockable rotation
vii. Capable of providing streaming or snapshot video
viii. Electric hoists for rapid deployment

c) SQT requirements:
i. Microwave detection reliably detects up to twenty-two (22) lanes of traffic
ii. Data provided includes speed, volume and occupancy
iii. Available as a mobile unit or permanent mount
iv. Digital cellular communications

4. The SVMQ shall be configured with the following variable message sign requirements or approved equal:

a) Trailer and power requirements:
i. 2-wheeled trailer structurally adequate to serve as both a carrier and an operating platform
ii. Meets Federal Regulations for safety and travel
iii. Color of trailer paint shall be safety orange or as approved by the Engineer
iv. Bank of batteries capable of being recharged automatically by a group of solar panels located at the highest point on the unit
v. Variable message signs shall be designed with sufficient energy backup to operate for a period of thirty (30) days (minimum) at 75°F without sun exposure
vi. Solar panel generator array shall recharge the battery bank at a rate of 2 1/2 hours peak sun per twenty-four (24) hour period of usage
vii. Solar panel array sized to replace the power used in typical daily operation with less than four (4) hours of sun
viii. Deep cycle, lead acid 12-volt batteries wired in parallel, housed in a lockable heavy duty steel weatherproof battery box
ix. Batteries recharged by a solar panel array producing 110 watts of power minimum
x. Built-in battery charger with minimum 25 ampere per hour rating
xi. Solar charge current meter and battery charger current meter visible
xii. Protective housing painted with manufacturer's standard colors

b) Variable Message Sign/Queue Sensor requirements:
i. Sign panel of welded aluminum alloy construction, assembled to prevent dissimilar metal action from occurring
ii. Length of sign panel 128 inches or less

iii. Front face of sign covered with clear UV-inhibited polycarbonate to prevent fading
iv. Message center:
1) Three (3) separate lines, center justified
2) Each line up to eight (8) characters, equally spaced a minimum of three (3) inches apart
3) Each character eighteen (18) inches high by twelve (12) inches wide
4) Each character configured with thirty-five (35) LED lamp pixels in a five (5) x seven (7) element arrangement
5) Message color 590 nanometers (yellow-orange)
i. Remote sign operation via central computer
ii. Messages to be displayed shall have capability to be timed to changes at various times of day and days of week
iii. Trailer-mounted variable message board consisting of optically enhanced LED lamp matrix panels powered by a bank of batteries in order to convey bright, distinctive messages to the traveling public
iv. Sign capable of displaying up to eight (8) pages in a multiple page message, with variable timing in one-tenth (1/10) second increments under computer control
v. Sign shall completely change all lines of message copy in not more than one hundred (100) milliseconds
vi. Sign clearly visible and legible from a distance of eight-hundred (800) feet under both day and night conditions, with a photocell automatically adjusting its light source for variable light level conditions
vii. Sign panel supported on a telescoping upright member with hydraulic lift to permit raising the sign for operation and lowering the sign for transport
viii. Telescoping upright able to rotate 360 degrees and shall lock into position
ix. Telescoping distance of nominally five (5) feet to allow bottom of sign to be at least seven (7) feet above the ground
x. Sign panel shall pivot to the longitudinal axis of the trailer for transport, to reduce aerodynamic drag
xi. Static sign attached identifying the message board is for the Project; coordinate sign content and appearance with the Engineer
xii. Microwave detection (Wavetronix Smart Sensor HD) with dual radar that reliably detects up to twenty-two (22) lanes of traffic, auto configuration
xiii. Data provided from sensor to include speed, volume and occupancy
xiv. Available as a mobile unit or permanent mount

c) Variable Message Sign on-board dedicated computer requirements:
i. Solid state design, removable, including a keyboard through which user originated messages may be entered for display or storage
ii. LCD display screen upon which messages can be reviewed before display on the message sign
iii. Storage of a minimum of one hundred (100) preprogrammed messages for display when called upon by an operator through the keyboard and a minimum of one hundred (100) users originated multiple page messages.
iv. Password coding or key entry.

v. Control programming to present sequenced messages under operator control through keyboard entry.
vi. Control for moving arrow displays.
vii. Calendar program to automatically start and stop the display of sequences at predetermined times.
viii. Character board and battery diagnostics.
ix. Computer housing: weather resistant, shock resistant lockable control box with a light for night operation.
x. Power control unit housed in a lockable, steel, weatherproof battery box containing two (2) current meters (to show amperage generated with battery charger and amperage from solar panels to battery bank).
xi. Power control unit to incorporate a PV regulator with thermal compensation for variances in ambient temperature, to regulate the charge rate to the battery bank.
xii. Control circuitry connected to variable message sign's photocell that detects ambient light conditions and reduces lamp intensity at night to reduce glare.

d) Variable Message Sign - other requirements:
i. Variable message sign operation using cellular telephone and cellular telephone service (trailer must be located within cellular telephone coverage), allowing operator remote control of the on-board computer
ii. A Queue Trailer/Sensor may be located next to designated SVMQ to collect data
iii. The message sign shall provide for remote sign operation via central computer base station or Website allowing operators to manually override the automated messaging in order to display a message at any time. The operator shall be able to cancel this override and initiate the systems automated messaging feature.
iv. Any request to change messages on the Variable Message Signs shall be approved by the CTDOT.

Deployment and Operation:

The decision to deploy or remove individual devices or the entire SWZ will be made by the Engineer. Once the decision is made to deploy the system, the Engineer will coordinate with the Contractor for the duration of system deployment.

1. The SWZ shall be installed as shown in the approved layout. The locations may require repositioning as directed by the Engineer and as the project continues. The system shall be maintained and operated for the duration of the Project or as directed by the Engineer. The Contractor shall service the SWZ on a six (6) month regular interval for the duration of the Project or as directed by the Engineer. Additionally, the Contractor shall clean the Camera dome bubbles at least once per month during the winter months between December and March for the duration of the project as directed by the Engineer. The service shall include cleaning the sign panel, removing snow/ice and debris from the solar panels as needed or as directed by the Engineer. The Contractor shall follow the manufacturer's requirements for cleaning the SVQS. The cost of the service shall be included in the items (Item Nos. 1131017A, 1131019A, and 1131024A) for each unit.

2. The Contractor shall prepare the locations to receive the equipment in accordance with the equipment manufacturer's requirements. Each location shall include clean stone or processed

rock provided and installed by the Contractor to level the surface area. Some location may require the trailers to be lifted over the safety barrier and placed on the level processed rock.

3. The Contractor shall install each of the system components in accordance with the manufacturer's recommendations, in compliance with all industry standards and codes such that each system is fully operational and can be operated and controlled from the Construction Field Office or remotely, as approved by the Engineer.

4. The Contractor shall coordinate the work with others as designated by the Engineer to complete installation and integration of all equipment for all system types.

5. System Calibration and Configuration: The SWZ shall provide the following:
   a) Software shall be configured for notification to appropriate personnel at the Highway Operations Center, the Construction Field Office and the Contractor by email each time a malfunction has occurred in the system. A malfunction record shall also be made in the database. The software shall be configured so that any number of approved personnel can be notified. The email shall display an error message for the device or devices affected. Through the Contractor, the SWZ Webpage Integrator shall be responsible for this notification procedure.
   b) Software shall be configured to provide current operational and location status (such as current traffic data and messages, communications system, signs, and sensors as well as latitude/longitude of all deployed devices) via the Internet to a dedicated Website established for the purpose of monitoring the corridor and the SWZ equipment.
   c) Software shall be configured to assess any type of malfunction that has occurred. This assessment includes communications disruption between any device in the system configuration, variable message board malfunctioning, speed sensor malfunction, loss of power, low battery, etc. This malfunction information shall be sent via email in text format to the Highway Operations Center, Engineer, or Contractor, as designated by the Engineer, for each occurrence.
   d) To support incident management, the SWZ software shall be configured to allow Project staff to manually override motorist information messages for a user-specified duration; after which, automatic operation will resume with display of messages appropriate to the prevailing traffic conditions. All overriding messages shall have the message content and the username logged into the database.

6. SWZ Website shall have the following:
   a) Password protected link for approved personnel to access the operational characteristics of the system, allowing manual override of errant messages.
   b) The website shall display current traffic conditions and real time speed at upstream locations to the nearest minute. The "real time" traffic delay information displayed on the SVMQ's shall be updated every one (1) minute minimum with the website delay information updated simultaneously.
   c) The website shall allow the scheduling of messages by the operator on a sign or group of signs, to turn on and to turn off messages at times set in the future.
   d) Placement of all devices shall be shown on the dedicated website using latitude/longitude coordinates. The placement of these devices on the website shall be approved by the Engineer prior to release of the website.

e) The website shall display camera images at least five (5) frames per second. Cameras images shall be displayed by a user selectable menu. Cameras can be selected one (1) at a time or all cameras images simultaneously using another page or "video wall." Camera images can be displayed by "hovering" over and selecting the camera icon.

f) Via the internet and the dedicated website, the website shall provide a full color map using Google Maps or equivalent depicting the Project area with locations of traffic sensors and SVMQ's. Using an administrator defined color-coding scheme, the map reflects the current average speed at each traffic sensor and displays the entire information message being shown by each SVMQ either on the map or on the side bar of the website. The Contractor shall use the third party traffic speed data to "fill" in the speed data display on the website between sensors. The contractor shall use the sensors for maximum distance of one-half (1/2) mile on the map. The map shall be automatically refreshed a minimum of once every minute to display any changes to traffic sensor(s) and/or SVMQ's. A legend of all icons and a short description of each shall be placed on the website.

g) The SWZ website shall be capable of providing and displaying the travel delay cost data (monetary values) in a graph and/or chart format and allow users to run reports against the data by hour, day and month intervals through the browser. This feature shall not be accessible by the public. The SWZ website shall have report output formats that include at minimum PDF, rich text format, and Microsoft Excel formats. See requirement 10. part o.

h) The SWZ Website shall provide a map with current traffic conditions by way of a colored layer over the road. The layer on the map shall display a different color for the different traffic speeds by use of colored bars over the existing road, with a legend explaining the meaning of each color. The color descriptions are as follows:

   i. less than 10 mph = black
   ii. less than 30 mph = red
   iii. less than 40 mph = orange
   iv. less than 50 mph = yellow
   v. 50 mph and over = green

7. Smart Work Zone Operations

a) System Communications shall meet the following requirements:

   i. The Contractor shall perform the required configuration of the SWZ's communications system during system initialization.
   ii. Communications between the server and any individual SVMQ or SVQS shall be independent through the full range of deployed locations and shall not rely upon communications with any other SVMQ or SVQS sensor.
   iii. The SWZ communications system shall incorporate an error detection/ correction mechanism to insure the integrity of all traffic conditions data and motorist information messages.

b) In addition to meeting manufacturer's specifications, the Contractor shall program the SWZ to ensure that the following General Operational requirements are met:

   i. The SWZ traffic sensors shall be such that the accuracy is not degraded by inclement weather and visibility conditions including precipitation, fog, darkness, excessive dust and road debris. The sensors shall be capable of

acquiring traffic data for a minimum of twenty-two (22) lanes of traffic on a lane-by-lane basis.

ii. The SWZ shall operate continuously (24 hours, 7 days a week) when deployed on the Project. It shall always be collecting and storing data.

iii. All traffic data and motorist information messages displayed by the SWZ shall be archived in the database with time and date stamps.

iv. The SWZ shall be capable of acquiring traffic volume and speed data, developing travel times, and selecting motorist information messages automatically without operator intervention after system initialization.

v. The SWZ shall automatically select default and advisory messages based on traffic conditions at a single traffic sensor point or at multiple traffic sensor points in combination.

vi. Administrative users shall be able to create and save a library of messages with up to twenty (20) different default or automatic advisory messages for each SVMQ.

vii. System operator control functions shall be password protected.

viii. To support incident management, the SWZ shall allow the Engineer and Project staff with password privileges to manually override motorist information messages for a user-specified duration, after which automatic operation shall resume with display of messages appropriate to the prevailing traffic conditions.

ix. The SWZ shall be capable of providing current operational status (such as current traffic data and messages, communications system, signs and sensors, video feeds) via the dedicated Project website.

x. For remote sign operation, the website shall allow password-protected access for Project staff to manually override automated messaging in order to display a message at any time. The staff shall be able to send a pre-programmed or custom message to a selected sign or group of signs. The staff shall be able to cancel this manual override and initiate any and all of the system's automated messaging features at any time.

xi. The default and advisory message content shall be programmable from the website as well as the field laptops.

xii. The dedicated Project website shall provide a full color map depicting the Project area with locations of SVQS sensors and SVMQ's. The graphical representation of each device location is based on latitude/longitude coordinates. The map shall show the current traffic conditions at each SQT and display the entire SVMQ message at each location.

xiii. The website shall have a link to the CTDOT's website and the website shall allow the CTDOT's website to link to it.

xiv. The system shall autonomously restart in case of power failure in any part of the system.

xv. Each SVMQ shall be capable of displaying eight (8) characters on each of three (3) rows. Standard messages shall be as defined in "Smart Work Zone Management System Motorist Information Messages" section below.

xvi. Cameras must be capable of operating on both solar and AC power. Should the visibility of the traffic cameras be degraded by inclement weather including snow, precipitation, excessive dust or road debris, the Contractor shall clean the camera housing to restore proper viewing.

8. Training and Support required:
   a) Ensure that the SWZ is furnished, installed and maintained by personnel who are experienced in this type of work. Deploying firm personnel must have a minimum of five (5) similar deployments.
   b) Training shall be provided to Project staff on their authorized use and operation of the physical field hardware, software and website of the SWZ.
   c) The Contractor shall supply training and documentation to enable the Engineer to add additional signs or traffic sensors to the system. The Contractor shall provide the communications for any of these additional signs or traffic sensors.

9. System Operational Performance:
   a) To ensure a prompt response to incidents involving the integrity of the SWZ devices, the Contractor shall be required to make all necessary corrections to the components of the system within twenty-four (24) hours of notification by the CTDOT.
   b) If all corrections are made within this twenty-four (24) hour period and the system is brought back on-line, no pay reduction (as outlined in the Method of Measurement section) will occur.
   c) If the twenty-four (24) timeframe expires and the components of the system are not fully restored to proper working order, no payment will be made from the time of initial notification until the system is brought back on-line. If the system is restored within ten (10) days, a pro-rated monthly payment reduction will be determined as outlined in the Method of Measurement section.
   d) If the components of the SWZ are down for more than ten (10) total days in a month, whether they are consecutive or cumulative, and then NO payment will be made for that month. Components are the SWZ variable message signs, SWZ Mobile Camera with PTZ, Communications Equipment, and SWZ Queue Sensors, computer hardware and software required to place the real time information on the signs, and the project's Website. The CTDOT reserves the right to remove the SWZ components if it determines the system is not performing in accordance with this specification, and no additional payment shall be made.

10. Data Acquisition requirements:
   a) Each SVQS sensor shall communicate with the field computers and the website to activate the appropriate SVMQ whenever the prevailing traffic speed slows to below fifteen (15) mph (or other designated speed as determined by the Engineer). Once activated, pre-programmed messages shall be automatically displayed on the SVMQ. The message content shall be as directed by the Engineer.
   b) The SWZ shall be capable of calculating and having "real time" delay information displayed on the SVMQ's. This "real time" delay shall be calculated and displayed on the SVMQ's to the nearest minute.
   c) The website delay information shall be updated simultaneously with the traffic speed information displayed on the Variable Message Signs.
   d) To allow for motorist information messages of high specificity, the SWZ shall acquire quantitative traffic data using an accurate speed measurement technique that includes the capability of detecting stopped traffic and counting traffic volume.

e) The SWZ system's traffic sensors shall be of a type whose accuracy is not degraded by inclement weather or low visibility conditions including precipitation, fog, darkness, excessive dust, and road debris.
f) The SWZ shall be capable of acquiring traffic data from up to twenty-two (22) lanes of traffic in multiple directions, for example: Eleven (11) northbound and eleven (11) southbound.
g) The Contractor shall provide redundancy for data archiving and exchange. The Contractor shall provide Content Delivery Network (CDN) to aggregate video data streams from any PTZ camera to a centralized location to reduce bandwidth consumption from each individual PTZ camera head to end users and allow for separate controllable/ configurable streams for public and operator use.
h) The CDN shall be capable of allowing the Project staff to start and stop public feeds from the SWZ website while not interfering with the private feeds being displayed on the website.
i) All traffic data acquired by the SWZ including, but not limited to, calculated data fields shall be archived in a log file with time and date stamps for the duration of the Project. During the Project, requests for archived data may be made through the Engineer to the SWZ contractor. The Contractor shall provide this data to the Engineer within five (5) days upon receipt of the original request.
j) At the end of the Project, the SWZ Contractor shall provide the CTDOT comprehensive Project archive data with the exception of video. This logged information shall be in a format compatible with CTDOT requirements. The Contractor shall coordinate with the Engineer for requirements.
k) The SWZ shall provide device outage alerts via email to the Engineer for outages greater than fifteen (15) minutes. The alerts shall be used to generate a monthly summary spreadsheet displaying outages greater than twenty-four (24) hours, submitted to the Engineer. The email addresses for recipients of outage alerts shall be provided by the Engineer. Any pay reductions as per the pro-rated schedule will be calculated from the monthly outage summaries, as described in the Method of Measurement section.
l) The system shall be capable of transferring for each camera device a video data format acceptable to the CTDOT.
m) The Contractor shall provide notification of data format changes to the CTDOT before they take place.
n) Unique device identifiers shall be coordinated at the beginning of the Project and shall not change once the SWZ contractor has initially defined them, unless otherwise approved by the Engineer.
o) The SWZ shall be capable of calculating travel delay cost (monetary value) information for passenger cars and trucks from the beginning of the Project to the end of the Project. The SWZ system shall maintain a database of current and historical travel delay cost data. The SWZ travel delay cost information shall be provided in dollars per hours ($/hr.) of travel time. The SWZ travel time delay cost information shall follow the Chapter 2 (Sections 2.2.1 – 2.2.2.3) of the Work Zone Road Users Costs Manual (FHWA-HOP-12-005). The Contractor shall provide the calculations and formulas for the travel delay costs to the Engineer for review and approval prior to the SWZ system implementation. The Contractor shall provide examples of the charts and tables for the travel delay costs to the Engineer for review and approval prior to the SWZ system

implementation. The scale of the travel delay costs charts and tables shall be consistent with the data accumulated by the SWZ throughout the Project period.

11. SWZ Motorist Information Message requirements:
    a) The SVMQ shall be capable of providing speed, delay, length of traffic queue, travel time, stopped vehicles, and lane closure message advisories to motorists.
    b) Records of all motorist information messages and travel times displayed by the SWZ shall be submitted to the Engineer in a format compatible with CTDOT requirements.
    c) The SWZ must have capacity to preset up to twenty (20) different default or automatic advisory messages for each SVMQ.
    d) Message Sets:
        i. The upstream SVMQs within 1 1/2 miles of the work zone shall display either the following message or an alternate message approved by the Engineer:

        ROAD WORK AHEAD
        XX MIN THRU WORKZONE

        ii. SVMQs located within the work zone will display different messages as per their location. Either the following sample message or an alternate message approved by the Engineer will be displayed:

        TO EXIT XX
        X MILES
        X - X MIN

        iii. Queue warning SVMQ's located prior to any construction activity that negatively impacts traffic flows shall display the following message or an alternate message approved by the Engineer:

        STOPPED TRAFFIC XX MILES
        BE PREPARED TO STOP
        - or -
        SLOW TRAFFIC XX MILES
        USE CAUTION

    e) The sequences above are a minimum requirement and can be adjusted by the Engineer at his or her discretion.
    f) The SWZ shall acquire traffic flow data and use an accurate speed calculation technique that includes the capability of detecting stopped traffic, counting traffic volume and lane occupancy.
    g) The wireless cellular communications system(s) used for the Project must be reliable, dependable, and capable of functioning at all times regardless of weather, locations and cell phone usage. The Contractor shall be responsible for all communications costs, utilities, and satellite or cellular phone services needed to provide the dependable functioning SWZ.

Approximate Location of SWZ:

Figures 1-5 and Tables 1-5 are provided as a guide. Actual locations of the SWZ equipment shall be determined in the field. The Engineer will review and approve final locations of the equipment.

FIGURE 1: I-91 Southern Section

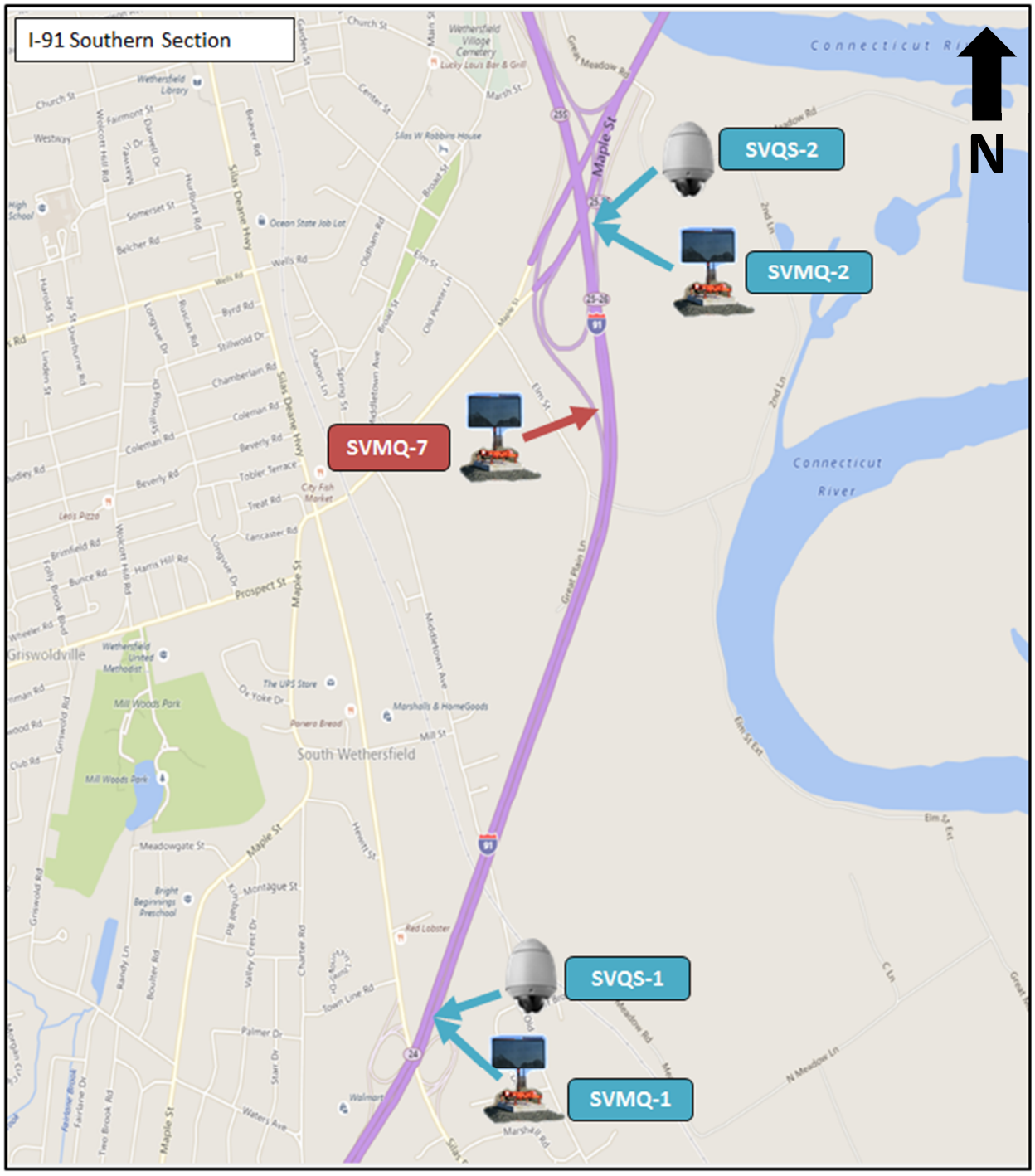
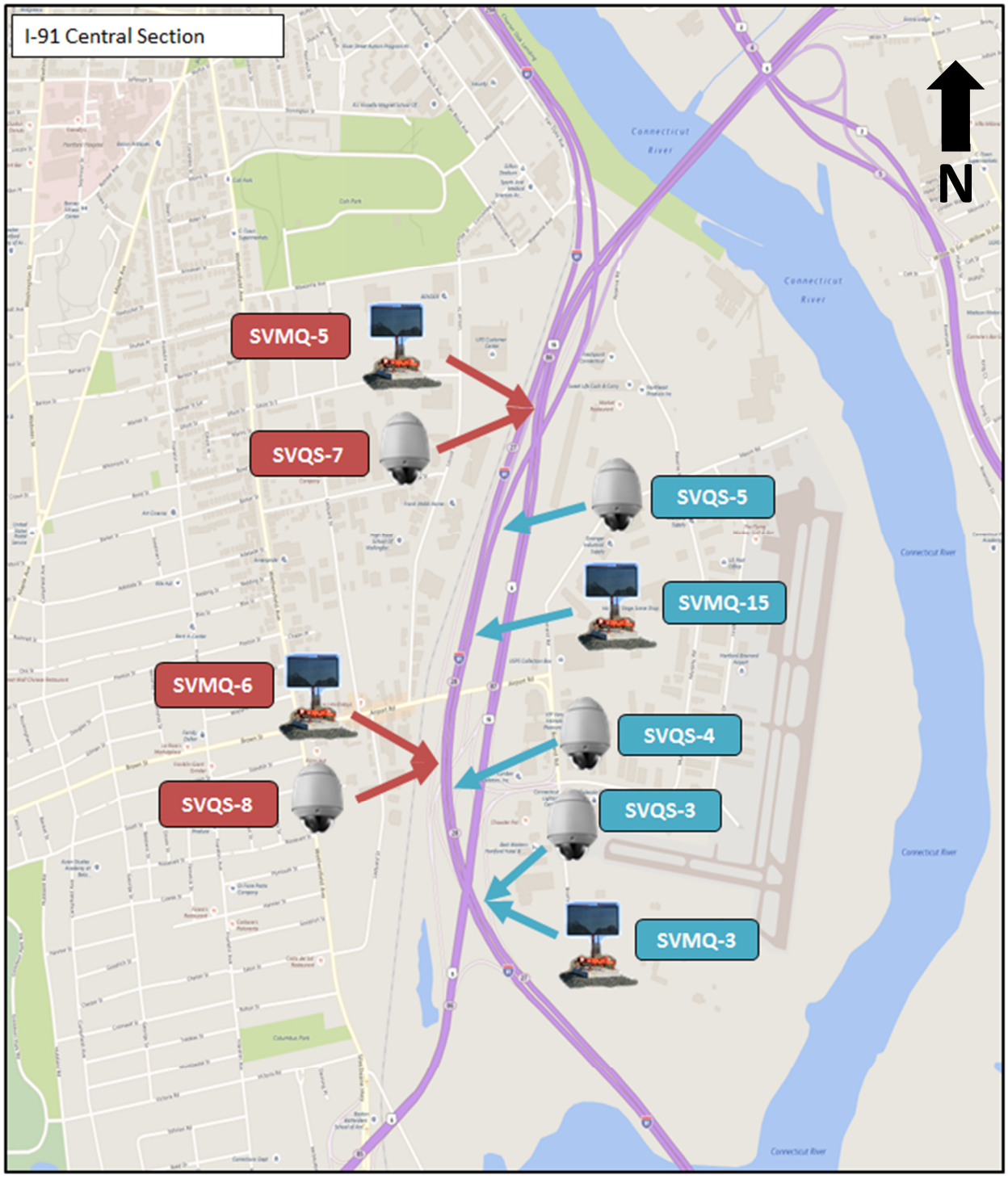


FIGURE 2: I-91 Central Section



LEGEND	
SB SQT	NB SQT
SB SVQS	NB SVQS
SB SVMQ	NB SVMQ

FIGURE 3: I-91 Northern Section

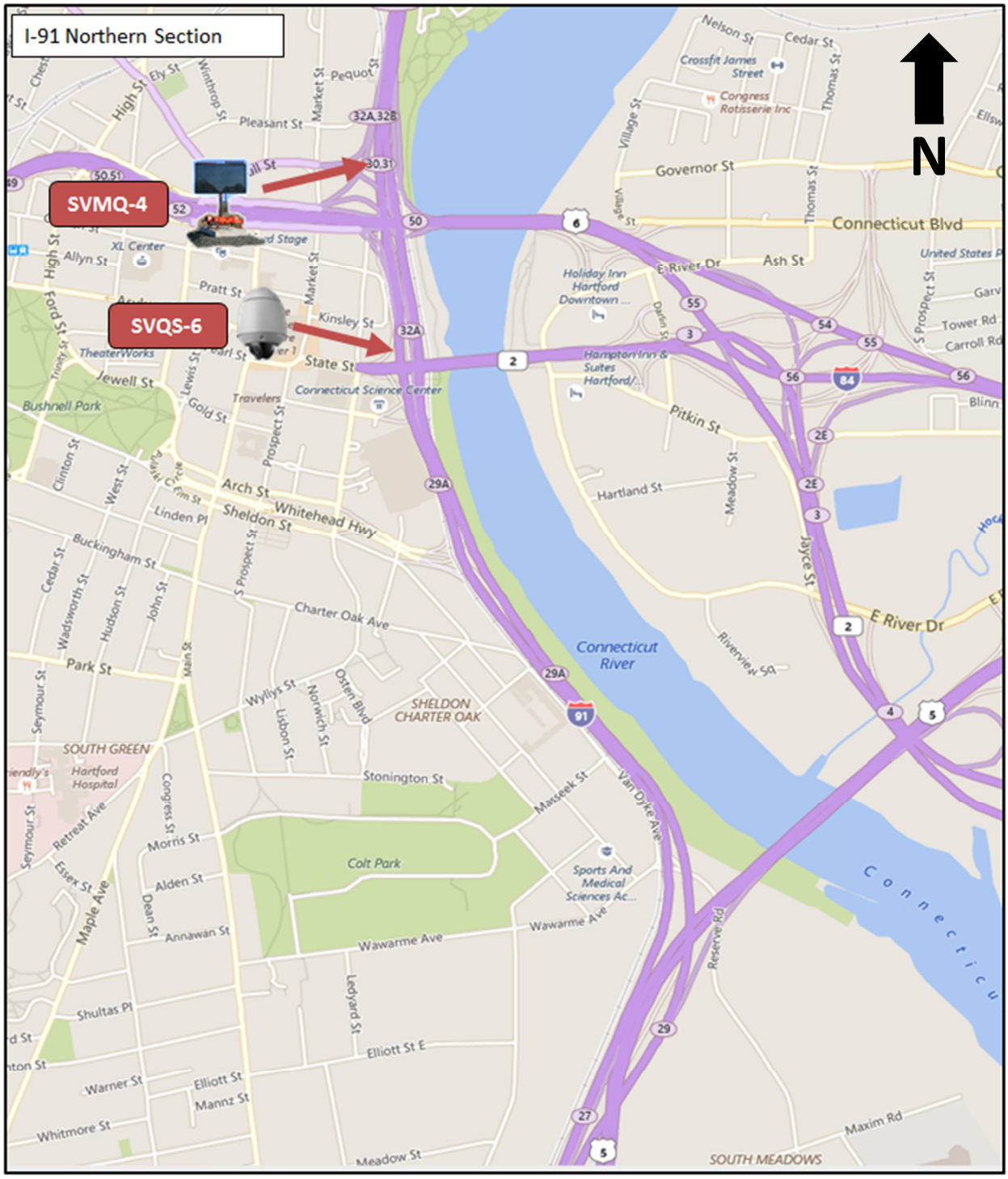
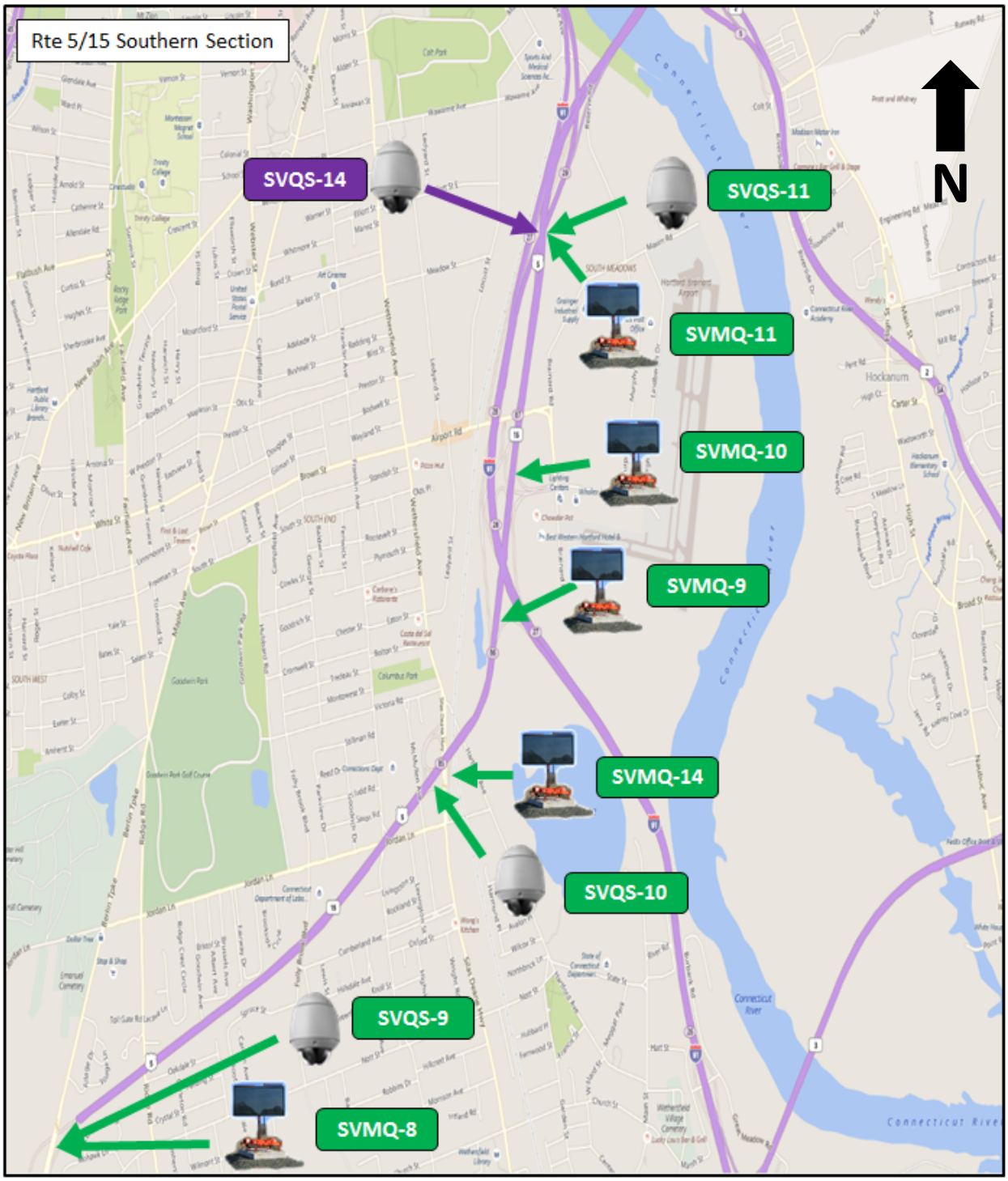
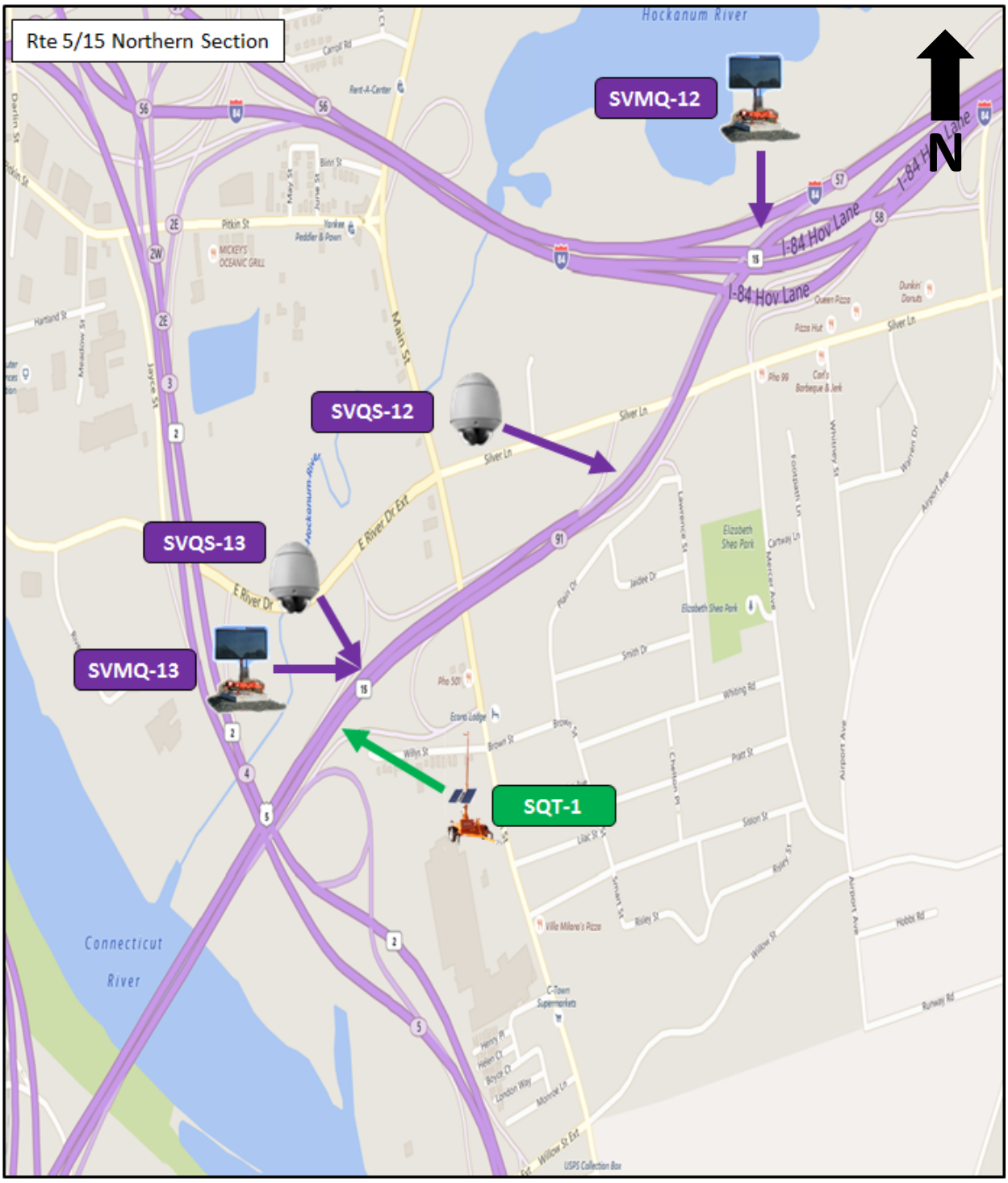


FIGURE 4: Rte 5/15 Southern Section



LEGEND	
SB SQT	NB SQT
SB SVQS	NB SVQS
SB SVMQ	NB SVMQ

FIGURE 5: Rte 5/15 Northern Section



LEGEND	
SB SQT	NB SQT
SB SVQS	NB SVQS
SB SVMQ	NB SVMQ

Tables: Approximate Location of SWZ Implementation for the Project Site. All locations shall be confirmed with the Engineer.

Table 1 – I-91 Southern Section				
Route	**Direction**	**Town**	**Location**	**Type of Equipment**
I-91	Northbound	Rocky Hill	On Ramp Gore Area after I-91 Exit 24	SVMQ
I-91	Northbound	Rocky Hill	On Ramp Gore Area after I-91 Exit 24	SVQS
I-91	Northbound	Wethersfield	Off Ramp Gore Area at I-91 Exit 25-26	SVMQ
I-91	Northbound	Wethersfield	Off Ramp Gore Area at I-91 Exit 25-26	SVQS
I-91	Southbound	Wethersfield	On Ramp Gore Area after I-91 Exit 25N	SVMQ

Table 2 – I-91 Central Section				
Route	**Direction**	**Town**	**Location**	**Type of Equipment**
I-91	Northbound	Hartford	Off Ramp Gore Area at I-91 Exit 27 to Brainard	SVMQ
I-91	Northbound	Hartford	Off Ramp Gore Area at I-91 Exit 27 to Brainard	SVQS
I-91	Northbound	Hartford	Off Ramp Gore Area at I-91 Exit 28	SVQS
I-91	Northbound	Hartford	Before Exit 29 Charter Oak Bridge Roadway Sign behind guiderails	SVMQ
I-91	Northbound	Hartford	Before Exit 29A Tourist Info Sign Roadway Sign behind guiderails	SVQS
I-91	Southbound	Hartford	Gore Area at Rte 5/15 and I-91 Split	SVQS

			Exit 86	
I-91	Southbound	Hartford	Gore Area at Rte 5/15 and I-91 Split Exit 86	SVMQ
I-91	Southbound	Hartford	Off Ramp Gore Area at I-91 Exit 28	SVQS
I-91	Southbound	Hartford	Off Ramp Gore Area at I-91 Exit 28	SVMQ

Table 3 - I-91 Northern Section				
Route	**Direction**	**Town**	**Location**	**Type of Equipment**
I-91	Southbound	Hartford	Off Ramp Gore Area at I-91 Exit 32A-B	SVMQ
I-91	Southbound	Hartford	Before Exit 29A Center Ctr Roadway Sign behind barrier	SVQS

Table 4 – Rte 5/15 Western Section				
Route	**Direction**	**Town**	**Location**	**Type of Equipment**
5/15	Southbound	Hartford	Gore Area Before I-91 Overpass on Rte 5/15	SVQS
5/15	Northbound	Hartford	Grass area Before I-91 Overpass on Rte 5/15	SVMQ
5/15	Northbound	Hartford	Before I-91 Overpass on Rte 5/15	SVQS
5/15	Northbound	Hartford	On Ramp Gore Area at Brainard Road to Rte 5/15	SVMQ
5/15	Northbound	Hartford	Off Ramp Gore Area at Rte 5/15 Exit 86	SVMQ
5/15	Northbound	Wethersfield	Off Ramp Gore Area at Rte 5/15 to Rte 99	SVQS
5/15	Northbound	Wethersfield	On Ramp Gore Area at Rte 5/15 to I-91	SVMQ
5/15	Northbound	Wethersfield	On Ramp at Rte	SVQS

			5/15 to I-91 Gore Area	
99	Northbound	Wethersfield	On Ramp at Rte 99 to Rte 5/15/I-91 behind guiderails	SVMQ

Table 5 – Rte 5/15 Northern Section				
Route	**Direction**	**Town**	**Location**	**Type of Equipment**
5/15	Southbound	East Hartford	Exit 57 Ramp Gore Area at I-84 and Rte 5/15 Split	SVMQ
5/15	Southbound	East Hartford	On Ramp Gore Area for Silver Ln to Rte 5/15	SVQS
5/15	Southbound	East Hartford	On Ramp Gore Area for E River Drive Extension to Rte 5/15	SVQS
5/15	Southbound	East Hartford	On Ramp Gore Area for E River Drive Extension to Rte 5/15	SVMQ
5/15	Northbound	East Hartford	After Exit 291 Roberts St Roadway Sign behind barrier	SQT

Trailer Relocation Operations:

1. The Contractor shall relocate the SWZ trailers as agreed between the Contractor and the Engineer.

2. The Contractor shall reconfigure the SWZ equipment including the SVQS sensor and the camera with PTZ shall to monitor travel lanes at the relocation site. The Contractor shall confirm the reconfigured settings with the Engineer.

3. The Contractor shall update the website with the relocation sites of the SWZ. The Website shall show the new location of the SWZs upon completion of the update. The update shall occur within two (2) weekdays of the relocation.

Method of Measurement:

1. The SWZ Deployment will be measured as a Contract lump sum item.

2. The SVMQ, SVQS, and SQT items will be measured based on uninterrupted operation of all trailer, sensors, cameras with pan-tilt-zoom, variable message signs, solar panels, batteries. SVMQ, SVQS, and SQT will be measured for payment on a per unit basis for each month that the piece of equipment is in use, and as follows:
   a) Measurement will begin from the date each unit is fully operational, as determined by the Engineer, to the date it is released back to the Contractor.
   b) The Engineer will compute periods of less than one (1) month at the rate of 1/30 of a month for each day of use.

3. The SVMQ, SVQS, and SQT service items will be measured for payment by the month or fraction of a month as follows:
   a) Includes monthly operations, monthly cellular service communications, maintenance, charging batteries, cleaning solar panels, camera dome bubble, repair, programming, and integration.
   b) The following pro-rated reduction of the monthly payment will be computed if the monthly summary spreadsheet of outages greater than twenty-four (24) hours indicates interruption of service has occurred:

1 day = 5% pay reduction	6 days = 30% pay reduction
2 days = 7% pay reduction	7 days = 35% pay reduction
3 days = 10% pay reduction	8 days = 40% pay reduction
4 days = 20% pay reduction	9 days = 50% pay reduction
5 days = 25% pay reduction	10 days = 75% pay reduction

   c) If the components of the SWZ are down for more than ten (10) total days in a month, whether they are consecutive or cumulative, and then NO payment will be made for that month.

4. The SWZ Operations item will be measure items will be measured for payment by the month for web site operations.

5. The SWZ Trailer Relocation item will be measured for payment each time a SQT, SVQS, or SVMQ is relocated from an existing location to another location, as approved or directed by the Engineer.

Basis of Payment:

1. Payment for accepted SWZ installation will be at the Contract lump sum price for "Smart Work Zone Deployment" which shall include submittals, component delivery, and system set up, all materials, equipment, tools, travel and labor incidental thereto. The Contractor shall comply with the requirements stated in the System Performance section herein.

2. Payment for accepted trailer-mounted components will be at the Contract unit price per month or a fraction of the month for each "Smart Work Zone Queue Trailer/Sensor

(SQT)," "Smart Work Zone Mobile Video Camera/Queue Sensor Trailer (SVQS)" and "Smart Work Zone Variable Message Sign/Queue Sensor Trailer (SVMQ)" which price shall include queue trailer and sensor, camera/queue sensors and trailers, variable message signs, sensors and trailers, cloud hosted third party traffic speed data, processed rock, temporary license plates, solar panels, batteries, removal, travel, and all materials, equipment, tools and labor incidental thereto.

3. Payment for accepted SQT Service, SVMQ Service, and SVQS Service items shall include all operational and service costs directly related to the furnishing and installing individual trailers and trailer-mounted equipment including, but not limited to, cellular communications, programming, service, maintenance, cleaning, repair, and all materials, equipment, tools, and labor incidental thereto.

4. Payment for uninterrupted SWZ operations as specified will be at the Contract unit price per month for "Smart Work Zone Operations" which price shall include all operations and maintenance costs not directly related to the individual trailers and trailer mounted equipment including, but not limited to, website operations, data collection and travel delay costs calculations, programming, system integration, maintenance, repair, and all materials, equipment, tools and labor Cost for hosting a web site incidental thereto.

5. Payment for approved relocation of SQT, SVQS and SVMQ units will be at the Contract unit price for each "Smart Work Zone Trailer Relocation" which price shall include processed rock, website revisions, and all materials, equipment, tools and labor incidental thereto.

6. The contractor shall provide the project SWZ Operational Data reports on spreadsheets in Microsoft Excel format on a monthly basis to the Engineer. The operational data reports shall include historical and real time data for the following:
    - Work Zone Travel Time
    - Work Zone Travel Speed
    - Work Zone Traffic Volume
    - Work Zone Travel Delay and Queue Length (if Available)
    - Work Zone User Delay Cost

    The data on the spreadsheets, in 15 minute intervals, shall include the directional Average Daily Travel Time (minutes), Average Travel Speed (mph), and Average Daily Traffic Volume (vehicles/hr.).

    Historical baseline (preconstruction phase) data shall be used to establish the benchmark for comparison with the actual real time (construction phase) data for assessment of the work zone mobility impacts. The baseline data should be collected a minimum of two (2) weeks prior to any construction impacts on the roadway.

    The cost of furnishing the monthly Operational Performance Measures report shall be included in the unit price for the Smart Work Zone Operations item.

    A template for a spreadsheet in Microsoft Excel format is shown below.

Time Interval (min)	Traffic Volume (vehicles)	Travel Time (min)	Travel Speed (mph)	Queue Length (mil)	Delay Cost ($)
00:00-00:15					
00:15-00:30					
00:30-00:45					
00:45-01:00					

The pay unit is each that will be paid on a monthly basis for each of the Smart Work Zone Variable Message Sign/Queue Sensor Trailer (SVMQ) and the Smart Work Zone Video Camera/Queue Sensor Trailer (SVQS). The Engineer may remove or add SWZ items by unit at the Engineer's discretion. The contractor will be notified thirty (30) days in advance by the Engineer. The payment shall be adjusted based on the actual number of SWZ units installed or removed including corresponding operations items.

Pay Item	*Pay Unit*
Smart Work Zone Deployment	l.s.
Smart Work Zone Operations	mo.
Smart Work Zone Trailer Relocation	ea.
Smart Work Zone Queue Trailer/Sensor (SQT)	ea.
Smart Work Zone Queue Trailer/Sensor (SQT) Service	mo.
Smart Work Zone Variable Message Sign/Queue Sensor Trailer (SVMQ)	ea.
Smart Work Zone Variable Message Sign/Queue Sensor Trailer (SVMQ) Service	mo.
Smart Work Zone Video Camera/Queue Sensor Trailer (SVQS)	ea.
Smart Work Zone Video Camera/Queue Sensor Trailer (SVQS) Service	mo.

ITEM #1201802A - 4 CHORD TRUSS BRIDGE SIGN STRUCTURE
ITEM #1201804A - 4 CHORD TRUSS CANTILEVER SIGN STRUCTURE

Description:
This item consists of site survey, designing, furnishing, fabricating, transporting, and erecting a galvanized overhead truss sign support of the length and type as shown on the plans and at the location indicated. This item does not include the sign, anchor bolts, or concrete foundations. Also included is the preparation of working drawings for erection of the structures.

Materials:
The fabricator shall be certified under the AISC Quality Control Program for Simple Steel Bridges with a Fracture Critical Endorsement (SBr.F).

All chords and bracing members are considered fracture critical and should be noted on the fabrication drawings. Charpy V-notch testing shall be required for all components of the truss chords, bracing, and connections. Impact values shall be at least 25 ft-lbs at 40° F. Charpy V-notch sampling and testing procedures shall be in accordance with AASHTO T243 (ASTM A673).

Round and rectangular structural tubing shall conform to the requirements of ASTM A500, Grade B. If available, tubing may conform to ASTM A501, Grade B. Mixing of material for the sign support is prohibited. Tubing conforming to ASTM A500 shall be heat treated at a minimum temperature of 1100°F for 1 hour per inch of thickness, ½ hour minimum.

Structural plate and rolled shapes shall conform to the requirements of AASHTO M270, Grade 50 (ASTM A709).

High strength bolts shall conform to ASTM F3125, Grade A325, Type 1. Nuts shall conform to ASTM A563, Grade DH or ASTM A194, Grade 2H. Flat hardened washers shall conform to ASTM F436.

Threaded rods and U-bolts shall conform to ASTM A449, Type 1 and shall be galvanized in accordance with ASTM B695, Class 50 or ASTM A153. Threads at the ends shall be chamfered or rolled undersize.

Joint sealant for sealing around the base plate backing ring shall be a two component polyurethane non-sag elastomeric sealant conforming to federal specification TT-S-00227E, type I or II, Class A.

Neoprene gasket material to seal handhole covers shall conform to ASTM D1056, Grade 2A2 or 2A3. Other grades of neoprene approved by the Engineer may be used.

Hot-dip galvanizing of all structural steel members shall be in accordance with AASHTO M111 (ASTM A123).

Hot-dip galvanizing for high strength bolts, washers, and nuts shall be in accordance with AASHTO M232 (ASTM A153).

Mechanically galvanizing of structural steel hardware shall be in accordance with ASTM B 695, Class 50.

Lubrication of hot-dip galvanized or mechanically galvanized nuts shall be in accordance with ASTM A563.

Zinc rich field primer for touch-up shall conform to the requirements of Federal Specification TT-P-641-Type I and ASTM A780. The use of aerosol spray cans will not be permitted.

Closed Cell Elastomer for sealing between the foundation and base plate shall conform to ASTM D1056, Grade RE-41 B2 and shall have a pressure-sensitive adhesive backing on one side for adhesion to the steel. Closed Cell Elastomer shall be contained within the anchor bolt pattern.

Bare Copper Wire shall conform to M.15.13.

Ground rods shall be 5/8 inches in diameter by 8 feet long copper clad steel. The copper cladding shall be a minimum thickness of 0.128 inches. The ground clamp shall be an approved square head bolt type.

Certified Test Reports and Materials Certificates will be required in accordance with Article 1.06.07 for all structural steel and all hot-dip galvanizing certifying that samples of the galvanizing have been tested and the galvanizing performed in accordance with AASHTO M111 (ASTM A123).

Submittal Procedure:
The Contractor shall follow Table A1 in Appendix A for all submittals regarding the overhead truss sign support structure. All incidental submittals not included in the table shall be sent to the District. A description of each submittal is included in Appendix A. A brief summary of the submittals is as follows:

1) Roadway Cross Section at the proposed sign support
2) Foundation Constructability Plan*
3) Plans and Calculations for Foundation*
4) Plans and Calculations for the Steel Structure
5) Working Drawings for erection
6) Working Drawing for the Foundation*
7) As-Built Top of Foundation Elevations
8) Fabrication Drawings for the Steel Structure
9) Steel Structure Constructability Plan
10) Final Mylar Drawings

* See Item #1202250A – Cantilever Truss Sign Support Foundation, or Item #1202239, Overhead Truss Sign Support Foundation; as applicable, for detailed description.

Design:
Design of overhead truss sign supports shall be in accordance with the 2015 AASHTO LRFD Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, with Interim Specifications up to and including 2017. All sections and articles noted below will refer to this specification. The Contractor shall also incorporate the following information into the design:

- Combined Stress Ratio's (CSR) for all members shall be tabulated and submitted along with a summary of the analysis results.
- Loads shall be applied to the structure in accordance with Article 3.4 Group Load Combinations. The Contractor shall design for the group load that produces the maximum load.
- All bolts and U-bolts shall have chamfered ends or the 1st thread rolled undersized.
- Connections shall conform to the following:
    - Slip critical connections shall be used due to fatigue loading and possible load reversal.
    - Bolted connections shall be used at splices connecting main load carrying members.
    - Bolted connections may be used for the top and bottom bracing members that connect the front and rear vertical trusses together. This will allow for easier galvanizing, transporting, and assembly in the field.
    - Where non-slip critical connections are specified, use double nuts to prevent loosening of the nuts.
- Minimum gusset plate thickness shall be ½ inches.
- Base plates and splice plates shall have a minimum thickness 1 ½ inches.
- Connections for diagonal members to gusset plates shall have a minimum of 2 bolts.
- Splice connections for the main chord members shall use a minimum of 8 bolts.
- Sign Area used for design:
    - "4 Chord Truss Bridge Sign Structure":
        - A maximum sign area of 1000 S.F. and a maximum sign height of 16.5 feet. These dimensions include the main sign and sign crown.
        - The 1000 S.F. maximum sign area shall be placed at locations along the truss arm that produce the maximum bending, axial, and shear stress in each truss member and in the posts.
    - "4 Chord Truss Cantilever Sign Structure":
        - Support shall be designed for the actual signs as shown on the contract drawings.
- Diagonal and transverse bracing members shall all be the same size. Chords may vary in size, provided they are designed to resist loads from the signs placed at any location along the arm.
- The design of the sign supports shall consider availability of material and member sizes when detailing the final design plans. Delays due to materials availability are the responsibility of the Contractor.

- Crown signs shall have at least 2 vertical supports connecting the crown sign to the main sign. Edge distances for these supports shall be within a minimum of 1’ -6” and a maximum of 2’ -0”.
- All main signs shall have a minimum of 3 vertical supports to attach the sign to the support arm.
- Sign stop shall be attached to the bottom of all vertical supports to prevent slippage of signs below the bottom of vertical supports.
- The minimum vertical clearance to the bottom of the sign stops above the roadway crown shall be in accordance with the Traffic signing plans.
- The minimum vertical distance from roadway crown to center line of truss shall be in accordance with the Traffic signing plans.
- All vertical supports connecting signs to the support arm shall have a minimum distance from the center of the vertical support to the edge of the sign of 1’ -6”.
- Diagonal bracing between the front and rear trusses shall be used to ensure proper stability during transportation, erection, and the design life of the structure.
- Anchor plates shall be used in the foundation design. No hooked bolts will be allowed.
- Connection of post to foundation shall be a minimum of 8 bolts.
- Post and chord end caps shall be removable to allow for proper galvanizing. End caps shall be designed to keep water out of the members. Post caps shall not allow ponding of water on them. Neoprene gaskets may be used in the end cap design.
- The area of vent and drain holes should be at least 25% of the inside area of the member and be strategically located for reducing stress and for proper galvanizing.
- The void between the top of the concrete foundation and underside of the base plate shall be sealed with closed cell elastomer, as shown on the plans, which shall conform to ASTM D1056, Grade RE-41 B2 with pressure-sensitive adhesive backing on one side.
- The sign shall be installed at an angle of 5° from the vertical, tilting the top away from the sign support structure.

Design Assumptions:

- Design for a minimum design life of 50 years.
- Live Load will not be considered due to the absence of walkways and service platforms.
- Design wind pressure shall be computed in accordance with Article 3.8.1 using Equation 3.8.1-1
- Basic wind speed (V) shall be 140 mph.
- The remaining variables shall be determined according to Article 3.8
- Fatigue design for the structural members and connections shall use the following assumptions:
    - Galloping shall not be considered due to a high degree of three-dimensional stiffness.
    - The structural members and connections shall be designed for fatigue using a fatigue importance factor (I_f) equal to 1.00.
    - Of the four different wind load effects associated with fatigue, only natural wind gusts shall be checked in the fatigue design of this structure.

Serviceability:
The design of the sign support should adhere to the serviceability requirements of Section 10.

Assembly:
The steel truss arm connections may be bolted, welded or combinations of bolted and welded connections. Consideration shall be given when designing welded connections that the overall size of the welded components are transportable and can be hot-dip galvanized in one dip. If possible, avoid design that limit galvanizing to a single galvanizer. The design shall also specify any specific sequences for welding to avoid locking stresses into the welded truss and re-distributing the stresses during galvanizing.

Erection shall be in accordance with working drawings and proper rigging procedures shall be used to ensure no damage to the structure occurs. This includes, but is not limited to protection of the galvanizing.

Assembly of bolted connections and splices shall conform to the special provision "Section 6.03-Structural Steel," amended as follows:

- The bolts shall be installed with direct tension indicators under the bolt head. The nut shall be turned to tighten the bolt and reduce the gap in the indicators to the recommended value.
- Bolts and direct tension indicators shall not be reused. If it becomes necessary to loosen a bolt previously tensioned, the bolt and direct tension indicator shall be discarded. Retightening previously tightened bolts, which may have been loosened by the tightening of adjacent bolts, shall not be considered as reuse.

The posts shall be securely bolted to their bases and shall be plumb or slightly raked back from the roadway upon completion of erection.

Construction Methods:
Fabrication of the steel sign support may begin once the design plans, calculations, and fabrication drawings have been approved by the Engineer.

All welding shall conform to the requirements of the following:

- AASHTO/ANSI/AWS D1.5 Bridge Welding Code.
- AWS D.1-1 Structural Welding Code – Steel.

The Contractor shall submit to the Engineer, no less than 48 hours prior to the start of fabrication, the name and location of the fabrication shop where the work will be done so that arrangements can be made for an audit of the facility and the assignment of the Department Quality Assurance inspector. No fabrication will be accepted unless the QA inspector is present during fabrication and the fabrication drawings are accompanied by a letter from the Department authorizing fabrication. No changes may be made during fabrication without prior written approval by the Department.

The joint between the backing ring and tubular member shall be sealed with silicone sealant.

If truss spans are to be erected in sections, blocking shall be used to give the proper camber. Blocking shall remain in place until the tension chord splices are fully bolted and all other truss connections are pinned or bolted.

The sign supports shall be completely shop fabricated except for the bolting of connections and splices.

Fabrication of the sign support shall conform to the requirements of Articles 6.03.03-3 and 6.03.03-4.

The Contractor shall submit methods to prevent warping of tubular members, base plates, connection plates, and splice plates during welding of the plates. Base plates and splice plates shall be a minimum of 1 ½" thick to prevent warping during welding. Fabricated members which are warped and do not fit together properly will be rejected.

All welding, drilling of holes and any other fabrication practices that would damage the galvanized coating shall be completed prior to galvanizing the steel components.

After tubular members have been completely fabricated, including camber, but prior to galvanizing, all connections and splices shall be trial-fitted and bolted in the fabricator's shop. The fabricated members may be rejected by the Engineer if the mating surfaces of the plates have a gap greater than ¼" at any location prior to bolting. If, after the shop bolting, the interfaces of the plates are not in contact at each bolt location or if the Engineer determines that excessive force was required to make contact, the fabricated members may be rejected by the Engineer. Bolts used for the trial shop fit-up shall not be reused in the final field assembly.

The trusses for the overhead sign support shall be checked for proper residual camber prior to being galvanized. Truss sections with splices shall be bolted together with temporary bolts for checking camber. With the trusses supported at the ends, the residual camber shall be measured at mid-span for the "4 Chord Truss Bridge Sign Structure", and shall be measured at the end of the truss for the "4 Chord Truss Cantilever Sign Structure"; and the member shall be rejected if it does not meet the following:

- Minimum Residual Camber Span/1000
- Maximum Residual Camber Span/500

Steel surface defects such as fins, slivers, tears, delaminations, burrs, sharp edges, and other defects shall be ground down with the use of a power disc grinder or other tools approved by the Engineer prior to galvanizing, to afford as close to a continuous surface characteristic as possible. For defects that can not be fixed by grinding due to being too large or deep, the Engineer shall be notified.

After the posts and trusses have been fabricated, welds ground smooth, flux and spatter removed, and with the camber and trail-fit requirements satisfied, the support shall be hot-dip galvanized in accordance with AASHTO M111 (A123). All pieces shall be galvanized in a single dip. Double-dipping shall not be used. No welding shall be performed after galvanizing.

Each lot of steel so treated shall bear a label clearly showing the name of the galvanizer, the ASTM specification used for the galvanizing and complete instructions for touch-up/repair of damaged material. Fabrications and materials shall be packed with sufficient dunnage and padding to protect finished surfaces.

Mating surfaces shall be free of dirt, loose scale, burrs, other foreign material and other defects that would prevent solid seating of the parts.

Mating surfaces that have been hot-dip galvanized shall be scored by wire brushing or light blasting after galvanizing and prior to assembly. The wire brushing treatment shall be a light application of manual power brushing that marks or scores the surface but removes relatively little of the zinc coating.

All damaged areas of the galvanizing shall be properly prepared and touched-up. "Damaged" does not include deliberate welding or drilling. Such deliberate destruction of the galvanized finish may be cause for rejection of the member. Damaged zinc shall be touched-up in accordance with ASTM A780. Spray aerosol cans of zinc rich primer will not be permitted.

The ground conductor shall be installed once the structure is erected.

Method of Measurement:
This work will be measured for payment by the number of units of "4 Chord Truss Bridge Sign Structure", or "4 Chord Truss Cantilever Sign Structure"; as applicable, installed and accepted. Each "4 Chord Truss Bridge Sign Structure" unit includes two vertical post assemblies and a horizontal truss arm with connections for mounting the designated signs. Each "4 Chord Truss Cantilever Sign Structure" unit includes one vertical post assembly and a horizontal truss arm with connections for mounting the designated signs.

Basis of Payment:
This work shall be paid for at the contract unit price each for "4 Chord Truss Bridge Sign Structure", or "4 Chord Truss Cantilever Sign Structure", as applicable; complete in place, which price shall include the survey, design, preparation of working drawings, furnishing, fabricating, transporting, assembly, erecting, materials, equipment, labor, tools, and work incidental thereto.

The Contractor will be paid according to the following schedule. Percentages are relative to the contract unit price:

- 20% after the Engineer has given written approval of the design.
- 60% after delivery and acceptance of the overhead truss sign support to a location approved by the Engineer.

- 20% after Engineer's written acceptance of the overhead truss sign support complete in place, after a semi-final inspection of the support.

Pay Item	**Pay Unit**
4 Chord Truss Bridge Sign Structure	EA
4 Chord Truss Cantilever Sign Structure	EA

The work for the concrete foundation shall be paid for at the contract unit price each for "Overhead Truss Sign Support Foundation" or "Cantilever Truss Sign Support Foundation", as applicable; complete in place, which price shall include the survey, design, preparation of working drawings, furnishing , fabricating, transporting, assembly, materials, equipment, labor, tools, and work incidental thereto.

Appendix A

Table of Contents

- Table A1 - Submittal Table and Procedure for a Contractor Design-Build
- Required Submittal Descriptions

Table A1 – Submittal Table and Procedure for Contractor Design Build

Description of Submittal	District	Reviewer				Additional Requirements for Distribution of Submittals
		Highway	Bridge	Traffic	Soils	
Roadway Cross Section	PR	3R	3R	1R	X	
Plans and Calculations						
Steel structure	PR	X	3R	X	X	
Foundation	PR	X	3R	X	1R	
Foundation Constructability Plan Submittals						
Access to area for construction of foundation	PR	3R	X	1R	X	Include final approved rdwy cross section
Traffic Protection	PR	FYI	X	1R	X	Include final approved rdwy cross section
Drilling Procedure	PR	X	3R	X	1R	Include final approved rdwy cross section
Steel Structure Constructability Plan Submittals						
Traffic Protection	PR	FYI	X	1R	X	
Erection plans and Working Drawings	PR	X	3R	FYI	X	
Working Drawings for Foundation	PR	X	3R	X	X	Include final approved plans for steel structure and foundations
As-built top of foundation Elevations	PR	X	FYI	FYI	X	
Fabrication Drawings for Steel Structure	PR	X	3R	X	X	Include accepted as-built top of foundation elevations
Incidental Submittals	PR	X	X	X	X	District will distribute to applicable reviewer

Code	Description	Requirements
#R*	Review and respond to submittal	Contractor to send all copies of submittal to District; District will distribute as necessary. Reviewer is required to send a response to the District for official approval or rejection.
PR	Primary Responder	Primary Responder to the contractor after all applicable reviewers submit responses to submittals
X	Distribution Not Required	Copy not required for reviewer
FYI	Information Copy	Information copy for future reference (1 copy)

* # Represents the number of copies of submittal required to be sent to each applicable reviewer

REQUIRED SUBMITTAL DESCRIPTIONS

1) **Roadway Cross Section**
The Contractor shall submit a survey of the roadway at the station noted on the sign location plans. This survey should include the following:
   - Height and offset of noise barrier from inside face of metal beam rail
   - Offsets of guide rails, concrete barriers, and light posts within 25 feet of the sign location
   - Existing signs supports
   - Proposed signs on overhead truss
   - Sign area, dimensions, placement of sign along arm, and vertical location of sign
   - Structure number and sign location numbers, stationing, route number, direction of traffic
   - Lane and shoulder widths
   - Offset of proposed foundation
   - Roadway crown elevations and ground elevations at the center line of the proposed foundations
   - Edge of pavement elevations
   - Top and bottom of slope elevations
   - Cross slope elevations
   - Proposed top of foundation elevations
   - Proposed elevation at center line of truss arm
   - Height from roadway crown to bottom of sign stops

2) **Plans and Calculations for the Steel Structure**
The Contractor shall submit all plans, analysis and design, and calculations for the steel structure including the following:
   - Approved roadway cross section
   - Plan, elevations, and end view of sign support
   - All dimensions of the structure
   - Sign attachment details
   - Sign support analysis and design including base plate
   - Time required for fabrication and delivery of steel structure
   - Lighting details of sign if needed
   - Handholes, nipple couplings, and conduits (flexible)

3) **Plans and Calculations for Foundation**
See the special provision for items #1202250A-Cantilever Truss Sign Support Foundation" or #1202239-Overhead Truss Sign Support Foundation, as applicable, for requirements.

4) **Foundation Constructability Plan**
See the special provision for items #1202250A-Cantilever Truss Sign Support Foundation" or #1202239-Overhead Truss Sign Support Foundation, as applicable, for requirements.

5) **Steel Structure Constructability Plan-Working Drawings**
The Contractor shall submit a steel structure constructability plan including the following:
- All traffic protection including lane closures or shifts and placement of temporary barrier
- Maintenance & Protection of Traffic Plans for all work that cannot be accomplished using the Typical Traffic Control Plans contained in the special provision for item 0971001A. Maintenance & Protection of Traffic Plans submitted by the Contractor shall include, but not be limited to, the following:
  - All plans shall conform to the MUTCD, the Highway Design Manual and Department guidelines,
  - Construction signs, traffic control devices, and temporary pavement markings,
  - Direction on how to remove existing pavement markings,
  - Temporary pavement markings are to be shown matching into existing markings,
  - Dimensions at the beginning and end of tapers and at locations where lane and shoulder widths change,
  - Any lane shifts, tapers, and shoulder closure tapers shall be designed per the MUTCD for a speed of 65 mph,
  - Typical sections showing minimum lane and shoulder widths,
  - Any necessary revisions to existing signs and any necessary relocation of existing signs,
  - Protection of temporary gaps in guiderail,
  - All plans shall be to scale.
- Erection details and procedure for the superstructure including:
  - Crane size and placement
  - Method of rigging structure including:
    - Assembly sequence
    - Lifting points
    - Length and weights of sections to be lifted
  - Temporary support, if needed, for erection of structure
  - Calculations for temporary support to verify structural adequacy
  - Staging area(s)

6) **Working Drawing for the Foundation**
See the special provision for items #1202250A-Cantilever Truss Sign Support Foundation" or #1202239-Overhead Truss Sign Support Foundation, as applicable, for requirements.

7) **As-Built Top of Foundation Elevations**
The Contractor shall submit the field-verified elevations at the top of foundation for use in detailing the steel structure.

8) **Fabrication Drawings for the Steel Structure**
The Contractor shall submit fabrication drawings for the steel structure to the Engineer a minimum of 30 days before fabrication is to begin to allow time for review and approval including the following:

- All material designations
- Details of all steel members
- Details of all connections including:
  - Welding procedures for approval
  - Truss connections
  - Non-destructive testing of welds
  - Chord splice plates
  - Connection of chord to post
  - Connection of post to base plate
  - Connection of vertical support to arm
  - Connection of signs to vertical supports
  - Cross bracing connections
  - Connection of end caps to posts and chords
- Details of venting and draining for galvanizing
- Truss arm camber details

9) **Final Drawings**
The Contractor must supply PDFs Signed and certified by a Professional Engineer Licensed in the State of Connecticut after all the comments made by the Engineer are resolved. The Contractor is also required to submit electronic copies of all drawings in a DGN format.

ITEM #1202239A - OVERHEAD TRUSS SIGN SUPPORT FOUNDATION
ITEM #1202250A - CANTILEVER TRUSS SIGN SUPPORT FOUNDATION

Description:
Work under this item shall consist of designing and constructing drilled shaft or spread footing foundations for an overhead or cantilever truss sign support. This includes all work incidental to this construction as described in this specification.

Materials:
Concrete for spread footings, pile caps, and pedestals shall conform to the requirements for Class "A" concrete in Sections 6.01 and Article M.03.

Concrete for drilled shafts shall attain a 28-day compressive strength of 4,000 psi, have a maximum aggregate size of No. 8 stone and have an initial slump between 7 and 9 inches. The slump shall not drop below 4 inches over the duration of the pour.

Reinforcing steel shall conform to the requirements of Section 6.02 and Article M.06.01.

Anchor plate shall conform to the requirements of AASHTO M270, Grade 50 and shall be hot-dip galvanized in accordance with ASTM A123.

Threaded anchor rods shall conform to the requirements of ASTM F1554, Grade 105.

Nuts for the anchor rods shall conform to ASTM A563, Grade DH. Double leveling nuts and double hex nuts shall be used to prevent loosening.

Washers shall conform to ASTM F436, Type 1 and shall be quenched, tempered and galvanized in accordance with ASTM A153, Class C.

Hot-dip galvanizing for anchor rods and nuts shall be in accordance with ASTM A153, Class C.

Mechanically galvanizing of anchor rods and nuts shall be in accordance with ASTM B 695, Class 50.

1 inch rigid metal conduit, ground rod sleeves and related hardware and end caps shall be galvanized steel conduit and shall conform to Section M.15.09.

Bonded bushings, couplings, and square head plugs shall conform to the requirements of ASTM A105.

Bare copper wire shall conform to M.15.13.

Zinc-rich field primer for touch up shall conform to the requirements of Federal Specification TT-P-641-Type 1 and ASTM A780. The use of aerosol spray cans will not be permitted.

Ground rods shall be 5/8-inch in diameter by 12-feet long copper clad steel. The copper cladding shall be a minimum thickness of 0.128 inches. The ground clamp shall be a square-head bolt type approved for direct burial.

Submittal Procedure:
The following submittals are required regarding the truss sign support foundation. All incidental submittals not included in the table shall be sent to the District. A description of each submittal is included below.

1) Plans and Calculations for Foundation
2) Roadway Cross Section at the proposed sign support
3) Foundation Constructability Plan
4) Working Drawing for the Foundation
5) As-Built Top of Foundation Elevations
6) Final Mylar Drawings

* See special provision for Item # 1201802A – 4 Chord Truss Bridge Sign Support Structure for a submittal procedure

1) **Roadway Cross Section**
   The Contractor shall submit a survey of the roadway at the station noted on the sign location plans. If there are any changes to proposed location of the foundation, the cross-section shall be re-submitted for review and approval. This survey should include the following:
   - Height and offset of noise barrier from inside face of metal beam rail
   - Offsets of guide rails, concrete barriers, and light posts within 25 feet of the sign location
   - Existing signs supports
   - Proposed signs on overhead truss
   - Sign area, dimensions, placement of sign along arm, and vertical location of sign
   - Structure number and sign location numbers, stationing, route number, direction of traffic
   - Lane and shoulder widths
   - Offset of proposed foundation
   - Roadway crown elevations and ground elevations at the center line of the proposed foundations
   - Edge of pavement elevations
   - Top and bottom of slope elevations
   - Cross slope elevations
   - Proposed top of foundation elevations
   - Proposed elevation at center line of truss arm
   - Height from roadway crown to bottom of sign stops (18’ -0” min)

2) **Plans and Calculations for Foundation**

The Contractor shall submit all plans and calculation for the foundation including the following:

- Selected type of foundation
- Conduit locations in the foundation
- Load and design parameters used in the foundation design
- All dimensions of foundation
- Anchorage details using anchor rods and plates
- Time required to construct foundation

3) **Foundation Constructability Plan**

The Contractor shall submit a foundation constructability plan which includes the following:

- Access to area including:
  - Temporary road
  - Removal of guide rails or concrete barriers
  - Utility locations and drainage installations that could obstruct construction
  - Clearing and grubbing, this shall be accomplished in accordance with Section 2.01.
  - Removal of noise barrier as required
- Traffic protection including:
  - Temporary guide rails and/or concrete barriers
  - The Contractor is to submit Maintenance and Protection of Traffic Control Plans for work that cannot be accomplished using the Typical Traffic Control Plans
- Maintenance & Protection of Traffic Plans for all work that cannot be accomplished using the Typical Traffic Control Plans contained in the special provision for item 0971001A. Maintenance & Protection of Traffic Plans submitted by the Contractor shall include, but not be limited to, the following:
  - All plans shall conform to the MUTCD, the Highway Design Manual and Department guidelines,
  - Construction signs, traffic control devices, and temporary pavement markings,
  - Direction on how to remove existing pavement markings,
  - Temporary pavement markings are to be shown matching into existing markings,
  - Dimensions at the beginning and end of tapers and at locations where lane and shoulder widths change,
  - Any lane shifts, tapers, and shoulder closure tapers shall be designed per the MUTCD for a speed of 65 mph,
  - Typical sections showing minimum lane and shoulder widths,
  - Any necessary revisions to existing signs and any necessary relocation of existing signs,
  - Protection of temporary gaps in guiderail,
  - All plans shall be to scale.

- Drilling procedure including all calculations and specifications associated with the Contractors proposed drilling procedure and tools and machinery used when drilled shaft foundation is designed. Temporary earth retaining shall be included when spread footing foundation is designed

4) **Working Drawing for the Foundation**
The Contractor shall submit working drawing in accordance with Article 1.05.02 for the foundation including the following:
   - Sequence plan outlining drilling, casing, installation of temporary earth retaining system, slurry, reinforcement, and concrete placement procedures for Engineer review
   - All reinforcement details
   - All anchorage details
     - Anchor rods, nuts, washers, and anchor plates
   - The Contractor shall submit working drawings to the Engineer a minimum of 30 calendar days before fabrication is to begin to allow time for review and approval.

5) **As-Built Top of Foundation Elevations and Anchorage Location**
The Contractor shall submit the field-verified elevations at the top of foundation elevations and the field-verified anchor rod pattern location for detailing of the steel structure.

6) **Final Mylar Drawings**
The Contractor is required to furnish the Engineer with a complete set of reproducible mylar drawings of all the 22 inch x 34 inch sheets after all the comments made by the Engineer are resolved. The Contractor is also required to submit electronic copies of all drawings in a DGN format

Design:
Design of truss sign support foundations shall be in accordance with the 2015 AASHTO LRFD Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, with Interim Specifications up to and including 2017. Plans and calculations shall be stamped by a Professional Engineer licensed in the State of Connecticut.

Construction Methods:
The Contractor is responsible for the selection of the foundation type, location, and proper orientation of the overhead truss sign support foundation.

Welding of reinforcing cages will not be permitted.

The Contractor shall submit a roadway cross section for approval specifying the locations and elevations for the foundations prior to submitting working drawings for the foundation and anchorage. See submittal procedure, 1) Roadway Cross Section, of this specification for details.

Drilled Shaft Foundation
A drilled shaft foundation unit consists of two drilled shafts, one pile cap and one pedestal.

This work may require rock excavation, drilling rock or using slurry filled shafts through whatever materials are encountered to reach the depths indicated on the plans and specifications. The Contractor shall submit a sequence plan outlining drilling, casing, slurry, reinforcement and concrete placement procedures for the Engineer to review.

Construction of drilled shaft shall be in accordance with AASHTO LRFD Bridge Construction Specifications, Section 5.

The concrete shall be finished in conformance with the pertinent requirements of Subarticle 6.01.03-21.

Casings, if used in drilling operations, shall be removed from the hole. The casing may be removed as concrete is placed provided a 5 foot head of concrete is maintained, or the casing may be removed after the concrete has been poured, provided that the concrete has not been set. Separation of the concrete by hammering or otherwise vibrating the casing during withdrawal operations shall be avoided.

The maximum allowable horizontal variation of the center of the top of the drilled shaft from the required location shall be 0.5% of the shaft diameter.

The concrete shaft shall not be out of plumb by more than 1% of the total length.

Spread Footing Foundation:
A spread footing foundation unit consists of a footing and pedestal.

Spread footing foundations shall be constructed in accordance with the requirements of Article 12.02.03.

General:
The top of the concrete foundation shall be level within ±1/8".

Cover for all reinforcing steel in the foundation shall be a minimum of 3”.

The anchor rod locations shall be in accordance with plans for the sign support structure.

Anchor plates in the foundation are required to have a minimum thickness of ½”.

The use of hooked anchor rods is not allowed. Only straight, galvanized anchor rods shall be used in the design.

Anchor rod assemblies shall be embedded in the concrete. The use of formed or drill holes to place the anchor rods will not be permitted.

A template to hold the required anchor rod assemblies, ground rod sleeve and conduit in their correct positions shall be used. Each of the anchor rods shall be fitted with two leveling nuts.

The leveling template shall be clamped in position by two leveling nuts at each anchor rod. These leveling nuts shall be adjusted to assure a truly level finished foundation surface at the proper elevations.

As-built anchor rod locations shall be provided to the steel sign support fabricator to insure proper fit of the support base plates on the foundation anchor rods and to confirm the span length of the truss arm.

All conduit ends terminating below grade shall be capped with a malleable iron cap. All above-grade conduit ends shall be terminated with an insulated bonding bushing with tinned insert. There shall be conduits in the foundation.

Ground rod and ground wire shall be installed as shown on the plans.

Method of Measurement:
This work will be measured for payment by the number of foundation units completely installed and accepted.
Two foundation units are required to support a "4 Chord Truss Bridge Sign Support"; each of the two units will be measured for payment.

Basis of Payment:
The work will be paid for at the contract unit price for "Overhead Truss Sign Support Foundation", or "Cantilever Truss Sign Support Foundation", as applicable; complete in place. The price shall include field survey, layout, materials, drilling, rock socket, temporary casing, slurry, excavation, rock excavation, cutting and removing existing pavement, granular fill, backfill, concrete, reinforcing, anchor rods and plates, rigid metal conduits, ground rod, ground wire, clamps and surface treatments to be restored, as directed by the Engineer, and all equipment, labor, tools and work incidental thereto.

No additional payment will be made for the Contractor to test the slurry when it is used to construct a drilled shaft foundation.

Temporary sheeting, if required, will not be paid for separately, but will be included as part of the work.

Borrow, if required, will not be paid for separately, but will be included as part of the work.

The removal of existing roadside barrier systems, installation and removal of temporary roadside barrier systems and resetting existing roadside barrier systems will not be paid for separately, but will be included as part of the work.

The temporary support, protection and restoration of utilities (if necessary), including existing underground wiring, conduits, drainage structures, pipes and underdrain systems within the excavation limits will not be paid for separately, but will be included as part of the work.

The restoration of existing surface treatments (pavement, slope protection, topsoil & seed, etc.) in all areas disturbed by the work will not be paid for separately, but will be included as part of the work. The Engineer will determine the type, thickness and horizontal limits of the surface treatments to be restored.

The installation of new or upgraded permanent roadside barrier systems, if required, will not be paid for as part of this work, but will be paid for under separate items.

Pay Item	**Pay Unit**
Overhead Truss Sign Support Foundation	EA
Cantilever Truss Sign Support Foundation	EA

ITEM #1206011A - REMOVAL OF EXISTING OVERHEAD SIGNING

Section 12.06 is supplemented as follows:

12.06.01 - Description:

Add the following:

Work under this item shall consist of the removal of designated existing overhead signs and sign support structures, where indicated on the plans and as directed by the Engineer.

12.06.03 – Construction Methods:

Add the following:

General

Overhead signs and sign support structures designated for removal shall be removed and disposed of by the Contractor as directed by the Engineer and in accordance with existing standards for removal of existing overhead signing.

Existing signs, sign bridge trusses and end frames shall only be removed after new signs and supports have been completely installed and approved by the Engineer.

Submittals

Submit for approval working drawings that consider at a minimum the weight and stability of the pieces to be disassembled, show the appropriate lifting points of assembled members, and detail the disassembly procedure for each sign structure location including equipment to be utilized for disassembly.

If the Contractor's proposed operations includes placement of a crane on the bridge deck during disassembly, working drawings shall also include calculations indicating that the bridge structure can adequately support the crane loading during all phases of disassembly.

Working drawings shall also indicate traffic staging, laydown areas, environmental constraints such as wind and inclement weather, and duration of disassembly procedures. Working drawings and associated loading calculations, shall be signed and sealed by a Professional Engineer licensed in the State of Connecticut.

Prior to starting actual disassembly, all traffic control and other safety measures as required by the Contract must be approved by the Engineer, and installed at the site.

12.06.04 - Method of Measurement:

Add the following:

The work of this Section will not be measured separately, but shall be included under the Contract lump sum for all locations of "Removal of Existing Overhead Signing."

12.06.05 - Basis of Payment:

Add the following:

This work shall be paid for at the contract lump sum price for "Removal of Existing Overhead Signing", which shall include removal of overhead extruded aluminum signs, overhead sign supports, and other materials designated for removal, and all equipment, material, tools and labor incidental thereto.

ITEM #1206023A - REMOVAL AND RELOCATION OF EXISTING SIGNS

Section 12.06 is supplemented as follows:

Article 12.06.01 – Description is supplemented with the following:
Work under this item shall consist of the removal and/or relocation of designated side-mounted extruded aluminum and sheet aluminum signs, sign posts, sign supports, and foundations where indicated on the plans or as directed by the Engineer. Work under this item shall also include furnishing and installing new sign posts and associated hardware for signs designated for relocation.

Article 12.06.03 – Construction Methods is supplemented with the following:
The Contractor shall take care during the removal and relocation of existing signs, sign posts, and sign supports that are to be relocated so that they are not damaged. Any material that is damaged shall be replaced by the Contractor at no cost to the State.

Foundations and other materials designated for removal shall be removed and disposed of by the Contractor as directed by the Engineer and in accordance with existing standards for Removal of Existing Signing.

Sheet aluminum signs designated for relocation are to be re-installed on new sign posts.

Article 12.06.04 – Method of Measurement is supplemented with the following:
Payment under Removal and Relocation of Existing Signs shall be at the contract lump sum price which shall include all extruded aluminum and sheet aluminum signs, sign posts, and sign supports designated for relocation, all new sign posts and associated hardware for signs designated for relocation, all extruded aluminum signs, sheet aluminum signs, sign posts and sign supports designated for scrap, and foundations and other materials designated for removal and disposal, and all work and equipment required.

Article 12.06.05 – Basis of Payment is supplemented with the following:
This work will be paid for at the contract lump sum price for "Removal and Relocation of Existing Signs" which price shall include relocating designated extruded aluminum and sheet aluminum signs, sign posts, and sign supports, providing new posts and associated hardware for relocated signs, removing and disposing of foundations and other materials, and all equipment, material, tools and labor incidental thereto. This price shall also include removing, loading, transporting, and unloading of extruded aluminum signs, sheet aluminum signs, sign posts, and sign supports designated for scrap and all equipment, material, tools and labor incidental thereto.

Pay Item	Pay Unit
Removal and Relocation of Existing Signs	L.S.

ITEM #1206025A - REMOVAL AND RELOCATION OF EXISTING OVERHEAD SIGNS

Section 12.06 is supplemented as follows:

12.06.01 – Description is supplemented with the following:
Work under this item shall consist of the removal and/or relocation of designated existing overhead signs, sign supports and foundations, where indicated on the plans or as directed by the Engineer.

12.06.03 - Construction Methods is supplemented with the following:
Overhead sign supports, foundations, and other materials designated for removal shall be removed and disposed of by the Contractor as directed by the Engineer and in accordance with existing standards for Removal of Existing Overhead Signing.

For overhead signs designated for reinstallation and/or relocation, the Contractor shall accomplish the work in a manner so as not to cause twisting, bending or deforming of sign panels, or scratching of the sign face. Any sign panel damaged shall be repaired or replaced at the Contractor's expense. The signs shall be level, correctly aligned as indicated on the plans and shall be properly fastened to the structure or supports with the necessary hardware as indicated on the plans.

12.06.04 - Method of Measurement is supplemented with the following:
This work will be paid for at the contract lump sum price for "Removal and Relocation of Existing Overhead Signs" which price shall include overhead signs designated for relocation, overhead extruded aluminum signs, overhead sign supports, foundations, and other materials designated for removal, and all equipment, material, tools and labor incidental thereto.

12.06.05 - Basis of Payment is supplemented with the following:
This work will be paid for at the contract lump sum price for "Removal and Relocation of Existing Overhead Signs". This price shall include the removal, relocation, and permanent installation of overhead signs. Also, the price shall include all necessary hardware required for the reinstallation of the existing sign panels onto existing or new sign supports, unless such hardware is paid for under separate pay items. The price shall include all equipment, material, labor and tools necessary to complete this work. This price shall also include removing, loading, transporting, and unloading of overhead extruded aluminum signs designated for removal and all equipment, material, tools and labor incidental thereto. This price shall also include removing and disposing of sign supports, foundations, and other materials, and all equipment, material, tools and labor incidental thereto.

Pay Item	Pay Unit
Removal and Relocation of Existing Overhead Signs	L.S.

ITEM #1207034A - SIGN FACE - EXTRUDED ALUMINUM (TYPE IV RETROREFLECTIVE SHEETING)

ITEM #1207039A - SIGN FACE - EXTRUDED ALUMINUM (TYPE IX RETROREFLECTIVE SHEETING)

Article 12.07.01 – Description is revised as follows:

This item shall consist of furnishing and installing Item #1207034A – Sign Face – Extruded Aluminum (Type IV Retroreflective Sheeting) and Item #1207039A – Sign Face – Extruded Aluminum (Type IX Retroreflective Sheeting) as indicated on the plans or as ordered and in accordance with the plans and these specifications.

Item #1207034A – Sign Face – Extruded Aluminum (Type IV Retroreflective Sheeting) shall only be used for signs with a brown background color.

Item # 1207039A – Sign Face – Extruded Aluminum (Type IX Retroreflective Sheeting) shall be used for all other sign background colors.

Sign Face – Extruded Aluminum is supplemented with the sign details that follow, with the exception that the sheeting type on the sign details has not been updated to reflect the sheeting types noted above.

63-703 & 159-191

1209

ITEM #1207034A, ITEM #1207039A

Rev. Date 07/18

SIGN DETAIL

1:75

SIGN NUMBER	003S_159_R803_EX91N_A
SIGN PANEL	17'-0" x 8'-6"
EXIT CROWN	
TOTAL AREA	144.5 Sq.Ft.
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	12"
BACKGROUND	TYPE: IV
	COLOR: Green
LEGEND/BORDER	TYPE: IV
	COLOR: White/White

SYMBOL	ROT	X	Y	WID	HT
AR_Type A	330	165.1	51.2	24	37.8

Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Ground
Sign Support No. N/A
Location : Wethersfield Route 91 N.B. Exit 91N Ramp R803
Project No. 159-191
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

REV'D /

PLOTTED : 01/05/18

LETTER POSITIONS (X)																					LENGTH	SERIES/SIZE
	M	a	r	s	h		S	t														EM 2000
36.4	18.9	17	10.1	15.5	10.6	16	16.3	8.3	54.9												112.6	16/12
	O	l	d																			EM 2000
74.3	18.2	8.2	10.6	92.8																	37	16/12
	W	e	t	h	e	r	s	f	i	e	l	d										EM 2000
14.8	19.4	13.9	13.4	15.5	15.5	10.1	13.9	11.7	8.2	15.5	8.2	10.6	33.3								155.8	16/12

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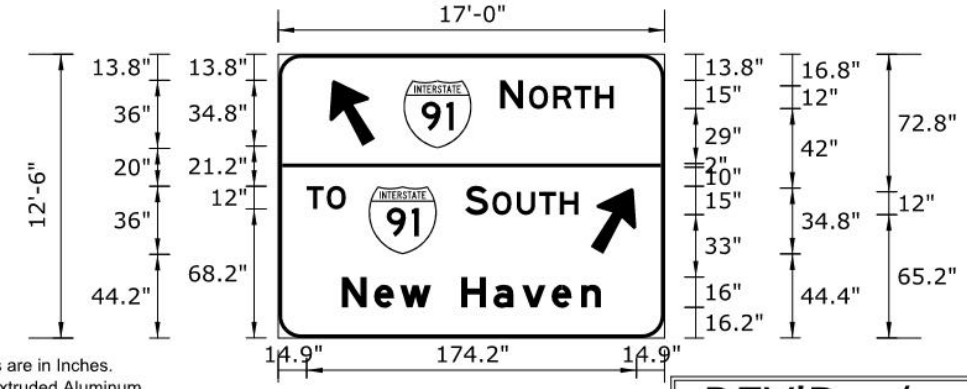
1210

ITEM #1207034A, ITEM #1207039A

Rev. Date 07/18

SIGN DETAIL

1:85



Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Ground
Sign Support No. N/A
Location : Wethersfield Route 3 N.B. Ramp R803 Exit 91N
Project No. 159-191
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

REV'D /

SIGN NUMBER	003S_159_R803_EX91N_B
SIGN PANEL	17'-0" x 12'-6"
EXIT CROWN	
TOTAL AREA	212.5 Sq.Ft.
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	12"
BACKGROUND	TYPE: IV
	COLOR: Green
LEGEND/BORDER	TYPE: IV
	COLOR: White/White

SYMBOL	ROT	X	Y	WID	HT
AR_Type A	30	27	101.5	24	37.8
M1_1	0	66.1	100.3	36	36
M1_1	0	47.7	44.3	36	36
AR_Type A	330	165	44.5	24	37.8

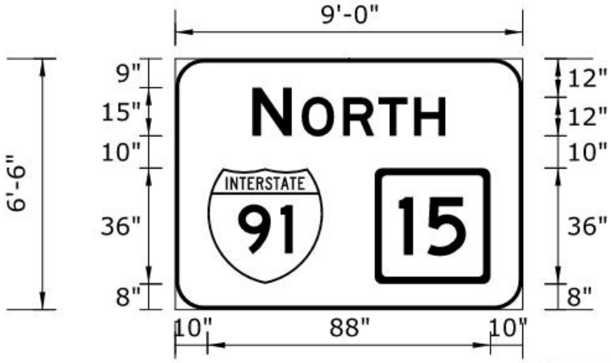
PLOTTED : 01/05/18

LETTER POSITIONS (X)

																					LENGTH	SERIES/SIZE
	N		O	R	T	H																E 2000
117.1	12.2	3.1	12.8	11	11	9.7	27														59.9	15,12
	T	O																				E 2000
14.9	10.7	10.1	168.3																		20.8	12
	S		O	U	T	H																E 2000
98.7	12.2	2.2	12.8	11.8	11	9.7	45.6														59.8	15,12
	N	e	w		H	a	v	e	n													EM 2000
33.6	17	13.8	16.3	16	17	15.2	15.5	15.5	10.6	33.6											136.8	16/12

SIGN DETAIL

1:50



Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Overhead
Sign Support No. 21015
Location : Hartford Route 5/15 N.B. Mileage : 80.24
Project No. 159-191
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

SIGN NUMBER	015N_063_80.24_A
SIGN PANEL	9'-0" x 6'-6"
EXIT CROWN	
TOTAL AREA	58.5 Sq.ft.
BDR INSET/WIDTH	0" / 1.25"
CORNER RADIUS	9"
BACKGROUND	TYPE: IV
	COLOR: Green
LEGEND/BORDER	TYPE: IV
	COLOR: White/White

SYMBOL	ROT	X	Y	WID	HT
M1_1	0	10	8	36	36
M1_5_1	0	62	8	36	36

REV'D /

PLOTTED : 01/05/18

LETTER POSITIONS (X)

																					LENGTH	SERIES/SIZE
	N		O	R	T	H																E 2000
24	12.2	3.1	12.8	11	11	9.7	24														59.9	15,12

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1212

ITEM #1207034A, ITEM #1207039A

Rev. Date 07/18

SIGN DETAIL

1:65

Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Overhead
Sign Support No. 21015
Location : Hartford Route 5/15 N.B. Mileage : 80.24
Project No. 159-191
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

REV'D /

SIGN NUMBER	015N_063_80.24_B
SIGN PANEL	15'-0" x 8'-0"
EXIT CROWN	22.5
TOTAL AREA	142.5 Sq.ft.
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	12"
BACKGROUND	TYPE: IV
	COLOR: Green
LEGEND/BORDER	TYPE: IV
	COLOR: White/White

SYMBOL	ROT	X	Y	WID	HT

PLOTTED : 01/05/18

LETTER POSITIONS (X)

																					LENGTH	SERIES/SIZE
	B	r	a	i	n	a	r	d		R	d											EM 2000
14.9	17.4	10.4	17	9.6	15.5	17	10.4	10.6	16	15.8	10.6	14.9									150.2	16/12
	A	i	r	p	o	r	t		R	d												EM 2000
23.8	20	9.6	11.8	14.1	15.8	10.2	8.3	16	15.8	10.6	23.8										132.3	16/12
	1/4		M	I	L	E																E 2000
57.5	22	10	12	4.4	9.2	7.5	57.5														65.1	15,10

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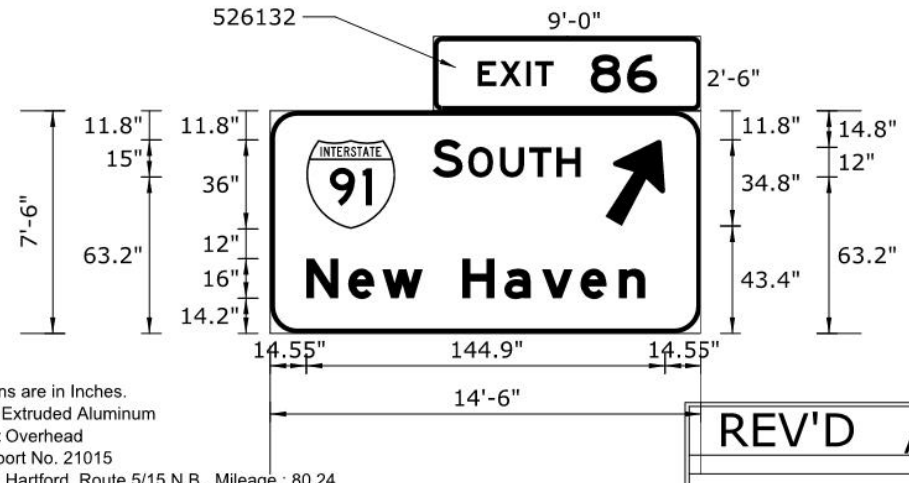
1213

ITEM #1207034A, ITEM #1207039A

Rev. Date 07/18

SIGN DETAIL

1:65



SIGN NUMBER	015N_063_80.24_C
SIGN PANEL	14'-6" x 7'-6"
EXIT CROWN	20.5
TOTAL AREA	131.25 Sq.ft.
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	11"
BACKGROUND	TYPE: IV
	COLOR: Green
LEGEND/BORDER	TYPE: IV
	COLOR: White/White

SYMBOL	ROT	X	Y	WID	HT
AR_Type A	330	135.3	43.5	24	37.8
M1_1	0	14.6	42.2	36	36

Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Overhead
Sign Support No. 21015
Location : Hartford Route 5/15 N.B. Mileage : 80.24
Project No. 159-191
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

REV'D /

PLOTTED : 01/05/18

LETTER POSITIONS (X)

																					LENGTH	SERIES/SIZE
	S		O	U	T	H																E 2000
65.6	12.2	2.2	12.8	11.8	11	9.7	48.7														59.8	15,12
	N	e	w		H	a	v	e	n													EM 2000
14.6	17	13.8	16.3	16	17	15.2	15.5	15.5	10.6	22.6											136.8	16/12

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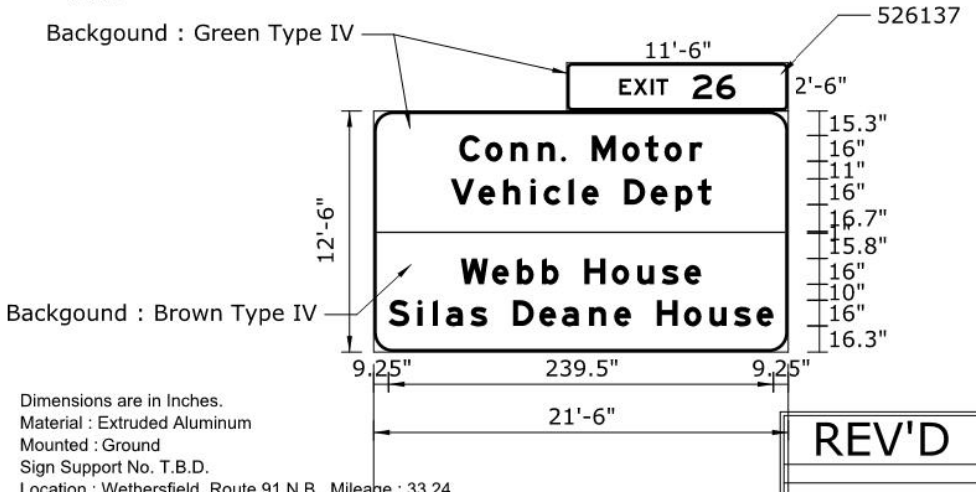
1214

ITEM #1207034A, ITEM #1207039A

Rev. Date 07/18

SIGN DETAIL

1:100



SIGN NUMBER	091N_159_33.24_A
SIGN PANEL	21'-6" x 12'-6"
EXIT CROWN	28.75
TOTAL AREA	297.5 Sq.Ft.
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	12"
BACKGROUND	TYPE: IV
	COLOR: See Sign
LEGEND/BORDER	TYPE: IV
	COLOR: White/White

SYMBOL	ROT	X	Y	WID	HT

Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Ground
Sign Support No. T.B.D.
Location : Wethersfield Route 91 N.B. Mileage : 33.24
Project No. 159-191
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

REV'D /

PLOTTED : 06/18/18

LETTER POSITIONS (X)

																					LENGTH	SERIES/SIZE
	C	o	n	n	.		M	o	t	o	r											EM 2000
53.3	16	15.8	17	14.4	3.2	16	18.9	14.2	12	15.8	8	53.3									151.4	16/12
	V	e	h	i	c	l	e		D	e	p	t										EM 2000
48	17.1	15.5	17	8.2	15.5	8.2	10.6	16	16.3	15.5	13.9	8.3	48								162.1	16/12
	W	e	b	b		H	o	u	s	e												EM 2000
54.2	19.4	15.5	15.5	10.6	16	17	15.8	15.2	14.1	10.6	54.2										149.6	16/12
	S	i	l	a	s		D	e	a	n	e		H	o	u	s	e					EM 2000
9.2	17.9	9.6	8.2	15.2	10.6	16	16.3	14.1	17	15.5	10.6	16	17	15.8	15.2	14.1	10.6	9.2			239.5	16/12

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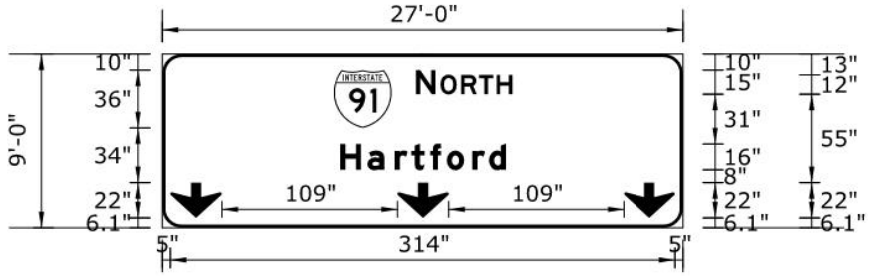
1215

ITEM #1207034A, ITEM #1207039A

Rev. Date 07/18

SIGN DETAIL
1:100



SIGN NUMBER	091N_159_33.49_A
SIGN PANEL	27'-0" x 9'-0"
EXIT CROWN	
TOTAL AREA	243.0 Sq.Ft.
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	12"
BACKGROUND	TYPE: IV
	COLOR: Green
LEGEND/BORDER	TYPE: IV
	COLOR: White/White

SYMBOL	ROT	X	Y	WID	HT
M1_1	0	106.5	62	36	36
ARDOWN	0	5	6.1	32	22
ARDOWN	0	146	6.1	32	22
ARDOWN	0	287	6.1	32	22

Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Overhead
Sign Support No. 21487
Location : Wethersfield Route 91 N.B. Mileage : 33.49
Project No. 159-191
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

REV'D /

PLOTTED : 01/05/18

LETTER POSITIONS (X)																				LENGTH	SERIES/SIZE
	N		O	R	T	H															E 2000
157.5	12.2	3.1	12.8	11	11	9.7	106.5													59.9	15,12
	H	a	r	t	f	o	r	d													EM 2000
110.5	17	17	10.2	11.8	10.2	15.8	10.4	10.6	110.5											103	16/12

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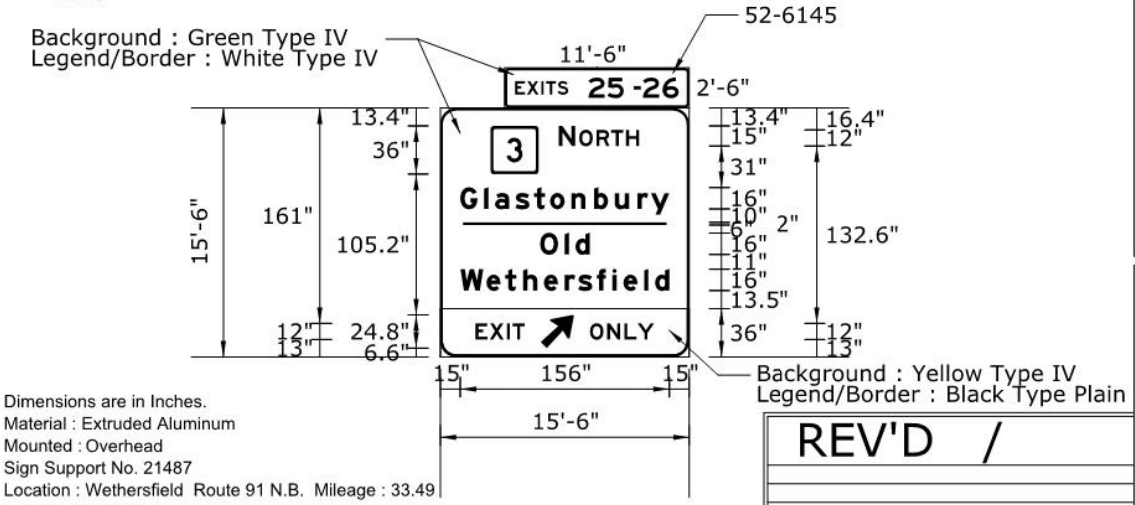
1216

ITEM #1207034A, ITEM #1207039A

Rev. Date 07/18

SIGN DETAIL

1:120



Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Overhead
Sign Support No. 21487
Location : Wethersfield Route 91 N.B. Mileage : 33.49
Project No. 159-191
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

SIGN NUMBER	091N_159_33.49_B
SIGN PANEL	15'-6" x 15'-6"
EXIT CROWN	28.75
TOTAL AREA	269.0 Sq.Ft.
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	12"
BACKGROUND	TYPE: See Sign
	COLOR: See Sign
LEGEND/BORDER	TYPE: See Sign
	COLOR: See Sign

SYMBOL	ROT	X	Y	WID	HT
M1_5_1	0	37.5	136.6	36	36
AR_Type A	315	75	6.6	20	31.5

REV'D /

PLOTTED : 01/05/18

LETTER POSITIONS (X)																					LENGTH	SERIES/SIZE
	N		O	R	T	H																E 2000
88.5	12.2	3.1	12.8	11	11	9.7	37.5														59.9	15,12
	G	l	a	s	t	o	n	b	u	r	y											EM 2000
15	17.8	8.2	15.2	13.9	12	15.8	17	15.5	17	10.1	13.6	15									156	16/12
	O	l	d																			EM 2000
74.6	18.2	8.2	10.6	74.4																	37	16/12
	W	e	t	h	e	r	s	f	i	e	l	d										EM 2000
15.2	19.4	13.9	13.4	15.5	15.5	10.1	13.9	11.7	8.2	15.5	8.2	10.6	15								155.8	16/12
	E	X	I	T																		E 2000
26.3	10.7	12.8	4.2	9	123																36.7	12
	O	N	L	Y																		E 2000
111.8	12.8	12.8	10	12.2	26.3																47.9	12

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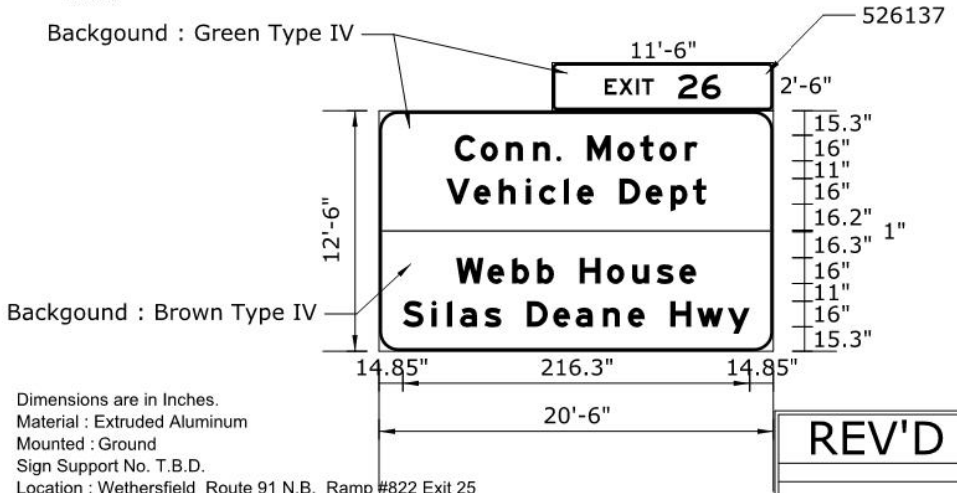
1217

ITEM #1207034A, ITEM #1207039A

Rev. Date 07/18

SIGN DETAIL

1:100



SIGN NUMBER	091N_159_R822_EX25_A
SIGN PANEL	20'-6" x 12'-6"
EXIT CROWN	28.75
TOTAL AREA	285.0 Sq.Ft.
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	12"
BACKGROUND	TYPE: IV
	COLOR: See Sign
LEGEND/BORDER	TYPE: IV
	COLOR: White/White

SYMBOL	ROT	X	Y	WID	HT

Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Ground
Sign Support No. T.B.D.
Location : Wethersfield Route 91 N.B. Ramp #822 Exit 25
Project No. 159-191
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

REV'D /

PLOTTED : 01/05/18

LETTER POSITIONS (X)																					LENGTH	SERIES/SIZE
	C	o	n	n	.		M	o	t	o	r											EM 2000
47.3	16	15.8	17	14.4	3.2	16	18.9	14.2	12	15.8	8	47.3									151.4	16/12
	V	e	h	i	c	l	e		D	e	p	t										EM 2000
42	17.1	15.5	17	8.2	15.5	8.2	10.6	16	16.3	15.5	13.9	8.3	42								162.1	16/12
	W	e	b	b		H	o	u	s	e												EM 2000
48.2	19.4	15.5	15.5	10.6	16	17	15.8	15.2	14.1	10.6	48.2										149.6	16/12
	S	i	l	a	s		D	e	a	n	e		H	w	y							EM 2000
14.8	17.9	9.6	8.2	15.2	10.6	16	16.3	14.1	17	15.5	10.6	16	16.6	19.2	13.6	14.8					216.3	16/12

63-703 & 159-191

1218

ITEM #1207034A, ITEM #1207039A

Rev. Date 07/18

SIGN DETAIL

1:75

Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Overhead
Sign Support No. 21488
Location : Wethersfield Route 91 N.B. Exit 25-26 Ramp
Project No. 159-191
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

REV'D /

SIGN NUMBER	091N_159_R822_EX25_B
SIGN PANEL	15'-0" x 9'-6"
EXIT CROWN	22.5
TOTAL AREA	165.0 Sq.Ft.
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	10"
BACKGROUND	TYPE: IV
	COLOR: Green
LEGEND/BORDER	TYPE: IV
	COLOR: White/White

SYMBOL	ROT	X	Y	WID	HT
M1_5_1	0	34.5	65	36	36
ARDOWN	0	74	9.1	32	22

PLOTTED : 01/05/18

LETTER POSITIONS (X)

																					LENGTH	SERIES/SIZE
	N		O	R	T	H																E 2000
85.5	12.2	3.1	12.8	11	11	9.7	34.5														59.9	15,12
	G	l	a	s	t	o	n	b	u	r	y											EM 2000
12	17.8	8.2	15.2	13.9	12	15.8	17	15.5	17	10.1	13.6	12									156	16/12

63-703 & 159-191

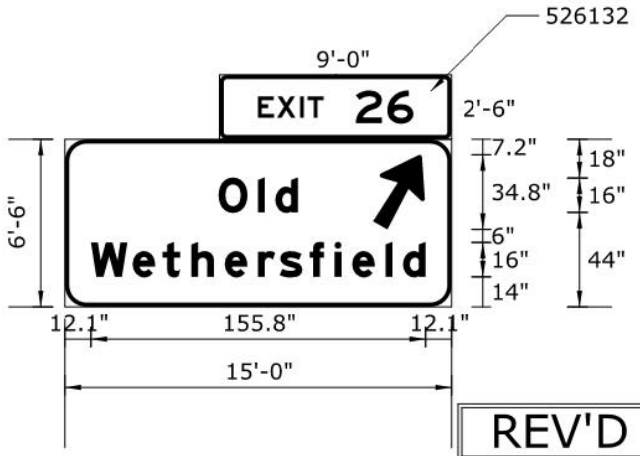
1219

ITEM #1207034A, ITEM #1207039A

Rev. Date 07/18

SIGN DETAIL

1:75



SIGN NUMBER	091N_159_R822_EX25_C
SIGN PANEL	15'-0" x 6'-6"
EXIT CROWN	22.5
TOTAL AREA	120.0 Sq.Ft.
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	10"
BACKGROUND	TYPE: IV
	COLOR: Green
LEGEND/BORDER	TYPE: IV
	COLOR: White/White

SYMBOL	ROT	X	Y	WID	HT
AR_Type A	330	143.4	36	24	37.8

Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Overhead
Sign Support No. 21488
Location : Wethersfield Route 91 N.B. Exit 25-26 Ramp
Project No. 159-191
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

REV'D /

PLOTTED : 01/05/18

LETTER POSITIONS (X)																					LENGTH	SERIES/SIZE
	O	l	d																			EM 2000
71.5	18.2	8.2	10.6	71.5																	37	16/12
	W	e	t	h	e	r	s	f	i	e	l	d										EM 2000
12.1	19.4	13.9	13.4	15.5	15.5	10.1	13.9	11.7	8.2	15.5	8.2	10.6	12.1								155.8	16/12

63-703 & 159-191

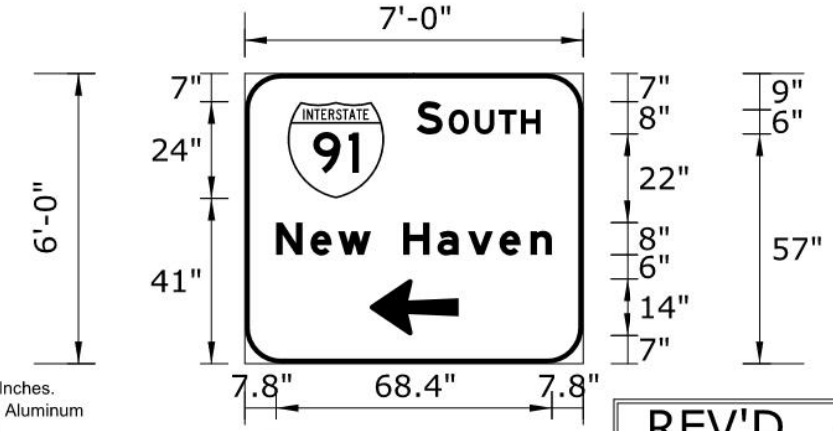
1220

ITEM #1207034A, ITEM #1207039A

Rev. Date 07/18

SIGN DETAIL

1:40



Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Ground
Sign Support No. N/A
Location : Wethersfield Great Meadow Road at I-91 NB on/off Ramps
Project No. 159-191
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

REV'D /

SIGN NUMBER	091N_159_RO57_EX26_A
SIGN PANEL	7'-0" x 6'-0"
EXIT CROWN	
TOTAL AREA	42.0 Sq.Ft.
BDR INSET/WIDTH	0" / 1.25"
CORNER RADIUS	9"
BACKGROUND	TYPE: IV
	COLOR: Green
LEGEND/BORDER	TYPE: IV
	COLOR: White/White

SYMBOL	ROT	X	Y	WID	HT
M1_1	0	10.6	41	24	24
AR_Type A	90	31	7	14	22

PLOTTED : 01/05/18

LETTER POSITIONS (X)

																					LENGTH	SERIES/SIZE
	S		O	U	T	H																EM 2000
42.6	6.5	1.5	6.5	5.9	5.5	4.9	10.6														30.8	8,6
	N	e	w		H	a	v	e	n													EM 2000
7.8	8.5	6.9	8.2	8	8.5	7.6	7.8	7.8	5.3	7.8											68.4	8/6

63-703 & 159-191

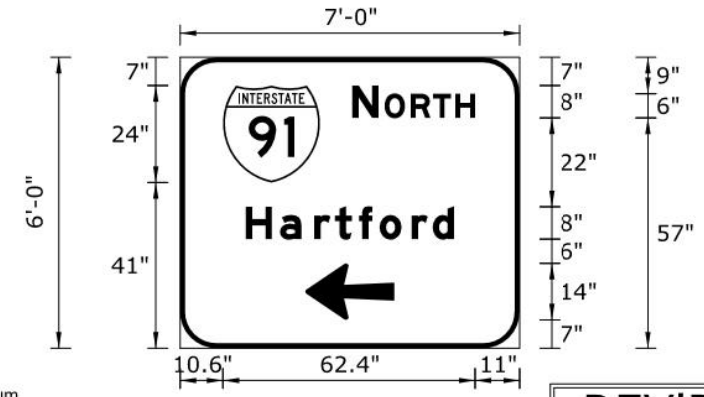
1221

ITEM #1207034A, ITEM #1207039A

Rev. Date 07/18

SIGN DETAIL

1:40



SIGN NUMBER	091N_159_RO57_EX26_B
SIGN PANEL	7'-0" x 6'-0"
EXIT CROWN	
TOTAL AREA	42.0 Sq.Ft.
BDR INSET/WIDTH	0" / 1.25"
CORNER RADIUS	9"
BACKGROUND	TYPE: IV
	COLOR: Green
LEGEND/BORDER	TYPE: IV
	COLOR: White/White

SYMBOL	ROT	X	Y	WID	HT
M1_1	0	10.6	41	24	24
AR_Type A	90	31	7	14	22

Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Ground
Sign Support No. N/A
Location : Wethersfield Great Meadow Road at I-91 NB on/off Ramps
Project No. 159-191
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

REV'D /

PLOTTED : 05/10/18

LETTER POSITIONS (X)

																					LENGTH	SERIES/SIZE
	N		O	R	T	H																EM 2000
42.6	6.5	1.5	6.5	5.5	5.5	4.9	11														30.4	8,6
	H	a	r	t	f	o	r	d														EM 2000
16.2	8.5	8.5	5.1	5.9	5.1	7.9	5.2	5.3	16.2												51.5	8/6

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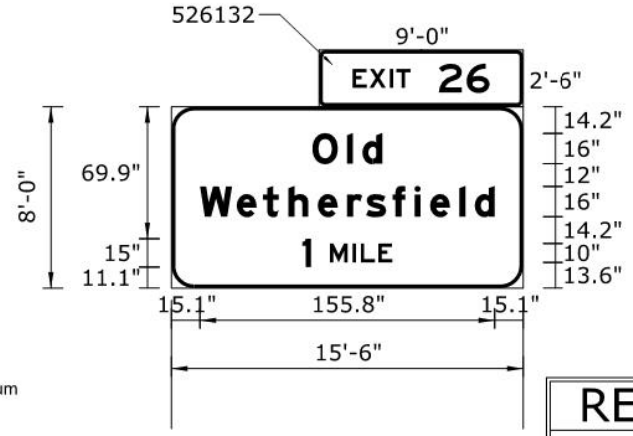
1222

ITEM #1207034A, ITEM #1207039A

Rev. Date 07/18

SIGN DETAIL

1:85



Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Overhead
Sign Support No. 21352
Location : Hartford Route 91 S.B. Mileage : 35.62
Project No. 159-191
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

SIGN NUMBER	091S_063_35.62_A
SIGN PANEL	15'-6" x 8'-0"
EXIT CROWN	22.5
TOTAL AREA	146.5 Sq.Ft.
BDR INSET/WIDTH	2" / 2"
CORNER RADIUS	12"
BACKGROUND	TYPE: IV
	COLOR: Green
LEGEND/BORDER	TYPE: IV
	COLOR: White/White

SYMBOL	ROT	X	Y	WID	HT

REV'D /

PLOTTED : 03/02/18

LETTER POSITIONS (X)

																					LENGTH	SERIES/SIZE
	9	'	-	0	"																	Verdana
118.9	7.7	3.1	5.2	7.6	3.4	40															27.1	8.5
	E	X	I	T		2	6															E 2000
17.8	8.9	10.7	3.5	7.5	15	14.7	12.2	17.8													72.5	10,15
	O	l	d																			EM 2000
74.5	18.2	8.2	10.6	74.5																	37	16/12
	W	e	t	h	e	r	s	f	i	e	l	d										EM 2000
15.1	19.4	13.9	13.4	15.5	15.5	10.1	13.9	11.7	8.2	15.5	8.2	10.6	15.1								155.8	16/12
	1		M	I	L	E																E 2000
69.2	4.5	10	12	4.4	9.2	7.5	69.2														47.6	15,10

63-703 & 159-191

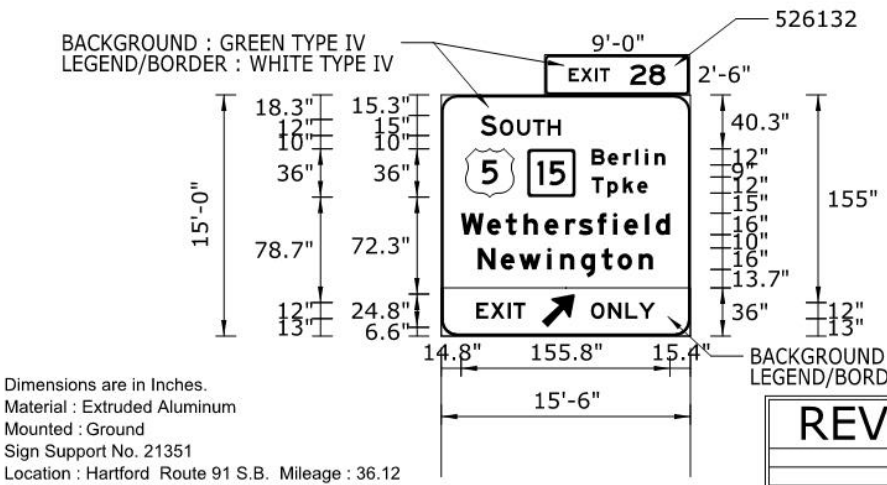
1223

ITEM #1207034A, ITEM #1207039A

Rev. Date 07/18

SIGN DETAIL

1:120



Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Ground
Sign Support No. 21351
Location : Hartford Route 91 S.B. Mileage : 36.12
Project No. 159-191
Engineer : C. Jurich / Designed by : J. Fascione / Checked by : _____

REV'D /

SIGN NUMBER	091S_063_36.12_A
SIGN PANEL	15'-6" x 15'-0"
EXIT CROWN	22.5
TOTAL AREA	255.0 Sq.Ft.
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	12"
BACKGROUND	TYPE: See Sign
	COLOR: See Sign
LEGEND/BORDER	TYPE: See Sign
	COLOR: See Sign

SYMBOL	ROT	X	Y	WID	HT
M1_4	0	18.3	103.7	36	36
M1_5_1	0	64.3	103.7	36	36
AR_Type A	315	75	6.6	20	31.5

PLOTTED : 03/02/18

LETTER POSITIONS (X)

																					LENGTH	SERIES/SIZE
	S		O	U	T	H																E 2000
29.4	12.2	2.2	12.8	11.8	11	9.7	96.8														59.8	15,12
	B	e	r	l	i	n																EM 2000
112.3	12	11.6	8.9	7.2	7.2	7.9	18.9														54.8	12/9
	T	p	k	e																		EM 2000
112.3	11.8	11.6	10.6	7.9	31.8																41.9	12/9
	W	e	t	h	e	r	s	f	i	e	l	d										EM 2000
14.8	19.4	13.9	13.4	15.5	15.5	10.1	13.9	11.7	8.2	15.5	8.2	10.6	15.4								155.8	16/12
	N	e	w	i	n	g	t	o	n													EM 2000
27.4	17	13.8	21	9.6	15.5	15.4	12	15.8	10.6	28											130.6	16/12
	E	X	I	T																		E 2000
26.3	10.7	12.8	4.2	9	123																36.7	12
	O	N	L	Y																		E 2000
111.8	12.8	12.8	10	12.2	26.4																47.9	12

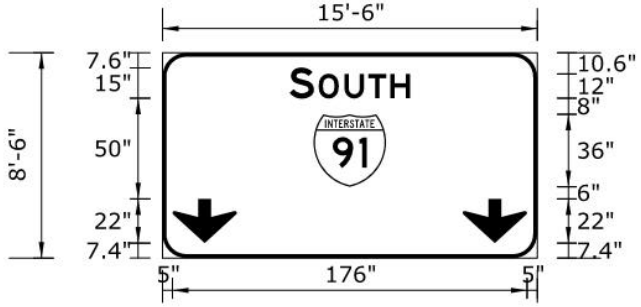
63-703 & 159-191

1224

ITEM #1207034A, ITEM #1207039A

SIGN DETAIL

1:80



SIGN NUMBER	091S_063_36.62_A
SIGN PANEL	15'-6" x 8'-6"
EXIT CROWN	
TOTAL AREA	131.8 Sq.Ft.
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	11"
BACKGROUND	TYPE: IV
	COLOR: Green
LEGEND/BORDER	TYPE: IV
	COLOR: White/White

SYMBOL	ROT	X	Y	WID	HT
M1_1	0	75	35.4	36	36
ARDOWN	0	5	7.5	32	22
ARDOWN	0	149	7.5	32	22

Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Overhead
Sign Support No. 21458
Location : Hartford Route 91 S.B. Mileage : 36.62
Project No. 159-191
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

REV'D /

PLOTTED : 03/02/18

LETTER POSITIONS (X)																					LENGTH	SERIES/SIZE
	S		O	U	T	H																E 2000
63.1	12.2	2.2	12.8	11.8	11	9.7	63.1														59.8	15,12

Rev. Date 07/18

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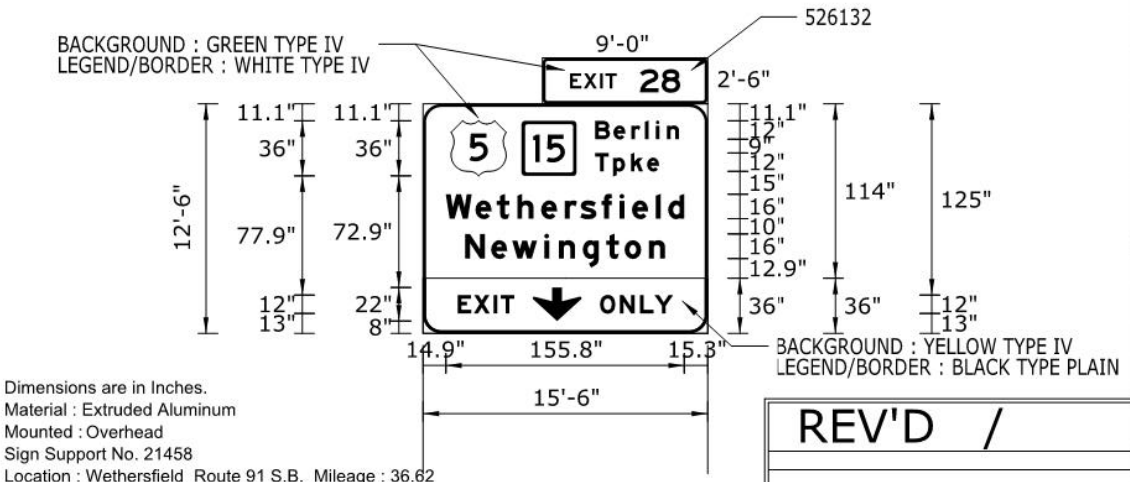
1225

ITEM #1207034A, ITEM #1207039A

Rev. Date 07/18

SIGN DETAIL

1:105



Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Overhead
Sign Support No. 21458
Location : Wethersfield Route 91 S.B. Mileage : 36.62
Project No. 159-191
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

REV'D /

SIGN NUMBER	091S_063_36.62_B
SIGN PANEL	15'-6" x 12'-6"
EXIT CROWN	22.5
TOTAL AREA	216.25 Sq.Ft.
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	12"
BACKGROUND	TYPE: See Sign
	COLOR: See Sign
LEGEND/BORDER	TYPE: See Sign
	COLOR: See Sign

SYMBOL	ROT	X	Y	WID	HT
M1_4	0	18.4	102.9	36	36
M1_5_1	0	64.4	102.9	36	36
ARDOWN	0	71.6	8	32	22

PLOTTED : 03/02/18

LETTER POSITIONS (X)																				LENGTH	SERIES/SIZE
	B	e	r	l	i	n															EM 2000
112.4	12	11.6	8.9	7.2	7.2	7.9	18.8													54.8	12/9
	T	p	k	e																	EM 2000
112.4	11.8	11.6	10.6	7.9	31.8															41.9	12/9
	W	e	t	h	e	r	s	f	i	e	l	d									EM 2000
14.9	19.4	13.9	13.4	15.5	15.5	10.1	13.9	11.7	8.2	15.5	8.2	10.6	15.3							155.8	16/12
	N	e	w	i	n	g	t	o	n												EM 2000
27.5	17	13.8	21	9.6	15.5	15.4	12	15.8	10.6	28										130.6	16/12
	E	X	I	T																	EM 2000
22.6	10.6	13	4.6	8.9	126.4															37	12
	O	N	L	Y																	EM 2000
115.6	13	13.1	9.6	12.1	22.7															47.8	12

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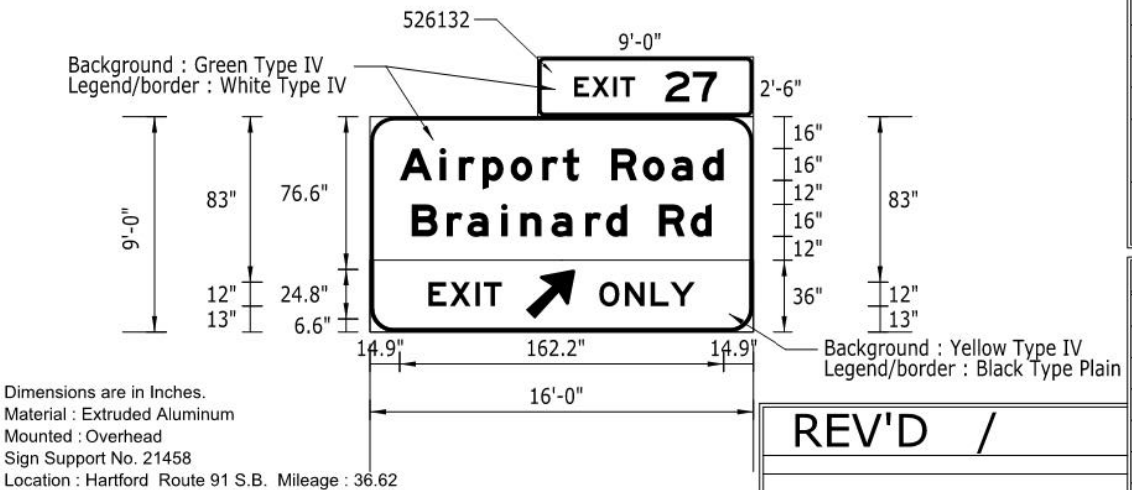
SIGN DETAIL

1:80



SIGN NUMBER	091S_063_36.62_C
SIGN PANEL	16'-0" x 9'-0"
EXIT CROWN	22.5
TOTAL AREA	166.5 Sq.Ft.
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	12"
BACKGROUND	TYPE: See Sign
	COLOR: See Sign
LEGEND/BORDER	TYPE: See Sign
	COLOR: See Sign

SYMBOL	ROT	X	Y	WID	HT
AR_Type A	315	78	6.6	20	31.5

Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Overhead
Sign Support No. 21458
Location : Hartford Route 91 S.B. Mileage : 36.62
Project No. 159-191
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

REV'D /

PLOTTED : 03/02/18

LETTER POSITIONS (X)

																					LENGTH	SERIES/SIZE
	A	i	r	p	o	r	t		R	o	a	d										EM 2000
14.9	20	9.6	11.8	14.1	15.8	10.2	8.3	16	15.8	14.4	15.5	10.6	14.9								162.2	16/12
	B	r	a	i	n	a	r	d		R	d											EM 2000
20.9	17.4	10.4	17	9.6	15.5	17	10.4	10.6	16	15.8	10.6	20.9									150.2	16/12
	E	X	I	T																		E 2000
29.3	10.7	12.8	4.2	9	126																36.7	12
	O	N	L	Y																		E 2000
114.8	12.8	12.8	10	12.2	29.3																47.9	12

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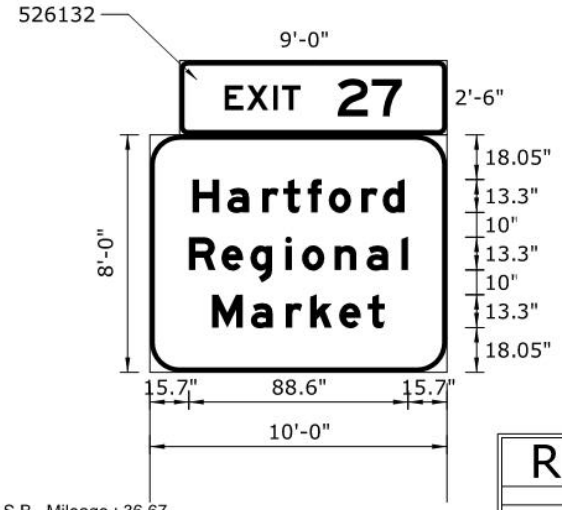
1227

ITEM #1207034A, ITEM #1207039A

Rev. Date 07/18

SIGN DETAIL

1:65



Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Ground
Sign Support No. T.B.D.
Location : Wethersfield Route 91 S.B. Mileage : 36.67
Project No. 159-191
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

REV'D /

SIGN NUMBER	091S_063_36.67_A
SIGN PANEL	10'-0" x 8'-0"
EXIT CROWN	23.75
TOTAL AREA	103.75 Sq.Ft.
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	12"
BACKGROUND	TYPE: IV
	COLOR: Green
LEGEND/BORDER	TYPE: IV
	COLOR: White/White

SYMBOL	ROT	X	Y	WID	HT

PLOTTED : 03/02/18

LETTER POSITIONS (X)

																				LENGTH	SERIES/SIZE
	H	a	r	t	f	o	r	d													EM 2000
17.2	14.1	14.1	8.5	9.8	8.5	13.2	8.6	8.8	17.2											85.7	13.3/10
	R	e	g	i	o	n	a	l													EM 2000
15.7	13.2	11.7	14.1	6.8	13.2	12.9	14.1	2.7	15.7											88.6	13.3/10
	M	a	r	k	e	t															EM 2000
25.1	15.7	14.1	9.8	11.7	11.6	6.9	25.1													69.8	13.3/10

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ITEM #1207034A, ITEM #1207039A

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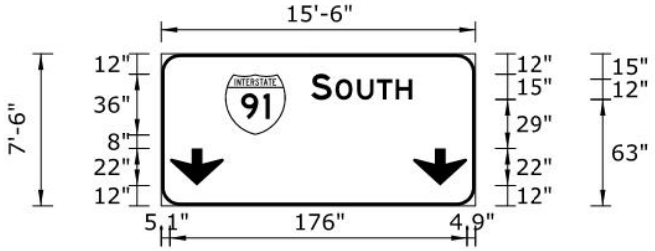
SIGN DETAIL

1:95



SIGN NUMBER	091S_063_37.13_A
SIGN PANEL	15'-6" x 7'-6"
EXIT CROWN	
TOTAL (Sq.fT.)	116.3 Sq.Ft.
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	11"
BACKGROUND	TYPE: IV
	COLOR: Green
LEGEND/BORDER	TYPE: IV
	COLOR: White/White

SYMBOL	ROT	X	Y	WID	HT
M1_1	0	37.7	42	36	36
ARDOWN	0	5.1	12	32	22
ARDOWN	0	149.1	12	32	22

Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Overhead
Sign Support No. 21457
Location : Hartford Route 91 S.B. Mileage : 37.13
Project No. 159-191
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

REV'D /

PLOTTED : 03/05/18

LETTER POSITIONS (X)

	S		O	U	T	H															LENGTH	SERIES/SIZE
	S		O	U	T	H																E 2000
88.7	12.2	2.2	12.8	11.8	11	9.7	37.5														59.8	15,12

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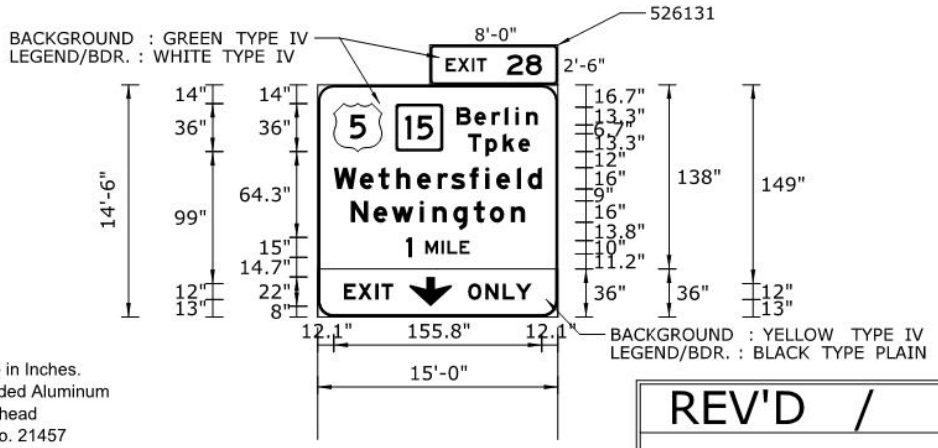
1229

ITEM #1207034A, ITEM #1207039A

Rev. Date 07/18

SIGN DETAIL

1:120



Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Overhead
Sign Support No. 21457
Location : Hartford Route 91 S.B. Mileage : 37.13
Project No. 159-191
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

SIGN NUMBER	091S_063_36.62_B
SIGN PANEL	15'-0" x 14'-6"
EXIT CROWN	20.0
TOTAL AREA	237.5 Sq.Ft.
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	12"
BACKGROUND	TYPE: See Sign
	COLOR: See Sign
LEGEND/BORDER	TYPE: See Sign
	COLOR: See Sign

SYMBOL	ROT	X	Y	WID	HT
M1_4	0	12.1	124	36	36
M1_5_1	0	58.1	124	36	36
ARDOWN	0	68.6	8	32	22

REV'D /

PLOTTED : 03/05/18

LETTER POSITIONS (X)

																					LENGTH	SERIES/SIZE
	B	e	r	l	i	n																EM 2000
104.1	13.3	12.9	9.8	8	8	8.8	15.1														60.8	13.3/10
	T	p	k	e																		EM 2000
112.7	13	12.9	11.7	8.8	20.9																46.4	13.3/10
	W	e	t	h	e	r	s	f	i	e	l	d										EM 2000
12.1	19.4	13.9	13.4	15.5	15.5	10.1	13.9	11.7	8.2	15.5	8.2	10.6	12.1								155.8	16/12
	N	e	w	i	n	g	t	o	n													EM 2000
24.7	17	13.8	21	9.6	15.5	15.4	12	15.8	10.6	24.7											130.6	16/12
	1		M	I	L	E																E 2000
66.2	4.5	10	12	4.4	9.2	7.5	66.2														47.6	15,10
	E	X	I	T																		EM 2000
19.7	10.6	13	4.6	8.9	123.4																37	12
	O	N	L	Y																		EM 2000
112.6	13	13.1	9.6	12.1	19.6																47.8	12

63-703 & 159-191

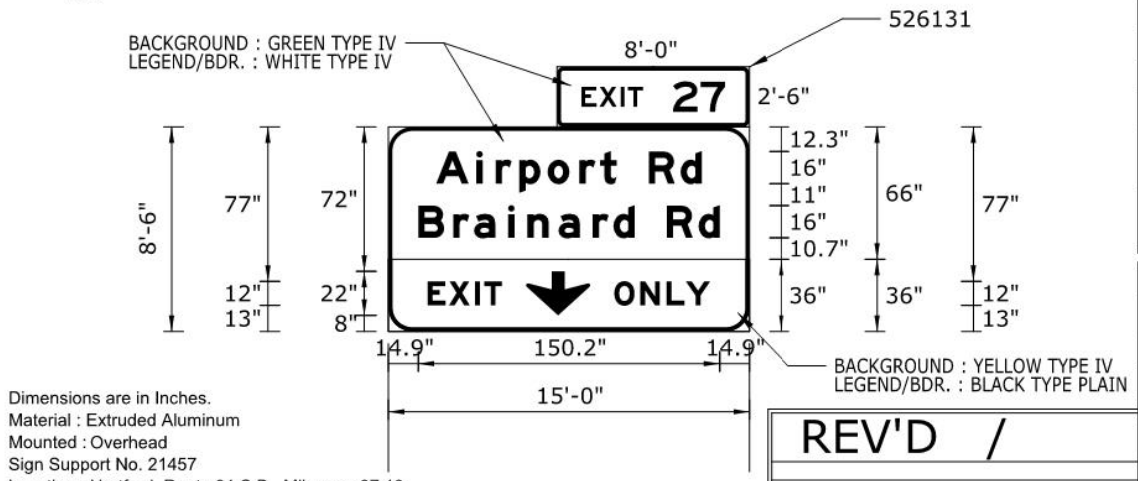
1230

ITEM #1207034A, ITEM #1207039A

Rev. Date 07/18

SIGN DETAIL

1:80



Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Overhead
Sign Support No. 21457
Location : Hartford Route 91 S.B. Mileage : 37.13
Project No. 159-191
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

REV'D /

SIGN NUMBER	091S_063_37.13_C
SIGN PANEL	15'-0" x 8'-6"
EXIT CROWN	20.0
TOTAL AREA	147.5 Sq.Ft.
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	12"
BACKGROUND	TYPE: See Sign
	COLOR: See Sign
LEGEND/BORDER	TYPE: See Sign
	COLOR: See Sign

SYMBOL	ROT	X	Y	WID	HT
ARDOWN	0	68.6	8	32	22

PLOTTED : 03/05/18

LETTER POSITIONS (X)																				LENGTH	SERIES/SIZE
	A	i	r	p	o	r	t		R	d											EM 2000
23.8	20	9.6	11.8	14.1	15.8	10.2	8.3	16	15.8	10.6	23.8									132.3	16/12
	B	r	a	i	n	a	r	d		R	d										EM 2000
14.9	17.4	10.4	17	9.6	15.5	17	10.4	10.6	16	15.8	10.6	14.9								150.2	16/12
	E	X	I	T																	EM 2000
19.6	10.6	13	4.6	8.9	123.4															37	12
	O	N	L	Y																	EM 2000
112.6	13	13.1	9.6	12.1	19.6															47.8	12

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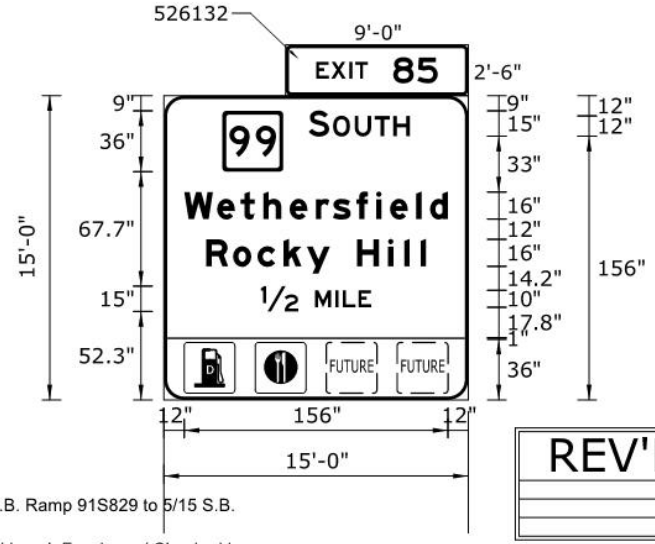
1231

ITEM #1207034A, ITEM #1207039A

Rev. Date 07/18

SIGN DETAIL

1:95



Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Ground
Sign Support No. N/A
Location : Hartford Route 91 S.B. Ramp 91S829 to 5/15 S.B.
Project No. 159-191
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

SIGN NUMBER	091S_063_R829_EX85_A
SIGN PANEL	15'-0" x 15'-0"
EXIT CROWN	22.5
TOTAL AREA	202.5 Sq.Ft.
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	12"
BACKGROUND	TYPE: IV
	COLOR: Green
LEGEND/BORDER	TYPE: IV
	COLOR: White/White

SYMBOL	ROT	X	Y	WID	HT
M1_5_1	0	34.6	135	36	36
517771	0	12	4	30	30
517772	0	54	4	30	30
FUTURE	0	96	4	30	30
FUTURE	0	138	4	30	30

REV'D /

PLOTTED : 05/08/18

LETTER POSITIONS (X)																					LENGTH	SERIES/SIZE
	S		O	U	T	H																E 2000
85.6	12.2	2.2	12.8	11.8	11	9.7	34.6														59.8	15,12
	W	e	t	h	e	r	s	f	i	e	l	d										EM 2000
12.1	19.4	13.9	13.4	15.5	15.5	10.1	13.9	11.7	8.2	15.5	8.2	10.6	12.1								155.8	16/12
	R	o	c	k	y		H	i	l	l												EM 2000
25.1	15.8	14.4	15.5	13.8	13.6	16	18.4	9.6	9.6	3.2	25										129.9	16/12
	1/2		M	I	L	E																E 2000
57.5	22	10	12	4.4	9.2	7.5	57.5														65.1	15,10

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1232

ITEM #1207034A, ITEM #1207039A

Rev. Date 07/18

SIGN DETAIL

1:60

SIGN NUMBER	091S_159_33.59_A
SIGN PANEL	15'-0" x 7'-0"
EXIT CROWN	22.5
TOTAL AREA	127.5 Sq.Ft.
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	10"
BACKGROUND	TYPE: IV
	COLOR: Green
LEGEND/BORDER	TYPE: IV
	COLOR: White/White

SYMBOL	ROT	X	Y	WID	HT
M1_5_1	0	16.7	39.3	36	36
AR_Type A	330	143.9	39.7	24	37.8

Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Overhead
Sign Support No. 21461
Location : Wethersfield Route 91 S.B. Mileage : 33.59
Project No. 159-191
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

REV'D /

PLOTTED : 01/05/18

LETTER POSITIONS (X)																					LENGTH	SERIES/SIZE
	N		O	R	T	H																E 2000
67.7	12.2	3.1	12.8	11	11	9.7	52.4														59.9	15,12
	G	l	a	s	t	o	n	b	u	r	y											EM 2000
12	17.8	8.2	15.2	13.9	12	15.8	17	15.5	17	10.1	13.6	12									156	16/12

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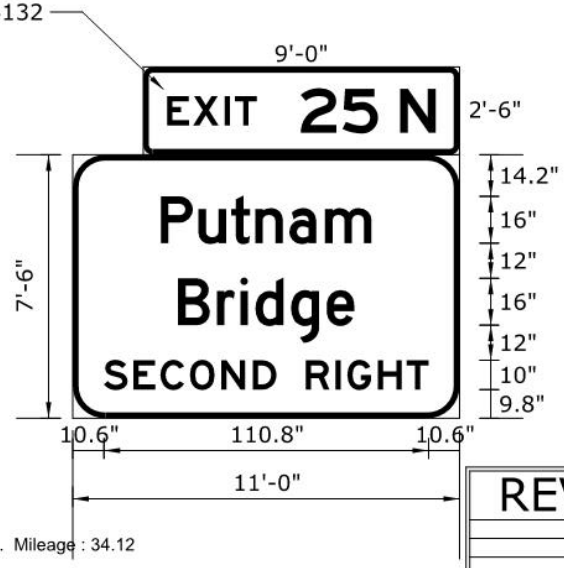
1233

ITEM #1207034A, ITEM #1207039A

SIGN DETAIL
1:55



Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Ground
Sign Support No. N/A
Location : Wethersfield Route 91 S.B. Mileage : 34.12
Project No. 159-191
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

SIGN NUMBER	091S_159_34.12_A
SIGN PANEL	11'-0" x 7'-6"
EXIT CROWN	
TOTAL AREA	82.5 Sq.Ft.
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	11"
BACKGROUND	TYPE: IV
	COLOR: Green
LEGEND/BORDER	TYPE: IV
	COLOR: White/White

SYMBOL	ROT	X	Y	WID	HT

REV'D /

PLOTTED : 01/05/18

LETTER POSITIONS (X)

																					LENGTH	SERIES/SIZE
	P	u	t	n	a	m																D 2000
30.1	12.8	11.2	8.2	11.7	12.2	15.8	30.1														71.8	16/12
	B	r	i	d	g	e																D 2000
35.9	13.3	8	5.1	12.2	12.2	9.4	35.9														60.2	16/12
	S	E	C	O	N	D		R	I	G	H	T										E 2000
10.6	10.1	9.2	10.1	10.7	10.7	8.1	10	10.1	4.1	10.4	9.8	7.5	10.6								110.8	10

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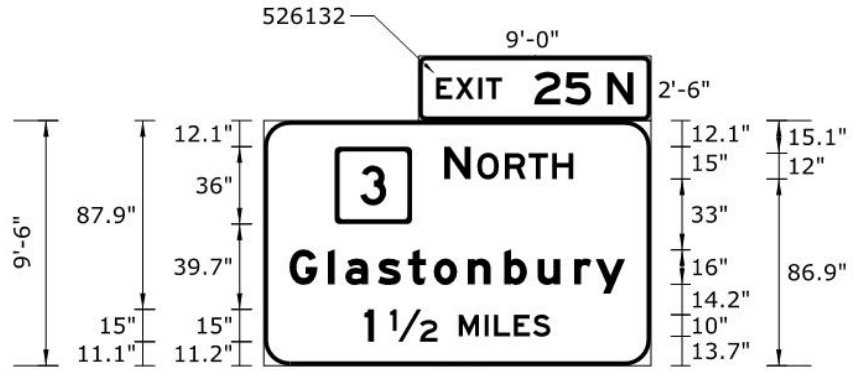
1234

ITEM #1207034A, ITEM #1207039A

SIGN DETAIL

1:75



Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Overhead
Sign Support No. 21349
Location : Wethersfield Route 91 S.B. Mileage : 35.10
Project No. 159-191
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

REV'D /

SIGN NUMBER	091S_159_35.10_A
SIGN PANEL	15'-0" x 9'-6"
EXIT CROWN	22.5
TOTAL AREA	165.0 Sq.ft.
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	12"
BACKGROUND	TYPE: IV
	COLOR: Green
LEGEND/BORDER	TYPE: IV
	COLOR: White/White

SYMBOL	ROT	X	Y	WID	HT
M1_5_1	0	33	65.9	36	36

PLOTTED : 01/05/18

LETTER POSITIONS (X)

																					LENGTH	SERIES/SIZE
	N		O	R	T	H																E 2000
84	12.2	3.1	12.8	11	11	9.7	36.1														59.9	15,12
	G	l	a	s	t	o	n	b	u	r	y											EM 2000
12	17.8	8.2	15.2	13.9	12	15.8	17	15.5	17	10.1	13.6	12									156	16/12
	1		1/2		M	I	L	E	S													E 2000
46.7	4.5	7.5	22	10	12	4.4	9.2	8.9	8.1	46.7											86.6	15,10

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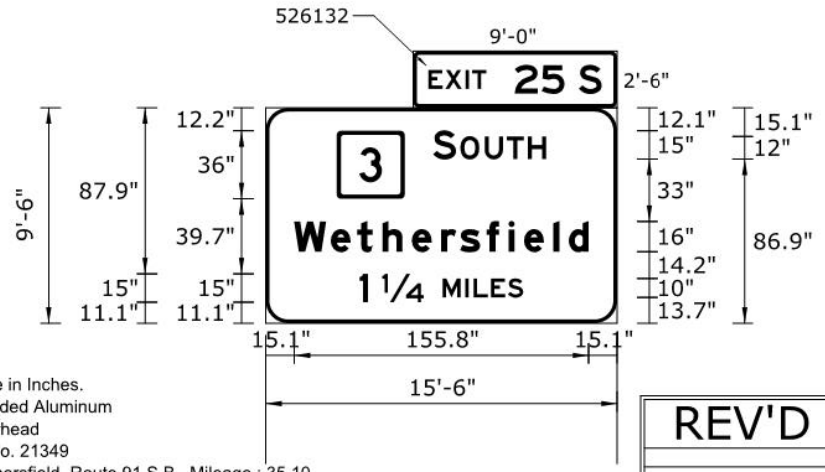
1235

ITEM #1207034A, ITEM #1207039A

Rev. Date 07/18

SIGN DETAIL

1:85



SIGN NUMBER	091S_159_35.10_A
SIGN PANEL	15'-6" x 9'-6"
EXIT CROWN	22.5
TOTAL AREA	169.75 Sq.Ft.
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	12"
BACKGROUND	TYPE: IV
	COLOR: Green
LEGEND/BORDER	TYPE: IV
	COLOR: White/White

SYMBOL	ROT	X	Y	WID	HT
M1_5_1	0	37.6	65.8	36	36

Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Overhead
Sign Support No. 21349
Location : Wethersfield Route 91 S.B. Mileage : 35.10
Project No. 159-191
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

REV'D /

PLOTTED : 03/02/18

LETTER POSITIONS (X)

																					LENGTH	SERIES/SIZE
	S		O	U	T	H																E 2000
88.6	12.2	2.2	12.8	11.8	11	9.7	37.6														59.8	15,12
	W	e	t	h	e	r	s	f	i	e	l	d										EM 2000
15.1	19.4	13.9	13.4	15.5	15.5	10.1	13.9	11.7	8.2	15.5	8.2	10.6	15.1								155.8	16/12
	1		1/4		M	I	L	E	S													E 2000
49.7	4.5	7.5	22	10	12	4.4	9.2	8.9	8.1	49.7											86.6	15,10

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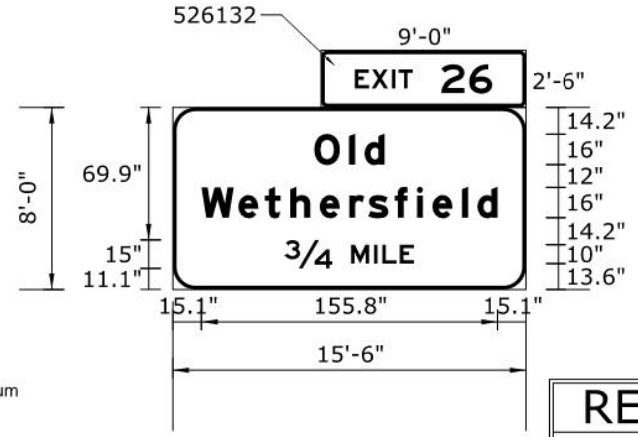
1236

ITEM #1207034A, ITEM #1207039A

Rev. Date 07/18

SIGN DETAIL

1:85



SIGN NUMBER	091S_159_35.10_C
SIGN PANEL	15'-6" x 8'-0"
EXIT CROWN	22.5
TOTAL AREA	146.5 Sq.ft.
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	12"
BACKGROUND	TYPE: IV
	COLOR: Green
LEGEND/BORDER	TYPE: IV
	COLOR: White/White

SYMBOL	ROT	X	Y	WID	HT

Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Overhead
Sign Support No. 21349
Location : Wethersfield Route 91 S.B. Mileage : 35.10
Project No. 159-191
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

REV'D /

PLOTTED : 01/05/18

LETTER POSITIONS (X)																					LENGTH	SERIES/SIZE
	O	l	d																			EM 2000
74.5	18.2	8.2	10.6	74.5																	37	16/12
	W	e	t	h	e	r	s	f	i	e	l	d										EM 2000
15.1	19.4	13.9	13.4	15.5	15.5	10.1	13.9	11.7	8.2	15.5	8.2	10.6	15.1								155.8	16/12
	3/4		M	I	L	E																E 2000
59	25	10	12	4.4	9.2	7.5	59														68.1	15,10

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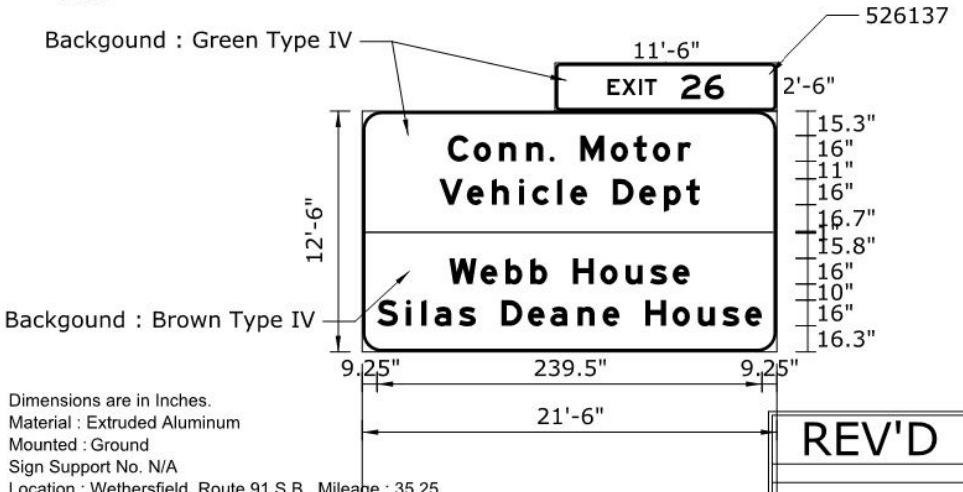
SIGN DETAIL

1:100



SIGN NUMBER	091S_159_35.25_A
SIGN PANEL	21'-6" x 12'-6"
EXIT CROWN	28.75
TOTAL AREA	313.75 Sq.Ft.
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	12"
BACKGROUND	TYPE: IV
	COLOR: See Sign
LEGEND/BORDER	TYPE: IV
	COLOR: White/White

SYMBOL	ROT	X	Y	WID	HT

Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Ground
Sign Support No. N/A
Location : Wethersfield Route 91 S.B. Mileage : 35.25
Project No. 159-191
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

REV'D /

PLOTTED : 06/18/18

LETTER POSITIONS (X)																					LENGTH	SERIES/SIZE
	C	o	n	n	.		M	o	t	o	r											EM 2000
53.3	16	15.8	17	14.4	3.2	16	18.9	14.2	12	15.8	8	53.3									151.4	16/12
	V	e	h	i	c	l	e		D	e	p	t										EM 2000
48	17.1	15.5	17	8.2	15.5	8.2	10.6	16	16.3	15.5	13.9	8.3	48								162.1	16/12
	W	e	b	b		H	o	u	s	e												EM 2000
54.2	19.4	15.5	15.5	10.6	16	17	15.8	15.2	14.1	10.6	54.2										149.6	16/12
	S	i	l	a	s		D	e	a	n	e		H	o	u	s	e					EM 2000
9.2	17.9	9.6	8.2	15.2	10.6	16	16.3	14.1	17	15.5	10.6	16	17	15.8	15.2	14.1	10.6	9.2			239.5	16/12

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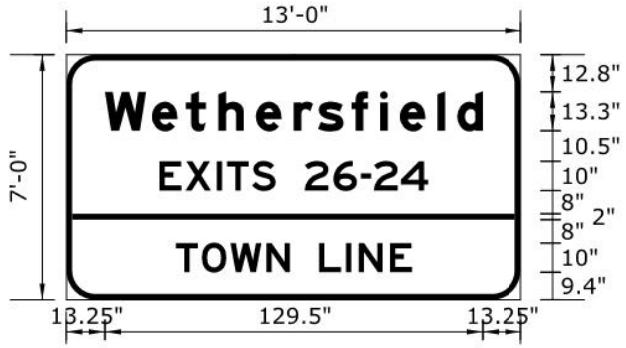
1238

ITEM #1207034A, ITEM #1207039A

SIGN DETAIL

1:55



Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Ground
Sign Support No. N/A
Location : Wethersfield Route 91 S.B. Mileage : 35.43
Project No. 159-191
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

SIGN NUMBER	091S_159_35.43_A
SIGN PANEL	13'-0" x 7'-0"
EXIT CROWN	
TOTAL AREA	91.0 Sq.ft.
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	10"
BACKGROUND	TYPE: IV
	COLOR: Green
LEGEND/BORDER	TYPE: IV
	COLOR: White/White

SYMBOL	ROT	X	Y	WID	HT

REV'D /

PLOTTED : 01/05/18

LETTER POSITIONS (X)

																					LENGTH	SERIES/SIZE
	W	e	t	h	e	r	s	f	i	e	l	d										EM 2000
13.2	16.1	11.6	11.2	12.9	12.9	8.4	11.6	9.7	6.8	12.9	6.8	8.8	13.2								129.5	13.3/10
	E	X	I	T	S		2	6	-	2	4											E 2000
32	8.9	10.7	3.5	8.6	8.1	10	9.8	9.4	4.5	9.2	9.4	32									92.1	10
	T	O	W	N		L	I	N	E													E 2000
37.6	8.9	9.8	12.3	8.1	10	9.2	4.4	10.7	7.5	37.5											80.9	10

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ITEM #1207034A, ITEM #1207039A

Rev. Date 07/18

SIGN DETAIL

1:40

SIGN NUMBER	091S_159_RO55_EX26_A
SIGN PANEL	7'-0" x 6'-0"
EXIT CROWN	
TOTAL AREA	42.0 Sq.Ft.
BDR INSET/WIDTH	0" / 1.25"
CORNER RADIUS	9"
BACKGROUND	TYPE: IV
	COLOR: Green
LEGEND/BORDER	TYPE: IV
	COLOR: White/White

SYMBOL	ROT	X	Y	WID	HT
M1_1	0	10.6	41	24	24
AR_Type A	90	31	7	14	22

Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Ground
Sign Support No. N/A
Location : Wethersfield Great Meadow Road at I-91 SB on/off Ramps
Project No. 159-191
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

REV'D /

PLOTTED : 01/05/18

LETTER POSITIONS (X)																					LENGTH	SERIES/SIZE
	S		O	U	T	H																EM 2000
42.6	6.5	1.5	6.5	5.9	5.5	4.9	10.6														30.8	8,6
	N	e	w		H	a	v	e	n													EM 2000
7.8	8.5	6.9	8.2	8	8.5	7.6	7.8	7.8	5.3	7.8											68.4	8/6

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1240

ITEM #1207034A, ITEM #1207039A

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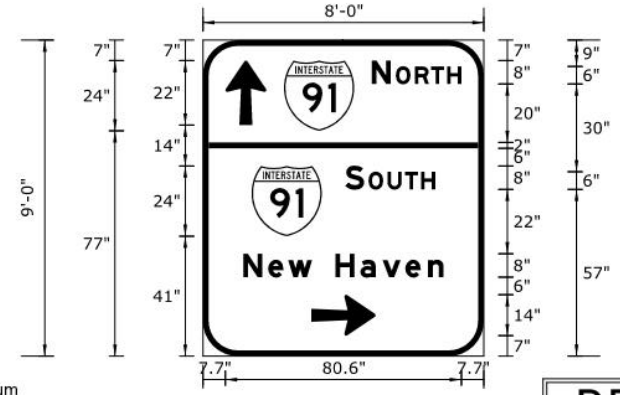
SIGN DETAIL

1:55



SIGN NUMBER	091S_159_RO55_EX26_B
SIGN PANEL	8'-0" x 9'-0"
EXIT CROWN	
TOTAL AREA	72.0 Sq.Ft.
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	12"
BACKGROUND	TYPE: IV
	COLOR: Green
LEGEND/BORDER	TYPE: IV
	COLOR: White/White

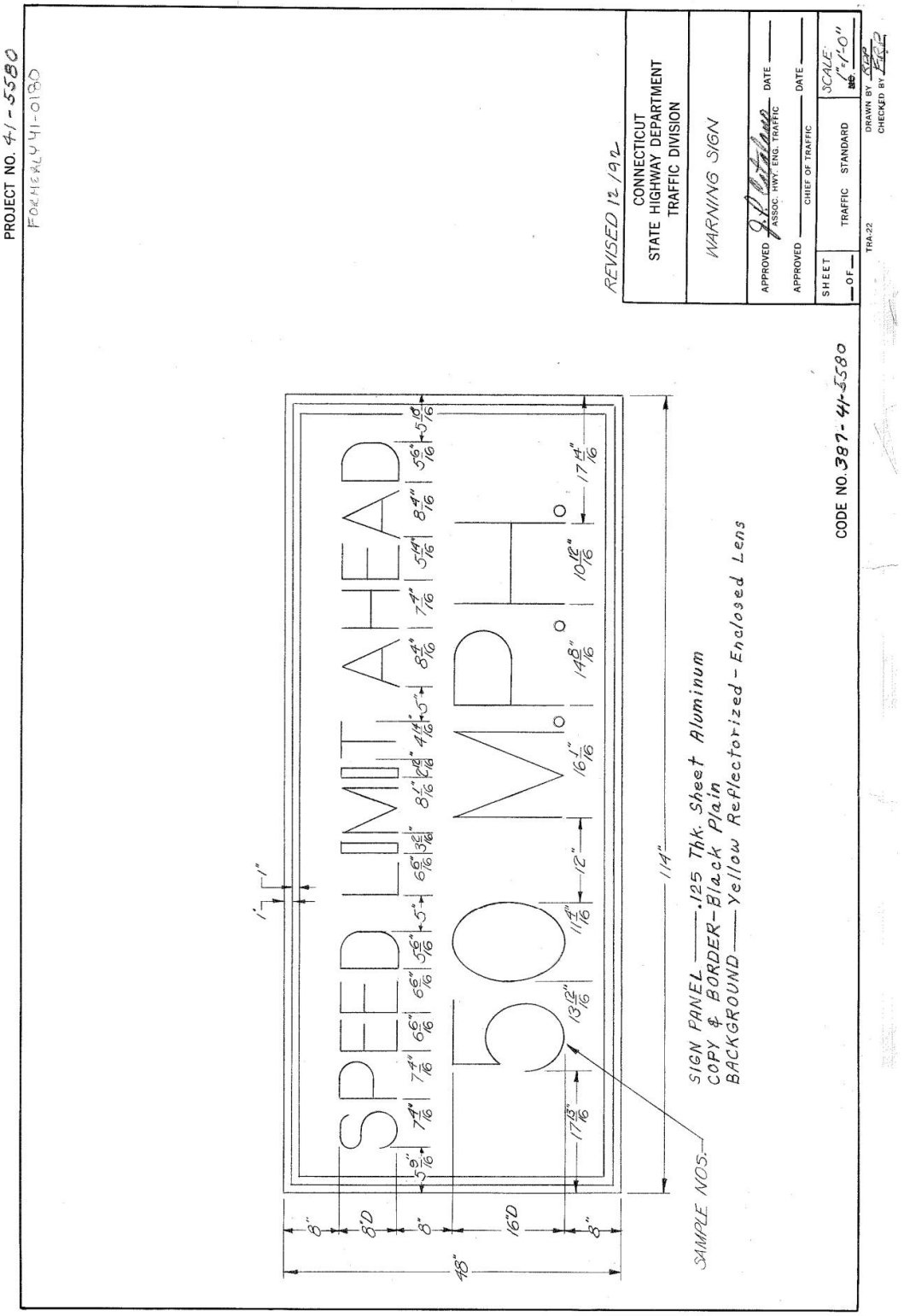
SYMBOL	ROT	X	Y	WID	HT
AR_Type A	0	7.7	79	14	22
M1_1	0	27.7	77	24	24
M1_1	0	16.6	41	24	24
AR_Type A	90	37	7	14	22

Dimensions are in Inches.
Material : Extruded_Aluminum
Mounted : Side
Sign Support No. N/A
Location : Wethersfield Great Meadow Road at I-91 SB on/off Ramps
Project No. 159-191
Engineer : C. Jurich / Designed by : J._Fascione / Checked by : _____

REV'D /

PLOTTED : 01/05/18

LETTER POSITIONS (X)																					LENGTH	SERIES/SIZE
	N		O	R	T	H																EM 2000
57.7	6.5	1.7	6.5	5.5	5.5	4.9	7.7														30.6	8,6
	S		O	U	T	H																EM 2000
48.6	6.5	1.5	6.5	5.9	5.5	4.9	16.6														30.8	8,6
	N	e	w		H	a	v	e	n													EM 2000
13.8	8.5	6.9	8.2	8	8.5	7.6	7.8	7.8	5.3	13.8											68.4	8/6


PROJECT NO. 41-5580
FORMERLY 41-0180
SPEED LIMIT AHEAD
50 MPH
SAMPLE NOS.
SIGN PANEL ——— .125 Thk. Sheet Aluminum
COPY & BORDER - Black Plain
BACKGROUND ——— Yellow Reflectorized - Enclosed Lens
REVISED 12/92
CONNECTICUT
STATE HIGHWAY DEPARTMENT
TRAFFIC DIVISION
WARNING SIGN
APPROVED ASSOC. HWY. ENG. TRAFFIC DATE
APPROVED CHIEF OF TRAFFIC DATE
SHEET OF
TRAFFIC STANDARD
SCALE: 1"=1'-0"
TRA-22
DRAWN BY
CHECKED BY
CODE NO. 387-41-5580

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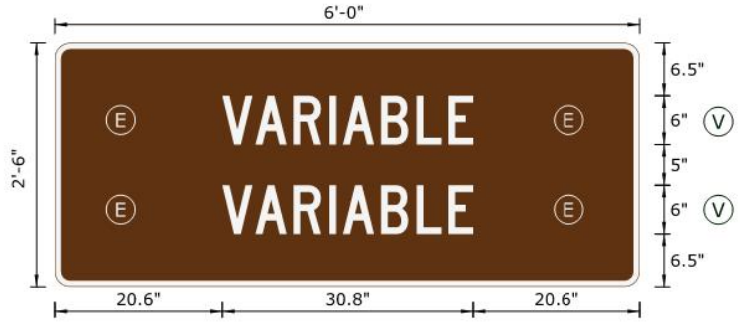
1242

ITEM #1207034A, ITEM #1207039A

Rev. Date 07/18

SIGN DETAIL
1:20

NOTE : FOR MEMORIAL AND COMMEMORATIVE SIGNS ON EXPRESSWAY HIGHWAYS USE ONLY.



SIGN NUMBER	512073
PANEL SIZE	6'-0" x 2'-6"
SIGN AREA	15.0 Sq.Ft.
MUTCD	
BDR INSET/WIDTH	0" / 0.75"
CORNER RADIUS	1.88"
BACKGROUND	TYPE: *
	COLOR: Brown
LEGEND/BORDER	TYPE: *
	COLOR: White/White

* REFER TO CATALOG OF SIGNS FOR SHEETING TYPE.
WHEN COLOR IS BLACK TYPE IS "PLAIN".

SYMBOL	ROT	X	Y	WID	HT

(E) Equal spacing.

(V) Variable legend.

Dimensions are in Inches
Material : .125 Thick Sheet Aluminum
Engineer : B. Schilling / Designed By: J. Fascione / Checked By:_____
Ground Mounted
SERIES "C" IS USED WHENEVER POSSIBLE OTHERWISE SERIES "B" IS USED.

REV'D /

FILE : 512073 Mar 15, 2018

LETTER POSITIONS (X)																					LENGTH	SERIES/SIZE
	V	A	R	I	A	B	L	E														C 2000
20.6	4.1	4.7	4.4	1.7	4.7	4.4	3.9	3.1	20.6												30.8	6
	V	A	R	I	A	B	L	E														C 2000
20.6	4.1	4.7	4.4	1.7	4.7	4.4	3.9	3.1	20.6												30.8	6

63-703 & 159-191

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Rev. Date 07/18

SIGN DETAIL

1:35

SIGN NUMBER	51-7846
SIGN PANEL	33.0
EXIT CROWN	--
TOTAL (Sq.fT.)	33.0
BDR INSET/WIDTH	0" / 1.25"
CORNER RADIUS	8"
BACKGROUND	TYPE: IV
	COLOR: Brown
LEGEND/BORDER	TYPE: IV
	COLOR: White/White

SYMBOL	ROT	X	Y	WID	HT

DIMENSIONS ARE IN INCHES
MATERIAL : .125 THK.SHEET ALUMINUM
SIDE MOUNTED
SIGN SUPPORT NO. N/A
LOCATION : EAST HARTFORD ROUTE I-91 N.B. MILEAGE : 36.40
ENGINEER : JGB DESIGNED BY : G.FASCIONE CHECKED BY :_____

REV'D /11

LETTER POSITIONS (X)																					LENGTH	SERIES/SIZE
E	X	I	T		2	9	A															EM 2000
10.2	17.3	25.9	28.7	34.7	38.7	46.3	53.6														51.6	8
A	d	r	i	a	e	n	'	s														EM 2000
6.8	16.1	24.6	30.5	34.6	42.3	50.1	57.3	59.9													58.4	8/6
L	a	n	d	i	n	g																EM 2000
11.2	18.2	26.7	34.4	42.9	47.7	55.5															49.5	8/6
D	i	s	t	r	i	c	t															EM 2000
12.2	21.1	25	32	38.7	44.6	48.7	55.6														47.6	8/6

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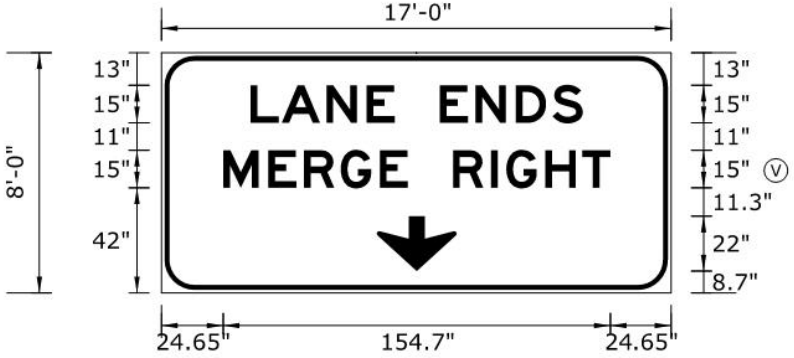
ITEM #1207034A, ITEM #1207039A

SIGN DETAIL
1:65



SIGN NUMBER	424418
PANEL SIZE	17'-0" x 8'-0"
SIGN AREA	136.0 Sq.Ft.
MUTCD	
BDR INSET/WIDTH	1.25" / 2"
CORNER RADIUS	12"
BACKGROUND	TYPE: *
	COLOR: Yellow
LEGEND/BORDER	TYPE: *
	COLOR: Black/Black

* REFER TO CATALOG OF SIGNS FOR SHEETING TYPE.
WHEN COLOR IS BLACK TYPE IS "PLAIN".

SYMBOL	ROT	X	Y	WID	HT
ARDOWN	0	86	8.7	32	22

Ⓥ Variable legend MERGE LEFT or MERGE RIGHT refer to chart below.
Dimensions are in Inches
Material : .080 Thick Sheet Aluminum
Engineer : B. Schilling / Designed By: J. Fascione / Checked By:_____
Ground Mounted

REV'D /

FILE :41_4264 Sep 26, 2017

LETTER POSITIONS (X)

																					LENGTH	SERIES/SIZE
	L	A	N	E		E	N	D	S													E 2000
35.6	12.4	17.9	16	11.3	18	14.3	16.1	14.7	12.1	35.6											132.7	15
	M	E	R	G	E		R	I	G	H	T											E 2000
24.7	18	14.2	14.7	15.6	11.3	18	15.1	6.1	15.6	14.7	11.3	24.7									154.7	15
	M	E	R	G	E		L	E	F	T												E 2000
30.2	18	14.3	14.7	15.6	11.3	18	13.8	14.3	12.5	11.3	30.2										143.6	15

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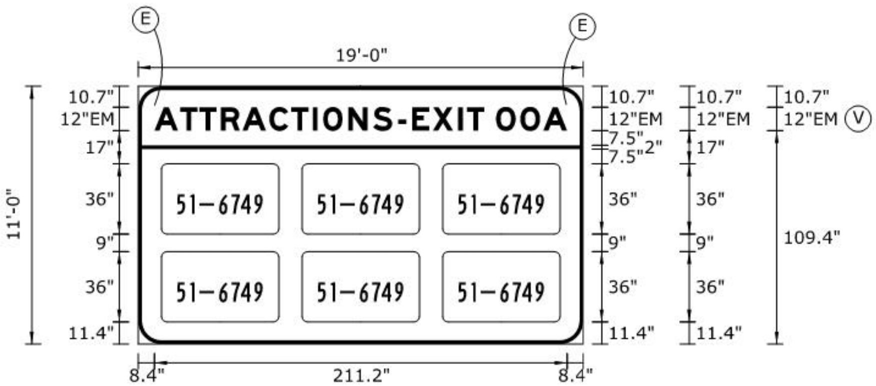
SIGN DETAIL
1:80

Ⓔ EQUAL SPACING
Ⓥ VARIABLE EXIT NO.



SIGN NUMBER	52-6747
SIGN PANEL	209.0
EXIT CROWN	--
TOTAL (Sq.fT.)	209.0
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	12"
BACKGROUND	TYPE: IV
	COLOR: Blue
LEGEND/BORDER	TYPE: IV
	COLOR: White/White

SYMBOL	ROT	X	Y	WID	HT
51-6749	0	12	56.4	60	36
51-6749	0	84	56.4	60	36
51-6749	0	156	56.4	60	36
51-6749	0	12	11.4	60	36
51-6749	0	84	11.4	60	36
51-6749	0	156	11.4	60	36

REV'D /

DIMENSIONS ARE IN INCHES
MATERIAL : EXTRUDED ALUMINUM
SIDE MOUNTED
SIGN SUPPORT NO. N/A
LOCATION : VARIOUS
PROJECT NO. 173-351 ENGINEER : PJC DESIGNED BY : JMF CHECKED BY :______

PLOTTED : 5/30/2012

LETTER POSITIONS (X)

																					LENGTH	SERIES/SIZE
	A	T	T	R	A	C	T	I	O	N	S		-									
8.4	13.1	9.8	11	11	13.8	11.2	11	5.3	13	12.7	9.7	3	4.2	3								
												E	X	I	T		O	O	A			EM 2000
												10.6	13	4.6	8.9	6	12.5	11.8	12.1	7.8	211.2	12

63-703 & 159-191

1246

ITEM #1207034A, ITEM #1207039A

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SIGN DETAIL
1:12

BUSINESS PANEL FOR EXPRESSWAY

NOTES FOR NON-LOGO BUSINESS PANEL

BACKGROUND COLORS :

- BROWN : AMUSEMENT PARK, CULTURAL CENTER, RECREATIONAL AREA, MUSEUM, ETC.
- BLUE : MAJOR SHOPPING CENTER, ETC.
- GREEN : COLLEGE, UNIVERSITY, ETC.

BACKGROUND COLOR MUST BE SPECIFIED NEXT TO SIGN # ON PLAN.

NOTES FOR LOGO BUSINESS PANEL

- SUBMIT TO THE DIVISION OF TRAFFIC ENGINEERING FOR REVIEW AND APPROVAL.

SIGN NUMBER	51-6749
SIGN PANEL	15.0
EXIT CROWN	--
TOTAL (Sq.fT.)	15.0
BDR INSET/WIDTH	0" / 1"
CORNER RADIUS	3"
BACKGROUND FOR NON-LOGO BUSINESS PANEL	TYPE: *
	COLOR: Variable
LEGEND/BORDER FOR NON-LOGO BUSINESS PANEL	TYPE: *
	COLOR: White/White
BACKGROUND FOR LOGO BUSINESS PANEL	TYPE: *
	COLOR: Variable
LEGEND/BORDER FOR LOGO BUSINESS PANEL	TYPE: *
	COLOR: Variable

* REFER TO CATALOG OF SIGNS FOR SHEETING TYPE. WHEN COLOR IS BLACK TYPE IS "PLAIN".

PLOTTED :6/11/2014

SYMBOL	ROT	X	Y	WID	HT

REV'D 6/14

ADDED NOTES FOR LOGO PANEL AND UPDATED BORDER FOR LOGO PANEL.

(E) EQUAL SPACING

(V) VARIABLE LEGEND OR LOGO TO FIT 60" x 36" SIGN

DIMENSIONS ARE IN INCHES
MATERIAL : .040 THK.SHEET ALUMINUM
OVERLAY PANEL
SIGN SUPPORT NO. N/A
LOCATION : TO BE USE WITH 52-6747, 52-6748, 52-6750 & TP-1283
ENGINEER : JJC DESIGNED BY : J.M.F. CHECKED BY : SDE

LETTER POSITIONS (X)																					LENGTH	SERIES/SIZE
H	A	R	B	O	R																	B 2000
16.1	20.6	26.1	30.8	35.3	40.5																27.8	8
Y	A	R	D																			B 2000
20.8	25.6	31	35.8																		18.4	8
B	A	L	L	P	A	R	K															B 2000
12.3	16.4	21.8	26	30.1	34	39.5	44.2														35.4	8

63-703 & 159-191

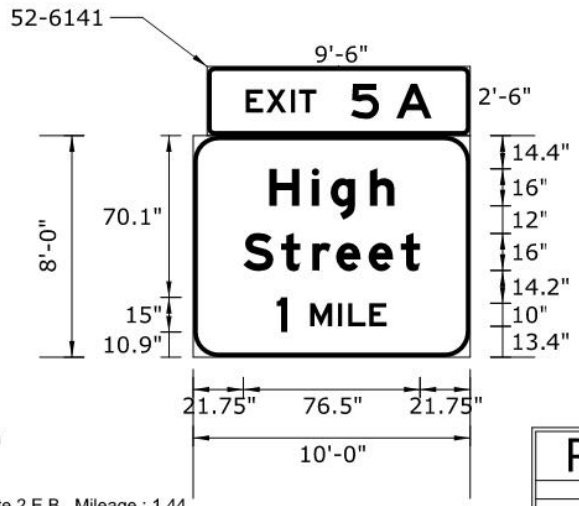
1247

ITEM #1207034A, ITEM #1207039A

Rev. Date 07/18

SIGN DETAIL

1:70



Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : T.B.D.
Sign Support No. T.B.D.
Location : East Hartford Route 2 E.B. Mileage : 1.44
Project No. 042-317
Engineer : K. McKernan / Designed by : J. Fascione / Checked by :

SIGN NUMBER	002E_042_1.44_B
SIGN PANEL	10'-0" x 8'-0"
EXIT CROWN	23.75
TOTAL AREA	103.75 Sq.Ft.
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	12"
BACKGROUND	TYPE: IV
	COLOR: Green
LEGEND/BORDER	TYPE: IV
	COLOR: White/White

SYMBOL	ROT	X	Y	WID	HT

REV'D /

PLOTTED : 10/03/17

LETTER POSITIONS (X)

																					LENGTH	SERIES/SIZE
	H	i	g	h																		EM 2000
33	18.4	8.2	17	10.6	33																54.1	16/12
	S	t	r	e	e	t																EM 2000
21.8	16.3	13.4	10.4	14.1	13.9	8.3	21.8														76.5	16/12
	1		M	I	L	E																E 2000
36.2	4.5	10	12	4.4	9.2	7.5	36.2														47.6	15,10

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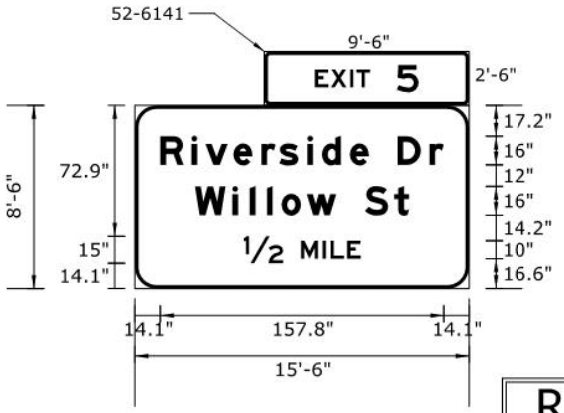
SIGN DETAIL

1:90



Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : T.B.D.
Sign Support No. T.B.D.
Location : East Hartford Route 2 E.B. Mileage : 1.44
Project No. 042-317
Engineer : K. McKerman / Designed by : J. Fascione / Checked by :

SIGN NUMBER	002E_042_1.44_C
SIGN PANEL	15'-6" x 8'-6"
EXIT CROWN	23.75
TOTAL AREA	155.5 Sq.Ft.
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	12"
BACKGROUND	TYPE: IV
	COLOR: Green
LEGEND/BORDER	TYPE: IV
	COLOR: White/White

SYMBOL	ROT	X	Y	WID	HT

REV'D /

PLOTTED : 10/03/17

LETTER POSITIONS (X)

																					LENGTH	SERIES/SIZE
	R	i	v	e	r	s	i	d	e		D	r										EM 2000
14.1	17.3	7.8	15.5	15.5	10.1	15.5	8.2	15.5	10.6	16	17.8	8	14.1								157.8	16/12
	W	i	l	l	o	w		S	t													EM 2000
33.4	20.8	9.6	9.6	8.2	14.1	16.3	16	16.3	8.3	33.4											119.2	16/12
	1/2		M	I	L	E																E 2000
60.5	22	10	12	4.4	9.2	7.5	60.5														65.1	15,10

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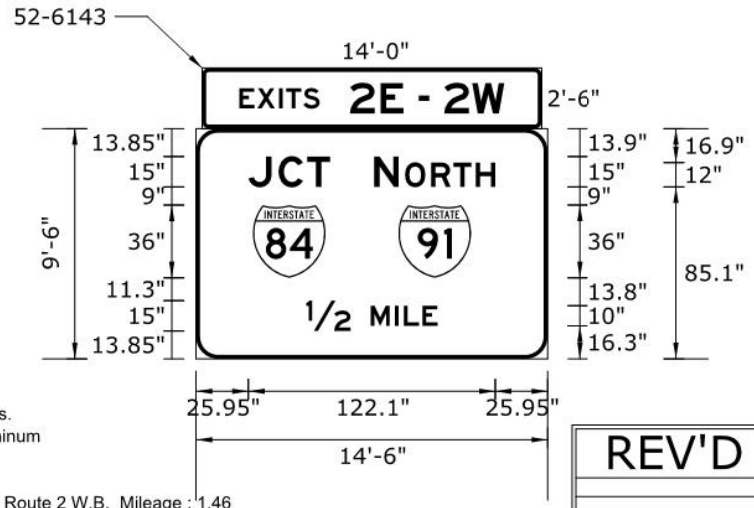
SIGN DETAIL

1:80



Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Overhead
Sign Support No. T.B.D.
Location : East Hartford Route 2 W.B. Mileage : 1.46
Project No. 042-317
Engineer : K. McKerman / Designed by : J. Fascione / Checked by :

REV'D /

SIGN NUMBER	002W_042_1.46_A
SIGN PANEL	14'-6" x 9'-6"
EXIT CROWN	35.0
TOTAL AREA	172.75 Sq.Ft.
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	12"
BACKGROUND	TYPE: IV
	COLOR: Green
LEGEND/BORDER	TYPE: IV
	COLOR: White/White

SYMBOL	ROT	X	Y	WID	HT
M1_1	0	28.1	40.1	36	36
M1_1	0	100.1	40.2	36	36

PLOTTED : 10/03/17

LETTER POSITIONS (X)

																				LENGTH	SERIES/SIZE
	J	C	T																		E 2000
25.9	14.8	14.2	11.3	107.7																40.4	15
	N		O	R	T	H															E 2000
88.1	12.2	3.1	12.8	11	11	9.7	25.9													59.9	15,12
	1/2		M	I	L	E															E 2000
54.5	22	10	12	4.4	9.2	7.5	54.5													65.1	15,10

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ITEM #1207034A, ITEM #1207039A

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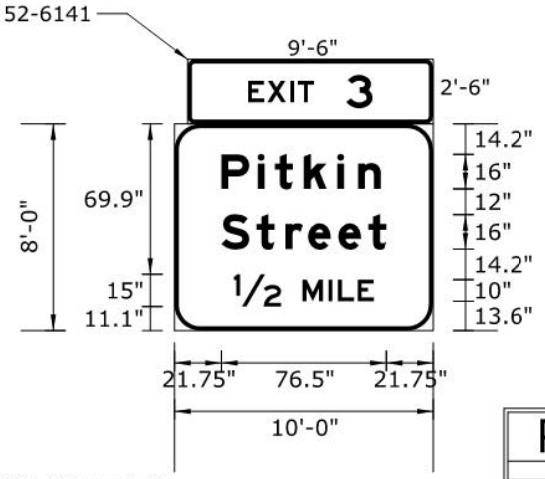
SIGN DETAIL

1:75



Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Overhead
Sign Support No. T.B.D.
Location : East Hartford Route 2 W.B. Mileage : 1.46
Project No. 042-317
Engineer : K. McKerman / Designed by : J. Fascione / Checked by :

SIGN NUMBER	002W_042_1.46_B
SIGN PANEL	10'-0" x 8'-0"
EXIT CROWN	23.75
TOTAL AREA	103.75 Sq.Ft.
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	12"
BACKGROUND	TYPE: IV
	COLOR: Green
LEGEND/BORDER	TYPE: IV
	COLOR: White/White

SYMBOL	ROT	X	Y	WID	HT

REV'D /

PLOTTED : 10/03/17

LETTER POSITIONS (X)

																					LENGTH	SERIES/SIZE
	P	i	t	k	i	n																EM 2000
21.8	16.8	8	13.4	15.5	9.6	10.6	24.3														73.9	16/12
	S	t	r	e	e	t																EM 2000
21.8	16.3	13.4	10.4	14.1	13.9	8.3	21.8														76.5	16/12
	1/2		M	I	L	E																E 2000
27.5	22	10	12	4.4	9.2	7.5	27.5														65.1	15,10

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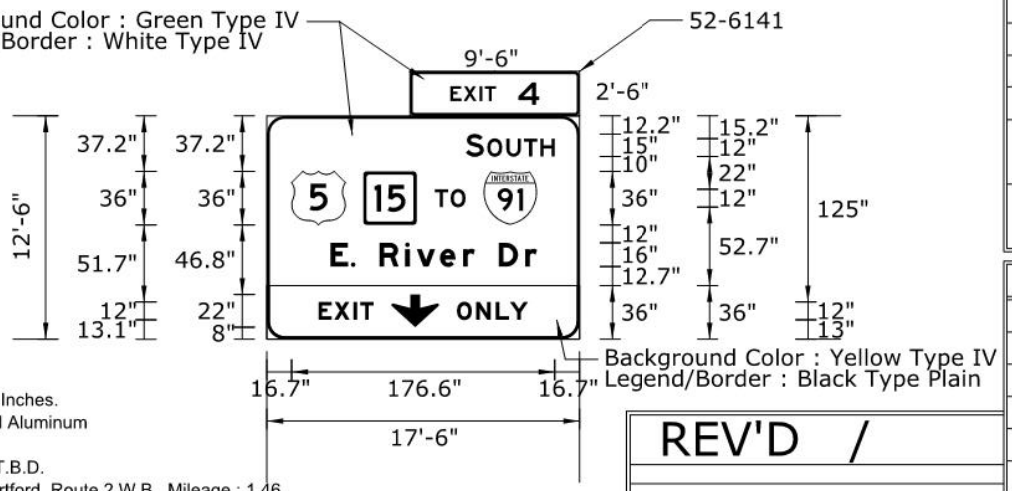
SIGN DETAIL

1:110



SIGN NUMBER	002W_042_1.46_C
SIGN PANEL	17'-6" x 12'-6"
EXIT CROWN	23.75
TOTAL AREA	242.5 Sq.Ft.
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	12"
BACKGROUND	TYPE: See Sign
	COLOR: See Sign
LEGEND/BORDER	TYPE: See Sign
	COLOR: See Sign

SYMBOL	ROT	X	Y	WID	HT
M1_4	0	16.7	76.8	36	36
M1_5_1	0	64.7	76.8	36	36
M1_1	0	145.4	76.8	36	36
ARDOWN	0	83.6	8	32	22

Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : T.B.D.
Sign Support No. T.B.D.
Location : East Hartford Route 2 W.B. Mileage : 1.46
Project No. 042-317
Engineer : K. McKerman / Designed by : J. Fascione / Checked by :

REV'D /

PLOTTED : 6/18/2018

LETTER POSITIONS (X)

																					LENGTH	SERIES/SIZE
	S		O	U	T	H																E 2000
133.6	12.2	2.2	12.8	11.8	11	9.7	16.7														59.8	15,12
	T	O																				E 2000
112.7	10.7	10.1	76.6																		20.8	12
	E	.		R	i	v	e	r		D	r											EM 2000
42.7	13.6	3.2	16	17.3	7.8	15.5	15.5	8	16	17.8	8	28.6									138.7	16/12
	E	X	I	T																		EM 2000
34.6	10.6	13	4.6	8.9	138.4																37	12
	O	N	L	Y																		EM 2000
127.6	13	13.1	9.6	12.1	34.6																47.8	12

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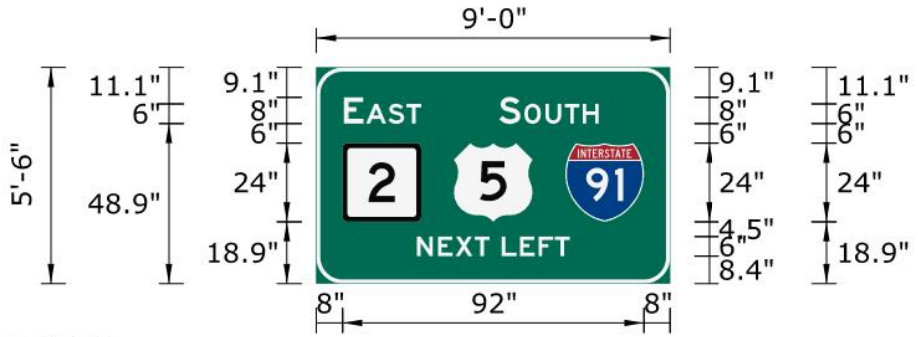
SIGN DETAIL

1:50



SIGN NUMBER	005N-042-35.02-A
SIGN PANEL	9'-0" x 5'-6"
EXIT CROWN	
TOTAL AREA	49.5 Sq.Ft.
BDR INSET/WIDTH	0" / 1.25"
CORNER RADIUS	8"
BACKGROUND	TYPE: IV
	COLOR: Green
LEGEND/BORDER	TYPE: IV
	COLOR: White/White

SYMBOL	ROT	X	Y	WID	HT
M1_5_1	0	8	18.9	24	24
M1_4	0	42	18.9	24	24
M1_1	0	76	18.9	24	24

Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Ground
Sign Support No. T.B.D.
Location : East Hartford Route 5 N.B. (Main Street) Mileage : 35.02
Project No. 063-703
Engineer : C. Baummer / Designed by : J. Fascione / Checked by :

REV'D /

PLOTTED : 4/2/2018

LETTER POSITIONS (X)

																					LENGTH	SERIES/SIZE
	E		A	S	T																	E 2000
8.4	6	0.8	6.8	5.5	4.5	76															23.6	8,6
	S		O	U	T	H																E 2000
55.8	6.5	1.2	6.4	5.9	5.5	4.9	21.8														30.3	8,6
	N	E	X	T		L	E	F	T													E 2000
30.7	6.4	5.3	5.9	4.5	3.8	5.5	5.7	5	4.5	30.7											46.6	6

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ITEM #1207034A, ITEM #1207039A

SIGN DETAIL

1:70

SIGN NUMBER	5N_042_82.28_A
SIGN PANEL	20'-0" x 6'-0"
EXIT CROWN	
TOTAL (Sq.fT.)	120.0
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	8"
BACKGROUND	TYPE: IV
	COLOR: Yellow
LEGEND/BORDER	TYPE: IV
	COLOR: Black/Black

SYMBOL	ROT	X	Y	WID	HT

Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Overhead
Sign Support No. 21002
Location : East Hartford Route 5 N.B. Mileage : 82.28
Project No. 063-0703
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

REV'D /

PLOTTED : 08/11/17

LETTER POSITIONS (X)																				LENGTH	SERIES/SIZE
	R	I	G	H	T		L	A	N	E		E	N	D	S						E 2000
16.2	15.2	6.1	15.6	14.7	11.3	15	12.5	17.8	16.1	11.3	15	14.3	16.1	14.7	12.2	16.2				207.6	15
	3/4		M	I	L	E															E 2000
86	25	10	12	4.4	9.2	7.5	86													68.1	15,10

Rev. Date 07/18

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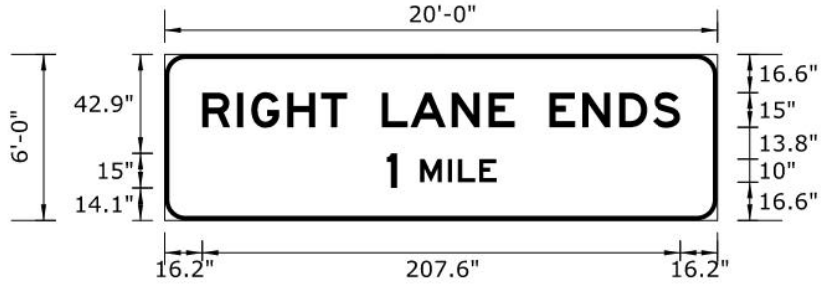
SIGN DETAIL
1:70



SIGN NUMBER	5N_042_82.02_A
SIGN PANEL	20'-0" x 6'-0"
EXIT CROWN	
TOTAL (Sq.fT.)	120.0
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	9"
BACKGROUND	TYPE: IV
	COLOR: Yellow
LEGEND/BORDER	TYPE: IV
	COLOR: White/White

SYMBOL	ROT	X	Y	WID	HT

Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Overhead
Sign Support No. 21004
Location : East Hartford Route 5 N.B. Mileage : 82.08
Project No. 063-0703
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

REV'D /

PLOTTED : 09/27/17

LETTER POSITIONS (X)

																					LENGTH	SERIES/SIZE
	R	I	G	H	T		L	A	N	E		E	N	D	S							E 2000
16.2	15.2	6.1	15.6	14.7	11.3	15	12.5	17.8	16.1	11.3	15	14.3	16.1	14.7	12.2	16.2					207.6	15
	1		M	I	L	E																E 2000
96.2	4.5	10	12	4.4	9.2	7.5	96.2														47.6	15,10

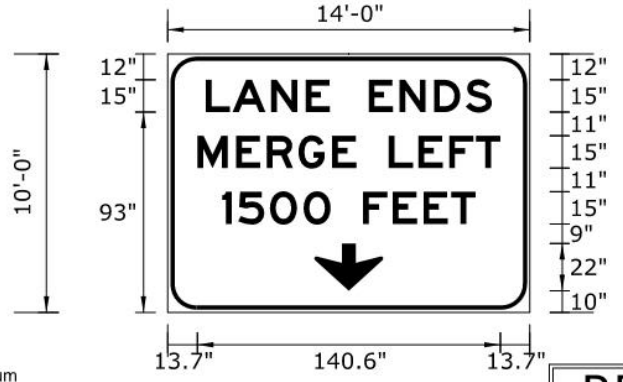
63-703 & 159-191

1255

ITEM #1207034A, ITEM #1207039A

SIGN DETAIL

1:75



SIGN NUMBER	15N_042_82.63_A
SIGN PANEL	14'-0" x 10'-0"
EXIT CROWN	
TOTAL (Sq.fT.)	140.0
BDR INSET/WIDTH	1.25" / 2"
CORNER RADIUS	12"
BACKGROUND	TYPE: IV
	COLOR: Yellow
LEGEND/BORDER	TYPE: IV
	COLOR: Black/Black

SYMBOL	ROT	X	Y	WID	HT
ARDOWN	0	68	10	32	22

Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Overhead
Sign Support No. T.B.D.
Location : East Hartford Route <15>> N.B. Mileage : 82.63
Project No. 063-0703
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

REV'D /

PLOTTED : 08/28/17

LETTER POSITIONS (X)																					LENGTH	SERIES/SIZE
	L	A	N	E		E	N	D	S													E 2000
17.6	12.5	17.8	16.1	11.3	18	14.3	16.1	14.7	12.2	17.6											132.8	15
	M	E	R	G	E		L	E	F	T												E 2000
13.7	18	14.3	14.7	15.6	11.3	15	13.8	14.3	12.5	11.3	13.7										140.6	15
	1	5	0	0		F	E	E	T													E 2000
25.2	7.5	14.7	15.6	12.6	15	13.8	14.2	12.9	11.3	25.2											117.6	15

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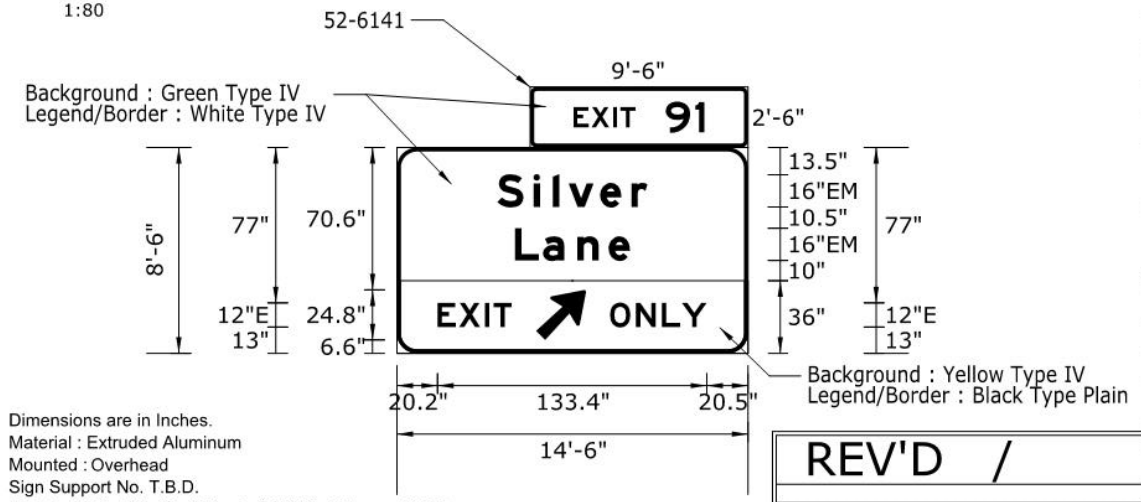
1256

ITEM #1207034A, ITEM #1207039A

Rev. Date 07/18

SIGN DETAIL

1:80



SIGN NUMBER	015N_042_82.63_B
SIGN PANEL	14'-6" x 8'-6"
EXIT CROWN	23.75
TOTAL (Sq.fT.)	147.0
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	10"
BACKGROUND	TYPE: See Sign
	COLOR: See Sign
LEGEND/BORDER	TYPE: See Sign
	COLOR: See Sign

SYMBOL	ROT	X	Y	WID	HT
AR_Type A	315	69	6.6	20	31.5

Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Overhead
Sign Support No. T.B.D.
Location : East Hartford Route 15 N.B. Mileage : 82.63
Project No. 063-0703
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

REV'D /

PLOTTED : 09/27/17

LETTER POSITIONS (X)																					LENGTH	SERIES/SIZE
	S	i	l	v	e	r																EM 2000
49.8	17.9	9.6	7.8	15.5	15.5	8	49.8														74.4	16/12
	L	a	n	e																		EM 2000
58.5	13.9	17	15.5	10.6	58.5																57	16/12
	E	X	I	T																		E 2000
20.2	10.7	12.8	4.2	9	117.1																36.7	12
	O	N	L	Y																		E 2000
105.7	12.8	12.8	10	12.2	20.5																47.9	12

63-703 & 159-191

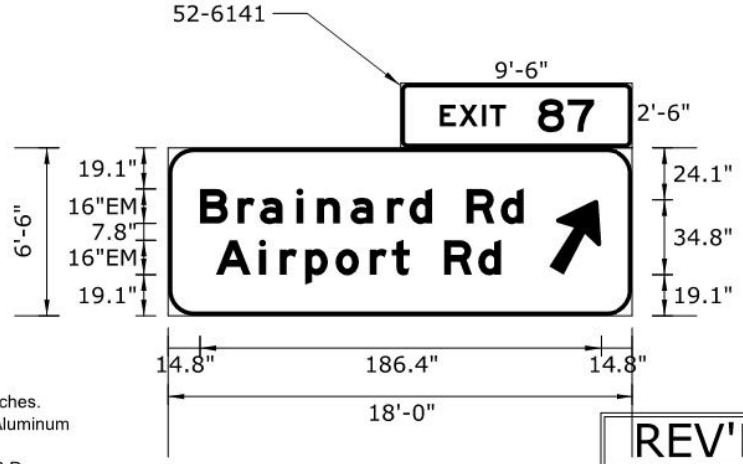
1257

ITEM #1207034A, ITEM #1207039A

Rev. Date 07/18

SIGN DETAIL

1:75



Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Overhead
Sign Support No. T.B.D.
Location : Hartford Route 15 N.B. Mileage : 80.39
Project No. 063-0703
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

SIGN NUMBER	15N_063_80.39_A
SIGN PANEL	18'-0" x 6'-6"
EXIT CROWN	23.75
TOTAL (Sq.fT.)	140.75
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	12"
BACKGROUND	TYPE: IV
	COLOR: Green
LEGEND/BORDER	TYPE: IV
	COLOR: White/White

SYMBOL	ROT	X	Y	WID	HT
AR_Type A	330	177.1	19.1	24	37.8

REV'D /

PLOTTED : 09/27/17

LETTER POSITIONS (X)

																					LENGTH	SERIES/SIZE
	B	r	a	i	n	a	r	d		R	d											EM 2000
14.8	17.4	10.4	17	9.6	15.5	17	10.4	10.6	16	15.8	10.6	50.9									150.2	16/12
	A	i	r	p	o	r	t		R	d												EM 2000
22.3	20	9.6	11.8	14.1	15.8	10.2	8.3	16	15.8	10.6	61.4										132.3	16/12

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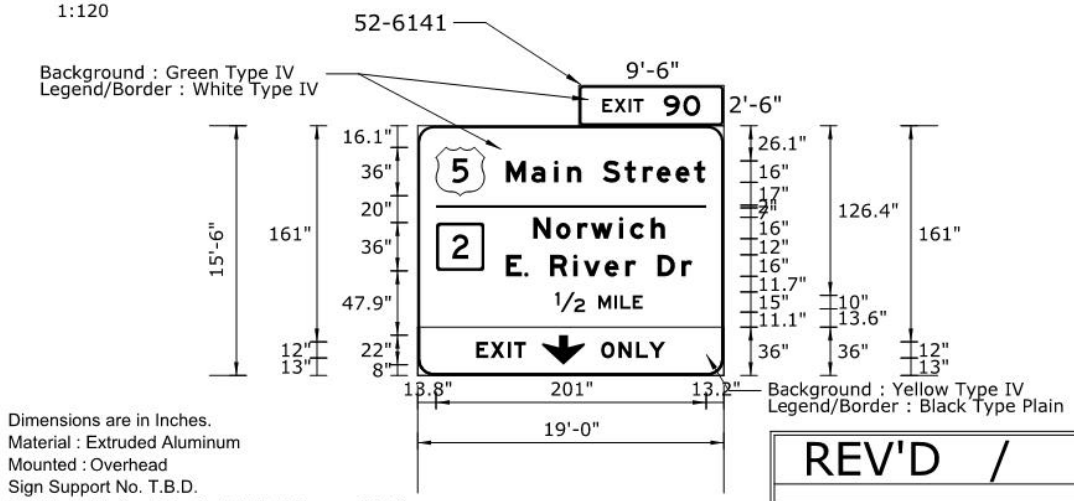
1258

ITEM #1207034A, ITEM #1207039A

SIGN DETAIL

1:120



Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Overhead
Sign Support No. T.B.D.
Location : Hartford Route 15 N.B. Mileage : 81.53
Project No. 063-703
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

SIGN NUMBER	15N_063_81.53_A
SIGN PANEL	19'-0" x 15'-6"
EXIT CROWN	23.75
TOTAL AREA	318.5 Sq.Ft.
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	12"
BACKGROUND	TYPE: See Sign
	COLOR: See Sign
LEGEND/BORDER	TYPE: See Sign
	COLOR: See Sign

SYMBOL	ROT	X	Y	WID	HT
M1_4	0	13.8	133.9	36	36
M1_5_1	0	13.8	77.9	36	36
ARDOWN	0	92.6	8	32	22

REV'D /

PLOTTED : $DATE$

LETTER POSITIONS (X)																				LENGTH	SERIES/SIZE
	M	a	i	n		S	t	r	e	e	t										EM 2000
65.8	18.9	17	9.6	10.6	16	16.3	13.4	10.4	14.1	13.9	8.3	13.8								148.5	16/12
	N	o	r	w	i	c	h														EM 2000
86.1	17	15.8	10.1	21	8.2	15.5	10.6	43.8												98.1	16/12
	E	.		R	i	v	e	r		D	r										EM 2000
65.8	13.6	3.2	16	17.3	7.8	15.5	15.5	8	16	17.8	8	23.5								138.7	16/12
	1/2		M	I	L	E															E 2000
102.6	22	10	12	4.4	9.2	7.5	60.3													65.1	15,10
	E	X	I	T																	EM 2000
43.7	10.6	13	4.6	8.9	147.4															37	12
	O	N	L	Y																	EM 2000
136.6	13	13.1	9.6	12.1	43.6															47.8	12

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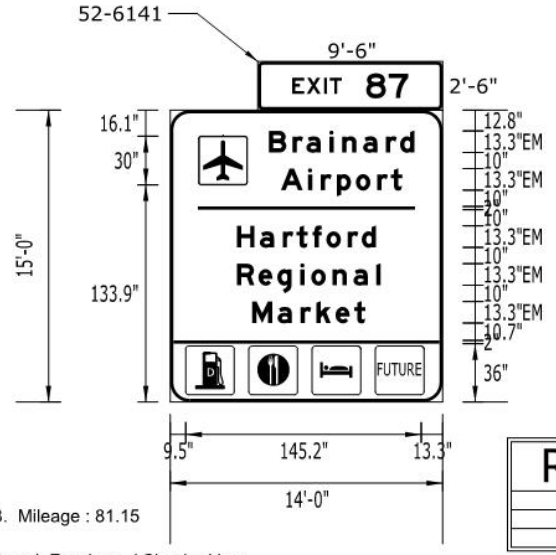
1259

ITEM #1207034A, ITEM #1207039A

Rev. Date 07/18

SIGN DETAIL

1:100



SIGN NUMBER	015S_063_81.15_A
SIGN PANEL	14'-0" x 15'-0"
EXIT CROWN	23.75
TOTAL (Sq.fT.)	233.75
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	12"
BACKGROUND	TYPE: IV
	COLOR: Green
LEGEND/BORDER	TYPE: IV
	COLOR: White/White

SYMBOL	ROT	X	Y	WID	HT
516094	0	17.6	133.9	30	30
517771	0	9.5	4.5	30	30
517772	0	48.5	4.5	30	30
517773	0	87.5	4.5	30	30

Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Ground
Sign Support No. T.B.D.
Location : Hartford Route 15 S.B. Mileage : 81.15
Project No. 063-0703
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

REV'D /

PLOTTED : 09/27/17

LETTER POSITIONS (X)																				LENGTH	SERIES/SIZE
	B	r	a	i	n	a	r	d													EM 2000
60.9	14.5	8.6	14.1	8	12.9	14.1	8.6	8.8	17.5											89.6	13.3/10
	A	i	r	p	o	r	t														EM 2000
68.3	16.6	8	9.8	11.7	13.2	8.5	6.9	25												74.7	13.3/10
	H	a	r	t	f	o	r	d													EM 2000
41.2	14.1	14.1	8.5	9.8	8.5	13.2	8.6	8.8	41.2											85.7	13.3/10
	R	e	g	i	o	n	a	l													EM 2000
41.2	13.2	11.7	14.1	6.8	13.2	12.9	14.1	2.7	38.2											88.6	13.3/10
	M	a	r	k	e	t															EM 2000
50.6	15.7	14.1	9.8	11.7	11.6	6.9	47.6													69.8	13.3/10
	F	U	T	U	R	E															Verdana
128.2	6.1	7	7.6	8	7.5	-9.7	13.3													26.6	7.9

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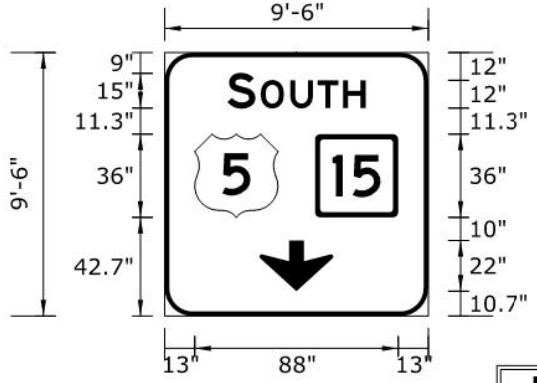
1260

ITEM #1207034A, ITEM #1207039A

Rev. Date 07/18

SIGN DETAIL

1:70



SIGN NUMBER	SIN_15S_063_81.30_A
SIGN PANEL	9'-6" x 9'-6"
EXIT CROWN	--
TOTAL (Sq.fT.)	90.25
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	12"
BACKGROUND	TYPE: IV
	COLOR: Green
LEGEND/BORDER	TYPE: IV
	COLOR: White/White

SYMBOL	ROT	X	Y	WID	HT
M1_4	0	13	42.7	36	36
M1_5_1	0	65	42.7	36	36
ARDOWN	0	41	10.7	32	22

Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Overhead
Sign Support No. T.B.D.
Location : Hartford Route 15 S.B. Mileage : 81.30
Project No. 063-0703
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

REV'D /

PLOTTED : 08/12/17

LETTER POSITIONS (X)																				LENGTH	SERIES/SIZE
	S		O	U	T	H															E 2000
27.1	12.2	2.2	12.8	11.8	11	9.7	27.1													59.8	15,12

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1261

ITEM #1207034A, ITEM #1207039A

Rev. Date 07/18

SIGN DETAIL

1:90

Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Overhead
Sign Support No. T.B.D.
Location : Hartford Route 15 S.B. Mileage : 81.30
Project No. 063-0703
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

SIGN NUMBER	SIN_15S_063_81.30_B
SIGN PANEL	15'-0" x 11'-6"
EXIT CROWN	23.75
TOTAL (Sq.fT.)	196.25
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	12"
BACKGROUND	TYPE: See Sign
	COLOR: See Sign
LEGEND/BORDER	TYPE: See Sign
	COLOR: See Sign

SYMBOL	ROT	X	Y	WID	HT
ARDOWN	0	68.6	8	32	22

REV'D /

PLOTTED : 08/21/17

LETTER POSITIONS (X)																					LENGTH	SERIES/SIZE
	B	r	a	i	n	a	r	d		R	d											EM 2000
14.9	17.4	10.4	17	9.6	15.5	17	10.4	10.6	16	15.8	10.6	14.9									150.2	16/12
	A	i	r	p	o	r	t		R	d												EM 2000
23.8	20	9.6	11.8	14.1	15.8	10.2	8.3	16	15.8	10.6	23.8										132.3	16/12
	1/2		M	I	L	E																E 2000
57.5	22	10	12	4.4	9.2	7.5	57.5														65.1	15,10
	E	X	I	T																		EM 2000
19.6	10.6	13	4.6	8.9	123.4																37	12
	O	N	L	Y																		EM 2000
112.6	13	13.1	9.6	12.1	19.6																47.8	12

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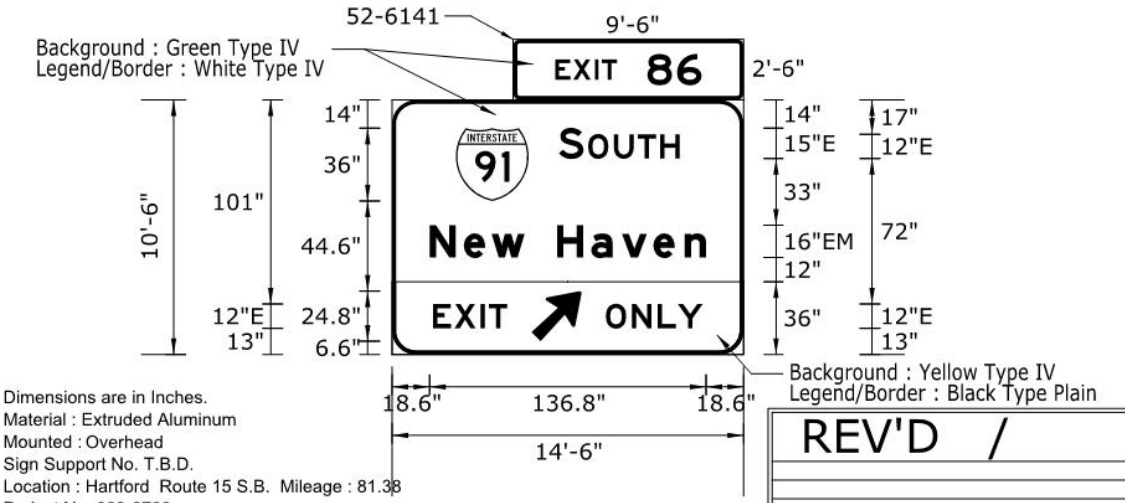
1262

ITEM #1207034A, ITEM #1207039A

Rev. Date 07/18

SIGN DETAIL

1:80



SIGN NUMBER	15S_063_81.38_A
SIGN PANEL	14'-6" x 10'-6"
EXIT CROWN	23.75
TOTAL (Sq.fT.)	176.0
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	12"
BACKGROUND	TYPE: See Sign
	COLOR: See Sign
LEGEND/BORDER	TYPE: See Sign
	COLOR: See Sign

SYMBOL	ROT	X	Y	WID	HT
M1_1	0	31.6	76	36	36
AR_Type A	315	69	6.6	20	31.5

Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Overhead
Sign Support No. T.B.D.
Location : Hartford Route 15 S.B. Mileage : 81.38
Project No. 063-0703
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

REV'D /

PLOTTED : 08/15/17

LETTER POSITIONS (X)																					LENGTH	SERIES/SIZE
	S		O	U	T	H																E 2000
82.6	12.2	2.2	12.8	11.8	11	9.7	31.6														59.8	15,12
	N	e	w		H	a	v	e	n													EM 2000
18.6	17	13.8	16.3	16	17	15.2	15.5	15.5	10.6	18.6											136.8	16/12
	E	X	I	T																		E 2000
20.3	10.7	12.8	4.2	9	117																36.7	12
	O	N	L	Y																		E 2000
105.8	12.8	12.8	10	12.2	20.3																47.9	12

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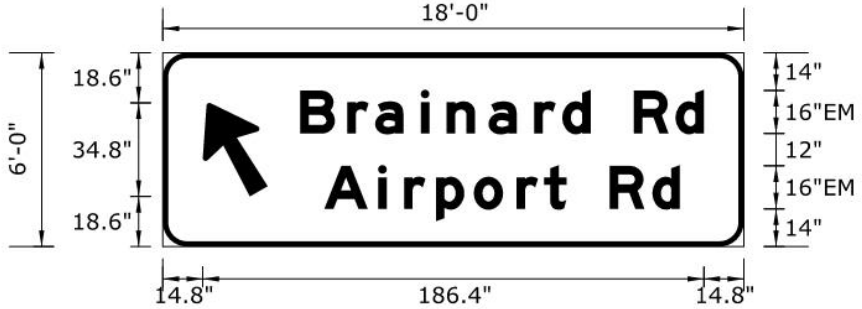
1263

ITEM #1207034A, ITEM #1207039A

SIGN DETAIL

1:60



SIGN NUMBER	015S_063_R161_EX87_A
SIGN PANEL	18'-0" x 6'-0"
EXIT CROWN	
TOTAL (Sq.fT.)	108.0
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	9"
BACKGROUND	TYPE: IV
	COLOR: Green
LEGEND/BORDER	TYPE: IV
	COLOR: White/White

SYMBOL	ROT	X	Y	WID	HT
AR_Type A	30	14.8	18.6	24	37.8

Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Overhead
Sign Support No. T.B.D.
Location : Hartford Route 15S.B. Ramp #161 Exit 87
Project No. 063-0703
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

REV'D /

PLOTTED : 08/15/17

LETTER POSITIONS (X)																					LENGTH	SERIES/SIZE
	B	r	a	i	n	a	r	d		R	d											EM 2000
50.9	17.4	10.4	17	9.6	15.5	17	10.4	10.6	16	15.8	10.6	14.8									150.2	16/12
	A	i	r	p	o	r	t		R	d												EM 2000
59.9	20	9.6	11.8	14.1	15.8	10.2	8.3	16	15.8	10.6	23.8										132.3	16/12

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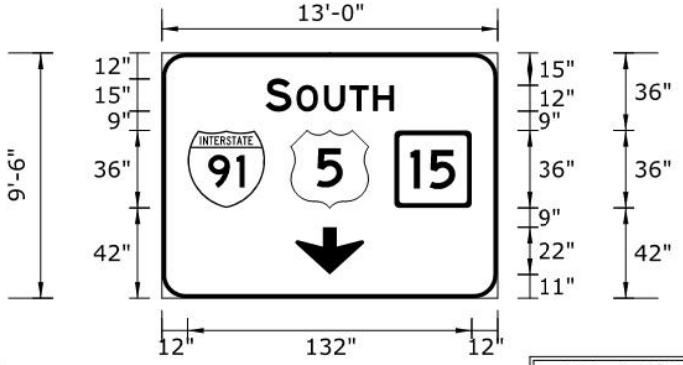
1264

ITEM #1207034A, ITEM #1207039A

SIGN DETAIL

1:75



SIGN NUMBER	015S_063_R161_EX87_B
SIGN PANEL	13'-0" x 9'-6"
EXIT CROWN	
TOTAL AREA	123.5 Sq.Ft.
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	11"
BACKGROUND	TYPE: IV
	COLOR: Green
LEGEND/BORDER	TYPE: IV
	COLOR: White/White

SYMBOL	ROT	X	Y	WID	HT
M1_1	0	12	42	36	36
M1_4	0	60	42	36	36
M1_5_1	0	108	42	36	36
ARDOWN	0	62	11	32	22

Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Overhead
Sign Support No. T.B.D.
Location :Hartford Route 15 S.B. Ramp #161 Exit 87
Project No. 063-0703
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

REV'D /

PLOTTED : 09/27/17

LETTER POSITIONS (X)																					LENGTH	SERIES/SIZE
	S		O	U	T	H																E 2000
48.1	12.2	2.2	12.8	11.8	11	9.7	48.1														59.8	15,12

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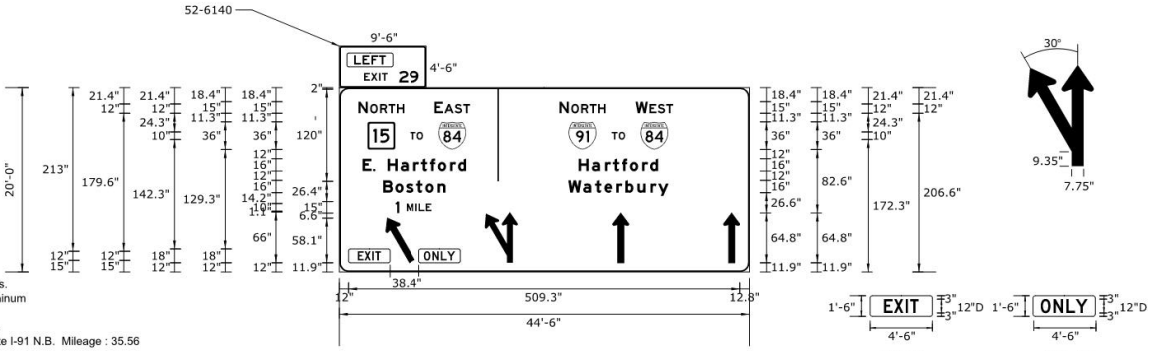
1265

ITEM #1207034A, ITEM #1207039A

Rev. Date 07/18

SIGN DETAIL

1:135



Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Overhead
Sign Support No. T.B.D.
Location : Hartford Route I-91 N.B. Mileage : 35.56
Project No. 063-0703
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

SIGN NUMBER	091N..063..35.56..A
SIGN PANEL	44'-6" x 20'-0"
EXIT CROWN	42.75
TOTAL (Sq.Ft.)	932.75
BDR INSET / WIDTH	0" / 2"
CORNER RADIUS	12"
BACKGROUND	TYPE: IV
	COLOR: Green
LEGEND/BORDER	TYPE: IV
	COLOR: White/White

SYMBOL	ROT	X	Y	WID	HT
M1_5_1	0	36.7	159.3	36	36
M1_1	0	130	159.3	36	36
M1_1	0	299.1	159.3	36	36
M1_1	0	392.4	159.3	36	36
APL_straight_L	30	60.6	12	21	64.8
APL_st_lt	0	190.2	12	43	66
APL_straight_L	0	356.2	12	21	64.8
APL_straight_L	0	500.2	12	21	64.8

LETTER POSITIONS (X)

																																			LENGTH	SERIES/SIZE
	N		O	R	T	H																														E 2000
24.7	12.2	3.1	12.8	11	11	9.7	449.3																												59.9	15,12
	E		A	S	T																																E 2000
124.8	11.3	1.5	13.6	11	9	362.8																														46.4	15,12
	N		O	R	T	H																															E 2000
287.2	12.2	3.1	12.8	11	11	9.7	186.9																													59.9	15,12
	W		E	S	T																																E 2000
386.1	15.9	2.2	10.7	11	9	99.2																														48.8	15,12
	T	O																																			E 2000
92.7	8.9	8.4	424																																	17.3	10
	T	O																																			E 2000
355.1	8.9	8.4	161.6																																	17.3	10
	E	.		H	a	r	t	f	o	r	d																										EM 2000
30.1	13.6	3.2	16	17	17	10.2	11.8	10.2	15.8	10.4	10.6	368																								135.8	16/12
	H	a	r	t	f	o	r	d																													EM 2000
312.3	17	17	10.2	11.8	10.2	15.8	10.4	10.6	118.7																											103	16/12
	B	o	s	t	o	n																															EM 2000
56.9	16	14.1	13.9	12	15.8	10.6	394.7																													82.4	16/12
	W	a	t	e	r	b	u	r	y																												EM 2000
298.7	19.4	15.4	12	15.5	11.8	15.5	17	10.1	13.6	105.1																										130.2	16/12
	1		M	I	L	E																															E 2000
73.3	4.5	10	12	4.4	9.2	7.5	413.1																													64.8	15,10
																																				E 2000
																																				47.6	15,10

63-703 & 159-191

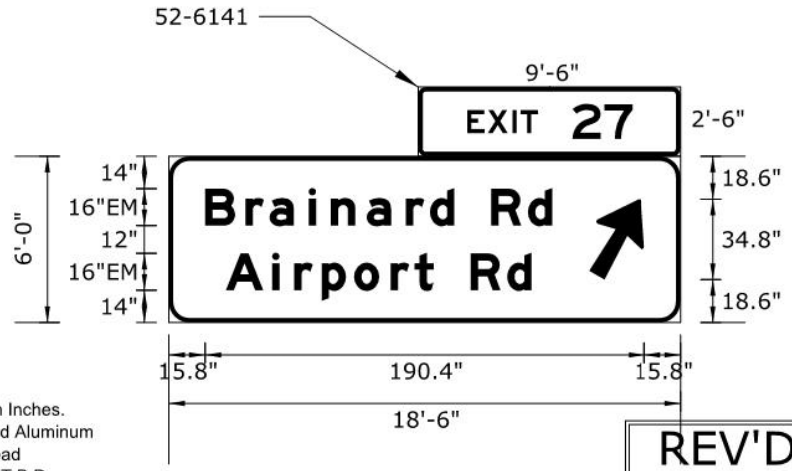
1266

ITEM #1207034A, ITEM #1207039A

Rev. Date 07/18

SIGN DETAIL

1:70



Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Overhead
Sign Support No. T.B.D.
Location : Hartford Route I-91 N.B. Mileage : 35.56
Project No. 063-0703
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

REV'D /

SIGN NUMBER	091N_063_35.56_B
SIGN PANEL	18'-6" x 6'-0"
EXIT CROWN	23.75
TOTAL (Sq.fT.)	134.75
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	9"
BACKGROUND	TYPE: IV
	COLOR: Green
LEGEND/BORDER	TYPE: IV
	COLOR: White/White

SYMBOL	ROT	X	Y	WID	HT
AR_Type A	330	182.1	18.6	24	37.8

PLOTTED : 09/27/17

LETTER POSITIONS (X)																					LENGTH	SERIES/SIZE
	B	r	a	i	n	a	r	d		R	d											EM 2000
15.8	17.4	10.4	17	9.6	15.5	17	10.4	10.6	16	15.8	10.6	55.9									150.2	16/12
	A	i	r	p	o	r	t		R	d												EM 2000
24.8	20	9.6	11.8	14.1	15.8	10.2	8.3	16	15.8	10.6	64.9										132.3	16/12

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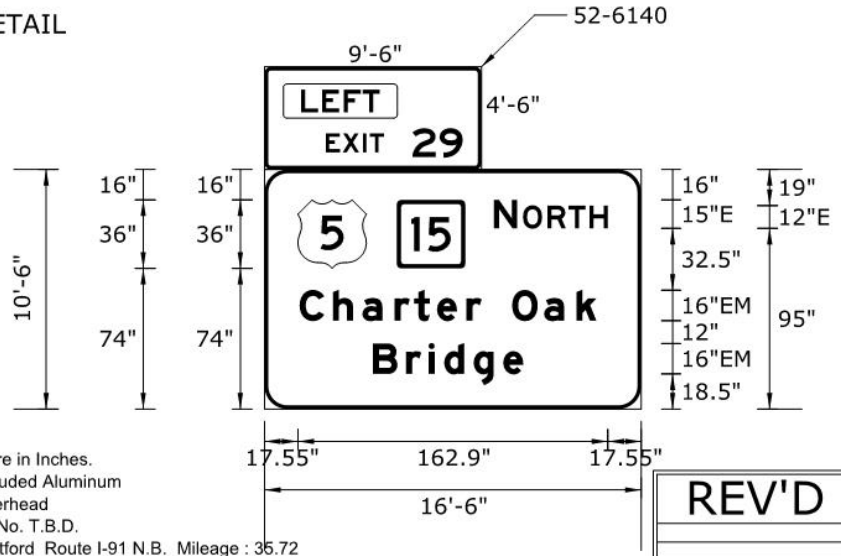
ITEM #1207034A, ITEM #1207039A

Rev. Date 07/18

SIGN DETAIL

1:85



SIGN NUMBER	091N_063_35.72_A
SIGN PANEL	16'-6" x 10'-6"
EXIT CROWN	42.75
TOTAL (Sq.fT.)	216.0
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	12"
BACKGROUND	TYPE: IV
	COLOR: Green
LEGEND/BORDER	TYPE: IV
	COLOR: White/White

SYMBOL	ROT	X	Y	WID	HT
M1_4	0	17.5	74	36	36
M1_5_1	0	69.5	74	36	36

Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Overhead
Sign Support No. T.B.D.
Location : Hartford Route I-91 N.B. Mileage : 35.72
Project No. 063-0703
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

REV'D /

PLOTTED : 09/27/17

LETTER POSITIONS (X)																					LENGTH	SERIES/SIZE
	N		O	R	T	H																E 2000
120.5	12.2	3.1	12.8	11	11	9.7	17.5														59.9	15,12
	C	h	a	r	t	e	r		O	a	k											EM 2000
18.5	17.4	15.5	17	10.2	12	15.5	8	16	16.8	17	10.6	23.5									156	16/12
	B	r	i	d	g	e																EM 2000
56.9	17.4	11.8	8.2	15.5	15.5	10.6	62														79	16/12

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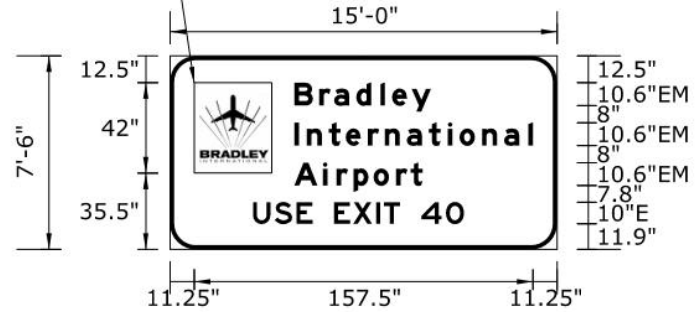
SIGN DETAIL

1:75

Background : White Type IV
Legend/Symbol : Blue Type IV



SIGN NUMBER	091N_063_35.72_B
SIGN PANEL	15'-0" x 7'-6"
EXIT CROWN	--
TOTAL (Sq.fT.)	112.5
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	12"
BACKGROUND	TYPE: IV
	COLOR: Blue
LEGEND/BORDER	TYPE: IV
	COLOR: White/White

SYMBOL	ROT	X	Y	WID	HT
Bradley Logo	0	11.3	35.5	36	42

Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Overhead
Sign Support No. T.B.D.
Location : Hartford Route I-91 N.B. Mileage : 35.72
Project No. 063-0703
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

REV'D /

PLOTTED : 09/27/17

LETTER POSITIONS (X)																					LENGTH	SERIES/SIZE
	B	r	a	d	l	e	y															EM 2000
57.9	11.6	6.9	10.3	11.2	5.4	9.1	9	58.6													63.5	10.6/8
	I	n	t	e	r	n	a	t	i	o	n	a	l									EM 2000
57.9	5.7	10.2	8	10.3	7.8	10.3	10.2	8.9	5.4	10.5	10.3	11.2	2.1	11.3							110.9	10.6/8
	A	i	r	p	o	r	t															EM 2000
57.9	13.3	6.4	7.8	9.3	10.5	6.8	5.5	62.6													59.6	10.6/8
	U	S	E		E	X	I	T		4	0											E 2000
38.6	10.1	10.1	7.5	10	8.9	10.7	3.5	7.5	10	11.4	8.4	43.3									98.1	10

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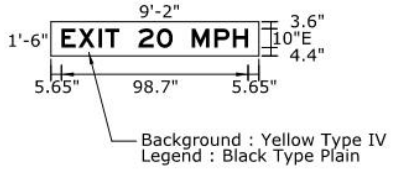
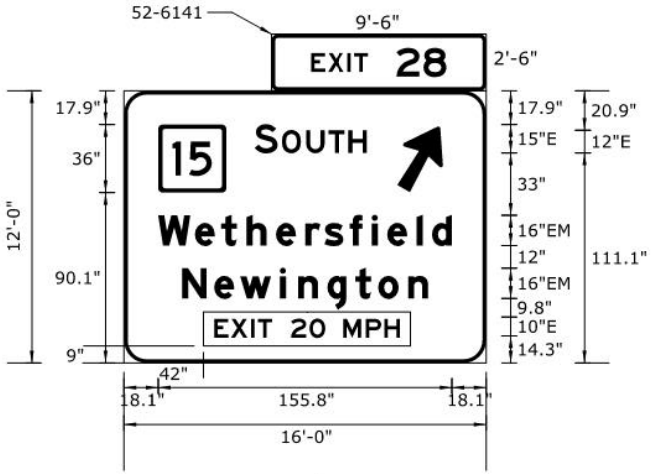
ITEM #1207034A, ITEM #1207039A

Rev. Date 07/18

SIGN DETAIL

1:85





SIGN NUMBER	091N_063_35.72_C
SIGN PANEL	16'-0" x 12'-0"
EXIT CROWN	23.75
TOTAL (Sq.fT.)	215.75
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	12"
BACKGROUND	TYPE: IV
	COLOR: Green
LEGEND/BORDER	TYPE: IV
	COLOR: White/White

SYMBOL	ROT	X	Y	WID	HT
M1_5_1	0	18.1	90.1	36	36
AR Type A	330	145	90.4	24	37.8

Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Overhead
Sign Support No. T.B.D.
Location : Hartford Route I-91 N.B. Mileage : 35.72
Project No. 063-0703
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

REV'D /

PLOTTED : 09/27/17

LETTER POSITIONS (X)																					LENGTH	SERIES/SIZE
	S		O	U	T	H																E 2000
69.1	12.2	2.2	12.8	11.8	11	9.7	63.2														59.8	15,12
	W	e	t	h	e	r	s	f	i	e	l	d										EM 2000
18.1	19.4	13.9	13.4	15.5	15.5	10.1	13.9	11.7	8.2	15.5	8.2	10.6	18.1								155.8	16/12
	N	e	w	i	n	g	t	o	n													EM 2000
30.7	17	13.8	21	9.6	15.5	15.4	12	15.8	10.6	30.7											130.6	16/12

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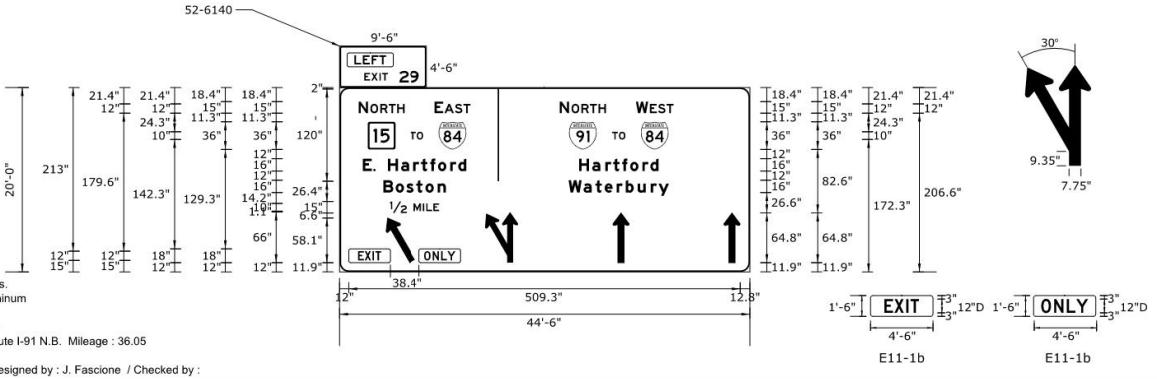
ITEM #1207034A, ITEM #1207039A

SIGN DETAIL

1:135



Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Overhead
Sign Support No. T.B.D.
Location : Hartford Route I-91 N.B. Mileage : 36.05
Project No. 063-0703
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

SIGN NUMBER	091N..063..36.05..A
SIGN PANEL	44'-6" x 20'-0"
EXIT CROWN	42.75
TOTAL (Sq.Ft.)	932.75
BDR INSET / WIDTH	0" / 2"
CORNER RADIUS	12"
BACKGROUND	TYPE: IV
	COLOR: Green
LEGEND/BORDER	TYPE: IV
	COLOR: White/White

SYMBOL	ROT	X	Y	WID	HT
M1_5_1	0	36.7	159.3	36	36
M1_1	0	130	159.3	36	36
M1_1	0	299.1	159.3	36	36
M1_1	0	392.4	159.3	36	36
APL_straight_L	30	60.6	12	21	64.8
APL_st_lt	0	190.2	12	43	66
APL_straight_L	0	356.2	12	21	64.8
APL_straight_L	0	500.2	12	21	64.8

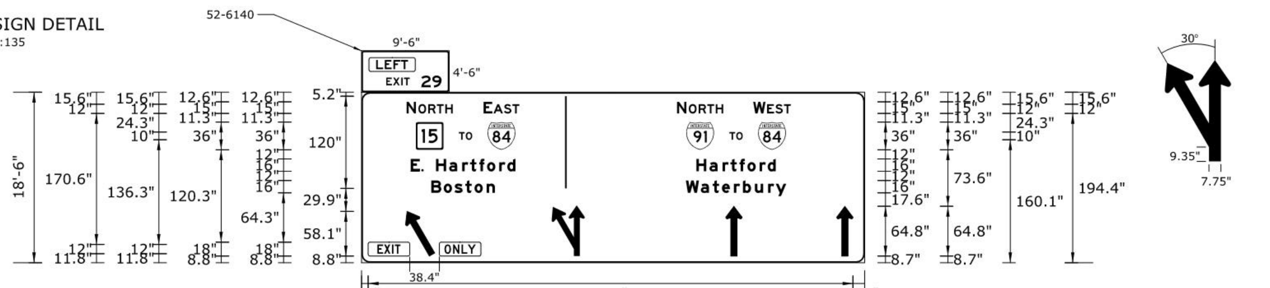
LETTER POSITIONS (X)

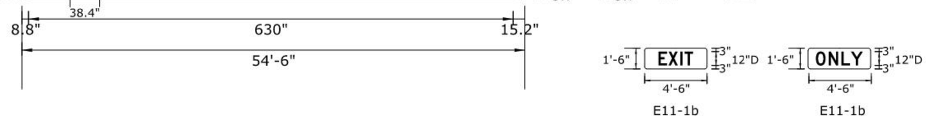
																																			LENGTH	SERIES/SIZE
	N		O	R	T	H																															E 2000
24.7	12.2	3.1	12.8	11	11	9.7	449.3																													59.9	15,12
	E		A	S	T																																	E 2000
124.8	11.3	1.5	13.6	11	9	362.8																															46.4	15,12
	N		O	R	T	H																																E 2000
287.2	12.2	3.1	12.8	11	11	9.7	186.9																													59.9	15,12
	W		E	S	T																																	E 2000
386.1	15.9	2.2	10.7	11	9	99.2																															48.8	15,12
	T	O																																			E 2000
92.7	8.9	8.4	424																																	17.3	10
	T	O																																			E 2000
355.1	8.9	8.4	161.6																																	17.3	10
	E	.		H	a	r	t	f	o	r	d																										EM 2000
30.1	13.6	3.2	16	17	17	10.2	11.8	10.2	15.8	10.4	10.6	368																									135.8	16/12
	H	a	r	t	f	o	r	d																														EM 2000
312.3	17	17	10.2	11.8	10.2	15.8	10.4	10.6	118.7																												103	16/12
	B	o	s	t	o	n																																EM 2000
56.9	16	14.1	13.9	12	15.8	10.6	394.7																														82.4	16/12
	W	a	t	e	r	b	u	r	y																													EM 2000
298.7	19.4	15.4	12	15.5	11.8	15.5	17	10.1	13.6	105.1																											130.2	16/12
	1/2		M	I	L	E																																E 2000
65.5	22	10	12	4.4	9.2	7.5	403.4																														65.1	15,10

Rev. Date 07/18

SIGN DETAIL

1:135





Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Overhead
Sign Support No. T.B.D.
Location : Hartford Route I-91 N.B. Mileage : 36.38
Project No. 063-0703
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

SIGN NUMBER	091N_063_36.38_A
SIGN PANEL	54'-6" x 18'-6"
EXIT CROWN	42.75
TOTAL (Sq.Ft.)	1056.45
BDR INSET / WIDTH	0" / 2"
CORNER RADIUS	12"
BACKGROUND	TYPE: IV
	COLOR: Green
LEGEND/BORDER	TYPE: IV
	COLOR: White/White

SYMBOL	ROT	X	Y	WID	HT
M1_5_1	0	70.7	147.1	36	36
M1_1	0	164.0	147.1	36	36
M1_1	0	422.4	147.1	36	36
M1_1	0	515.7	147.1	36	36
APL_straight_L	30	57.3	8.8	21	64.8
APL_st_lt	0	152.6	8.8	56	64.8
APL_straight_L	0	473.8	8.8	21	64.8
APL_straight_L	0	617.8	8.8	21	64.8

LETTER POSITIONS (X)

														LENGTH	SERIES/SIZE
	N		O	R	T	H									E 2000
58.7	12.2	3.1	12.8	11	11	9.7	535.4							59.9	15,12
	E		A	S	T										E 2000
158.8	11.3	1.5	13.6	11	9	448.9								46.4	15,12
	N		O	R	T	H									E 2000
410.4	12.2	3.1	12.8	11	11	9.7	183.6							59.9	15,12
	W		E	S	T										E 2000
509.3	15.9	2.2	10.7	11	9	95.9								48.8	15,12
	T	O													E 2000
126.7	8.9	8.4	510											17.3	10
	T	O													E 2000
478.4	8.9	8.4	158.3											17.3	10
	E	.		H	a	r	t	f	o	r	d				EM 2000
64.1	13.6	3.2	16	17	17	10.2	11.8	10.2	15.8	10.4	10.6	454		135.8	16/12
	H	a	r	t	f	o	r	d							EM 2000
435.5	17	17	10.2	11.8	10.2	15.8	10.4	10.6	115.4					103	16/12
	B	o	s	t	o	n									EM 2000
90.8	16	14.1	13.9	12	15.8	10.6	480.8							82.4	16/12
	W	a	t	e	r	b	u	r	y						EM 2000
421.9	19.4	15.4	12	15.5	11.8	15.5	17	10.1	13.6	101.8				130.2	16/12

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ITEM #1207034A, ITEM #1207039A

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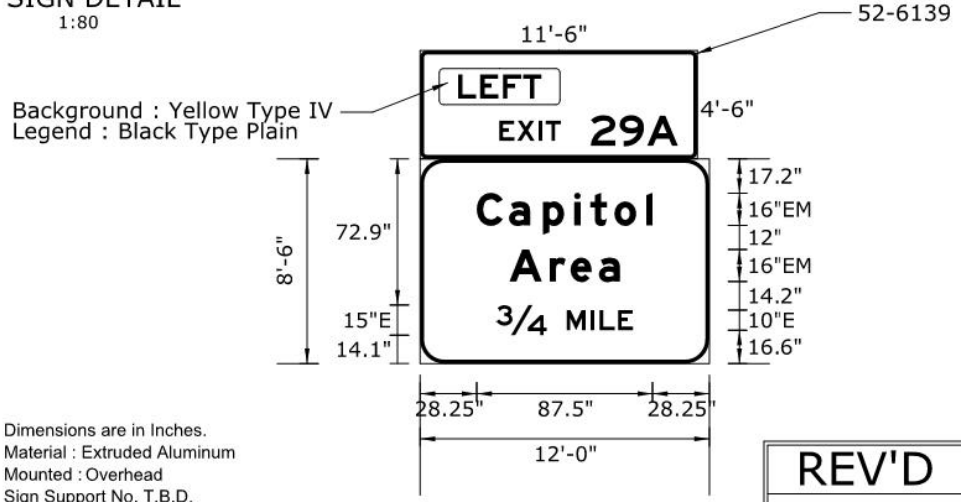
SIGN DETAIL

1:80



Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Overhead
Sign Support No. T.B.D.
Location : Hartford Route I-91 N.B. Mileage : 36.83
Project No. 063-0703
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

SIGN NUMBER	91N_063_36.83_A
SIGN PANEL	12'-0" x 8'-6"
EXIT CROWN	51.75
TOTAL (Sq.fT.)	153.75
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	12"
BACKGROUND	TYPE: IV
	COLOR: Green
LEGEND/BORDER	TYPE: IV
	COLOR: White/White

SYMBOL	ROT	X	Y	WID	HT

REV'D /

PLOTTED : 08/16/17

LETTER POSITIONS (X)																					LENGTH	SERIES/SIZE
	C	a	p	i	t	o	l															EM 2000
28.2	16	17	15.5	8	12	15.8	3.2	28.2													87.5	16/12
	A	r	e	a																		EM 2000
44.5	20	10.4	14.1	10.6	44.5																55	16/12
	3/4		M	I	L	E																E 2000
38	25	10	12	4.4	9.2	7.5	38														68.1	15,10

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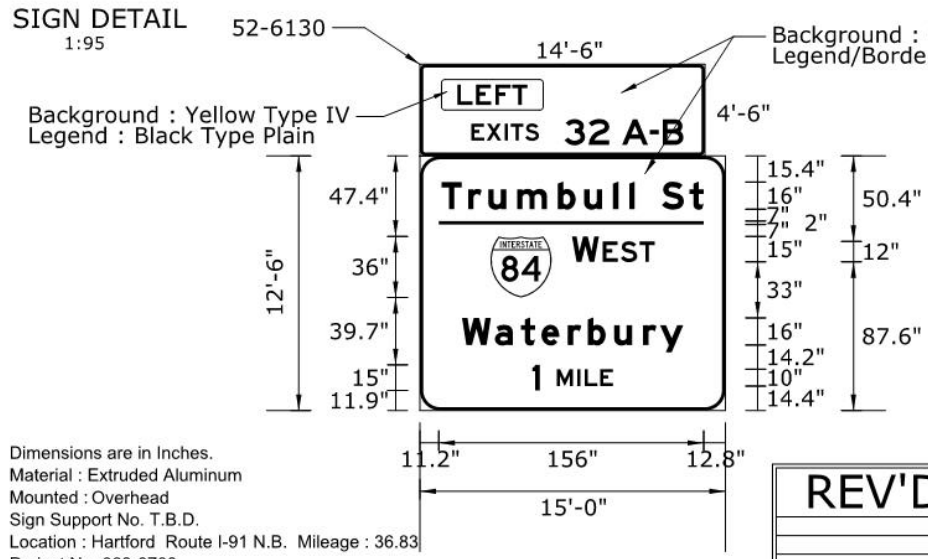
ITEM #1207034A, ITEM #1207039A

Rev. Date 07/18

SIGN DETAIL

1:95



Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Overhead
Sign Support No. T.B.D.
Location : Hartford Route I-91 N.B. Mileage : 36.83
Project No. 063-0703
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

REV'D /

SIGN NUMBER	91N_063_36.83_B
SIGN PANEL	187.5 Sq.Ft.
EXIT CROWN	65.25
TOTAL (Sq.fT.)	252.75
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	12"
BACKGROUND	TYPE: IV
	COLOR: See Sign
LEGEND/BORDER	TYPE: IV
	COLOR: See Sign

SYMBOL	ROT	X	Y	WID	HT
M1_1	0	41.6	66.6	36	36

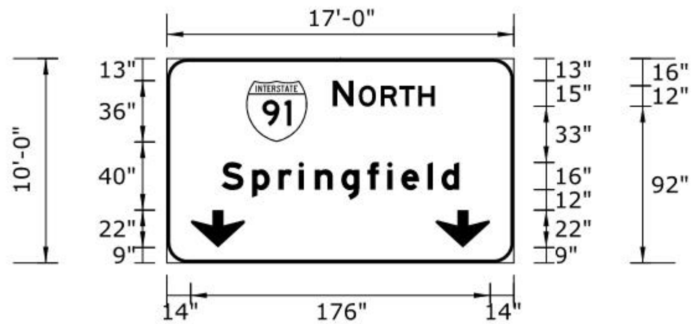
PLOTTED : 08/10/17

LETTER POSITIONS (X)

																				LENGTH	SERIES/SIZE
	T	r	u	m	b	u	l	l		S	t										EM 2000
12.8	15.7	11.8	17	24	15.5	17	9.6	3.2	16	16.3	8.3	12.8								154.4	16/12
	W		E	S	T																E 2000
89.6	15.9	2.2	10.7	11	9	41.6														48.8	15,12
	W	a	t	e	r	b	u	r	y												EM 2000
24.9	19.4	15.4	12	15.5	11.8	15.5	17	10.1	13.6	24.9										130.2	16/12
	1		M	I	L	E															E 2000
66.2	4.5	10	12	4.4	9.2	7.5	66.2													47.6	15,10

SIGN DETAIL

1:95



SIGN NUMBER	91N_063_36.83_C
SIGN PANEL	170.0 Sq.Ft.
EXIT CROWN	
TOTAL (Sq.fT.)	170.0
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	12"
BACKGROUND	TYPE: IV
	COLOR: Green
LEGEND/BORDER	TYPE: IV
	COLOR: White/White

SYMBOL	ROT	X	Y	WID	HT
M1_1	0	46.5	71	36	36
ARDOWN	0	14	9.1	32	22
ARDOWN	0	158	9.1	32	22

Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Overhead
Sign Support No. T.B.D.
Location : Hartford Route I-91 N.B. Mileage : 36.83
Project No. 063-0703
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

REV'D /

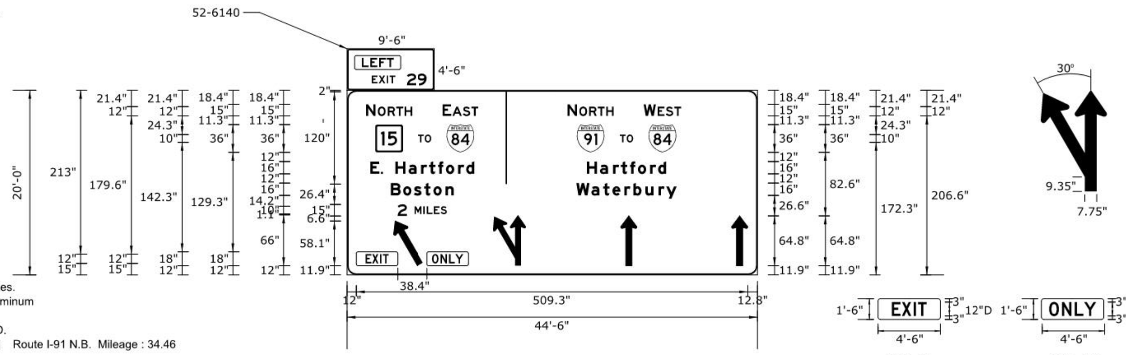
PLOTTED : 08/10/17

LETTER POSITIONS (X)

													LENGTH	SERIES/SIZE
	N		O	R	T	H								E 2000
97.5	12.2	3.1	12.8	11	11	9.7	46.5						59.9	15,12
	S	p	r	i	n	g	f	i	e	l	d			EM 2000
32.1	17.9	15.5	11.8	9.6	15.5	15.4	11.7	8.2	15.5	8.2	10.6	32.1	139.8	16/12

SIGN DETAIL

1:135



Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Overhead
Sign Support No. T.B.D.
Location : Wethersfield Route I-91 N.B. Mileage : 34.46
Project No. 063-0703
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

SIGN NUMBER	091N_159_34.46_A
SIGN PANEL	44'-6" x 20'-0"
EXIT CROWN	42.75
TOTAL (Sq.Ft.)	932.75
BDR INSET / WIDTH	0" / 2"
CORNER RADIUS	12"
BACKGROUND	TYPE: IV
	COLOR: Green
LEGEND/BORDER	TYPE: IV
	COLOR: White/White

SYMBOL	ROT	X	Y	WID	HT
M1_5_1	0	36.7	159.3	36	36
M1_1	0	130	159.3	36	36
M1_1	0	299.1	159.3	36	36
M1_1	0	392.4	159.3	36	36
APL_straight_L	30	60.6	12	21	64.8
APL_st_lt	0	190.2	12	43	66
APL_straight_L	0	356.2	12	21	64.8
APL_straight_L	0	500.2	12	21	64.8

LETTER POSITIONS (X)

													LENGTH	SERIES/SIZE
	N		O	R	T	H								E 2000
24.7	12.2	3.1	12.8	11	11	9.7	449.3						59.9	15,12
	E		A	S	T									E 2000
124.8	11.3	1.5	13.6	11	9	362.8							46.4	15,12
	N		O	R	T	H								E 2000
287.2	12.2	3.1	12.8	11	11	9.7	186.9						59.9	15,12
	W		E	S	T									E 2000
386.1	15.9	2.2	10.7	11	9	99.2							48.8	15,12
	T	O												E 2000
92.7	8.9	8.4	424										17.3	10
	T	O												E 2000
355.1	8.9	8.4	161.6										17.3	10
	E	.		H	a	r	t	f	o	r	d			EM 2000
30.1	13.6	3.2	16	17	17	10.2	11.8	10.2	15.8	10.4	10.6	368	135.8	16/12
	H	a	r	t	f	o	r	d						EM 2000
312.3	17	17	10.2	11.8	10.2	15.8	10.4	10.6	118.7				103	16/12
	B	o	s	t	o	n								EM 2000
56.9	16	14.1	13.9	12	15.8	10.6	394.7						82.4	16/12
	W	a	t	e	r	b	u	r	y					EM 2000
298.7	19.4	15.4	12	15.5	11.8	15.5	17	10.1	13.6	105.1			130.2	16/12
	2		M	I	L	E	S							E 2000
65.7	12.2	10	12	4.4	9.2	8.9	8.1	403.6					64.8	15,10

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1276

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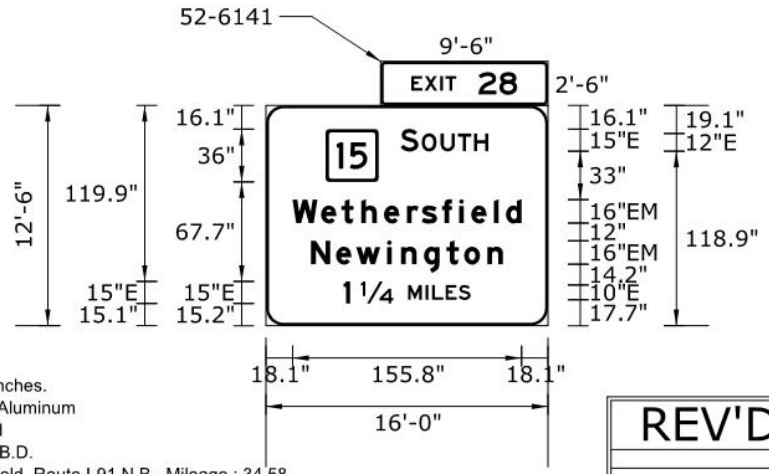
SIGN DETAIL

1:110



Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Overhead
Sign Support No. T.B.D.
Location : Wethersfield Route I-91 N.B. Mileage : 34.58
Project No. 063-0703
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

REV'D /

SIGN NUMBER	091N_159_34.58_A
SIGN PANEL	16'-0" x 12'-6"
EXIT CROWN	23.75
TOTAL (Sq.fT.)	223.75
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	12"
BACKGROUND	TYPE: IV
	COLOR: Green
LEGEND/BORDER	TYPE: IV
	COLOR: White/White

SYMBOL	ROT	X	Y	WID	HT
M1_5_1	0	40.6	97.8	36	36

PLOTTED : 08/14/17

LETTER POSITIONS (X)

																				LENGTH	SERIES/SIZE
	S		O	U	T	H															E 2000
91.6	12.2	2.2	12.8	11.8	11	9.7	40.6													59.8	15,12
	W	e	t	h	e	r	s	f	i	e	l	d									EM 2000
18.1	19.4	13.9	13.4	15.5	15.5	10.1	13.9	11.7	8.2	15.5	8.2	10.6	18.1							155.8	16/12
	N	e	w	i	n	g	t	o	n												EM 2000
30.7	17	13.8	21	9.6	15.5	15.4	12	15.8	10.6	30.7										130.6	16/12
	1		1/4		M	I	L	E	S												E 2000
52.7	4.5	7.5	22	10	12	4.4	9.2	8.9	8.1	52.7										86.6	15,10

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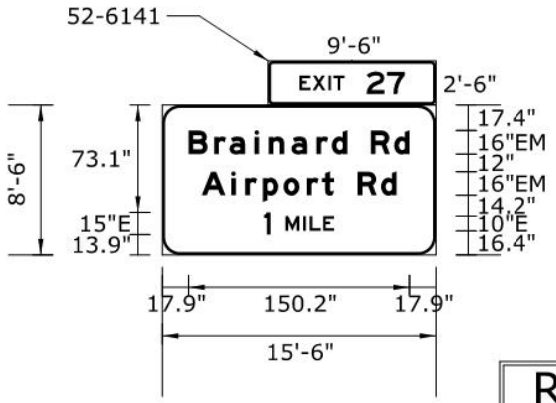
SIGN DETAIL
1:110



SIGN NUMBER	091N_159_34.58_B
SIGN PANEL	15'-6" x 8'-6"
EXIT CROWN	23.75
TOTAL (Sq.fT.)	155.5
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	12"
BACKGROUND	TYPE: IV
	COLOR: Green
LEGEND/BORDER	TYPE: IV
	COLOR: White/White

SYMBOL	ROT	X	Y	WID	HT

Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Overhead
Sign Support No. T.B.D.
Location : Wethersfield Route I-91 N.B. Mileage : 34.58
Project No. 063-0703
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

REV'D /

PLOTTED : 08/14/17

LETTER POSITIONS (X)																					LENGTH	SERIES/SIZE
	B	r	a	i	n	a	r	d		R	d											EM 2000
17.9	17.4	10.4	17	9.6	15.5	17	10.4	10.6	16	15.8	10.6	17.9									150.2	16/12
	A	i	r	p	o	r	t		R	d												EM 2000
26.8	20	9.6	11.8	14.1	15.8	10.2	8.3	16	15.8	10.6	26.8										132.3	16/12
	1		M	I	L	E																E 2000
69.2	4.5	10	12	4.4	9.2	7.5	69.2														47.6	15,10

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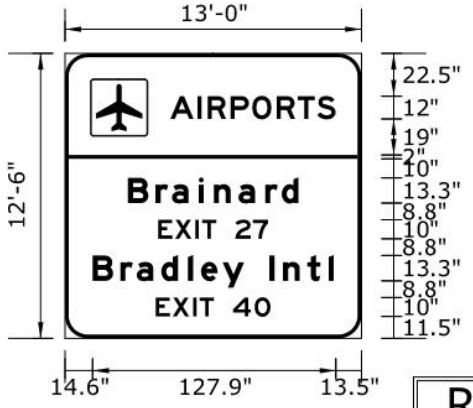
SIGN DETAIL

1:85



SIGN NUMBER	091N_159_34.90_A
SIGN PANEL	13'-0" x 12'-6"
EXIT CROWN	
TOTAL AREA	162.5 Sq.Ft.
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	12"
BACKGROUND	TYPE: IV
	COLOR: Green
LEGEND/BORDER	TYPE: IV
	COLOR: White/White

SYMBOL	ROT	X	Y	WID	HT

Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Ground
Sign Support No. T.B.D.
Location : Wethersfield Route I-91 N.B. Mileage : 34.90
Project No. 063-703
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

REV'D /

PLOTTED : 09/27/17

LETTER POSITIONS (X)																				LENGTH	SERIES/SIZE
	A	I	R	P	O	R	T	S													E 2000
55.5	14.3	5.3	12.1	11.4	12.8	11	10.3	9.7	13.5											87	12
	B	r	a	i	n	a	r	d													EM 2000
33.2	14.5	8.6	14.1	8	12.9	14.1	8.6	8.8	33.2											89.6	13.3/10
	E	X	I	T		2	7														E 2000
49	8.9	10.7	3.5	7.5	10	9.2	8.1	49.1												57.9	10
	B	r	a	d	l	e	y		I	n	t	l									EM 2000
14.6	14.5	8.6	12.9	14.1	6.8	11.4	11.3	13.3	7.2	12.8	11.2	2.7	14.6							126.7	13.3/10
	E	X	I	T		4	0														E 2000
47.8	8.9	10.7	3.5	7.5	10	11.4	8.4	47.8												60.4	10

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ITEM #1207034A, ITEM #1207039A

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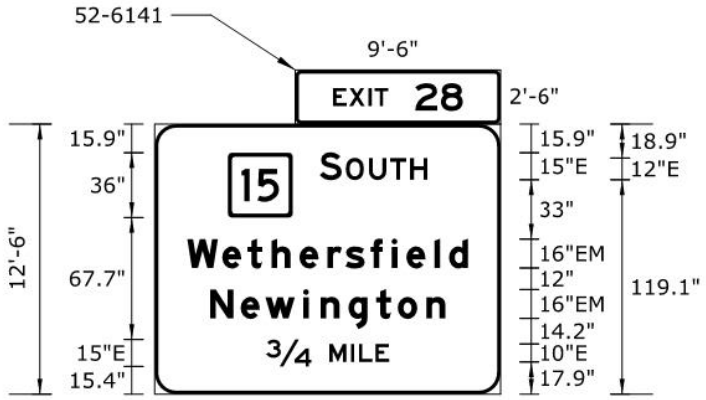
SIGN DETAIL

1:90



SIGN NUMBER	091N_159_35.10_A
SIGN PANEL	16'-0" x 12'-6"
EXIT CROWN	23.75
TOTAL (Sq.fT.)	223.75
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	12"
BACKGROUND	TYPE: IV
	COLOR: Green
LEGEND/BORDER	TYPE: IV
	COLOR: White/White

SYMBOL	ROT	X	Y	WID	HT
M1_5_1	0	40.6	98.1	36	36

Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Overhead
Sign Support No. T.B.D.
Location : Wethersfield Route I-91 N.B. Mileage : 35.10
Project No. 063-0703
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

REV'D /

PLOTTED : 08/14/17

LETTER POSITIONS (X)																					LENGTH	SERIES/SIZE
	S		O	U	T	H																E 2000
91.6	12.2	2.2	12.8	11.8	11	9.7	40.6														59.8	15,12
	W	e	t	h	e	r	s	f	i	e	l	d										EM 2000
18.1	19.4	13.9	13.4	15.5	15.5	10.1	13.9	11.7	8.2	15.5	8.2	10.6	18.1								155.8	16/12
	N	e	w	i	n	g	t	o	n													EM 2000
30.7	17	13.8	21	9.6	15.5	15.4	12	15.8	10.6	30.7											130.6	16/12
	3/4		M	I	L	E																E 2000
62	25	10	12	4.4	9.2	7.5	62														68.1	15,10

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1280

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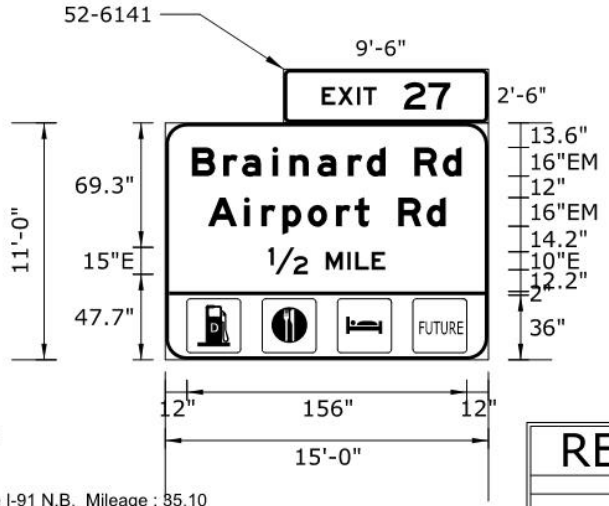
SIGN DETAIL

1:90



SIGN NUMBER	091N_159_35.10_B
SIGN PANEL	15'-0" x 11'-0"
EXIT CROWN	23.75
TOTAL (Sq.fT.)	188.75
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	12"
BACKGROUND	TYPE: IV
	COLOR: Green
LEGEND/BORDER	TYPE: IV
	COLOR: White/White

SYMBOL	ROT	X	Y	WID	HT
517771	0	12	4	30	30
517772	0	54	4	30	30
517773	0	96	4	30	30
FUTURE	0	138	4	30	30

Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Ground
Sign Support No. T.B.D.
Location : Wethersfield Route I-91 N.B. Mileage : 35.10
Project No. 063-0703
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

REV'D /

PLOTTED : 08/16/17

LETTER POSITIONS (X)																				LENGTH	SERIES/SIZE
	B	r	a	i	n	a	r	d		R	d										EM 2000
14.9	17.4	10.4	17	9.6	15.5	17	10.4	10.6	16	15.8	10.6	14.9								150.2	16/12
	A	i	r	p	o	r	t		R	d											EM 2000
23.8	20	9.6	11.8	14.1	15.8	10.2	8.3	16	15.8	10.6	23.8									132.3	16/12
	1/2		M	I	L	E															E 2000
57.5	22	10	12	4.4	9.2	7.5	57.5													65.1	15,10

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1281

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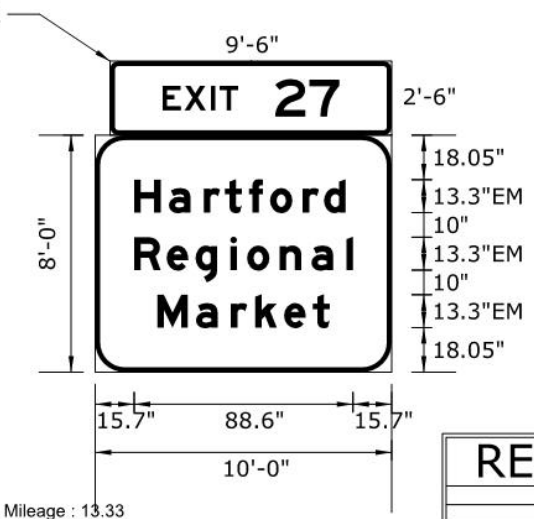
Rev. Date 07/18

SIGN DETAIL

1:65



Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Ground
Sign Support No. T.B.D.
Location : Wethersfield Route I-91 N.B. Mileage : 13.33
Project No. 063-0703
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

SIGN NUMBER	091N_159_35.22_A
SIGN PANEL	10'-0" x 8'-0"
EXIT CROWN	23.75
TOTAL (Sq.fT.)	103.75
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	12"
BACKGROUND	TYPE: IV
	COLOR: Green
LEGEND/BORDER	TYPE: IV
	COLOR: White/White

SYMBOL	ROT	X	Y	WID	HT

REV'D /

PLOTTED : 08/16/17

LETTER POSITIONS (X)

																				LENGTH	SERIES/SIZE
	H	a	r	t	f	o	r	d													EM 2000
15.7	14.1	14.1	8.5	9.8	8.5	13.2	8.6	8.8	18.6											85.7	13.3/10
	R	e	g	i	o	n	a	l													EM 2000
15.7	13.2	11.7	14.1	6.8	13.2	12.9	14.1	2.7	15.7											88.6	13.3/10
	M	a	r	k	e	t															EM 2000
25.1	15.7	14.1	9.8	11.7	11.6	6.9	25.1													69.8	13.3/10

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1282

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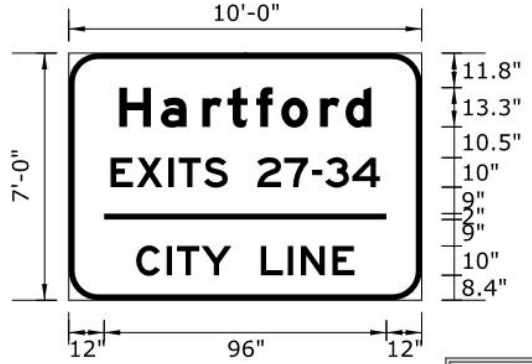
SIGN DETAIL
1:55



SIGN NUMBER	091N_159_35.39_A
SIGN PANEL	10'-0" x 7'-0"
EXIT CROWN	
TOTAL (Sq.fT.)	70.0
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	10"
BACKGROUND	TYPE: IV
	COLOR: Green
LEGEND/BORDER	TYPE: IV
	COLOR: White/White

SYMBOL	ROT	X	Y	WID	HT

Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Ground
Sign Support No. N/A
Location : Wethersfield Route I-91 N.B. Mileage : 35.39
Project No. 063-0703
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

REV'D /

PLOTTED : 08/11/17

LETTER POSITIONS (X)																					LENGTH	SERIES/SIZE
	H	a	r	t	f	o	r	d														EM 2000
17.2	14.1	14.1	8.5	9.8	8.5	13.2	8.6	8.8	17.2												85.7	13.3/10
	E	X	I	T	S		2	7	-	3	4											E 2000
14.3	8.9	10.7	3.5	8.6	8.1	10	9.2	9.4	4.5	9.2	9.4	14.3									91.5	10
	C	I	T	Y		L	I	N	E													E 2000
22.9	10.4	3.5	8.3	10.2	10	9.2	4.4	10.7	7.5	22.9											74.2	10

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1283

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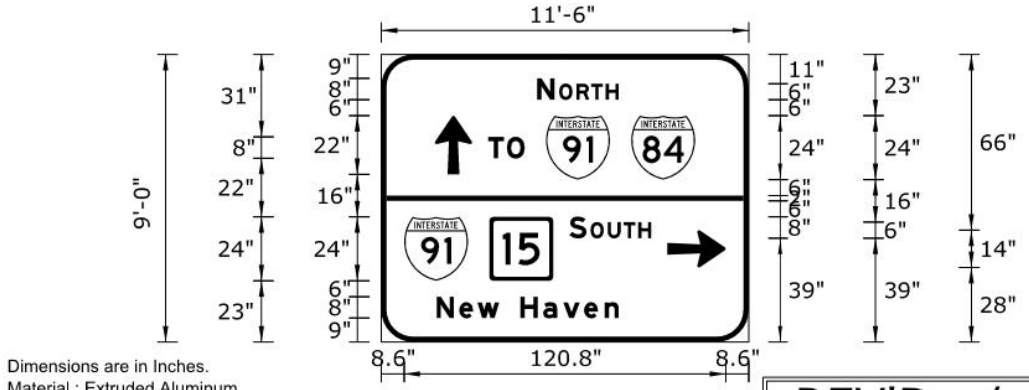
SIGN DETAIL

1:60



Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Ground
Sign Support No. T.B.D.
Location : Hartford Airport Road Ramp #149
Project No. 063-703
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

SIGN NUMBER	91S_063_R149_EX27_A
SIGN PANEL	11'-6" x 9'-0"
EXIT CROWN	
TOTAL AREA	103.5 Sq.Ft.
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	12"
BACKGROUND	TYPE: IV
	COLOR: Green
LEGEND/BORDER	TYPE: IV
	COLOR: White/White

SYMBOL	ROT	X	Y	WID	HT
AR_Type A	0	20.1	63	14	22
M1_1	0	61.9	61	24	24
M1_1	0	93.9	61	24	24
AR_Type A	270	107.4	28	14	22
M1_1	0	8.6	23	24	24
M1_5_1	0	40.6	23	24	24

REV'D /

PLOTTED : 03/08/18

LETTER POSITIONS (X)																					LENGTH	SERIES/SIZE
	N		O	R	T	H																EM 2000
58.6	6.5	1.7	6.5	5.5	5.5	4.9	48.8														30.6	8,6
	T	O																				EM 2000
40.1	7	6.7	84.1																		13.8	8
	S		O	U	T	H																EM 2000
70.6	6.5	1.5	6.5	5.9	5.5	4.9	36.6														30.8	8,6
	N	e	w		H	a	v	e	n													EM 2000
20.8	8.5	6.9	8.2	8	8.5	7.6	7.8	7.8	5.3	48.8											68.4	8/6

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ITEM #1207034A, ITEM #1207039A

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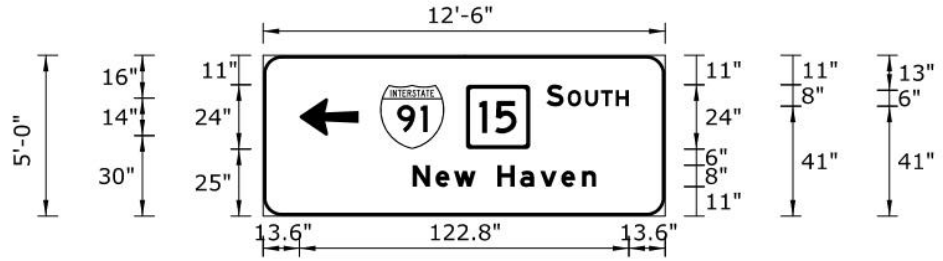
SIGN DETAIL

1:60



SIGN NUMBER	91S_063_R149_EX27_B
SIGN PANEL	12'-6" x 5'-0"
EXIT CROWN	
TOTAL AREA	62.5 Sq.Ft.
BDR INSET/WIDTH	0" / 1.25"
CORNER RADIUS	7"
BACKGROUND	TYPE: IV
	COLOR: Green
LEGEND/BORDER	TYPE: IV
	COLOR: White/White

SYMBOL	ROT	X	Y	WID	HT
AR_Type A	270	13.6	30	14	22
M1_1	0	43.6	25	24	24
M1_5_1	0	75.6	25	24	24

Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Ground
Sign Support No. T.B.D.
Location : Hartford Airport Road Ramp #149
Project No. 063-703
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

REV'D /

PLOTTED : 03/08/18

LETTER POSITIONS (X)																					LENGTH	SERIES/SIZE
	S		O	U	T	H																EM 2000
105.6	6.5	1.5	6.5	5.9	5.5	4.9	13.6														30.8	8,6
	N	e	w		H	a	v	e	n													EM 2000
55.8	8.5	6.9	8.2	8	8.5	7.6	7.8	7.8	5.3	25.8											68.4	8/6

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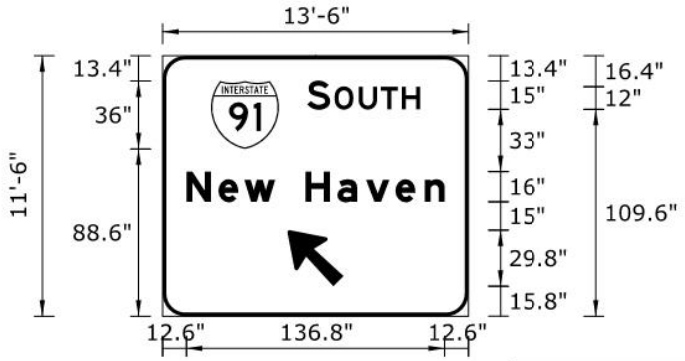
SIGN DETAIL

1:85



SIGN NUMBER	91S_063_R827_EX87_A
SIGN PANEL	13'-6" x 11'-6"
EXIT CROWN	
TOTAL (Sq.fT.)	155.3 Sq.Ft.
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	12"
BACKGROUND	TYPE: IV
	COLOR: Green
LEGEND/BORDER	TYPE: IV
	COLOR: White/White

SYMBOL	ROT	X	Y	WID	HT
M1_1	0	25.6	88.6	36	36
AR_Type A	45	66.1	15.9	24	37.8

Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Ground
Sign Support No. T.B.D.
Location : Hartford Route I-91 S.B. Mileage : Ramp 827 EXIT87
Project No. 063-0703
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

REV'D /

PLOTTED : 02/28/18

LETTER POSITIONS (X)																				LENGTH	SERIES/SIZE
	S		O	U	T	H															E 2000
76.6	12.2	2.2	12.8	11.8	11	9.7	25.6													59.8	15,12
	N	e	w		H	a	v	e	n												EM 2000
12.6	17	13.8	16.3	16	17	15.2	15.5	15.5	10.6	12.6										136.8	16/12

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1286

ITEM #1207034A, ITEM #1207039A

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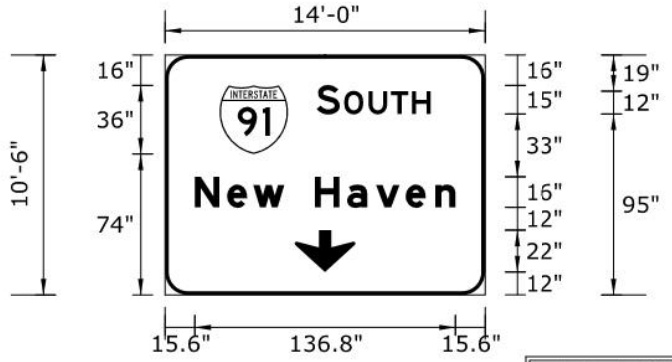
SIGN DETAIL

1:85



SIGN NUMBER	91S_063_R827_EX87_A
SIGN PANEL	14'-0" x 10'-6"
EXIT CROWN	
TOTAL (Sq.fT.)	147.0
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	12"
BACKGROUND	TYPE: IV
	COLOR: Green
LEGEND/BORDER	TYPE: IV
	COLOR: White/White

SYMBOL	ROT	X	Y	WID	HT
M1_1	0	28.6	74	36	36
ARDOWN	0	68	12.1	32	22

Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Overhead
Sign Support No. T.B.D.
Location : Hartford Route I-91 S.B. Mileage : Ramp 827 EXIT87
Project No. 063-0703
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

REV'D /

PLOTTED : 08/11/17

LETTER POSITIONS (X)																					LENGTH	SERIES/SIZE
	S		O	U	T	H																E 2000
79.6	12.2	2.2	12.8	11.8	11	9.7	28.6														59.8	15,12
	N	e	w		H	a	v	e	n													EM 2000
15.6	17	13.8	16.3	16	17	15.2	15.5	15.5	10.6	15.6											136.8	16/12

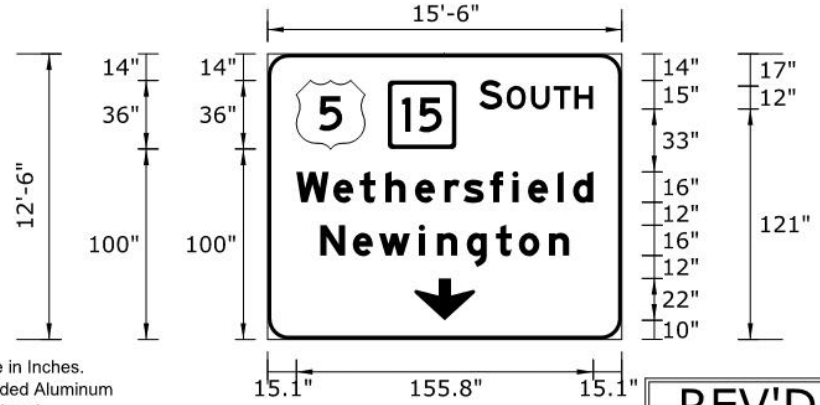
63-703 & 159-191

1287

ITEM #1207034A, ITEM #1207039A

SIGN DETAIL

1:85



Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Overhead
Sign Support No. T.B.D.
Location : Hartford Route I-91 S.B. Ramp 827 EXIT 87
Project No. 063-0703
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

SIGN NUMBER	91S_063_R827_EX87_B
SIGN PANEL	15'-6" x 12'-6"
EXIT CROWN	
TOTAL AREA	193.8 Sq.Ft.
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	11"
BACKGROUND	TYPE: IV
	COLOR: Green
LEGEND/BORDER	TYPE: IV
	COLOR: White/White

SYMBOL	ROT	X	Y	WID	HT
M1_4	0	15.1	100	36	36
M1_5_1	0	63.1	100	36	36
ARDOWN	0	77	10.1	32	22

REV'D /

PLOTTED : 09/21/17

LETTER POSITIONS (X)																					LENGTH	SERIES/SIZE
	S		O	U	T	H																E 2000
111.1	12.2	2.2	12.8	11.8	11	9.7	15.2														59.8	15,12
	W	e	t	h	e	r	s	f	i	e	l	d										EM 2000
15.1	19.4	13.9	13.4	15.5	15.5	10.1	13.9	11.7	8.2	15.5	8.2	10.6	15.1								155.8	16/12
	N	e	w	i	n	g	t	o	n													EM 2000
27.7	17	13.8	21	9.6	15.5	15.4	12	15.8	10.6	27.7											130.6	16/12

Rev. Date 07/18

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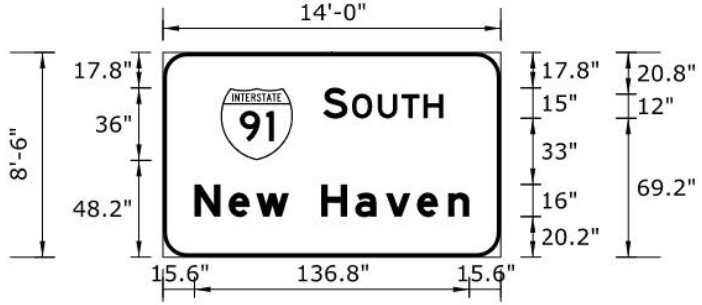
1288

ITEM #1207034A, ITEM #1207039A

Rev. Date 07/18

SIGN DETAIL
1:80



SIGN NUMBER	091S_159_33.91_A
SIGN PANEL	14'-0" x 8'-6"
EXIT CROWN	
TOTAL AREA	119.0 Sq.Ft.
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	12"
BACKGROUND	TYPE: IV
	COLOR: Green
LEGEND/BORDER	TYPE: IV
	COLOR: White/White

SYMBOL	ROT	X	Y	WID	HT
M1_1	0	28.6	48.3	36	36

Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Overhead
Sign Support No. T.B.D.
Location : Wethersfield Route 91 S.B. Mileage : 33.91
Project No. 063-703
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

REV'D /

PLOTTED : 02/28/18

LETTER POSITIONS (X)

																					LENGTH	SERIES/SIZE
	S		O	U	T	H																E 2000
79.6	12.2	2.2	12.8	11.8	11	9.7	28.6														59.8	15,12
	N	e	w		H	a	v	e	n													EM 2000
15.6	17	13.8	16.3	16	17	15.2	15.5	15.5	10.6	15.6											136.8	16/12

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1289

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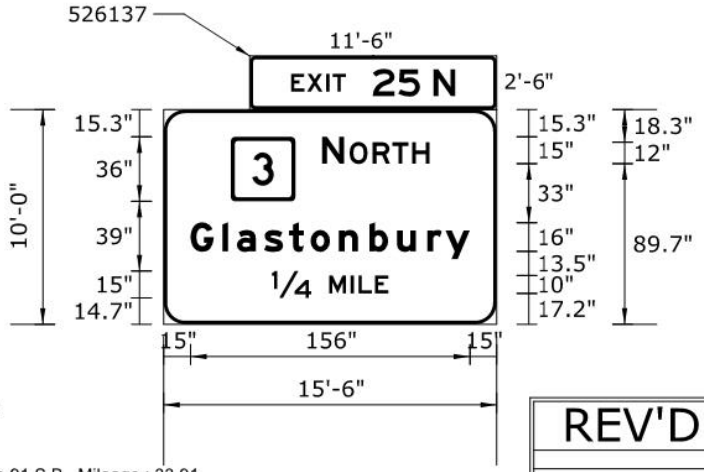
Rev. Date 07/18

SIGN DETAIL

1:90



Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Overhead
Sign Support No. T.B.D.
Location : Wethersfield Route 91 S.B. Mileage : 33.91
Project No. 063-703
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

REV'D /

SIGN NUMBER	091S_159_33.91_B
SIGN PANEL	15'-6" x 10'-0"
EXIT CROWN	28.75
TOTAL AREA	183.75 Sq.Ft.
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	12"
BACKGROUND	TYPE: IV
	COLOR: Green
LEGEND/BORDER	TYPE: IV
	COLOR: White/White

SYMBOL	ROT	X	Y	WID	HT
M1_5_1	0	37.5	68.7	36	36

PLOTTED : 02/28/18

LETTER POSITIONS (X)

																					LENGTH	SERIES/SIZE
	N		O	R	T	H																E 2000
88.5	12.2	3.1	12.8	11	11	9.7	37.5														59.9	15,12
	G	l	a	s	t	o	n	b	u	r	y											EM 2000
15	17.8	8.2	15.2	13.9	12	15.8	17	15.5	17	10.1	13.6	15									156	16/12
	1/4		M	I	L	E																E 2000
60.5	22	10	12	4.4	9.2	7.5	60.5														65.1	15,10

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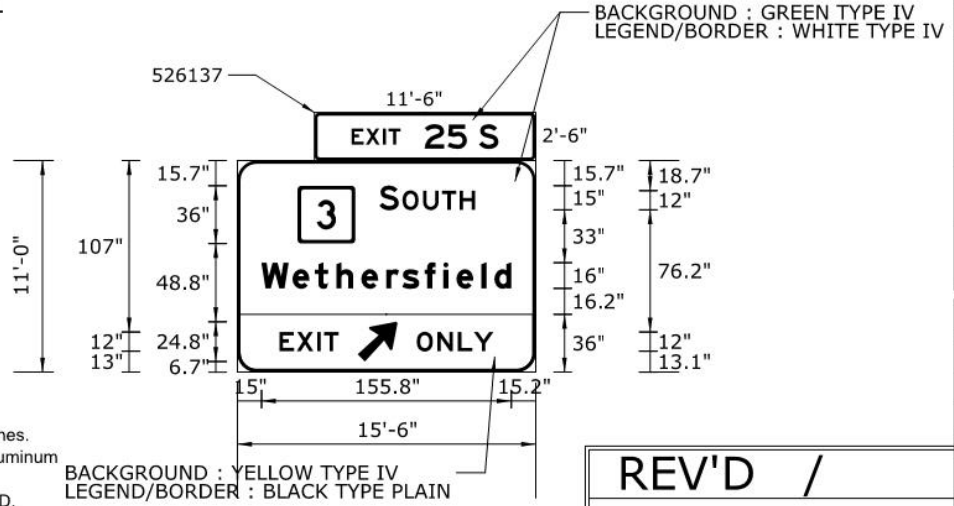
1290

ITEM #1207034A, ITEM #1207039A

Rev. Date 07/18

SIGN DETAIL

1:100



SIGN NUMBER	091S_159_33.91_C
SIGN PANEL	15'-6" x 11'-0"
EXIT CROWN	28.75
TOTAL AREA	199.25 Sq.Ft.
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	12"
BACKGROUND	TYPE: See Sign
	COLOR: See Sign
LEGEND/BORDER	TYPE: See Sign
	COLOR: See Sign

SYMBOL	ROT	X	Y	WID	HT
M1_5_1	0	37.5	80.3	36	36
AR_Type A	315	75	6.6	20	31.5

Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Overhead
Sign Support No. T.B.D.
Location : Wethersfield Route 91 S.B. Mileage : 33.91
Project No. 063-703
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

REV'D /

PLOTTED : 02/28/18

LETTER POSITIONS (X)

																					LENGTH	SERIES/SIZE
	S		O	U	T	H																E 2000
88.5	12.2	2.2	12.8	11.8	11	9.7	37.7														59.8	15,12
	W	e	t	h	e	r	s	f	i	e	l	d										EM 2000
15	19.4	13.9	13.4	15.5	15.5	10.1	13.9	11.7	8.2	15.5	8.2	10.6	15.2								155.8	16/12
	E	X	I	T																		E 2000
26.3	10.7	12.8	4.2	9	123																36.7	12
	O	N	L	Y																		E 2000
111.8	12.8	12.8	10	12.2	26.3																47.9	12

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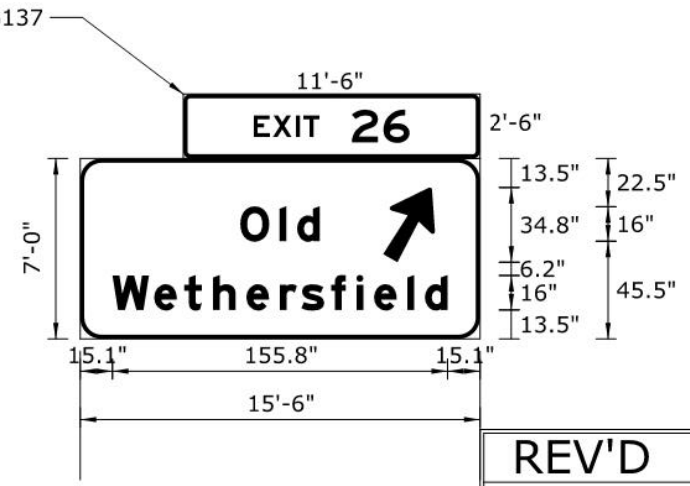
1291

ITEM #1207034A, ITEM #1207039A

SIGN DETAIL

1:75



SIGN NUMBER	091S_159_34.33_A
SIGN PANEL	15'-6" x 7'-0"
EXIT CROWN	28.75
TOTAL AREA	137.25 Sq.Ft.
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	10"
BACKGROUND	TYPE: IV
	COLOR: Green
LEGEND/BORDER	TYPE: IV
	COLOR: White/White

SYMBOL	ROT	X	Y	WID	HT
AR_Type A	330	140.9	35.7	24	37.8

Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Overhead
Sign Support No. T.B.D.
Location : Wethersfield Route 91 S.B. Mileage : 34.33
Project No. 063-703
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

REV'D /

PLOTTED : 02/28/18

LETTER POSITIONS (X)

																					LENGTH	SERIES/SIZE
	O	l	d																			EM 2000
74.5	18.2	8.2	10.6	74.5																	37	16/12
	W	e	t	h	e	r	s	f	i	e	l	d										EM 2000
15.1	19.4	13.9	13.4	15.5	15.5	10.1	13.9	11.7	8.2	15.5	8.2	10.6	15.1								155.8	16/12

Rev. Date 07/18

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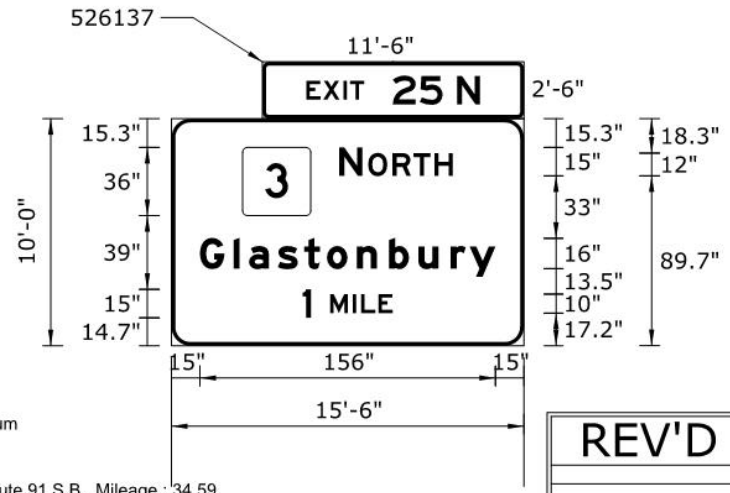
1292

ITEM #1207034A, ITEM #1207039A

Rev. Date 07/18

SIGN DETAIL

1:85



Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Overhead
Sign Support No. T.B.D.
Location : Wethersfield Route 91 S.B. Mileage : 34.59
Project No. 063-703
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

REV'D /

SIGN NUMBER	091S_159_34.59_A
SIGN PANEL	15'-6" x 10'-0"
EXIT CROWN	28.75
TOTAL AREA	183.75 Sq.Ft.
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	12"
BACKGROUND	TYPE: IV
	COLOR: Green
LEGEND/BORDER	TYPE: IV
	COLOR: White/White

SYMBOL	ROT	X	Y	WID	HT
M1_52C	0	37.5	68.7	36	36

PLOTTED : 02/28/18

LETTER POSITIONS (X)

																					LENGTH	SERIES/SIZE
	N		O	R	T	H																E 2000
88.5	12.2	3.1	12.8	11	11	9.7	37.5														59.9	15,12
	G	l	a	s	t	o	n	b	u	r	y											EM 2000
15	17.8	8.2	15.2	13.9	12	15.8	17	15.5	17	10.1	13.6	15									156	16/12
	1		M	I	L	E																E 2000
69.2	4.5	10	12	4.4	9.2	7.5	69.2														47.6	15,10

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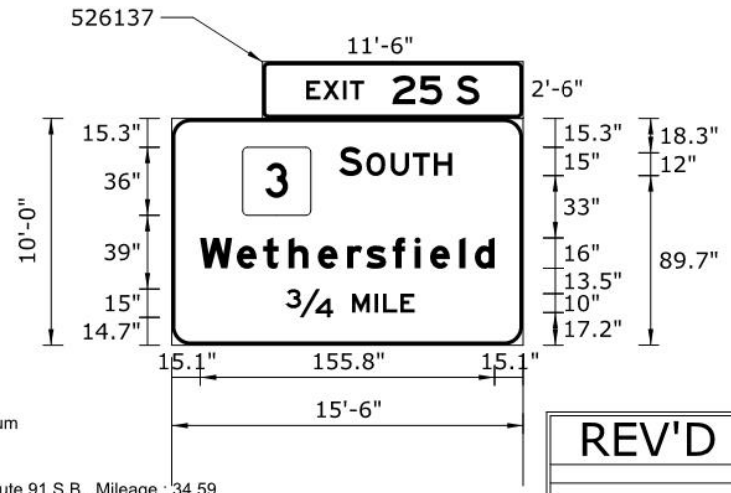
1293

ITEM #1207034A, ITEM #1207039A

Rev. Date 07/18

SIGN DETAIL

1:85



Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Overhead
Sign Support No. T.B.D.
Location : Wethersfield Route 91 S.B. Mileage : 34.59
Project No. 063-703
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

REV'D /

SIGN NUMBER	091S_159_34.59_B
SIGN PANEL	15'-6" x 10'-0"
EXIT CROWN	28.75
TOTAL AREA	183.75 Sq.Ft.
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	12"
BACKGROUND	TYPE: IV
	COLOR: Green
LEGEND/BORDER	TYPE: IV
	COLOR: White/White

SYMBOL	ROT	X	Y	WID	HT
M1_52C	0	37.6	68.7	36	36

PLOTTED : 02/28/18

LETTER POSITIONS (X)

																					LENGTH	SERIES/SIZE
	S		O	U	T	H																E 2000
88.6	12.2	2.2	12.8	11.8	11	9.7	37.6														59.8	15,12
	W	e	t	h	e	r	s	f	i	e	l	d										EM 2000
15.1	19.4	13.9	13.4	15.5	15.5	10.1	13.9	11.7	8.2	15.5	8.2	10.6	15.1								155.8	16/12
	3/4		M	I	L	E																E 2000
60.5	25	10	12	4.4	9.2	7.5	57.5														68.1	15,10

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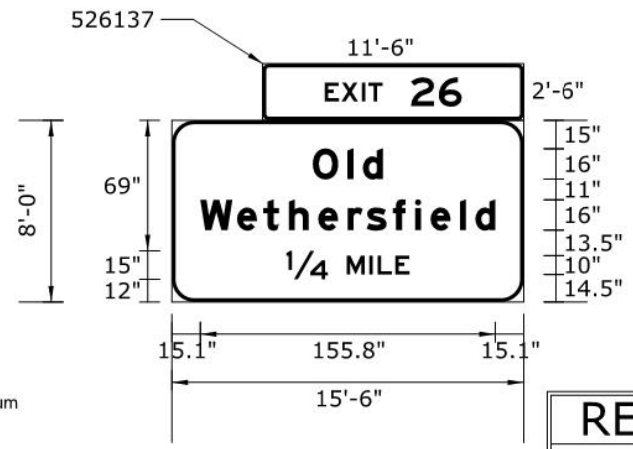
1294

ITEM #1207034A, ITEM #1207039A

SIGN DETAIL

1:85



Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Overhead
Sign Support No. T.B.D.
Location : Wethersfield Route 91 S.B. Mileage : 34.59
Project No. 063-703
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

SIGN NUMBER	091S_159_34.59_C
SIGN PANEL	15'-6" x 8'-0"
EXIT CROWN	28.75
TOTAL AREA	152.75 Sq.Ft.
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	12"
BACKGROUND	TYPE: IV
	COLOR: Green
LEGEND/BORDER	TYPE: IV
	COLOR: White/White

SYMBOL	ROT	X	Y	WID	HT

REV'D /

PLOTTED : 02/28/18

LETTER POSITIONS (X)																					LENGTH	SERIES/SIZE
	O	l	d																			EM 2000
74.5	18.2	8.2	10.6	74.5																	37	16/12
	W	e	t	h	e	r	s	f	i	e	l	d										EM 2000
15.1	19.4	13.9	13.4	15.5	15.5	10.1	13.9	11.7	8.2	15.5	8.2	10.6	15.1								155.8	16/12
	1/4		M	I	L	E																E 2000
60.5	22	10	12	4.4	9.2	7.5	60.5														65.1	15,10

Rev. Date 07/18

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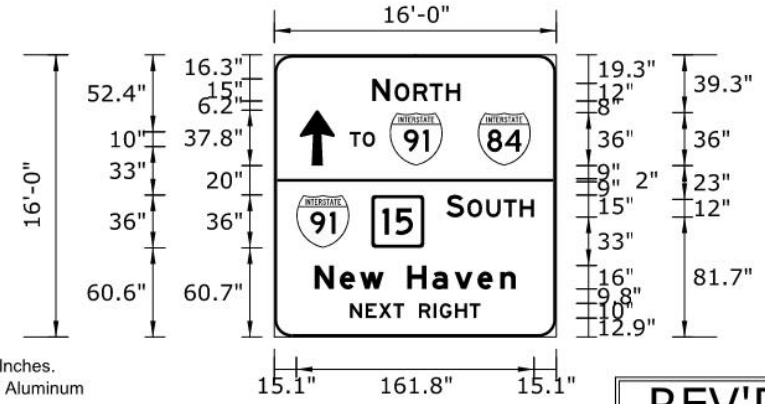
1295

ITEM #1207034A, ITEM #1207039A

Rev. Date 07/18

SIGN DETAIL

1:110



SIGN NUMBER	530E_063_AT_I-91_OVERPASS_A
SIGN PANEL	16'-0" x 16'-0"
EXIT CROWN	
TOTAL (Sq.fT.)	256.0
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	12"
BACKGROUND	TYPE: IV
	COLOR: Green
LEGEND/BORDER	TYPE: IV
	COLOR: White/White

SYMBOL	ROT	X	Y	WID	HT
AR_Type A	0	17.4	116.7	24	37.8
M1_1	0	78.6	116.7	36	36
M1_1	0	138.6	116.7	36	36
M1_1	0	15.1	60.6	36	36
M1_5_1	0	66.1	60.6	36	36

Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Ground
Sign Support No. N/A
Location : Hartford Route 530 E.B. at I-91 Overpass
Project No. 063-0703
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

REV'D /

PLOTTED : 08/11/17

LETTER POSITIONS (X)																					LENGTH	SERIES/SIZE
	N		O	R	T	H																E 2000
66.7	12.2	3.1	12.8	11	11	9.7	65.4														59.9	15,12
	T	O																				E 2000
51.3	8.9	8.4	123.4																		17.3	10
	S		O	U	T	H																E 2000
117.1	12.2	2.2	12.8	11.8	11	9.7	15.1														59.8	15,12
	N	e	w		H	a	v	e	n													EM 2000
27.6	17	13.8	16.3	16	17	15.2	15.5	15.5	10.6	27.6											136.8	16/12
	N	E	X	T		R	I	G	H	T												E 2000
51.6	10.7	8.9	9.8	7.5	10	10.1	4.1	10.4	9.8	7.5	51.6										88.8	10

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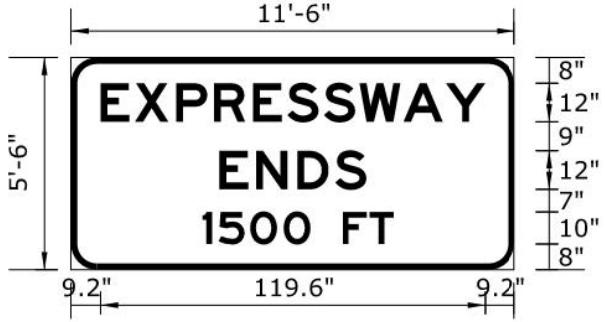
1296

ITEM #1207034A, ITEM #1207039A

SIGN DETAIL

1:50



SIGN NUMBER	003S_159_11.50_A
SIGN PANEL	11'-6" x 5'-6"
EXIT CROWN	
TOTAL AREA	63.3 Sq.Ft.
BDR INSET/WIDTH	0" / 2"
CORNER RADIUS	8"
BACKGROUND	TYPE: IV
	COLOR: Yellow
LEGEND/BORDER	TYPE: Plain
	COLOR: Black/Black

SYMBOL	ROT	X	Y	WID	HT

Dimensions are in Inches.
Material : Extruded Aluminum
Mounted : Overhead
Sign Support No. 21507
Location : Wethersfield Route 3 S.B. Mileage : 11.50
Project No. 159-191
Engineer : C. Jurich / Designed by : J. Fascione / Checked by :

REV'D /

PLOTTED : 01/05/18

LETTER POSITIONS (X)																				LENGTH	SERIES/SIZE
	E	X	P	R	E	S	S	W	A	Y											E 2000
9.2	10.7	12.8	11.8	12.1	10.7	11.4	11	13.7	13.2	12.2	9.2									119.6	12
	E	N	D	S																	E 2000
46.1	11.4	12.8	11.8	9.7	46.1															45.7	12
	1	5	0	0		F	T														E 2000
40.9	5	9.8	10.4	8.4	10	8.3	7.5	37.7												59.4	10

Rev. Date 07/18

Pay Item	Pay Unit
Sign Face - Extruded Aluminum (Type IX Retroreflective Sheeting)	S.F.
Sign Face - Extruded Aluminum (Type IV Retroreflective Sheeting)	S.F.

ITEM #1208931A - SIGN FACE - SHEET ALUMINUM (TYPE IX RETROREFLECTIVE SHEETING)

ITEM #1208932A - SIGN FACE - SHEET ALUMINUM (TYPE IV RETROREFLECTIVE SHEETING)

Section 12.08 is supplemented and amended as follows:

12.08.01—Description:

Add the following:

This item shall also include field testing of metal sign base posts as directed by the Engineer.

12.08.03—Construction Methods:

Delete the last sentence and add the following:

Metal sign base posts shall be whole and uncut. Sign base post embedment and reveal lengths shall be as shown on the plans. The Contractor shall drive the metal sign base posts by hand tools, by mechanical means or by auguring holes. If an obstruction is encountered while driving or placing the metal sign base post, the Contractor shall notify the Engineer who will determine whether the obstruction shall be removed, the sign base post or posts relocated, or the base post installation in ledge detail shall apply. Backfill shall be thoroughly tamped after the posts have been set level and plumb.

Field Testing of Metal Sign Posts: When the sign installations are complete, the Contractor shall notify the Engineer the Project is ready for field testing. Based on the number of posts in the Project, the Engineer will select random sign base posts which shall be removed by the Contractor for inspection and measurement by the Engineer. After such inspection is completed at each base post location, the Contractor shall restore or replace such portions of the work to the condition required by the Contract. Refer to the table in 12.08.05 for the number of posts to be field tested.

12.08.04—Method of Measurement:

Add the following:

The work required to expose and measure sign base post length and embedment depth using field testing methods, and restoration of such work, will not be measured for payment and shall be included in the general cost of the work.

12.08.05—Basis of Payment:

Replace the entire Article with the following:

This work will be paid for at the Contract unit price per square foot for "Sign Face - Sheet Aluminum" of the type specified complete in place, adjusted by multiplying by the applicable Pay Factor listed in the table below. The price for this work shall include the completed sign, metal sign post(s), span-mounted sign brackets and mast arm-mounted brackets, mounting

hardware, including reinforcing plates, field testing, restoration and replacement of defective base post(s), and all materials, equipment, and work incidental thereto.

Pay Factor Scale: Work shall be considered defective whenever the base post length or base post embedment depth is less than the specified length by more than 2 inches. If the number of defects results in rejection, the Contractor shall remove and replace all metal sign base posts on the Project, at no cost to the Department.

Number of Posts to be Tested and Pay Factors (Based on Number of Defects)

Number of Posts in Project =>	**51-100**	**101-250**	**251-1000**	**>1000**
Sample Size=>	**5 Posts**	**10 Posts**	**40 Posts**	**60 Posts**
0 Defects	1.0	1.0	1.025	1.025
1 Defect	0.9	0.95	0.975	0.983
2 Defects	Rejection	0.9	0.95	0.967
3 Defects	Rejection	Rejection	0.925	0.95
4 Defects	Rejection	Rejection	0.9	0.933
5 Defects	Rejection	Rejection	Rejection	0.917
6 Defects	Rejection	Rejection	Rejection	0.9
7 or more Defects	Rejection	Rejection	Rejection	Rejection

Note: Projects with 50 or fewer posts will not include field testing.

ITEM #1302061A - ADJUST GATE BOX (WATER)

Description: Reference to the "District" in this item refers to "The Metropolitan District".

The Contractor shall adjust to final grade, the gate boxes and covers appurtenant to the water mains as required to furnish and install extension rings, extension stems, covers, and additional top and bottom sections if necessary, as shown on the Contract Drawings or as directed by the Engineer in accordance with these specifications.

Materials: The Contractor shall furnish standard District cast iron Dwyer type gate box sections and extensions as required and extension stems according to the detail shown in the Contract Documents and the District's "Standard Details Manual".

All additional materials, including any resurfacing materials and any additional fill required, shall be furnished and placed by the Contractor. Gravel shall conform to Article M.02.01.

Construction Methods: The Contractor shall carefully excavate around the gate boxes, remove the boxes, install extension stems, reinstall the present gate box if reusable, adjust the box to final grade using extension rings, if applicable, and refill the excavation. Care shall be taken to prevent material from filling the inside of the gate box.

Any damage done to District facilities by the Contractor shall be repaired or replaced by the Contractor at his expense.

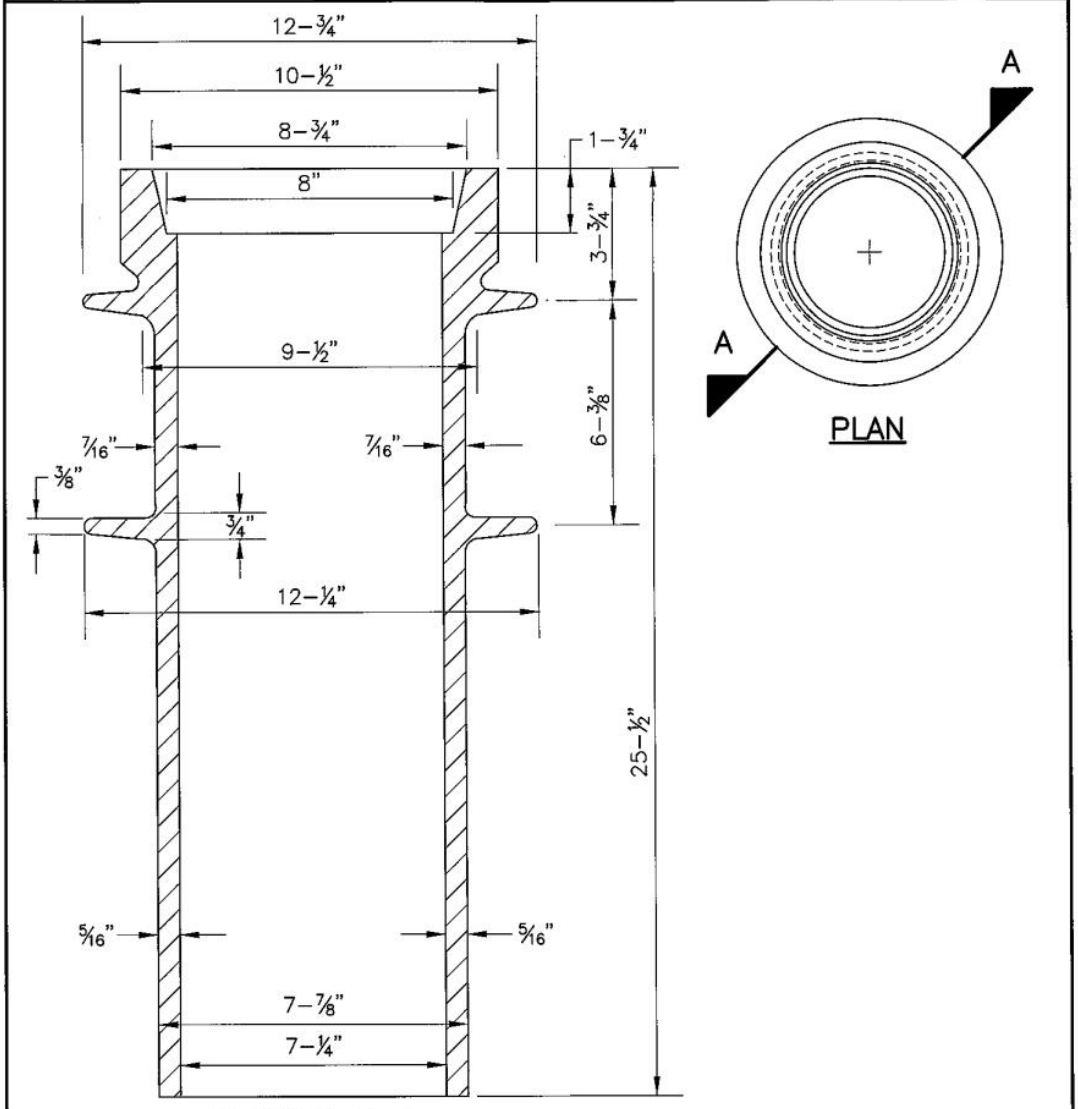
Method of Measurement: The number of adjust gate boxes, complete with extension stems, gate box extension rings, covers, and additional top or bottom sections, if necessary, measured for payment shall be the actual number of each box reset.

Basis of Payment: This work will be paid for at the contract unit price for "Adjust Gate Box (Water)" complete in place, which price shall include the cost of furnishing material, including labor and equipment to incorporate them into the work. It shall also include the clearing, trenching and disposal of excavated materials, refilling trenches, furnishing the additional material for refilling, grading, sheeting, bracing, and pumping.

Pay Item	Pay Unit
Adjust Gate Box (Water)	EA.

THE METROPOLITAN DISTRICT

WATER STANDARD DETAILS



CAST IRON GATE BOX TOP SECTION (DWYER TYPE)

DETAIL W 14

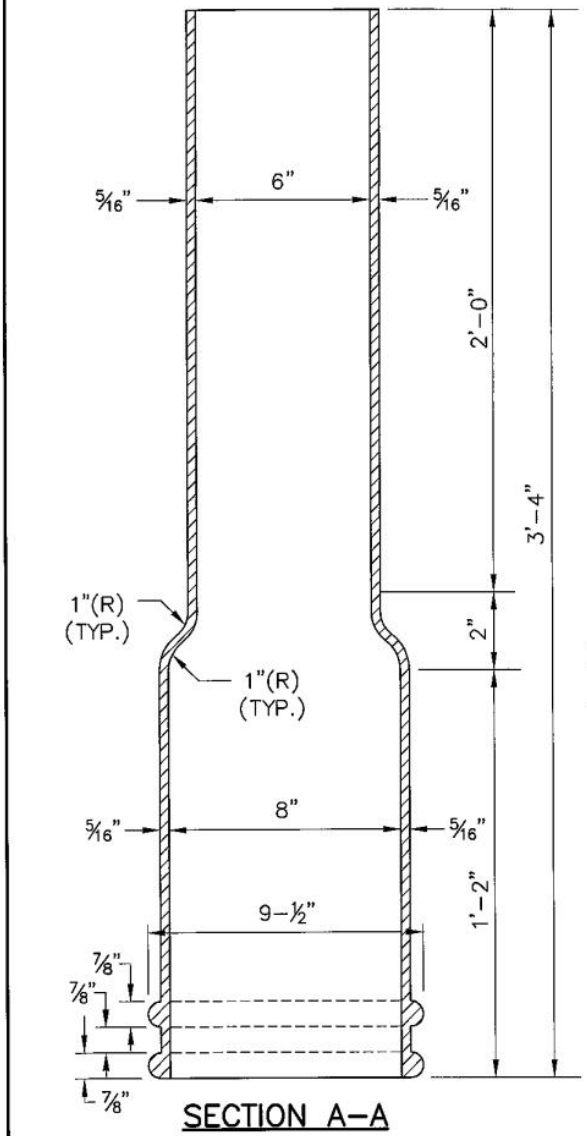
NTS

File: W-14 Cast Iron Gate Box Top Section (Dwyer Type).dwg

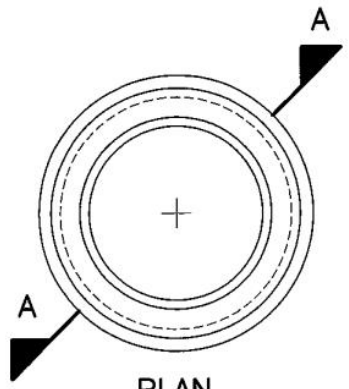
Latest Revision: JANUARY 2017

THE METROPOLITAN DISTRICT

WATER STANDARD DETAILS



SECTION A-A



PLAN

NOTE:

1. FOR USE ON 8" AND SMALLER GATE VALVES AND ALL BUTTERFLY VALVES.

CAST IRON GATE BOX BOTTOM SECTION 8-INCH (DWYER TYPE)

DETAIL W-15

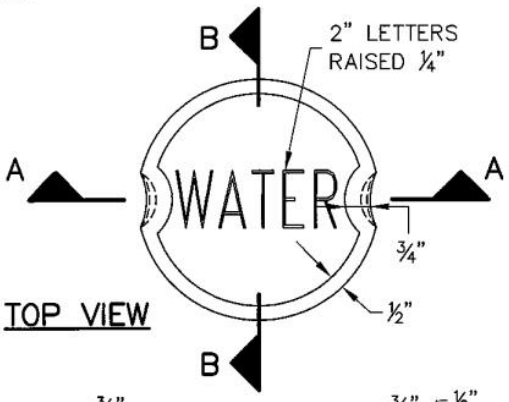
NTS

File: W-15 Cast Iron Gate Box Bottom Section 8-inch (Dwyer Type).dwg

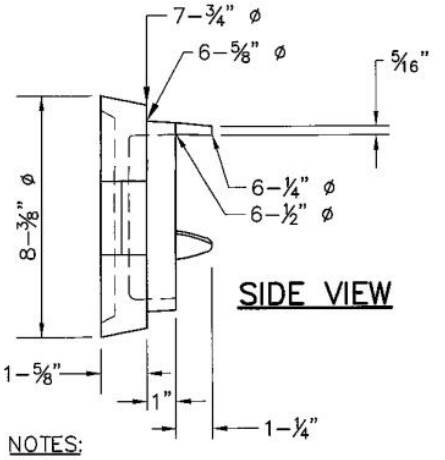
Latest Revision: JANUARY 2017

THE METROPOLITAN DISTRICT

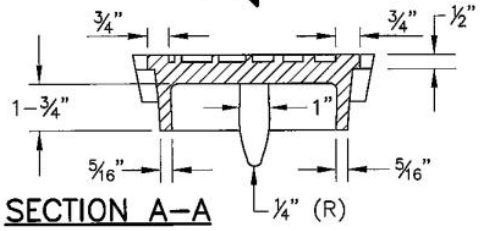
WATER STANDARD DETAILS



TOP VIEW



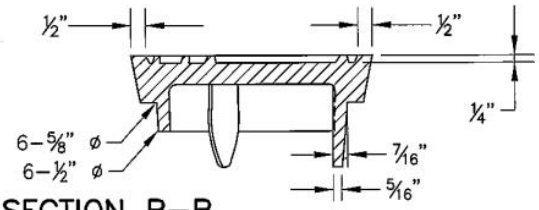
SIDE VIEW



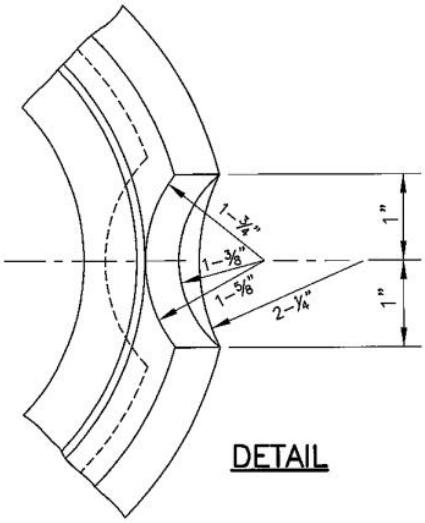
SECTION A–A

NOTES:

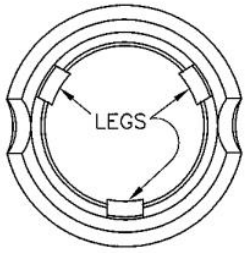
1. APPROXIMATE WEIGHT 20 LBS.
2. FOR NEW CONSTRUCTION.



SECTION B–B



DETAIL



BOTTOM VIEW

CAST IRON GATE BOX COVER (DWYER TYPE)

DETAIL W 17

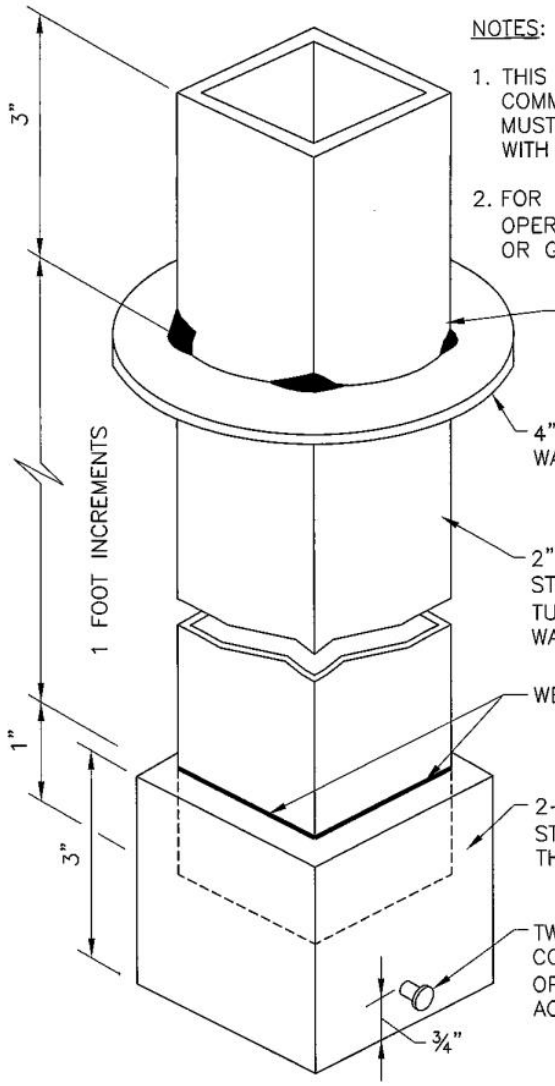
NTS

File: W–17 Standard Gate Box Cover (Dwyer Type).dwg

Latest Revision: JANUARY 2017

THE METROPOLITAN DISTRICT

WATER STANDARD DETAILS



NOTES:

1. THIS EXTENSION STEM IS NOT COMMERCIALLY AVAILABLE. IT MUST BE SPECIALLY FABRICATED WITH STAINLESS STEEL.
2. FOR USE WHEN GATE VALVE OPERATING NUT DEPTH IS 4'–6" OR GREATER.

TACK WELD FOUR CORNERS (TYP.)

4" ø STEEL WASHER

2" SQUARE OR ROUND STRUCTURAL STEEL TUBING WITH ¼" THICK WALL

WELD AS REQUIRED

2–½" SQUARE STAINLESS STEEL TUBING WITH 3⁄16" THICK WALL

TWO ⅜" CAP SCREWS COUNTERSINK VALVE OPERATING NUT ⅛" TO ACCEPT SCREWS

GATE NUT EXTENSION STEM FOR GATE BOX

DETAIL W 21

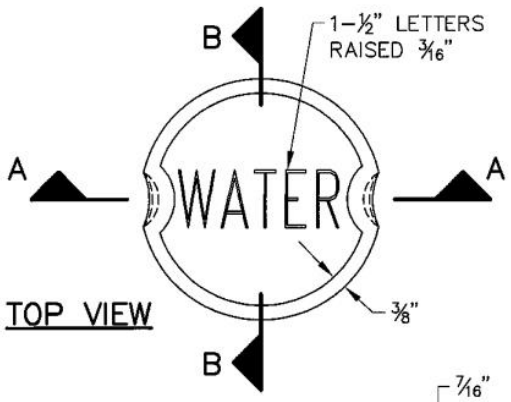
NTS

File: W–21 Gate Nut Extension Stem for Gate Box.dwg

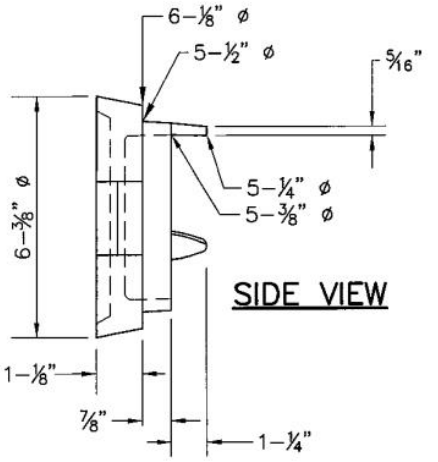
Latest Revision: JANUARY 2017

THE METROPOLITAN DISTRICT

WATER STANDARD DETAILS



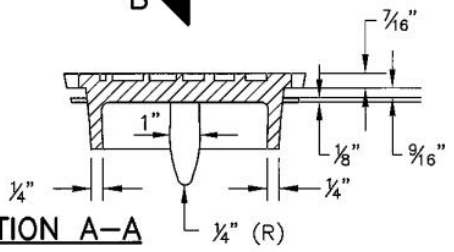
TOP VIEW



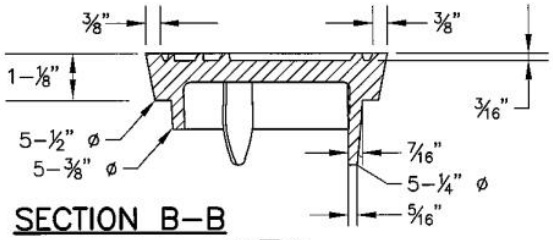
SIDE VIEW

NOTE:

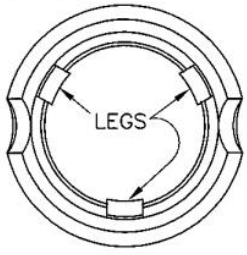
1. APPROXIMATE WEIGHT 20 LBS.



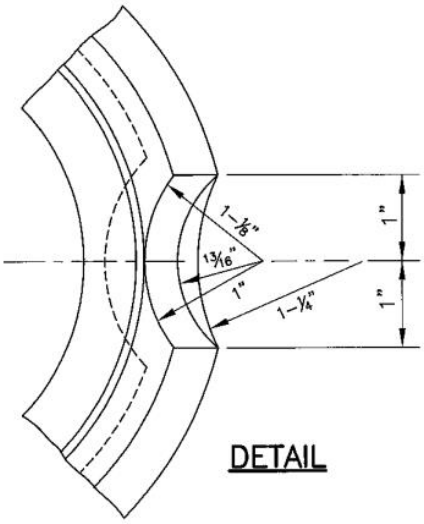
SECTION A–A



SECTION B–B



BOTTOM VIEW



DETAIL

CAST IRON GATE BOX EXTENSION COVER 6–INCH (DWYER TYPE)

DETAIL W 18

NTS

File: W-18 Standard Gate Box Extension Cover 6-inch (Dwyer Type).dwg

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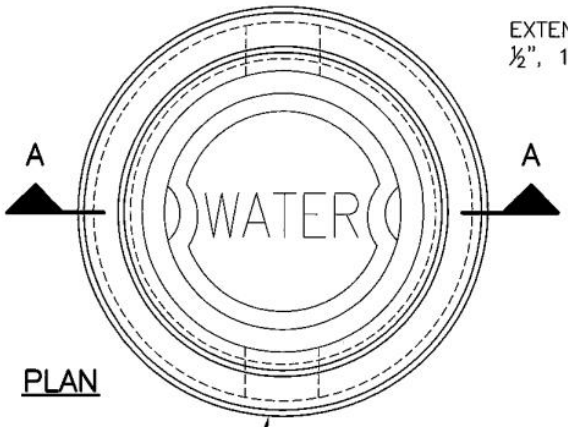
Latest Revision: JANUARY 2017

THE METROPOLITAN DISTRICT

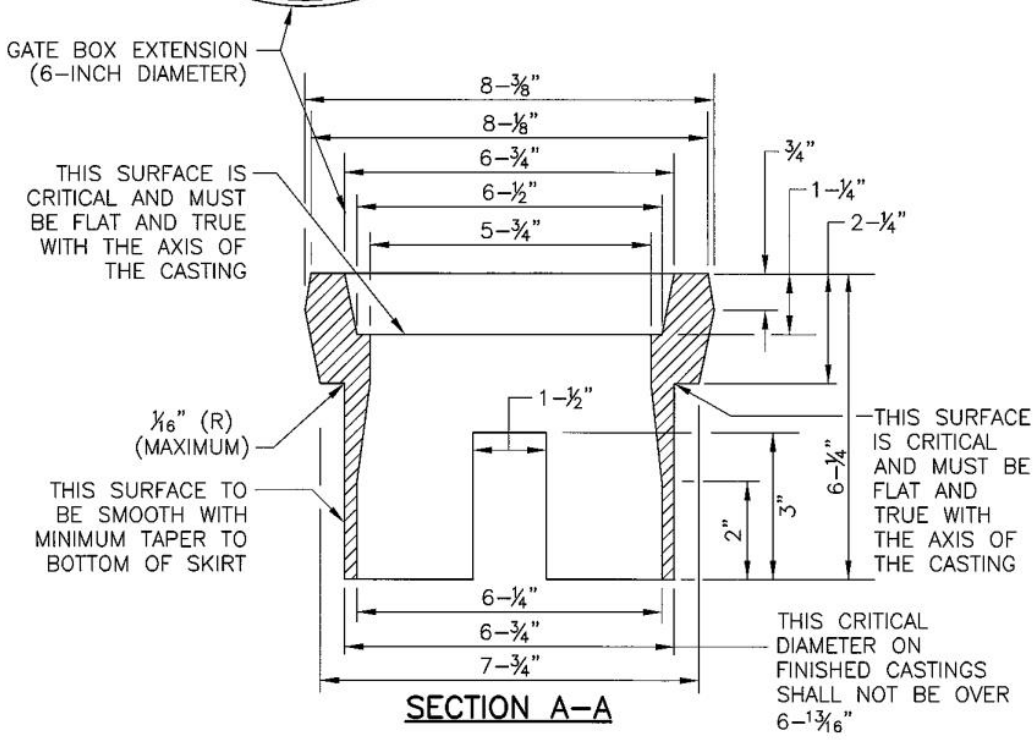
WATER STANDARD DETAILS



EXTENSION RING HEIGHTS
½", 1", 1–½" & 2"

NOTES:

1. A MAXIMUM OF THREE EXTENSION RINGS CAN BE USED PER GATE BOX.
2. ALL DIMENSION AREA TO BE ± 1/16" UNLESS INDICATED OTHERWISE.
3. NOT TO BE USED FOR NEW WATER MAIN INSTALLATIONS.



GATE BOX EXTENSION

DETAIL W 19

NTS

File: W–19 Gate Box Extension.dwg

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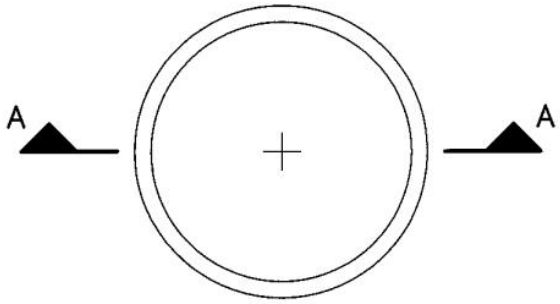
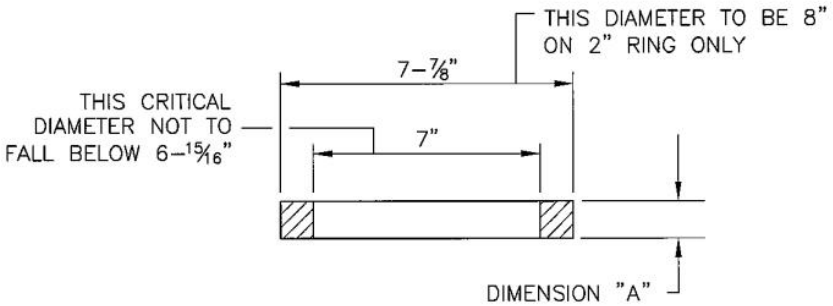
Latest Revision: JANUARY 2017

THE METROPOLITAN DISTRICT

WATER STANDARD DETAILS



PLAN



SECTION A–A

DIMENSION "A"	APRROXIMATE WEIGHT
½"	1.50 LBS
1"	2.75 LBS
1-½"	3.75 LBS
2"	6.00 LBS

NOTE:

1. ALL DIMENSIONS ARE TO BE ±1/16" UNLESS INDICATED OTHERWISE.

GATE BOX EXTENSION SPACER RINGS

DETAIL W 20

NTS

File: W-20 Gate Box Extension Spacer Rings.dwg

Latest Revision: JANUARY 2017

ITEM #1303230A - FIRE SUPPRESSION STANDPIPE SYSTEM

Description:

This work shall consist of the furnishing, fabricating, transporting, installing, and testing dry standpipes and all appurtenances for fire protection at each Bridge Site as shown on the plans and in accordance with this specification. This work shall also include all piping supports, mounting hardware, and standpipe identification signing.

All work shall conform to the requirements of the current edition of the National Fire Protection Association's "NFPA 14 – Standard for the Installation of Standpipe and Hose Systems", and the current AASHTO "LRFD Bridge Design Specifications".

Materials:

Testing
The Contractor shall furnish a Materials Certificate in accordance with Article 1.06.07, certifying the conformance of the materials to the requirements set forth in this specification.

Pipe Supports
Structural steel for support members, anchorage plates and shims shall conform to the requirements of ASTM A709, Grade 36 and shall be galvanized after fabrication to meet the requirements of ASTM A123.

Threaded rods, anchor bolts, bolts and nuts shall conform to the requirements of ASTM A449, A563-Grade DH, A194-Grade 2H or F436 as applicable. All hardware shall be hot dip galvanized in accordance with ASTM A153 or A123 as applicable.

Welding required for fabrication of the pipe supports shall be in accordance with the current AWS specifications. Welding of pipe to supports shall not be permitted.

Anchorage System
Chemical anchors and testing shall be in accordance with Section M.03.01-15 of the Standard Specifications.

Non shrink grout filler material shall be in accordance with Section M.03.01-12.

Inlets and Outlets
Inlets and outlets shall be of the type and size and at the locations as shown on the plans.

Where shown, standpipes are to have a 5 inch Storz outlet equipped with standard caps and chains. Storz connections shall be aluminum or brass.

Steel Pipe, Fittings and Couplings
Pipe shall be mild steel, seamless or welded, Schedule 40, galvanized, ASTM A53, with threaded or cut grooved connections.

Fittings shall be malleable iron threaded Class 150, galvanized, ANSI/ASTM B16.3, and ductile iron fittings for grooved connections, galvanized.

Pipe couplings shall be ductile iron, galvanized, at least 300 psi maximum working pressure and 10,000 lb. maximum end load, flexible or rigid type, as indicated on the Contract Drawings. Flexible couplings shall be Victualic Style 77 or approved equal, rigid couplings shall be Victualic Style 07 Zero-Flex or approved equal. Gaskets for grooved connections must be as recommended by the couplings manufacturer for the required service.

Other acceptable manufacturers of fittings and couplings for grooved connections are Anvil International and Tyco Fire Products or approved equal. All fittings, couplings and gaskets for grooved connections must be from one manufacturer.

Pipe Anchors

Pipe Anchors shall be as shown on the drawings. All elements of the anchor shall be galvanized. U-bolts shall be tightened securely to provide reliable anchoring of the pipe.

Galvanizing

Areas in which galvanizing has been damaged shall be given two (2) coats of zinc paint conforming to the requirements of the Federal Specification TT-P-64lb or Military Specification MIL-P-21035.

Identification Signs

Signs shall be made from plastic or galvanized metal as approved by the Engineer. Signs shall be mounted on pipe by methods approved by the Engineer.

Construction Methods:

Shop Drawings:

Prior to the commencement of work and fabrication of any materials, the Contractor shall take all field measurements necessary to assure proper fit of the finished dry standpipe assemblies, and shall submit working drawings to the Engineer in accordance with Article 1.05.02. These drawings shall include, but not be limited to the following information:

a. A layout plan and elevation indicating pipe lengths for vertical and horizontal standpipe runs including location, type and number of fittings, couplings, supports and appurtenances for each location.

b. Commercial items shall be identified by manufacturer, trade name and catalog number. Catalog sheets, including pertinent specifications, shall be included with the submission.

c. All pipe supports, as shown on the plans, shall be detailed.

d. All field measurements shall be submitted for reference.

e. The Contractor shall submit a parts list including the quantity, make, model and supplier of all the materials incorporated into the work.

Installation:

The Contractor shall lay out the pipe anchorages and install anchors in accordance with manufacturer recommendations. The layout and installation of anchorages shall satisfy the geometric tolerances necessary to ensure all pipe joints are aligned within the recommended setting limits for the coupling or fitting, as applicable.

All pipe, fittings and associated items shall be carefully examined for defects immediately prior to installation and no pipe or fittings shall be laid which is known to be defective in any way. Any pipe or fittings discovered as defective after laying shall be promptly removed and replaced at no additional cost to the State. Proper and suitable tools and equipment for the safety and convenient handling and laying of the pipe, fittings and appurtenance shall be used, and great care shall be taken to prevent damage to the pipe coating and lining.

Horizontal standpipe runs shall be installed with a minimum 0.5% cross slope to assure proper drainage of the system.

Welding of pipe joints and welding of piping to supports shall not be permitted.

Pipe and fittings shall be thoroughly cleaned before being installed and shall be kept clean until accepted in the completed work. Open ends shall be closed with wooden or other suitable bulkheads at all times when pipe laying is not actually in progress.

Jointing of pipe or fittings shall be made only by persons thoroughly skilled in this work. All adjoining parts shall be thoroughly cleaned and inspected and the jointing done in strict accordance with the manufacturer's recommendations.

Provide Identification Signs and anchorages required to secure the signs to the bridge structure at all inlets and outlets. Signs shall have the following legend: “DRY FIRE STANDPIPE, *LOCATION IDENTIFIER*, 5” STORZ CONNECTION” or “DRY FIRE STANDPIPE, LOCATION IDENTIFIER, HOSE CONNECTIONS” as applicable. Identification Signs at standpipe inlets with clappers shall also include the legend "OPEN DRAIN VALVE AFTER USE". Signs shall have a red background with white lettering or as noted on the plans. Lettering shall be 1 ½” minimum or as approved by the Engineer.

The location identifiers to be used for the standpipe identification signing shall be as follows:

Location	Location Identifier
Elm Street Bridge	I-91 NB OVER ELM STREET
	I-91 SB OVER ELM STREET
Great Meadow Road Bridge	I-91 NB OVER GREAT MEADOW ROAD
	I-91 SB OVER GREAT MEADOW ROAD
Route 3 Bridge	ROUTE 3 NB OVER I-91

Testing

Upon completion of the installations, each standpipe system shall be tested hydrostatically at not less than a pressure of 200 psi for 2 hours by the Wethersfield Fire Department in accordance with NFPA-14 – "Installation of Standpipe and Hose Systems". The system shall exhibit no signs of leakage. If a system does not satisfy the testing requirements, the Contractor shall repair or replace all defective pipe or fittings, and a new test shall be performed.

At the completion and acceptance of the test, the standpipe system shall be drained by the Wethersfield Fire Department.

The Contractor shall coordinate all system testing with the Town of Wethersfield Fire Department and shall provide temporary shoulder or lane closings as required to perform the testing. All traffic protection shall be in accordance with the contract requirements for "Maintenance and Protection of Traffic" and "Prosecution and Progress".

Method of Measurement:

Fire Suppression Standpipe Systems will be measured for payment by the number of systems installed and accepted with a system defined as a complete functional standpipe from inlet connection to outlet connection.

Basis of Payment:

Fire Suppression Standpipe Systems will be paid for at the Contract unit price each for "Fire Suppression Standpipe System", complete and accepted in place, which price shall include furnishing, fabricating, transporting, installing the dry standpipe system, and all materials, equipment, tools and labor incidental thereto. The cost of clearing and/or removal of debris shall be included in the lump sum bid for this item. Traffic protection for both the installation and testing of the systems shall be paid for under the applicable traffic items with the exception that if an initial pressure test of a standpipe fails, then all costs for traffic protection for the subsequent testing shall be borne by the Contractor.

Pay Item	Pay Unit
Fire Suppression Standpipe System	EA

ITEM #1303238A - RESET FIRE SUPPRESSION SYSTEM

Description:

Work under this item shall consist of removing, modifying, and resetting the existing fire suppression system. This includes furnishing, fabricating, transporting and installing all necessary components and all appurtenances for fire protection at locations shown on the plans and in accordance with this specification. This work shall also include all piping support, mounting hardware and concrete inserts.

The Contractor has the option to temporarily support the fire suppression system in place during construction. Contractor shall design the temporary support system and submit working drawings for approval to the Engineer prior to the start of any work. Any temporary support system will be included in this item. Contractor to ensure protection of system from damage during duration of construction. If temporarily supported in place, Contractor to clearly mark and label the system as being out of service.

Contractor to notify Hartford and East Hartford Fire Departments, as well as ConnDOT District office before the system is taken out of service and indicate how long it is expected to be out of service.

The existing stand pipe system and its components and attachments shall be reused except for concrete anchoring hardware. In addition, it shall be modified to go around new scupper downpipes as shown in the Contract Documents. Where new components are required, as approved by the Engineer, they shall comply with the requirements noted herein. Storage of existing stand pipe system is included in this item.

All work shall conform to the requirements of the current edition of the National Fire Protection Association's "NFPA 14 – Standard for the Installation of Standpipe and Hose Systems" and the latest AASHTO LRFD Specifications.

Materials:

Certified Test Reports, Materials Certificate, and Certificate of Compliance

The Contractor shall furnish the Department with a written certification, signed by the pipe manufacturer, the pipe fittings manufacturer, the pipe joint gasket manufacturer, and the anchorage system manufacturer; all duly notarized, certifying that the particular products provided for this contract are suitable for the intended use (i.e. conveyance of potable water under high pressure); and that the manufacturer has supplied the same product for other jobs with similar applications. The form of certification shall be, in all respects, in conformance with Section 1.06.07, and satisfactory to the Engineer.

Pipe Supports
Structural steel for support members and anchorage plates shall conform to the requirements of ASTM A709, Grade 36 and shall be galvanized after fabrication to meet the requirements of ASTM A123.

Threaded rods, anchor bolts, bolts, washers and nuts shall conform to the requirements of ASTM F1554, Grade 36 and shall be galvanized to meet the requirements of ASTM A153. All hardware shall be hot dip galvanized in accordance with ASTM A153 or A123 as applicable.

Anchorage System
Threaded concrete inserts shall be compatible with the galvanized steel threaded rods and be of the Contractors design to support all applicable loads.

Chemical anchors and testing shall be in accordance with Section M.03.01-15 of the Standard Specifications.

Hose Couplings
The existing coupling and caps (top and bottom) shall be inspected and reused. If discovered as defective, it shall be promptly removed and replaced with in-kind.

Steel Pipe, Fittings and Couplings
Existing steel pipe, fittings and couplings shall be reused. Where new components are required, as approved by the Engineer, they shall comply with the requirements noted herein:

Pipe shall be mild steel, seamless or welded, Schedule 40, galvanized, ASTM A53, with threaded or cut grooved connections, as indicated on the plans. No rolled groove connections will be permitted.

Fittings shall be malleable iron threaded Class 150, galvanized, ANSI/ASTM B16.3, and ductile iron fittings for grooved connections, galvanized.

Pipe couplings shall be ductile iron, galvanized, at least 300 psi maximum working pressure and 10,000lb maximum end load, flexible or rigid type, as indicated on the Contract Drawings. Flexible couplings shall be Victualic Style 77 or approved equal, rigid couplings shall be Victualic Style 07 Zero-Flex or approved equal. Gaskets for grooved connections must be as recommended by the couplings manufacturer for the required service.

Other acceptable manufacturers of fittings and couplings for grooved connections are Anvil International and Tyco Fire Products. All fittings, couplings and gaskets for grooved connections must be from one manufacturer.

Pipe Guides
Pipe Guides shall be as shown on the drawings. All elements of the guide shall be galvanized.

Pipe Anchors
Pipe Anchors shall be as shown on the drawings. All elements of the anchor shall be galvanized. U-bolts shall be tightened securely to provide reliable anchoring of the pipe.

Galvanizing
Areas in which galvanizing has been damaged shall be given two (2) coats of zinc paint conforming to the requirements of the Federal Specification TT-P-641b or Military Specification MIL-P-21035.

Signs
Provide at the bottom of each standpipe as shown on the plans, a 1" drain outlet with a 1" normally open drain valve to spill on grade. Provide a sign at each drain outlet "DRY STANDPIPE: OPEN DRAIN VALVE AFTER USE".

A Fire Department Sign shall be approved by the Engineer. Wording of the sign is to be adjusted to meet site conditions and submitted to the Engineer for approval prior to fabrication. The sign shall be made from plastic or galvanized metal with a red background and white lettering.

Construction Methods:

Shop Drawings
Prior to the commencement of work and fabrication of any materials, the Contractor shall take all field measurements necessary to assure proper fit of the finished standpipe assemblies, and shall submit shop drawings to the Engineer for approval in accordance with Article 1.05.02-3. These drawings shall include, but not be limited to the following information:

A. A layout plan and elevation indicating pipe lengths for vertical and horizontal standpipe runs indicating sections of existing standpipe system being reused and shop drawings for any new components, type and number of fittings, couplings, supports and appurtenances for each location.
B. Commercial items shall be identified by manufacturer, trade name and catalog number. Catalog sheets, including pertinent specifications, shall be included with the submission.
C. All pipe supports, as shown on the plans, shall be detailed.
D. All field measurements shall be submitted for reference.
E. The Contractor shall submit a parts list including the quantity, make, model and supplier of all the materials incorporated into the work.

Horizontal standpipe runs shall be installed with a minimum 0.5% pitch toward the lowest end of the system to assure proper drainage of the system.

Working Drawings
The Contractor shall prepare and submit to the Engineer working drawings and design computations for any temporary and permanent support systems or bracing for review in accordance with Article 1.05.02. A Professional Engineer licensed in the State of Connecticut

shall seal the working drawings and design calculations. Each page of the working drawings shall have the seal of the Professional Engineer. Only the first page of the design calculations need to have the seal of the Professional Engineer. No work shall begin until acceptance of the drawings has been obtained from the Engineer.

Installation:
Install flexible connections between lengths of pipe anchored to substructure and superstructure so that pipes are in alignment at 50 degrees Fahrenheit and can move with thermal expansion.

Welding of pipe joints and welding of piping to supports shall not be permitted.

All existing and new pipe, fittings and such other items shall be carefully examined for defects immediately prior to installation and no pipe or fittings shall be used which is known to be defective in any way. Any pipe or fittings discovered as defective shall be promptly removed and replaced at no additional cost to the State. Proper and suitable tools and equipment for the safe and convenient handling and installation of the pipe, fittings and appurtenance shall be used, and great care shall be taken to prevent damage to the pipe coating and lining.

Pipe and fittings shall be thoroughly cleaned before being installed and shall be kept clean until accepted in the completed work. Open ends shall be closed with wooden or other suitable bulkheads at all times when pipe laying is not actually in progress.

Jointing of pipe or fittings shall be made only by persons thoroughly skilled in this work. All adjoining parts shall be thoroughly cleaned and inspected and the jointing done in strict accordance with the manufacturer's recommendations.

Testing:
Upon completion of the installations, each standpipe system shall be tested by the City/Town Fire Department in accordance with NFPA-14 — "Installation of Standpipe and Hose Systems"; and shall meet or exceed a minimum “Rated Working Pressure” of l50 psi and be tested to a minimum pressure of 200 psi for two hours.

At the completion and acceptance of the test, the standpipe system shall be drained.

All visible leaks in the joints shall be stopped and any cracked or defective pipe, or fittings shall be removed and replaced.

Method of Measurement:

This work shall be measured for payment by the number of fire suppression standpipe systems removed and reset and which pass the testing requirements.

Basis of Payment:

This work will be paid for at the Contract unit price, per each, for "Reset Fire Suppression System", complete and accepted in place, which price shall include removing, modifying, and resetting the existing fire suppression system, furnishing, fabricating, transporting, installing, surface preparation, galvanizing, and all materials, equipment, tools and labor incidental thereto. Cost of clearing and/or removal of vegetation and/or debris and additional maintenance and protection of traffic required for standpipe installation and testing shall be included in the bid for this item. Also included is the cost of any design, installation and maintenance of a temporary support system.

Pay Item	Pay Unit
Reset Fire Suppression System	Each

ITEM #1304025A - RESET MANHOLE (WATER)

Description: This item shall consist of the adjustment to final grade the manhole frames and covers on Water Manholes, all as shown, specified or directed. It shall also consist of the furnishing and the installation of additional manhole riser sections, brick masonry, where necessary, and metal manhole extension rings to manhole frame; where indicated on the plans or directed by the engineer.

Reference to the "District" in this item refers to "The Metropolitan District".

Materials: Materials shall conform to the following:

BRICK UNITS - Shall conform to ASTM C-32, Grade MS

MORTAR – Shall conform to Section M.11

MANHOLE RISER SECTIONS - Shall conform to ASTM C-478

MANHOLE RUNGS (STEPS) - Shall be 14 inches x 10 7/8 inches forged aluminum safety rung fabricated from 6061-T6 aluminum alloy as manufactured by ALCOA, or equal; or copolymer polypropylene steps in conformance with ASTM D4101, Grade 60 steel reinforcing rod, ASTM A615, with epoxy coating, ASTM A-934/M-95. The steps shall be either Model PS-1B or PS2-PFSL as manufactured by M.A. Industries, Inc. or equal.

MANHOLE EXTENSION RINGS - Shall conform to Article M.08.02-5 Metal for Drainage Structures. The type of manhole extension rings will be designed so that the existing manhole cover, when set in place, will have substantially the same bearing, fitness and load carrying capacity as existed in the existing manhole frame. The extension rings shall be designed to fit into the original manhole frame resting specifically on the flange area that originally supported the manhole cover.

Construction Methods: The Contractor shall carefully excavate the manhole frame and cover and add or delete brick masonry as necessary to reset the frame and cover to the final grade.

The present cover slab or cone section may be reused if it is not damaged. If the cover slab or cone section is damaged, it shall be replaced by the Contractor at his expense.

The Contractor may be required to "un-stack" the existing cone section so that riser sections can be added or deleted, where the change in grade is greater than 12 inches.

The distance between the proposed elevation of the manhole cover and the first manhole step shall be a minimum of 12 inches and a maximum of 16 inches.

Any material damaged by the Contractor shall be repaired or replaced by the Contractor at no cost to the Town, State or District.

Where the change in grade is 3 inches or less, metal manhole extension rings shall be used to raise and support the existing manhole covers to the grade of the proposed roadway surface without disturbing the existing manhole frame.

Method of Measurement: The work for "Reset Manhole (Water)" will be measured for payment by the actual number of each manhole reset to grade and accepted by the Engineer.

Basis of Payment: This work will be paid for at the Contract unit price for each contract price for "Reset Manhole (Water)" complete in place, which price shall include all labor and equipment necessary to incorporate the manhole into the work. It shall also include the clearing, trenching, excavation and disposal of excavated materials, refilling trenches, furnishing additional material for refilling, grading, sheeting, bracing, pumping, and temporary and permanent resurfacing of disturbed areas.

The maximum 3 feet vertical adjustments shall not apply to adjusting water main manholes, and there will be no extra compensation for adjusting the manhole in excess of 3 feet.

Pay Item	Pay unit
RESET MANHOLE (WATER)	EA.

ITEM #1403501A - RESET MANHOLE (SANITARY SEWER)

DESCRIPTION

Work under this item shall include furnishing materials, equipment and labor for the resetting of sewer manholes within the project limits to meet the proposed grades at each location as ordered by the Engineer.

MATERIALS

Brick intended for use below ground level shall conform to ASTM C-32-04 except that the table therein is amended to provide that the required minimum compressive strength in pounds per square inch shall be for any individual brick 3,000 pounds, for the average of five brick selected at random 4,000 pounds, and the maximum absorption of water by five-hour boiling test shall not exceed 18% for any individual brick or 15% for the average of any five brick selected at random. The above strength and absorption requirements, being somewhat less exacting than part of those of ASTM, are intended to admit the use of the product of most, but not all, of the brick manufacturing plants in the vicinity of Hartford.

Mortar shall be composed of one part portland cement and two parts, by volume, of surface dry fine aggregate.

Extension rings for raising manhole frames will be provided by the Metropolitan District Commission at no cost. Adjustment of manhole frames by this method is limited to 2".

All materials furnished by the Metropolitan District Commission must be picked up at the Metropolitan District Commission Yard at Maxim Road. Contractors are to be accompanied by the City of Hartford Construction Inspector assigned to the project.

CONSTRUCTION METHODS

For sewer manholes where extension rings are not used, bituminous concrete pavement and/or reinforced concrete base shall be removed around the frame, the walls or sides shall be rebuilt to conform to the required elevation of the new construction and the frames and grates or covers reset to within 1/4” of proposed grade.

When a new precast section is added, it is the responsibility of the contractor to ensure that the joint of the new precast section will interlock properly with that of the existing section below. All washers and bolts shall be replaced and tightened prior to acceptance.

If frames or covers are found to be broken or damaged, they shall be replaced with new material conforming to the requirements of the Metropolitan District Commission. The

Metropolitan District Commission will provide replacements at no charge provided these fixtures were not damaged by the contractor during his operations.

Frames and covers to be reset shall be removed from their existing beds. The existing brick work or concrete shall be cleaned to ensure a good bond prior to laying fresh brick and mortar against it. The walls or sides of the manhole shall be rebuilt to conform to the requirements of the Metropolitan District Commission and the frames and covers reset on full mortar beds. Each brick shall be thoroughly wet before laying and shall be laid with a push joint, that is, by placing sufficient mortar on the bed and forcing the brick into it; so as to fill every joint with mortar in one operation, whether on the bottom side, or end of the brick.

Mortar joints shall not be over 1/4" except on the outside curved manhole walls. All brick work shall be raked brick, unless toothing is specifically ordered by the Engineer.

The outside of all brick work which is below ground shall be covered, as soon as possible after laying with a coat of mortar not less than 1/4" in thickness.

METHOD OF MEASUREMENT

"Reset Manhole (Sanitary Sewer)" will be measured for payment as units, completed and accepted by the Engineer.

BASIS OF PAYMENT

Payment for this work will be measured by the number of units of "Reset sewer manhole" completed and accepted and will be paid as follows:

Reset Manhole (Sanitary Sewer)	EA

ITEM #1507000A - PROTECTION AND SUPPORT OF EXISTING UTILITIES

Description: Work under this item shall consist of the design, construction, maintenance and removal of temporary protection and temporary support for existing utilities.

Temporary steel plating shall be installed over the existing Comcast underground conduit in Airport Road as called for on the staging plans. The plating shall be of sufficient thickness to support construction vehicle loads until such time that the final pavement course is installed. The platting shall be removed prior to the final paving.

The protection and support of the existing Incident Management System (IMS) conduits on or near Bridge Nos. 00480, 0813, 01459, 01460 and 01466, which will be necessary during the bridge reconstruction work as shown on the plans, as directed by the Engineer and in accordance with these specifications.

The protection and support of the existing Comcast and Level 3 underground facilities adjacent to and west of the entrance ramp to US 5 / RTE 15 SB from East River Drive will be necessary during the replacement of drainage piping as shown on the plans, as directed by the Engineer and in accordance with these specifications.

Contractors are cautioned that it is their responsibility to verify locations, conditions and field dimensions of all existing features, as actual conditions may differ from information indicated on the plans or contained in these specifications.

Materials:

The materials for this work shall be of satisfactory quality for the purpose intended and shall be approved by the Engineer. The material shall be intended for use in structures, trench or excavations and shall be sound and capable of safely carrying the specified loads.

Construction Methods:

The Contractor is herein made aware that construction will require the installation of shoring or other lateral support work and will require construction beneath or adjacent to active conduits and duct banks.

The Contractor is advised that no service interruption resulting from his operations will be allowed, except as otherwise provided for in Section 1.05 – Control of the Work or Section 1.08 - Prosecution and Progress. Extreme caution shall be exercised during all stages of construction in order to preserve the existing IMS. A Department representative shall be present at the installation of the temporary supports. Further attention shall be paid to "Section 1.07 – Legal Relations and Responsibilities," and the Notices to Contractor for "Existing IMS" and "Installation Qualifications".

The Contractor shall notify the Engineer prior to the start of his work and shall be responsible for all coordination with the Department. The Contractor shall allow the Engineer complete access to the work.

The Contractor shall prepare working drawings and computations showing his proposed method of support and protection for the IMS to be supported and protected. Preparation of working drawings and computations shall conform to the requirements of Subarticle 1.05.02. The support shall safely carry all IMS dead loads and any imposed loadings under all possible construction conditions. Said supports and protections shall be constructed in a manner that will not interfere with the partial the existing structure or its reconstruction.

The Contractor's design shall consider the stiffness of the existing conduit system including connections to the parapet and shall allow for a small magnitude lateral shift of the conduit to accommodate formwork for the concrete reconstruction.

When the temporary supports are no longer required, they shall be removed from the site by the Contractor.

At locations where existing conduit supports are within the limits of concrete removal and reconstruction, the Contractor shall either salvage the existing support or reuse or furnish and install a typical IMS conduit support per standard.

Method of Measurement: This work shall be paid on lump sum basis and will not be measured for payment.

Basis of Payment: The work will be paid for at the contract lump sum price for "Protection and Support of Existing Utilities," which price shall include designing and detailing the temporary supports and furnishing and installing permanent supports, temporary plating or shields, periodic inspection and removing temporary supports and installing permanent supports, and all materials, equipment, tools and labor incidental thereto.

Pay Item	Pay Unit
Protection and Support of Existing Utilities	l.s.

ITEM #1806226A - PRE-WARNING VEHICLE

Description: Work under this item shall include furnishing, deploying and maintaining a Truck-Mounted Impact Attenuator equipped with a changeable message sign (CMS) for use as a Pre-Warning Vehicle (PWV) in a rolling road block operation on limited access highways. Impact attenuators shall only be truck-mounted. The message on the sign shall warn motorists of slow or stopped traffic conditions.

Materials: The Truck-Mounted Impact Attenuator shall meet the requirements of Article 18.06.02, except replace all instances of "flashing arrow," "arrow sign," and "arrow" with "CMS".

The CMS shall meet the requirements of Article 11.31.02, with the following amendments:

1. **Physical Characteristics of the CMS**
   a) Mounting – The CMS shall be truck mounted only
   b) Sign Display Dimensions – Width of 6 feet, height of 4 feet
2. **Visual Characteristics of the CMS Display**
   a) Sign Type – CMS shall have a LED display only
   b) Color – CMS shall have black background with orange, yellow, or amber legend
   c) Characters – Letter height shall be 13 inches; Single stroke
   d) Visibility– CMS brightness must provide for visibility at 1/2 mile
   e) Message – The message shall read as follows, or shall be as directed by the Engineer:

Frame 1: SLOWED TRAFFIC AHEAD
Frame 2: BE PREPARED TO STOP
Or
Frame 1: STOPPED TRAFFIC AHEAD
Frame 2: BE PREPARED TO STOP

Construction Methods: The PWV shall be initially positioned in the right shoulder ½ mile prior to the rolling road block operation.

If a traffic queue reaches the PWV's initial location, the Contractor shall slowly reverse the PWV along the shoulder to position itself prior to the new back of queue.

The Contractor shall meet the requirements of Article 18.06.03.

Method of Measurement: This work will be measured for payment by the actual number of hours that the Pre-Warning Vehicle is used to alert motorists of slowed or stopped traffic ahead.

Basis of Payment: This work will be paid for at the Contract unit price per hour for "Pre-Warning Vehicle," which shall include the furnishing and use of the pre-warning vehicle and a driver, attenuator reflector, flashing lights, changeable message sign, and all equipment, materials, tools, labor, disposal of damaged Truck-Mounted Impact Attenuator components and work incidental thereto.

Pay Item	Pay Unit
Pre-warning Vehicle	hr

ITEM #2999998A - ON-THE-JOB TRAINING PROGRAM

This On-The-Job Training Program Special Provision supersedes Section 7b of the Required Contract Provision entitled "Specific Equal Employment Opportunity Responsibilities", as amended, and is included in this contract in implementation of Title 23
U.S.C. Section 140(a) as established by Section 22 of the Federal-Aid Highway Act of 1968.

As part of the Contractor's equal employment opportunity affirmative action program, on-the-job training shall be provided as follows:

The Contractor shall provide on-the-job training aimed at developing and retaining full journeypersons in the type of trade involved. The number of trainee hours required under this program for this project is 40,000 hours. In the event the Contractor subcontracts a portion of the contract work, he shall determine how many, if any, of the trainee hours are to be trained by the subcontractor, however, the Contractor shall retain the primary responsibility for meeting the training requirements imposed by this provision. The Contractor shall also ensure that this On-the-Job Training Special Provision is made applicable to such subcontract.

The Contractor shall submit for approval to the CDOT Office of Contract Compliance a training outline for each trainee or apprentice that will be trained on this project. The training outline shall include the trade, the training categories, the number of training hours that will be provided, and if there will be any off-site training. If the Contractor is participating in a bona fide apprenticeship program approved by the Connecticut State Labor Department (CDOL) Apprentice Training Division, identification of such apprentice program shall also be submitted to CDOT.

Training and upgrading of minorities and women toward journeymen status is a primary objective of this Training Special Provision. Accordingly, the contractor shall make every effort to enroll minorities and women (e.g., by conducting systematic and direct recruitment through public and private sources likely to yield minority and women trainees) to the extent that such persons are available within a reasonable area of recruitment. The contractor will be responsible for demonstrating the steps that he has taken in pursuance thereof, prior to a determination as to whether the contractor is in compliance with this Training Special Provision. This training commitment is not intended, and shall not be used, to discriminate against any applicant for training, whether a member of a minority group or not.

A Contractor choosing to utilize a non-apprenticeship program shall make use of the supportive services consultant and/or make every effort to enroll minority and women trainees or apprentices by conducting systematic and direct recruitment through public and private sources likely to yield minority and women trainees to the extent such persons are available within a reasonable area of recruitment. The Contractor will be given an opportunity and will be responsible for demonstrating the steps that he has taken in pursuance thereof; prior to a determination as to whether the Contractor is in compliance with this Training Special Provision.

No employee shall be employed as a trainee or apprentice in any classification in which he/she

has successfully completed a training course leading to journeyperson status or in which he/she has been employed as a journeyperson.

After the award of the Contract and prior to the order to start date, the Contractor shall in conjunction with the required schedule of progress or time chart, submit and obtain approval for the number of trainees or apprentices for each classification selected and provide the training outline for each classification and the estimated start date of each trainee as it relates to the schedule of progress or time chart.

The minimum length and type of training for each classification will be as established in the training program selected by the Contractor and approved by CDOT and the FHWA. CDOT and the FHWA shall approve a program if it is reasonably calculated to meet the equal employment opportunity obligations of the Contractor and to qualify the average trainee or apprentice for journeyperson status in the classification concerned by the end of the training period. Furthermore, programs approved by the U.S. Department of Labor (USDOL) or CDOL, including apprenticeship programs, shall be considered acceptable under this On-the-Job Training Program Special Provision, except in those cases where the Secretary of Transportation, the Federal Highway Administrator, or CDOT, has determined that the program is not administered in a manner consistent with the equal employment obligations of Federal-aid highway construction contracts.

The Contractor shall furnish each trainee or apprentice with a copy of the program that will be followed in providing the training. The Contractor shall provide each trainee or apprentice with a certification showing the type and length of training satisfactorily completed.

The Contractor shall provide for the maintenance of records and furnish monthly and final reports documenting his performance under this On-the-Job Training Special Provision to the Engineer. The monthly updates and final report shall be made on forms provided by CDOT or by providing signed copies of the "Apprentice Handbook and Progress Record" provided by CDOL.

In the event that the Contractor intends to transfer a trainee or apprentice to another CDOT, (FHWA funded) project, the Contractor shall provide CDOT with a minimum of a 14-day advance notice.

Except as otherwise noted below, the Contractor will be reimbursed at $0.80 per hour of training given an employee in accordance with an approved training or apprenticeship program. As approved by CDOT, reimbursement may be made for training hours in excess of the number specified. This reimbursement will be made even though the Contractor receives additional training program funds from other sources, provided such other source does not specifically prohibit the Contractor from receiving other reimbursement.

Payment for training is made upon completion of the training program on this Contract or as agreed upon by CDOT.

No payment shall be made to the Contractor if either the failure to provide the required training,

or the failure to hire the trainee as a journeyperson, is caused by the Contractor. It is normally expected that a trainee or apprentice will remain on the project as long as training opportunities exist in his work classification or until he has completed his training program. It is not required that all trainees or apprentices be on board for the entire length of the Contract. A Contractor will have fulfilled his responsibilities, under this On- the-Job Training Special Provision, if he has provided acceptable training for the number of hours specified in the Training Program.

Trainees will be paid at least 60 percent of the appropriate minimum journeyman's rate specified in the Contract for the first half of the training period, 75 percent for the third quarter of the training period, and 90 percent for the last quarter of the training period, unless apprentices or trainees in an approved existing program are enrolled as trainees on this project. In that case, the appropriate rates approved by the Department of Labor in connection with the existing program shall apply to all trainees or apprentices being trained for the same classification who are covered by this On-the-Job Training Program Special Provision.

The number of hours shown on the proposal form for Item #2999998A On-The-Job Training Program is not to be altered in any manner by the bidder. Should the bidder alter the amount shown, the altered figures will be disregarded and the original quantity will be used to determine the amount bid for the contract.

The On-The-Job Training Pilot Program will not apply for this project. The 40,000 hour requirement must be met, regardless of a firm's participation in the Pilot Program. However, the trainees utilized on this project can be used to meet a firm's trainee requirements if the firm is enrolled in the OJT Pilot Program.

The contact person for the Office of Contract Compliance for the On-The-Job Training Program is Phylisha Coles (Phylisha.coles@ct.gov, 860-594-2178).

Pay Item	Pay Unit
On-The-Job Training Program	Hour

PERMITS AND PERMIT APPLICATIONS

PROJECT NO. 63-703

- Flood Management General Certification
- United States Coast Guard Coordination Letter
- OLISP Coastal Maintenance General Permit
- CTDEEP Stormwater Construction General Permit
- CTDEEP Inland Wetlands and Watercourses General Permit
- Programmatic General Permit 401 Water Quality Certification (PGP)
- Army Corps of Engineers Section 404 Pre-Construction Notification (PCN)
- Environmental Land Use Restriction (ELUR)
- Disruption Authorization Permit

PROJECT NO. 159-191

- Flood Management General Certification
- United States Coast Guard Coordination Letter
- OLISP Coastal General Maintenance
- CTDEEP Stormwater Construction General Permit
- CTDEEP Inland Wetlands and Watercourses General Permit
- Army Corps of Engineers Self Verification (SV)