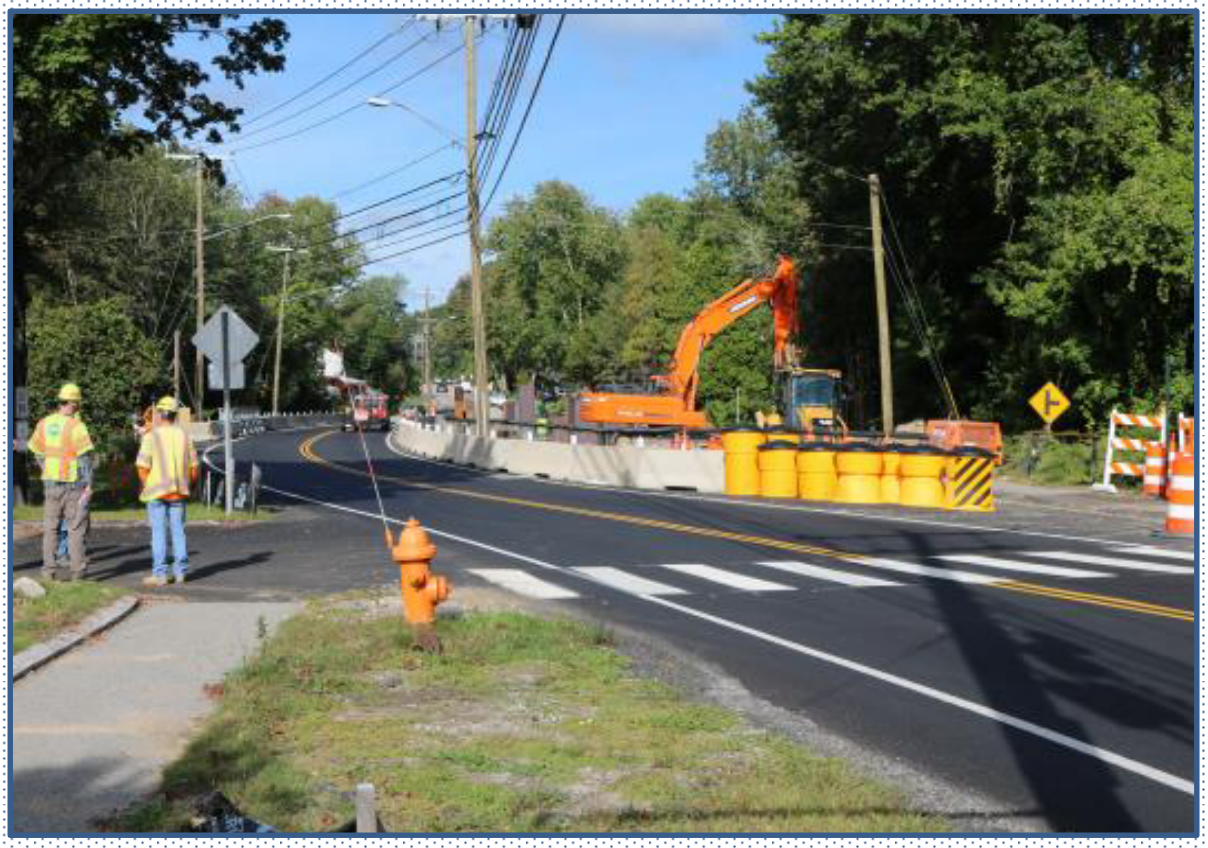
Work Zone Safety and Mobility

PROCESS REVIEW

2017 FINAL REPORT



WORK ZONE SAFETY and MOBILITY
PROCESS REVIEW FINAL REPORT

December 2017

This Work Zone Safety and Mobility Process Review Report was jointly prepared by the Connecticut Department of Transportation and the Federal Highway Administration, and is evidence of Connecticut's compliance with 23 CFR 630.1008(e).

STATE OF CONNECTICUT
DEPARTMENT OF TRANSPORTATION
BUREAU of ENGINEERING and CONSTRUCTION

By: Ravi V. Chandran Digitally signed by Ravi V. Chandran DN: C=US, E=ravi.chandran@ct.gov, O=CT DOT, OU=Construction, CN=Ravi V. Chandran Date: 2017.12.27 08:39:04-05'00' Date: _____

for Mark D. Rolfe, P.E.
Bureau Chief and Chief Engineer

FEDERAL HIGHWAY ADMINISTRATION

By: _____ Date: _____

Amy D. Jackson-Grove
Division Administrator

TABLE OF CONTENTS

EXECUTIVE SUMMARY

This Process Review was conducted jointly by the Connecticut Department of Transportation (CTDOT or Department) and the Federal Highway Administration (FHWA) Connecticut Division to comply with the requirements of 23 CFR Part 630, Subpart J – *Work Zone Safety and Mobility*. It is the fourth such process review conducted for this program area since this regulation became effective on October 12, 2007.

Six (6) areas of observation were documented with corresponding recommendations for improvements (see Observations and Recommendations). The key areas which require continuous focus are summarized as follows:

- **Annual Field Reviews** – CTDOT's goal is to conduct a minimum of ten (10) regular reviews and four (4) in-depth reviews per year.
- **Performance Measures** – CTDOT is conducting data reviews, researching for opportunities to establish and implement performance measures for work zone congestion, delays, and crashes.
- **Policies** – CTDOT needs to continuously review its policy statements concerning Work Zone Safety and Mobility, and look for opportunities for improvement, including references to current federal regulations when applicable.
- **Directives** – CTDOT Office of Construction issued new directives for the proper use of the Rolling Road Block operation and the implementation of the Smart Work Zone Guide.
- **Smart Work Zone Technology** – CTDOT has researched and implemented new technology to enhance safety and mobility through specific project work zones.
- **Regional Traffic Coordination** – CTDOT has made an increased effort to coordinate lane closures and detour routes among projects located in the same area to mitigate traffic impacts.

This biennial review process addresses the steps required to support these observations.

Work Zone field reviews of active construction projects have been conducted annually by CTDOT since the 2010 Work Zone Self-Assessment. Findings and recommendations resulting from these field reviews were provided by the CTDOT Office of Construction directly to the project personnel for action subsequent to each site visit.

Several best practices for CTDOT's implementation of the Work Zone Safety and Mobility program were found through the work zone field reviews. These best practices are going to be evaluated to see if they can be implemented on a broader scale.

The last Work Zone Process Review reported the findings of the 2013 and 2014 Work Zone Safety Field Reviews and these findings have become action items to improve the Department's Work Zone Program. Any action items still ongoing or pending have been

noted in this 2017 report as continuous efforts of the work zone program. Also, the 2015 and 2016 Work Zone Safety Field Review findings have been added to the list to be addressed.

Work zone performance measures are in the developmental stages for specific projects.

- Operational performance measures have been tested by analyzing data obtained from a Smart Work Zone System on a major highway reconstruction project on I-84.
- Safety performance measures have been explored by cross-referencing data from the UConn Crash Repository and the CTDOT's Project Web-GIS Map to ascertain if work zone crash data can be associated to projects.

These tools may provide the framework to establish work zone performance measures in the future.

The next required Work Zone Process Review should be completed by December 31, 2019.

BACKGROUND

Federal Regulations

23 CFR Part 630, Subpart J – *Work Zone Safety and Mobility*, contains the requirements and guidance for systematically addressing and managing work zone safety and mobility impacts on federal-aid highway projects. This Process Review was prepared to comply with 23 CFR Part 630.1008, paragraph (e), *State-level processes and procedures*, that requires States to perform a process review every two years in order to assess the effectiveness of work zone safety and mobility procedures.

To help States evaluate their work zone practices and to assess work zone practices nationally, FHWA developed the Work Zone Safety and Mobility Self-Assessment (WZ SA) tool. The WZ SA tool consists of 46 questions designed to assist those with work zone management responsibilities in assessing their programs, policies, and procedures against many of the good work zone practices in use today. The policies, strategies, processes, and tools identified in the WZ SA were gathered from the best practices currently in place in State departments of transportation (DOTs), metropolitan planning organizations, and local municipalities. Many of the items can be found in the *Work Zone Best Practices Guidebook*.

The work zone areas that were found to need improvement have laid the foundation of the Work Zone Safety and Mobility Process Review.

Moving Ahead for Progress in the 21st Century Act (MAP-21)

MAP-21 as amended became effective on October 1, 2012. Section 1405 *Highway Worker Safety* requires the Secretary of Transportation to modify 23 CFR Part 630.1108, paragraph (a) *Work zone safety management measures and strategies,* concerning the use of positive protective measures to separate workers on highway construction projects from motorized traffic. New rulemaking by FHWA is still pending.

Fixing America's Surface Transportation Act (FAST Act)

The FAST Act directs FHWA to move rapidly to finalize regulations as directed in MAP-21 for highway work zones to protect workers.

PURPOSE and OBJECTIVE

The purpose and objective of this Process Review is to comply with the requirements contained in 23 CFR Part 630.1008, paragraph (e) and to determine whether the CTDOT is adequately and programmatically identifying, addressing, and managing work zone safety and mobility impacts on its highway projects.

The results of this Process Review are intended to produce systematic improvements to work zone processes and procedures with the objective of improving safety and mobility on current and future highway projects in Connecticut.

SCOPE and METHODOLOGY

Scope of Review

The scope of this Process Review included six (6) areas to provide a statewide and programmatic perspective regarding the current status of work zone safety and mobility in Connecticut. The scope of each area is discussed below.

2015-2016 Work Zone Safety Field Reviews

Work zone field reviews were held for randomly selected active highway construction projects administered by CTDOT. These field reviews were performed in order to assess current field practices relative to work zone safety and mobility.

During a regular work zone safety field review, personnel from the CTDOT Office of Construction and Division of Traffic Engineering were accompanied by project staff from the Construction District to tour selected projects during active construction operations.

For in-depth field reviews, staff from the Office of Construction, the Division of Traffic Engineering, the Construction District, and FHWA attended. Reports documented both successes and areas of improvement for the individual projects reviewed.

The reviews included an overview of traffic control devices, sign installation and removal methods, sign recognition and visibility, and a questionnaire for project personnel to determine strengths and weaknesses in work zone procedures. The goal was to identify best practices and needed improvements through consensus among the various offices present.

Projects were chosen from each of the four (4) districts in the state:

- District 1 – Central Connecticut
- District 2 – Eastern Connecticut
- District 3 – Southwestern Connecticut
- District 4 – Western Connecticut

Each review had multiple focus areas, selected from a predetermined list. Once a project was selected, the review team was notified, and a date for the field review was scheduled. The field review team typically met with project personnel at the field office for an initial meeting to answer the questionnaire, and then proceeded to conduct a field review of all other aspects of the work zone. Upon completion of the field review, a report was generated detailing the findings and recommendations. These reports were circulated to the review team and project personnel for comments before being finalized.

For the two (2) construction seasons covered, a total of twenty-eight (28) regular field reviews and eight (8) in-depth reviews were conducted. Six (6) areas of focus were selected for the 2015-2016 field reviews:

- Detours
- Night Work
- Pedestrian/Bicycle Access
- Stage Construction
- Temporary Lane Closures
- Temporary Signalization

Tables 1a & 1b below summarizes the number of reviews conducted. In addition, the tables also show the areas of focus on active construction projects in each of the CTDOT Districts.

Table 1a – Summary of 2015 Work Zone Field Reviews

	District 1	District 2	District 3	District 4	**TOTAL**
TOTAL PROJECTS REVIEWED	**4**	**6**	**4**	**2**	**16**
Focus Areas					
Detour		2	3	1	**6**
Night Work	3	2	3	1	**9**
Pedestrian / Bicycle Access	1	1	3	2	**7**
Stage Construction	1	3	2	1	**7**
Temporary Lane Closure	3	4	3	1	**11**
Temporary Signalization		2	2	1	**5**

Table 1b – Summary of 2016 Work Zone Field Reviews

	District 1	District 2	District 3	District 4	**TOTAL**
TOTAL PROJECTS REVIEWED	**5**	**4**	**5**	**5**	**20**
Focus Areas					
Detour	3	2	5	4	**15**
Night Work	2	3	5	5	**15**
Pedestrian / Bicycle Access	3	2	4	3	**12**
Stage Construction	3	4	5	5	**17**
Temporary Lane Closure	5	4	5	5	**19**
Temporary Signalization	2		5	2	**9**

Each year a Work Zone Safety Review Annual Report is compiled, summarizing the findings and recommended changes found for that year. Each report contains an

executive summary, a table of action items, and copies of the work zone review reports. A new Work Zone Review database has been created to allow better querying of information. The reviews for 2015 and 2016 have been entered into the data base to have those findings easily queried for a specific focus. The database created in 2010 will be archived if past information is needed. CTDOT has continued to conduct annual work zone field reviews every construction season since 2010 in order to continually improve work zone safety for construction crews and the traveling public.

Work Zone Program Performance Measures

Work Zone Performance Measures are being investigated in the areas related to safety and congestion.

Work Zone Safety Performance Measures

Accurate crash data is necessary to develop Work Zone safety performance measures. Such data would include, but is not limited to:

- Number of crashes
- Types of crashes
- Severity of crashes
- Location in relation to the work zone

A new crash reporting form has been implemented in Connecticut beginning January 1, 2015, which identifies crashes within work zones. Now that this key element is in place, CTDOT is beginning to track, analyze and report on work zone related incidents. Therefore, it will take several years of compiling reported information to have enough data to adequately create meaningful performance measures.

Work Zone Operational Performance Measures

Operational data is also necessary to develop Work Zone congestion related performance measures. This data is more difficult to acquire and includes, but is not limited to:

- Historical and real time speed
- Travel time and delay
- Queue length
- Traffic Volume in real time

Operational related data is produced in a variety of ways. Collecting some of this data in-house can be labor and time intensive and requires specialized equipment. However, purchasing data such as real time speed and travel time from a third party can be extremely costly. This data will most likely come from a combination of sources and is fundamental to developing operational related performance measures.

Data from the Smart Work Zone System (SWZS) on Project No. 0151-0273, I-84 in Waterbury is being analyzed to explore project specific Work Zone operational performance measures. Other projects with SWZS will be analyzed in the future.

Delay is a measure of the extra time incurred by motorists due to the presence of the work zone. It is measured in terms of average delay per vehicle. The delay data is derived as a function of the speed, travel time and traffic volume through the work zone. Baseline speed and travel time data should be used as a benchmark for comparison. The actual data values are compared to the benchmark data to determine the extent the work zone has created a negative mobility impact. Historical baseline data is being used as the benchmark for comparison because it allows for the separation of the actual work zone mobility impacts from pre-construction recurring congestions. The values of the benchmark data varies by time of day rather than a constant benchmark such as the posted speed limit or a theoretical variable travel speed. Accurate volume data from sensor counts is vital to determine the average delay per vehicle and the total vehicle delay in hours.

Queue length is a measure of congestion experienced in a work zone when reported travel speeds drop below a pre-defined threshold selected by the agency. This is not measured directly but is an estimated length and duration based on a selected speed threshold. Queue traffic is typically identified where the traffic is stopped or slowed more than 25 mph below the posted speed limit. The deployed SWZS is not configured to measure the traffic flow density (vpmpl) and to determine queue lengths.

CTDOT must proceed cautiously in this endeavor, as there is much to be learned and researched prior to developing any value added performance measures in these areas.

CTDOT Work Zone Policies

Nine (9) work zone policies and two (2) memoranda referencing work zone procedures (Appendix 5) were identified. These policies and memoranda are currently being reviewed and suggested changes will be submitted to the appropriate approving authority.

CTDOT Engineering & Construction Directives

Construction Directive CD-2016-2: Work Zone Safety Rolling Road Block Procedure was issued on April 11, 2016. The procedure includes the allowable time for a Rolling Road Block and when a Rolling Road Block can be used. This was created to help mitigate traffic delays incurred by traffic pattern set ups and break downs during construction operations.

Engineering & Construction Directive ECD-2017-2: Implementation of Smart Work Zones Guide was issued on June 22, 2017. The guide introduces SWZ concepts, components, goals, objectives, and applications for project designers to use.

(Appendix 6: Engineering & Construction Directives)

Smart Work Zone Technology

The Process Review Team has researched and implemented the use of Smart Work Zone (SWZ) technology within work zones to display real time information to motorists and collect data for performance measures. The use of SWZ technology is a critical public information tool, and can aid in making more informed choices about improving work zone set ups and traffic mobility in and around them.

Regional Transportation Management Plan

CTDOT has made efforts to coordinate traffic impacts within highly congested corridors and regions. Although federal regulations require the use of Transportation Management Plans for significant projects, the plans are usually limited to traffic coordination between projects adjacent to one another or areas immediately surrounding the project. When multiple projects are actively working in a corridor, motorists try to avoid the restricted areas by diverting to other less travelled routes which can result in the whole corridor being congested.

In 2017, the Department made a concerted effort to address two Regional Transportation Management Plans: Hartford Region and Norwalk/Westport Region. Both plans will attempt to coordinate staging plans for projects active in construction for the 2017-2019 construction seasons. There are a number of significant projects with high impacts coming out in that timeframe along with other smaller projects surrounding them administered by Construction, Maintenance, and Municipal entities. The regional coordination will bring together project managers and stakeholders to mitigate traffic conflicts.

PROCESS REVIEW TEAM MEMBERS

The members of the Process Review team that conducted and analyzed the 2015-2016 work zone field reviews or compiled the final process review report were:

James P. Connery, *Construction Division Chief* (**CTDOT Construction**)
Anthony O. Kwentoh, *Transportation Supervising Engineer* (**CTDOT Construction**)
Dean S. Dickinson, *Transportation Engineer 3* (**CTDOT Construction**)
Shannon N. Brewster, *Transportation Engineer 2* (**CTDOT Construction**)
Kiah A. Patten, *Transportation Engineer 2* (**CTDOT Construction**)
John S. DeCastro, *Maintenance Manager* (**CTDOT Highway Operations**)
Frederick E. DiNardi, *Maintenance Planner 2* (**CTDOT Highway Operations**)
Joseph P. Ouellette, *Transp. Supervising Engineer* (**CTDOT Traffic Engineering**)
Michael A. Chachakis, *Transportation Engineer 3* (**CTDOT Traffic Engineering**)
Maribeth C. Wojenski, *Assistant Planning Director* (**CTDOT Policy & Planning**)
Kerry Ross, *Transportation Supervising Planner* (**CTDOT Policy & Planning**)
Bradley J. Overturf, *Transportation Supervising Planner* (**CTDOT Policy & Planning**)
Edgardo D. Block, *Transportation Supervising Engineer* (**CTDOT Policy & Planning**)
Craig J. Babowicz, *Transportation Engineer 3* (**CTDOT Policy & Planning**)
Michael Cohen, *Transportation Engineer 3* **(CTDOT Policy & Planning)**
Robert W. Turner, *Safety / Area Engineer* (**Federal Highway Administration**)
Anthony A. Lorenzetti, *Technical Associate* (**UConn Technology Transfer Center**)

OBSERVATIONS and RECOMMENDATIONS

2015-2016 Work Zone Safety Field Reviews

- Observation No. 1-1:

  Issues were identified in the various subject areas including accommodation of stakeholder needs, best practices, conducting more thorough plan reviews, coordination of traffic signs, design issues, managing work zone traffic, opportunities to enhance safety, opportunity for policy improvements, pedestrian issues, Rolling Road Blocks, training needs, and unit communication. The issues are listed within the Action Items section of this report.

  Recommendation:

  The issues will be assigned to the appropriate office for resolution. The progress of the items will be noted within the recommendations of the Action Items List (Appendix 1).

  Compliance:

  The most significant avenue to address the findings listed is through training of the staff directly involved. For the findings from the 2015 and 2016 reviews, training was given to the construction inspectors during their Annual Winter Training. Other findings related to Engineering or Planning have been brought to the respective unit's attention to be resolved through policy or coordination with staff.

  Resolution:

  Keeping staff aware of the issues found in the field is an ongoing effort within the engineering and construction process.

- Observation No. 1-2:

  In 2015, the Work Zone Review Team completed twelve (12) regular reviews and four (4) in-depth reviews. In 2016, the team completed sixteen (16) regular reviews and four (4) in-depth reviews (Appendix 2).

  Recommendation:

  The recommendation of having a list of potential projects at the beginning of the year and contacting project personnel at the start of work has been an effective method to ensure the goal of ten (10) regular reviews and four (4) in-depth reviews were being met.

Work Zone Program Performance Measures

- Observation No. 2-1:

Using the SWZS for Project No. 0151-0273, the average daily speed, volume and travel time between construction hours (M-F 9pm to 6am) for time period Jul 2015 to Dec 2016, was compared to the established baseline (pre-construction May – Jun 2015). Initial comparisons of the data are summarized below.

Average Daily Speed (MPH) - Construction Hours

I-84 EB			
Quarter	Baseline	Quarterly Mean	Difference
Jul - Sep 15	55.76	54.22	-1.53
Oct - Dec 15	55.76	55.10	-0.66
Jan - Mar 16	55.76	56.79	1.03
Apr - Jun 16	55.76	55.77	0.02
Jul - Sep 16	55.76	52.74	-3.01
Oct - Dec 16	55.76	54.57	-1.19

I-84 WB			
Quarter	Baseline	Quarterly Mean	Difference
Jul - Sep 15	55.70	54.77	-0.93
Oct - Dec 15	55.70	55.20	-0.50
Jan - Mar 16	55.70	57.24	1.54
Apr - Jun 16	55.70	56.12	0.42
Jul - Sep 16	55.70	54.49	-1.21
Oct - Dec 16	55.70	53.19	-2.51

Legend: faster traffic thru wz; slower traffic thru wz

Posted Speed Limit is 55 mph

The speed drops noted in the data analysis for the Average Daily Speeds were deemed to be minimal and would not result in quantifiable queue lengths.

Average Daily Volume (Veh) - Construction Hours

I-84 EB			
Quarter	Baseline	Quarterly Mean	Difference
Jul - Sep 15	11259	8277	-2981
Oct - Dec 15	11259	7124	-4134
Jan - Mar 16	11259	5154	-6105
Apr - Jun 16	11259	6605	-4654
Jul - Sep 16	11259	6808	-4450
Oct - Dec 16	11259	6115	-5144

I-84 WB			
Quarter	Baseline	Quarterly Mean	Difference
Jul - Sep 15	11234	7464	-3770
Oct - Dec 15	11234	5960	-5274
Jan - Mar 16	11234	5183	-6052
Apr - Jun 16	11234	6406	-4828
Jul - Sep 16	11234	6741	-4493
Oct - Dec 16	11234	6148	-5086

Legend: less congestion/more diversion thru wz; more congestion/less diversion thru wz

Average Daily Travel Time (min) - Construction Hours

I-84 EB			
Quarter	Baseline	Quarterly Mean	Difference
Jul - Sep 15	8.31	8.65	-0.34
Oct - Dec 15	8.31	7.24	1.07
Jan - Mar 16	8.31	5.71	2.60
Apr - Jun 16	8.31	6.10	2.21
Jul - Sep 16	8.31	7.87	0.44
Oct - Dec 16	8.31	6.69	1.62

I-84 WB			
Quarter	Baseline	Quarterly Mean	Difference
Jul - Sep 15	7.45	5.68	1.78
Oct - Dec 15	7.45	5.56	1.89
Jan - Mar 16	7.45	4.50	2.95
Apr - Jun 16	7.45	4.80	2.66
Jul - Sep 16	7.45	5.36	2.09
Oct - Dec 16	7.45	5.39	2.07

Legend: reduced travel time thru wz

incresed travel time thru wz

Overall, the preliminary data analysis for the work zone indicate that traffic volumes have decreased, travel times have improved and speed fluctuates depending on the time of year. Decreased traffic volumes are typically associated with commuters using alternate routes to potentially avoid work zone impacts. Traffic diversions from work zones will result in improved travel times, speeds and possibly reduced congestions. (Appendix 3: Work Zone Safety Performance Measures and Appendix 4: Work Zone Operational Performance Measures)

Recommendation:

The data obtained from the system may be used to set performance measures for what is an acceptable level of service for roadway while a work zone is in place.

- Observation No. 2-2:

  Crash data from the UCONN Crash Data Repository for crashes in 2015 and 2016, associated with active projects (i.e. work zones) are mapped using CTDOT GIS Project Map for analysis. Data from Project No. 0151-0273 was further analyzed to determine the areas within the work zone where crashes are more prevalent.

  Recommendation:

  The analysis of the crash data may be used to guide future performance measures for safety to ensure that the work zone crash rate does not exceed the pre-construction crash rate for the area.

CTDOT Work Zone Policies

- Observation No. 3-1:

  Nine (9) Department polices and two (2) internal memoranda related to work zones were identified and are being reviewed for potential updates (Appendix 5). The updates to the policies are minor and will be suggested for the Department approval.

  Two (2) of the nine (9) policies were identified in the 2013 Process Review Report: E&C-40 – *Work Zone Safety and Accessibility* and E&C-46 – *Systematic Consideration and Management of Work Zone Impacts* are still being reviewed. The policy on *Work Zone Safety and Accessibility* does reference the Manual of Uniform Traffic Control Devices (MUTCD) but does not cite 23 CFR 655 *Traffic Operations*. The policy on *Systematic Consideration and Management of Work Zone Impacts* defines what constitutes a significant project which is the basis of requiring Transportation Management Plans, but does not cite either 23 CFR 630.1010 *Significant Projects* or 23 CFR 630.1012 *Project-level procedures*.

  The other seven (7) policies identified will be reviewed for accuracy and relevancy. The policies include:

  - E&C-5: Municipal Roads and Streets Affected by Construction
  - E&C-6: Policy on Trafficpersons on Construction Projects
  - E&C-25: Policy on Dissemination of Construction Information to Local Officials
  - E&C-32A: Protective Headgear
  - E&C-32B: Protective Footwear (Steel Toe Shoes)
  - E&C-32C: Protective Clothing
  - HO-11: Wheel Chocks

  The two (2) memoranda identified: the 2007 CTDOT internal memorandum about *Systematic Consideration and Management of Work Zone Impacts* and the corresponding 2007 CTDOT Consulting Engineers General Memorandum transmitted the initial version of Policy E&C-46.

  Recommendation:

  All CTDOT's policies and memoranda related to work zones should be reviewed for relevancy and accuracy every two (2) years.

Compliance:

The above listed policies have been reviewed by the Work Zone Process Review Team and commented on for possible revisions.

Resolution:

Policies will be reviewed every two years and revision will be noted in the Work Zone Process Review Final Report.

CTDOT Work-Zone Related Construction Directives

- Observation No. 4-1:

  The Rolling Road Block is a method used by CTDOT to slow down traffic in all travel lanes on a highway with the use of law enforcement, Truck-Mounted Attenuators (TMAs), and/or contractors' work vehicles equipped with flashing lights to set up traffic patterns.

  It was found that the unrestricted use of the Rolling Road Block had slowed traffic down to the extent of causing significant delays in highly congested corridors. The Office of Construction conducted an evaluation of the methods of how the Rolling Road Block was executed, and monitored the impacts on the traveling public. A few randomly selected construction projects, with operations that would need temporary lane closures on major roadways with two or more lanes, were reviewed to better understand how it was actually being implemented.

  The use of the Rolling Road Block on these selected projects was performed in a different manner for each project. There were differences in the devices installed, the length of time the slowdown took place, and the purposes for which the slowdown was used for. The only similarity between all the Rolling Road Block usages was essentially the traffic coming to a temporary stop on all travel lanes, including on ramps within the affected work area.

  Recommendation:

  Construction Directive CD-2016-2: Work Zone Safety Rolling Block Procedure was issued on April 11, 2016. The Directive was issued to address the excessive time taken for traffic pattern set ups and take downs, and to establish a consistent process. The Directive was coordinated with the Connecticut Road Builders Association and the Connecticut State Police. This procedure established the rules and criteria for proper implementation.

Compliance:

During work zone safety field reviews, the Rolling Road Block is an aspect observed during the traffic pattern set up. Adherence is noted in the findings of the reviews.

Resolution:

From the observed Rolling Road Blocks, most have been reduced in time with some exceptions. A Non-Conformance Notice should be issued whenever the Directive gets violated and further administrative action may be taken if the issue is not resolved.

Smart Work Zone Technology

- Observation No. 5-1:

  Project No. 151-273, I-84 Reconstruction in Waterbury has deployed a smart work zone system provided by VER-MAC. This system has collected operational data including speeds, volumes, and travel times; and displayed that data-based information on programmed messages to the traveling public. The intent of using the system is to help mitigate traffic delays due to congestion or traffic incidents and to inform the travelling public. This system also uses technology to measure, manage, and improve work zone operations to reduce congestion and delays.

  There have been a significant number of crashes on the project and the Changeable Message Signs that are a component of the system have been instrumental in reducing the number of incidents throughout the limits of the work zones.

  Recommendation:

  To obtain more substantial work zone operational data and to display more real time information to motorists, more systems need to be deployed within work zones throughout the state.

  Compliance:

  In 2016, Project No. 50-219, I-95 Pavement Preservation in Fairfield, deployed a smart work zone system provided by ASTI. In 2017, Project No. 158-211, Merritt Parkway Safety Improvements in Westport deployed another smart work zone system provided by ASTI.

Resolution:

Motorists are informed of any traffic delays as they occur. Operational data from these systems will be collected and analyzed to add to the data analysis underway.

Regional Traffic Coordination

- Observation No. 6-1:

  CTDOT has established steps to create a Traffic Coordination Plan for the Hartford Region. The effort is being spearheaded by the Bridge Design Unit with the assistance of a consultant.

  There were a significant number of construction and maintenance projects scheduled for construction during the 2017-2020 seasons within Hartford. Without regional coordination of the limits of operations, lane closures and detours, traffic could become impacted to an unacceptable level.

  The consultant has taken staging and detour information for each project and compiled them all into one comprehensive plan so conflicts can be visually identified and mitigated during the design phase.

  Recommendation:

  If conflicts are minimized with the use of this plan, this strategy can be carried forward in other impacted regions.

- Observation No. 6-2:

  CTDOT is working on a regional Transportation Management Plan for the Westport/Norwalk area as well. The regional plan is being led by the Walk Bridge program staff. This plan is currently a work in progress.

  Recommendation:

  The strategy for this comprehensive plan will primarily focus on mitigation of project work zone impacts within the Fairfield corridor.

BEST PRACTICES

FHWA and CTDOT identified the following noteworthy practices during the 2015-2016 Work Zone Field Reviews:

- Alternate Traffic Strategy: One project implemented a detour for I-95 during low volume periods instead of using the original planned intermittent stops to erect steel.
- Signing: Additional signs were added to a detour for local traffic which reduced confusion for motorists during the construction.
- Traffic Coordination: Regular traffic coordination meetings are a successful way to mitigate traffic impacts during construction.
- Stakeholder Coordination: Coordination between all the stakeholders, especially first responders, should always be considered to maximize mobility through work zones.
- Storage of Traffic Devices: If enough clear zone is available, storage of signs and equipment adjacent to the road can facilitate a timely traffic pattern deployment each night.
- Pedestrian Access and Protection: Installation of temporary crosswalks and sidewalks are good practices for providing the required pedestrian access within work zones.

FUTURE EMPHASIS

- Regional Transportation Management Plans
- Queue Management with Technology
- Statewide Work Zones Operational Improvement Evaluations
- Work Zone Performance Management
  - Project Specific Performance Measures
  - Data-Driven Interstate Network Performance (e.g. WAZE, INRIX, other external data sources for travel time based index, delay per mile, and total delay)
- Road User Cost Analysis and Reporting

CONCLUSIONS

The primary issue identified during the work zone safety field reviews was proper compliance with the project's Maintenance and Protection of Traffic specifications and plans. As previously noted, construction project inspection staff were informed by the Work Zone Safety Review Team of non-conforming issues that required correction. Some of these issues will be addressed programmatically via the construction inspection training sessions and others will be addressed by delegating action items (Appendix 1) through this Work Zone Safety and Mobility Process Review. The Office of Construction will periodically hold meetings with the Process Review team members to check the status of the action items and the final dispositions.

Ensuring that the goal of conducting a minimum of ten (10) regular reviews and four (4) in-depth reviews a year is met will help to identify systemic work zone safety issues being implemented in the field.

The successful practices that were identified during field reviews will continue to be incorporated into construction project development and administration. The use of SWZ technology on more construction projects can help reduce congestion and delays caused by work zones. The systems can directly inform motorists of current conditions and aide with data analysis and strategy development. Also, establishing better coordination of lane closures and detours for projects within a region, not just from project to project, can reduce congestion. A future improvement that will transform the review process will be the ability to analyze crash and operational data specifically within work zones to better strategize how to minimize crashes and delays.

With the participation of diverse Department personnel in the Work Zone Process Review Team, the recommendations can go directly to the appropriate units for faster response and implementation. Through peer collaboration, Department coordination, and public outreach, CTDOT will continuously emphasize improving safety and mobility on current and future highway projects in the State of Connecticut.

APPENDIX 1: WORK ZONE PROCESS REVIEW ACTION ITEMS

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
2013-2014				
PENDING				
Leadership and Policy	Establish performance measures to track work zone congestion and delay (e.g. vehicle throughput or queue length).	Define metrics for performance measures for queue lengths, speed volume, and delay time.	Planning, Construction	Completed
Leadership and Policy	Implement performance measures to track work zone crashes (e.g. crash rates).	Define metrics to be used for performance measure (e.g. type, frequency, location) and develop baseline to determine threshold values for measuring crashes.	Construction, Planning	Completed
Program Evaluation	Collect work zone congestion and delay performance data for evaluation.	b. Obtain and evaluate data collected.	Planning	b. Completed
		d. Establish some performance parameters that can be used in design.		d. Pending – Reviewing to develop for more projects.

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Signing	Uncoordinated lane closures and construction signs between adjacent projects.	Adjust TMP to include coordination of lane closures of both projects.	Engineering	COMPLETED - Addressed in Section 1.08.04 – Prosecution and Progress Special Provision under "Additional Lane Closure Restrictions"
CLOSED / COMPLETED				
Program Evaluation	Conduct customer surveys to evaluate work zone traffic management practices and policies on a statewide/area-wide basis.	Develop a web-based survey questionnaire.	Planning, Communications Webmaster	Completed - Via comments webpage
Program Evaluation	Conduct customer surveys to evaluate work zone traffic management practices and policies on a statewide/area-wide basis.	Develop a web-based survey questionnaire.	Communications Webmaster, Construction, Maintenance	Completed Note: The Department has a public comments page on the Department's website.

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Program Evaluation	Collect work zone congestion and delay performance data for evaluation.	Research equipment to track work zone information such as speed, volume, and delay (i.e. length of queues) in order to establish some performance parameters that can be used in the design of work zones.	Planning	CLOSED
Program Evaluation	Collect data to track, analyze and evaluate work zone safety performance.	Obtain reliable Crash Data in Work Zones.	Planning, Traffic Engineering	COMPLETED
		b. Decrease crash data receipt time.		b. COMPLETED
		c. Categorize crash data		c. COMPLETED
		d. Establish criteria addressing crash frequency (CRASH THRESHOLDS) for design.		d. NO FURTHER ACTION

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Traffic Control in Work Zones	Experience with and understanding of work zone safety. Establishing levels of enforcement effectiveness (i.e. presence versus enforcement).	D. Review policies and procedures and guidance documents and revise to meet current MUTCD, new policy and other standards in place at state and federal level.	Construction, Traffic, Maintenance, Safety, State Police	D. CLOSED
Queues	Stopped traffic queue extended in advance of the Series 16 construction sign.	Move state police vehicle to back of queue to improve advance warning and additional Changeable Message Signs.	Traffic, Construction	CLOSED
Construction Sign Retro-Reflective Issues	Plastic substrate does not appear to be rigid enough to utilize the reflective properties of the sheeting so that the sign can be read properly by the traveling public during night time hours. Also, condensation found to reduce retro-reflectivity	C. Monitor use of new sign provision on new projects.	Construction, Traffic, Planning - Research	C. Completed
		D. Propose research studies - Testing different types of sheeting and substrates to find qualities that provide optimum visibility and durability.		D. CLOSED

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
	of construction signs.	F. Review results and, if necessary, revise the specification so that condensation is removed from construction signs.		F. CLOSED - Currently use aluminum or plywood only
Moveable Barrier Systems	Currently only one system available for use – proprietary – therefore difficult to use on federal participating projects.	A. Need to work with Design to develop a specification and design guidance on positive separation equipment and materials for work zones that are not proprietary and has potential for use on other projects.	Construction, Traffic, FHWA, Highway Design	A. Closed
		B. Investigate if other systems have been developed. If so, compare the systems.		B. Closed - See Department-owned special provision

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Pedestrian/ Bicycle Access Issues	Incomplete sidewalks, pedestrian buttons inaccessible or inoperable, lack of crosswalks at intersections, and lack of handicap ramps.	E. Conduct more of these types of reviews to see if these pedestrian/bicycle issues are more widespread.	Traffic, Construction	E. Completed
Variable Message Signs	Defining proper placement (i.e. distance from the anticipated queue), proper messaging, and message legibility.	A. Continue to verify proper messaging during reviews.	Construction, Traffic, Maintenance, Highway Operations	A. Completed - PVMS Guidance Manual being used
		B. Research different types of portable/variable message signs and capabilities to find best approach.		B. Completed - Highway Ops has a PVMS guide to be used
Detours	Traffic and detour plans were not included in the plans; project staff has to produce plans as needed.	Address in plan review process	Construction, Traffic Engineering	Completed - Detour Plans are included in projects during design more frequently
Queues	State police vehicle with flashing lights was not positioned in advance of stopped traffic queue.	Move state police vehicle to back of queue to improve advance warning.	Construction	Completed - CD-2016-2

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Signing	In certain areas it was difficult to install warning signs due to limited space.	Creative plan design for limited access and sign placement.	Engineering	Closed - Too project-specific
Signing	Signs that were to be mounted on an inside barrier were relocated because the subsequent stage would not provide enough height clearance for pedestrians.	Consider pedestrian access and use when mounting signs on barrier in all stages.	Engineering	Closed - Too project-specific
Traffic Control Devices	Due to an oversight, traffic cones, traffic drums and Type III Barricades were not included in the contract.	Plan review to ensure completeness of contract specifications.	Construction, Engineering	CLOSED
Traffic Control Devices	The contract quantity for traffic cones was insufficient.	Improve estimating.	Engineering	Closed - Project by project
Transportation Management Plan	Project staff and Contractor were not aware a TMP was developed for the project.	C. Include NTC into contract documents.	Construction, Traffic, Design, Contract Development	C. Closed - Not applicable by NTC, refer to Department Policy E&C-46

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Program Evaluation	Collect data to track, analyze and evaluate work zone safety performance.	a. Obtain reliable Crash Data in Work Zones.	Planning, Traffic Engineering	a. Completed
		b. Decrease crash data receipt time.		b. Completed
		c. Categorize crash data		c. Completed
Program Evaluation	Conduct customer surveys to evaluate work zone traffic management practices and policies on a statewide/area-wide basis.	Develop a web-based survey questionnaire.	Planning, Communications Webmaster	Completed - Via comments webpage
Program Evaluation	Conduct customer surveys to evaluate work zone traffic management practices and policies on a statewide/area-wide basis.	Develop a web-based survey questionnaire.	Communications Webmaster, Construction, Maintenance	Completed (Note: The Department has a public comments page on the Department's website.)

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Program Evaluation	Collect work zone congestion and delay performance data for evaluation.	Research equipment to track work zone information such as speed, volume, and delay (i.e. length of queues) in order to establish some performance parameters that can be used in the design of work zones.	Planning	CLOSED
Construction Sign Retro-Reflective Issues	Plastic substrate does not appear to be rigid enough to utilize the reflective properties of the sheeting so that the sign can be read properly by the traveling public during night time hours. Also, condensation found to reduce retro-reflectivity of construction signs.	C. Monitor use of new sign provision on new projects.	Construction, Traffic, Planning - Research	C. Completed
		D. Propose research studies - Testing different types of sheeting and substrates to find qualities that provide optimum visibility and durability.		D. CLOSED
		F. Review results and, if necessary, revise specification so that condensation is removed from construction signs.		F. CLOSED - Currently use aluminum or plywood only

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Moveable Barrier Systems	Currently only one system available for use – proprietary – therefore difficult to use on federal participating projects.	A. Need to work with Design to develop a specification and design guidance on positive separation equipment and materials for work zones that are not proprietary and has potential for use on other projects.	Construction, Traffic, FHWA, Highway Design	A. Closed
		B. Investigate if other systems have been developed. If so, compare the systems.		B. Closed - See Department-owned special provision
Pedestrian/ Bicycle Access Issues	Incomplete sidewalks, pedestrian buttons inaccessible or inoperable, lack of crosswalks at intersections, and lack of handicap ramps.	E. Conduct more of these types of reviews to see if these pedestrian/bicycle issues are more widespread.	Traffic, Construction	E. Completed
Variable Message Signs	Defining proper placement (i.e. distance from the anticipated	A. Continue to verify proper messaging during reviews.	Construction, Traffic, Maintenance, Highway Operations	A. Completed - PVMS Guidance Manual being used

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
	queue), proper messaging, and message legibility.	B. Research different types of portable/variable message signs and capabilities to find best approach.		B. Completed - Highway Ops has a PVMS guide to be used
Detours	Traffic and detour plans were not included in the plans; project staff has to produce plans as needed.	Address in plan review process	Construction, Traffic Engineering	Completed - Detour Plans are included in projects during design more frequently
Queues	State police vehicle with flashing lights was not positioned in advance of stopped traffic queue.	Move state police vehicle to back of queue to improve advance warning.	Construction	Completed - CD-2016-2
Signing	In certain areas it was difficult to install warning signs due to limited space.	Creative plan design for limited access and sign placement.	Engineering	Closed - Too project-specific

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Signing	Signs that were to be mounted on an inside barrier were relocated because the subsequent stage would not provide enough height clearance for pedestrians.	Consider pedestrian access and use when mounting signs on barrier in all stages.	Engineering	Closed - Too project-specific
Traffic Control Devices	Due to an oversight, traffic cones, traffic drums and Type III Barricades were not included in the contract.	Plan review to ensure completeness of contract specifications.	Construction, Engineering	CLOSED
Traffic Control Devices	The contract quantity for traffic cones was insufficient.	Improve estimating.	Engineering	Closed - Project by project
Transportation Management Plan	Project staff and Contractor were not aware a TMP was developed for the project.	C. Include NTC into contract documents.	Construction, Traffic, Design, Contract Development	C. Closed - Not applicable by NTC, addressed by E&C-46
ONGOING				
Program Evaluation	Develop strategies to improve work zone program performance based on work zone	Work Zone Safety Field Reviews.	Construction	Ongoing
		b. Conduct field reviews.		b. Ongoing

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
	performance data and customer surveys.	c. Prepare Annual Report.		c. Ongoing - Biannual
Program Evaluation	Develop strategies to improve work zone program performance based on work zone performance data and customer surveys.	Maintain Work Zone Operations Action Item List in Process Review.	Work Zone Process Review Team	Ongoing
Construction Sign Retro-Reflective Issues	Plastic substrate does not appear to be rigid enough to utilize the reflective properties of the sheeting so that the sign can be read properly by the traveling public during night time hours. Also, condensation found to reduce retro-reflectivity of construction signs.	C. Monitor use of new sign provision on new projects.	Construction, Traffic, Planning - Research	C. Ongoing
Pedestrian/ Bicycle Access Issues	Incomplete sidewalks, pedestrian buttons inaccessible or inoperable, lack of crosswalks at intersections, and lack of handicap ramps.	E. Conduct more of these types of reviews to see if these pedestrian/bicycle issues are more widespread.	Traffic, Construction	E. Ongoing

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
		F. Review plans and specifications and revise if necessary.		F. Ongoing
Lighting for Nighttime Inspection	Inspectors working on night projects do not have sufficient lighting to inspect work. This could be previously completed work or areas requested by contractor prior to placement of material.	B. Request Specification Committee to include wording that for any night work, portable and hand held lighting is to be supplied by contractor for inspection staff.	Construction	B. Ongoing
Barricade Warning Lights – High Intensity	High-intensity, solar powered warning lights are not effective in rural areas with significant canopy surroundings.	B. Review specifications of solar powered warning lights in wooded areas.	Construction, Traffic, Safety	B. Ongoing
		C. Projects should require and monitor battery-operated lights in areas where this may be an issue.		C. Ongoing
		D. Add as an item on a Daily Site Review checklist for project personnel.		D. Ongoing

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Variable Message Signs	Defining proper placement (i.e. distance from the anticipated queue), proper messaging, and message legibility.	A. Continue to verify proper messaging during reviews.	Construction, Traffic, Maintenance, Highway Design, Highway Operations	A. Ongoing
		B. Research different types of portable/variable message signs and capabilities to find best approach.		B. Ongoing
Visibility of Signs and Markings	Visibility of retro-reflective properties of construction signs.	Reviewing new MUTCD requirements and incorporating changes into contracts.	Traffic, Construction, Maintenance, FHWA	Ongoing
Project-Level Work Zone Reviews	Inconsistent applications of work zone principles at the project level.	A. Continue reviewing plans and monitor projects for conformance.	Construction, Maintenance, Safety	A. Ongoing
		B. Have project personnel use a Daily Site Review checklist.		B. Ongoing
Signing	Breakaway post anchor height does not conform to plans.	B. Continue monitoring projects during work zone reviews for compliance.	Construction	B. Ongoing

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Signing	Signs appear scuffed and dirty, making them difficult to read.	B. Continue monitoring projects during work zone reviews for compliance.	Construction	B. Ongoing
Detours	Traffic and detour plans were not included in the plans; project staff has to produce plans as needed.	Address in plan review process	Construction, Traffic Engineering	Ongoing
Maintenance and Protection of Traffic	There were missing delineators on the TPCBC.	Enforce contract specification and plans.	Construction	Ongoing
Maintenance and Protection of Traffic	Pavement drop offs were greater than 3 inches.	Construction should enforce the less than 3 inch drop off requirement or use safety edge.	Construction	Ongoing
Maintenance and Protection of Traffic	Raised manholes need better delineation.	Apply visibility paint on manholes.	Construction	Ongoing
Maintenance and Protection of Traffic	The DE-7C delineators installed on the TPCBC are not all showing the correct color.	Enforce contract specifications and plans.	Construction	Ongoing

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Pedestrian Issues	Crosswalk markings and signage needed to be added for guidance to the temporary pedestrian walkway.	Address specific field conditions as needed.	Construction	Ongoing
Queues	Stopped traffic queue extended in advance of the Series 16 construction sign.	Move state police vehicle to back of queue to improve advance warning and additional Changeable Message Signs.	Traffic, Construction	Ongoing
Signing	Signs need to be installed according to plans.	Enforce contract specifications and plans.	Construction	Ongoing
Signing	Inadequate advance warning signing for temporary lane closure.	Enforce contract specifications and plans.	Construction	Ongoing
Staging	There was not a stage construction plan for maintaining two lanes of traffic as directed in the Notice to Contractor.	Ensure completeness and accuracy of plans in design reviews.	Traffic, Construction	Ongoing

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Traffic Control Devices	Marginal or unacceptable quality of drums, cones and barricades that should be replaced or do not meet standard.	Refer to ATSSA/MUTCD guidelines for quality of traffic devices; Systemic problem since found in 2013 and 2014, training personnel may be needed.	Construction	Ongoing
Traffic Control Devices	Due to an oversight, traffic cones, traffic drums and Type III Barricades were not included in the contract.	Plan review to ensure completeness of contract specifications.	Construction, Engineering	Ongoing
Traffic Control Devices	There has been an issue with traffic cones being knocked down.	Have a dedicated person to check traffic patterns a few times a night.	Construction	Ongoing
Transportation Management Plan	A copy of the TMP was not readily available for reference in the project field office.	Project Engineer responsible to advise project staff that TMPs are available on ProjectWise.	Construction	Ongoing
2015				
COMPLETED / CLOSED				

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Best Practices	Truck drivers getting out of trucks while waiting for loading or off-loading should wear high visibility apparel.	A good practice to remind even truck drivers exposed within a work zone to wear high visibility apparel.	Construction	Completed
Training Needs	State Police are unaware of the electronic time card procedure that is being piloted on the project or don't have the means to fill them out electronically.	Training is required for the CT State Police. Subsequent to this finding, it was determined that the pilot was not successful because CSP was reluctant to implement it.	DESPP, Construction	CLOSED due to Police Union rules that prevent any change

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Work Zone Technology	The Contractor used a rolling road block to install the advance warning signs and the taper of the traffic pattern. The road block took place from 9:35 PM to 9:54 PM (19 minutes) and a queue length of approximately five miles accumulated which didn't clear until just prior to 11:00 PM.	Traffic Stoppages/Rolling Road Blocks:	Construction	COMPLETED

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Best Practices	Secondary roads in rural areas may have little to no existing lighting along roadways. Therefore the angle of the construction sign is critical for proper retro-reflectivity.	a. Section 3d of the M&PT special provision discusses how traffic may "under certain circumstances" be "briefly impeded" during the installation and removal of Traffic Control Patterns using "slowing techniques".		COMPLETED
Best Practices	The project used a rolling road block to install advance warning signs. Once completed, the traffic was let through the open lane and a truck-mounted attenuator was used to continue in the closed lane to set up the traffic pattern.	b. The Department needs to establish a policy on use of the Rolling Road Blocks for Work Zones where multiple lanes exists rather than solely relying on a case by case determination by the Engineer and/or State Police		COMPLETED

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Best Practices	A rolling road block was used for a total of 10 minutes (7:19 PM – 7:29 PM) to set up the work zone traffic pattern and then traffic was allowed through the left lane. The residual queue length is estimated to be about 3 miles.	c. Note: A Construction Directive for Use of Rolling Road Blocks was issued on April 11, 2016.		COMPLETED
PENDING				
Best Practices	A temporary pathway was built to meet the requirement of having a sidewalk open at all times. The Contractor installed formwork for the parapet walls that would be poured at a later date but then built the sidewalk on top of the forms.	The Contractor was able to maintain pedestrian access and still progress the work using creative means and methods.	Construction	Pending

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Best Practices	The original plan for the two projects was to have a detour for both projects, but they had to run consecutively. One project was not able to be completed on time creating a substantial traffic impact on the route than originally planned, so a revision to the detour plan was needed.	The Contractor proposed to change the detour for the retaining wall on one project to a temporary signal, this way both projects could be done concurrently allowing adequate traffic flow during construction.	Traffic Engineering, Construction	Pending
Design Issues	Although the project was allowed to work at night, the project limits were adjacent to campgrounds which would have impacted campers.	The limits of operation should take into consideration the local businesses and utilize the context sensitive design philosophy.	Engineering	Pending
Design Issues	The maintenance and protection of traffic (M&PT) was difficult to maintain when the milling machine had to make a pass in the center of a two-lane road.	During design, accommodations should be made for proper traffic flow around the milling operation.	Engineering, Construction	Pending

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Design Issues	The Chief Inspector drove the suggested detour route for the exit off ramp and had to modify the plans because of a low bridge with posted 11'-3" clearance. This bridge and others on other suggested detours are too low for trucks to pass.	Suggested detour plans should ensure that height clearances for overpasses meet the minimum requirement.	Engineering, Construction	Pending
Design Issues	Motorists were confused when the two lanes that merge onto Route 15 from I-84 WB were closed with minimum warning of a temporary exit to Route 15. This caused motorists to veer into the traffic pattern before the temporary exit on I-84.	Construction and Traffic revised the traffic plan to mitigate the merging issue. Motorists were channeled from two lanes down to one lane around the work zone which improved traffic flow. Temporary exits should be clearly delineated for the traveling public.	Traffic Engineering, Construction	Pending

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Design Issues	From the Contractor's experience on prior projects with temporary signalization, the Contractor installed poles and hard wire temporary signals instead of using portable signals as a preferred method.	Traffic should consider having details in the plans for hard-wired temporary signals where feasible.	Traffic Engineering	Pending

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Design Issues	The traffic pattern started right after the I-91 SB Interchange 8 on ramp. The length of the transition from a one-lane closure to a two-lane closure was found to be insufficient. The shortened transition area for a two-lane closure for the entrance ramp traffic was too abrupt. This resulted in a slowdown of mainline and entrance traffic flow.	The pattern should have been started after the Interchange 8 off ramp, closing only one lane and channeling the mainline traffic into three lanes. Another taper should have been started after the Interchange 8 on ramp to allow entrance traffic to merge into the one-lane traffic pattern with the mainline traffic. Once the entrance traffic merged with the mainline traffic, the second lane should have been taken, channeling all traffic into the open lanes. Construction staff should consult with Traffic when encountering complex geometry.	Traffic Engineering	Pending

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Design Issues	The contract called for tape to be used for the temporary pavement markings; however, it did not bond to the milled surface.	The District applied best practices by changing the pavement markings from temporary tape to hot-applied paint. Engineering should avoid using tape.	Traffic Engineering	Pending
Design Issues	The original detour plan would have negatively impacted local roads with congestion. Although it would be safer for the project to close exits within the work area and detour traffic, there would be a high impact on local roads. The resolution for this project was to shift the right lane traffic into the existing wide shoulder and maintain access to the off ramps.	Establish a protocol for possible traffic impacts on adjacent local roads if ramps are to be closed near work areas on highways.	Traffic Engineering	Pending

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Design Issues	The Project Engineer stated that motorists were having difficulty going through the detour without getting confused on the direction because the detour is too long.	The project needed additional and larger signs to better direct motorists through the detour.	Traffic Engineering	Pending
Completeness of Design Plans	The bridge repairs were found to be more extensive than initially planned and the load ratings for allowable limits weren't done prior to the use of heavy equipment.	Better scoping should be done for bridge work including load ratings to find out allowable weight limits for paving equipment.	Bridge Design	Pending

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Completeness of Design Plans	There were no details in the plans for taking two lanes. There were areas on the highway where there was a climbing lane. The plans showed how to take one lane but not two lanes which could be applied to areas where both the right lane and climbing lane had to be closed.	Provide standard details in the traffic plans to close two lanes on a roadway where there is an auxiliary climbing lane or three lanes for two throughway lanes and an auxiliary climbing lane.	Traffic Engineering	Pending
Completeness of Design Plans	The staff had to use an alternating one-way traffic pattern from another project so they can perform work on the bridge parapets and reopen the bridge for use.	An optional alternating one-way traffic plan should be included if work on narrow bridges will call for lane width reduction.	Traffic Engineering	Pending

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Completeness of Design Plans	This project is a significant project on Interstate-95, but it does not have a TMP.	Future significant projects on I-95 should include a TMP in accordance with the Department Policy No. E&C-46: Systematic Consideration and Management of Work Zone Impacts.	Engineering, Construction	Pending
Specification Issues	The inspection staff did not have computers set up in the field office for months at the beginning of the project to do electronic tasks (i.e. print out the electronic State Police form for signature or enter Daily Work Reports).	The lead time to get computers set up for inspectors to use should be reduced. There are too many tasks that are computer-based where the delay to access a computer can hinder the job duties. Note: A Construction Bulletin (April 22, 2016) for a field office device order form has been issued to address this issue.	OIS, Construction	Pending

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Opportunity for Policy Improvements	To set up the traffic pattern, the State Police and Contractor used a rolling road block which stopped traffic for 45 minutes (9:15 pm to 10:00 pm). The Contractor is required to maintain the minimum number of lanes shown in the Limitations of Operation charts included in the Prosecution and Progress special provision.	The rolling road blocks have become a common practice for projects on limited access highways. Subsequent to the Work Zone review findings, a Rolling Road Block Construction Directive has been issued (April 11, 2016).	Construction	Pending
Opportunity for Policy Improvements	State police should have a cancellation policy to notify project personnel in a timely manner if they are unable to fill a request. This can help prevent Contractors from working without police presence or at least be able to plan to work without one accordingly.	Contractors are allowed to work on the highway without State Police. There was discussion between CT State Police and CTDOT to clarify the State Police cancellation policy.	DESPP, Construction	Pending

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Opportunity for Policy Improvements	Construction Work Zone "Reduce Speed to 45 mph" signs are no longer being used because they aren't enforceable.	Construction recommended continued use of "Reduce Speed to 45 mph" signs for awareness. Traffic opposed the recommendation. Now Construction is reviewing other strategies to reduce speeds in work zones such as radar speed displays.	Construction, Traffic Engineering	Pending – A legislative action may be necessary to make signs enforceable
Opportunity for Policy Improvements	It is an observed reoccurrence for State Police to not show up after being assigned.	Discussion on how to mitigate the issue of State Police not being available for construction work after being requested needs to take place. Subsequently, meetings have been held with CT State Police and CTDOT to address this issue. Monitoring will continue.	DESPP, Construction	Pending

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Opportunity for Policy Improvements	During the review, discussion about the Reduce Speed to 45 mph advisory signs being taken out of plans came up. Although the signs aren't enforceable, project personnel felt that it was a good means to get motorists to slow down when entering the work zone. For this project, regulatory signs legally reducing the speed limit through the Office of the State Traffic Administration (OSTA) have been installed due to reduced roadway width between temporary barriers during construction.	With subsequent discussions with the Division of Traffic, the Reduce Speed signs will not be used. Only when approved by OSTA, new legally reduced speed limit signs are used.	Construction, Traffic Engineering	Pending – A legislative action may be necessary to make the signs enforceable

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Specification Enforcement	Various breakaway sign posts mounted on sidewalks had brackets 6 inches in height.	Breakaway sign anchor brackets should not exceed 4 inches in height from ground line per specification.	Construction	Pending
Specification Enforcement	Detour signs were pinned only at the top of sign allowing movement at bottom. They also weren't in the best condition.	Signs should be properly secured to prevent wind blowing them off posts and the conditions should be checked periodically to ensure specification compliance.	Construction	Pending

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Specification Enforcement	The work truck parked diagonally behind the work area next to live traffic lanes posed a hazard to the work crew. If a vehicle veered and hit the truck it would impact workers.	Project staff can increase awareness through tail-gate talks or training of the proper placement of work trucks next to live traffic, as well as, proper protection of work crews next to live traffic. The use of TMAs is the proper protection of the work area rather than a work truck. If work trucks are needed by the crew, they need to be parked parallel to live traffic lanes in a protected area or clear zone.	Construction	Pending

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Specification Enforcement	No post-mounted "diamond-shaped" construction signs had barricade warning lights.	Barricade warning lights should be installed according to the Maintenance and Protection of Traffic Special Provision. M&PT Notes say, “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.”	Construction	Pending

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Specification Enforcement	Initially, the Contractor did not want to use 7-foot stands for the temporary exit signs which are called for in the specifications.	If roadways have sightline issues with temporary exit signs on tripods being obstructed by the 42” traffic cones and traffic drums, the use of 7-foot stands for the exit signs should be a best practice to use for projects with those conditions.	Construction	Pending
Training Needs	The procedure used on this project for removing the traffic pattern from both ends of the pattern was unsafe and against policy.	The procedure of removing the traffic control devices from the end of the pattern going backwards towards the advance warning signs needs to be enforced.	Construction	Pending

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Training Needs	Moving the traffic cones or drums into the travel lanes to allow more space for the work area is an unsafe practice.	If more space is needed, the devices can be moved for a temporary solution but must be moved back to their alignment when completed. If necessary, an additional lane should be taken. Traffic lanes should not be reduced to less than 11 feet.	Construction	Pending
Training Needs	There was an alternate route offered for motorists to take opposed to going through the work zone. However, signs stating DETOUR and ROAD CLOSED TO THRU TRAFFIC were used and should have been covered to eliminate conflicting messaging.	Signs can be mounted before they're needed, but should be covered if not currently in use. The conflicting advance warning signs can confuse motorists.	Construction	Pending

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Training Needs	Temporary Precast Concrete Barrier Curb (TPCBC) used for positive protection has some marginally acceptable units.	Relevant manuals such as the MUTCD, ATSSA Quality Guidelines for Traffic Control Devices, etc. provide guidance on acceptable devices. Inspectors should refer to those guidelines and enforce the requirements.	Construction	Pending
Training Needs	Most of the traffic control devices were in poor condition; either they were dirty, scuffed, bent, or had very little reflectivity.	For traffic control signs and devices that were dirty, they need to be cleaned or removed. For bent or scuffed devices or devices missing reflective tape, they should be replaced. Devices in poor condition will prevent motorists from properly seeing the delineation of the traffic pattern.	Construction	Pending

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Training Needs	The advance flashing arrow in the closed lane was not in the correct mode and the Changeable Message Sign had a message too long to read while driving.	Proper use of the advance warning devices will notify motorists of the road conditions ahead. Messages should be in accordance with the contract plans.	Construction	Pending
Training Needs	The project staff was unaware of the Transportation Management Plan (TMP) for the project.	Better communication between Engineering and Construction to bring awareness of the TMP requirements.	Construction	Pending
Training Needs	The height of the Changeable Message Sign on I-84 Eastbound was placed too low, especially with a guiderail immediately in front of it.	CMS should be installed at the proper height for visibility.	Construction	Pending

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Training Needs	Some of the detectable tactile warning strips did not extend to the full width of the curb.	According to ADA requirements, the detectable tactile warning needs to extend a minimum of two feet in the direction of travel and the full width of the curb ramp.	Construction	Pending
Training Needs	The plywood protecting the sidewalk from the concrete barrier projected into the walkway of the new sidewalk and posed a trip hazard to pedestrians.	The plywood should be cut down to flush with the edge of the barrier or smaller pieces be used to rest the barrier on.	Construction	Pending

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Training Needs	The delineators on the concrete barrier were in poor condition, were not facing in the correct direction, or were missing the appropriate color on one side.	The delineators should be replaced if in poor condition or incorrect application. Delineators with the appropriate colors of white (used on the right side of oncoming traffic) and yellow (used on the left side of oncoming traffic) should be applied.	Construction	Pending
Training Needs	The Project Engineer was unaware that informing nearby hospitals was a necessary part of the public outreach for the project.	Project staff should contact all the stakeholders of the project and inform them of the work being done and how it could affect them. Stakeholders include police (either State or municipal), fire departments, hospitals or medical facilities, etc.	Construction	Pending

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Training Needs	State Police closed the left and middle lane to aid in the setup of the traffic pattern. When the pattern is setup at the beginning of the allowable work hours, only one lane could be taken at that time not two.	State Police should incorporate a Rolling Road Block for advance signs and the taper. Subsequently, a Construction Directive for Use of Rolling Road Blocks was issued on April 11, 2016.	Construction	Pending
Training Needs	The Changeable Message Sign was placed within the 30 feet clear zone and only protected by two traffic drums.	Any equipment or material stored within 30 feet of the roadway's clear zone needs to have positive protection.	Construction	Pending

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Work Zone Technology	The work crew was adjacent to live traffic on a high-speed interstate roadway. The work activities called for the workers to be on their knees or bending over most of the time. Workers not standing have less time to move out of the way of vehicles that could veer into work area. A Truck Mounted Attenuator (TMA) was placed behind the work area for oncoming traffic; however, there was no protection on the side of the work area. The traffic cones or drums were not sufficient protection.	Positive protection should be considered to prevent errant vehicles from intruding the work area where activities call for workers to work on their knees or bending over (e.g. bridge joint repairs).	Engineering, Construction	Pending

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Work Zone Technology	Motorists are exceeding the speed limit through work zones.	An extra trooper should be requested solely for enforcement in work zones. Also, use of Speed Trailers may also be used to calm down speeds in work zones.	Traffic Engineering, Construction	Pending
Enterprise Coordination	It was observed that the timing of the signal phases appeared to be prolonged.	Traffic Engineering will follow up to make an adjustment for correct timing of the signal lights.	Traffic Engineering	Pending
Enterprise Coordination	Bridge Operations (Overweight / Oversize Permits) didn't know that the bridge was closed on Route 148 and didn't inform trucks taking that route to find an alternate route.	Communication between the project staff and Bridge Operations needs to be improved to make sure trucks don't get stuck on routes that are closed.	Construction	Pending

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Enterprise Coordination	The Chief Inspector said that the project received permission to start at 9:30 PM instead of 11:00 PM as noted in the Specifications. However, Traffic did not recall reviewing this request.	When requesting a change to the hours of operation, Traffic Engineering needs to be consulted before approving the change to see if the traffic volumes will allow lane closures at the time requested. The District should maintain a written concurrence from Traffic in the project files.	Construction	Pending
2016				
TABLED				
Accommodation of Stakeholder Needs	The special provisions did not include direction on how to handle parking while replacing residential driveway aprons. The right lane of the road had to be closed to allow residents to park on the street.	For cases where parking is limited for residents, a special provision should be included for temporary lane closures for resident parking or other arrangements parking at nearby locations.	Traffic Engineering	TABLED – An isolated occurrence.

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
CLOSED				
Reevaluate Contract Items	The Chief Inspector suggested combining both the Temporary Detection and the Temporary Signalization special provisions since the work is closely related to one another.	The Office of Traffic Engineering can consider the possible cost savings of combining related items.	Traffic Engineering	CLOSED – items cannot be combined since each item can be added to a project without the other
PENDING				
Best Practices	The intermittent traffic stops for ten minutes was not feasible to splice and set steel to a level of stability before having to open for traffic to be let through.	The project implemented a two-hour detour for the I-95 closure during times when traffic was the lowest is a good practice.	Traffic Engineering	Pending
Best Practices	The project felt there weren't enough advisory signs for the detour overall.	The project added eight additional signs for the detour of local traffic, which is a good practice.	Traffic Engineering	Pending

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Best Practices	The project had multiple traffic coordination meetings regularly in preparation of the I-91 NB Exits 3 and 5 shifts.	Regular traffic coordination meetings were successful in mitigation of traffic impacts during shifts.	Construction	Pending
Best Practices	The project installed temporary CAUTION BLIND DRIVEWAY signs on U.S. Route 1 during construction to bring more awareness of blind driveways adjacent to the work zone.	The initiative to install additional signs to bring more awareness to motorists is a good practice that all projects should consider.	Traffic Engineering, Construction	Pending
Best Practices	The barrier curb along the west side of the road was modified to allow EMS access into the driveway of a multi-unit complex.	Coordination between all the stakeholders especially EMS should always be considered for mobility in work zones.	Traffic Engineering, Construction	Pending

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Best Practices	The project placed additional signs on I-95 mainline to inform motorists that the local road near the highway commonly taken as a "cut-through" was closed.	Placing additional signs to provide clarity to motorists due to closures is a good practice to be considered.	Construction	Pending
Best Practices	The traffic control devices are stored behind the median guiderail.	If given enough clearance to store devices in a protected area on the road, it can facilitate a timely traffic pattern deployment each night.	Construction	Pending
Best Practices	The bridge on Mayflower Street has an alternating one-way traffic pattern. Also, temporary crosswalks with ADA-compliant ramps and pedestrian pedestals to enhance pedestrian safety around the work zone were installed mid-block.	Installation of temporary crosswalks is a good practice for pedestrian access within work zones.	Construction	Pending

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Conduct More Thorough Plan Reviews	The inspection staff discovered in the field that the barrier curb did not extend enough for the lane drop-off on I-84 during stage construction.	A field revision to the M&PT plan was made to extend the barrier curb and impact attenuation system.	Traffic Engineering	Pending
Conduct More Thorough Plan Reviews	The M&PT plan did not identify all business driveways and pedestrian access throughout the project.	Field adjustments were made to accommodate local businesses and pedestrians.	Traffic Engineering	Pending
Conduct More Thorough Plan Reviews	Although the plans called for existing sidewalks to be closed, no temporary sidewalks were designated or installed in the field.	The project added temporary sidewalks to the plans.	Traffic Engineering	Pending
Conduct More Thorough Plan Reviews	No pedestrian accommodations were noted on the plans for Tamarack Avenue although there is significant pedestrian traffic due to a hospital and a high school located nearby.	Preliminary studies need to account for all road users within a work zone and provide a protected travel way.	Traffic Engineering	Pending

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Conduct More Thorough Plan Reviews	There was no contract items included for hot-applied temporary pavement markings. The items were added by construction change order.	Plan reviews need to be thorough and ensure standard items are included in contracts.	Traffic Engineering	Pending
Conduct More Thorough Plan Reviews	The project staff indicated that half-section barriers weren't included in the list of contract items but were called for on the plans. However, the half-section barriers were going to be an expensive item if added in because of their limited quantity.	The units conducting plan reviews should ensure that work called for in the plans should have associated contract items. Half-section barriers should be included where aptly needed to allow for limited travel width (i.e. tight ramps). All structure barriers are required to be pinned.	Traffic Engineering	Pending

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Conduct More Thorough Plan Reviews	The contract plans called for the use of a Type A Impact Attenuation System but there was no contract item included.	All devices called for on the plans need to have a corresponding contract item unless the specification includes it in the general costs for the work.	Traffic Engineering	Pending
Adjacent Projects Coordination	Construction signs from an adjacent project overlapped with this project.	Projects adjacent to each other need to coordinate their construction signage to reduce possible confusion for motorists traveling from one work zone into the next.	Construction	Pending
Adjacent Projects Coordination	When traveling on the project route there is a “Road Work Ahead” sign for an adjacent project and 20 feet ahead an “End Road Work” sign for this project.	Overlapping signs from adjacent projects should be coordinated to ensure that signs do not give conflicting messages to the motorists.	Construction	Pending

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Enforcement of Contract Plans	Sign anchors on post-mounted signs exceeded the height required as noted on the plans.	As stated in typical sign mounting plan TR-1208_02, sign anchors should be a maximum of 4 inches above ground.	Construction	Pending
Enforcement of Contract Plans	Traffic pattern tapers were not established with traffic drums as shown on the plans.	Traffic patterns are typically comprised of traffic drums along the taper and traffic cones on the tangent for the closed lane. Traffic drums are more visible for delineating the pattern to motorists.	Construction	Pending
Enforcement of Contract Plans	Traffic cones were used on the taper of the closed lane at instead of traffic drums.	Traffic drums should be used on traffic pattern tapers to increase the visual awareness to the motorists in a closed lane.	Construction	Pending

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Enforcement of Contract Plans	The advance warning before the construction lot entrance had signs placed out of sequence. Motorists were informed of a lane closure before being informed of construction trucks entering/exiting the main route. However, they would approach the construction trucks before they would encounter the lane closure.	Advance warning signs should be placed in the order of occurrence so motorists can be properly informed of the action they need to take while traveling through a work zone with sufficient time to transition beforehand.	Construction	Pending
Enforcement of Contract Plans	The DE-7C delineators at the trailing end of the crossover on the northbound side were yellow on the right side of traffic.	DE-7C delineators should match with the shoulder pavement markings by having the yellow side on the left side of traffic and the white side on the right.	Construction	Pending

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Enforcement of Contract Plans	The temporary double yellow centerline skip pavement markings shown on Drawing MPT-02 were not installed.	Temporary pavement markings should be installed according to the plans to help delineate lanes for proper guidance to motorists.	Construction	Pending
Enforcement of Contract Plans	The temporary “bicycle” construction sign shown on Drawing MPT-02 were not installed.	The bicycle construction signs should be installed to bring awareness to cyclists of the route they should take through the work zone.	Construction	Pending
Enforcement of Contract Plans	Some of the TPCBC delineators were not attached to the barrier.	The missing TPCBC delineator should be reinstalled. Delineators help define the travel way to motorists especially at night and during inclement weather.	Construction	Pending

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Enforcement of Contract Plans	A couple of the construction signs were mounted directly in front of or mounted on top of regulatory signs.	Signs should be mounted on their own posts and with enough distance from regulatory signs to prevent obstruction from viewing them.	Construction	Pending
Enforcement of Contract Plans	DE-9 delineators were used at the nose of the Type A Impact Attenuation Systems.	The correct delineator to be used is Sign No. 50-5032 as noted on plan sheet TR_1205_01.	Construction	Pending
Enforcement of Contract Plans	The detour plan was missing a Sign Assembly 'I' (Detour South 136 Turn Left).	Proper signage should be placed as shown on the detour plans so drivers headed southbound can be directed to the detour.	Construction	Pending

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Inadequate Signage	Sidewalks around work zones were closed but no SIDEWALK CLOSED, CROSS HERE signs were installed directing pedestrians where to access an open pathway.	When existing pathways are disturbed, an alternate pathway should be provided.	Traffic Engineering	Pending
Inadequate Signage	There are currently insufficient advance warning signs on the main route prior to the intersection with another major route.	Traffic Engineering should address inadequate signage for the detour to better indicate where routes are to avoid confusion.	Traffic Engineering	Pending
Managing Work Zone Traffic	Traffic on the northbound side will be shifted to a new configuration and will have a conflict when merging from the new lane back onto the existing roadway as planned.	Traffic Engineering was requested to review the possibility of putting a temporary signal to facilitate transition from the new northbound lane back onto the existing roadway.	Traffic Engineering	Pending

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Managing Work Zone Traffic	Temporary traffic shifts to accommodate the work area in the road were not properly delineated with traffic devices.	When travel lanes are shifted, clear delineation to motorists is needed to ensure the safety and mobility of the motorists.	Construction	Pending
Managing Work Zone Traffic	Traffic approaching an intersection in two lanes and then merging into one lane just past the intersection created a bottleneck condition in the intersection.	Motorists should be channeled into one lane before the intersection to prevent any backups within the intersection.	Traffic Engineering	Pending
Managing Work Zone Traffic	Traffic shift was done with inadequate devices thereby improperly channeling traffic into a closed lane.	The Review Team identified the conflict and advised the project team to address the issue.	Construction	Pending

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Managing Work Zone Traffic	Item No. 113000 - High Mounted Internally Illuminated Flashing Arrow was requested to be added to the project. The flashing arrow would be used in advance of the work zone on limited access highway.	High Mounted Internally Illuminated Flashing Arrows are typically used to notify drivers in advance of a lane closure on limited access highways. The work on highway involves a slight lane shift with a shoulder closure, so a flashing arrow is not required.	Traffic Engineering	Pending
Managing Work Zone Traffic	Motorists speed up to 10 mph over the posted speed limit when traveling through the work zone.	The use of a radar speed display can help reduce speeds through the work zone.	Traffic Engineering	Pending
Message Confusion	Some of the blasting zone signs were not covered even though blasting was not currently taking place.	Signs that are not in use should be covered to prevent conflicting messaging to the motorists.	Construction	Pending

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Message Confusion	A DETOUR sign with an arrow was used instead of a directional arrow to indicate the lane was closed and motorists to proceed to the left of the work area.	Displaying a confusing message like DETOUR when a detour is not in place will misleading to motorists traveling through a work zone.	Construction	Pending
Message Confusion	The CMS for the project is located directly under the I-91 VMS.	CMS need to be placed at least 1000 feet from a VMS to prevent any confusion to the motorists reading too many signs at once.	Construction	Pending
Message Confusion	Detour arrow signs were left uncovered.	All detour signs should be covered when the detour is not in use.	Construction	Pending

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Need for Better Work Zone Devices	The Type A Impact Attenuation System was hit multiple times on the project. The main angle of impact was side swipes by passing motorists because the array extended too closely to the shoulder line.	A more compact or durable impact attenuation system should be considered for roadways with limited space in lieu of sand barrel arrays. Alternate consideration would be to use the Trinity Quad-Guard system that attaches to the end of a metal beam rail.	Construction	Pending
Opportunities to Enhance Safety	Exposed traffic signal foundations adjacent to the roadway were lacking proper delineation from errant motorists.	More traffic drums can be used around the foundations to better delineate traffic away from them.	Construction	Pending
Opportunities to Enhance Safety	The edge of roadway near the rock cut location has a significant drop off.	The project will install TPCBC along the edge of the roadway.	Engineering	Pending

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Opportunities to Enhance Safety	Some material was stored within the clear zone of the roadway.	Materials and equipment need to be stored outside of the roadway's clear zone. If there is not enough clearance, then they need to be positively protected.	Construction	Pending
Opportunities to Enhance Safety	A vehicle was parked in front of the impact attenuation system.	Vehicles should be parked outside the clear zone or in a positively protected area.	Construction	Pending
Opportunities to Enhance Safety	The CMS at the west end of the project was placed within the clear zone.	Blunt objects stored within the clear zone need to be positively protected.	Construction	Pending
Opportunities to Enhance Safety	A couple of the CMS were placed within the clear zone or within the deflection zone of the metal beam rail. Although CMS are to warn motorists of upcoming work zone activities, they are still a hazard to errant motorists.	The placement of CMS needs to be outside of the clear zone or deflection zone of metal beam rail or need to be positively protected.	Construction	Pending

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Opportunities to Enhance Safety	Catch basins were stored within the clear zone adjacent to the closed lane.	Objects need to be stored outside of the clear zone or positively protected.	Construction	Pending
Opportunities to Enhance Safety	Material and equipment stored off local roads were too close to the roadway without positive protection.	Although speed limits on local roads are lower than that of interstates, material and equipment which expose blunt ends to motorists should still be stored outside of the clear zone or positively protected.	Construction	Pending
Opportunities to Enhance Safety	The project requested the Contractor to relocate utility poles and fire hydrants.	Objects within the clear zone of the roadway are a hazard to motorists and more so within a work zone. Objects either need to be positively protected or moved outside of the clear zone.	Construction	Pending

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Opportunities to Enhance Safety	A storage container is placed by the edge of the road without positive protection.	The storage container should be positively protected to eliminate the hazard of a blunt object adjacent to the edge of the road.	Construction	Pending
Pavement Marking Issues	Temporary tape for pavement markings would not have lasted through the winter due to snow plowing and was replaced by Change Order to epoxy paint.	Projects extending through the winter should not use temporary tape for pavement markings. It creates more work for the Contractor to have to replace it in winter.	Traffic Engineering	Pending
Pavement Marking Issues	The black cover-up resin pavement markings are too shiny for motorists traveling towards the sun and often misrepresent where the lane markings are.	Division of Material Testing should research a material that can be used to cover up pavement markings adequately for all conditions.	Traffic Engineering	Pending
Pavement Marking Issues	The pavement marking tape was torn and missing pieces.	Temporary pavement marking tape that has been damaged should be repaired or replaced.	Construction	Pending

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Pavement Marking Issues	Cold-applied membrane took too long to cure prior to paving within the same night; it wasn't practical.	Design selection of the appropriate membrane to allow paving within the same night is a good practice.	Engineering	Pending
Pavement Marking Issues	Sidewalks were closed using only traffic cones and caution tape which is not ADA compliant.	Type III barricades that can be detected at ground level should help disabled people navigate around a closed sidewalk.	Construction	Pending
Pedestrian Issues	Work areas on the sidewalk were not closed with proper devices and signs and there was no clear path for pedestrians to travel around them.	Work areas on an existing travel way for pedestrians should be properly protected and have advance warning. A new defined travel way for the pedestrians needs to be provided while the existing one is under construction.	Engineering, Construction	Pending

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Pedestrian Issues	The temporary driveway aprons were too steep for wheelchairs to navigate and the HMA material was deteriorating at the crown.	Temporary driveway aprons need to be ADA compliant.	Engineering	Pending
Pedestrian Issues	The detour route is currently having pedestrians cross an intersection where the pedestrian pedestal at the northeast corner of the intersection was destroyed and removed. The absence of this pedestal is currently negatively affecting the operation of the pedestrian facilities at the intersection, as well as the pedestrian detour route for the project.	The installation of the permanent pedestrian signal should be considered at the northeast corner of the intersection under this project.	Traffic Engineering	Pending

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Pedestrian Issues	The sidewalk on Ella Grasso Boulevard underneath the bridge was in very poor condition especially for disabled pedestrians to use.	Temporary sidewalks need to be safe and ADA compliant. The conditions need to be repaired for the pedestrians' safety.	Engineering	Pending
Pedestrian Issues	There is a safety concern with pedestrians walking through the work zone on the secondary road where there is no existing sidewalk or provision to protect pedestrian traffic included in the contract.	Although there is no provision to address pedestrians on this type of project, the safety of the pedestrians within the work zone should be a concern. The safety of pedestrians should be addressed in design phase.	Traffic Engineering	Pending

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Pedestrian Issues	Currently, there are no pedestrian accommodations. The existing sidewalk on the north side of the street was inoperable. On the main route, work vehicles were parked on the sidewalk making it unusable.	Pedestrian access should be maintained along Route 57 (Main Street) at all times according to Item # 0971001A – Maintenance and Protection of Traffic under Pedestrian Access.	Traffic Engineering, Construction	Pending
Project Constraints and Pattern Installation	The project finds it difficult to install the traffic pattern around on ramp and off ramp within 100 feet of each other.	Traffic Engineering reviewed and approved their request to close both on and off ramps to place a continuous pattern.	Traffic Engineering	Pending
Proper Protection of Work Zones	The stability of the TPCBC being pinned to the top of concrete blocks and temporary pavement is questionable in consideration of the crashworthiness.	There should be working drawings and crash testing reports made available to the Engineer for pinned barriers on top of the roadway retention systems.	Engineering	Pending

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Quality Standards of Traffic Devices	A number of the traffic cones and traffic drums were bent or distorted.	Devices in marginal or unacceptable quality should be removed and replaced with those of acceptable quality. Refer to the ATSSA Quality Guidelines for Temporary Traffic Control Devices and Features.	Construction	Pending
Quality Standards of Traffic Devices	Some of the construction signs are backed with waffle board.	The Office of Construction issued a memo dated October 15, 2011 eliminating the use of waffle boards as a substrate for construction signs.	Construction	Pending
Quality Standards of Traffic Devices	Some “Business Access” signs had dull sheeting.	Signs need to have their condition and reflectivity maintained to remain clear and visible to motorists.	Construction	Pending

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Quality Standards of Traffic Devices	Some of the construction signs were mounted on waffle board.	Item No. 1220013A – Construction Signs – Bright Fluorescent Sheeting states that corrugated or waffle board type substrates shall not be used. The signs need to comply with the special provisions.	Construction	Pending
Quality Standards of Traffic Devices	Some traffic control devices were marginal to unacceptable in condition; either by being deformed or missing reflective tape. Devices in poor condition can hinder a motorist's awareness of the limits of a work zone especially in poor weather or at night.	The ATSSA Quality Guidelines for Temporary Traffic Control Devices and Features should be referenced for acceptable quality of devices.	Construction	Pending

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Quality Standards of Traffic Devices	A number of the delineators atop of the barrier curb were in poor condition or the wrong color for the side of the road the curb was on.	Any devices in poor condition should be removed from the site. Yellow delineators should only be on the left side and white delineators only on the right side of traffic.	Construction	Pending
Quality Standards of Traffic Devices	Some of the traffic cones were bent or scuffed or missing reflective tape.	Traffic devices that are marginal or unacceptable in condition should be removed from the site.	Construction	Pending
Quality Standards of Traffic Devices	The temporary construction signs on tripods were made of waffle board.	Waffle boards are no longer permitted to be used for construction signs.	Construction	Pending
Quality Standards of Traffic Devices	The signs placed on I-95 SB appeared to be smudged and/or streaked.	Signs need to be cleaned before placement to enhance their visibility to motorists.	Construction	Pending

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Quality Standards of Traffic Devices	A post-mounted sign was loose from its anchor.	Post-mounted signs needed to be securely anchored to prevent them from falling and becoming a potential hazard if impacted.	Construction	Pending
Quality Standards of Traffic Devices	Some traffic control devices were badly distorted, scuffed, and missing reflective tape which is unacceptable in quality.	Devices unacceptable in quality should be removed from the project and replaced with those that are acceptable.	Construction	Pending
Quality Standards of Traffic Devices	The quality of the traffic control devices was marginal to unacceptable. Devices in poor quality will hinder delineation through the work zone.	Unacceptable traffic control devices should be removed from the project.	Construction	Pending
Reevaluate Contract Items	The municipal police are considered expensive and the estimated amount will be exceeded.	Traffic Engineering should reevaluate the cost estimating for municipal police per Town.	Traffic Engineering	Pending

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Reevaluate Contract Items	Some items are routinely added based on field conditions and result in adjustments through change orders.	Adequate contingency allowance should be made to adjust traffic items as needed, including, square footage for signs, anti-tracking pads, temporary paint, and black-out paint.	Traffic Engineering	Pending
Rolling Road Blocks	The Contractor used a Rolling Road Block (RRB) to close a three-lane section of a limited access highway that turned into a four-lane section when installing the advance warning signs and taper. The RRB took 18 minutes before traffic was let through. (NOTE: The RRB was deemed necessary in this case to use to keep the project's ABC schedule on track to accomplish the bridge's milestone date.)	All projects are required to comply with the Construction Directive: Work Zone Safety Rolling Road Block (CB-2016-2).	Construction	Pending

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Rolling Road Blocks	The Rolling Road Block (RRB) used to install the traffic pattern, took place from 9:51 pm to 10:17 pm (26 minutes) on the southbound side; and then from 10:21 pm to 10:44 pm (23 minutes) on the northbound side. It was witnessed that RRB was used for the installation of the advance warning signs and the entire pattern. The Inspector spoke with the Sergeant on duty before the traffic pattern installation about adhering to the RRB policy. On the contrary, the Sargent decided it is safer to keep all lanes closed until the pattern is completed.	Construction Directive CD-2016-2 on Rolling Road Blocks allows a maximum time of 15 minutes. The Review Team said they would discuss the need for compliance about the DOT policy with State Police Liaison since this has been an ongoing issue.	Construction	Pending

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Rolling Road Blocks	The Rolling Road Block was excessive in time. In total it took 57 minutes which is much longer than the allowed 15 minutes. (NOTE: This was a major traffic shift for an interchange for limited-access highways.)	Other options to mitigate significant impacts to traffic should have been explored. The residual back up will take even longer to dissipate.	Construction	Pending
Rolling Road Blocks	The traffic stop to allow the structural steel to be set over a limited-access highway took 23 minutes which is considerably longer than the 10 minutes allowed in the contract provisions.	The suggested method of operation to set the steel should be analyzed in design phase to closely match the allowable time for an intermittent closure.	Construction	Pending
Selective Clearing	Some construction signs and devices were obstructed by shrubs, tall grass, and fences.	Selective clearing should be done to improve visibility to signs and access to devices.	Construction	Pending
Selective Clearing	A construction sign had overgrown tree branches with leaves in front.	Selective clearing is needed when the sign messages are obstructed from any angle.	Construction	Pending

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Selective Clearing	Some signs were blocked by overgrowth of bushes which can occur from one season to the next.	Selective clearing should be conducted throughout the construction season.	Construction	Pending
Selective Clearing	Some signs along the detour and a signal head on Route 114 are obstructed from view by low hanging tree branches.	Selective clearing can be used to ensure construction signs and signals heads are visible to motorists.	Construction	Pending
Selective Clearing	Post-mounted signs were slightly obstructed by trees.	Selective clearing is recommended.	Construction	Pending
Selective Clearing	Some signs were covered by overgrown plants.	Selective clearing is recommended for signs in place for long periods of time.	Construction	Pending
Sign Visibility	Some signs on the interstate are mounted too low when placed behind barrier.	Signs need to be raised if obstructed by barrier so their full messages are visible to motorists.	Construction	Pending

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Sign Visibility	Parked vehicles were blocking construction signs and devices for the road closure in the work zone.	Vehicles need to be parked where construction devices and signs are not visually impeded by oncoming traffic.	Construction	Pending
TMP Maintenance	Project staff indicated that the Transportation Management Plan for the project isn't currently being maintained. However, the project intends to start updating it once future projects adjacent to it become active.	The TMP is a guidance document required by 23 CFR 630 Subpart J to be maintained for significant projects.	Construction	Pending
Training Needs	Barricade warning lights were missing from all post-mounted diamond-shaped construction signs.	This is a recurring issue from 2015 and may be systemic. Training is needed to ensure construction inspectors don't repeat this error.	Construction	Pending

ACTION ITEMS LIST

Category	Observation	Recommendation	Assigned Office	Status
Training Needs	Materials and equipment stored within the clear zone of the roadway were not positively protected. Also, other materials were stored behind metal beam rail within the deflection zone.	Since this observation was also noted in 2015, this is a possible systemic issue that needs training to address it.	Construction	Pending
Unit Communication	The project didn't know to contact the Overweight/Oversized Permit Unit to notify them of lane closures or lane width reductions on the bridges.	Field staff contacting Overweight/Oversized Permits Unit should become a standard practice for bridge projects. Notifying them ahead of time can help detour oversized/overweight loads to an unimpeded travel route.	Construction	Pending

APPENDIX 2: 2015 & 2016 WORK ZONE SAFETY REVIEW ANNUAL REPORTS

2015 Regular Reviews

1. 0028-0201, Colchester and Salem
2. 0035-0195, Darien and Norwalk
3. 0053-0177, Glastonbury and Marlborough
4. 0069-0077, Killingworth
5. 0069-0079, Killingworth
6. 0088-0166, New Britain
7. 0092-0612, New Haven
8. 0104-0164, Old Lyme
9. 0115-0114, Putnam
10. 0153-0118, Watertown
11. 0157-0083,0157-0084, Weston
12. 0160-0145, Willington

2015 In-Depth Reviews

1. 0042-0320, East Hartford
2. 0092-0522, New Hartford
3. 0094-0255, New London
4. 0151-0273, Waterbury

2016 Regular Reviews

1. 0034-0313, Danbury
2. 0042-0315, East Hartford
3. 0044-0147, East Lyme and Waterford
4. 0073-0182, Litchfield
5. 0076-0217, Manchester
6. 0087-0142, Naugatuck
7. 0092-0522, New Haven
8. 0092-0531, New Haven
9. 0092-0669, New Haven
10. 0106-0121, Orange
11. 0109-0172, New Britain and Plainville
12. 0151-0273, Waterbury
13. 0152-0157, Waterford
14. 0155-0169, West Hartford
15. 0158-0201, Westport

2016 In-Depth Reviews

1. 0015-0363, Bridgeport
2. 0032-0130, Coventry
3. 0044-0152, East Lyme
4. 0051-0260, Farmington

APPENDIX 3: WORK ZONE SAFETY PERFORMANCE MEASURES

APPENDIX 4: WORK ZONE OPERATIONAL PERFORMANCE MEASURES

APPENDIX 5: DEPARTMENT POLICIES AND MEMORANDUMS

APPENDIX 6: ENGINEERING & CONSTRUCTION DIRECTIVES

APPENDIX 7: PUBLIC INFORMATION & PUBLIC OUTREACH GUIDANCE