I-95 CORRIDOR
BRANFORD TO RHODE ISLAND
FEASIBILITY STUDY

FINAL REPORT

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1 Introduction

The Transportation Strategy Board (TSB) and the Connecticut Department of Transportation (ConnDOT) have identified the need to evaluate existing and future transportation deficiencies and define the long-term transportation improvements needed along the I-95 corridor from Exit 54 in Branford to the Connecticut/Rhode Island border. This study was prepared as part of Public Act 01-5, Section 16, a project endorsed and funded by the TSB, in cooperation with the Federal Highway Administration (FHWA).

This report presents an assessment of the existing transportation and environmental conditions, an analysis of future transportation conditions (projected to the year 2025), recommended improvement concepts and an implementation plan of action for the I-95 corridor improvements.

The complete report consists of three individually bound documents. This document consists of the report text divided into six chapters. The second document consists of the report figures. These are graphical representations of the geometric, safety, operational and environmental elements of the I-95 study corridor, as well as the near and long term corridor improvement recommendations. The third document consists of the report appendices which are referenced throughout the text.

1.1 Project Background

The *Southeastern Connecticut Corridor Study*, completed in 1999 by ConnDOT Bureau of Policy and Planning, Office of Inventory and Forecasting, was prepared in response to Public Act 97-214 which required the Commissioner of Transportation to conduct a study of the transportation demands and needs of the southeast corridor of the state. The study analyzed existing and future transportation conditions on I-95 and US Route 1. The study also inventoried and evaluated ridership data for the Shore Line East rail line and other transit services operating in the I-95 study corridor.

The 1999 study identified the need for additional capacity on I-95. It also recommended that a more detailed study including environmental and financial analysis be performed to assess the feasibility of providing a third travel lane in all two lane sections of I-95 between the Town of Branford and the Rhode Island state line. The study found that the most severe congestion occurs Friday through Sunday in the summer months on I-95 and as such, “traditional transportation demand management strategies that can be successful in relieving congestion

for urban commuter peak period problems will not succeed in this corridor". Traffic in the peak period along this corridor is a combination of commuter traffic and traffic heading to and from recreational attractions in the southeastern Connecticut region and Rhode Island including Hammonasset State Beach, Mystic Marine Life Aquarium, Mystic Seaport, Rocky Neck State Park, Harkness Memorial, Mohegan Sun Casino, Foxwoods Resort Casino, Rhode Island beaches and Cape Cod.

This feasibility study provides an assessment of the transportation-related deficiencies and needs in the corridor, an evaluation of potential improvement concepts, and an evaluation of various transportation modes that currently exist and could potentially serve travel demand along I-95 including rail, bus and rideshare options.

The evaluation of potential improvement concepts considers environmental sensitivity and social factors. Environmental documentation requirements have been identified and are presented in subsequent sections of this report. A schedule for completion has also been developed. The documentation requirements are consistent with National Environmental Policy Act (NEPA) and Connecticut Environmental Policy Act (CEPA) procedures.

The study identifies existing and future capacity and operational needs within the study area including the I-95 mainline from Exit 54 in Branford to the Rhode Island state line, interchange ramps and selected intersections along local and state roads in the corridor, including US Route 1. I-95 mainline, interchange and intersection improvement concepts have been developed to address the identified operational and capacity deficiencies, as well as other safety-related issues in the corridor. The direction of this study was guided with the help of a steering committee; and ConnDOT maintained close coordination with the TSB. A public outreach program was also conducted to obtain public input through an on-going process during the study.

1.2 Study Goals and Objectives

Preserve/improve the capacity of I-95:
The study will review the mainline I-95 capacity issues that exist today and those anticipated for the future. It is essential, and required by FHWA policy, that the improvement alternatives identified for the I-95 interchanges also preserve the capacity of the mainline. This requires careful consideration of changes to ramp merge and diverge locations and weave conditions within the corridor.

Address each interchange's unique operating conditions and placement in the overall system:
Each interchange under study will be considered individually and in the context of the overall I-95 transportation system. The study will examine opportunities to improve safety conditions within the interchanges and eliminate and/or consolidate traffic movements through them while maintaining access to the local communities and major attractions. Particular attention will be paid to intersections and signals at the base of ramps and queuing distances to determine how they affect the ramp and interchange operation.

Enhance arterial street system operations:
The tight geometry of the interchanges and close proximity of adjacent intersections have constrained operations and affected safety along both the arterial street system and the Interstate.

Provide for future growth:
The I-95 system is tremendously important to provide access to existing and developing land uses. Future improvements will consider the options for development and the need to accommodate growth in traffic flow, both regionally and locally.

1.3 Study Area

The I-95 study corridor includes the I-95 mainline between Exit 54 in Branford and the Connecticut/Rhode Island border and the existing transit operations serving the corridor within these limits. The I-95 freeway within the study area is approximately 58 miles long and there are 38 interchanges which provide access to local and regional roadways. Figure 1-1 presents a map of the I-95 study area.

1.4 Study Process

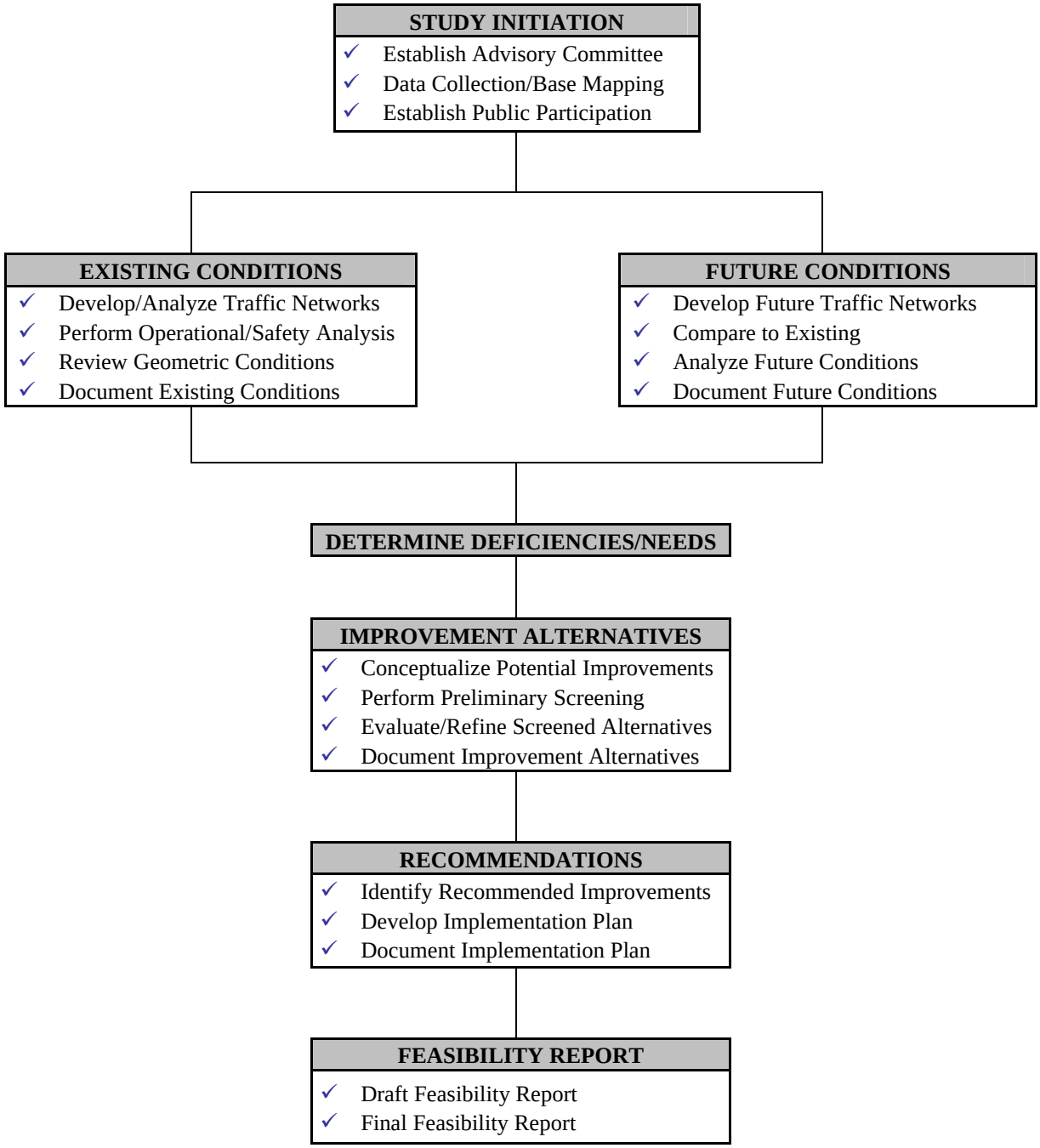
Similar to most engineering and planning studies, a structure or "process" was established at the onset for the development of this study. This process, which is depicted in Figure 1-2, provides a detailed overview of the project, task sequences and deliverables.

A general overview of the study mileposts is as follows:

1 – Study Management/Public Participation	**6** – Development of Recommendations
2 – Analysis of Existing Conditions	**7** – Implementation Plan
3 – Analysis of Future Conditions	**8** – Draft Feasibility Report
4 – Identification of Improvement Alternatives	**9** – Final Feasibility Report
5 – Refinement of Alternatives	

The initial stages of this study involved the establishment of an Advisory Committee (AC). The AC was comprised of transportation stakeholders in the shoreline region who were invited by ConnDOT to participate in the study process. A *stakeholder* was defined as a representative from a municipality, government agency, business, or other group with interest in the corridor. The purpose of the AC was to help guide the study process, review all technical documents, and provide direct input regarding improvement recommendations. Most importantly, the AC helped foster regional cooperation and consensus for the study. AC meetings were held throughout the course of the study to provide members with technical information and to solicit input from the members at critical decision points. A list of AC members who participated in the study is provided in the appendix.

Figure 1-2
Study Process



1.5 Public Participation

Public participation was a major component of this study. In addition to the involvement of the Advisory Committee, public input was solicited through local outreach meetings and public informational meetings. Local outreach meetings were targeted meetings with key stakeholders to identify specific issues in the I-95 study corridor and to develop potential solutions that will benefit the traveling public. Public informational meetings were informal "open-house" meetings where input was solicited from the general public for consideration in the development of the study recommendations.

Public informational meetings were scheduled in the early evenings to accommodate work schedules and to encourage attendance. These meetings were publicized extensively well in advance to provide early notice to the public. Public informational meetings coincided with the completion of the existing and future conditions analysis, and again with the completion of the *Draft Final Report*, to present the proposed improvement concepts prior to developing the final study recommendations.

In total, the public participation component of this study consisted of six AC meetings, 34 local outreach meetings and six public informational meetings. In addition, a website (http://www.i95southeastct.org) was developed to allow the general public to view relevant information and provide comments. A toll-free telephone number (800-236-0794) was also established allowing the public to provide comments.

1.6 Project Team

The "Project Team" involved in the completion of this study consisted of staff from ConnDOT, the Clough, Harbour & Associates LLP (CHA) consultant team, and the TSB. The CHA consultant team included staff from Parsons Transportation Group (PTG), Fitzgerald & Halliday, Inc. (FHI), and VN Engineers, Inc. (VN). Key project staff included:

ConnDOT – *Lead Agency*

- Edgar Hurle, Director of Policy and Planning
- Carmine Trotta, Assistant Director of Intermodal Project Planning
- James Andrini, Project Manager
- James Morrin, Transportation Planner

CHA – *Project Management, Improvement Concept Development, Final Report Preparation*

- Rodney Bascom, P.E., Project Manager
- Peter Perkins, P.E., Project Coordinator
- Raymond Rumanowski, P.E., Senior Transportation Engineer
- Robert Faulkner, P.E., Senior Highway Engineer
- Jeffrey Parker, P.E., Project Engineer
- David Sousa, R.L.A., A.I.C.P., Senior Planner
- David Kahlbaugh, A.I.C.P., Senior Traffic Planner

PTG – *Environmental Conditions Assessment, Transit Services Analysis*

- Kevin Slattery, Principal Environmental Planner
- Eugene Kennedy, A.I.C.P., Principal Environmental Planner
- Duncan W. Allen, P.E., Senior Technical Consultant

FHI – *Public Outreach Facilitation, Website Administration*

- A. Ruth Fitzgerald, A.I.C.P., Principal-in-Charge
- Jill Barrett, Principal Planner

VN – *Traffic Analysis*

- Michael Dion, Project Engineer

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Existing Infrastructure System Inventory

This chapter describes the existing transportation infrastructure system within the study area. Sections of this chapter present the existing traffic demands and operations, safety and geometrics, and a summary of the deficiencies of the corridor. Information is provided specific to mainline freeway sections, interchange ramps, and signalized and unsignalized intersections that have the potential to affect operations on I- 95.

This chapter also presents information related to major transit services within the corridor such as Amtrak and Shore Line East rail, Southeast Area Transit buses, and Rideshare vanpools.

2.1 Existing I-95 Traffic Demand

Traffic volumes presented in this study have been developed by the study team. The I-95 mainline average daily traffic (ADT) volumes are representative of year 2000 conditions and are the most recent ADT volumes available from ConnDOT. The I-95 mainline and ramp peak hour traffic volumes are representative of 2001/2002 conditions and were developed by ConnDOT through an ongoing statewide traffic counting program. This information was supplemented by manual counts conducted by the study team at intersections considered central to corridor operations. Detailed traffic volume networks are presented in the appendix.

2.1.1 Daily Volumes

Year 2000 two-way average daily traffic (ADT) volumes for mainline sections are presented in Table 2-1. As shown in the table, traffic volumes along mainline I-95 range from 36,600 vehicles per day (vpd) between Exits 92 and 93 to 121,000 vpd between Exits 84 and 85.

Table 2-1
I-95 Average Daily Traffic Volumes

Section	2000 ADT	Section	2000 ADT	Section	2000 ADT
Exit 54 to 55	83,900	Exit 67 (Elm St) to 67 (Rte154)	64,400	Exit 82 to 82A	77,400
Exit 55 to 56	80,000	Exit 67 (Rte 154) to 68	57,600	Exit 82A to 83	68,800
Exit 56 to 57	75,700	Exit 68 to 69	66,500	Exit 83 to 84	90,100
Exit 57 to 58	74,200	Exit 69 to 70	80,600	Exit 84 to 85	121,000
Exit 58 to 59	71,300	Exit 70 to 71	69,800	Exit 85 to 86	91,500
Exit 59 to 60	68,400	Exit 71 to 72	70,100	Exit 86 to 87(Rte 1)	67,400
Exit 60 to 61	71,600	Exit 72 to 73	71,400	Exit 87(Rte 1) to 87 (Rte 349)	60,800
Exit 61 to 62	67,100	Exit 73 to 74	71,600	Exit 87(Rte 349) to 88	75,900
Exit 62 to 63	66,600	Exit 74 to 75	75,800	Exit 88 to 89	69,400
Exit 63 to 64	64,200	Exit 75 to 76	83,500	Exit 89 to 90	63,800
Exit 64 to 65	64,100	Exit 76 to 80	61,200	Exit 90 to 91	52,600
Exit 65 to 66	61,000	Exit 80 to 81	61,600	Exit 91 to 92	42,900
Exit 66 to 67 (Elm St.)	58,900	Exit 81 to 82	66,700	Exit 92 to 93	36,600

2.1.2 Peak Hour Volumes

While daily volume data provides an overview of the traffic flows along the I-95 mainline, this study evaluates how the mainline and interchange facilities accommodate the peak hour demands placed upon them. In 1999, ConnDOT completed the *Southeastern Connecticut Corridor Study* that evaluated the transportation demands and needs of the southeast corridor of the state. The study analyzed existing traffic demands on I-95 and selected locations on US Route 1. The result of that analysis, in part, was the identification of the peak traffic periods.

The 1999 study found that severe congestion on I-95 occurs Friday through Sunday in the summer months due to commuter traffic and traffic heading to and from recreational attractions in the southeastern Connecticut region and Rhode Island. The study further found that traffic is highest on Friday in the summer months most likely due to a combination of commuter and tourist traffic. Therefore, the traffic volumes presented in this feasibility study are representative of the summer peak traffic periods. These volumes identify capacity and operational needs for existing and future conditions on the I-95 mainline, its interchanges, and selected adjacent intersections along local and state roads.

The morning and evening peak hour traffic volumes representing 2001 and 2002 conditions for the mainline sections were provided by ConnDOT and are shown in Table 2-2. For the 2001 AM peak hour, the table shows that southbound (SB) is the predominant direction of flow from Exits 54 to 63 and from Exits 87 to 91. The northbound (NB) direction is the predominant flow direction for the remainder of the mainline. In the 2002 PM peak hour, the predominant direction of flow is the northbound direction with the exception of the sections from Exits 75 to 82A and from Exits 84 to 87.

The peak hour volumes shown in Table 2-2 will be the basis of the capacity and level of service analyses presented in subsequent sections of this report.

Table 2-2
I-95 Mainline Peak Hour Volumes – 2001 AM and 2002 PM Existing Conditions

Section	2001 AM Peak Hour				2002 PM Peak Hour			
	Volume (vph)	% of Daily Traffic	Directional Split (vph) NB/SB	Directional Distribution	Volume (vph)	% of Daily Traffic	Directional Split (vph) NB/SB	Directional Distribution
Exit 54 to 55	6,100	7.3	2,600 / 3,500	57% SB	7,000	8.3	3,700 / 3,300	53% NB
Exit 55 to 56	5,940	7.4	2,460 / 3,480	59% SB	6,830	8.5	3,670 / 3,160	54% NB
Exit 56 to 57	5,740	7.6	2,340 / 3,400	59% SB	6,520	8.6	3,520 / 3,000	54% NB
Exit 57 to 58	5,670	7.6	2,330 / 3,340	59% SB	6,420	8.6	3,420 / 3,000	53% NB
Exit 58 to 59	5,550	7.8	2,400 / 3,150	57% SB	6,160	8.6	3,190 / 2,970	52% NB
Exit 59 to 60	5,130	7.5	2,240 / 2,890	56% SB	5,760	8.4	3,090 / 2,670	54% NB
Exit 60 to 61	5,390	7.5	2,370 / 3,020	56% SB	6,130	8.6	3,290 / 2,840	54% NB
Exit 61 to 62	5,010	7.5	2,320 / 2,690	54% SB	5,690	8.5	3,080 / 2,610	54% NB
Exit 62 to 63	5,000	7.5	2,440 / 2,560	51% SB	5,750	8.6	3,040 / 2,710	53% NB
Exit 63 to 64	4,790	7.5	2,480 / 2,310	52% NB	5,580	8.7	2,940 / 2,640	53% NB
Exit 64 to 65	4,700	7.3	2,550 / 2,150	54% NB	5,550	8.7	2,850 / 2,700	51% NB
Exit 65 to 66	4,450	7.3	2,450 / 2,000	55% NB	5,230	8.6	2,750 / 2,480	53% NB
Exit 66 to 67 (Elm St)	4,340	7.4	2,420 / 1,920	56% NB	5,030	8.5	2,650 / 2,380	53% NB
Exit 67 (Elm St) to 67 (Rte 154)	4,300	6.7	2,260 / 2,040	53% NB	5,140	8.0	2,630 / 2,510	51% NB
Exit 67 (Rte 154) to 68	4,160	7.2	2,260 / 1,900	54% NB	4,870	8.4	2,630 / 2,240	54% NB
Exit 68 to 69	4,860	7.3	2,560 / 2,300	53% NB	6,170	9.3	3,330 / 2,840	54% NB
Exit 69 to 70	6,360	7.9	3,230 / 3,130	51% NB	7,920	9.8	4,180 / 3,740	53% NB
Exit 70 to 71	5,740	8.2	3,100 / 2,640	54% NB	6,670	9.6	3,430 / 3,240	51% NB
Exit 71 to 72	6,010	8.6	3,300 / 2,710	55% NB	7,030	10.0	3,640 / 3,390	52% NB
Exit 72 to 73	5,960	8.4	3,300 / 2,660	55% NB	6,900	9.7	3,540 / 3,360	51% NB
Exit 73 to 74	6,020	8.4	3,390 / 2,630	56% NB	6,950	9.7	3,490 / 3,460	50% NB
Exit 74 to 75	6,230	8.2	3,660 / 2,570	59% NB	7,370	9.7	3,750 / 3,620	51% NB
Exit 75 to 76	6,770	8.1	4,000 / 2,770	59% NB	8,170	9.8	3,900 / 4,270	52% SB
Exit 76 to 80	4,970	8.1	3,100 / 1,870	62% NB	6,120	10.0	2,800 / 3,320	54% SB
Exit 80 to 81	5,040	8.2	3,150 / 1,890	63% NB	6,220	10.1	2,820 / 3,400	55% SB
Exit 81 to 82	5,360	8.0	3,320 / 2,040	62% NB	6,750	10.1	3,140 / 3,610	53% SB
Exit 82 to 82A	6,290	8.1	3,800 / 2,490	60% NB	8,180	10.6	3,750 / 4,430	54% SB
Exit 82A to 83	5,670	8.2	3,680 / 1,990	65% NB	6,860	10.0	3,500 / 3,360	51% NB
Exit 83 to 84	7,230	8.0	4,690 / 2,540	65% NB	8,860	9.8	4,500 / 4,360	51% NB
Exit 84 to 85	9,110	7.5	5,320 / 3,790	58% NB	11,860	9.8	5,750 / 6,110	52% SB
Exit 85 to 86	6,910	7.6	3,620 / 3,290	52% NB	9,710	10.6	4,550 / 5,160	53% SB
Exit 86 to 87 (Rte 1)	5,440	8.1	3,000 / 2,440	55% NB	7,410	11.0	3,550 / 3,860	52% SB
Exit 87 (Rte 1) to 87 (Rte 349)	4,660	7.7	2,170 / 2,490	53% SB	6,560	10.8	3,300 / 3,260	50% NB
Exit 87 (Rte 349) to 88	6,130	8.1	2,540 / 3,590	59% SB	8,130	10.7	4,570 / 3,560	56% NB
Exit 88 to 89	5,730	8.3	2,420 / 3,310	58% SB	7,430	10.7	4,170 / 3,260	56% NB
Exit 89 to 90	5,030	7.9	2,320 / 2,710	54% SB	6,720	10.5	3,670 / 3,050	55% NB
Exit 90 to 91	4,710	9.0	2,320 / 2,390	51% SB	5,390	10.2	3,100 / 2,290	58% NB
Exit 91 to 92	3,910	9.1	2,070 / 1,840	53% NB	4,370	10.2	2,470 / 1,900	57% NB
Exit 92 to 93	3,390	9.3	1,950 / 1,440	58% NB	3,370	9.2	2,000 / 1,370	59% NB

2.1.3 Surface Street Traffic Volumes

In addition to the traffic volumes collected on the I-95 mainline, existing traffic volumes were collected at 75 intersections throughout the study area during the summer Friday evening peak hour. The volumes were collected between Memorial Day and Labor Day during 2002. The locations are summarized in the appendix of this report and were selected due to their proximity to the interstate, and/or their potential to influence future improvement alternatives. Later sections of this report address the operational characteristics at each of these locations.

2.1.4 Trucks

To quantify truck volumes on I-95, ConnDOT conducted a vehicle classification study in 2000. In this study, vehicles were classified as either cars or trucks. Cars consisted of all passenger vehicles, motorcycles, and two-axle pick-up trucks. Trucks consisted of all vehicles with six or more tires.

The percentage of trucks in the two-way traffic stream varies from 8 to 22 percent during the peak hour. The highest truck percentages occur near the Connecticut/Rhode Island border in North Stonington where the northbound and southbound truck percentages are 8 percent and 14 percent, respectively. A traffic diagram showing the truck percentages in each section along I-95 is included in the appendix.

2.1.5 Mainline Speeds

Using the floating car method, a speed study was conducted along the I-95 mainline within the study area on Friday, July 19, 2002. The purpose of this study was to determine the prevailing vehicle speeds through each section of I-95 during the summer Friday evening peak hour. For each direction, three observations of the corridor were taken during the evening peak hour. An observer recorded travel times between exits while the driver maintained the tempo of the traffic stream.

The posted speed limit on I-95 in the study area is 65 mph with the exception of the area between Exits 74 and 76 where the posted speed limit is 55 mph. Travel Time–Speed Diagrams are shown in the appendix and indicate that travel speeds are generally in the posted speed limit range. Two areas with significant speed reduction occur between Exits 54 and 57 and between Exits 70 and 71. Mean travel speeds of 25 mph to 35 mph between Exits 54 and 57 in the southbound direction are the result of traffic congestion in this area. The northbound speeds are also reduced (60 mph to 45 mph), but to a lesser degree than the southbound direction. Between Exits 70 and 71, the mean travel speed of 40 mph in the northbound direction is also the result of traffic congestion.

2.2 Geometrics

I-95 is a major north-south route that traverses through New England. However, I-95 actually runs in a west-east direction in southeastern Connecticut. The section of I-95 from Branford to Waterford was opened in 1958 and the section from Waterford to the Connecticut/Rhode Island border was opened in 1964.

The southeastern Connecticut corridor carries a significant amount of traffic during typical commuting hours that is primarily comprised of a combination of commuter and recreational traffic, especially during the summer. Since I-95 was constructed, traffic volumes on this highway have increased dramatically. As a result, interchanges that were designed in accordance with the recommended standards at the time they were constructed may not conform to current freeway standards. Additionally, capacity issues at the ramps have begun to affect the operating conditions on the mainline. The significant traffic volumes combined with the geometric deficiencies increase the potential for operational and safety problems. Each interchange located within the study area was evaluated for conformance with current design standards. These evaluations included acceleration and deceleration lane lengths, approximate design speed of interchange ramps, minimum horizontal curvature and ramp terminal separations.

2.2.1 Methodology/Review of Geometrics

The study area encompasses the I-95 corridor beginning at Exit 54 in Branford and ending east of Exit 93 at the Rhode Island state line. Thirty-eight interchanges consisting of 69 exit ramps and 69 entrance ramps are located along this section of I-95.

2.2.2 Mainline Review

The I-95 mainline geometry generally consists of a four lane freeway with two 12 foot wide lanes in each direction, 10 foot wide outside shoulders, and 4 foot wide median shoulders. Exceptions to the four lane freeway section include:

- Six lane sections on both approaches to the Baldwin Bridge (Old Saybrook to Old Lyme) widening to an eight lane section on the bridge
- Six lane sections on both approaches to the Gold Star Bridge (New London to Groton) widening to a ten lane section on the bridge

The mainline geometric features were evaluated using existing geometric mapping. I-95 is classified as an urban freeway in accordance with current design conventions; this corresponds to a design speed of 70 mph. Four geometric features along the mainline were evaluated for conformance with current design standards, including:

- Minimum lane width (12 feet)
- Minimum outside shoulder width (10 feet)
- Maximum grade (4% for rolling terrain)
- Maximum degree of horizontal curvature (2°-45')

All design values were taken from the 2001 Fourth Edition of *A Policy on Geometric Design of Highways and Streets* published by the American Association of State Highway and Transportation Officials (2001 AASHTO). Lane and shoulder widths were evaluated using year 2000 digital orthophotos. No minimum lane width deficiencies were identified within the project limits, but two areas were identified where inadequate outside shoulder widths are present. The results of the geometric analysis are summarized in Tables 2-3 to 2-5 and are illustrated on Figure 2-1.

Table 2-3
I-95 Outside Shoulder Width Deficiencies (10' Minimum)

Town	Closest Interchange	Approximate Location	Shoulder Width (ft)	Length (ft)
Northbound				
Old Lyme	Exit 70	Lieutenant River	8	2,000
Southbound				
Old Lyme	Exit 70	Lieutenant River	8	2,000

Table 2-4
I-95 Mainline Grade Deficiencies (4% Maximum)

Town	Closest Interchange	Approximate Location	Grade (%)	Length (ft)
Northbound				
Old Lyme	Exit 72	North Bride Brook Road	4.4	160
Waterford	Exit 80	Oil Mill Brook	5.0	290
Waterford	Exit 81	750' west of Stony Brook	4.4	635
Waterford	Exit 82	500' west of Route 85	5.0	1,370
Southbound				
Old Lyme	Exit 71	1500' west of Hatchetts Hill Rd	4.9	1,110

Table 2-5
I-95 Mainline Degree of Horizontal Curvature Deficiencies (2°-45' Maximum)

Town	Closest Interchange	Approximate Location	Degree of Curvature	Length (ft)
Northbound				
New London	Exit 84	Exit 84 Entrance Ramp	3°	845
Southbound				
East Lyme	Exit 76	Exit 76 Entrance Ramp	4°	1,270
Groton	Exit 86	Route 184	3°-30'	730

2.2.3 Interchange Review

Each interchange ramp was evaluated for standard acceleration and deceleration lane length and minimum horizontal curvature. According to 2001 AASHTO guidelines, the minimum desirable ramp design speed is equal to one-half the mainline design speed. Therefore the I-95 mainline design speed, which is 70 mph, translates to a minimum ramp design speed of 35 mph. Although this is the desired minimum value, it is often impractical to design ramps to meet this criterion where existing site constraints dictate a less conservative design is required. This is typical where loop or partial-loop ramps are utilized in cloverleaf-type interchanges to minimize the overall footprint of the interchange. AASHTO recommends a minimum design speed of 25 mph for these ramps.

Existing horizontal curvature determined from ConnDOT right-of-way plans and digital orthophotos was used to estimate existing ramp design speeds. These estimated speeds were then used to evaluate each ramp for conformance with the minimum desirable speed of 35 mph. For the purposes of this study, ramps with estimated speeds of less than 35 mph were considered deficient. These locations are shown in Table 2-6 and are illustrated on Figure 2-1. It should be noted, however, that numerous ramps within the study area are loop or partial-loop ramps that require a minimum speed of 25 mph in accordance with AASHTO standards. The locations of these ramps are also shown in Table 2-6.

Existing acceleration and deceleration lane lengths obtained from right-of-way plans and digital orthophotos were also used to evaluate each ramp terminal for conformance with AASHTO design standards. The acceleration and deceleration lane lengths were compared to the estimated ramp speeds to identify locations where inadequate speed-change lengths exist. Table 2-7 and Figure 2-1 provide a summary of these deficient locations.

Table 2-6
I-95 Ramp Design Speed Deficiencies ('X' indicates a deficiency)

Location	Design Speed			Radius (ft)
	25 mph and below	25 – 30 mph	30 – 35 mph	
Northbound				
Exit 55 Off[1,2]		X		180
Exit 57 On[1]		X		200
Exit 66 On[1]	X			140
Exit 69 Off[1]			X	275
Exit 71 Off[1,2]		X		180
Exit 81 On		X		230
Exit 87 Off			X	250
Southbound				
Exit 55 Off[1,2]		X		180
Exit 57 On[1]		X		180
Exit 59 Off[1,2]		X		180
Exit 61 On[1]		X		180
Exit 62 On[1]		X		180
Exit 63 Off[1,2]		X		180
Exit 66 On[1]	X			140
Exit 67 On[1]	X			140
Exit 72 Off[1]		X		180
Exit 74 Off[1]	X			130
Exit 74 On		X		160
Exit 81 Off		X		230
Exit 81 On		X		200
Exit 85 On			X	250
Exit 88 On[1]			X	260
Exit 89 On[1]			X	260
Exit 90 On[1]			X	260
Exit 91 On[1]			X	250

1 Loop or partial-loop ramp type. In accordance with 2001 AASHTO guidelines, minimum design speeds of 25 mph and minimum curve radii of 150 feet are acceptable.
2 Radius shown is for controlling (smallest radius) curve on ramp. Radius at diverge is standard for 35 mph.

Table 2-7
I-95 Ramp Acceleration/Deceleration Lane Length Deficiencies ('X' indicates a deficiency)

Interchange	Northbound		Southbound	
	Deceleration Lane	Acceleration Lane	Deceleration Lane	Acceleration Lane
Exit 54	N/A	X	X	N/A
Exit 55	X	X	X	X
Exit 56	X	X		X
Exit 57	X	X	X	X
Exit 58	X	X	X	X
Exit 59	X		X	X
Exit 60	N/A	X	X	N/A
Exit 61	X		X	X
Exit 62	X	X	X	X
Exit 63	X	X	X	X
Exit 64	X	X	X	X
Exit 65	X	X		X
Exit 66		X	X	X
Exit 67 (Elm St)	N/A	X		N/A
Exit 67 (Rte 154)	X	N/A	N/A	X
Exit 68	N/A	Lane Ahead		N/A
Exit 69	X	Lane Ahead	Exit Only Lane	X
Exit 70	Exit Only Lane	X	X	Lane Ahead
Exit 71	X	X		X
Exit 72		X	X	X
Exit 73	X	X	X	X
Exit 74	X	X	X	X
Exit 75		X	X	X
Exit 76		N/A	N/A	
Exit 80	N/A	X	X	N/A
Exit 81		X	X	X
Exit 82	X	X		
Exit 82A	X		N/A	X
Exit 83		Lane Ahead	Exit Only Lane	N/A
Exit 84	N/A	Lane Ahead	Exit Only Lane	N/A
Exit 85		N/A	N/A	Lane Ahead
Exit 86	Exit Only Lane	N/A	N/A	Lane Ahead
Exit 87				
Exit 88	X	X	X	X
Exit 89		X	X	X
Exit 90	X		X	X
Exit 91	X	X	X	X
Exit 92	X	X	X	X
Exit 93	X	X	X	X

The minimum separation distance between successive interchange ramps was also compared to 2001 AASHTO recommendations. A minimum spacing of 500 feet is recommended between exit and entrance ramps and 2,000 feet is recommended between entrance and exit ramps. The southbound ramps at Exit 74, which are separated by 425 feet, are the only ramps with deficient exit-entrance ramp separation. Locations with deficient entrance-exit ramp separation distances are shown in Table 2-8 and on Figure 2-1.

Table 2-8
I-95 Entrance to Exit Ramp Separation Deficiencies (2,000' Minimum)

Northbound			Southbound		
From	**To**	**Separation (ft)**	**From**	**To**	**Separation (ft)**
Madison Rest Area	Exit 62	1000	Exit 62	Madison Rest Area	1900
Exit 71	Exit 72	800	Exit 69	Exit 68	900
Exit 75	Exit 76	1400	Exit 72	Exit 71	400
Exit 82	Exit 82A	1500	Exit 82A	Exit 82	1200

2.3 Existing Traffic Operations

The next step in the study process was to evaluate the operations of I-95 within the study area. This analysis provides a technical assessment of the operational characteristics of the ramps, freeway, weaving sections, and intersections using the procedures documented in the *2000 Highway Capacity Manual* (HCM) and compares these characteristics with the hourly traffic demand volumes. The traffic analysis was conducted using the peak hour traffic volumes described in Section 2.1.2 and the geometric design conditions as they currently exist along the study area roadways.

Understanding the relationship between the supply and demand on a roadway is a fundamental consideration in evaluating how well a transportation facility fulfills its objective to safely and efficiently accommodate the travelling public. The traffic operations analysis procedures used to evaluate the I-95 study area roadways assigns a level of service (LOS) rating for each specific section, intersection, or area of roadway analyzed. LOS is a qualitative measurement of the operating conditions of a roadway facility or intersection taking into account a number of variables such as speed, vehicle maneuverability, driver comfort, and safety. Similar to a report card, LOS designations are letter based, ranging from A to F, with LOS A representing the best operating condition and LOS F representing the worst operating condition. LOS A represents free flow conditions and LOS E and F represent conditions where demands approach or are at the available capacity. A more detailed description of the various LOS designations is included in the appendix.

The HCM does not recommend a specific LOS for design purposes, rather it offers a description of the conditions associated with each level of service. For example, LOS C is described in the manual with key words and phrases such as "stable operations," "traffic stream is notably affected," "lane change requires additional care," and "a noticeable increase in (driver) tension." As conditions deteriorate to LOS D, the HCM describes conditions with words such as "unstable flow," "average travel speeds are noticeably reduced," "freedom to maneuver is severely limited," and "drastically reduced physical and psychological (driver) comfort."

2.3.1 Methodology/Criteria

The criteria used to evaluate the I-95 roadway capacity were based on the methodology presented in the 2000 HCM. The HCM presents various methods for evaluating traffic operations for various types of roadway facilities as defined by the Federal Highway Administration (FHWA). The criteria presented in the HCM is based on years of research in traffic operations and traffic flow and is a tool that FHWA and the traffic

engineering community utilize for analyzing traffic operations. The following HCM chapters were utilized in the evaluation of the I-95 study area transportation facilities:

- Chapter 16 – Signalized Intersections
- Chapter 17 – Unsignalized Intersections
- Chapter 23 – Basic Freeway Segments
- Chapter 24 – Freeway Weaving
- Chapter 25 – Ramps and Ramp Junctions

All of these chapters were used to define the operating conditions for the various traffic conditions and traffic volumes experienced along I-95 and the study area roadways.

The following sections provide a summary of the existing conditions for the I-95 mainline, ramps and intersection in the study area. For the purposes of this study, LOS D and better are considered acceptable conditions. LOS E and F represent operational deficiencies.

2.3.2 Mainline Operations

The procedures for analyzing the operational conditions of the I-95 mainline are based on analysis procedures presented in Chapter 23 (Basic Freeway Segments) of the HCM. The HCM procedures for analyzing freeway sections use a number of factors including traffic volumes, number of lanes, width of those lanes, percentage of trucks in the traffic stream, lateral clearance to obstructions along the side of the road, freeway speed, terrain, and driver population (primary commuters, or some mix of recreational and commuter) in the analysis section.

Levels of service (LOS) for freeway sections are defined in terms of density and are measured in passenger cars per mile per lane (pc/mi/ln). LOS A would describe a freeway section where vehicles are operating at free flow speeds, vehicle maneuverability is relatively unimpeded, and densities are less than 11 pc/mi/ln. LOS C would describe a freeway where vehicles are operating close to or at free-flow speeds, maneuverability is becoming noticeably restricted but it is possible with diligence, and densities are between 18 and 26 pc/mi/ln. At LOS E, the freeway section is operating at capacity, maneuverability is severely restricted, and densities are highly variable due to potential volatility of the congestion but are greater than 35 pc/mi/ln. At LOS F, the traffic volume on the freeway section exceeds the capacity of that section.

The results of the freeway section analysis for existing traffic conditions are summarized in Table 2-9 and illustrated on Figure 2-2. The table shows each section of I-95 within the study area that was evaluated, the number of travel lanes in that section, the general terrain type, the existing peak hour volume (the higher of the AM or the PM peak hour), and the corresponding level of service. A section is defined as the area of I-95 between successive interchanges (i.e., the area between Exit 54 and Exit 55 is a section).

Northbound Freeway Sections

The northbound direction of I-95 operates between LOS C to F. There are no northbound sections that operate at LOS A or B. Almost half of all sections operate at LOS E or F and experience operational deficiencies. Generally, the freeway can be separated into areas which operate with similar levels of service. The northbound sections that operate at LOS E or F are as follows: Exits 54 to 56, Exits 70 to 76 and Exits 82 to 84. The other northbound sections generally operate at LOS C or D. These sections include the Baldwin Bridge (Exits 69 to 70) and the Gold Star Bridge (Exits 84 to 85). There are a few northbound sections

however, within these groups that operate at LOS E or F. Those individual sections are Exits 68 to 69, Exits 85 to 86 and Exits 89 to 90.

Southbound Freeway Sections

The southbound direction of I-95 operates between LOS B and F. About one-third of the sections operate at LOS E or F and experience operational deficiencies. The section between Exit 92 and the Rhode Island state line operates at LOS B. As with the northbound direction, the southbound direction also has areas which operate at similar levels of service. The southbound sections that operate at LOS C or D are Exits 84 to 92 and Exits 56 to 70. These sections include the Baldwin Bridge (Exits 69 to 70) and the Gold Star Bridge (Exits 84 to 85). The other southbound sections, Exits 54 to 56 and Exits 70 to 84, operate at LOS E or F.

Table 2-9
Freeway Section Analysis — Summary of 2002 Existing Conditions

Section		Terrain	Number of Lanes	Peak Hour	Level of Service	2025 Volumes (vph)[1]
From	To					
Northbound						
Exit 54	**Exit 55**	**Level**	**2**	**PM**	**F**	**3,700**
Exit 55	**Exit 56**	**Level**	**2**	**PM**	**F**	**3,670**
Exit 56	Exit 57	Level	2	PM	D	3,520
Exit 57	Exit 58	Level	2	PM	D	3,420
Exit 58	Exit 59	Level	2	PM	D	3,190
Exit 59	Exit 60	Rolling	2	PM	D	3,090
Exit 60	Exit 61	Rolling	2	PM	D	3,290
Exit 61	Exit 62	Rolling	2	PM	D	3,080
Exit 62	Exit 63	Rolling	2	PM	D	3,040
Exit 63	Exit 64	Rolling	2	PM	D	2,940
Exit 64	Exit 65	Rolling	2	PM	D	2,850
Exit 65	Exit 66	Rolling	2	PM	D	2,750
Exit 66	Exit 67 (Elm St)	Rolling	2	PM	D	2,650
Exit 67 (Rte 154)	Exit 68	Rolling	2	PM	D	2,630
Exit 68	**Exit 69**	**Rolling**	**3**	**PM**	**E**	**3,330**
Exit 69	Exit 70	Rolling	4	PM	C	4,180
Exit 70	**Exit 71**	**Rolling**	**2**	**PM**	**E**	**3,430**
Exit 71	**Exit 72**	**Rolling**	**2**	**PM**	**E**	**3,640**
Exit 72	**Exit 73**	**Rolling**	**2**	**PM**	**E**	**3,540**
Exit 73	**Exit 74**	**Rolling**	**2**	**PM**	**E**	**3,490**
Exit 74	**Exit 75**	**Rolling**	**2**	**PM**	**E**	**3,750**
Exit 75	**Exit 76**	**Rolling**	**2**	**AM**	**F**	**4,000**
Exit 76	Exit 80	Rolling	2	AM	D	3,100
Exit 80	Exit 81	Rolling	2	AM	D	3,150
Exit 81	Exit 82	Rolling	2	AM	D	3,320
Exit 82	**Exit 82A**	**Rolling**	**2**	**AM**	**E**	**3,800**
Exit 82A	**Exit 83**	**Rolling**	**3**	**AM**	**F**	**3,680**
Exit 83	**Exit 84**	**Rolling**	**4**	**AM**	**F**	**4,690**
Exit 84	Exit 85	Rolling	5	PM	C	5,750
Exit 85	**Exit 86**	**Rolling**	**3**	**PM**	**F**	**4,550**
Exit 86	Exit 87	Rolling	3	PM	C	3,550
Exit 87	Exit 88	Rolling	3	PM	D	4,570
Exit 88	Exit 89	Rolling	3	PM	D	4,170
Exit 89	**Exit 90**	**Rolling**	**2**	**PM**	**E**	**3,670**

Table 2-9
Freeway Section Analysis — Summary of 2002 Existing Conditions

Section		Terrain	Number of Lanes	Peak Hour	Level of Service	2025 Volumes (vph)[1]
From	To					
Exit 90	Exit 91	Rolling	2	PM	D	3,100
Exit 91	Exit 92	Rolling	2	PM	C	2,470
Exit 92	Exit 93	Rolling	2	PM	C	2,000
Exit 93	State Line	Rolling	2	PM	C	2,050
Southbound						
Exit 54	**Exit 55**	**Level**	**2**	**AM**	**F**	**3,500**
Exit 55	**Exit 56**	**Level**	**2**	**AM**	**F**	**3,480**
Exit 56	Exit 57	Level	2	AM	D	3,400
Exit 57	Exit 58	Level	2	AM	D	3,340
Exit 58	Exit 59	Level	2	AM	D	3,150
Exit 59	Exit 60	Rolling	2	AM	D	2,890
Exit 60	Exit 61	Rolling	2	AM	D	3,020
Exit 61	Exit 62	Rolling	2	AM	D	2,690
Exit 62	Exit 63	Rolling	2	PM	D	2,710
Exit 63	Exit 64	Rolling	2	PM	D	2,640
Exit 64	Exit 65	Rolling	2	PM	D	2,700
Exit 65	Exit 66	Rolling	2	PM	D	2,480
Exit 66	Exit 67 (Elm St)	Rolling	2	PM	C	2,380
Exit 67 (Elm St)	Exit 67 (Rte 154)	Rolling	2	PM	D	2,510
Exit 67 (Rte 154)	Exit 68	Rolling	2	PM	C	2,240
Exit 68	Exit 69	Rolling	2	PM	D	2,840
Exit 69	Exit 70	Rolling	4	PM	C	3,740
Exit 70	**Exit 71**	**Rolling**	**2**	**PM**	**E**	**3,240**
Exit 71	**Exit 72**	**Rolling**	**2**	**PM**	**E**	**3,390**
Exit 72	**Exit 73**	**Rolling**	**2**	**PM**	**E**	**3,360**
Exit 73	**Exit 74**	**Rolling**	**2**	**PM**	**E**	**3,460**
Exit 74	**Exit 75**	**Rolling**	**2**	**PM**	**E**	**3,620**
Exit 75	**Exit 76**	**Rolling**	**2**	**PM**	**F**	**4,270**
Exit 76	**Exit 80**	**Rolling**	**2**	**PM**	**E**	**3,320**
Exit 80	**Exit 81**	**Rolling**	**2**	**PM**	**E**	**3,400**
Exit 81	**Exit 82**	**Rolling**	**2**	**PM**	**E**	**3,610**
Exit 82	**Exit 82A (Frontage Rd)**	**Rolling**	**2**	**PM**	**F**	**4,430**
Exit 82A (Frontage Rd)	**Exit 83**	**Rolling**	**2**	**PM**	**F**	**3,360**
Exit 83	**Exit 84**	**Rolling**	**4**	**PM**	**F**	**4,360**
Exit 84	Exit 85	Rolling	5	PM	D	6,110
Exit 85	Exit 86	Rolling	4	PM	D	5,160
Exit 86	Exit 87 (Rte 1)	Rolling	3	PM	C	3,860
Exit 87 (Rte 1)	Exit 87 (Rte 349)	Level	3	PM	C	3,260
Exit 87 (Rte 349)	Exit 88	Rolling	3	AM	C	3,590
Exit 88	Exit 89	Rolling	3	AM	C	3,310
Exit 89	Exit 90	Rolling	2	PM	D	3,050
Exit 90	Exit 91	Rolling	2	AM	C	2,390
Exit 91	Exit 92	Rolling	2	PM	C	1,900
Exit 92	Exit 93	Rolling	2	AM	B	1,440
Exit 93	State Line	Rolling	2	AM	B	1,540

Note: Boldface entries denote capacity deficiencies during the peak period.
1 vph – Vehicles per hour, including all vehicle types (e.g. passenger cars, trucks, motorcycles, etc.)

2.3.3 Ramp Operations

The HCM procedures for analyzing the operational conditions of highway ramps focus on the interaction between freeway mainline through traffic and merging and diverging traffic to and from the ramps. These analyses consider a number of factors including the length of acceleration or deceleration lanes and free-flow vehicle speeds along the freeway. In particular, the analysis for merging vehicles focuses on the areas where individual on-ramp vehicles attempt to find gaps in the adjacent mainline traffic stream. The action of this merging traffic creates turbulence along the mainline that can affect freeway operations. The converse of this is the diverge movement which forces exiting vehicles to shift in advance of the exit and occupy the right-hand lane (in the case of a right-hand exit lane) in order to exit the freeway. This action causes some turbulence to the overall traffic stream as the vehicles shift lanes and slow their speed in preparation for the off-ramp.

There are three left-hand off-ramps and two left-hand on-ramps within the corridor. Left-hand off-ramps are undesirable because they can cause driver uncertainty and require slower traffic to merge into the left lane to exit the mainline. Left-hand on-ramps are undesirable because they require the driver to merge into the higher speed, passing lane to enter the mainline. Left-hand ramps exist at the following locations:

- Exit 76 NB Off-ramp
- Exit 86 NB Off-ramp
- Exit 86 SB On-ramp
- Exit 87 SB Off-ramp
- Exit 87 SB On-ramp

Level of service for ramp operations is based on the density of the vehicles within the influence areas created by the merging or diverging vehicles. According to the HCM, the influence area for these movements is about 1,500 feet before the diverge area and 1,500 feet beyond the merge area. LOS A represents a condition where merging and diverging vehicles create no disruption to the mainline through vehicles and there is virtually no turbulence within the ramp influence area. On the other hand, LOS E/F represents conditions where the turbulence created by the merging and diverging vehicles becomes intrusive to all drivers in the influence area. Under these conditions, any minor changes to the traffic conditions could result in the creation of unacceptable queues along the ramps and for the mainline through traffic.

It is also important to note that ramp analyses do not evaluate the weaving conditions created by ramp operations along some freeway exits. For example, the ramp analysis does not take into account the factors involved where an on-ramp (such as I-95 southbound at Exit 72) is immediately followed (within 2,500 feet) downstream by an off-ramp (such as I-95 southbound Exit 71). This condition is evaluated as part of the weaving analysis presented in Section 2.3.4. The results of the I-95 ramp analyses are shown in Table 2-10 and also on Figure 2-2.

Northbound Ramps

Slightly more than one-third of the on and off-ramps along the northbound direction of I-95 operate at LOS E or F. The remaining ramps operate at LOS C or D. As with the freeway analysis, there is a general operational trend that shows groups of ramps operating under similar levels of service. The ramp groups that generally operate at LOS E or F are in the area of Exits 54 to 58, Exits 69 to 76, and Exits 82 to 90. The ramp groups that operate at LOS C or D are in the area of Exits 58 to 68, Exits 80 to 81 and Exits 90 to 93.

Southbound Ramps

Approximately one-third of the on and off-ramps along the southbound direction of I-95 operate at LOS E or F. There are three ramps (Exit 92 Off and Exit 93 On/Off) that operate at LOS B. The remaining ramps operate at LOS C or D. The ramp groups that generally operate at LOS E or F are in the area of Exits 70 to 89. The ramp groups that generally operate at LOS C or D are in the area of Exits 54 to 69 and Exits 90 to 92.

Table 2-10
Ramp Merge/Diverge Analysis – Summary of 2002 Existing Conditions

Ramp	Ramp Volume	Terrain	Peak Hour	Level of Service	Density (pc/mi/ln)
Northbound					
Exit 54 On	**540**	**Level**	**PM**	**E**	**36**
Exit 55 Off	**400**	**Level**	**PM**	**E**	**39**
Exit 55 On	**370**	**Level**	**PM**	**E**	**36**
Exit 56 Off	**500**	**Level**	**PM**	**E**	**39**
Exit 56 On	350	Level	PM	D	35
Exit 57 Off	**370**	**Rolling**	**PM**	**E**	**38**
Exit 57 On	270	Rolling	PM	D	35
Exit 58 Off	**450**	**Rolling**	**PM**	**E**	**37**
Exit 58 On	220	Rolling	PM	D	33
Exit 59 Off	550	Rolling	PM	D	35
Exit 59 On	450	Rolling	PM	D	31
Exit 60 On	200	Rolling	PM	D	35
Exit 61 Off	**450**	**Rolling**	**PM**	**E**	**36**
Exit 61 On	240	Rolling	PM	D	30
Exit 62 Off	350	Rolling	PM	D	34
Exit 62 On	310	Rolling	PM	D	31
Exit 63 Off	550	Rolling	PM	D	35
Exit 63 On	450	Rolling	PM	D	30
Exit 64 Off	340	Rolling	PM	D	32
Exit 64 On	250	Rolling	PM	D	29
Exit 65 Off	410	Rolling	PM	D	31
Exit 65 On	310	Rolling	PM	D	28
Exit 66 Off	300	Rolling	PM	D	30
Exit 66 On	200	Rolling	PM	D	30
Exit 67 (Elm St) On	310	Rolling	PM	D	33
Exit 67 (Rte 154) Off	330	Rolling	PM	D	32
Exit 68 On	700	Rolling	PM	D	33
Exit 69 Off	**200**	**Rolling**	**PM**	**E**	**36**
Exit 69 On	**1050**	**Rolling**	**PM**	**F**	**40**
Exit 70 Off	**1000**	**Rolling**	**PM**	**F**	**44**
Exit 70 On	**250**	**Rolling**	**PM**	**E**	**37**
Exit 71 Off	**90**	**Rolling**	**PM**	**E**	**36**
Exit 71 On	**300**	**Rolling**	**PM**	**E**	**38**
Exit 72 Off	**350**	**Rolling**	**PM**	**E**	**38**
Exit 72 On	**250**	**Rolling**	**PM**	**E**	**37**

Table 2-10
Ramp Merge/Diverge Analysis – Summary of 2002 Existing Conditions

Ramp	Ramp Volume	Terrain	Peak Hour	Level of Service	Density (pc/mi/ln)
Exit 73 Off	**100**	**Rolling**	**PM**	**E**	**39**
Exit 73 On	**50**	**Rolling**	**PM**	**E**	**36**
Exit 74 Off	**300**	**Rolling**	**PM**	**E**	**38**
Exit 74 On	**560**	**Rolling**	**PM**	**E**	**39**
Exit 75 Off	**250**	**Rolling**	**PM**	**F**	**41**
Exit 75 On	**400**	**Rolling**	**PM**	**F**	**40**
Exit 76 Off	**1100**	**Rolling**	**PM**	**F**	**43**
Exit 80 On	20	Rolling	PM	D	31
Exit 81 (Cross Rd) Off	220	Rolling	PM	D	31
Exit 81 (Parkway South) On	540	Rolling	PM	D	32
Exit 82 Off	**330**	**Rolling**	**PM**	**E**	**35**
Exit 82 On	**940**	**Rolling**	**PM**	**E**	**39**
Exit 82A Off	**400**	**Rolling**	**PM**	**F**	**41**
Exit 82A On	**150**	**Rolling**	**PM**	**E**	**36**
Exit 83 Off	**250**	**Rolling**	**PM**	**E**	**39**
Exit 83 On	1250	Rolling	PM	D	28
Exit 84 On	**1250**	**Rolling**	**PM**	**F**	**35**
Exit 85 Off	**1200**	**Rolling**	**PM**	**F**	**34**
Exit 86 Off	**1000**	**Rolling**	**PM**	**F**	**41**
Exit 87 Off	250	Rolling	PM	D	34
Exit 87 On	1270	Rolling	PM	D	29
Exit 88 Off	**750**	**Rolling**	**PM**	**F**	**47**
Exit 88 On	**350**	**Rolling**	**PM**	**F**	**40**
Exit 89 Off	**750**	**Rolling**	**PM**	**F**	**44**
Exit 89 On	**250**	**Rolling**	**PM**	**E**	**36**
Exit 90 Off	**900**	**Rolling**	**PM**	**F**	**41**
Exit 90 On	330	Rolling	PM	D	29
Exit 91 Off	700	Rolling	PM	D	33
Exit 91 On	70	Rolling	PM	C	25
Exit 92 Off	870	Rolling	PM	C	28
Exit 92 On	400	Rolling	PM	C	22
Exit 93 Off	200	Rolling	PM	C	24
Exit 93 On	250	Rolling	PM	C	21
Southbound					
Exit 54 Off	650	Level	PM	D	35
Exit 55 Off	360	Level	PM	D	34
Exit 55 On	500	Level	PM	D	33
Exit 56 (Industrial Rd) Off	320	Level	PM	D	35
Exit 56 (Leetes Island Rd) On	480	Level	PM	D	34
Exit 57 Off	250	Rolling	PM	D	35
Exit 57 On	250	Rolling	PM	D	33
Exit 58 Off	300	Rolling	PM	D	33

Table 2-10
Ramp Merge/Diverge Analysis – Summary of 2002 Existing Conditions

Ramp	Ramp Volume	Terrain	Peak Hour	Level of Service	Density (pc/mi/ln)
Exit 58 On	330	Rolling	PM	D	32
Exit 59 Off	250	Rolling	PM	D	31
Exit 59 On	550	Rolling	PM	D	31
Exit 60 Off	170	Rolling	PM	D	33
Exit 61 Off	200	Rolling	PM	D	31
Exit 61 On	430	Rolling	PM	D	30
Exit 62 Off	380	Rolling	PM	D	31
Exit 62 On	280	Rolling	PM	D	30
Exit 63 Off	430	Rolling	PM	D	31
Exit 63 On	500	Rolling	PM	D	29
Exit 64 Off	310	Rolling	PM	D	31
Exit 64 On	250	Rolling	PM	D	29
Exit 65 Off	230	Rolling	PM	D	30
Exit 65 On	450	Rolling	PM	D	29
Exit 66 Off	200	Rolling	PM	D	30
Exit 66 On	300	Rolling	PM	D	28
Exit 67 (Elm St) Off	310	Rolling	PM	D	32
Exit 67 (Rte 154 – SB) On	180	Rolling	PM	D	31
Exit 67 (Rte 154 – NB) On	270	Rolling	PM	D	28
Exit 68 Off	600	Rolling	PM	D	33
Exit 69 Off	**1200**	**Rolling**	**PM**	**F**	**43**
Exit 69 On	300	Rolling	PM	D	31
Exit 70 Off	**200**	**Rolling**	**PM**	**E**	**39**
Exit 70 On	**700**	**Rolling**	**PM**	**F**	**41**
Exit 71 Off	**270**	**Rolling**	**PM**	**E**	**40**
Exit 71 On	**120**	**Rolling**	**PM**	**E**	**36**
Exit 72 Off	**220**	**Rolling**	**PM**	**E**	**40**
Exit 72 On	**250**	**Rolling**	**PM**	**E**	**38**
Exit 73 Off	**180**	**Rolling**	**PM**	**E**	**38**
Exit 73 On	**80**	**Rolling**	**PM**	**E**	**37**
Exit 74 Off	**460**	**Rolling**	**PM**	**F**	**43**
Exit 74 On	**300**	**Rolling**	**PM**	**E**	**37**
Exit 75 Off	**800**	**Rolling**	**PM**	**F**	**48**
Exit 75 On	**150**	**Rolling**	**PM**	**E**	**40**
Exit 76 On	**950**	**Rolling**	**PM**	**F**	**45**
Exit 80 Off	**80**	**Rolling**	**PM**	**E**	**39**
Exit 81 (Cross Road) On	**270**	**Rolling**	**PM**	**E**	**36**
Exit 81 (Parkway North) Off	**480**	**Rolling**	**PM**	**E**	**41**
Exit 82 Off	**1220**	**Rolling**	**PM**	**F**	**50**
Exit 82 On	**400**	**Rolling**	**PM**	**E**	**39**
Exit 82A (Frontage Rd) On	**1070**	**Rolling**	**PM**	**F**	**44**
Exit 83 Off	1000	Rolling	PM	D	33

Table 2-10
Ramp Merge/Diverge Analysis – Summary of 2002 Existing Conditions

Ramp	Ramp Volume	Terrain	Peak Hour	Level of Service	Density (pc/mi/ln)
Exit 84 Off	**1750**	**Rolling**	**PM**	**F**	**36**
Exit 85 On	**950**	**Rolling**	**PM**	**F**	**40**
Exit 86 On	**1300**	**Rolling**	**PM**	**E**	**37**
Exit 87 (Rte 349) Off	300	Rolling	PM	D	33
Exit 87 (US Rte 1) Off	**250**	**Rolling**	**PM**	**F**	**33**
Exit 87 On	**850**	**Rolling**	**PM**	**F**	**29**
Exit 88 Off	250	Rolling	PM	D	35
Exit 88 On	**550**	**Rolling**	**PM**	**E**	**38**
Exit 89 Off	**250**	**Rolling**	**PM**	**E**	**35**
Exit 89 On	**460**	**Rolling**	**PM**	**E**	**36**
Exit 90 Off	290	Rolling	PM	C	28
Exit 90 On	1050	Rolling	PM	D	30
Exit 91 Off	70	Rolling	PM	C	22
Exit 91 On	460	Rolling	PM	C	26
Exit 92 Off	250	Rolling	PM	B	15
Exit 92 On	780	Rolling	PM	C	22
Exit 93 Off	300	Rolling	PM	B	18
Exit 93 On	150	Rolling	PM	B	18

Note: Boldface entries denote capacity deficiencies during the peak hour.

2.3.4 Weaves

HCM analysis procedures define a weaving movement as the interaction between the crossings of two or more traffic streams travelling in the same direction without the aid of traffic control devices. There are a number of weaving areas along I-95 which require a significant amount of driver awareness as vehicles are simultaneously accelerating onto the mainline freeway from the on-ramp and decelerating from the mainline freeway to the off-ramp.

The HCM procedures for analyzing freeway weaving areas uses the interaction between conflicting traffic streams to estimate vehicle speeds within a weaving section. More formally defined, weaving areas occur when the merge area of an on-ramp is closely followed (within 2,500 feet) by the diverge area of an off-ramp. Thus, traffic within a weaving area is subject to turbulence above that which is normally present on basic freeway sections. This turbulence is in the form of forced lane changes within a restricted distance.

Critical inputs used to arrive at the LOS of the weaving section are traffic volumes in the weaving section (weaving and non-weaving), the length and configuration of the section, and free-flow vehicle speeds. LOS is determined separately for weaving and non-weaving vehicles, and is based on the average speeds of these vehicles in the weaving section. The results of the weaving analysis under existing traffic volume conditions are summarized in Table 2-11 and illustrated on Figure 2-2.

Northbound Weaving Sections

There are four weaving sections in the northbound direction. The weaves between Exit 68 and Exit 69 and Exit 71 and Exit 72 operate at LOS C and LOS D, respectively. The weave between Exit 75 and Exit 76 operates at LOS F. The weave between Exit 82A and Exit 83 operates at LOS B.

Southbound Weaving Sections

There are four weaving sections in the southbound direction. The weaves between Exit 69 and Exit 68 and Exit 72 and Exit 71 operate at LOS C and LOS D, respectively. The weaves between Exit 76 and Exit 75 and Exit 82A and Exit 82 operate at LOS E and LOS F, respectively.

Table 2-11
Weaving Sections Analysis – Summary of 2002 Existing Conditions

Section Description	Weave Length (ft)	Peak Hour	Level of Service	Density (pc/mi/ln)
Northbound				
Exit 68 to Exit 69	1320	PM	C	24
Exit 71 to Exit 72	800	PM	D	30
Exit 75 to Exit 76	**1250**	**PM**	**F**	**71**
Exit 82A to Exit 83	2300	PM	B	17
Southbound				
Exit 69 to Exit 68	1000	PM	C	22
Exit 72 to Exit 71	500	PM	D	31
Exit 76 to Exit 75	**1000**	**PM**	**E**	**42**
Exit 82A (Frontage Rd) to Exit 82	**1000**	**PM**	**F**	**47**

2.3.5 Intersections

The level of service (LOS) for signalized intersections is defined in terms of delay, which is a measure of driver discomfort, frustration, and lost travel time. Specifically, LOS criteria are stated in terms of the control delay per vehicle for a 15-minute analysis period. Control delay includes initial deceleration delay, queue move-up time, stopped delay and final acceleration delay.

The LOS for unsignalized intersections assumes that traffic on the local arterial is not affected by traffic on the side streets. That is, the through and right-turning movements on the mainline are unimpeded by side street traffic. The level of service is determined for left-turns from the main street onto the side street and for all side street movements. The level of service for each movement is calculated by determining the number of gaps that are available in the conflicting traffic stream. Based on the number of gaps, the capacity of the movement can be calculated. The demand of the movement is then compared to the capacity and utilized to determine average delay for a particular movement.

Capacity analyses were conducted at all intersections of ramp termini with local streets within the study area. In addition, capacity analyses were conducted at several predefined intersections within the study area that are adjacent to the I-95 mainline.

The results of the intersection analysis, utilizing summer 2001 Thursday and Friday evening traffic counts are summarized in Table 2-12 for signalized intersections and Table 2-13 for unsignalized intersections. Figure 2-3 presents graphical representations of the analyses. The following is a summary of locations operating at saturated levels (LOS E or LOS F):

Signalized Intersections

- Intersection of US Route 1 (Main Street) and SR 740 (Cedar Street) operates at LOS F
- At Exit 55, intersection of US Rte 1 (E. Main Street) and southbound ramps operates at LOS F
- At Exit 63, intersections of Route 81 (Killingworth Turnpike) with northbound on-ramp and southbound ramps operate at LOS F
- At Exit 70, intersections of the southbound on-ramp and Route 156 (Neck Road), and the southbound off-ramp and US Route 1 (Boston Post Road) operate at LOS F
- At Exit 82, intersection of Route 85 (Broad Street) and northbound ramps operates at LOS E
- At Exit 82, intersection of Route 85 (Broad Street) and southbound ramps, and intersection of Route 85 (Broad Street) and US Route 1 (Coleman Street) operate at LOS F
- At Exit 90, intersection of Route 27 (White Hall Avenue) and northbound ramps operates at LOS F
- Intersection of Route 27 (White Hall Avenue) and Coogan Boulevard operates at LOS F
- At Exit 91, intersection of Route 234 (Pequot Trail) and northbound ramps operates at LOS E
- At Exit 92, intersection of Route 2 (Liberty Street) and southbound on-ramp operates at LOS F

Unsignalized Intersections

- Eastbound approach of Cedar Knolls Drive to intersection with SR 740 (Cedar Street) operates at LOS F
- At Exit 59, southbound off-ramp at SR 718 (Goose Lane) operates at LOS E
- At Exit 61, northbound off-ramp at Route 79 (Durham Road) operates at LOS F
- At Exit 64, northbound off-ramp at Route 145 (Horse Hill Road) operates at LOS E
- At Exit 64, southbound off-ramp at Route 145 (Horse Hill Road) operates at LOS F
- At Exit 67, northbound off-ramp at Route 154 (Middlesex Turnpike) operates at LOS E and F
- At Exit 89, northbound and southbound off-ramps at SR 614 (Allyn Street) operate at LOS F

Table 2-12
Signalized Intersection Analysis – Summary of 2002 Existing Conditions

Signalized Intersections	Peak Hour	Level of Service	V/C[1]	Delay[2]
Exit 54 NB Ramps at SR 740 (Cedar St)	PM	C	0.63	24
Exit 54 SB Ramps at SR 740 (Cedar St)	PM	D	0.63	51
US Rte 1 (Main St) at SR 740 (Cedar St)	**PM**	**F**	**0.94**	**99**
Exit 55 NB Ramps at US Rte 1 (East Main St)	PM	C	0.55	34
Exit 55 SB Ramps at US Rte 1 (East Main St)	**PM**	**F**	**0.88**	**85**
Exit 57 NB Ramps at US Rte 1 (Boston Post Rd)	PM	D	0.65	49
Exit 58 NB Ramps at Rte 77 (Church St)	PM	C	0.76	25
US Rte 1 at SR 718 (Goose Lane)	PM	C	0.67	34
Exit 61 SB Ramps at Rte 79 (Durham Rd)	PM	C	0.40	23
Route 79 (Durham Rd) at Old Rte 79/Woodland Rd	PM	B	0.42	14
Exit 62 NB Ramps at Hammonasset Connector	PM	B	0.3	17
Exit 63 NB Off-Ramp at North High St	PM	C	0.37	29
Exit 63 NB On-Ramp at Rte 81 (Killingworth Tpke)	**PM**	**F**	**0.93**	**172**

Table 2-12
Signalized Intersection Analysis – Summary of 2002 Existing Conditions

Signalized Intersections	Peak Hour	Level of Service	V/C[1]	Delay[2]
Exit 63 SB Ramps at Rte 81 (Killingworth Tpke)	**PM**	**F**	**0.62**	**149**
Rte 81 (Killingworth Tpke) at Glenwood Rd	PM	B	0.51	20
Rte 145 at Old Clinton Rd	PM	C	0.42	21
Exit 65 NB Ramps at Rte 153 (Essex Rd)	PM	A	0.40	9
Exit 65 SB Ramps at Rte 153 (Essex Rd)	PM	B	0.42	15
Rte 153 at Westbrook Mall Entrance	PM	B	0.39	19
Exit 70 NB Off-Ramp at Rte 156 (Neck Rd)	PM	C	0.30	26
Exit 70 SB On-Ramp at Rte 156	**PM**	**F**	**0.96**	**196**
US Rte 1 (Halls Rd) at Rte 156	PM	D	0.44	52
Exit 70 SB Off-Ramp at US Rte 1 (Boston Post Rd)	**PM**	**F**	**0.84**	**119**
SR 449 (Rocky Neck Connector) at Rte 156	PM	C	0.33	25
Exit 82 NB Ramps at Rte 85 (Broad St)	**PM**	**E**	**0.65**	**78**
Exit 82 SB Ramps at Rte 85 (Hartford Tpke)	**PM**	**F**	**0.87**	**116**
US Rte 1 (Coleman St) at Rte 85 (Broad St)	**PM**	**F**	**0.71**	**102**
Vauxhall St at US Rte 1 (Coleman St)	PM	C	0.51	34
US Rte 1 at Bridge St	PM	B	0.37	18
Exit 88 NB Ramps at Rte 117 (North Rd)	PM	C	0.49	31
Exit 88 SB Ramps at Rte 117 (North Rd)	PM	B	0.40	14
Exit 90 NB Ramps at Rte 27 (White Hall Ave)	**PM**	**F**	**0.83**	**157**
Rte 27 (White Hall Ave) at Coogan Blvd	**PM**	**F**	**0.65**	**68**
Exit 91 NB Ramps at Rte 234 (Pequot Trail)	**PM**	**E**	**0.54**	**68**
Exit 92 NB Off-Ramp at Rte 2 (Liberty St)	PM	D	0.73	51
Exit 92 SB On-Ramp at Rte 2 (Liberty St)	**PM**	**F**	**0.50**	**101**
Exit 92 SB Off-Ramp at Rte 49 (Pendleton Hill Rd)	PM	D	0.43	46

Note: Boldface entries denote operational deficiencies during the peak hour.
1 V/C - Volume to Capacity ratio
2 Delay - Average stopped delay to all vehicles entering the intersection in seconds per vehicle

Table 2-13
Unsignalized Intersection Analysis – Summary of 2002 Existing Conditions

Unsignalized Intersections	Movement	Demand[1]	Delay[2]	Level of Service
SR 740 (Cedar St) at Cedar Knolls Drive	Northbound Left	100	11	B
	Eastbound	**100**	**>100**	**F**
Exit 57 SB Ramps at US Rte 1 (Boston Post Rd)	Westbound	250	18	C
	Southbound	20	8	A
Rte 77 at Commuter Lot Drive	Northbound Left	10	9	A
Exit 58 SB Ramps at Rte 77 (Church St)	Northbound Left	200	10	A
Exit 58 NB Off-Ramp at North River St	Southbound	60	13	B
	Northbound	80	12	B
Exit 59 NB Ramps at SR 718 (Goose Lane)	Southbound Left	100	11	B
Exit 59 SB Ramps at SR 718 (Goose Lane)	Northbound Left	450	10	A
	Eastbound	**250**	**41**	**E**

Table 2-13
Unsignalized Intersection Analysis – Summary of 2002 Existing Conditions

Unsignalized Intersections	Movement	Demand[1]	Delay[2]	Level of Service
SR 718 (Goose Lane) at Clapboard Hill Rd	Southbound Left	10	9	A
	Westbound	120	21	C
Exit 60 SB Off-Ramp at Mungertown Rd	Northbound Left	40	8	A
	Westbound	170	12	B
	Eastbound	60	9	A
Exit 60 NB On-Ramp at Fort Path Rd	Northbound	50	10	A
Mungertown Rd at Fort Path Rd	Westbound	30	8	A
	Southbound Left	70	9	A
Exit 61 NB Ramps at Rte 79 (Durham Rd)	Southbound Left	80	10	B
	Eastbound Left	**190**	**>100**	**F**
	Eastbound Right	260	16	C
	Eastbound		**>100**	**F**
Rte 79 (Durham Road) at Commuter Lot Drive	Southbound Left	10	10	A
	Westbound	30	23	C
Exit 62 SB Ramps at Hammonasett Connector	Southbound Left	90	9	A
	Westbound	380	24	C
Exit 64 NB Ramps at Rte 145 (Horse Hill Rd)	Southbound Left	70	9	A
	Eastbound	**340**	**39**	**E**
Exit 64 SB Ramps at Rte 145 (Horse Hill Rd)	Northbound Left	150	9	A
	Westbound	**310**	**78**	**F**
Exit 66 NB Ramps at Rte 166 (Spencer Plains Rd)	Northbound Left	130	9	A
	Eastbound	300	17	C
Exit 66 SB Ramps at Rte 166 (Spencer Plains Rd)	Southbound Left	40	8	A
	Westbound	200	17	C
Exit 67 SB Off-Ramp at Elm St	Westbound	310	12	B
Exit 67 NB On-Ramp at Elm St	Northbound Left	70	8	A
	Southbound Left	20	8	A
	Eastbound	140	20	C
Exit 67 NB Off-Ramp at Rte 154 (Middlesex Tpke)	Eastbound Right	230	19	C
	Eastbound Left	**100**	**90**	**F**
	Eastbound		**41**	**E**
Exit 68 SB Off-Ramp at Rte 628	Westbound	600	18	C
Exit 69 SB Off-Ramp at Essex Rd	Northbound	60	10	A
Exit 71 NB Ramps at Four Mile River Rd	Southbound Left	160	8	A
	Westbound	90	14	B
Exit 71 SB Ramps at Four Mile River Rd	Northbound Left	90	8	A
	Westbound	270	15	C
Four Mile River Rd at Hatchetts Hill Rd	Northbound Left	20	8	A
	Westbound	160	13	B
Exit 73 SB Ramps at West Society Rd	Northbound		9	A
	Northbound Left	0	10	B
	Northbound Right	180	9	A
	Westbound	80	8	A

Table 2-13
Unsignalized Intersection Analysis – Summary of 2002 Existing Conditions

Unsignalized Intersections	Movement	Demand[1]	Delay[2]	Level of Service
Exit 73 NB Ramps at Society Rd	Southbound	100	10	B
	Eastbound Left	20	8	A
Parkway North at Vauxhall St Extension	Northbound	480	12	B
Parkway South at Vauxhall St Extension	Southbound	220	10	A
Exit 89 NB Ramps at Rte 614 (Allyn St)	Southbound Left	80	8	A
	Eastbound Left	**360**	**>100**	**F**
	Eastbound Right	390	14	B
	Eastbound		**93**	**F**
Exit 89 SB Ramps at SR 614 (Allyn St)	Southbound Left	180	9	A
	Westbound	**250**	**69**	**F**
Exit 90 SB Ramps at Rte 27 (White Hall Ave)	Northbound Left	70	8	A
Exit 90 NB Ramps at Clara Dr (Aquarium)	Northbound		11	B
	Northbound Right	140	11	B
Exit 91 SB Ramps at Taugwonk Rd	Southbound Left	40	8	A
	Westbound		11	B
	Westbound Left	60	11	B
	Westbound Right	10	9	A
Exit 93 NB Ramps at Rte 216 (Clark Falls Rd)	Southbound Left	210	8	A
	Eastbound	200	15	C
Exit 93 SB Ramps at Rte 216 (Clark Falls Rd)	Northbound Left	60	8	A
	Westbound	300	13	B
Rte 216 (Clark Falls Rd) at Rte 184	Northbound	410	16	C
	Southbound	80	9	A
	Eastbound	280	11	B
	Westbound	70	10	A
	Intersection		13	B

Note: Boldface entries denote operational deficiencies during the peak hour.
1 Demand is expressed in vehicles per hour, including all vehicle types (e.g. passenger cars, trucks, motorcycles, etc.)
2 Delay - Average stopped delay in seconds per vehicle

2.3.6 Other Geometric Issues

The presence of slow vehicle lanes affects mainline operations. There are slow vehicle lanes located on the northbound lanes east of Exit 63, Exit 90, Exit 91and Exit 92 and west of Exit 93; on the southbound lanes east of Exit 90; on the southbound lanes east of Exit 91; on the southbound lanes east and west of Exit 92; and on the southbound lanes in the vicinity of Exit 93. Due to the inadequate capacity of the mainline, when the slow vehicle lanes end and trucks attempt to merge back into the mainline traffic stream, additional turbulence is created within the mainline traffic stream and traffic operations and safety issues result. This situation was identified in the 1999 *Southeastern Connecticut Corridor Study* completed by ConnDOT.

As part of the 1999 study, a recommendation was made to evaluate all slow vehicle lanes within the corridor and determine if each is warranted. As a result of this assessment, the Division of Traffic Engineering has recently directed the removal of slow vehicle lanes on the northbound lanes in Stonington east of Exit 90 between Deans Mills Road and Route 234 (Pequot Trail Road); on the northbound lanes in Stonington east of Exit 91 between North Anguilla Road and Route 2; on the northbound lanes in North Stonington east of Exit

92 between Route 2 and the northbound on-ramp from Route 49; and on the southbound lanes in Stonington east of Exit 90 between Route 234 (Pequot Trail Road) and Jerry Browne Road. All other slow vehicle lanes were found to be warranted. Slow vehicle lane locations are shown on Figure 2-2.

2.4 Safety Analysis

A safety analysis was conducted for the I-95 freeway system within the study area to determine if the year 2000 traffic demands combined with the geometric conditions of the roadways or ramps result in potentially unsafe operating conditions.

2.4.1 Methodology

The safety analysis was based on an examination of accident rates on the roadway and a comparison to statewide averages for similar type facilities. The source of the accident data is the ConnDOT *Traffic Accident Surveillance Report*. The Traffic Accident Surveillance Report compiles statewide accident data on a three-year basis. The report calculates actual accident rates for every roadway link and intersection on state numbered roadways. Also calculated is a critical accident rate for each location based on the type of roadway or intersection, the traffic volume, and the vehicle miles of travel on the roadway. The ratio of the actual accident rate to the critical accident rate is then calculated. If this ratio is higher than one, then the rate of accident occurrence at that location is said to be "higher than expected." When a location has 15 or more accidents, and a "higher than expected" accident rate, the location meets the criteria of a high accident location. The objective in developing the report and identifying high accident locations is to define those locations which have the greatest promise for accident reduction and thus to give a broad measure of overall needs of highway safety improvements. High accident locations are given priority for funding of future safety improvement projects.

2.4.2 Qualitative Description

Traffic accident data for I-95 was supplied by ConnDOT for the period from January 1997 to December 1999, which represents the most recent three-year period available. These data included all reported accidents on State roadways with property damage greater than $1,000 or personal injury. A review of these data indicates that nine locations along I-95 within the project limits exhibit a "higher than expected" ratio of actual accident rate to the critical accident rate and are identified as high accident locations. These locations are shown on Figure 2-1.

2.4.3 Quantitative Accident Data

For each of the high accident locations, a more detailed analysis was undertaken to determine if the traffic demands placed on the roadway or the geometric conditions of the roadway including ramps or weaves are the cause of unsafe operating conditions. The sections of I-95 identified as high accident locations within the study area are discussed below with a summary of the accident data presented in Table 2-14.

Exit 54 to North Ivy Street (Branford)

On the section of I-95 between Exit 54 and the overpass at North Ivy Street, a total of 66 accidents occurred during the three-year study period. Forty-three accidents (65%) occurred in the southbound direction with 32 on the mainline and 11 occurring on the Exit 54 southbound off-ramp. The remaining 23 accidents (35%) occurred in the northbound direction, 19 on the mainline and 4 accidents occurring on the Exit 54 northbound on ramp. The predominant collision type on this section was 44 rear-end collisions (67%). This area includes deficient northbound acceleration and southbound deceleration ramps, and LOS F conditions.

Twenty-seven of the 44 (61%) rear-end collisions occurred on the southbound mainline. The predominant reasons listed for cause of accidents were following too close and driving too fast for conditions. Congestion was listed as a major factor contributing to some of these accidents. Excessive speed and slippery road surfaces were major factors in other accidents.

Exit 61 to Exit 62 (Madison)

A total of 68 accidents occurred on this section of I-95 during the three-year period. Thirty-nine (57%) of the accidents were located within the northbound and southbound rest areas and they were primarily associated with maneuvers in and out of parking spaces. There were two accidents between vehicles and pedestrians within the rest areas. There are no LOS or geometric deficiencies in this area.

On the northbound and southbound mainline there were 27 accidents, 13 northbound and 14 southbound. Seventeen of these accidents (63%) were collisions with fixed objects. The collisions were primarily with guiderails, concrete barriers, and light poles. These were attributed mostly to driving too fast for conditions/slippery road surfaces.

Exit 69 to Exit 70 (Old Saybrook/Old Lyme)

From Exit 69 to Exit 70 there were a total of 28 accidents over the three-year period. Twenty-five accidents (89%) occurred on the mainline, 15 accidents northbound and 10 accidents southbound. The remaining three accidents occurred on Exit 70 ramps. The predominant collision types on the mainline included 11 fixed object collisions (39%) and 7 rear-end collisions (25%). There are no LOS deficiencies in this area. The Exit 70 northbound off-ramp is listed as deficient.

The fixed object collisions were primarily with guiderails and concrete barriers. Causes of these accidents were driving too fast for conditions with slippery road conditions a major contributing factor. Rear-end collisions were most numerous on the northbound mainline, making up six (67%) of the total 9 rear-end collisions. Rear-end collisions listed following too close as the primary cause of accident. Congestion was a major factor contributing to some of these accidents. Excessive speed was another major factor in other accidents.

Exit 70 to Exit 71 (Old Lyme)

A total of 159 accidents occurred on this section of I-95 during the three-year period. All 159 accidents occurred on the mainline with 77 accidents (48%) northbound and 82 accidents (52%) southbound. Sixty-five accidents (41%) involved collisions with fixed objects. The other predominant collision types were rear-end collisions with 54 accidents (34%), and sideswipes with 28 accidents (18%). This area operates at congested LOS E conditions. There are no geometric deficiencies in this area.

The fixed object collisions were primarily with guiderails and concrete barriers. Causes of these accidents were driving too fast for conditions with slippery road conditions a major contributing factor.

Rear-end collisions were distributed almost evenly between the northbound and southbound mainline. Rear-end collisions listed following too close as the primary cause of accident. Congestion was a major factor contributing to some of these accidents. Excessive speed was another major factor in other accidents. The sideswipes were attributed to either improper lane change or slippery conditions.

Exit 71 to Exit 72 (Old Lyme/East Lyme)

A total of 95 accidents occurred on this section of I-95 during the three-year period. Seventy-one accidents (75%) occurred on the mainline and 24 accidents (25%) occurred on the ramps. Of the mainline accidents, 37 (52%) occurred northbound and 34 (48%) occurred southbound. The predominant accident types were 46 rear-end collisions (48%) and 37 fixed object collisions (39%). This area contains a nonstandard interchange terminal spacing with deficient acceleration and deceleration lanes. It also operates under congested LOS E conditions. There are no geometric deficiencies in this area.

Rear-end collisions were more abundant on the mainline, making up 55% of the total mainline accidents. Northbound mainline had the majority of rear-end collisions, 24 accidents versus 15 accidents on the southbound mainline. Typical reasons listed for cause of these accidents were following too close and driving too fast for conditions. Congestion was listed as a major factor contributing to some of these accidents. Excessive speed and slippery road surfaces were major factors in other accidents. Fixed object collisions had a distribution of 11 accidents to 15 accidents between northbound and southbound mainline. The predominant object involved in these collisions was guiderails. Typical reason listed for cause of these accidents was driving too fast for conditions, with slippery road surfaces being the largest contributing factor. The majority of accidents (75%) that occurred at the ramps were rear-end and fixed object collisions. The major reason listed for cause of rear-end accidents was following too close, the result of congestion at the ramps. Fixed object collisions were mostly involved with guiderails and highway signs near the gore areas.

Exit 84 to Exit 85 (Waterford/Groton)

Of the 94 accidents on this section of I-95, 72 (77%) were on the Gold Star Bridge. The other 22 accidents were on the mainline off of the bridge. Predominant accident types include 39 fixed object collisions (41%), 26 sideswipes (28%), and 19 rear-end collisions (22%). There are no LOS deficiencies in this area. Geometric deficiencies in this area include the Exit 85 northbound deceleration lane and the Exit 85 southbound acceleration lane.

For the 72 accidents on the Gold Star Bridge, 33 (46%) were fixed object collisions, 27 (38%) were sideswipes, and 12 (17%) were rear-end collisions. Fixed objects hit were mainly bridge rail and concrete barriers. The primary reasons listed for cause of these accidents were driving too fast for conditions and driver lost control of vehicle. Almost all of these accidents occurred during icy conditions. The sideswipes were attributed to either improper lane change or slippery conditions. Rear-end collisions were the result of following too close and driving too fast for conditions.

For the other 22 mainline accidents, nine (41%) were rear-end collisions, six (27%) were sideswipes, and six (27%) were fixed object collisions. Similar accident causes for the bridge also apply to the non-bridge mainline.

Exit 92 Interchanges (Stonington/North Stonington)

This section of I-95 lies between the two Exit 92 interchanges: the western interchange with Route 2 and the eastern interchange with Route 49. A total of 42 accidents occurred along this section of I-95 during the three-year period. Seventeen accidents (40%) occurred on the mainline, while 25 accidents (60%) occurred on the ramps. Eleven accidents (65%) occurred on the northbound mainline and 6 accidents (35%) occurred on the southbound mainline. Twenty-one accidents (84%) occurred at the Exit 92/Route 2 northbound off ramp. The remaining 4 accidents were at the Exit 92/Route 2 southbound on-ramp. The predominant accident types included 24 fixed object collisions (57%) and 11 rear-end collisions (26%). There are no LOS or geometric deficiencies in this area.

Twenty fixed object collisions (46%) were on the mainline northbound and at the Exit 92/ Route 2 northbound off-ramp. Guiderails was the fixed object involved with most of the accidents that occurred on the mainline. The majority of the fixed object collisions at the off ramp involved sliding off/into an embankment. The major reason listed for cause of accidents was driving too fast for conditions. Slippery road surface was considered to be a major contributing factor. Nine of the 11 rear-end collision accidents (82%) occurred at the Exit 92/Route 2 northbound off-ramp. The primary reason listed as the cause of these accidents was following too close. Excessive speed and driver inattention were predominant contributing factors.

Exit 92 Interchanges (North Stonington)

A total of 25 accidents occurred along this section of I-95 during the three-year period. Twenty-two accidents (88%) occurred on the mainline, while 3 accidents (12%) occurred in the southbound rest area. Seventeen accidents (77%) occurred on the northbound mainline and 5 accidents (23%) occurred on the southbound mainline. The predominant accident type included 19 (76%) fixed object collisions. There are no LOS or geometric deficiencies in this area.

Fifteen of the 19 fixed object collisions were on the northbound mainline. The predominant object involved in these collisions was guiderails. Typical reason listed for the cause of these accidents was driving too fast for conditions, with slippery road surfaces being the largest contributing factor.

Exit 92 to Exit 93 (North Stonington)

All of the 66 accidents on this section of I-95 occurred on the mainline, split evenly between northbound and southbound. The predominant collision type was fixed object collision, with 53 (80%) of the 66 total accidents. There are no LOS or geometric deficiencies in this area.

Fixed object collisions were distributed evenly between northbound and southbound directions. Primary reasons listed for the cause of accidents were driver lost control of vehicle and driver falling asleep. The primary object hit in these collisions was guiderail, with a few vehicles driving into/off an embankment. Most of these accidents were attributable to slippery road surfaces. The six sideswipes that occurred were generally caused by improper lane changes. The four rear-end collisions had various reasons listed for cause of accident, with excessive speed and slippery road surfaces being contributing factors.

Table 2-14
High Accident Locations Summary – January 1, 1997 to December 31, 1999

Location	Collision Type					
	Rear End	Side	Fixed	Moving	Turning	Other
Mile 53.21 to 53.54, Branford						
Exit 54 to N. Ivy Street						
Mainline Northbound	8	3	6	2		
Mainline Southbound	27	4	1			
Exit 54 NB On Ramp	2	1	1			
Exit 54 SB Off Ramp	7	1	1		1	1
Mile 65.17 to 66.08, Madison						
Exit 61 to Exit 62						
Mainline Northbound	1	2	9	1		
Mainline Southbound	3	2	8	1		
Rest Areas						
Northbound		3	4		2	8
Southbound	1	5	1		1	14
NB Rest Area Exit Ramp			2			
Mile 78.59 to 78.75, Old Saybrook/Old Lyme						
Exit 69 to Exit 70						
Mainline Northbound	6	1	6	1		1
Mainline Southbound	1	2	5	2		
Ramps						
Exit 70 NB On Ramp	1		1			
Exit 70 SB Off Ramp	1					
Mile 80.21 to 83.19, Old Lyme						
Exit 70 to Exit 71						
Mainline Northbound	26	10	37	4		
Mainline Southbound	28	18	28	7		1
Mile 83.20 to 83.70, Old Lyme/East Lyme						
Exit 71/72						
Mainline Northbound	24	1	11			1
Mainline Southbound	15	3	15	1		
Ramps						
Off Ramp Northbound	2		4			
On Ramp Southbound	1	2	3			
Off Ramp Southbound	4	1	4	1	2	
Mile 93.90 to 94.47, Waterford/Groton						
Exit 84 to Exit 85						
Mainline Northbound	5	2	2			
Mainline Southbound	4	4	4	1		
Gold Star Bridge						
Northbound	4	12	15	4		
Southbound	8	8	18	3		
Mile 107.42 to 107.80, Stonington/North Stonington						
Exit 92 at Route 2 to Exit 92 at Route 49						
Mainline Northbound	1		9			1
Mainline Southbound		1	3	2		
Ramps (Route 2)						
Exit 92 NB Off Ramp	9		11			1
Exit 92 SB On Ramp	1	2	1			

Table 2-14
High Accident Locations Summary – January 1, 1997 to December 31, 1999

Location	Collision Type					
	Rear End	Side	Fixed	Moving	Turning	Other
Mile 107.81 to 108.64, North Stonington						
Exit 92 at Route 2 to Exit 92 at Route 49						
Mainline Northbound		1	15	1		
Mile 107.81 to 108.64, North Stonington (Continued)						
Mainline Southbound	2	1	2			
Rest Area						
Southbound			2			1
Mile 109.03 to 111.01, North Stonington						
Exit 92 to Exit 93						
Mainline Northbound	4	3	26			
Mainline Southbound		3	27	1		2

2.5 Deficiencies Summary

The evaluation of existing traffic operations has provided an overview of the operational characteristics for the I-95 freeway mainline, ramps, and weaving movements along the mainline. Additionally, the analysis has provided an overview of a number of signalized and unsignalized intersections that are affected by traffic entering or exiting I-95. The analysis has shown that there are specific locations where traffic operations do not meet current operational guidelines exclusive of any future traffic volume growth throughout the study area. The following findings were presented:

Traffic Demands

- In 2000, average daily traffic demand on I-95 varied from 36,600 vehicles per day (vpd) between Exits 92 and 93 (the eastern end of the study area) to 121,000 vpd between Exits 84 to 85.
- For the weekday morning peak hour, I-95 southbound is the predominant direction of flow from Exits 91 to 87 and from Exits 63 to 54. The northbound direction is the predominant flow direction for the remainder of the mainline. In the weekday evening peak hour, the predominant direction of flow on I-95 is the northbound direction except between Exits 75 and 82A and Exits 84 and 87.
- Heavy vehicles comprise 8 to 22 percent of the two-way traffic stream during the peak hour.

Geometry

In the study area, there are 38 interchanges consisting of 68 exit ramps and 68 entrance ramps. Each of these ramps has been evaluated for geometric deficiencies based on the 2001 AASHTO design standards. Within the study area, 10 exit ramps and 15 entrance ramps were identified as not meeting current design standards for minimum ramp design speeds.

Traffic Operations

This study analyzed traffic operations on I-95 mainline sections, interchange ramps, weaving sections, and key intersections in the study area. Level of service (LOS) is used as the qualitative measurement denoting the different operating conditions that occur under various traffic volume loadings. LOS designations are letter based, ranging from A to F, with LOS A representing the best operating condition under relatively free flowing

traffic conditions and LOS F representing the worst operating condition, or locations that are at or approaching capacity. LOS E or F on a mainline section is an indication of volumes approaching or exceeding the roadway capacity. LOS E or F at a ramp is an indication where the turbulence created by merging or diverging vehicles is intrusive to all drivers. LOS E or F in a weaving area is an indication of the high volume of vehicles creating turbulence within a limited maneuver area. LOS E or F at an intersection is an indication of volumes approaching or exceeding the capacity of the intersection, or in the case of a signalized intersection, it may also be an indication of poor signal timings.

- **Mainline** - There are 38 northbound sections and 40 southbound sections between Exit 54 and the Rhode Island state line. The analysis indicates that 14 northbound and 14 southbound sections operate at LOS E or F. A section is defined for this study as the area of I-95 between successive interchanges.
- **Ramps** - A total of 138 ramps were analyzed – 68 in each direction. The ramp analysis showed that 35 northbound ramps operate at LOS E or F and 28 southbound ramps also operate at LOS E or F.

Weaves

Eight weaving sections were analyzed including four in the northbound direction and four in the southbound direction. Three of the eight sections operate at LOS E or F. These weave areas are located northbound and southbound between Exit 75 and Exit 76 and southbound between Exit 82A and Exit 82.

Intersections

A total of 75 intersections were evaluated. These locations were at ramp termini, or on key roadways in the vicinity of the I-95 corridor. Of these intersections, 37 were signalized and 38 were unsignalized. For the signalized locations, 13 operate at LOS E or F during the summer, Friday evening peak hour. Ten of these locations occur where I-95 ramps intersect the local street system. For the unsignalized locations, eight operate at LOS E or F during the summer, Friday evening peak hour. Seven of those locations are intersections of the local street system with I-95 ramps.

Safety

Traffic accident data for I-95 for the most recent period available indicates that there are nine locations along I-95 within the project limits which are exhibiting a “higher than expected” accident rate. These include two ramp interchanges and seven mainline sections.

The two interchange sections are at Exit 92 (Mile 107.42 to 107.80) and Exit 92 (Mile 107.81 to 108.64). The first Exit 92 section has predominant accident types which include rear-end and fixed object collisions. The second Exit 92 section has fixed object collisions as the major accident type. The primary reasons listed for these accidents types were following too close and driving too fast for conditions.

The mainline section from Exit 54 to North Ivy Street (Mile 53.21 to 53.54) had rear-end collisions as the most frequent type of accident. Forty-four rear-end collisions (67%) occurred in this area. The predominant reasons listed for the cause of these accidents were following too close and driving too fast for conditions. Congestion, excessive speed and slippery road surfaces were major factors contributing to these accidents.

The two mainline sections from Exit 61 to Exit 62 (Mile 65.17 to 66.08) and Exit 92 to Exit 93 (Mile 109.03 to 111.01) had fixed object collisions as their most common re-occurring accident type. These collisions were

primarily with guiderails, concrete barriers, and light poles. These were attributed mostly to driving too fast for conditions and slippery road surfaces.

The two mainline sections from Exit 69 to Exit 70 (Mile 78.59 to 78.75) and Exit 70 to Exit 71 (Mile 83.20 to 83.70) had predominant accident types that included rear-end accidents and fixed object collisions. The primary reasons listed were following too close and driving too fast for conditions.

The remaining two mainline sections from Exit 70 to Exit 71 (Mile 80.21 to 83.19) and Exit 84 to Exit 85 (Mile 93.90 to 94.47) had several predominant accident types. Those types were rear-end, fixed object, and sideswipes. The sideswipes were attributed to either improper lane change or slippery conditions. The other reasons listed were following too close and driving too fast for conditions.

2.6 Multi-Modal Transportation Services

Several transit modes exist within the corridor which provide options to vehicular travel on I-95. The types of services and available riderships of other modes of transportation are presented in this section. Actual schedules for some of the services are included in the appendix.

Rail Service

- **Shore Line East (SLE)** – The southeastern Connecticut corridor is served by the Shore Line East rail line (SLE), which operates between New London and Stamford. The SLE mainly serves commuters, since it operates only weekdays, in the morning and evening peak hours. Morning service starts at 5:33 a.m. and runs until 10:00 a.m., while afternoon service operates between 2:10 p.m. and 10:06 p.m. In December 2001 the SLE started Express service through to Stamford with one morning train and one evening train to and from Stamford with a stop in Bridgeport. In June 2002 a second train was added providing additional morning and evening express service. Easy connections to MetroNorth trains are available in New Haven with a simple crossing of the platform. The SLE provides service between New London and Stamford with stations along the corridor in New London, Old Saybrook, Westbrook, Clinton, Madison, Guilford, Branford, New Haven, Bridgeport and Stamford. The New Haven stops include the new State Street station which is within walking distance to the Downtown New Haven Green area and provides access to Commuter Connection bus service. The Commuter Connection service is a special Connecticut Department of Transportation commuter shuttle bus service picking up passengers at New Haven's State Street Station in the morning and taking them to New Haven's central business district & the Sargent Drive/Long Wharf area. Currently, eastbound (toward New London) daily service consists of 12 trains, three in the AM and nine in the PM. Westbound (toward New Haven) daily service consists of 13 trains, seven in the AM and six in the PM. The SLE average daily bi-directional ridership between New London and New Haven in 2002 was approximately 2700 riders/day.
- **Amtrak/ACELA (Amtrak) –** The corridor is served by Amtrak rail service which provides interstate rail service between Boston and Washington, D.C. There are six stops within Connecticut along the corridor: Mystic, New London, Old Saybrook, New Haven, Bridgeport, and Stamford. The ACELA Express does not stop in Mystic or Bridgeport. Table 2-16 shows the number of trains departing from each station for Amtrak and Acela Express services separately. Additional schedule information is included in the appendix.

Table 2-15
Amtrak/ACELA Express Daily Stops

Amtrak – Number of Daily Stops							
Station	**Mon.**	**Tues.**	**Wed.**	**Thurs.**	**Fri.**	**Sat.**	**Sun.**
Northbound							
Stamford	8	8	8	8	9	9	9
Bridgeport	5	5	5	5	6	5	5
New Haven	9	9	9	9	10	9	9
Old Saybrook	6	6	6	6	6	8	8
New London	8	8	8	8	9	9	8
Mystic	4	4	4	4	4	6	6
Southbound							
Mystic	4	4	4	4	4	4	5
New London	9	9	9	9	9	8	9
Old Saybrook	7	7	7	7	7	5	6
New Haven	9	9	9	9	9	9	10
Bridgeport	6	6	6	6	6	7	8
Stamford	9	9	9	9	9	9	10
ACELA Express – Number of Daily Stops							
Station	**Mon.**	**Tues.**	**Wed.**	**Thurs.**	**Fri.**	**Sat.**	**Sun.**
Northbound							
Stamford	8	8	8	8	8	4	5
Bridgeport	0	0	0	0	0	0	0
New Haven	8	8	8	8	8	4	5
Old Saybrook	0	0	0	0	0	0	0
New London	1	1	1	1	1	1	1
Mystic	0	0	0	0	0	0	0
Southbound							
Mystic	0	0	0	0	0	0	0
New London	2	2	2	2	2	0	1
Old Saybrook	0	0	0	0	0	0	0
New Haven	9	9	9	9	9	3	6
Bridgeport	0	0	0	0	0	0	0
Stamford	7	7	7	7	7	1	4

Amtrak has completed a major upgrading of service for the northeast. The four primary components of the upgrade were:

- Upgrading the infrastructure to a high-speed rail line with improvements to reduce congestion between Amtrak and other commuter trains
- Electrification of the rail line between Boston and New Haven. This eliminates the need to change locomotives from electric to diesel in New Haven and permits the usage of high-speed electric trains with significantly greater acceleration.
- Acquisition of new high-speed trains
- Introducing new high-speed rail service

Bus Service

- **Southeast Area Transit (SEAT)** – The Southeast Area Transit District (SEAT) provides regional bus service in the corridor with multi-modal coordination with Rail, ferry, and long haul bus services in New London. The transit district serves nine towns: New London, Groton, Norwich, Griswold, Montville, East Lyme Waterford, Ledyard, and Stonington. SEAT operates thirteen Bus runs in the region. There are four corridor service runs (Run #1, Run #2, Run #3, and Run #9) connecting major cities and towns starting at 6:00 am and ending at 6:55 pm. Run #1 makes six, two hour round trips per day between Norwich and New London primarily along Route 32. Run #2 makes six, two hour round trips per day between Norwich, Groton, and New London primarily along Route 12. Run #3 makes five, two hour round trips per day between Groton, New London, and Niantic along several routes including I-95, Route 12, Route 156, Route 1, and Route 161. Run #9 makes three morning and three evening one-hour round trips between Norwich and Jewett City primarily along Route 12. In addition to the corridor runs, there are three local runs serving Norwich starting at 6:00 am and ending at 6:55 pm; there are three local runs serving New London starting at 7:00 am and ending at 6:55 pm; and there is one local run serving Groton starting at 6:40 am and ending at 6:45 pm. There are also two runs that serve the Mohegan Sun (Run #101) and Foxwoods (Run #108) Resort casinos. Run # 101 makes four AM stops and six PM stops at the Mohegan Sun at approximately one hour intervals on Monday through Saturday. Run #101 has no Sunday service. Run #101 stops at New London, Route 32/163, Norwich Transportation Center, and Westgate Plaza. Run #108 makes eight stops at Foxwoods at approximately 2 hour intervals starting at 6:55 am and ending at 8:00 pm Monday through Saturday. On Sunday, Run 108 makes six stops at Foxwoods at approximately two hour intervals starting at 9:50 am and ending at 6:00 pm. Run #108 stops at New London, and Mistick Village. Both of the casino routes accommodate the Amtrak schedule at the New London station. The service provides connections to five northbound and four southbound Amtrak trains.

  Most of the routes operate Monday through Saturday with no Sunday service. Only the Foxwoods Resort Casino run operates from 9:10 am to 6:00 pm on Sunday.

  The SEAT 2002 average daily ridership was approximately 2,300 riders per day.

- **CT Transit, New Haven Metro Area** – CT Transit New Haven Metro Area operates three bus routes in the corridor. These routes include the S-Route, the F-Route, and Route-26. The S-Route is operated by Dattco Inc. and provides weekday service from New Haven to Madison along Route 1. The last bus in the evening is extended east to Old Saybrook. There are twelve round trips daily with 30 minute departures, making a stop in Madison, and Guilford, and two stops in Branford and New Haven with additional stops at Shore Line East train stations upon request. The S-Route 2002 average daily ridership was 300 riders per day. There is no Saturday or Sunday service.

  In the corridor, the F-Route provides service from Branford to New Haven along local roads. There are three morning and eight afternoon and evening 30 minute round trips per week day and one morning round trip on Saturday. The route includes several local stops. There is no service to Branford on Sunday.

  Route-26 provides weekday express service from Old Saybrook to New Haven along I-95. There is one am and one pm trip in each direction making various stops. There is no Saturday or Sunday service.

- **Estuary Transit District (ET)** – ET operates the Shoreline Shuttle providing weekday service from Madison to Old Saybrook similar to the S-Route. There are 12 round trips daily with varying Headway intervals along US Route 1, making a stop in Madison and Guilford, and two stops in Branford and New Haven with additional stops at Shore Line East train stations upon request. The last bus in the evening is extended east to Old Saybrook. The ET Shoreline Shuttle average daily ridership was 74 riders per day.
- **Madison-New Haven Commuter Express Bus** – The Madison-New Haven Commuter Express Bus, operated by Dattco Inc., runs from Madison to New Haven along Route I-95. There is one morning and one evening trip that makes a stop at the commuter parking lots at exit 61 in Madison and exit 65 in Clinton, and terminates in downtown New Haven. The average daily ridership is 9 riders/day.

Commuter Ferry Service

- **Cross Sound Ferry** – The Cross Sound Ferry operates between New London and Orient Point, Long Island. The company operates six boats that can carry vehicles and one high speed boat for passengers only. The fleet makes 26 round trips daily in the summer and eight round trips daily in the winter. In 1999 the fleet carried approximately 1.2 million passengers, 360,000 cars, and 12,000 trucks.
- **Montauk Ferry** – The Montauk Ferry operates between New London and Montauk, New York. The company makes one round trip on Friday night and one round trip on Saturday night between Mother's Day and Labor Day. The boat carries between 80 and 120 passengers per trip.

Rideshare Service

- ***EasyStreet* Vanpool –** A total of 113 vans encompass the *EasyStreet* Vanpool system operating on I-95 between Branford and the Rhode Island state line. These vans carry an approximate total of 2000 commuters on a typical workday. In addition, *Rideworks* provides a matching service that helps commuters locate vanpool and carpool availability in their area.
- **Park and Ride Facilities –** There are 19 Park and Ride lots located at various interchanges within the study area which accommodate parking for approximately 1,360 commuter vehicles.

Bicycle Facilities

- **Recommended Routes –** There are numerous recommended bicycle routes located within the study corridor. These routes, which are identified on the *Connecticut 2002 Bicycle Map* published by ConnDOT, include Route 77 in Guilford, Route 79 in Madison, Route 81 in Clinton, Route 154 in Old Saybrook, Route 156 in Old Lyme, Route 161in East Lyme and Route 27 in Stonington. US Route 1 is also a recommended bicycle route along much of the I-95 corridor between Branford and Rhode Island. Figure 2-4, which was developed from ConnDOT's *2002 Bicycle Map*, shows the existing bicycle routes located within the I-95 study area.

3
Future Transportation Conditions

This chapter presents the anticipated future traffic demands in the I-95 study corridor and evaluates the resultant impacts of these future traffic demands on the operations along the existing roadway infrastructure. The resultant impacts were determined assuming no future geometric improvements will be made, except for already programmed construction and maintenance improvements, including the planned Route 11 project and the associated I-95/I-395/Route 11 interchange reconfiguration. This is generally referred to as the future no-build condition. Traffic growth projections were based on historical growth data and anticipated future land uses under the no-build condition. Mainline, interchange and intersection operations were analyzed utilizing future traffic demands and the results of this analysis are provided in this chapter.

For the purposes of this study, a design year of 2025 was selected as the basis for the future conditions analysis. Federal design guidelines recommend the design year for a project be established 20 years beyond the estimated time of completion of that project. For this study, that is year 2025. The selection of a design year that is 20 years beyond the estimated time of completion ensures that recommended improvements will provide long-term benefits to the traveling public.

3.1 Forecasting Future Traffic Conditions — 2002 to 2025

Based on existing traffic volume patterns and historical growth, forecasting changes in future traffic demand is best accomplished through predicting future land use and demographics. This information can then be used to develop a travel forecast model. Pursuant to this, the Connecticut Department of Transportation (ConnDOT) statewide travel demand model was used to predict future traffic volumes on roadways within the study area for the design year 2025. The model is comprehensive and requires the following inputs to generate future traffic volumes:

- A schematic roadway network of major and secondary roads within the state. Each road's characteristics and geometry, such as length, number of lanes, capacity, and travel speed are entered into the model. Planned improvements to the roadway network, such as widenings, that will increase roadway capacity are also entered into the future year model.
- A detailed zone system throughout the state with load points for trips to and from each zone accessing the roadway network. Towns within the state are represented by aggregations of zones. Trips originating in each zone are put into the schematic roadway network.

- Population and employment data for the 2025 future conditions were developed for each zone. The model uses the existing population and employment data from each zone to generate a trip table that represents the travel demand on a daily basis between all zones in the model for present day conditions. The forecasted population and employment are used to predict future traffic demand for the average weekday.
- Expected vehicle trips are then assigned to the roadway network, taking into account the roadway characteristics and travel times to determine travel routes from one zone to another. The statewide model is maintained by ConnDOT and is regularly updated.

The 2025 future condition includes the preferred alternative for reconfiguration of the Route 11/I-395/I-95 interchange that is being planned under a separate project. This reconfiguration includes the elimination of Exit 75 and Exit 80 and is reflected in all the tables and figures.

3.1.1 Study Area Land Use Update

As part of the 2025 future conditions assessment, meetings were held with each of the towns within the study area to obtain information on future land use. Town representatives identified planned and predicted developments which may have an effect on future operations in the I-95 corridor. This information was based on a 20 year schedule. Representatives from each community researched and compiled information relative to the increase and/or changes in land use if these identified developments were implemented.

The information and data compiled from local input were mapped and compared with population and employment forecast data already in the statewide model. This analysis found that the population and employment growth inputs to the model are consistent with anticipated land use changes in the I-95 study corridor.

3.2 Future Traffic Demand – Year 2025

Estimates of year 2025 daily and peak hour traffic volumes were obtained from ConnDOT for the mainline, interchange ramps, mainline weaving sections, and key intersections within the study area. Summer Friday peak hour volumes were used as the basis of analysis for the road-based transportation system. Traffic volume networks representing average summer Friday peak hour traffic volumes for 2025 are provided in the appendix. These projected volumes account for the potential developments in the region, as well as growth expected elsewhere in the state.

3.2.1 2025 Daily Volumes

Table 3-1 presents a comparison of the average daily traffic volumes (ADT) in the 2000 existing condition and 2025 future condition for each mainline section in the study area. All sections are projected to experience increased traffic demand. ADT volumes are projected to increase between 24 and 53 percent over the study period. The average change for this time period is 39 percent. This corresponds to an average yearly change of 1.6 percent assuming uniform annual increases.

The increased traffic demand is generally spread evenly throughout the corridor with minor deviations on specific sections due to land use changes or planned improvement projects such as the Route 11 construction project.

Table 3-1
I-95 Mainline Average Daily Traffic Volumes (ADT) Comparison – 2000 to 2025 (Two-Way)

Section	2000 ADT	2025 ADT	% Change (2000 TO 2025)	Average Yearly % Change (2000 to 2025)
Exit 54 to 55	83,900	114,600	37	1.5
Exit 55 to 56	80,000	108,400	36	1.4
Exit 56 to 57	75,700	104,000	37	1.5
Exit 57 to 58	74,200	102,600	38	1.5
Exit 58 to 59	71,300	99,600	40	1.6
Exit 59 to 60	68,400	93,400	37	1.5
Exit 60 to 61	71,600	97,800	37	1.5
Exit 61 to 62	67,100	90,000	34	1.4
Exit 62 to 63	66,600	89,200	34	1.4
Exit 63 to 64	64,200	85,400	33	1.3
Exit 64 to 65	64,100	85,000	33	1.3
Exit 65 to 66	61,000	79,000	30	1.2
Exit 66 to 67 (Elm St)	58,900	74,800	27	1.1
Exit 67 (Elm St) to 67 (Rte 154)	64,400	82,300	28	1.1
Exit 67 (Rte 154) to 68	57,600	71,300	24	1.0
Exit 68 to 69	66,500	88,900	34	1.3
Exit 69 to 70	80,600	114,300	42	1.7
Exit 70 to 71	69,800	98,300	41	1.6
Exit 71 to 72	70,100	101,700	45	1.8
Exit 72 to 73	71,400	99,100	39	1.6
Exit 73 to 74	71,600	99,100	38	1.5
Exit 74 to Exit 76	75,800	107,600	42	1.7
Exit 76 to 81	61,600	94,500	53	2.1
Exit 81 to 82	66,700	101,500	52	2.1
Exit 82 to 82A	77,400	107,700	39	1.6
Exit 82A to 83	68,800	92,300	34	1.4
Exit 83 to 84	90,100	123,900	38	1.5
Exit 84 to 85	121,000	167,400	38	1.5
Exit 85 to 86	91,500	130,100	42	1.7
Exit 86 to 87 (Rte 1)	67,400	95,500	42	1.7
Exit 87 (Rte 1) to 87 (Rte 349)	60,800	86,500	42	1.7
Exit 87 (Rte 349) to 88	75,900	106,900	41	1.6
Exit 88 to 89	69,400	100,300	45	1.8
Exit 89 to 90	63,800	91,300	43	1.7
Exit 90 to 91	52,600	77,300	47	1.9
Exit 91 to 92	42,900	65,300	52	2.1
Exit 92 to 93	36,600	54,100	48	1.9
Study Area Average			**39**	**1.6**

Note: Some existing condition sections were omitted because a direct comparison could not be made to a section in the 2025 future condition. The best corresponding existing section was used for a basis of comparison.

3.2.2 2025 Evening Peak Hour Volumes

Table 3-2 presents 2025 evening peak hour mainline volumes compared to 2002 evening peak hour volumes. The percent change for this period ranges from 36 to 65 percent. The average percent change for the study area is 43 percent. The average yearly percent change is 1.9 percent for the evening peak hour.

Table 3-2
I-95 Mainline Evening Peak Hour Volume Comparison – 2002 to 2025 (Two-Way)

Section	2002 Volume (vph)[1]	2025 Volume (vph)[1]	% Change (2002 to 2025)	Average Yearly % Change (2002 to 2025)
Exit 54 to 55	7,000	9,720	39	1.7
Exit 55 to 56	6,830	9,490	39	1.7
Exit 56 to 57	6,520	9,070	39	1.7
Exit 57 to 58	6,420	8,930	39	1.7
Exit 58 to 59	6,160	8,580	39	1.7
Exit 59 to 60	5,760	8,030	39	1.7
Exit 60 to 61	6,130	8,530	39	1.7
Exit 61 to 62	5,690	7,930	39	1.7
Exit 62 to 63	5,750	8,010	39	1.7
Exit 63 to 64	5,580	7,790	40	1.7
Exit 64 to 65	5,550	7,760	40	1.7
Exit 65 to 66	5,230	7,340	40	1.8
Exit 66 to 67 (Elm St)	5,030	7,070	41	1.8
Exit 67 (Elm St) to 67 (Rte 154)	5,140	7,930	54	2.4
Exit 67 (Rte 154) to 68	4,870	6,860	41	1.8
Exit 68 to 69	6,170	8,620	40	1.7
Exit 69 to 70	7,920	10,800	36	1.6
Exit 70 to 71	6,670	9,380	41	1.8
Exit 71 to 72	7,030	9,870	40	1.8
Exit 72 to 73	6,900	9,690	40	1.8
Exit 73 to 74	6,950	9,760	40	1.8
Exit 74 to Exit 76	7,370	10,590	44	1.9
Exit 76 to 81	6,220	10,030	61	2.7
Exit 81 to 82	6,750	10,830	60	2.6
Exit 82 to 82A	8,180	11,620	42	1.8
Exit 82A to 83	6,860	9,820	43	1.9
Exit 83 to 84	8,860	12,520	41	1.8
Exit 84 to 85	11,860	16,620	40	1.7
Exit 85 to 86	9,710	13,700	41	1.8
Exit 86 to 87 (Rte 1)	7,410	10,600	43	1.9
Exit 87 (Rte 1) to 87 (Rte 349)	6,560	10,850	65	2.8
Exit 87 (Rte 349) to 88	8,130	11,060	36	1.6
Exit 88 to 89	7,430	10,650	43	1.9
Exit 89 to 90	6,720	9,680	44	1.9
Exit 90 to 91	5,390	7,900	47	2.0
Exit 91 to 92	4,370	6,520	49	2.1
Exit 92 to 93	3,370	5,170	53	2.3
Study Area Average			**43**	**1.9**

1 vph — Vehicles per hour, including all vehicle types (e.g. passenger cars, trucks, motorcycles, etc.)

The highest growth experienced along I-95 in the study area is between Exits 87 (Rte 1) and 87 (Rte 349) — experiencing a 65 percent increase over existing traffic demands. The sections between Exits 69 and 70, and between Exits 87 (Rte 349) and 88 experience the least change in traffic with a 36 percent increase.

More detailed characteristics of the evening 2025 peak hour traffic volumes for the I-95 mainline sections in the study area are presented in Table 3-3.

Table 3-3
I-95 Mainline Evening Peak Hour Volumes – 2025 Future Conditions (Two-Way)

Section	2025 PM Peak Hour					
	2025 Volume (vph)[1]	% of Daily Traffic	Directional Split (vph)[1]		Directional Distribution	
			NB	SB		
Exit 54 to 55	9,720	8.5	5,200	4,520	53%	NB
Exit 55 to 56	9,490	8.8	5,160	4,330	54%	NB
Exit 56 to 57	9,070	8.7	4,960	4,110	55%	NB
Exit 57 to 58	8,930	8.7	4,820	4,110	54%	NB
Exit 58 to 59	8,580	8.6	4,510	4,070	53%	NB
Exit 59 to 60	8,030	8.6	4,370	3,660	54%	NB
Exit 60 to 61	8,530	8.7	4,640	3,890	54%	NB
Exit 61 to 62	7,930	8.8	4,350	3,580	55%	NB
Exit 62 to 63	8,010	9.0	4,300	3,710	54%	NB
Exit 63 to 64	7,790	9.1	4,150	3,640	53%	NB
Exit 64 to 65	7,760	9.1	4,040	3,720	52%	NB
Exit 65 to 66	7,340	9.3	3,910	3,430	53%	NB
Exit 66 to 67 (Elm St)	7,070	9.5	3,780	3,290	53%	NB
Exit 67 (Elm St) to 67 (Rte 154)	7,930	9.6	4,210	3,720	53%	NB
Exit 67 (Rte 154) to 68	6,860	9.6	3,760	3,100	55%	NB
Exit 68 to 69	8,620	9.7	4,710	3,910	55%	NB
Exit 69 to 70	10,800	9.4	5,770	5,030	53%	NB
Exit 70 to 71	9,380	9.5	4,870	4,510	52%	NB
Exit 71 to 72	9,870	9.7	5,150	4,720	52%	NB
Exit 72 to 73	9,690	9.8	5,010	4,680	52%	NB
Exit 73 to 74	9,760	9.8	4,940	4,820	51%	NB
Exit 74 to 76	10,590	9.8	5,410	5,180	51%	NB
Exit 76 to 81	10,030	10.6	4,840	5,190	52%	SB
Exit 81 to 82	10,830	10.7	5,230	5,600	52%	SB
Exit 82 to 82A	11,620	10.8	5,440	6,180	53%	SB
Exit 82A to 83	9,820	10.6	5,090	4,730	52%	NB
Exit 83 to 84	12,520	10.1	6,440	6,080	51%	NB
Exit 84 to 85	16,620	9.9	8,140	8,480	51%	SB
Exit 85 to 86	13,700	10.5	6,520	7,180	52%	SB
Exit 86 to 87 (Rte 1)	10,600	11.1	5,170	5,430	51%	SB
Exit 87(Rte 1) to 87 (Rte 349)	10,850	12.5	6,570	4,280	61%	NB
Exit 87 (Rte 349) to 88	11,060	10.3	6,020	5,040	54%	NB
Exit 88 to 89	10,650	10.6	6,020	4,630	57%	NB
Exit 89 to 90	9,680	10.6	5,330	4,350	55%	NB
Exit 90 to 91	7,900	10.2	4,570	3,330	58%	NB
Exit 91 to 92	6,520	10.0	3,720	2,800	57%	NB
Exit 92 to 93	5,170	9.6	3,080	2,090	60%	NB
Study Area Average		**9.7**			**54%**	

1 vph — Vehicles per hour, including all vehicle types (e.g. passenger cars, trucks, motorcycles, etc.)

3.3 Future Traffic Operations — Year 2025

The procedures and criteria used to evaluate the future conditions were based on the methodology presented in the 2000 Highway Capacity Manual (HCM). The HCM presents various methods for evaluating traffic operations for different types of roadway facilities based on 44 years of research into traffic operations and traffic flow. Level of service (LOS) is the qualitative designation used to describe operations. A detailed description of the LOS methodology and criteria is provided in Chapter 2. The following sections provide a summary of the future conditions in the study area.

3.3.1 Mainline Operations

The results of the 2025 future condition freeway section analysis are summarized in Table 3-4 and are illustrated in Figure 3-1. Table 3-4 provides a brief description of the geometric characteristics and the resulting level of service for the evening peak hour for each section of I-95 within the study area.

Table 3-4
Freeway Section Analysis – Summary of 2025 Future Conditions

Section		Terrain	Number of Lanes	Peak Hour	Level of Service	2025 Volumes (vph)[1]
From	To					
Northbound						
Exit 54	**Exit 55**	**Level**	**2**	**PM**	**F**	**5,200**
Exit 55	**Exit 56**	**Level**	**2**	**PM**	**F**	**5,160**
Exit 56	**Exit 57**	**Level**	**2**	**PM**	**F**	**4,960**
Exit 57	**Exit 58**	**Level**	**2**	**PM**	**F**	**4,820**
Exit 58	**Exit 59**	**Level**	**2**	**PM**	**F**	**4,510**
Exit 59	**Exit 60**	**Rolling**	**2**	**PM**	**F**	**4,370**
Exit 60	**Exit 61**	**Rolling**	**2**	**PM**	**F**	**4,640**
Exit 61	**Exit 62**	**Rolling**	**2**	**PM**	**F**	**4,350**
Exit 62	**Exit 63**	**Rolling**	**2**	**PM**	**F**	**4,300**
Exit 63	**Exit 64**	**Rolling**	**2**	**PM**	**F**	**4,150**
Exit 64	**Exit 65**	**Rolling**	**2**	**PM**	**F**	**4,040**
Exit 65	**Exit 66**	**Rolling**	**2**	**PM**	**F**	**3,910**
Exit 66	**Exit 67 (Elm St)**	**Rolling**	**2**	**PM**	**E**	**3,780**
Exit 67 (Rte 154)	**Exit 68**	**Rolling**	**2**	**PM**	**E**	**3,760**
Exit 68	**Exit 69**	**Rolling**	**3**	**PM**	**F[2]**	**4,710**
Exit 69	Exit 70	Rolling	4	PM	D	5,770
Exit 70	**Exit 71**	**Rolling**	**2**	**PM**	**F**	**4,870**
Exit 71	**Exit 72**	**Rolling**	**2**	**PM**	**F[2]**	**5,150**
Exit 72	**Exit 73**	**Rolling**	**2**	**PM**	**F**	**5,010**
Exit 73	**Exit 74**	**Rolling**	**2**	**PM**	**F**	**4,940**
Exit 74	Exit 76	Rolling	3[3]	PM	C[3]	5,410
Exit 76	Exit 81	Rolling	3[3]	PM	D[3]	4,840
Exit 81	**Exit 82**	**Rolling**	**2**	**PM**	**F**	**5,230**
Exit 82	**Exit 82A**	**Rolling**	**2**	**PM**	**F**	**5,440**

Table 3-4
Freeway Section Analysis – Summary of 2025 Future Conditions

Section		Terrain	Number of Lanes	Peak Hour	Level of Service	2025 Volumes (vph)[1]
From	To					
Exit 82A	**Exit 83**	**Rolling**	**3**	**PM**	**F[2]**	**5,090**
Exit 83	**Exit 84**	**Rolling**	**4**	**PM**	**F**	**6,440**
Exit 84	**Exit 85**	**Rolling**	**5**	**PM**	**E**	**8,140**
Exit 85	**Exit 86**	**Rolling**	**3**	**PM**	**F**	**6,520**
Exit 86	**Exit 87**	**Rolling**	**3**	**PM**	**E**	**5,170**
Exit 87	**Exit 88**	**Rolling**	**3**	**PM**	**F**	**6,570**
Exit 88	**Exit 89**	**Rolling**	**3**	**PM**	**F**	**6,020**
Exit 89	**Exit 90**	**Rolling**	**2**	**PM**	**F**	**5,330**
Exit 90	**Exit 91**	**Rolling**	**2**	**PM**	**F**	**4,570**
Exit 91	**Exit 92**	**Rolling**	**2**	**PM**	**E**	**3,720**
Exit 92	Exit 93	Rolling	2	PM	D	3,080
Exit 93	State Line	Rolling	2	PM	D	3,160
Southbound						
Exit 54	**Exit 55**	**Level**	**2**	**PM**	**F**	**4,520**
Exit 55	**Exit 56**	**Level**	**2**	**PM**	**F**	**4,330**
Exit 56	**Exit 57**	**Level**	**2**	**PM**	**F**	**4,110**
Exit 57	**Exit 58**	**Level**	**2**	**PM**	**F**	**4,110**
Exit 58	**Exit 59**	**Level**	**2**	**PM**	**F**	**4,070**
Exit 59	**Exit 60**	**Rolling**	**2**	**PM**	**F**	**3,660**
Exit 60	**Exit 61**	**Rolling**	**2**	**PM**	**F**	**3,890**
Exit 61	**Exit 62**	**Rolling**	**2**	**PM**	**F**	**3,580**
Exit 62	**Exit 63**	**Rolling**	**2**	**PM**	**F**	**3,710**
Exit 63	**Exit 64**	**Rolling**	**2**	**PM**	**F**	**3,640**
Exit 64	**Exit 65**	**Rolling**	**2**	**PM**	**F**	**3,720**
Exit 65	**Exit 66**	**Rolling**	**2**	**PM**	**E**	**3,430**
Exit 66	**Exit 67 (Elm St)**	**Rolling**	**2**	**PM**	**E**	**3,290**
Exit 67 (Elm St)	**Exit 67 (Rte 154)**	**Rolling**	**2**	**PM**	**F**	**3,720**
Exit 67 (Rte 154)	**Exit 68**	**Rolling**	**2**	**PM**	**E**	**3,100**
Exit 68	**Exit 69**	**Rolling**	**2**	**PM**	**F[2]**	**3,910**
Exit 69	Exit 70	Rolling	4	PM	C	5,030
Exit 70	**Exit 71**	**Rolling**	**2**	**PM**	**F**	**4,510**
Exit 71	**Exit 72**	**Rolling**	**2**	**PM**	**F[2]**	**4,720**
Exit 72	**Exit 73**	**Rolling**	**2**	**PM**	**F**	**4,680**
Exit 73	**Exit 74**	**Rolling**	**2**	**PM**	**F**	**4,820**
Exit 74	Exit 76	Rolling	3[3]	PM	D[3]	5,180
Exit 76	Exit 81	Rolling	3[3]	PM	D[3]	5,190
Exit 81	**Exit 82**	**Rolling**	**2**	**PM**	**F**	**5,600**
Exit 82	**Exit 82A (Frontage Rd)**	**Rolling**	**2**	**PM**	**F[2]**	**6,180**
Exit 82A (Frontage Rd)	**Exit 83**	**Rolling**	**2**	**PM**	**F**	**4,730**
Exit 83	**Exit 84**	**Rolling**	**4**	**PM**	**F**	**6,080**
Exit 84	**Exit 85**	**Rolling**	**5**	**PM**	**E**	**8,480**
Exit 85	**Exit 86**	**Rolling**	**4**	**PM**	**E**	**7,180**

Table 3-4
Freeway Section Analysis – Summary of 2025 Future Conditions

Section		Terrain	Number of Lanes	Peak Hour	Level of Service	2025 Volumes (vph)[1]
From	To					
Exit 86	**Exit 87 (Rte 1)**	**Rolling**	**3**	**PM**	**E**	**5,430**
Exit 87 (Rte 1)	Exit 87 (Rte 349)	Level	3	PM	D	4,280
Exit 87 (Rte 349)	**Exit 88**	**Rolling**	**3**	**PM**	**E**	**5,040**
Exit 88	Exit 89	Rolling	3	PM	D	4,630
Exit 89	**Exit 90**	**Rolling**	**2**	**PM**	**F**	**4,350**
Exit 90	**Exit 91**	**Rolling**	**2**	**PM**	**E**	**3,330**
Exit 91	Exit 92	Rolling	2	PM	D	2,800
Exit 92	Exit 93	Rolling	2	PM	C	2,090
Exit 93	State Line	Rolling	2	PM	C	2,290

Note: Boldface entries denote capacity deficiencies during the peak period.
1 vph – Vehicles per hour, including all vehicle types (e.g. passenger cars, trucks, motorcycles, etc.).
2 Weaving area
3 Number of lanes and LOS for 2020 taken from Administrative Final Environmental Impact Statement "Route 11 Corridor" dated December 5, 2002.

Northbound Freeway Sections

During the evening peak hour in year 2025, the northbound direction of I-95 will operate between LOS C and LOS F. Only 5 of the 36 northbound sections will operate at an acceptable level of service. One section will operate at LOS C, and four sections will operate at LOS D. Of the remaining 31 sections, six will operate at LOS E, and 25 will operate at LOS F. In general, the majority of northbound I-95 within the study area will experience operational deficiencies in the 2025 evening peak hour.

Southbound Freeway Sections

During the evening peak hour in year 2025, the southbound direction of I-95 will operate between LOS C and LOS F. Only eight of the 38 southbound sections will operate at an acceptable level of service. Three sections will operate at LOS C, and five will operate at LOS D. Of the remaining 30 sections, eight will operate at LOS E, and 22 will operate at LOS F. In general, the majority of northbound I-95 within the study area will experience operational deficiencies in the 2025 evening peak hour.

3.3.2 Ramp Operations

Level of service for ramp operations is based on the density of vehicles within the influence areas on the mainline created by merging or diverging vehicles. The results of the freeway merge and diverge analyses for 2025 traffic conditions are summarized in Table 3-5 and illustrated on Figure 3-1.

Table 3-5
Ramp Merge/Diverge Analysis – Summary of 2025 Future Conditions

Ramp	Ramp Volume	Terrain	Peak Hour	Level of Service	Density (pc/mi/ln)
Northbound					
Exit 54 On	**730**	**Level**	**PM**	**F**	**49**
Exit 55 Off	**540**	**Level**	**PM**	**F**	**53**
Exit 55 On	**500**	**Level**	**PM**	**F**	**49**
Exit 56 Off	**700**	**Level**	**PM**	**F**	**53**
Exit 56 On	**500**	**Level**	**PM**	**F**	**47**
Exit 57 Off	**500**	**Rolling**	**PM**	**F**	**53**
Exit 57 On	**360**	**Rolling**	**PM**	**F**	**48**
Exit 58 Off	**610**	**Rolling**	**PM**	**F**	**52**
Exit 58 On	**300**	**Rolling**	**PM**	**F**	**46**
Exit 59 Off	**750**	**Rolling**	**PM**	**F**	**48**
Exit 59 On	**610**	**Rolling**	**PM**	**F**	**43**
Exit 60 On	**270**	**Rolling**	**PM**	**F**	**46**
Exit 61 Off	**610**	**Rolling**	**PM**	**F**	**50**
Exit 61 On	**320**	**Rolling**	**PM**	**F**	**42**
Exit 62 Off	**470**	**Rolling**	**PM**	**F**	**47**
Exit 62 On	**420**	**Rolling**	**PM**	**F**	**43**
Exit 63 Off	**750**	**Rolling**	**PM**	**F**	**48**
Exit 63 On	**600**	**Rolling**	**PM**	**F**	**41**
Exit 64 Off	**460**	**Rolling**	**PM**	**F**	**45**
Exit 64 On	**350**	**Rolling**	**PM**	**F**	**40**
Exit 65 Off	**550**	**Rolling**	**PM**	**F**	**44**
Exit 65 On	**420**	**Rolling**	**PM**	**F**	**39**
Exit 66 Off	**410**	**Rolling**	**PM**	**F**	**43**
Exit 66 On	**280**	**Rolling**	**PM**	**E**	**40**
Exit 67 (Elm St) On	**430**	**Rolling**	**PM**	**F**	**46**
Exit 67 (Rte 154) Off	**450**	**Rolling**	**PM**	**F**	**44**
Exit 68 On	**950**	**Rolling**	**PM**	**F**	**46**
Exit 69 Off	**270**	**Rolling**	**PM**	**E**	**37**
Exit 69 On	**1,330**	**Rolling**	**PM**	**F**	**39**
Exit 70 Off	**1,210**	**Rolling**	**PM**	**F**	**44**
Exit 70 On	**310**	**Rolling**	**PM**	**F**	**50**
Exit 71 Off	**130**	**Rolling**	**PM**	**F**	**51**
Exit 71 On	**410**	**Rolling**	**PM**	**F**	**52**
Exit 72 Off	**480**	**Rolling**	**PM**	**F**	**54**
Exit 72 On	**340**	**Rolling**	**PM**	**F**	**51**
Exit 73 Off	**140**	**Rolling**	**PM**	**F**	**54**
Exit 73 On	**70**	**Rolling**	**PM**	**F**	**50**
Exit 74 Off	**420**	**Rolling**	**PM**	**F**	**53**
Exit 74 On	**890**	**Rolling**	**PM**	**F**	**52**
Exit 76 Off	1580	Rolling	PM	D[1]	58
Exit 76 On	1010	Rolling	PM	D[1]	49
Exit 81 (Cross Rd) Off	**300**	**Rolling**	**PM**	**F**	**52**
Exit 81 (Parkway South) On	**690**	**Rolling**	**PM**	**F**	**51**
Exit 82 Off	**450**	**Rolling**	**PM**	**F**	**56**
Exit 82 On	**660**	**Rolling**	**PM**	**F**	**55**

Table 3-5
Ramp Merge/Diverge Analysis – Summary of 2025 Future Conditions

Ramp	Ramp Volume	Terrain	Peak Hour	Level of Service	Density (pc/mi/ln)
Exit 82A Off	**550**	**Rolling**	**PM**	**F**	**59**
Exit 82A On	**200**	**Rolling**	**PM**	**F**	**51**
Exit 83 Off	**350**	**Rolling**	**PM**	**F**	**55**
Exit 83 On	**1700**	**Rolling**	**PM**	**F**	**42**
Exit 84 On	**1700**	**Rolling**	**PM**	**F**	**49**
Exit 85 Off	**1620**	**Rolling**	**PM**	**F**	**48**
Exit 86 Off	**1350**	**Rolling**	**PM**	**F**	**44**
Exit 87 Off	**350**	**Rolling**	**PM**	**F**	**51**
Exit 87 On	**1750**	**Rolling**	**PM**	**F**	**42**
Exit 88 Off	**1020**	**Rolling**	**PM**	**F**	**39**
Exit 88 On	**470**	**Rolling**	**PM**	**F**	**41**
Exit 89 Off	**1030**	**Rolling**	**PM**	**F**	**63**
Exit 89 On	**340**	**Rolling**	**PM**	**F**	**51**
Exit 90 Off	**1210**	**Rolling**	**PM**	**F**	**58**
Exit 90 On	**450**	**Rolling**	**PM**	**F**	**43**
Exit 91 Off	**950**	**Rolling**	**PM**	**F**	**48**
Exit 91 On	**100**	**Rolling**	**PM**	**E**	**37**
Exit 92 Off	**1180**	**Rolling**	**PM**	**F**	**51**
Exit 92 On	540	Rolling	PM	D	32
Exit 93 Off	**270**	**Rolling**	**PM**	**E**	**36**
Exit 93 On	350	Rolling	PM	D	32
Southbound					
Exit 54 Off	**880**	**Level**	**PM**	**F**	**47**
Exit 55 Off	**490**	**Level**	**PM**	**F**	**46**
Exit 55 On	**680**	**Level**	**PM**	**F**	**44**
Exit 56 (Industrial Rd) Off	**450**	**Level**	**PM**	**F**	**44**
Exit 56 (Leetes Island Rd) On	**670**	**Level**	**PM**	**F**	**42**
Exit 57 Off	**340**	**Rolling**	**PM**	**F**	**47**
Exit 57 On	**340**	**Rolling**	**PM**	**F**	**45**
Exit 58 Off	**410**	**Rolling**	**PM**	**F**	**45**
Exit 58 On	**450**	**Rolling**	**PM**	**F**	**43**
Exit 59 Off	**340**	**Rolling**	**PM**	**F**	**42**
Exit 59 On	**750**	**Rolling**	**PM**	**F**	**42**
Exit 60 Off	**230**	**Rolling**	**PM**	**F**	**44**
Exit 61 Off	**270**	**Rolling**	**PM**	**F**	**42**
Exit 61 On	**580**	**Rolling**	**PM**	**F**	**40**
Exit 62 Off	**520**	**Rolling**	**PM**	**F**	**42**
Exit 62 On	**390**	**Rolling**	**PM**	**F**	**39**
Exit 63 Off	**600**	**Rolling**	**PM**	**F**	**42**
Exit 63 On	**670**	**Rolling**	**PM**	**F**	**39**
Exit 64 Off	**420**	**Rolling**	**PM**	**F**	**42**
Exit 64 On	**340**	**Rolling**	**PM**	**F**	**39**
Exit 65 Off	**310**	**Rolling**	**PM**	**F**	**40**
Exit 65 On	**600**	**Rolling**	**PM**	**F**	**39**
Exit 66 Off	**270**	**Rolling**	**PM**	**E**	**40**
Exit 66 On	**410**	**Rolling**	**PM**	**E**	**38**
Exit 67 (Elm St) Off	**430**	**Rolling**	**PM**	**F**	**42**

Table 3-5
Ramp Merge/Diverge Analysis – Summary of 2025 Future Conditions

Ramp	Ramp Volume	Terrain	Peak Hour	Level of Service	Density (pc/mi/ln)
Exit 67 (Rte 154 – SB) On	**250**	**Rolling**	**PM**	**F**	**41**
Exit 67 (Rte 154 – NB) On	**370**	**Rolling**	**PM**	**E**	**38**
Exit 68 Off	**810**	**Rolling**	**PM**	**F**	**46**
Exit 69 Off	1530	Rolling	PM	D	30
Exit 69 On	**410**	**Rolling**	**PM**	**F**	**42**
Exit 70 Off	**250**	**Rolling**	**PM**	**F**	**46**
Exit 70 On	770	Rolling	PM	D	29
Exit 71 Off	**380**	**Rolling**	**PM**	**F**	**55**
Exit 71 On	**170**	**Rolling**	**PM**	**F**	**49**
Exit 72 Off	**300**	**Rolling**	**PM**	**F**	**54**
Exit 72 On	**340**	**Rolling**	**PM**	**F**	**51**
Exit 73 Off	**250**	**Rolling**	**PM**	**F**	**53**
Exit 73 On	**110**	**Rolling**	**PM**	**F**	**49**
Exit 74 Off	**770**	**Rolling**	**PM**	**F**	**60**
Exit 74 On	**410**	**Rolling**	**PM**	**F**	**50**
Exit 76 Off	1,400	Rolling	PM	D[1]	58
Exit 76 On	1,390	Rolling	PM	D[1]	53
Exit 81 (Cross Road) On	**370**	**Rolling**	**PM**	**F**	**53**
Exit 81 (Parkway North) Off	**780**	**Rolling**	**PM**	**F**	**62**
Exit 82 Off	**1,120**	**Rolling**	**PM**	**F**	**68**
Exit 82 On	**540**	**Rolling**	**PM**	**F**	**58**
Exit 82A (Frontage Rd) On	**1,450**	**Rolling**	**PM**	**F**	**61**
Exit 83 Off	**1350**	**Rolling**	**PM**	**F**	**42**
Exit 84 Off	**2400**	**Rolling**	**PM**	**F**	**51**
Exit 85 On	**1300**	**Rolling**	**PM**	**F**	**54**
Exit 86 On	**1750**	**Rolling**	**PM**	**F**	**50**
Exit 87 (Rte 349) Off	**410**	**Rolling**	**PM**	**F**	**47**
Exit 87 (Rte 1) Off	350	Rolling	PM	D	30
Exit 87 On	**1150**	**Rolling**	**PM**	**F**	**43**
Exit 88 Off	**340**	**Rolling**	**PM**	**F**	**42**
Exit 88 On	**750**	**Rolling**	**PM**	**E**	**36**
Exit 89 Off	**350**	**Rolling**	**PM**	**F**	**50**
Exit 89 On	**630**	**Rolling**	**PM**	**F**	**49**
Exit 90 Off	**390**	**Rolling**	**PM**	**E**	**39**
Exit 90 On	**1410**	**Rolling**	**PM**	**F**	**42**
Exit 91 Off	100	Rolling	PM	D	32
Exit 91 On	**630**	**Rolling**	**PM**	**E**	**37**
Exit 92 Off	340	Rolling	PM	C	23
Exit 92 On	1050	Rolling	PM	D	31
Exit 93 Off	410	Rolling	PM	C	27
Exit 93 On	210	Rolling	PM	C	26

Note: Boldface entries denote capacity deficiencies during the peak hour.
1 LOS for 2020 taken from Administrative Final Environmental Impact Statement "Route 11 Corridor" dated December 5, 2002.

Northbound Ramps

During the evening peak hour, four of the 66 northbound ramps analyzed are expected to operate under acceptable conditions at LOS D. The remaining 62 ramps are expected to experience operational deficiencies at LOS E or LOS F. Only four of these 62 will operate at LOS E.

Southbound Ramps

During the evening peak hour, ten of the 66 southbound ramps are expected to operate under acceptable conditions at LOS D or better. The remaining 56 ramps analyzed are expected to experience operational deficiencies at LOS E or LOS F. Of these, six ramps are expected to operate at LOS E.

3.3.3 Weaves

As detailed in Chapter 2, weaving areas occur when an on-ramp merge area is closely followed by an off-ramp diverge area. The LOS criteria is based on vehicle speeds, vehicular volume, and weaving length within the weaving section.

There are four study area locations where weaving conditions are experienced on I-95 during the 2002 existing condition. There is a proposed on/off ramp being constructed at Route 11 & I-395. It is assumed that this construction will be completed prior to year 2025 and will encompass Exits 75, 76, and 80. Due to the location of these new on/off ramps, the existing weave section between Exits 75 and 76 will be eliminated. The remaining three locations and the resulting LOS analyses are presented in Table 3-6 and shown graphically on Figure 3-1.

Table 3-6
Weaving Sections Analysis – Summary 2025 Future Conditions

Section Description	Weave Length (ft)	Peak Hour	Level of Service	Density (pc/mi/ln)
Northbound				
Exit 68 to Exit 69	**1320**	**PM**	**E**	**35**
Exit 71 to Exit 72	**800**	**PM**	**F**	**48**
Exit 82A to Exit 83	2300	PM	C	23
Southbound				
Exit 69 to Exit 68	1000	PM	D	32
Exit 72 to Exit 71	**500**	**PM**	**F**	**50**
Exit 82A (Frontage Rd) to Exit 82	**1000**	**PM**	**F**	**72**

During the evening peak hour, the weave areas for both northbound and southbound directions between Exits 71 and 72 are expected to operate at LOS F. The northbound weave areas between Exits 68 and 69 and Exits 82A and 83 are expected to operate at LOS E and C, respectively, during the evening peak hour in the 2025 design year. The southbound weave area between Exits 69 and 68 is expected to operate at LOS D. The southbound weave area between Exits 82A and 82 is expected to operate at LOS F during the evening peak hour. The northbound and southbound weave areas between Exits 75 and 76 will be removed as part of planned improvements to this section of the corridor. Therefore, analysis is not applicable for the 2025 design year.

3.3.4 Intersections

The results of the signalized intersection analysis for 2025 future traffic conditions are summarized in Table 3-7. Table 3-8 summarizes the unsignalized intersection analysis. The intersection LOS results are also presented graphically on Figure 3-2.

The tables and figures encompass the intersections that were evaluated for the existing evening peak hour levels of service. These intersections are listed in the appendix to Chapter 2. Additionally, LOS for intersections at the Exit 74 ramps have been obtained from the Administrative Final Environmental Impact Statement "Route 11 Corridor," and are included in the table.

Signalized Intersections

Of the 38 signalized intersections analyzed, 21 are expected to experience saturated conditions at LOS F during the evening peak hour. An additional nine intersections expected to operate at LOS E results in 30 total intersections that are expected to experience operational deficiencies. An estimated seven signalized intersections are projected to be significantly over capacity with a volume-to-capacity (V/C) ratio in excess of 1.2 during the evening peak hour.

When V/C ratios significantly exceed 1.0, the intersection cannot accommodate the traffic demands placed upon it and will fail (LOS F). As a result, significant delays and long queues occur. Furthermore, an intersection can only operate efficiently at capacity (V/C equals 1.0) under ideal conditions. There are four intersections that are expected to operate with a V/C ratio over 1.0 but less than 1.2. Eight intersections will operate under acceptable conditions at LOS D or better.

Unsignalized Intersections

There are 39 unsignalized intersections within the study area that were analyzed under the 2025 future traffic condition. Seventeen of these intersections are expected to operate at LOS E or F during the evening peak hour, including 12 of the 28 intersections where the I-95 ramps intersect the local street system. This represents an increase of nine locations over existing conditions that are expected to operate at saturated levels.

Table 3-7
Signalized Intersection Analysis – Summary of 2025 Future Conditions

Signalized Intersections	Peak Hour	Level of Service	V/C[1]	Delay[2]
Exit 54 NB Ramps at SR 740 (Cedar St)	**PM**	**E**	**0.88**	**58**
Exit 54 SB Ramps at SR 740 (Cedar St)	**PM**	**F**	**0.87**	**81**
US Rte 1 (Main St) at SR 740 (Cedar St)	**PM**	**F**	**1.65**	**356**
Exit 55 NB Ramps at US Rte 1 (East Main St)	**PM**	**F**	**0.75**	**98**
Exit 55 SB Ramp at US Rte 1 (East Main St)	**PM**	**F**	**1.20**	**195**
Exit 57 NB Ramps at US Rte 1 (Boston Post Rd)	**PM**	**F**	**0.98**	**197**
Exit 58 NB Ramps at Rte 77 (Church St)	**PM**	**F**	**1.02**	**99**
US Rte 1 at SR 718 (Goose Lane)	**PM**	**F**	**1.03**	**120**
Exit 61 SB Ramps at Rte 79 (Durham Rd)	**PM**	**E**	**0.58**	**72**
Route 79 (Durham Rd) at Old Rte 79/Woodland Rd	**PM**	**E**	**0.65**	**70**
Exit 62 NB Ramps at Hammonasset Connector	PM	B	0.43	19
Exit 63 NB Off-Ramp at North High St	PM	D	0.58	44
Exit 63 NB On-Ramp at Rte 81 (Killingworth Tpke)	**PM**	**F**	**1.52**	**229**
Exit 63 SB Ramps at Rte 81 (Killingworth Tpke)	**PM**	**F**	**0.89**	**285**
Rte 81 (High St) at Glenwood Rd	**PM**	**F**	**0.71**	**87**
Rte 145 at Old Clinton Rd	**PM**	**E**	**0.62**	**78**
Exit 65 NB Ramps at Rte 153 (Essex Rd)	PM	B	0.50	12
Exit 65 SB Ramps at Rte 153 (Essex Rd)	PM	C	0.61	31
Rte 153 at Westbrook Mall Entrance	PM	D	0.68	39
Exit 70 NB Off-Ramp at Rte 156 (Neck Rd)	PM	D	0.41	42
Exit 70 SB On-Ramp at Rte 156	**PM**	**F**	**1.52**	**510**
US Rte 1 (Halls Rd) at Rte 156	**PM**	**E**	**0.50**	**77**
Exit 70 SB Off-Ramp at US Rte 1(Boston Post Rd)	**PM**	**F**	**1.66**	**446**
SR 449 (Rocky Neck Connector) at Rte 156	**PM**	**E**	**0.46**	**67**
Exit 74 NB Off-Ramp at Rte 161 (Flanders Rd)	**PM**	**E[3]**	**-**	**-**
Exit 82 NB Ramps at Rte 85 (Broad St)	**PM**	**F**	**0.67**	**104**
Exit 82 SB Ramps at Rte 85 (Hartford Tpke)	PM	D	0.85	51
US Rte 1 (Coleman St) at Rte 85 (Broad St)	**PM**	**F**	**1.01**	**215**
Vauxhall St at US Rte 1 (Coleman St)	**PM**	**F**	**1.46**	**82**
US Rte 1 at Bridge St	**PM**	**E**	**0.51**	**72**
Exit 88 NB Ramps at Rte 117 (North Rd)	**PM**	**E**	**0.68**	**65**
Exit 88 SB Ramps at Rte 117 (North Rd)	PM	C	0.56	24
Exit 90 NB Ramps at Rte 27 (White Hall Ave)	**PM**	**F**	**1.13**	**127**
Rte 27 (White Hall Ave) at Coogan Blvd	**PM**	**F**	**1.32**	**189**
Exit 91 NB Ramps at Rte 234 (Pequot Trail)	**PM**	**F**	**0.81**	**179**
Exit 92 NB Off-Ramp at Rte 2 (Liberty St)	**PM**	**F**	**0.94**	**132**
Exit 92 SB On-Ramp at Rte 2 (Liberty St)	**PM**	**F**	**0.69**	**213**
Exit 92 SB Off-Ramp at Rte 49 (Pendleton Hill Rd)	**PM**	**F**	**0.61**	**99**

Note: Boldface entries denote operational deficiencies during the peak hour.
1 V/C - Volume to Capacity ratio
2 Delay - Average stopped delay to all vehicles entering the intersection in seconds per vehicle
3 LOS for 2020 taken from Administrative Final Environmental Impact Statement "Route 11 Corridor" dated December 5, 2002.

Table 3-8
Unsignalized Intersection Analysis – Summary of 2025 Future Conditions

Unsignalized Intersections	Movement	Demand[1]	Delay[2]	Level of Service
SR 740 (Cedar St) at Cedar Knolls Drive	Northbound Left	100	14	B
	Eastbound	**100**	**>100**	**F**
Exit 57 SB Ramps at US Rte 1 (Boston Post Rd)	**Westbound**	**340**	**55**	**F**
	Southbound	30	9	A
Rte 77 at Commuter Lot Drive	Northbound Left	10	9	A
Exit 58 SB Ramps at Rte 77 (Church St)	Northbound Left	270	12	B
Exit 58 NB Off-Ramp at North River St	Southbound	80	16	C
	Northbound	110	15	B
Exit 59 NB Ramps at SR 718 (Goose Lane)	Southbound Left	140	13	B
Exit 59 SB Ramps at SR 718 (Goose Lane)	Northbound Left	610	13	B
	Eastbound	**340**	**>100**	**F**
SR 718 (Goose Lane) at Clapboard Hill Rd	Southbound Left	20	10	B
	Westbound	**160**	**61**	**F**
Exit 60 SB Off-Ramp at Mungertown Rd	Northbound Left	50	8	A
	Westbound	230	15	C
	Eastbound	80	9	A
Exit 60 NB On-Ramp at Fort Path Rd	Northbound	70	10	B
Mungertown Rd at Fort Path Rd	Westbound	40	10	A
	Southbound Left	90	8	A
Exit 61 NB Ramps at Rte 79 (Durham Rd)	Southbound Left	110	13	B
	Eastbound Left	**260**	**>100**	**F**
	Eastbound Right	350	32	D
	Eastbound		**>100**	**F**
Rte 79 (Durham Road) at Commuter Lot Drive	Southbound Left	10	12	B
	Westbound	**30**	**42**	**E**
Exit 62 SB Ramps at Hammonasset Connector	Southbound Left	130	11	B
	Westbound	**520**	**>100**	**F**
Exit 64 NB Ramps at Rte 145 (Horse Hill Rd)	Southbound Left	100	10	A
	Eastbound	**460**	**>100**	**F**
Exit 64 SB Ramps at Rte 145 (Horse Hill Rd)	Northbound Left	200	9	A
	Westbound	**420**	**>100**	**F**
Exit 66 NB Ramps at Rte 166 (Spencer Plains Rd)	Northbound Left	180	9	A
	Eastbound	**410**	**49**	**E**
Exit 66 SB Ramps at Rte 166 (Spencer Plains Rd)	Southbound Left	60	9	A
	Westbound	**270**	**43**	**E**
Exit 67 SB Off-Ramp at Elm St	Westbound	430	16	C
Exit 67 NB On-Ramp at Elm St	Northbound Left	100	9	A
	Southbound Left	30	8	A
	Eastbound	**200**	**54**	**F**
Exit 67 NB Off-Ramp at Rte 154 (Middlesex Tpke)	**Eastbound Right**	**310**	**52**	**F**
	Eastbound Left	**140**	**>100**	**F**
	Eastbound		**>100**	**F**
Exit 68 SB Off-Ramp at Rte 628	**Westbound**	**810**	**47**	**E**
Exit 69 SB Off-Ramp at Essex Rd	Northbound	80	10	B

Table 3-8
Unsignalized Intersection Analysis – Summary of 2025 Future Conditions

Unsignalized Intersections	Movement	Demand[1]	Delay[2]	Level of Service
Exit 71 NB Ramps at Four Mile River Rd	Southbound Left	220	9	A
	Westbound	130	21	C
Exit 71 SB Ramps at Four Mile River Rd	Northbound Left	130	8	A
	Westbound	380	33	D
Four Mile River Rd at Hatchetts Hill Rd	Northbound Left	30	8	A
	Westbound	220	17	C
Exit 73 SB Ramps at West Society Rd	Northbound		10	A
	Northbound Left	0	11	B
	Northbound Right	250	10	A
	Westbound	110	8	A
Exit 73 NB Ramps at Society Rd	Southbound	140	11	B
	Eastbound Left	30	8	A
Exit 74 SB Ramps at Rte 161 (Flanders Rd)	**Intersection**	**-**	**-**	**F[3]**
Parkway North at Vauxhall St Extension	Northbound	780	19	C
Parkway South at Vauxhall St Extension	Southbound	300	10	B
Exit 89 NB Ramps at SR 614 (Allyn St)	Southbound Left	110	9	A
	Eastbound Left	**500**	**>100**	**F**
	Eastbound Right	530	25	C
	Eastbound		**>100**	**F**
Exit 89 SB Ramps at SR 614 (Allyn St)	Southbound Left	250	10	B
	Westbound	**350**	**>100**	**F**
Exit 90 SB Ramps at Rte 27 (White Hall Ave)	Northbound Left	70	9	A
Exit 90 NB Ramps at Clara Dr (Aquarium)	Northbound		13	B
	Northbound Right	190	13	B
Exit 91 SB Ramps at Taugwonk Rd	Southbound Left	60	8	A
	Westbound		12	B
Exit 91 SB Ramps at Taugwonk Rd (continued)	Westbound Left	80	13	B
	Westbound Right	20	10	A
Exit 93 NB Ramps at Rte 216 (Clark Falls Rd)	Southbound Left	290	9	A
	Eastbound	270	33	D
Exit 93 SB Ramps at Rte 216 (Clark Falls Rd)	Northbound Left	80	9	A
	Westbound	410	21	C
Rte 216 (Clark Falls Rd) at Rte 184	**Northbound**	**570**	**49**	**E**
	Southbound	110	12	B
	Eastbound	390	19	C
	Westbound	100	12	B
	Intersection		33	D

Note: Boldface entries denote operational deficiencies during the peak hour.
1 Demand is expressed in vehicles per hour, including all vehicle types (e.g. passenger cars, trucks, motorcycles, etc.).
2 Delay - Average stopped delay in seconds per vehicle
3 LOS for 2020 taken from Administrative Final Environmental Impact Statement "Route 11 Corridor" dated December 5, 2002.

3.3.5 Comparison of Existing and Future Conditions

The analyses of the 2025 future condition in the I-95 corridor and study area present a substantial degradation from the existing operations. Table 3-9 provides a summary comparison of the existing and future traffic conditions within the I-95 corridor as detailed in the previous sections.

Table 3-9
Comparison of Existing and Future Traffic Conditions – 2002 to 2025

Location	Total Locations Reviewed 2002 / (2025)	Summary of Deficient Locations (LOS E or F)	
		2002 Peak Hour	2025 Peak Hour
Mainline			
Northbound	38 / (36)	14	31
Southbound	40 / (38)	14	30
Ramps			
Northbound	68 / (66)	35	61
Southbound	68 / (66)	28	60
Weaves			
Northbound	4 / (3)	1	2
Southbound	4 / (3)	2	2
Intersections			
Signalized	37 / (38)	13	30
Unsignalized	38 / (39)	8	17

Mainline

The expected 2025 evening peak hour operating conditions of the northbound I-95 mainline will see a dramatic increase in the number of congested sections. Thirty-one sections will experience operational deficiencies in the design year. This is more than double the existing condition total of 14. It should be noted that in the future condition there will be two less sections due to the construction of Route 11.

The southbound direction results are almost identical to the northbound. Thirty sections will experience operational deficiencies. Again, this is more than double the 14 sections in the existing condition. It should be noted that in the future condition there are also two less sections.

Ramps

During the evening peak hour, 61 of the 66 northbound ramp junctions analyzed are expected to operate under congested conditions at LOS E or F during the 2025 design hour. Under existing conditions, 35 of the 68 ramps operate at LOS E or F.

During the evening peak hour, 60 of the 66 southbound ramp junctions analyzed are expected to operate under congested conditions at LOS E or F. This is an increase of 32 ramps over the existing condition, which has 28 of 68 ramps operating at LOS E or F.

Weaves

Under the 2025 future condition, two of the three weaving sections in both the northbound and southbound directions are expected to operate at LOS E or F during the evening peak hour. Under the existing condition, one section northbound and two sections southbound operate at LOS E or F. There is a decrease in the number of weaving sections for both directions from four in the existing condition to three in the future condition due to the construction of Route 11.

Intersections

Under the 2025 future condition, the operating LOS of most intersections (signalized and unsignalized) will deteriorate from the LOS of the existing conditions due to increased volumes. The number of signalized intersections operating at LOS E or F during the evening peak hour is expected to increase from 13 under the 2002 existing condition to 30 under the 2025 future condition. Similarly, the unsignalized intersections operating at a LOS E or F during the evening peak hour is expected to increase from eight under the 2002 existing condition to 17 under the 2025 future condition. All intersections are expected to encounter volume increases, longer delays, and higher volume to capacity (V/C) ratios.

3.4 Future Demand vs. Capacity

The future LOS analyses provide a "snapshot" of the evening peak hour conditions given the projected "unconstrained" traffic volumes. The word "unconstrained" is used because the traffic forecasts for the analysis were allowed to exceed the theoretical capacity of the corridor. In simple terms, this analysis demonstrates that there will be more demand for I-95 than the corridor can accommodate in the future. As the I-95 corridor approaches capacity and is not physically able to handle additional demands placed upon it, one of these four actions is typically triggered:

- Motorists decide to divert to other local and regional routes
- Motorists change the time of their travel to avoid the congested periods ("peak spreading")
- Motorists elect to travel by alternative mode (where options exist)
- Motorists decide not to travel at all

The level of forecasted demands expected to exceed the capacity of the I-95 corridor are quantified and discussed in the next section of this report.

3.4.1 2025 Demands Exceeding Capacity

Table 3-10 compares the estimated capacity of I-95 to the projected 2025 future demand. The hourly demands were adjusted to account for the influence of heavy vehicles and non-uniform hourly flow patterns based on the methodology documented in the Highway Capacity Manual. The "unmet demand," as defined in the table, is the demand over capacity that the roadway cannot accommodate. Again, these unmet demands in Table 3-10 assume I-95 can operate at or close to its theoretical capacity. An incident or accident along the corridor would significantly affect this assumption.

Table 3-10
2025 Forecasted Demand Compared to Capacity

Section		Number of Lanes	Ideal Capacity[1] (pcph)	Unconstrained Demand[2] (pcph)	Unmet Demand[3] (pcph)
From	To				
Northbound					
Exit 54	Exit 55	2	4,400	5,922	1,522
Exit 55	Exit 56	2	4,400	5,876	1,476
Exit 56	Exit 57	2	4,400	5,676	1,276
Exit 57	Exit 58	2	4,400	5,516	1,116
Exit 58	Exit 59	2	4,400	5,162	762
Exit 59	Exit 60	2	4,400	5,292	892
Exit 60	Exit 61	2	4,400	5,620	1,220
Exit 61	Exit 62	2	4,400	5,268	868
Exit 62	Exit 63	2	4,400	5,208	808
Exit 63	Exit 64	2	4,400	5,026	626
Exit 64	Exit 65	2	4,400	4,892	492
Exit 65	Exit 66	2	4,400	4,736	336
Exit 66	Exit 67 (Elm St)	2	4,400	4,578	178
Exit 67 (Rte 154)	Exit 68	2	4,400	4,554	154
Exit 68	Exit 69	3	6,900	8,556	1,656
Exit 69	Exit 70	4	9,200	6,988	---
Exit 70	Exit 71	2	4,400	5,816	1,498
Exit 71	Exit 72	2	4,400	6,152	1,838
Exit 72	Exit 73	2	4,400	5,984	1,584
Exit 73	Exit 74	2	4,400	5,900	1,500
Exit 74	Exit 76	2	4,400	6,462	2,062
Exit 76	Exit 81	2	4,400	5,700	1,300
Exit 81	Exit 82	2	4,400	6,160	1,760
Exit 82	Exit 82A	2	4,400	6,408	2,008
Exit 82A	Exit 83	3	6,900	8,991	2,091
Exit 83	Exit 84	4	9,200	7,584	---
Exit 84	Exit 85	5	11,500	9,585	---
Exit 85	Exit 86	3	6,900	7,680	780
Exit 86	Exit 87	3	6,900	6,174	---
Exit 87	Exit 88	3	6,900	7,956	1,056
Exit 88	Exit 89	3	6,900	7,290	390
Exit 89	Exit 90	2	4,400	6,544	2,144
Exit 90	Exit 91	2	4,400	5,610	1,210
Exit 91	Exit 92	2	4,400	4,568	168
Exit 92	Exit 93	2	4,400	3,832	---
Exit 93	State Line	2	4,400	3,932	---
Southbound					
Exit 54	Exit 55	2	4,400	5,224	824
Exit 55	Exit 56	2	4,400	5,004	604
Exit 56	Exit 57	2	4,400	4,772	372
Exit 57	Exit 58	2	4,400	4,772	372
Exit 58	Exit 59	2	4,400	4,726	326
Exit 59	Exit 60	2	4,400	4,676	276
Exit 60	Exit 61	2	4,400	4,970	570
Exit 61	Exit 62	2	4,400	4,574	174

Table 3-10
2025 Forecasted Demand Compared to Capacity

Section		Number of Lanes	Ideal Capacity[1] (pcph)	Unconstrained Demand[2] (pcph)	Unmet Demand[3] (pcph)
From	To				
Exit 62	Exit 63	2	4,400	4,740	340
Exit 63	Exit 64	2	4,400	4,652	252
Exit 64	Exit 65	2	4,400	4,754	354
Exit 65	Exit 66	2	4,400	4,382	---
Exit 66	Exit 67 (Elm St)	2	4,400	4,204	---
Exit 67 (Elm St)	Exit 67 (Rte 154)	2	4,400	4,754	354
Exit 67 (Rte 154)	Exit 68	2	4,400	3,962	---
Exit 68	Exit 69	2	4,400	4,996	596
Exit 69	Exit 70	4	9,200	6,428	---
Exit 70	Exit 71	2	4,400	5,762	1,362
Exit 71	Exit 72	2	4,400	5,952	1,552
Exit 72	Exit 73	2	4,400	5,902	1,502
Exit 73	Exit 74	2	4,400	5,998	1,598
Exit 74	Exit 76	2	4,400	6,532	2,132
Exit 76	Exit 81	2	4,400	6,372	1,972
Exit 81	Exit 82	2	4,400	6,782	2,382
Exit 82	Exit 82A (Frontage Rd)	2	4,400	7,484	3,084
Exit 82A (Frontage Rd)	Exit 83	2	4,400	5,650	1,250
Exit 83	Exit 84	4	9,200	7,264	---
Exit 84	Exit 85	5	11,500	9,990	---
Exit 85	Exit 86	4	9,200	8,456	---
Exit 86	Exit 87 (Rte 1)	3	6,900	6,486	---
Exit 87 (Rte 1)	Exit 87 (Rte 349)	3	6,900	4,923	---
Exit 87 (Rte 349)	Exit 88	3	6,900	6,273	---
Exit 88	Exit 89	3	6,900	5,763	---
Exit 89	Exit 90	2	4,400	5,486	1,086
Exit 90	Exit 91	2	4,400	4,254	---
Exit 91	Exit 92	2	4,400	3,624	---
Exit 92	Exit 93	2	4,400	2,740	---
Exit 93	State Line	2	4,400	3,078	---

1 The 2000 Highway Capacity Manual defines ideal freeway capacity to be 2,200 passenger cars per hour per lane (pcphpl) for 2-lane sections and 2,300 (pcphpl) for sections with 3 or more lanes. This assumes no obstructions and 12-foot lane widths.
2 To be comparable with the 2000 Highway Capacity Manual's definition of freeway capacity, the hourly volume is adjusted to account for the influence of heavy vehicles and variations in hourly flow.
3 The unmet demand is the difference between the adjusted unconstrained demand and the ideal capacity, expressed in passenger cars per hour (pcph).

Table 3-10 indicates the majority of the sections are forecasted to operate under constrained conditions in the evening peak periods. Peak hour unmet demands vary from approximately 80 to more than 3,000 vehicles. Only six of the 36 northbound sections will have adequate capacity to meet the projected demands. On average, the northbound ideal capacity is exceeded by an average of 1,159 vehicles for each constrained section. The southbound direction has 15 of the 38 sections that will be able to provide adequate capacity to meet the projected demands. On the constrained sections, there is an average of 1,015 vehicles in excess of the ideal capacity.

3.5 Future Deficiencies Summary – Year 2025

This chapter presented the future transportation conditions within the study area under the no-build condition. The existing deficiencies presented in Chapter 2 are worsened in the year 2025 as traffic demands increase by as much as 60 percent. The majority of mainline sections, ramps, and study area intersections degrade to unacceptable levels under 2025 design year conditions. The land use and traffic demand changes from 2002 to 2025, the future operating deficiencies, and the impacts of unmet demands for the study area corridor are summarized below.

Traffic Demand

From 2002 to 2025, daily and peak hour traffic volumes on I-95 are expected to increase by an average of 43 percent - about 1.9 percent per year. In general, the traffic growth is spread evenly along the I-95 Corridor. Although the magnitude of traffic demand is expected to increase from 2002 to 2025, the same patterns emerge. Peak hour volumes generally represent between about 8 and 12 percent of the daily volumes and traffic flow is distributed at approximately a 50/50 split directionally.

Traffic Operations

A comparison of Figures 2-2 and 2-3 (existing conditions) to Figures 3-1 and 3-2 (future conditions), respectively, graphically illustrates how the projected 2025 no-build condition worsens in comparison to existing operations. The operational problems identified in the existing conditions are exacerbated in the design year. The sheer magnitude of growth in traffic volumes result in constrained operations where capacity cannot accommodate the projected peak hour demands given the current geometry.

LOS E or F operations are projected during the evening peak hour in the design year for the following cases: 61 of the 74 mainline sections; 121 of the 132 ramp merge/diverge areas; four of the six weaving sections; 30 of the 38 signalized intersections; and 17 of the 39 unsignalized intersections. Under LOS E conditions, the facility is operating at its capacity. At LOS F, the facility is operating under "forced flow" conditions. LOS E and F are both considered to be unstable conditions where the slightest disruption in traffic flow could result in gridlock conditions.

Table 3-11 compares the existing LOS currently on the I-95 freeway sections to those that would be experienced under 2025 future traffic conditions assuming no geometric improvements are made.

Table 3-11
Comparative Levels of Service for Freeway Sections – Existing vs. 2025 No-Build Conditions

Section		Northbound				Southbound			
		2002 Existing Condition		2025 Future Condition		2002 Existing Condition		2025 Future Condition	
From	To	V/C	LOS	V/C	LOS	V/C	LOS	V/C	LOS
Exit 54	Exit 55	0.84	F	1.18	F	0.80	F	1.03	F
Exit 55	Exit 56	0.83	F	1.17	F	0.79	F	0.98	F
Exit 56	Exit 57	0.80	D	1.13	F	0.77	D	0.93	F
Exit 57	Exit 58	0.78	D	1.10	F	0.76	D	0.93	F
Exit 58	Exit 59	0.73	D	1.03	F	0.72	D	0.93	F
Exit 59	Exit 60	0.70	D	0.99	F	0.66	D	0.83	F
Exit 60	Exit 61	0.75	D	1.05	F	0.69	D	0.88	F

Table 3-11
Comparative Levels of Service for Freeway Sections – Existing vs. 2025 No-Build Conditions

Section		Northbound				Southbound			
		2002 Existing Condition		2025 Future Condition		2002 Existing Condition		2025 Future Condition	
From	To	V/C	LOS	V/C	LOS	V/C	LOS	V/C	LOS
Exit 61	Exit 62	0.70	D	0.99	F	0.61	D	0.81	F
Exit 62	Exit 63	0.69	D	0.98	F	0.62	D	0.84	F
Exit 63	Exit 64	0.67	D	0.94	F	0.60	D	0.83	F
Exit 64	Exit 65	0.65	D	0.92	F	0.61	D	0.85	F
Exit 65	Exit 66	0.63	D	0.89	F	0.56	D	0.78	E
Exit 66	Exit 67 (Elm St)	0.60	D	0.86	E	0.54	C	0.75	E
Exit 67 (Elm St)	Exit 67 (Rte 154)	---	---	---	---	0.57	D	0.85	F
Exit 67 (Rte 154)	Exit 68	0.60	D	0.85	E	0.51	C	0.70	E
Exit 68	Exit 69	0.48	E	0.68	F	0.65	D	0.89	F
Exit 69	Exit 70	0.45	C	0.63	D	0.41	C	0.55	C
Exit 70	Exit 71	0.78	E	1.11	F	0.74	E	1.03	F
Exit 71	Exit 72	0.83	E	1.17	F	0.77	E	1.07	F
Exit 72	Exit 73	0.80	E	1.14	F	0.76	E	1.06	F
Exit 73	Exit 74	0.79	E	1.12	F	0.79	E	1.10	F
Exit 74	Exit 76	0.85	E	1.23	C[1]	0.82	E	1.18	D[1]
Exit 76	Exit 81	0.72	D	1.10	D[1]	0.77	E	1.18	D[1]
Exit 81	Exit 82	0.75	D	1.19	F	0.82	E	1.27	F
Exit 82	Exit 82A	0.86	E	1.24	F	1.01	F	1.40	F
Exit 82A	Exit 83	0.53	F	0.74	F	0.76	F	1.08	F
Exit 83	Exit 84	0.51	F	0.70	F	0.47	F	0.66	F
Exit 84	Exit 85	0.50	C	0.71	E	0.53	D	0.74	E
Exit 85	Exit 86	0.66	F	0.94	F	0.56	D	0.78	E
Exit 86	Exit 87 (Rte 1)	0.51	C	0.75	E	0.56	C	0.79	E
Exit 87 (Rte 1)	Exit 87 (Rte 349)	---	---	---	---	0.47	C	0.62	D
Exit 87 (Rte 349)	Exit 88	0.66	D	0.95	F	0.52	C	0.73	E
Exit 88	Exit 89	0.60	D	0.87	F	0.48	C	0.67	D
Exit 89	Exit 90	0.83	E	1.21	F	0.69	D	0.99	F
Exit 90	Exit 91	0.70	D	1.04	F	0.54	C	0.76	E
Exit 91	Exit 92	0.56	C	0.85	E	0.43	C	0.64	D
Exit 92	Exit 93	0.45	C	0.70	D	0.33	B	0.48	C
Exit 93	State Line	0.47	C	0.72	D	0.35	B	0.52	C

Note: Some existing condition sections were omitted because a direct comparison could not be made to a section in the 2025 no-build condition. The best corresponding existing section was used for a basis of comparison.

1 LOS for 2020 taken from Administrative Final Environmental Impact Statement "Route 11 Corridor" dated December 5, 2002.

Table 3-11 shows 61 of the 74 freeway sections will experience operational deficiencies at LOS E or LOS F as demand approaches or exceeds capacity during the 2025 future condition. The overall mean volume-to-capacity (V/C) ratio for the freeway sections under the future condition is 0.92. Twenty-six of the 74 freeway sections have a V/C ratio at or above 1.0 (capacity). As discussed in Chapter 2, 28 of the 78 freeway sections operate at LOS E or LOS F during the 2002 evening peak period. Only one of these sections has a V/C ratio at or above 1.0. The overall mean V/C ratio for all the sections under the 2002 existing condition is 0.65.

4
Existing Environmental Conditions

This chapter provides information on the environmental resources found within the 58-mile I-95 Southeast Corridor study area. Each environmental resource is described and mapped. Specific resources that could potentially be affected by transportation improvements within the I-95 corridor are identified. The study area includes the I-95 corridor right of way and additional distances around each intersection (generally 300 feet) sufficient to identify resources that may be directly affected by design alternatives.

The purpose of the environmental data collection effort is to support the preliminary transportation alternatives analysis process concerning highway improvements to I-95. The preliminary environmental data provides information regarding critical resources that may be affected and which, in some cases, should be avoided if possible. The data is also useful in determining the extent of impacts for a given alternative. The data and mapping can be used to identify and evaluate alternatives, to identify potential fatal flaws in the alternative development process, and to determine the relative environmental impact for each set of alternatives for a given interchange or highway section. Including this data in the highway improvement review process will assist decision-making, help to identify preferred alternatives, and contribute to an understanding of the permitting requirements for selected improvements.

The resources discussed in this section include: surface water and wetland resources, 100 year floodplains, groundwater resources including aquifer protection areas, wells and groundwater quality classifications, water supply reservoirs, coastal resources, areas where threatened and endangered species may exist, farmland soils and active farms, cultural resources including historic structures and districts and archaeological resources, land uses within the I-95 corridor, section 4(f) and 6(f) lands, areas of potential hazardous materials contamination, and other unique features found along the I-95 corridor.

4.1 Constraint Mapping Process

Data used in the constraint mapping process was collected from a variety of sources. Available GIS data from the Connecticut Department of Environmental Protection (CTDEP) were used to identify surface water, wetland soils, groundwater, threatened and endangered species, and Section 4(f) and 6(f) lands. The University of Connecticut Mapping and Geographic Information Center (MAGIC) site provided some floodplain and National Wetlands Inventory (NWI) data. Additional data was obtained from private GIS sources. Coastal resource mapping was obtained from CTDEP and those resources within 1,000 feet of the

highway were digitized as a GIS data layer. Farmland soils data were obtained from the Natural Resources Conservation Service (NRCS) soils mapping and active farms were identified by aerial photography and field investigation. Cultural resource information was obtained by consultation with the State Historic Preservation Officer (SHPO), local contacts and field investigation. Environmental Data Resources, Inc. (EDR) identified potentially contaminated and hazardous material sites for the entire corridor (1/8 mile on either side of the highway). Land use and other data were obtained from the three regional planning agencies within the corridor including South Central Regional Council of Governments (SCRCOG), Connecticut River Estuary Regional Planning Agency (CRERPA), and Southeastern Connecticut Council of Governments (SCCOG). In addition, local plans of conservation and development and municipal GIS data layers were obtained where available. Existing year 2000 aerial photography was used to confirm resources where applicable and field investigations were conducted using the aerial photography to approximate wetland boundaries and streams. United States 2000 Census data was provided by SCRCOG for use in the environmental justice evaluation.

4.2 Corridor Environmental Constraints

Each of the environmental and social constraints for the I-95 study corridor is described below. Each set of data (combined in logical groupings for mapping purposes) is shown on 1" = 2000' figures (presented in the report figures booklet) with the corridor divided into 13 sheets.

4.2.1 Surface Water Resources

This section includes a range of related resources that are associated with water. Resources such as water supply reservoirs, rivers, streams, ponds, the near coastal shore, and wetlands, have obvious ecological, social and economic importance to people and the environment. Figure 4-1 represents water-related features including the watercourses, ponds and lakes, floodplains, and wetlands.

Surface Waters

Surface waters include streams, rivers, ponds and lakes. For the purposes of this study, streams are reported using U.S. Geological Survey quadrangle maps and CTDEP hydrography data from the Environmental and Geographic Information Center. Streams are denoted as perennial, meaning flowing year-round, and intermittent, meaning it flows seasonally, or resulting from a weather event. Due to the project proximity to Long Island Sound, several streams are tidally influenced. The largest surface waters in the corridor are the Connecticut River and the Thames River. The watershed for a particular water feature includes all the contributing land areas that flow to the stream or water body. Drainage basins are the contributing watersheds for a watercourse or river.

Drainage Basins

CTDEP mapped major and regional drainage basins throughout the State. That information was used to identify the drainage basins describe herein. The study corridor passes through four major water basins including South Central Coast Major Basin, Connecticut Major Basin, Thames Major Basin, and Pawcatuck Major Basin. There are two smaller basins near the Thames River basin, which are also crossed by the I-95 study corridor. They are designated as Southeast Western Regional Complex and Southeast Eastern Regional Complex. The smaller regional drainage basins contain small coastal rivers and streams that discharge directly to Long Island Sound, compared with the largest river basins that collect tributary water

and discharge through the major rivers. There are 29 unique drainage basins crossed by the I-95 corridor in the study area. Although the I-95 roadway passes over streams and rivers within the 29 basins, some of the watercourses crossed are tributaries and do not share the watercourse name of the primary basin.

The river watersheds crossed by I-95 include from west to east: Branford River, West River, East River, Neck River, Hammonasset River, Indian River, Menunketesuck River, Patchoque River, Oyster River, Lieutenant River, Black Hall River, Four Mile River, Pataguanset River, Niantic River, Poquonock River, Mystic River, Wequetequock River, Shunock River, Pawcatuck River, and Ashaway River. The study corridor's proximity to Long Island Sound and its east-west orientation relative to the north-south river orientations are evidenced by the number of unique river watersheds crossed.

Watercourses

There are 94 watercourses crossed by I-95 in the study corridor as shown by the U.S Geological Survey and CTDEP. Most of the 94 watercourses are perennial streams (75 streams/rivers flow year-round) and many are named watercourses. Several small tributaries are unnamed intermittent streams in the corridor. The watercourses are shown in Figure 4-1. Where applicable, the stream name is included in the figure. The stream counts by town are reported in Table 4-1 below.

Table 4-1
Stream Crossings Along the I-95 Corridor by Town

Town	Perennial	Intermittent	Total
Branford	5	0	5
Guilford	8	0	8
Guilford/Madison*	1	0	1
Madison	4	1	5
Madison/Clinton*	1	0	1
Clinton	4	5	9
Westbrook	3	0	3
Old Saybrook	8	0	8
Old Saybrook/Old Lyme*	1	0	1
Old Lyme	9	0	9
Old Lyme/East Lyme*	1	0	1
East Lyme	7	2	9
Waterford	6	2	8
New London	3	0	3
New London/Groton*	1	0	1
Groton	5	4	9
Groton/Stonington*	1	0	1
Stonington	3	5	8
North Stonington	4	0	4
Total	**75**	**19**	**94**

* = Stream or river forming boundary between two municipalities.

Public Water Supply Reservoirs

Public water supplies are critical reservoirs that collect predominantly surface water from clean watersheds, and store it for consumptive uses. The study corridor passes near and over public drinking water supply reservoirs. In addition, several streams near or passing beneath I-95 are tributaries to reservoirs.

The Connecticut Department of Public Health (CTDPH) is primarily responsible for administration of all State and Federal drinking water regulations in Connecticut. Divisions within the CTDPH have responsibilities ranging from monitoring water quality, reviewing activities involving public water supplies, and public outreach, to regulatory permitting activities such as construction work within water company lands, land sales, changes to distribution systems, and treatment processes among others. Water supply reservoirs have protective buffers for Water Company Lands, ranging from 100 feet for streams feeding reservoirs, to 250 feet (horizontal) of the high water for a reservoir. Water company lands are classified as Class I, Class II, or Class III, represented by criteria that afford protection of the water supply. Generally, Class I is most critical and typically directly adjacent to or connected to the integrity of the water. Further protection of Water Company Land is made in Class II and Class III lands. Any project involving Water Company Land must be reviewed and permitted by the CTDPH.

The I-95 study corridor encompasses eight water supply reservoirs owned and managed by four water companies (Figure 4-1, Sheets 1, 9, 10, 12). The water companies include: South Central Connecticut Regional Water Authority, New London Water Division, Groton Utilities, and Connecticut AM Water Company, Mystic Valley District. The reservoir names include: Lake Brandegee (two ponds) in Waterford; Buddington Pond, Poquonnock Reservoir, Poheganut Reservoir, and Smith Lake, in Groton; and Dean's Mill Reservoir and Palmer Reservoir in Stonington. All reservoirs are active with the exception of the New London Water Division reservoir (Lake Brandegee). In Groton, the four water bodies form a network of surface supply ponds that comprise the Groton Utilities water. Each surface pond is individually designated as a reservoir by the CTDPH. A ninth reservoir (Lake Saltonstall at the Branford/East Haven municipal boundary) occurs immediately west of the study corridor, but the contributing watershed is crossed by the I-95 roadway in Branford.

Wild and Scenic Rivers

The 1968 National Wild and Scenic Rivers Act, Public Law 90-542, protects and preserves designated rivers from degradation. There is only one designated Wild and Scenic River in Connecticut, which is located outside the study corridor. There are no designated Wild and Scenic Rivers in the study corridor. There is presently a study of a 15-mile portion of the Eight Mile River for designation to the National Wild and Scenic Rivers inventory; however, it lies just north of the I-95 study corridor.

The Connecticut River was designated an "American Heritage River" in 1998 by President Clinton. There are only 14 designated rivers in the entire United States. The designation provides communities along the river more opportunities to receive Federal funding for river-related projects (Connecticut River Estuary Regional Planning Agency).

Wetlands

Wetlands are land areas that are transitional between upland and aquatic ecosystems. Wetlands are important because they provide a variety of functions such as providing fish and wildlife habitats, purifying water, maintaining groundwater supplies, preventing flooding, supporting water-dependent uses by humans, and providing critical habitats for rare and endangered species. A number of scientific and regulatory definitions are used to denote an area as wetland. State and Federal laws protect wetlands, watercourses, and water bodies.

Connecticut's regulatory definition of wetlands is based upon soil drainage classes and types. Connecticut has two regulatory definitions, including inland and tidal wetlands. Connecticut wetland regulations also protect perennial and intermittent watercourses and water bodies. Connecticut General Statutes, Sections

22a-36 to 45 inclusive, specify inland wetland definitions. "Wetlands mean land, including submerged land, which consists of any of the soil types designated as poorly drained, very poorly drained, alluvial, and floodplain by the National Cooperative Soils Survey, as may be amended from time to time, of the Soil Conservation Service of the United States Department of Agriculture. Watercourses are defined as rivers, streams, brooks, waterways, lakes, ponds, marshes, swamps, bogs, and all other bodies of water, natural or artificial, public or private" (Metzler & Tiner 1992).

Connecticut General Statutes, Sections 22a-28 to 35 inclusive, specify tidal wetland definitions. "Wetlands are those areas which border on or lie beneath tidal waters, such as, but not limited to banks, bogs, salt marshes, swamps, meadows, flats or other low lands subject to tidal action, including those areas now or formerly connected to tidal waters, and whose surface is at or below an elevation of one foot above local extreme high water" (Metzler & Tiner 1992).

Federal wetlands are defined using a combination of three parameters including soil indicators, vegetation dominated by plants adapted for growing in wetland, and indicators of hydrology. For the most part, State and Federal wetlands coincide, however, there are instances where wetland boundaries differ. Typically, State defined wetlands are more extensive than Federal criteria. There are several definitions of wetlands from different Federal agencies, such as the U.S. Environmental Protection Agency, U.S. Fish and Wildlife Service, U.S. Natural Resources Conservation Service, and the U.S. Army Corps of Engineers. Since current Federal policy requires permits from the Army Corps of Engineers through Section 404 of the Clean Water Act, the Army Corps definition is provided. "Wetlands are those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas" (Metzler & Tiner 1992).

Wetland Permits

Since State and Federal laws protect wetlands, permits are required to dredge, fill, drain, or otherwise alter wetlands and watercourses. Both CTDEP and the U.S. Army Corps of Engineers administer wetland permit programs in Connecticut, and the U.S. Environmental Protection Agency has review, oversight, and policy responsibility for the Federal wetland programs (Want 1999). Wetlands in the study corridor include flowing freshwater (palustrine), lakes (lacustrine), and saltwater (estuarine) types. Due to the proximity of the study corridor to Long Island Sound, tides affect water levels in some study corridor wetlands. Those wetlands are designated as tidal wetlands, which are further distinguished by freshwater and saltwater types. Generally, tidal wetlands are afforded greater protection by the wetland laws, and permitting reviews are often more controversial for tidal wetlands.

Wetland Data Sources

Mostly digital data were used to show wetlands within the region near the study corridor. Four information sources were used to identify wetlands in the study corridor. Note that the wetland locations presented do not represent formal field delineated wetland boundaries. Wetlands shown are representations taken from available sources including: soil survey maps from the Natural Resources Conservation Service (NRCS) (formerly Soil Conservation Service); National Wetland Inventory (NWI) maps from the U.S. Fish & Wildlife Service; Coastal Resource Maps from CTDEP, and hydrography data from CTDEP. Digital information was collected from the CTDEP Environmental and Geographic Information Center, regional planning agencies, and digital data vendors. Some levels of redundancy are afforded by using multiple data sources. In order to improve the representation of wetland soils used from county soil surveys, adjustment of wetland soils were made relative to the approximate footprints of I-95 and the Amtrak rail line.

Some information, for instance NWI maps at the western end of the corridor, and the Connecticut tidal wetland maps, were not available in digital formats. For the tidal wetlands, information was digitized in a 2,000-foot swath (1,000 feet either side of I-95) along the study corridor. Therefore, tidal wetland data gaps exist for wetland resources outside the limits of digitized information. For the most part, the incidence of tidal wetland increases to the south toward Long Island Sound. However, due to distance from the corridor, that data was not digitized. Note that the absence of tidal wetland information to the south and removed from I-95 is not reflective of non-occurrence, but is due to digital data gaps.

Generally, NWI wetlands occur in the same locations as NRCS-designated poorly drained soils. However, some wetlands are found outside of mapped wetland soils and are shown by the National Wetland Inventory. In order to maintain figure clarity, only those NWI wetland areas that are not coincident with poorly drained soils, and are adjacent to the I-95 corridor, are shown on Figure 4-1. As such, the NWI data gaps do not present substantive areas of missed wetland. Wetland locations were further refined and adjusted by limited field reconnaissance and transferring approximated wetland boundaries to aerial photographs. That information was used to evaluate wetland impacts and permitting requirements in more detail than is available from remote sources.

Wetlands denoted using large-scale sources such as soil surveys and NWI maps are suitable for large study areas and context determinations. The wetland information is sufficient to determine areas to avoid, where practicable. These sources are not suitable for site-specific or permit-level assessments. Large-scale sources provide sufficient information to assess relative wetland impacts and likelihood of encountering wetlands necessitating permits. Potentially, sufficient information is available to determine relative wetland value or importance. That qualitative information can be considered when developing transportation alternatives. Once a project is advanced, detailed wetland determinations will be made by on-site delineation and assessments, and permits will be sought for any wetland alterations.

Study Area Wetlands

The study area contains a diverse assemblage of wetland types ranging from watercourses and rivers, freshwater swamps, marshes, meadows, to estuarine tidal marshes and inter-tidal rocky shores and flats. Many of the wetlands are integral parts of systems following the streams flowing toward Long Island Sound. Other wetlands are isolated depressions or occur on hill slope faces. As the Surface Water Resources figure illustrates (Figure 4-1) the floodplains, streams, water bodies, and wetlands, are closely related and generally superimposed in many locations. The study corridor crosses and passes by hundreds of wetland areas. The majority of wetlands along the corridor are inland, freshwater systems. However, as described earlier, the I-95 corridor's proximity to the coast and tidal effects means there are also freshwater and saltwater tidal wetlands encountered.

Based upon the available information, there are more wetlands near I-95 in the western half of the study corridor, compared with the eastern half.

Regulated tidal wetlands occur adjacent to I-95 at nine locations along the corridor. Coastal freshwater wetlands and undesignated tidal wetlands occur at 34 locations along the corridor. Coastal freshwater wetlands are wetlands denoted by CTDEP that occur within the coastal zone, but are non-tidal, while the undesignated tidal wetlands are not specifically designated by CTDEP. Coastal freshwater wetlands are coincident with wetlands identified using soil surveys and National Wetland Inventory mapping. For clarity, those freshwater coastal zone wetlands are not shown in Figure 4-1. Table 4-2 reports the locations of

CTDEP regulated tidal wetlands. Figure 4-1 shows the locations of regulated tidal, wetlands within 1,000 feet of I-95.

Table 4-2
Regulated Tidal Wetlands Near I-95

Town	Watercourse	Regulated Tidal Wetland	Freshwater and Undesignated Tidal Wetland Nearby
Guilford/Madison*	East River	Yes	Yes
Madison/Clinton*	Hammonasset River	Yes	Yes
Clinton	Hammonasset Tributary	Yes	Yes
Westbrook	Patchogue River	Yes	Yes
Old Saybrook	Oyster River	Yes	Yes
Old Saybrook	Connecticut River	Yes	Yes
Old Lyme	Lieutenant River	Yes	No
East Lyme	Niantic River	Yes	Yes
Groton/Stonington*	Mystic River	Yes	Yes

* = Stream or river forming boundary between two municipalities.

The greatest concentration of tidal wetlands to the south of the study corridor occur at the Branford River in Branford, West River in Guilford, East River at the Guilford/Madison boundary, Hammonasset River in Clinton, Menunketesuck and Patchogue River in Westbrook, Oyster River in Old Saybrook, and along the Connecticut River in Old Saybrook and Old Lyme.

The Connecticut River estuary and tidal wetlands from the mouth to north of Middletown were designated as "Wetland of International Importance" under the international Ramsar Convention Treaty in 1994. There were only 15 designations for the United States. In 1993, The Nature Conservancy designated the tidal lands of the Connecticut River as one of 40 biologically important ecosystems in the western hemisphere (Connecticut River Estuary Regional Planning Agency)

Floodplains & Stream Channel Encroachments

Floodplains are areas near streams, rivers, lakes, ponds, and the ocean that are subject to periodic flooding. Water bodies and lands with higher frequencies of flooding, or with potential for causing property damage or injury are identified by the Federal Emergency Management Agency (FEMA) and the Federal Insurance Agency (FIA) through the Flood Insurance Study (FIS) for communities. To provide a national standard without regional inconsistencies, the 100-year flood was adopted by the FIA as the base flood for floodplain management. Many flood insurance studies also identify 500-year flood as areas of additional risk. The 100-year flood zone represents land areas, based upon their elevation and connectivity to a flood source, that are prone to inundation at a recurrence interval of once every 100 years (100/1). That means the probability that flooding will occur each year is 1% in that location. The FIA points out that not all streams are evaluated to the same level of detail in a community FIS and generally, areas of higher density development or near larger watercourses are studied in greater detail.

Floodplains and floodways are protected through Executive Order 11988, Floodplain Management; US DOT Order 5640.2 Floodplain Management and Protection; and Connecticut General Statutes (CGS Section 25-68d through 25-68h) as regulated by the Connecticut Department of Environmental Protection. All State projects must comply with the floodplain management standards and criteria. To the extent practicable,

projects should avoid impacts to floodplains, and where unavoidable, minimize impacts. Mitigation may be required in some instances if practicable.

The low-lying coastal areas of Connecticut are also subject to occasional coastal flooding due to tidal and storm surges. High winds and low barometric pressure such as occur with hurricanes, as well as tidal effects can combine to cause severe coastal flooding. Areas subject to flooding from rising ocean areas are designated as Coastal Flood Hazard Zones and mapped in the community Flood Insurance Studies. The rising ocean level effects extend upstream and contribute to areas mapped as 100-year floodplain in the study corridor.

Floodplains and floodways were mapped along the project corridor using digital GIS data from both the University of Connecticut's Map and Geographic Information Center (MAGIC) database and vendor sources of Digital Flood Insurance Rate Maps (DFIRM). Figure 4-1 Surface Water Resources, shows the areas of 100-year floodplain within the I-95 study area.

The study corridor encounters 100-year floodplains at approximately 45 locations along the corridor. Generally, the project corridor lies in proximity to Long Island Sound and crosses many tributary rivers and streams that are affected by coastal flood events. High tides and storm surges influence the flooding characteristics of many of the crossed watercourses. Of the 45 floodplain locations, only the Connecticut River and Thames River are identified as flood zones with coastal wave action effects. These larger rivers have wide-open reaches to Long Island Sound such that waves can reach the I-95 crossing points. The Connecticut and Thames rivers are crossed by substantive bridges with wide decks, and any transportation improvement alternatives are unlikely to require re-configuration of the bridge, its approaches and appurtenances (piers, abutments) within floodplains or flood hazard areas.

The corridor floodplains are somewhat evenly distributed along the study area. The distribution of 100-year floodplains that are crossed by I-95, sorted by town include: Branford 4; Guilford 6; Guilford/Madison boundary 1; Madison 2; Madison/Clinton boundary 1; Clinton 5; Westbrook 2; Old Saybrook 5; Old Saybrook/Old Lyme boundary 1; Old Lyme 2; Old Lyme/East Lyme boundary 1; East Lyme 3; Waterford 4; New London/Groton boundary 1; Groton/Stonington boundary 1; Stonington 3; and North Stonington 3.

The majority of the floodplain areas along the corridor are narrow and directly border a watercourse or river. However, in some instances, floodplains extend moderate distances from the source watercourse. Examples of this condition include near Exit 53 in Branford, and just east of Exit 55 in Branford near East Industrial Road.

Floodways are portion of a flood channel that carries the majority of the flows. The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept unobstructed to allow the flood to pass without substantial increases in flood height. The Federal Insurance Administration limits such increases in flood heights to 1.0 foot, provided that hazardous velocities are not produced.

CTDEP identifies stream channel encroachment areas, which are closely representative of a riverine floodplain, and generally encompass the outer floodplain limit as well as the floodway in the river. Work or structures within stream channel encroachment areas requires a permit from CTDEP. Although the study corridor crosses many streams and rivers, there are no CTDEP identified Channel Encroachment lines in the project corridor (CTDEP 2000).

4.2.2 Groundwater Resources

Groundwater Quality Classifications

Connecticut's water quality standards and criteria were developed following the principles set forth under Connecticut's Clean Water Act, and in accordance with the directives of Section 303 Federal Clean Water Act. Groundwater is assigned a classification of GAA, GA, GB, or GC. The Connecticut Department of Environmental Protection defines these standards:

Class GAA

Designated uses: existing or potential public supply of water suitable for drinking without treatment; base flow for hydraulically connected surface water bodies.
Discharge restricted to: treated domestic sewage, certain agricultural wastes, and certain water treatment wastewaters.

Class GA

Designated uses: existing private and potential public or private supplies of water suitable for drinking without treatment; base flow for hydraulically connected surface water bodies.
Discharge restricted to: for GAA and discharge from septage treatment facilities subject to stringent treatment and discharge requirements, and other wastes of natural origin that easily biodegrade and present no threat to groundwater.

Class GB

Designated uses: industrial process water and cooling waters; base flow for hydraulically connected surface water bodies; presumed not suitable for human consumption without treatment.
Discharge restricted to: same as for GA (Note; same treatment standards apply), certain other biodegradable wastewaters subject to soil attenuation.

Class GC

Designated uses: assimilation of discharge authorized by the Commissioner pursuant to Section 22a-430 of the General Statutes. As an example a lined landfill for disposal of ash residue from a resource recovery facility. The GC hydrogeology and setting provides the safest back up in case of technological failure.

Discharge restricted to: potential discharges from certain waste facilities subject to extraordinary permitting requirements.

All groundwater not otherwise classified is considered GA. Classifications GA-impaired and GAA-impaired indicate that those areas may not currently be obtaining their respective groundwater standards. GAAs is a subclass of GAA that indicates that the groundwater is a tributary to a public water supply watershed. The groundwater classifications reflect known and/or potential uses that the groundwater will support.

The classifications provide a basis for regulatory and permitting decisions in that CTDEP's goal is to maintain or improve the groundwater quality at all locations, and certain regulated activities and discharges may be appropriate for some locations (GC) but not for others (GAA).

The groundwater classification data shown in Figure 4-2 was obtained from CTDEP, published in 1995 and updated in 1997. The mapping in Figure 4-2 indicates that relatively urbanized areas such as portions of Branford, New London, Groton, and the Mystic section of Stonington are designated GB. A GAA or GAAs

rating is assigned to the area around the Saltonstall Reservoir, north of I-95 just west of the project area, as well as the region of Waterford near Brandegee Lake, near Exits 82 and 82A. Much of Groton north of I-95, and south of I-95 in the vicinity of the Groton Reservoir (near Exit 88) also is rated GAA, as is the area immediately surrounding the Mystic Reservoir in Stonington, (between Exits 90 and 91) both north and South of I-95.

Public Drinking Water Wells: Community and Non-Community Water Supply Wells

Community Water Systems are defined by the CT Department of Public Health (CT DPH) as a public water system that pipes water for human consumption to at least 15 service connections used by year-round residents, or one that regularly services at least 25 year-round residents (e.g., municipality, subdivision, mobile home park). A Non-Community Water System is defined as a public water system that pipes water for human consumption to at least 15 service connections used by individuals other than year-round residents for at least 60 days a year, or serves 25 or more people at least 60 days a year (e.g., schools, factories, rest stops, interstate carrier conveyances). Note that a buffer zone of 500 foot radius is created around each community well and this buffered area is classified by CT DPH as GAA unless the buffered area overlaps with an area already known to be impaired.

The Community and Non-Community Well locations were obtained from the University of Connecticut's MAGIC Website. They are depicted in Figure 4-2. While fairly common throughout the mapped area, these wells occur within 1,000 feet of I-95 in only a few locations.

Community Wells are located at the following points:

- North of I-95 in Guilford, on Granite Road
- South of I-95 in Guilford, near Exit 58
- South of I-95 in Madison, along Copse Road
- North of I-95 along the Hammonasset River in Madison/Clinton
- South of I-95 in East Lyme, along Old Bride Brook Road (between Exits 72 and 73), and
- North of I-95 in Stonington, at Exit 90

Non-Community Wells within 1,000 feet of I-95 are located at the following points:

- South of I-95 in Branford near Exit 55
- North and south of I-95 in the vicinity of Exit 70 (multiple wells)
- South of I-95 in Old Lyme near Exit 71 (multiple wells)

Aquifer Protection Areas

Aquifer Protection Area Wells are major "community" wells that provide water service to more than 1,000 people and are set in stratified drift aquifers. Not all community wells are included as Aquifer Protection Area Wells. Associated with these wells are Aquifer Protection Areas (APA's). The APA's are submitted to CTDEP for approval by the owning water companies. They are classified as either final (Level A) or preliminary (Level B). The preliminary (Level B) APA's are roughly approximated, while the final (Level A) APAs are determined based upon a site-specific investigation.

All of the APA's in the study area are preliminary (Level B). Several APA wells lack any designated APA.

The I-95 corridor crosses APA's at five locations:

- Guilford Wellfield, Guilford near Exits 57 and 58
- Rettich Wellfield, Madison and Clinton near Exit 62
- Clinton Wellfield, Clinton near Exit 63
- Bride's Lake Wellfield, East Lyme between Exits 73 and 73
- Gorton's Pond Wellfield, East Lyme near Exit 74

The Connecticut Department of Environmental Protection has proposed aquifer protection land use regulations that would restrict certain high-risk land-uses such as gas stations and dry cleaners. As proposed in the regulations, each municipality would designate its own aquifer protection areas. The regulations remain in draft while CTDEP refines the regulations. The regulations would apply to final (Level A) Aquifer Protection Areas only.

Sole Source Aquifers

A 'sole source aquifer' is an aquifer that supplies at least 50% of the drinking water for an area for which there is no other reasonable available sources of drinking water should the aquifer become contaminated. The Federal Sole Source Aquifer Program was established under Section 1424(c) of the Safe Drinking Water Act of 1974. Under these regulations, any Federal financially assisted project planned within a sole source aquifer must be coordinated with the regional EPA office.

Only one of the Connecticut's two sole source aquifers falls within the project area. The Pawcatuck River Sole Source Aquifer encompasses portions of Stonington and North Stonington, as well as most of southwestern Rhode Island. (See Figure 4-2, Sheets 12 and 13).

4.2.3 Farmland

The Farmland Protection Policy Act (FPPA) of 1981 (7 CFR 658, as amended at 59 Federal Register 31117) was enacted by the United States Department of Agriculture (USDA) "to minimize the extent to which Federal programs contribute to the unnecessary and irreversible conversion of farmland to nonagricultural uses,...". The Act requires that before undertaking an activity that would convert farmland to another use, a Federal agency must examine the effects of the action on farmland and, if the action would have adverse effects on the farmland, the agency must consider alternatives to lessen the impacts.

The Act defines four categories of "farmland", based on the soil types: (1) Prime, (2) Unique, (3) Other than Prime or Unique that is of Statewide Importance (Statewide Important), and (4) Other than Prime or Unique that is of Local Importance (Local). The FPPA does not apply to some areas mapped as "farmland" soil types, because of other considerations. Such exceptions include land that is already developed with houses, or is otherwise committed to non-agricultural uses, including transportation. Highway embankments or other heavily regraded soils associated with development are classified as Ud (Udorthents), and urbanized areas may be classified as Ur (Urban Land).

Once the general layout and approximate 'footprint' of transportation improvements are known, the project proponent must complete a Farmland Conversion Impact Rating Form (Form AD-1006). This form quantifies impacts and must be submitted to the USDA's Natural Resource Conservation Service (NRCS) to assist them in determining whether there will be an adverse effect on farmlands.

The Prime and Statewide Important soils were mapped along the project corridor (Figure 4-3) using soil mapping and digital data produced under the Connecticut Department of Environmental Protection/Natural Resources Conservation Service soils cooperative. That database contains all soil units, and identifies those soils qualifying as Prime or Statewide Important. No Unique soils or soils of Local Importance have been identified by NRCS within the study area. Since the soils data used for the mapping often depicts farmland soils extending across the existing I-95 corridor, a mapping technique known as 'clipping' was used to graphically indicate that the existing interstate has already displaced the farmland soils under the pavement and immediately adjacent to the edge of pavement. This modification prevents the appearance that intact farmland soils overlap with the existing interstate highway. The farmland soils were similarly 'clipped' along the adjacent Amtrak rail line.

The Prime and Statewide Important farmland soils are common along the study corridor (Figure 4-3) but the relatively developed nature of the corridor has already displaced much of the farming potential offered by the soil types, particularly in the western portion of the corridor and in the New London/Groton urban area.

Figure 4-3 also denotes active farms, although the FPPA is based on soil types, rather than current land use. A review of year 2000 aerial photography of the corridor reveals that active farmland is uncommon immediately adjacent to the I-95 corridor. Sizable active farms, however, are found at the following locations:

Branford:

- West of Exit 53 along Hosley Avenue (north of I-95) (outside study area)
- Between Exits 53 and 54, east of Cherry Hill Road (north of I-95)

Guilford:

- East of Exit 57 along Long Hill Road and east of State Street (both north and south of I-95)
- East of Exit 58 near State Street (north and south of I-95)
- Between Exit 58 and 59 near Tanner Marsh Road and Wildwood Avenue (north of I-95)

East Lyme:

- East of Exit 72, east of North Bride Brook Road (both north and south of I-95)

Waterford:

- West of Exit 81 south of South Frontage Road (south of I-95)

Groton:

- East of Exit 88 between Flanders and Ledyard Roads (north of I-95)
- Between Exits 89 and 91, along Jerry Browne Road (south of I-95)

Stonington:

- East of Exit 91, along Pequot Trail south of I-95 and in corresponding location north of I-95

North Stonington:

- Between Exits 92 and 93, in several locations (both north and south of I-95).

The active farms often encompass or overlap Prime or Statewide Important soils.

4.2.4 Coastal Resources

Coastal Management Act

In 1972, the United States Congress passed the Federal Coastal Zone Management Act (P.L. 92-583, that was subsequently amended in 1976 (P.L. 94-370)). The Act required each state to develop, approve, and implement a State Coastal Zone Management Plan. Connecticut's Coastal Management Act (CCMA)(CGS Sections 22a-90 through 22a-112) was passed in 1979 by the General Assembly, and took effect on January 1, 1980. The act is a regulatory mechanism designed to balance the needs of economic development with the responsibility to preserve and protect the natural resources associated with the coastal environment. The CCMA furthermore called upon the local municipalities to prepare their own coastal programs. By directive, the municipal coastal programs are consistent with the CCMA and serve as a more detailed statement of goals and policies to be applied to coastal use and development.

The jurisdiction of both the Statewide and local plans is the Coastal Zone, which is defined by the Coastal Boundary. The source of the Coastal Boundary used for this study, as depicted on Figure 4-4, is the CTDEP, Office of Long Island Sound Programs (Published 1995). The boundary is a 'hybrid' of the original statewide boundary and more recent and refined town-defined coastal boundaries. The boundary is precisely defined in the CCMA; it extends to a 1,000 foot setback from mean high water, or a 1,000 foot setback from the inland boundary of tidal wetlands, or the inland limit of the 100-year coastal flood-zone, whichever is furthest inland. The seaward portion of the boundary follows the State's jurisdiction line in Long Island Sound.

The CCMA describes its goals and policies in four parts, with Federal and State agencies subject to the greatest number of requirements, relative to private landowners and municipal agencies. In all, 15 goals and policies appear in the legislation, many with numerous sub-policies. The goals and policies can be loosely categorized into five groupings.

- Minimize environmental impacts to the extent practical
- Promote economic development in an orderly fashion, and favoring water dependent uses
- Coordinate regulatory agencies and ensuring consistency between planning documents
- Provide for public safety and access to waterfront areas
- Promote research on coastal matters.

Any State-sponsored transportation construction projects within the coastal zone must be evaluated relative to fulfilling the intent of the CCMA. Any proposed actions would be sponsored by State and Federal governments, and would not be legally subject to local regulations. However, since State and Federal coastal legislation enlists the local governments to develop specific plans to carry out the intent of their more general policies, local coastal policies should be addressed during planning.

As depicted in Figure 4-4, the Coastal Zone extends inland to, or across, I-95 at 16 locations, for a total length of approximately 14 miles:

- Branford: West of Exit 55 near Mill Plain Road
- Guilford: At Exit 59
- Guilford/Madison: In the vicinity of the East River, and eastward in Madison to Copse Road
- Madison/Clinton: Near Exit 62/Hammonasset River
- Clinton/Westbrook/Old Saybrook: Intermittently throughout (at 7 locations)

- Old Saybrook/Old Lyme: Near the Connecticut River
- Old Lyme: near the Black Hall River/Whippoorwill Road crossing
- East Lyme/Waterford: At the Niantic River/Exit 76
- New London/Groton: At the Thames River
- Groton/Stonington: Mystic River/Exit 89/90

The section of I-95 between Exit 59 in Guilford and Exit 70 in Old Lyme is predominately within the Coastal Zone.

Coastal Resources

The CCMA defines Coastal Resources as the coastal waters of the State, their natural resources, related marine and wildlife habitat and the adjacent shorelands, both developed and undeveloped, that together form an integrated terrestrial and estuarine ecosystem. (P.A. 79-535, sec 3(7)).

Coastal Resources within 1,000 feet north and south of I-95 (a 2,000-foot-wide corridor) were digitally mapped for this project using maps published in 1979 by CTDEP's Coastal Area Management (CAM) Program. The CAM Coastal Resources maps identify 11 coastal land resources, two intertidal resources, and three resources associated with Coastal Waters, as well as the Coastal Boundary. The Shellfish CAM Concentration Area maps identify areas believed to support and produce significant concentrations of shellfish that are of commercial or recreational value.

Among the Coastal Resources within the Coastal Zones of the I-95 corridor are Freshwater Wetlands and Undesignated Tidal Wetlands, Regulated Tidal Wetlands, Open Water, Estuarine Embayments, and Shellfish Concentration Areas. Estuarine Embayments crossed by I-95 occur at major rivers: Connecticut River, Niantic River, Thames River, and Mystic River. Two coastal 'resources' are intentionally omitted from Figure 4-4 in the interest of clarity. The first is Coastal 'Flood' Hazard Areas, which are present at most locations within the Coastal Zone, (also discussed in Section 4.2.1 and the associated Figure 4-1, which depicts the 100-year flood hazard area). The second is Developed Shorefront, which is present on both shores of the Thames River. Shellfish Concentration Areas within the I-95 corridor are limited to the Thames and Mystic Rivers. Shellfish Concentration Areas in the Thames River include hard clam (*Mercenaria mercenaria*) and eastern oyster (*Crassostrea virginica*). The Mystic River supports a concentration of hard clam, south of the I-95 crossing. Extensive shellfish concentration areas exist seaward of the I-95 corridor along most of the shoreline.

4.2.5 Historic and Archeological Resources

Section 106 of the National Historic Preservation Act of 1966, as amended, requires Federal agencies to take into account the effect of an undertaking on historic properties listed or eligible for listing in the National Register of Historic Places (NRHP). The proposed undertaking's impact on historic properties listed or eligible for listing in the NRHP is studied to determine if the project would have no effect, no adverse effect, or an adverse effect on these resources (36 CFR 800.3). A preliminary assessment was initiated to identify NRHP and Connecticut State Register listed resources that are located within the area of potential effect.

It should be noted that although the project may lie within an historic district eligible for the NRHP, contributing features to the district must be affected in order for Section 4(f) of the Department of Transportation Act of 1966 to apply. Even if Section 4(f) does not apply, Section 106 of the National Historic Preservation Act may or may not apply depending on coordination with the State Historic Preservation Office (SHPO), FHWA and Connecticut Department of Transportation.

Existing Conditions: Known Architectural Resources

Methodology

In January 2003, architectural resource files at the Connecticut State Historic Preservation Office in Hartford were examined for previously identified architectural resources within 1,000 feet of the project corridor. Previous survey reports for each town were reviewed for additional architectural resources identified within the project corridor. Locations of the resources listed on the National Register and Connecticut State Register were transferred to project base maps and information was obtained from the National Register/Connecticut Inventory forms.

The locations of previously identified resources were examined during the windshield survey of the project area in January 2003.

Known Architectural Resources

As of January 2003, five National Register listed Historic Districts and five National Register/State Register resources have been identified within 1,000 feet of the project corridor. One resource, the Florence-Griswold House and Museum (Old Lyme), is a National Historic Landmark within the Old Lyme Historic District. In addition, one historic district and one historic resource have been recommended for listing on the National Register during a previous survey. These resources were added to the study's existing conditions maps (see Figure 4-4).

Two of the historic districts, the Guilford Historic Town Center and Dudleytown Historic Districts, are located in Guilford with boundaries that abut I-95 at Exits 58 and 59. The boundaries of the Old Lyme Historic District encompass Lyme Street directly north and south of I-95 at Exit 70 east. The remaining two historic districts are the Post Hill Historic District in New London (Exit 84) and the Groton Bank Historic District (Exit 85). The boundaries of the Post Hill Historic District abut the exit interchange while the boundaries for Groton Bank are two blocks to the south of Exit 85. The remaining five resources date from the 17th through the 20th centuries and are located at exits 68, 69, 70 east, 84, and 90. See Table 4-3.

These historic resources are summarized as follows:

Guilford Historic Town Center, Guilford: The Guilford Historic Town Center Historic District includes approximately 700 buildings dating from the 17th to the 20th century. First settled in 1639 by a group of Puritans, Guilford's economy and growth was based on modest shipbuilding and related maritime industries with the development of several foundries after the Civil War (sheet 3 on Figure 4-4).

Dudleytown Historic District, Guilford: The Dudleytown Historic District encompasses the farms established by the Dudley family during the 18th and 19th centuries. The historic district includes 60 contributing buildings such as farmhouses, sheds, barns and other farm-related buildings (sheet 3 on Figure 4-4).

Jedidiah Dudley House, Springbrook Road, Old Saybrook: The Jedidiah Dudley House, constructed after 1750, is a 1½ story frame building with clapboard siding, a steeply pitched side gable roof and central chimney. Constructed upon a coursed rubble foundation, the symmetrical house is five bays wide. The house is associated with the Dudley and Whittlesey families who shared operation of the ferry and ferry landing on the west bank of the Connecticut River in Old Saybrook during the 17th and early 18th centuries. The house is located 200 feet north of Exit 68 (sheet 7 on Figure 4-4).

John Whittlesey Jr. House, 40 Ferry Road, Old Saybrook: The John Whittlesey Jr. House, constructed in 1693 (ell) and 1750 (main block), is a 2½ story frame building with clapboard siding, a side gable roof, and central chimney. Constructed upon a stone rubble foundation, the main block of the house is five bays wide. The house is associated with the Whittlesey family who were co-operators of the ferry on the Connecticut River. The house is located 900 feet southwest of Exit 69 (sheet 7 on Figure 4-4).

Old Lyme Historic District, Old Lyme: The Old Lyme Historic District includes approximately 71 buildings located along Lyme Street and Old Boston Post Road. The buildings date from the 18th to the 20th centuries and include designs by architect Alexander Jackson Davis and master builder Colonel Samuel Belcher (sheet 7 on Figure 4-4).

Florence Griswold House & Museum, Old Lyme: The Florence Griswold House & Museum, is a contributing resource to the Old Lyme Historic District and is individually listed as a National Historic Landmark. Designed by Samuel Belcher in 1817, the late Georgian house was home to the Lyme Art Colony which combined the French Barbizon and American Impressionist style schools in the early half of the 20th century. The building is located approximately 600 feet north of Exit 70 but the exit drive from the museum grounds is less than 100 feet from an Exit 70 off ramp (sheet 7 on Figure 4-4).

Post Hill Historic District, New London: The Post Hill Historic District includes approximately 212 contributing buildings dating from the 19th to the 20th centuries. This neighborhood is one of the oldest sections of New London and is a cohesive group of buildings with examples from the Greek Revival, Italianate, Second Empire, Queen Anne, Shingle, and Colonial Revival styles (sheet 10 on Figure 4-4).

Winthrop (Old Town) Mill, New London: The 1½ story frame gristmill was constructed ca. 1650 and is associated with John Winthrop Jr. who would serve as governor of Connecticut from 1657-1676. The mill property is located between the eastbound and westbound lanes under the elevated portion of I-95 as it begins to cross the Thames River (sheet 10 on Figure 4-4).

Table 4-3
National Register/State Register Listed Architectural Resources Within 1000 Feet of I-95 Interchanges Exit 54-93

Exit	CR ID	Name and Location	Date	Description
58	**A**	Guilford Historic Town Center HD, Guilford	17th century-1944	Historic District with buildings dating from 1640 to the mid 20th century
59		Guilford Historic Town Center HD, Guilford	17th century-1944	Historic District with buildings dating from 1640 to the mid 20th century (South of US Rte 1)
59	**B**	Dudleytown HD, Guilford	18th-19th centuries	Historic District associated with the Dudley family
68	**C**	Jedidiah Dudley House Springbrook Road, Old Saybrook	Post 1750	1 ½ story frame building
68 & 69	**D**	J. Whittlesey Jr. House 40 Ferry Road, Old Saybrook	1693, ca. 1750	2 ½ story frame building
70 east	**E**	Old Lyme HD	18th-19th centuries	Historic District extends across the north and south side of I-95 and includes buildings dating from 1700 to the late 19th c.
70 east	**F**	Florence-Griswold House & Museum, 96 Lyme Street, Old Lyme	1817	National Historic Landmark, within the Old Lyme Historic District
84	**G**	Post Hill HD, New London	Ca. 1845-1925	Historic District abuts exit 84 interchange at south side; Includes 216 contributing buildings
84	**H**	Winthrop (Old Town) Mill, New London	1650	Mill is located beneath I-95 ramps leading to bridge over Thames
85	**I**	Groton Bank HD Groton	Mid-18th c.-1915	Northeast boundary of historic district is south of exit 85 Includes great examples of Queen Anne & Greek Revival styles.
90	**J**	Whitehall Mansion, 42 Whitehall Ave. Stonington	1771-1775	Moved in 1962 from its original location for construction of I-95
80	**K**	Gurley Rd & Oil Mill Rd, Waterford	18th-19th century	Cluster of resources developed along an early mill site on the Niantic River; Recommended as potentially eligible
80	**L**	21 Gurley Road, Waterford	Joshua Moore House (18th c.?)	Recommended as potentially eligible for National Register listing in 1997 survey
85	**M**	NY, NH, & H RR Bridge, Groton	ca. 1919	Determined eligible by SHPO but owner objection by Amtrak

Groton Bank Historic District, Groton: The Groton Bank Historic District comprises approximately 130 buildings dating from the 18th to the 20th centuries. Shipbuilding and maritime activities had been at the center of Groton Bank's economy since the 17th century and the architecture of the district reflects the wealth of the residents (sheet 10 on Figure 4-4).

Whitehall Mansion, 42 Whitehall Avenue, Stonington: Whitehall Mansion, constructed ca.1771-1775, is a 2½ story frame dwelling with a center chimney and gambrel roof. The mansion was constructed for Dr. Dudley Woodbridge who was a local physician that served in the Connecticut colonial legislative in the 18th century. The mansion was moved from its original location in 1962 as a result of the construction of I-95. The Whitehall Mansion is located 250 feet north of Exit 90 (sheet 11 on Figure 4-4).

Potential for Historic Resources

Methodology

In January 2003, the area within 800 feet of each interchange in the project corridor was examined during a windshield survey to determine the potential for architectural resources, which could qualify for inclusion in the National Register of Historic Places (NRHP) or listing in the Connecticut State Register. In addition, historic USGS topographic maps and Sanborn Fire Insurance maps (if available) were studied to identify potential historic architectural resources within the study area. Areas not readily accessible were examined on the project's large-scale aerial photographs.

In assessing potential eligibility of buildings for listing in the National Register of Historic Places (NRHP), the age and integrity of the buildings were considered during this windshield survey. The initial assessments were based on site visits, information on file in the Connecticut State Historic Preservation Office, and previous survey reports.

The previous reconnaissance, intensive or comprehensive surveys prepared for each town were primarily conducted between 1980-1997. As a result of the length of time since these surveys were conducted, a number of mid 20th century resources previously not assessed or previously recommended as ineligible for potential listing in the NRHP should be revisited as a result of reaching 50 years of age. An historic resource which is less than 50 years of age is not considered eligible for the National Register unless it is of exceptional importance.

Potential Historic Resources

Historic resources were investigated within 800 feet of each interchange. In general, the date of construction of the resources ranges from the 19th to the mid-20th centuries and includes both residential and commercial buildings. Buildings that are less than 50 years of age or have undergone extensive alterations are not recommended for additional survey/research and are listed as having no potential. The windshield survey identified approximately 75 resources that have the potential to be eligible for listing in the National Register of Historic Places. Of these 75 resources, 13 are identified as multi-building resources within individual blocks and/or neighborhoods. Two resources were identified during a 1997 survey of Waterford and were recommended as potentially eligible for listing in the NRHP. One property (Exit 91 south side), located on the Pequot Trail, could possibly be the James Noyes House (ca.1740), which is listed on the Connecticut State Register. The original survey form for this house did not list an exact address, but it appears that the building at 709 Pequot Trail is the same resource (John Herzon, personal communication 2/4/2003). Five architectural resources were not accessible and could not be assessed for potential eligibility.

Existing Conditions: Known Archaeological Resources

Methodology

In January 2003, archaeological site files at the Connecticut State Historic Preservation Office (SHPO) in Hartford were examined for previously identified archaeological resources within 1,000 feet of the project corridor. Locations of these archaeological sites were transferred to study base maps and information was obtained from the State site forms. In several cases where site forms were not available, the staff archaeologist, David Poirier, indicated that the site was probably an older surface collection of a prehistoric site. In assessing potential eligibility of each site for listing in the National Register of Historic Places, the integrity of the site was a main consideration. Some sites had already been destroyed by subsequent development, according to supplemental site forms. The locations of known sites were examined during the windshield survey of the project area in January 2003. In cases where the site location was not readily accessible, the project's large-scale aerial photographs were examined for current site conditions.

Known Archaeological Resources

Fifteen archaeological sites have been identified within 1,000 feet of the project corridor. Eight of these sites do not appear to be eligible for listing in the NRHP because they were heavily disturbed or destroyed by subsequent development. The remaining seven sites could still be relatively intact and therefore may be potentially eligible for listing in the NRHP. None of the seven sites are within 500 feet of an interchange although one site may be within 150 feet of the eastbound lane of I-95.

Six of the seven potentially eligible sites are within the western portion of the project corridor and one site is in the eastern portion. Most of the sites are prehistoric, although one also has an historic component. Four of the prehistoric sites are of unknown date, one dates to roughly 1,000 BC, and one is from the Archaic/Woodland Period. The multi-component site dated to the Archaic, Late Archaic, and undated historic time periods; a Carbon-14 sample from this site was dated to roughly 300 BC. The sites functioned as a fish weir or a prehistoric camp. One campsite reportedly also contains bones from a Native American, which were re-interred here by a local historian in the 1940s or 1950s.

Potential for Undiscovered Archaeological Resources

Methodology

In January 2003, the area within 500 feet of each interchange in the project corridor was examined during a windshield survey to determine the potential for discovering archaeological resources. Areas not readily accessible were examined on the corridor's large-scale aerial photographs. The locations of modern development (i.e. buildings, paved parking, paved roadways) were judged to have a low potential for containing intact archaeological sites and were eliminated from further consideration. Remaining, undeveloped areas were judged to have low, moderate, or high potential for archaeological resources. Decisions were based on the existing conditions in each area, including vegetation, slope, and distance to a water source. Other factors included an examination of former conditions on topographic, surficial geological and general historic maps to determine former uses of the land.

Potential for Archaeological Resources

The archaeological potential of the undeveloped areas within 500 feet of each interchange was entered into a database table. The boundaries of the described areas were recorded on the corridor's large-scale aerial photographs. This data will be used to assess potential impacts of proposed transportation improvement alternatives.

Areas that have been developed were judged to have low potential for undiscovered archaeological resources. Exceptions included yards surrounding pre-modern houses. Undeveloped areas close to a water source were usually moderate to high potential. Areas near previously discovered archaeological sites tended to have moderate to high potential, as did undeveloped locations where maps indicated a house once stood.
In general, areas judged to have a low potential for undiscovered archaeological resources are not recommended for archaeological survey. Areas with low to moderate, moderate, or high potential are recommended for archaeological survey prior to ground-disturbing activities. Survey plans should be coordinated with the Connecticut State Archaeologist or SHPO.

Information regarding listed and resources eligible for listing for the Connecticut State Register and the NRHP gathered during the feasibility study provides an opportunity to identify resources that directly adjoin the I-95 corridor. These resources are of particular concern as a result of their close proximity to the existing roadway and sensitivity to any proposed alterations to I-95. They include the Guilford Historic Town Center Historic District (Exit 58), the Dudleytown Historic District (Exit 59), the Jedidiah Dudley House (Exit 68), the Old Lyme Historic District and the Florence Griswold House and Museum (Exit 70 east), the Gurley Road/Oil Mill Road proposed Historic District (Exit 80), and the Post Hill Historic District and the Winthrop Mill (Exit 84). These resources adjoin or are less than 200 feet from the I-95 corridor at various exit interchanges.

Two archaeological sites have been identified which are not located directly next to an interchange, but which are within close proximity to the I-95 corridor. The exact location of archaeological sites are not disclosed to the public in order to protect the sites from disturbance. Archaeological site 27-9 was identified on the Connecticut State site form as "probably [being] destroyed by I-95", but it is unclear if it has indeed been destroyed. Site 27-30 is approximately 150 feet from the I-95 corridor and could be potentially disturbed by transportation improvements on the corridor. It is more than 1,000 feet from the nearest t interchange.

The windshield survey of the proposed area of potential effect (APE) at the interchanges identified numerous historic resources that will require additional documentation to ascertain possible eligibility for listing in the Connecticut State Register and the NRHP. The preliminary assessment discussed in this section does not address these resources or previously identified resources which do not adjoin the I-95 corridor but are within the proposed APE.

4.2.6 Section 4(f) and Section 6(f) Resources

Section 4(f) Resources

Section 4(f) of the 1966 Department of Transportation Act requires that special efforts be made to protect any public park, recreational area, or wildlife or waterfowl refuge, or any public or private historic property or archeological site on or eligible for listing on the National Register of Historic Places from adverse impacts resulting from any Department of Transportation project. Section 4(f) only applies if federal funds are used on the project. The law states that the Secretary of Transportation shall approve a project which requires use of a public park, recreation area, wildlife or waterfowl refuge, or historic or archeological site of significance only if (1) there is no prudent and feasible alternative to using that land and (2) the project includes all possible planning to minimize harm to the resource being affected by the use.

This section discusses the public parks, recreation areas and wildlife and waterfowl properties contained in the study area, and re-lists historic properties and archaeological sites that may qualify as a Section 4(f) property. A summary of these resources is found in Table 4-4 and described below. Final determination of a property's 4(f) status normally requires consultation with FHWA and the management agency associated with the property. The data presented in Table 4-4, therefore, provides a preliminary list of potential Section 4(f) properties (Personal communication, E. Kennedy to Robert Turner, FHWA).

Data was derived from CTDEP GIS sources of Federal, CTDEP-owned and municipal properties, a review of property data contained in local Plans of Conservation and Development, municipal GIS data where available, and confirmed during field investigations.

Five parcels were identified as being potentially eligible for Section 4(f) status. These parcels are adjacent to the existing I-95 right of way and include one recreation area, two State Wildlife Areas, one State Forest and one State Park. Further research is necessary to determine if these two wildlife areas qualify as refuges and whether the State Forest qualifies due to the presence of park or recreation activities.

- Branford River Wildlife Area, Branford – North of Exit 55 and including approximately 3,000 feet adjacent to the right of way
- East River Wildlife Area, Madison - State owned property including 600 feet adjacent to the I-95 right of way
- Cockaponset State Forest, Westbrook – The State Forest parallels the I-95 right of way on the north side and east of Exit 64 for approximately 1,000 feet
- Rocky Neck State Park, East Lyme – A 34 acre portion of the State Park is adjacent to the Exit 72 on-ramp from Route 156 to I-95
- Recreation Field, Stonington – The field is on the west side of Taugwonk Road across from the I-95 southbound off ramp

Three schools are located adjacent to I-95 or one of its interchanges. Section 4(f) does not apply to areas of multiple use lands where the primary use is not one included in the definition of 4(f) properties. However, Section 4(f) does apply to those areas which function primarily for Section 4(f) purposes. Additional research will be necessary once transportation improvement alternatives are developed to determine if park or recreation activities at these sites are affected.

- Guilford Jr. High School, Guilford – School play fields adjacent to the northbound on ramp at Exit 58
- Morgan High School in Clinton – The school parking lot is across Route 81 opposite the southbound on ramp to I-95. There are no active recreation fields in the vicinity
- William Seeley School, Groton – School grounds are adjacent to the southbound portion of I-95

In addition, one Federally owned wildlife sanctuary; the Salt Meadow National Wildlife Refuge in Westbrook is approximately 1,000 feet south of I-95 east of Exit 64.

An additional 14 open space and recreation parcels are adjacent to the I-95 right of way but may not qualify for Section 4(f) status. These parcels include ten town-owned open space parcels (no active recreational activity is evident) and five water access points to the Connecticut, Lieutenant and Thames Rivers owned by the State of Connecticut. All potential Section 4(f) properties as well as other publicly and privately owned open space and recreation properties are shown on Figure 4-4. The 'uncategorized' properties shown on

Figure 4-4 are privately owned open space/recreation lands such as conservation trust areas, beach clubs, and marinas. The 'other' category includes CTDEP-owned properties such as the DEP Marine District Headquarters.

Historic and archeological resources found in the study area are discussed in the previous section and historic resources are shown on Figure 4-4**.** Archeological resources are not shown on any of the figures. Their locations are confidential in order to protect them from disturbance. It should be noted that if a site is archaeologically sensitive, Section 4(f) applicability cannot be determined until all subsurface testing is completed and approved by SHPO, FHWA, and Connecticut Department of Transportation. A summary of historic and archeological resources that would potentially be eligible for Section 4(f) status is provided below.

Information regarding listed and resources eligible for listing for the Connecticut State Register and the NRHP gathered during the feasibility study provides an opportunity to identify resources that directly adjoin the I-95 corridor. These resources are of particular concern as a result of their close proximity to the existing roadway and sensitivity to any proposed alterations to I-95. They include the Guilford Historic Town Center Historic District (Exit 58), the Dudleytown Historic District (Exit 59), the Jedidiah Dudley House (Exit 68), the Old Lyme Historic District and the Florence Griswold House and Museum (Exit 70 east), the Gurley Road/Oil Mill Road proposed Historic District (Exit 80), and the Post Hill Historic District and the Winthrop Mill (Exit 84). These resources adjoin or are less than 200 feet from the I-95 corridor at interchanges.

Two archaeological sites have been identified which are not located directly next to an interchange, but which are within close proximity to the I-95 corridor. The exact locations of archaeological sites are not disclosed to the public in order to protect the sites from disturbance. Archaeological site 27-9 was identified on the Connecticut State site form as "probably [being] destroyed by I-95", but it is unclear if it has indeed been destroyed. Site 27-30 is approximately 150 feet from the I-95 corridor. It could be disturbed by transportation improvements, however, it is more than 1,000 feet from the nearest exit interchange.

Table 4-4
Potential Section 4(f) Lands Adjacent to I-95

Town	Parcel	Ownership	Location
Branford	Branford River Wildlife Area	DEP	Exit 55 northside
Guilford	Guilford Jr. High School	Guilford	Exit 58 southside
Guilford	Guilford Historic Town Center Historic District	Mult. Private/Public	Exit 58 southside
Madison	East River Wildlife Area	DEP	East of Exit 59
Guilford	Dudleytown Historic District	Mult. Private/Public	Northeast of Exit 59
Clinton	Town Open Space River Road	Clinton	East of Exit 62
Clinton	Morgan High School	Clinton	Exit 63 northside
Clinton	Town Open Space	Clinton	Exit 63 southside
Clinton	Town Open Space - Fairy Dell Road	Clinton	East of Exit 63
Clinton	Menunketsuck River Water Access	DEP	West of Exit 64
Westbrook	Cockaponset State Forest	DEP	East of Exit 64
Westbrook	Salt Meadow National Wildlife Refuge	USFWS	1000' South of I-95
Old Saybrook	Jedidiah Dudley House	Private	Exit 68 northside
Old Saybrook	Connecticut River Water Access	DEP	East of Exit 69
Old Lyme	Old Lyme Historic District	Mult. Private/Public	Exit 70
Old Lyme	Florence Griswold House and Museum	Private	Exit 70 northside
Old Lyme	Lieutenant River Water Access	DEP	West of Exit 70
East Lyme	Rocky Neck State Park	DEP	East of Exit 72
East Lyme	Town Open Space – Smith-Harris Tract	East Lyme	West of Exit 74
Waterford	Gurley Road/Oil Mill Road proposed Historic District	Mult. Private/Public	Exit 80
Waterford	Town Open Space – Snowden Street	New London	Exit 82A
New London	Winthrop Mill	Private	Exit 84
New London	Post Hill Historic District	Mult. Private/Public	Exit 84 southside
New London	Thames River Water Access	DEP	East of Exit 84
Groton	Thames River Water Access	DEP	West of Exit 85
Groton	Seeley School	Groton	Exit 85
Groton	Town Open Space Winthrop Estates I-95 North	Groton	Exit 86
Groton	Town Open Space Winthrop Estates Plymouth Ave. East	Groton	Exit 87
Groton	Town Open Space Woodcrest Open Space	Groton	Exit 89
Stonington	Town Open Space Jerry Browne Rd.	Stonington	Exit 90
Stonington	Town Open Space Anguilla Preserve	Stonington	East of Exit 91
Stonington	Town Recreation Field	Stonington	Exit 91

Section 6(f) Resources

Section 6(f) of the 1965 Land and Water Conservation Act (LWCF) states that any lands that were purchased or developed with LWCF funds, cannot be 'converted' to another use for purposes inconsistent with the Act, without being replaced with other land that is of equal use and value to the land proposed for conversion. Section 6(f) documentation is required for 6(f) properties that are directly impacted (acquired) by transportation projects. CTDEP was consulted to identify Section 6(f) properties that received funding or improvements from the Land and Water Conservation Fund.

According to property data provided by CTDEP there are 19 properties within the I-95 study area communities that were purchased with monies from the Land and Water Conservation Fund (seven of these are shown on Figure 4-4). None of these Section 6(f) parcels are adjacent to I-95 or its intersections. The following list identifies those Section 6(f) properties that are within 2,000 feet of the I-95 corridor:

- Daniel P. Wren Park, Westbrook – 1,000 feet south of Exit 65
- Town Park, Old Saybrook – 1,000 feet north of Exit 66
- Washington Park, Groton – 2,000 feet south of Exit 85

4.2.7 Rare, Threatened and Endangered Species

Threatened and endangered plants and animals are protected by both Federal and State legislation. These components of the ecological mosaic are important due to their rarity and importance maintaining biological diversity. The Connecticut Endangered Species Act (C.G.S. Sec. 26-303 to Sec. 26-315) and the Federal Endangered Species Act (16 U.S.C. 1531-1543) provide protection of these resources.

CTDEP Geological and Natural History Survey maintains a database of known occurrences of these species and further classifies them based upon the degree of rarity. The database, designated as the Natural Diversity Data Base (NDDB) is a compilation of locations of species and natural communities based upon knowledge and data from CTDEP, private conservation groups, and the scientific community. The NDDB includes data for both State and Federally listed species through data sharing with the U.S. Fish and Wildlife Service.

The natural diversity database was obtained from CTDEP in GIS format in a compact disk data set. Since the NDDB list is updated twice annually, the latest information on locations was gathered at CTDEP and transferred to the project database. Data for this study is current as of December 2002.

Three classifications of rarity or occurrence are used by CTDEP, including Endangered, Threatened, and Special Concern. Endangered are the least common, representing species within danger of extirpation throughout all or a significant portion of its range, and having no more than five occurrences in the State. Threatened are uncommon and likely to become endangered within the foreseeable future throughout all or a significant portion of its range and have no more than nine occurrences in the State. Species of Special Concern are species that are naturally restricted in range or habitat in the State, or in low population levels or in such high demand that unregulated taking could be detrimental to the conservation of the species.

Federal classifications include Endangered, Threatened, and Candidate species. Endangered species are in danger of extinction within the foreseeable future throughout all or a significant portion of its range. Threatened species are likely to become endangered within the foreseeable future throughout all or a

significant portion of its range. Candidate species are under study and should be proposed for addition to the Federal endangered and threatened species list.

In order to afford some protection of the species from collection or vandalism, CTDEP only provides generalized and non-specific data represented by large circular shapes several thousand feet in diameter. These shapes are not necessarily centered on the species occurrence to further buffer their exact location. In addition, the species name for a particular occurrence is not provided. The data in this generalized form is used to conduct an initial screening for potential encounters with listed species or important natural communities. CTDEP reviewed the project corridor in the context of this corridor analyses. Further information about specific plants and animal resources will be provided for specific consideration as the study proceeds. Consultation with CTDEP, based upon specifics of potential transportation improvements will reveal if impacts will likely occur and if further investigation or mitigation is warranted.

The CTDEP database indicates several potential encounters with listed species or natural communities along the I-95 corridor. Approximately 17 generalized areas are denoted encroaching upon I-95 and interchanges as shown in Figure 4-4. Most of the data indicates single occurrences, however, in a couple of locations, clusters of species are found. Reviewing the published locations reveals patterns of greatest concentrations along the shores of Long Island Sound, and northward along estuaries. The highest density of generalized listed species and natural community occurrences in which the I-95 roadway corridor passes, occurs at the Connecticut River. The near coastal estuarine environment provides important habitats to support a wide variety of uncommon species.

Responses from CTDEP are included in the Appendix to this report. Among the listed animals are several bird species, a reptile, and several invertebrate species. There are four locations containing listed plants that will require further investigation as the transportation improvements are developed.

4.2.8 Land Use

Land use along the Route I-95 corridor is an important component for the evaluation of transportation alternatives. The nature, type and location of different land uses influence existing traffic volumes and the level of service that is experienced along sections of the highway. In addition, future development and changes to existing land use patterns must be accommodated in the alternatives analysis phase of this feasibility study. The existing land uses along the corridor therefore serve as a baseline for transportation planning purposes.

Land use information was collected from a variety of sources. Each of the three regional planning agencies (SCROG, CRERPA, and SCCOG) and the 13 communities were contacted for information. Parcel based land use data was acquired where available. Regional and local plans of conservation and development were also obtained. Parcel based land use data will be useful in the evaluation of alternatives because site-specific impacts can be determined.

Generalized land use maps were prepared for the study corridor (Figure 4-5). Because land use categories vary among municipalities, a set of general categories were identified and used for all 13 communities. These categories include:

- Agriculture – active agricultural lands
- Open Space – dedicated public or private open space, including cemeteries
- Low Density Residential – rural or single-family residential uses
- Medium Density Residential – two-family, townhouse, garden apartments or retirement communities
- High Density Residential – apartment buildings and high density multi-family neighborhoods
- Public/Institutional – public lands, schools, hospitals, nursing homes or public utility lands
- Commercial – retail, office, restaurants, motels
- Industrial- light manufacturing, industrial buildings, distribution facilities
- Vacant/Undeveloped – unused and undedicated privately owned land

The land use maps were prepared using GIS data where available. For communities without GIS land use or parcel data, land use data was digitized using paper maps and aerial photography. Limited fieldwork was also conducted. Land use data was collected for parcels within 300 feet of each intersection in the study corridor. This site-specific data include individual building uses and/or their occupants. This data was loaded into the GIS database so that, for each community, generalized as well as site specific data is available. The land use characteristics of each of the interchanges in the study area are described in Table 4-5.

Table 4-5
Generalized Land Use Along the I-95 Corridor

Town	Exit	Generalized Land Use Characteristics	Unique/Special Land Uses
Branford	Exit 54	Medium Density Residential (townhouses); Commercial	
Branford	Exit 55	Commercial; Single-Family Residential	
Branford	Exit 56	Commercial; Industrial	
Guilford	Exit 57	Commercial; Single-Family Residential; Undeveloped	
Guilford	Exit 58	Residential; Institutional; Undeveloped	Guilford Jr. High School
Guilford	Exit 59	Commercial; Industrial	
Madison	Exit 60	Single-Family Residential	
Madison	Exit 61	Commercial; Single-Family Residential, incl. townhouses	
Madison	Exit 62	Single-Family Residential; Undeveloped; Industrial	
Clinton	Exit 63	Commercial; Single-Family Residential	
Westbrook	Exit 64	Undeveloped; Rural Residential	
Westbrook	Exit 65	Commercial; Single-Family Residential	Cemetery
Old Saybrook	Exit 66	Industrial; Undeveloped; Rural Residential	
Old Saybrook	Exit 67	Single-Family Residential; Undeveloped; Industrial	Water
Old Saybrook	Exit 68	Commercial; Single-Family Residential	
Old Saybrook	Exit 69	Commercial; Single-Family Residential	
Old Lyme	Exit 70	Commercial; Rural Residential; Single-Family Residential	Historic properties
Old Lyme	Exit 71	Industrial; Undeveloped	
East Lyme	Exit 72	Undeveloped; Industrial	
East Lyme	Exit 73	Rural Residential; Undeveloped	
East Lyme	Exit 74	Commercial; Single-Family Residential	
East Lyme	Exit 75	Undeveloped; Commercial; Single-Family Residential	
East Lyme	Exit 76	Undeveloped; Single-Family Residential	
Waterford	Exit 80	Undeveloped	
Waterford	Exit 81	Commercial; Rural Residential	Retirement community; cemetery
Waterford	Exit 82	Commercial; Urban Residential	
Waterford	Exit 82A	Commercial; Urban Residential	Lake, water
New London	Exit 83	Urban Residential	
New London	Exit 84	Urban Residential; Industrial	Historic property
Groton	Exit 85	Urban Residential; Undeveloped	
Groton	Exit 86	Commercial; Industrial; Single-Family Residential	
Groton	Exit 87	Undeveloped; Commercial; Moderate Residential	
Groton	Exit 88	Commercial; Undeveloped	Groton and Pohegunt Reservoirs
Groton	Exit 89	Undeveloped; Rural Residential	
Stonington	Exit 90	Commercial	Elm Grove Cemetery
Stonington	Exit 91	Industrial; Rural Residential; Undeveloped	Soccer field
North Stonington	Exit 92	Industrial; Undeveloped; Rural Residential	Casino facilities
North Stonington	Exit 93	Commercial	

State Planning

The *Conservation and Development Policies Plan for Connecticut 1998 - 2003* provides guidelines for the use of land in the State. Eight generalized land use categories are used in the plan: Regional Centers, Neighborhood Conservation Areas, Growth Areas, Rural Community Centers, Rural Land, Existing Preserved Open Space, Preservation Areas and Conservation Areas. There are also two overlay categories: level A/B Aquifer Protection Areas and Historic Areas.

New London is the only Regional Center within the I-95 study area. Neighborhood Conservation Areas, defined as significantly built-up and populated areas, are found throughout Branford and at Exit 58 in Guilford, Exit 63 in Clinton, Exit 65 in Westbrook, Exit 74 in East Lyme, Exit 83 in Waterford, Exits 85 and 86 in Groton, and Exit 90 in Stonington. Growth Areas are defined as "..lands that provide the opportunity for staged urban expansion generally in conformance with municipal or regional development plans." Portions of the I-95 corridor found within the Growth Area category include areas from Branford to Clinton, most of Westbrook and Waterford, the eastern half of Groton and around Exit 92 in North Stonington. The only Rural Community Center is found at Exit 70 in Old Lyme. Areas of Rural Land, considered to be low-density residential areas, are found in Old Saybrook, Old Lyme, East Lyme, Stonington and North Stonington. The other three categories, Preserved Open Space, Preservation Areas and Conservation Areas, are found throughout the corridor wherever sensitive environmental resources exist.

Regional Planning Context

There are three regional planning agencies within the I-95 study area: South Central Regional Council of Governments (SCROG), Connecticut River Estuary Regional Planning Agency (CRERPA), and Southeastern Connecticut Council of Governments (SCCOG). Each agency has prepared a regional plan of development that has specific recommendations related to the I-95 corridor. These are summarized below.

South Central Regional Council of Governments (SCROG)

Three corridor communities, Branford, Guilford and Madison, are members of SCCROG. The regional plan, *Vision for the Future: Regional Plan of Development*, was adopted in November 2000. These communities comprise the East Shore sub-region of which the plan states "Selective infilling and enhancement can help grow the I-95 east corridor while preserving key community values." The plan notes, in particular, intersection improvements at Exit 56 (Leetes Island Road) and this area's potential for supporting sub-regional economic growth.

Connecticut River Estuary Regional Planning Agency (CRERPA)

CRERPA includes the I-95 corridor communities of Clinton, Westbrook, Old Saybrook and Old Lyme. The *Connecticut River Estuary Region Plan of Development* was adopted in May 1995. The plan identifies six generalized land use categories in the regional land use plan. Economic Growth Areas are identified along the corridor west of Exit 63 in Clinton, east of Exit 64 and east of Exit 65 in Westbrook, at Exit 67 and 68 in Old Saybrook and Exit 71 in Old Lyme. Resource Protection Areas are located along both sides of the Connecticut River and in Old Lyme and Water Supply Uses are identified in Clinton and Westbrook. The remainder of the corridor is classified as 'Established Residential' or 'Rural Residential' areas. The last category – Village Areas- is found at Exit 71 in Old Lyme.

Southeastern Connecticut Council of Governments (SCCOG)

The remaining six corridor communities, from East Lyme to North Stonington, are members of SCCOG. The *Regional Conservation and Development Policy Guide for Southeastern Connecticut* was adopted in October 1997. The policy guide identifies six generalized land use categories – Mixed Urban Areas, Mixed

Suburban Areas, Low Density Uses, Major Institutional Uses, Recreation and Open Space Uses and Conservation Areas. The Mixed Urban Use category is found throughout Waterford, New London and Groton and at Exit 90 in Stonington and Exit 92 in North Stonington. East Lyme categories include Mixed Suburban Uses, Low Density Uses and Major Institutional Uses. Most of the remainder of Stonington is within the Low Density Use category and the remaining land in North Stonington is categorized as Mixed Suburban Use.

Local Planning Summary

Branford
Single-family residential subdivisions, areas of multi-family housing, commercial areas (strip malls) along Route 1 and industrial parks characterize the Route I-95 corridor through the town of Branford. In particular, Exits 54 and 55 provide direct access to commercial areas most of which are found along Route 1. Very little vacant land is available along the corridor.

The *Branford Plan of Conservation and Development* was adopted in 1997. The future land use plan includes a large office/industrial area in the northeast portion of town at Exit 56 (Leetes Island Road). The plan recommended interchange improvements to Exit 56. These improvements have been recently completed and will support future industrial growth in this area.

Guilford
Guilford is more of a suburban residential community with lower density residential subdivisions and large lot zoning. Agricultural lands are found adjacent to the corridor. Exits 57 and 59 provide direct access to office and retail areas most of which are found along Route 1.

The *Guilford Plan of Conservation and Development* was adopted in January 2002. The future land use plan includes office/industrial areas at Exits 57 and 59. These areas have some potential for further development. Much of the remainder of the corridor is devoted to existing residential land uses. Most of the agricultural lands in the corridor are zoned for residential use should they be developed.

Madison
Most of the I-95 corridor in Madison is devoted to single-family residential neighborhoods. Unlike most other communities in the corridor, the interchanges in Madison are not used extensively for commercial purposes although there are several professional office use developments at Exits 61 and 62. Limited amounts of vacant land exist in the corridor. Notable land uses in Madison include the Harborside Healthcare Rehab and Nursing Center on Wildwood Avenue and the Connecticut Light and Power facilities on New Road at Exit 62.

The *Madison Plan of Conservation and Development* was adopted in 1998. The future land use plan identifies one area of limited commercial/industrial potential north of the corridor between Exits 60 and 61.

Clinton
The predominant land use in Clinton along the corridor consists of single-family residential subdivisions with some industrial activity in the western part of the town. Exit 63 provides direct access to commercial areas including the mall at Clinton Crossing. There is little available vacant land north of I-95. The corridor south of I-95 is almost exclusively used for single-family housing.

The *Clinton Plan of Conservation and Development* was adopted in July 2000. The future land use plan reinforces the existing land use pattern. The large tract of undeveloped land north of I-95 and east of Exit 63 is identified as potential open space in the plan.

Westbrook

Rural residential land uses and large tracts of undeveloped land characterize Westbrook. Commercial land uses, including the regional Westbrook Mall, are clustered at Exit 65. Development potential in Westbrook exists north of the I-95 at Exit 64 and south of I-95 at Exit 65.

The *Westbrook Plan of Conservation and Development* is undergoing revisions and updates, and is not currently available.

Old Saybrook

Land uses in Old Saybrook are predominately mixed with large areas of commercial and industrial uses mixed with residential areas as Route 1 approaches and merges with I-95 prior to crossing the Connecticut River. Industrial parks are found at Exits 66 and 67. There are some undeveloped lands along the corridor.

The *2000 Plan of Conservation and Development* is "in progress" and has not been officially adopted at this time. The plan recognizes Old Saybrook's location at the mouth of the Connecticut River as being environmentally sensitive and the need to protect environmentally sensitive lands is an important community consideration. The plan also states that economic development should occur in a limited manner in support of local needs rather than to support the regional population.

Old Lyme

Old Lyme is characterized by some single-family neighborhoods with large undeveloped tracts of land some of which are dedicated open space areas. Exit 70 in Old Lyme provides access to an historical district, museums and schools.

The *Old Lyme Plan of Conservation and Development* was adopted in August 2000. The future land use plan seeks to maintain the rural residential character of the town throughout the corridor except at Exits 70 and 71 where commercial and industrial land uses are encouraged.

East Lyme

Much of the I-95 corridor through East Lyme is undeveloped, privately and publicly owned land with occasional residential areas. A commercial center is located at Exit 74 along Flanders Road (Route 161) with a variety of commercial business activities and multi-family housing developments. Recent construction of commercial facilities such as motels and restaurants is also evident at this exit. This area is desirable because Route I-395 merges with I-95 at this location and is close to the tourist attractions and casinos located in southeastern Connecticut. This is also the area where Route 11 will connect to I-395/I-95. The remaining portions of the corridor include undeveloped land north of I-95 and land on the south side of I-95 that is undeveloped but is part of the Gates and York Correctional Institutions on North Bridebrook Road and West Main Street, respectively, in East Lyme.

The *East Lyme Plan of Conservation and Development* was adopted in November 1999. The plan seeks to reinforce the existing land use pattern. The plan notes the importance of the Exit 74 interchange and recommends that future commercial development be accommodated at this location. The plan identifies approximately 100 acres of land north of I-95 and west of Flanders Road that should be targeted for commercial growth. The remaining portions of the corridor would be used for rural residential purposes.

Waterford

As a suburban community adjacent to New London, Waterford has been experiencing recent construction of commercial shopping malls (Crystal Mall) and large stand-alone retail outlets (Home Depot, Walgreen's and BJ Wholesale). However there are a number of large, vacant, commercially available parcels remaining on both sides of I-95 in Waterford.

The *Waterford Plan of Preservation, Conservation and Development* was adopted in October 1998. The plan identifies a 'business triangle' that includes both sides of I-95 extending north along Cross Road and Route 85. This area is the focus for future commercial and industrial growth in Waterford and large portions of this corridor are currently undeveloped. The plan also recognizes the value of the two roadways that parallel Route I-95, Parkway North and Parkway South, and proposes that both be extended to Exit 82. The plan also recommends improvements at Exit 81 at Cross Road.

New London

Higher density residential areas, shopping malls and supporting commercial activities and transportation facilities characterize the urbanized I-95 corridor of New London. Older single and two-family neighborhoods are located on both sides of the highway. There are also multi-family developments including garden apartments and high-rise apartment buildings. Frontage roads east of Exit 82A provide access to the New London Mall and the New London Shopping Center. Transportation facilities within the corridor include numerous ramps, collector/distributor roads, connections with Route 32 and downtown New London and the State Pier facilities on the Thames River.

The *New London Plan of Conservation and Development* was adopted in April 1997. The plan reinforces the existing land use pattern in the corridor and recognizes the importance of marine industrial uses along the Thames River. It supports the redevelopment activities that have occurred along the waterfront and identifies the economic development potential in the State Pier area. Approximately 110 acres of land surrounding the State Pier could be used for economic development, according to the plan.

Groton

Land uses in Groton include higher density residential and commercial uses on both sides of the highway at Exits 85 and 86 where Routes 12 and 184 connect to I-95. Suburban residential development is evident at the eastern end of the town at Exit 89. In between are the Groton and Pohegunt Reservoirs and conservation lands associated with these public water supplies. Large, undeveloped tracts of land continue to be available in Groton primarily around Exit 87 and east of Exit 88.

The *Groton Plan of Conservation and Development* was adopted in February 2002. The plan proposes that large, undeveloped areas of the corridor east of Route 117 and north and south of I-95 be used for office, research and development, light industrial and distribution activities. The amount of vacant land in this area is significant (approximately 500 acres north of I-95). Other vacant land in the corridor located north and south of Exit 87 would be used for medium density and multi-family residential development.

Stonington
Exit 90 in Stonington provides direct access to Mystic Seaport and other tourist attractions. This exit has experienced recent outlet mall construction and provides a mix of motels and restaurants that cater to tourists coming to the area. Beyond Exit 90, land uses become more rural with large tracts of vacant land, agricultural uses and rural residential areas.

The *Stonington Plan of Conservation and Development* is over 11 years old. It contains some general goal statements but no maps.

North Stonington
North Stonington land uses along the I-95 corridor consist of large tracts of vacant land, agricultural uses and rural residential areas. The nearby presence of the Foxwoods Casino is apparent by a recent development of administrative and training facilities at Exit 92. Commercial services to travelers, including restaurants, lodging, and a truck service area are found at Exit 93 on the Rhode Island border.

The *North Stonington Draft Plan of Conservation and Development* was prepared in July 2002. The plan seeks to encourage and support residential and agricultural land uses in the town. It discusses a 'mixed use village' concept for an unspecified area near I-95. This village area could provide a focus for the town while supporting a mix of uses including high-density residential, retail and offices, restaurants, motels or a conference center and light industrial uses. According to the plan, high value commercial uses, not strip retail activities, should be encouraged at Exit 93. The plan acknowledges traffic impacts associated with the Foxwoods Casino but recommends that Route 2, the main access from I-95 to Foxwoods, not be widened to more than the current two lanes and that its scenic qualities be preserved and enhanced.

4.2.9 Environmental Risk Sites

The relative environmental risk associated with current and former land uses in the vicinity of the I-95 study area was determined. The need for further evaluation as appropriate was also assessed.

A Federal and State environmental database search was conducted for the study area. Environmental Data Resources, Inc. (EDR) performed the search. The extent of the search was set at 1/8 mile on either side of I-95. This ¼ mile screening area was extended for the entire length of the corridor.

Databases Searched
The following databases are included in the search by EDR:

Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS) - EPA's list of potentially hazardous waste sites that have been reported to EPA by states, municipalities, private companies and private persons. This list contains properties that are on or proposed to be on the National Priorities List (NPL).

Comprehensive Environmental Response, Compensation and Liability Information System No Further Action Planned (CERCLIS-NFRAP) – Includes sites that have been removed from CERCLIS following an initial investigation by EPA.

Resource Conservation and Recovery Act (RCRIS) - An EPA database that includes information on sites that generate, store, treat, or dispose of hazardous materials that are defined in the Act. The database consists of multiple categories including Treatment, Storage and Disposal (TSD); Large Quantity Generators (LQG), and Small Quantity Generators (SQG) lists.

CORRACTS database is a list of handlers of RCRA corrective action activity.

Emergency Response and Notification System (ERNS)- An EPA database of reported releases of oil and hazardous materials.

State Hazardous Waste Sites (SHWS) – This database consists of Connecticut's equivalent of CERCLIS. The sites may or may not be on the Federal list. The data comes from CTDEP's Inventory of Hazardous Disposal Sites.

Solid Waste Facilities/Landfill Sites (SWF/LF) – The database contains an inventory of solid waste disposal facilities or landfills and comes from CTDEP's Inventory of Hazardous Disposal Sites.

Leaking Underground Storage Tanks (LUST) – The database, maintained by CTDEP, contains an inventory of reported leaking underground storage tank incidents.

Underground Storage Tank (UST) – This database contains a list of registered underground storage tanks for each town.

Facility Index System (FINDS) – This database contains facility information and pointers to other databases and sources of information.

Hazardous Materials Incident Report System (HMIRS) – An EPA list containing hazardous materials spill incidents reported to the Department of Transportation.

Material Licensing Tracking System (MLTS) – This list is maintained by the Nuclear Regulatory Commission and contains sites that possess or use radioactive materials.

PCB Activity Database (PADS) - This database is maintained by the EPA and identifies generators, transporters, commercial storers and/or brokers and disposers of PCBs.

Toxic Chemicals Release Inventory System (TRIS) – This database identifies facilities that release toxic chemicals to the air, water and land in reportable quantities under SARA Title III, Section 313. The EPA maintains the list.

FTTS – This database tracks administrative and pesticide enforcement actions and compliance activities related to FIFRA, TSCA, and EMPCRA (Emergency Planning and Community Right to Know).

Oil and Chemical Spill Database (SPILLS) – This database is maintained by CTDEP.

Site Discovery and Assessment Database (SDADB) – This database includes sites reported to CTDEP where hazardous waste may have been disposed or sites eligible for listing on the State Inventory of Hazardous Waste Disposal Sites.

Leachate and Waste Water Discharge Inventory Data (LWDS) – This database includes surface and groundwater discharges that have received State permits, are abandoned waste sites or locations of accidental spills, leaks or discharges.

CT Property – A database listing of sites that meet the definition of hazardous waste generator that have been sold to another owner.

The EDR review retrieved a total of 373 sites or locations listed in the various databases. Because multiple databases were searched some of the same properties appear multiple times. Consequently, there are 454 specific references to the environmental databases shown on Figure 4-5. These references include specific properties as well as locations where hazardous materials spill incidents have occurred. Approximately one third of the total references (154) include spill incidents reported from the CT Oil and Chemical Spill (SPILLS) database.

An initial screening was conducted to identify those sites and spill locations that are proximate to the I-95 study area. The data was reviewed to identify sites or spill locations within 300 feet of an intersection or within or adjacent to the I-95 right of way. This screening analysis identified 65 occurrences and 84 spill incidents. The following summarizes the data for locations that may warrant further research due to the nature of the database reported for the site. Sites not included below include those for which the reported database (i.e. an underground storage tank registration or RCRA small quantity generator status) is not likely to suggest a hazardous condition. Also, the 84 spill incidents, most of which have occurred on I-95 or at an interchange, occur generally throughout the corridor although the most reported incidents were in Groton (17), North Stonington (13), Branford (11) and Old Saybrook (7). Additional research would be necessary to further identify specifics of these incidents.

Branford:

- Two sites reported in the CT SDADB
- Site reported in CERLIS-NFRAP and CORRACT
- Site reported in LWDS – oil spills and junkyard
- 11 CT SPILLS

Guilford:

- Two sites reported in LUST
- Site reported in LWDS – filter backwash discharge
- 1 CT SPILLS

Madison:

- Site reported in the CT SDADB
- Site reported in CT SDADB, LUST, ERNS, PADS, and FTTS
- 4 CT SPILLS

Clinton:

- Site reported in SHWS and SWF/LF
- 4 CT SPILLS

Westbrook:

- No sites
- 3 CT SPILLS

Old Saybrook:

- Site reported in the CT SDADB
- Three sites reported in LWDS – industrial wastewater discharge, salt storage area and bulky waste disposal
- 7 CT SPILLS

Old Lyme:

- Site reported in LWDS – septage disposal site
- Site reported in FTTS
- 2 CT SPILLS

East Lyme:

- Two sites reported in the LUST
- Site reported in FTTS
- Site reported in LWDS – septic system failure
- 5 CT SPILLS

Waterford:

- Site reported in the LUST
- Site reported in LUST and CT SDADB
- 5 CT SPILLS

New London:

- Site reported in the LUST
- Site reported in ERNS
- 5 CT SPILLS

Groton:

- Site reported in the CT SDADB
- Site reported in FINDS
- 17 CT SPILLS

Stonington:

- Site reported in the LWDS - cooling water discharge
- 5 CT SPILLS

North Stonington:

- Site reported in the CT SDADB
- Site reported in FINDS
- 13 CT SPILLS

4.2.10 Environmental Justice

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority and Low-Income Populations*, directs Federal agencies to "promote nondiscrimination in Federal programs substantially affecting human health and the environment, and provide minority and low-income communities access to public information on, and an opportunity for public participation in, matters relating to human health or the environment." The Order directs agencies to utilize existing law to ensure that when they act:

- They do not discriminate on the basis of race, color, or national origin.
- They identify and address disproportionately high and adverse human health or environmental effects of their actions on minority and low-income communities.
- They provide opportunities for community input in the National Environmental Policy Act (NEPA) process, including input on potential effects and mitigation measures.

The Federal Highway Administration (FHWA) of the US Department of Transportation issued guidance in 1998 entitled *FHWA Actions to Address Environmental Justice in Minority Population and Low Income Populations* (DOT Order 6640.23). This Order reaffirms the principles of EO 12898 by incorporating EJ in all FHWA programs and states that FHWA "…will rely upon existing authorities to collect necessary data and conduct research associated with environmental justice concerns..."

According to available guidance, an Environmental Justice (EJ) analysis should analyze disproportionately high and adverse human health and environmental effects on minority and low-income populations or Indian tribes. Toward this end, the guidance requires that the following types of effects be analyzed:

- Significant effects on minority or low-income populations
- Effects that exceed, or are likely to appreciably exceed, effects on the general population or other appropriate comparison groups; or
- Whether EJ populations experience cumulative or multiple adverse exposures from environmental hazards

Methodology for Identification of Environmental Justice Populations

Executive Order 12898 does not define the terms "minority" or "low-income." However, guidance provided by the CEQ describes these terms in the context of EJ analysis. These definitions are unique to EJ analysis and are the basis for the methodology that follows:

- Minority Individual - A Minority individual is classified by the U.S. Bureau of Census as belonging to one of the following groups: American Indian or Alaskan Native, Asian or Pacific Islander, Black (not of Hispanic Origin), and Hispanic.
- Minority Populations - According to the CEQ Guidelines, minority populations should be identified where either (a) the minority population of the affected area exceeds 50% or (b) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis.
- Low-income Population - Low-income populations are identified where individuals have incomes below the U.S. Department of Health and Human Services poverty guidelines. A low-income population is either a group of low-income individuals living in proximity to one another or a set of individuals who share common conditions of environmental exposure or effect.

This analysis profiles the demographic composition of the I-95 corridor and surrounding area to determine whether these areas can be characterized as areas of potentially affected EJ population (EJ areas). For the purpose of gathering population data, the U.S. Census tracts and block groups used for this analysis were those that are located within 1,000 feet of the I-95 corridor. Data was collected in the study area corridor, as well as for the 13 I-95 communities within the study area. The following data were used to identify minority and low-income populations in the study area:

- Population data from the 2000 U.S. Census
- Income data from the 2000 U.S. Census; and
- Graphical representations of Census Block Group (Block Group) boundaries from the 2000 U.S. Census

This EJ analysis evaluates the racial and income characteristics of persons within the study area. Impacts to block groups meeting the EJ threshold have the potential to be disproportionately borne by minority or low-income populations. The evaluation consists of the following two steps to determine whether each block group along the I-95 corridor meets the "EJ threshold" for further analysis:

Step 1: Calculation of Minority or Low-income Populations – The following 2000 U.S. Census information was collected for each block group in the study area corridor: (1) the total population, (2) the total minority population, and (3) the total low-income population. From these raw numbers the percentage of persons in each minority group and persons below the poverty level were determined.

Step 2: Calculation to Determine if EJ Threshold is Met – Once the baseline minority and low-income populations were determined for comparison purposes, specific block groups that meet the EJ threshold were identified. The EJ threshold for further analysis is met in either of the following cases:

- Block groups where the minority or low-income population in the block groups equals or exceeds 50 percent of the population in that block group.
- Block groups where the percentage of the minority or low-income population is at least 10 percent higher than the average minority or low-income population percentage for the study area corridor.

Results of the Census Data Collection

Racial and economic census data were examined for the block groups along the I-95 corridor. The study area consists of a total of 42 Census Tracts and 75 Block Groups (see Figure 4-6). The EJ threshold was met by all Census Tract Block Groups on either side of I-95 in New London as well as two Census Tract Block Groups south of I-95 in East Lyme. New Haven, Middlesex, and New London County census data was also reviewed for comparative purposes. This analysis resulted in no changes to this set of EJ Block Groups.

As presented in Table 4-6, three out of the 75 block groups examined have minority percentages that exceed 50 percent of the total population in each block group. These block groups include two in New London (Census Tracts 690100 BG2 and 690300 BG4) and one in East Lyme (Census Tract 716101 BG4). One block group (690100 BG2) has a minority population of 91 percent and includes a large, multi-story apartment complex owned and managed by the New London Housing Authority. Six other block groups also meet the second threshold for EJ status with minority percentage at least 10 percent greater than the average for the study area corridor, which has 13.3 percent minority population. These block groups include five in New London (Census Tract 690100 BG 1 and 3, Census Tract 690300 BG 1 and 2 and Census Tract 690500

BG 1) and one in East Lyme (Census Tract 716101 BG 2). The Gates and York Correctional Facilities are located within the two East Lyme block groups. Table 4-7 provides the minority composition for the nine block groups that qualify for EJ status based on minority population.

There are four block groups within the study area that meet the low-income threshold for EJ status. One block group, Census Tract 690100 BG 2, has a percentage of low-income persons that exceeds 50 percent of block group's total population. Census Tract 690100 BG1 (19.2 percent), Census Tract 690300 BG4 (18.7 percent), and Census Tract 690500 BG1 (20.5 percent) meet the second test for the low-income EJ threshold. These block groups, all of which are located in New London, have percentages of low-income persons at least 10 percent greater than the average for the study area (5.0 percent).

Table 4-6
Environmental Justice Thresholds

Community	Census Tract	Block Group	Total Block Group Population	Total Minority Population	Percentage Minority Population	Total Population Poverty Level	Persons Below Poverty Level	Percentage of Persons Below Poverty Level	Question #1	Question #2
Branford	184100	1	902	72	8.0	902	48	5.3	No	No
Branford	184100	5	1394	195	14.0	1394	76	5.5	No	No
Branford	184200	1	1127	168	14.9	1127	59	5.2	No	No
Branford	184500	1	1442	33	2.3	1429	35	2.4	No	No
Branford	184600	1	1959	90	4.6	1959	62	3.2	No	No
Branford	184700	1	1008	57	5.7	1008	69	6.8	No	No
Branford	184700	2	1995	144	7.2	1995	100	5.0	No	No
Branford	184700	3	606	10	1.7	596	0	0.0	No	No
Branford	184700	4	2255	236	10.5	2251	161	7.2	No	No
Guilford	190100	1	859	33	3.8	859	76	8.8	No	No
Guilford	190100	2	1182	101	8.5	1182	43	3.6	No	No
Guilford	190100	3	1256	69	5.5	1165	50	4.3	No	No
Guilford	190200	3	1685	99	5.9	1685	14	0.8	No	No
Guilford	190301	1	2155	115	5.3	2155	69	3.2	No	No
Guilford	190301	2	1296	58	4.5	1296	40	3.1	No	No
Guilford	190302	1	1626	124	7.6	1626	94	5.8	No	No
Guilford	190302	4	917	64	7.0	917	11	1.2	No	No
Madison	194100	1	542	49	9.0	542	39	7.2	No	No
Madison	194100	2	994	14	1.4	994	9	0.9	No	No
Madison	194201	4	1843	102	5.5	1750	37	2.1	No	No
Madison	194202	3	1102	53	4.8	1102	17	1.5	No	No
Madison	194202	4	1129	42	3.7	1129	11	1.0	No	No
Clinton	610100	1	1017	84	8.3	1017	43	4.2	No	No
Clinton	610200	3	760	33	4.3	760	19	2.5	No	No
Clinton	610200	4	1048	57	5.4	1048	13	1.2	No	No
Clinton	610300	1	1496	118	7.9	1496	39	2.6	No	No
Clinton	610300	2	832	23	2.8	832	0	0.0	No	No
Clinton	610400	1	1419	30	2.1	1402	34	2.4	No	No
Clinton	610400	2	1925	221	11.5	1925	35	1.8	No	No
Westbrook	680100	1	1159	79	6.8	1155	27	2.3	No	No
Westbrook	680100	2	1526	50	3.3	1516	21	1.4	No	No
Westbrook	680100	3	1411	0	0.0	1407	133	9.5	No	No
Westbrook	680100	4	781	83	10.6	781	46	5.9	No	No
Old Saybrook	670100	2	1702	76	4.5	1655	147	8.9	No	No
Old Saybrook	670100	3	1214	73	6.0	1214	29	2.4	No	No
Old Saybrook	670100	4	836	115	13.8	836	0	0.0	No	No

Table 4-6
Environmental Justice Thresholds

Community	Census Tract	Block Group	Total Block Group Population	Total Minority Population	Percentage Minority Population	Total Population Poverty Level	Persons Below Poverty Level	Percentage of Persons Below Poverty Level	Question #1	Question #2
Old Saybrook	670200	3	1905	131	6.9	1905	88	4.6	No	No
Old Lyme	660101	2	1039	43	4.1	1039	32	3.1	No	No
Old Lyme	660101	3	1201	24	2.0	1201	23	1.9	No	No
Old Lyme	660102	1	881	7	0.8	869	14	1.6	No	No
Old Lyme	660102	2	2080	102	4.9	2080	41	2.0	No	No
East Lyme	716101	1	500	15	3.0	500	9	1.8	No	No
East Lyme	716101	2	2843	894	31.4	1778	71	4.0	Yes	No
East Lyme	716101	3	1097	106	9.7	1097	0	0.0	No	No
East Lyme	716101	4	1436	833	58.0	172	0	0.0	Yes	No
East Lyme	716102	1	1836	156	8.5	1836	36	2.0	No	No
East Lyme	716102	2	1268	262	20.7	1268	22	1.7	No	No
East Lyme	716102	3	1635	110	6.7	1627	28	1.7	No	No
East Lyme	716200	1	2862	275	9.6	2862	143	5.0	No	No
Waterford	693300	1	658	73	11.1	658	19	2.9	No	No
Waterford	693400	1	731	150	20.5	720	24	3.3	No	No
Waterford	693700	1	1625	218	13.4	1572	55	3.5	No	No
Waterford	693700	2	1606	195	12.1	1520	48	3.2	No	No
New London	690100	1	689	343	49.8	689	132	19.2	Yes	Yes
New London	690100	2	1464	1334	91.1	1452	747	51.4	Yes	Yes
New London	690100	3	2198	675	30.7	1353	160	11.8	Yes	No
New London	690300	1	806	267	33.1	755	11	1.5	Yes	No
New London	690300	2	1335	460	34.5	1335	132	9.9	Yes	No
New London	690300	4	1968	1552	78.9	1927	361	18.7	Yes	Yes
New London	690500	1	577	204	35.4	577	118	20.5	Yes	Yes
Groton	702100	9	3316	327	9.9	3309	146	4.4	No	No
Groton	702201	1	992	65	6.6	992	28	2.8	No	No
Groton	702300	2	785	109	13.9	785	17	2.2	No	No
Groton	702400	1	462	47	10.2	448	0	0.0	No	No
Groton	702400	2	1812	382	21.1	1812	86	4.7	No	No
Groton	702700	9	3727	843	22.6	3456	221	6.4	No	No
Groton	702800	9	1950	155	7.9	1944	107	5.5	No	No
Groton	703000	3	976	59	6.0	876	13	1.5	No	No
Stonington	705100	1	2384	147	6.2	2384	142	6.0	No	No
Stonington	705200	1	1381	45	3.3	1381	0	0.0	No	No
Stonington	705300	1	1520	104	6.8	1337	25	1.9	No	No
Stonington	705300	3	1126	50	4.4	1126	45	4.0	No	No
Stonington	705400	1	1582	124	7.8	1582	47	3.0	No	No
Stonington	705400	2	1188	110	9.3	1182	57	4.8	No	No
North Stonington	707100	3	1477	50	3.4	1477	62	4.2	No	No
Totals			105318	14016	13.3	100990	5016	5.0		
Question #1: Does the Block Group meet the threshold for Environmental Justice status for Minorities?										
Question #2: Does the Block Group meet the threshold for Environmental Justice status for poverty?										

Table 4-7
Composition of Minority Population

Community	Census Tract	Block Group	Percentage Black Population	Percentage Hispanic Population	Percentage Other Minority Population	Percentage Minority Population
East Lyme	716101	2	16.3%	10.0	5.2	31.5
East Lyme	716101	4	29.6%	21.5	6.9	58.0
New London	690100	1	9.6%	29.3	10.9	49.8
New London	690100	2	19.6%	69.3	2.3	91.1
New London	690100	3	8.8%	12.0	9.9	30.7
New London	690300	1	14.3%	14.3	4.6	33.1
New London	690300	2	6.1%	19.0	9.4	34.5
New London	690300	4	32.9%	40.7	5.2	78.9
New London	690500	1	23.6%	8.7	3.1	35.4

4.2.11 Other Unique Features

This section describes areas of local importance or character that are particularly 'notable' because of their uniqueness or local significance. This section is intended to provide the reader with a feeling for the many notable points of interest along this corridor. This discussion is not limited to any particular buffer zone/corridor width, but is based on a review of tourism brochures, town Planning and conservation documents, and field observations made during data collection for land use and other resources.

Three unique features are components of I-95 itself: the new Baldwin Bridge over the Connecticut River and the Gold Star Bridge over the Thames River are notable features in the landscape owing to heir monumental proportions. A scenic overlook in Groton, on the northbound side between Exits 89 and 90 provides a pleasing and dramatic vista of Mystic Seaport Harbor.

Other Unique Features include:
A boardwalk and pier are open to the public at the DEP Marine Headquarters on the Connecticut River in Old Lyme (Exit 70), and boat launches are provided at several waterways along the corridor, including two at the Thames River in New London and Groton.

Large shoreline State Parks located in Madison (Hammonasset) and East Lyme (Rocky Neck) are proximate to I-95 and are well served by limited access connector roadways at their respective exits.

Three culturally significant art institutions are sites along Lyme Street in Old Lyme (Exit 70), along with the architecturally impressive Old Lyme Inn.

A small fish ladder alongside Latimer Brook is a point of conservation interest at Exit 80 in East Lyme.

The U.S. Coast Guard Academy and the U.S. Submarine World War II Veteran's Memorial are located along the Thames River in New London and Groton, respectively.

The Mystic section of Stonington features two longstanding tourist attractions: the Mystic Aquarium and Marine Institute, and the Mystic Seaport.

4.2.12 Air Quality

The 1990 Clean Air Act Amendment (CAAA) requires each region of the country be designated as either being in attainment or non-attainment of the National Ambient Air Quality Standards (NAAQS). States with any non-attainment regions must have approved state air quality implementation plans (SIPs) which set forth measures to achieve compliance with the NAAQS. Metropolitan Planning Organizations (MPOs) are responsible for ensuring that the transportation plan and transportation improvement program (TIP) within metropolitan boundaries conform to the SIP. In metropolitan areas, each MPO must formally make a conformity determination on its transportation plan/TIP. The CAAA requires that transportation plans, programs and projects in non-attainment or maintenance areas that are funded or approved by the FHWA or FTA be in conformity with the SIP. A conformity determination must show that transportation plans and TIPs will not:

- Create new NAAQS violations
- Increase the frequency or severity of existing NAAQS violations
- Delay the attainment of the NAAQS

ConnDOT conducts the analysis on the transportation plans and TIPs for the MPOs, which is published in the Air Quality Conformity Report. MPOs endorse this analysis through the adoption of their Air Quality Conformity Statements.

The State of Connecticut is designated as attainment or non-attainment with respect to the National Ambient Air Quality standards (NAAQS) for the following six criteria air pollutants: particulate matter no greater than 10 micrometers in diameter (PM_{10}); sulfur dioxide (SO_2); ozone (O_3); nitrogen dioxide (NO_2); carbon monoxide (CO); and lead (Pb). The State is currently designated as attainment for all of these pollutants except ozone and PM_{10}. Three regions of the State (the Connecticut portion of the New York-New Jersey-Long Island CO maintenance area, the New Haven-Meriden-Waterbury CO maintenance area, and the Hartford-New Britain-Middletown CO maintenance area) have approved limited maintenance plans for CO.

The State of Connecticut has two ozone non-attainment areas, both of which are designated as moderate non-attainment. Fairfield, New Haven and Middlesex counties are part of the New York-New Jersey-Connecticut moderate non-attainment area. The remainder of the State is referred to as the Greater Connecticut moderate non-attainment area. With regard to CO, the towns of Branford, Guilford and Madison are part of the New Haven-Meriden-Waterbury CO maintenance area. The study area is also in an attainment area with respect to PM_{10} (only the city of New Haven is in non-attainment). As stated above, projects that are proposed in any non-attainment or maintenance area must come from a conforming transportation plan and TIP. Therefore, any project resulting from this study must be included in a transportation plan and TIP that has been determined to be in conformance with the respective SIP. Also, any project resulting from this study located in the towns of Branford, Guilford and Madison are subject to CO project level conformity.

The New Haven Urban Area is designated as a Transportation Management Area (TMA). Since portions of this project are located within this TMA, which is designated as a non-attainment area for ozone (as is the entire state), the requirements of 23 CFR 450.320(b) apply. This means that an increase in the carrying capacity of I-95 will require that this project come from a Congestion Management System (CMS) which meets the requirements of 23 CFR 500.

Any expansion projects that might be recommended as a result of this feasibility study will need to be vetted through the metropolitan planning process and included in the respective MPO's transportation plan/TIP and ConnDOT's statewide transportation improvement program (STIP).

The National Environmental Policy Act (NEPA) and its state counterpart, the Connecticut Environmental Policy Act (CEPA) require that the applicable environmental documentation include an air quality analysis of the regional and project level impacts associated with any proposed improvements. In addition, any new interchange service, or any new highway on a new location, or any new lane, greater than a mile in length and connecting either signalized intersections or expressway interchanges will require an Indirect Source Permit from CTDEP.

4.2.13 Noise

The study corridor is typical of developed urban and suburban locations. Noise is generated by traffic on major arterial roadways, the Interstate highway, local streets to a lesser degree, and from other non-transportation sources. Within the study corridor, infrequent contributions of noise can be expected from other transportation modes such as rail. The Federal Highway Administration provides noise criteria and guidance at 23 CFR 772 (*Procedures for Abatement of Highway Traffic Noise and Construction Noise*). FHWA's noise regulations are applicable to this project because of the proposed increase in the number of through-traffic lanes.

Traffic noise impacts occur when future noise levels approach (within one decibel) or exceed the Noise Abatement Criteria (NAC) for various land uses as shown in Table 4-8 or when the future noise levels exceed the existing noise levels by 15 decibels. All exterior noise levels are recorded and predicted as Leq(h) dBA. This represents the equivalent steady-state sound level which in a stated period of time (h) contains the same acoustic energy as the time-varying sound level during the same period, commonly shortened to "Leq". This descriptor closely approximates normal human hearing response. The primary consideration in abating traffic noise impacts is given to exterior activities such as residences, churches and hospitals.

Table 4-8
FHWA Noise Abatement Criteria (NAC) Hourly A-Weighted Sound Level – decibels (dBA)*

Activity Category	Leq(h)	L10(h)	Description of Activity Category
A	57 (Exterior)	60 (Exterior)	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B	67 (Exterior)	70 (Exterior)	Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries, and hospitals.
C	72 (Exterior)	75 (Exterior)	Developed lands, properties, or activities not included in Categories A or B above.
D	--	--	Undeveloped lands.
E	52 (Interior)	55 (Interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums.

* Either L10(h) or Leq(h) (but not both) may be used on a project.

Noise analysis for this feasibility study will focus on a qualitative noise impact review for project alternatives. Potentially noise-sensitive areas are shown in Figure 5-2 (Sheets 1 to 124) of this study. Additional traffic noise impact analysis will be required to meet federal (NEPA) and state (CEPA) environmental documentation requirements. The components of a traffic noise study include:

- Identification of existing land use activities and existing noise levels
- Prediction of future noise levels (design year 2025) using traffic volumes for the no-build and build conditions
- Determination of traffic noise impacts
- Determination of the feasibility/cost effectiveness and reasonableness of noise abatement

The governing factor for identifying a traffic noise impact on a lane addition project is usually not the incremental noise increase, but the total noise level of the final facility. The traffic noise analysis would show a comparison between the future traffic noise levels for the expanded facility and the "no-build" alternative for the design year.

Traffic noise is influenced by traffic volumes, travel speed and vehicle type mix, and roadway elevations relative to the locations evaluated. The noise climate of any potentially affected location can be improved or worsened based upon these variables. A three decibel change in the noise climate is the smallest change detectable by the average human ear.

If traffic noise impact(s) are identified and traffic noise abatement measures are required, the abatement measures would weigh the benefits, costs, and overall social, economic and environmental effects. Abatement is considered only where frequent human activity occurs and a beneficial (seven decibels or greater) reduction in noise levels can be achieved. For noise barriers to be effective they must be of sufficient unbroken length and the height should break the line-of-sight from the receptor (at approximately five feet above the ground) to the roadway. Abatement measures that are found to be reasonable and feasible must be incorporated into the project and considered as part of the proposed project. In determining the feasibility, reasonableness and cost effectiveness for providing noise abatement, the following criteria, pursuant to Connecticut Department of Transportation's 1997 *Highway Traffic Noise Impact Analysis and Abatement Policies and Procedures*, are applied:

- The neighborhood is within 300 feet of the nearest travel lane of the highway
- The neighborhood must approach or exceed the FHWA NAC of 67 dBA Leq(h)
- A noise barrier would provide at least a seven decibel reduction in the noise climate of the neighborhood at the middle of the barrier system
- The cost of a barrier system must meet the cost/residence index of $50,000 per residence

Another noise consideration is construction noise, which would be temporary. Construction equipment would be in operation proximate to the structures abutting the I-95 corridor, but the activities would be of short duration. Construction phase activities such as pile driving would increase noise levels throughout the project area. Contractors would be required to take measures to control the noise intensity caused by construction operations and equipment, including but not limited to equipment used for drilling, pile driving, blasting, excavation or hauling. All methods and devices employed to minimize noise would be subject to the continuing approval of ConnDOT. The maximum allowable level of noise at the nearest residence or occupied building should not exceed 90 decibels on the "A" weighted scale (dBA). Any operation that exceeds this standard would cease until a different construction methodology was developed to allow the work to proceed within the 90 dBA limit.

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5
Improvement Concepts Analysis

This chapter presents the potential improvement concepts that were investigated to address the transportation-related deficiencies along the I-95 corridor that were presented in Chapters 2 and 3 of this report. The overall feasibility, derived benefits, construction costs and impacts were evaluated for each of these improvement concepts. The following sections will include discussion regarding these potential improvements which include transit enhancements, mainline capacity improvements and interchange and intersection improvements within the study area. Recommended improvements have been developed with input from the study advisory committee, affected regional planning agencies and municipalities, the Transportation Strategy Board and the general public.

5.1 Future Demand vs. Capacity

Traffic demand along the I-95 corridor within the study area is projected to increase by approximately 43% in the peak hour between 2002 and 2025. Table 5-1 illustrates the effects of this increase on the existing I-95 roadway mainline sections by comparing the existing and future levels of service (LOS) for each of the mainline sections.

As Table 5-1 shows, approximately 35% of the northbound and southbound sections experience operational deficiencies at LOS E or LOS F in the 2002 existing condition. By 2025, this percentage will increase to approximately 80% if existing travel trends and roadway conditions do not change and existing capacity is maintained. This level of congestion translates into potentially significant delays for motorists using the I-95 corridor.

Table 5-1
Comparative Levels of Service for Freeway Sections – Existing vs. 2025 No-Build Conditions

Section		Northbound				Southbound			
		2002 Existing Condition		2025 No-Build Condition		2002 Existing Condition		2025 No-Build Condition	
From	To	V/C	LOS	V/C	LOS	V/C	LOS	V/C	LOS
Exit 54	Exit 55	0.84	F	1.18	F	0.80	F	1.03	F
Exit 55	Exit 56	0.83	F	1.17	F	0.79	F	0.98	F
Exit 56	Exit 57	0.80	D	1.13	F	0.77	D	0.93	F
Exit 57	Exit 58	0.78	D	1.10	F	0.76	D	0.93	F
Exit 58	Exit 59	0.73	D	1.03	F	0.72	D	0.93	F
Exit 59	Exit 60	0.70	D	0.99	F	0.66	D	0.83	F
Exit 60	Exit 61	0.75	D	1.05	F	0.69	D	0.88	F
Exit 61	Exit 62	0.70	D	0.99	F	0.61	D	0.81	F
Exit 62	Exit 63	0.69	D	0.98	F	0.62	D	0.84	F
Exit 63	Exit 64	0.67	D	0.94	F	0.60	D	0.83	F
Exit 64	Exit 65	0.65	D	0.92	F	0.61	D	0.85	F
Exit 65	Exit 66	0.63	D	0.89	F	0.56	D	0.78	E
Exit 66	Exit 67 (Elm St)	0.60	D	0.86	E	0.54	C	0.75	E
Exit 67 (Elm St)	Exit 67 (Rte 154)	---	---	---	---	0.57	D	0.85	F
Exit 67 (Rte 154)	Exit 68	0.60	D	0.85	E	0.51	C	0.70	E
Exit 68	Exit 69	0.48	E	0.68	F	0.65	D	0.89	F
Exit 69	Exit 70	0.45	C	0.63	D	0.41	C	0.55	C
Exit 70	Exit 71	0.78	E	1.11	F	0.74	E	1.03	F
Exit 71	Exit 72	0.83	E	1.17	F	0.77	E	1.07	F
Exit 72	Exit 73	0.80	E	1.14	F	0.76	E	1.06	F
Exit 73	Exit 74	0.79	E	1.12	F	0.79	E	1.10	F
Exit 74	Exit 76	0.85	E	1.23	C[1]	0.82	E	1.18	D[1]
Exit 76	Exit 81	0.72	D	1.10	D[1]	0.77	E	1.18	D[1]
Exit 81	Exit 82	0.75	D	1.19	F	0.82	E	1.27	F
Exit 82	Exit 82A	0.86	E	1.24	F	1.01	F	1.40	F
Exit 82A	Exit 83	0.53	F	0.74	F	0.76	F	1.08	F
Exit 83	Exit 84	0.51	F	0.70	F	0.47	F	0.66	F
Exit 84	Exit 85	0.50	C	0.71	E	0.53	D	0.74	E
Exit 85	Exit 86	0.66	F	0.94	F	0.56	D	0.78	E
Exit 86	Exit 87 (Rte 1)	0.51	C	0.75	E	0.56	C	0.79	E
Exit 87 (Rte 1)	Exit 87 (Rte 349)	---	---	---	---	0.47	C	0.62	D
Exit 87 (Rte 349)	Exit 88	0.66	D	0.95	F	0.52	C	0.73	E
Exit 88	Exit 89	0.60	D	0.87	F	0.48	C	0.67	D
Exit 89	Exit 90	0.83	E	1.21	F	0.69	D	0.99	F
Exit 90	Exit 91	0.70	D	1.04	F	0.54	C	0.76	E
Exit 91	Exit 92	0.56	C	0.85	E	0.43	C	0.64	D
Exit 92	Exit 93	0.45	C	0.70	D	0.33	B	0.48	C
Exit 93	State Line	0.47	C	0.72	D	0.35	B	0.52	C

Note: Some existing condition sections were omitted because a direct comparison could not be made to a section in the 2025 no-build condition. The best corresponding existing section was used for a basis of comparison.

1 LOS for 2020 taken from Administrative Final Environmental Impact Statement "Route 11 Corridor" dated December 5, 2002.

5.2 Alternatives to Reduce Demands

When the delays experienced by motorists become significant enough to affect typical travel behaviors, one or more of the following mechanisms is usually triggered to naturally reduce traffic demands on an interstate facility:

- Peak spreading – i.e. motorists alter typical travel times to avoid congested periods
- Motorists divert to alternate routes in the region
- Motorists divert to alternate modes of transportation where available
- Motorists decide not to travel

Experience has shown that motorists, in general, will not decide to forego travel plans in order to avoid traffic congestion. Therefore, only the other three mechanisms will be discussed and evaluated for their potential to effectively reduce demands in the I-95 corridor.

Peak Spreading

Peak spreading can occur when a corridor experiences defined peak travel periods during the course of a travel day. For example, in areas where the peak periods are defined by heavy volumes of commuter traffic, motorists can adjust their morning and evening travel times to avoid the heaviest periods of congestion. When significant numbers of motorists resort to traveling "off-peak," the duration of the peak period increases. Conversely, the magnitude of the peak traffic volume decreases as does the average delay experienced along the corridor. This is peak spreading.

The I-95 corridor, as described in the *1999 Southeastern Connecticut Corridor Study*, exhibits several traffic patterns unique to the corridor that prevent effective peak spreading from occurring. The peak daily travel period begins in the early morning and continues throughout the day until late in the evening. This is particularly true in the summer months when there is no mid-day decline in traffic volumes. In addition, weekly peak periods occur on Friday evening in the northbound direction and on Sunday in the southbound direction. These high volume patterns are indicative of a combination of though-State, recreational, and commuter traffic, as opposed to the more common pattern of predominantly local commuter traffic. Because it would be difficult for motorists to alter their travel times to avoid these long and unusual peak periods, peak spreading is not an effective mechanism for reducing demand within the I-95 corridor.

Alternate Routes – US Route 1

The main alternative travel route for northbound (eastbound) and southbound (westbound) traffic in the southern Connecticut region is US Route 1. This roadway primarily serves local, commercial and recreational traffic and is characterized in many locations by high density commercial development along the route. The route is also characterized by heavy traffic volumes and congestion, frequent traffic signals and high accident rates in many areas.

The *1999 Southeastern Connecticut Corridor Study* examined the traffic conditions along US Route 1 and concluded that this roadway exhibits daily and weekly traffic patterns similar to the I-95 corridor. As a result, motorists choosing to divert to US Route 1 during peak periods of congestion along I-95 would experience similar congested conditions on US Route 1. For this reason, US Route 1 is an unlikely alternative route to I-95 and is a non-factor in reducing traffic demands on the interstate.

Alternate Modes – *Transit Service Enhancements Analysis*

As part of this study, an in-depth evaluation of potential transit service enhancements in the I-95 corridor was conducted. The purpose of this evaluation was to determine whether local and regional transit improvements could effectively reduce peak traffic demands on the I-95 mainline. Transit enhancements that were considered included:

- Extension of Shore Line East (SLE) service east to Westerly, RI including new seasonal stops in Mystic and Niantic, and additional weekday and weekend service
- Expansion of Commuter Connection bus service in New Haven in conjunction with SLE
- Additional trips on the DATTCO commuter bus service between Hartford and Old Saybrook
- Additional service on CT Transit Route S between Old Saybrook and New Haven
- New bus service between Madison and Old Saybrook to complement existing Shoreline Shuttle service
- New regional bus service between New London and Hartford via Norwich and Colchester offering rail and bus connections north of Hartford and east of New London

The complete evaluation of these enhancements is included in the *Transit Service Enhancements Analysis* located in the appendix of this report. The overall analysis concluded that the transit service enhancements listed above could divert less than one percent of the peak hour vehicle-miles traveled on I-95 to a combination of existing and enhanced transit services. Essentially, this level of diversion, which equates to less than one year's traffic growth, would provide minimal relief of the peak hour congestion in 2025. The conclusions drawn from the analysis do however suggest that benefits derived from transit service enhancements in southeastern Connecticut should be considered an important component of the overall transportation improvements in the corridor. These enhancements could serve as a possible means of maintaining mobility through the corridor during construction of the recommended roadway improvements to be discussed in subsequent sections of this report.

5.3 Mainline Improvement Concepts to Increase Capacity

The information presented in the previous sections demonstrates that no mechanism or combination of mechanisms will sufficiently reduce the future traffic demands in the I-95 corridor such that acceptable levels of service (LOS) will be attained in the design year with the roadway as currently configured. As a result, it will be necessary to increase the capacity of the overall corridor in areas where deficient LOS exists in order to meet the 2025 traffic demands. This will require widening of the corridor to accommodate the addition of a third travel lane in the northbound and southbound directions.

The need to expand the existing facility is supported not only by the analyses performed under this study, but also by the recommendations outlined in the *1999 Southeastern Connecticut Corridor Study*. The conclusions drawn in that report mandated that an I-95 corridor study be performed to assess the physical and economical feasibility of providing a third travel lane along I-95 between Branford and the Rhode Island state line.

5.3.1 Approach to Mainline Widening Analysis

Analysis of the mainline widening improvement concept was approached by the study team in three basic steps. The first step was to identify, using the results from the future conditions analysis in Chapter 3, the mainline sections within the study area that will exhibit an unacceptable LOS in the 2025 design hour and will therefore require additional capacity. The next step was to develop design criteria for the conceptual typical section and develop strategies for implementing the widening in each of the mainline sections. The final step in the process was to assess the overall feasibility, economic cost, environmental impacts and overall transportation benefits associated with the widening in each of the mainline sections.

5.3.2 Locations Warranting Additional Capacity

The existing cross section along the I-95 corridor between Exit 54 in Branford and the Rhode Island state line is typically two lanes in both the northbound and southbound directions. In certain areas, however, the existing typical section consists of three or more travel lanes in each direction. These areas are located between Exit 69 and Exit 70, including the Baldwin Bridge, and between Exit 83 and Exit 88, including the Gold Star Bridge. The area located between Exit 74 and Exit 81 currently consists of two-lane sections in each direction. However, for the purposes of this study, it was assumed the Route 11 project currently planned for this area would be completed prior to the construction of any future widening projects. The Route 11 project when completed will provide three lanes in each direction through this area.

The initial step in the mainline analysis process considered all existing two-lane sections of I-95 with unacceptable LOS E or F in the design hour potential candidates for mainline widening to three lanes. Existing sections with three or more travel lanes were not considered candidates for widening, despite the fact that some of these sections exhibit unacceptable LOS in the design hour. Table 5-2 summarizes the freeway section analysis for the 2025 no-build condition showing the future LOS for each mainline section.

Table 5-2
Freeway Section Analysis — Summary of 2025 No-Build Conditions

Section		Terrain	Number of Lanes	Peak Hour	Level of Service	2025 Volumes (vph)[1]
From	To					
Northbound						
Exit 54	Exit 55	Level	2	PM	F	5,200
Exit 55	Exit 56	Level	2	PM	F	5,160
Exit 56	Exit 57	Level	2	PM	F	4,960
Exit 57	Exit 58	Level	2	PM	F	4,820
Exit 58	Exit 59	Level	2	PM	F	4,510
Exit 59	Exit 60	Rolling	2	PM	F	4,370
Exit 60	Exit 61	Rolling	2	PM	F	4,640
Exit 61	Exit 62	Rolling	2	PM	F	4,350
Exit 62	Exit 63	Rolling	2	PM	F	4,300
Exit 63	Exit 64	Rolling	2	PM	F	4,150
Exit 64	Exit 65	Rolling	2	PM	F	4,040
Exit 65	Exit 66	Rolling	2	PM	F	3,910
Exit 66	Exit 67 (Elm St)	Rolling	2	PM	E	3,780
Exit 67 (Rte 154)	Exit 68	Rolling	2	PM	E	3,760

Table 5-2
Freeway Section Analysis — Summary of 2025 No-Build Conditions

Section		Terrain	Number of Lanes	Peak Hour	Level of Service	2025 Volumes (vph)[1]
From	To					
Exit 68	**Exit 69**	**Rolling**	**3**	**PM**	**F[2]**	**4,710**
Exit 69	Exit 70	Rolling	4	PM	D	5,770
Exit 70	**Exit 71**	**Rolling**	**2**	**PM**	**F**	**4,870**
Exit 71	**Exit 72**	**Rolling**	**2**	**PM**	**F[2]**	**5,150**
Exit 72	**Exit 73**	**Rolling**	**2**	**PM**	**F**	**5,010**
Exit 73	**Exit 74**	**Rolling**	**2**	**PM**	**F**	**4,940**
Exit 74	Exit 76	Rolling	3[3]	PM	C[3]	5,410
Exit 76	Exit 81	Rolling	3[3]	PM	D[3]	4,840
Exit 81	**Exit 82**	**Rolling**	**2**	**PM**	**F**	**5,230**
Exit 82	**Exit 82A**	**Rolling**	**2**	**PM**	**F**	**5,440**
Exit 82A	**Exit 83**	**Rolling**	**3**	**PM**	**F[2]**	**5,090**
Exit 83	**Exit 84**	**Rolling**	**4**	**PM**	**F**	**6,440**
Exit 84	**Exit 85**	**Rolling**	**5**	**PM**	**E**	**8,140**
Exit 85	**Exit 86**	**Rolling**	**3**	**PM**	**F**	**6,520**
Exit 86	**Exit 87**	**Rolling**	**3**	**PM**	**E**	**5,170**
Exit 87	**Exit 88**	**Rolling**	**3**	**PM**	**F**	**6,570**
Exit 88	**Exit 89**	**Rolling**	**3**	**PM**	**F**	**6,020**
Exit 89	**Exit 90**	**Rolling**	**2**	**PM**	**F**	**5,330**
Exit 90	**Exit 91**	**Rolling**	**2**	**PM**	**F**	**4,570**
Exit 91	**Exit 92**	**Rolling**	**2**	**PM**	**E**	**3,720**
Exit 92	Exit 93	Rolling	2	PM	D	3,080
Exit 93	State Line	Rolling	2	PM	D	3,160
Southbound						
Exit 54	**Exit 55**	**Level**	**2**	**PM**	**F**	**4,520**
Exit 55	**Exit 56**	**Level**	**2**	**PM**	**F**	**4,330**
Exit 56	**Exit 57**	**Level**	**2**	**PM**	**F**	**4,110**
Exit 57	**Exit 58**	**Level**	**2**	**PM**	**F**	**4,110**
Exit 58	**Exit 59**	**Level**	**2**	**PM**	**F**	**4,070**
Exit 59	**Exit 60**	**Rolling**	**2**	**PM**	**F**	**3,660**
Exit 60	**Exit 61**	**Rolling**	**2**	**PM**	**F**	**3,890**
Exit 61	**Exit 62**	**Rolling**	**2**	**PM**	**F**	**3,580**
Exit 62	**Exit 63**	**Rolling**	**2**	**PM**	**F**	**3,710**
Exit 63	**Exit 64**	**Rolling**	**2**	**PM**	**F**	**3,640**
Exit 64	**Exit 65**	**Rolling**	**2**	**PM**	**F**	**3,720**
Exit 65	**Exit 66**	**Rolling**	**2**	**PM**	**E**	**3,430**
Exit 66	**Exit 67 (Elm St)**	**Rolling**	**2**	**PM**	**E**	**3,290**
Exit 67 (Elm St)	**Exit 67 (Rte 154)**	**Rolling**	**2**	**PM**	**F**	**3,720**
Exit 67 (Rte 154)	**Exit 68**	**Rolling**	**2**	**PM**	**E**	**3,100**
Exit 68	**Exit 69**	**Rolling**	**2**	**PM**	**F[2]**	**3,910**
Exit 69	Exit 70	Rolling	4	PM	C	5,030
Exit 70	**Exit 71**	**Rolling**	**2**	**PM**	**F**	**4,510**
Exit 71	**Exit 72**	**Rolling**	**2**	**PM**	**F[2]**	**4,720**
Exit 72	**Exit 73**	**Rolling**	**2**	**PM**	**F**	**4,680**
Exit 73	**Exit 74**	**Rolling**	**2**	**PM**	**F**	**4,820**
Exit 74	Exit 76	Rolling	3[3]	PM	D[3]	5,180
Exit 76	Exit 81	Rolling	3[3]	PM	D[3]	5,190

Table 5-2
Freeway Section Analysis — Summary of 2025 No-Build Conditions

Section		Terrain	Number of Lanes	Peak Hour	Level of Service	2025 Volumes (vph)[1]
From	To					
Exit 81	**Exit 82**	**Rolling**	**2**	**PM**	**F**	**5,600**
Exit 82	**Exit 82A (Frontage Rd)**	**Rolling**	**2**	**PM**	**F[2]**	**6,180**
Exit 82A (Frontage Rd)	**Exit 83**	**Rolling**	**2**	**PM**	**F**	**4,730**
Exit 83	**Exit 84**	**Rolling**	**4**	**PM**	**F**	**6,080**
Exit 84	**Exit 85**	**Rolling**	**5**	**PM**	**E**	**8,480**
Exit 85	**Exit 86**	**Rolling**	**4**	**PM**	**E**	**7,180**
Exit 86	**Exit 87 (Rte 1)**	**Rolling**	**3**	**PM**	**E**	**5,430**
Exit 87 (Rte 1)	Exit 87 (Rte 349)	Level	3	PM	D	4,280
Exit 87 (Rte 349)	**Exit 88**	**Rolling**	**3**	**PM**	**E**	**5,040**
Exit 88	Exit 89	Rolling	3	PM	D	4,630
Exit 89	**Exit 90**	**Rolling**	**2**	**PM**	**F**	**4,350**
Exit 90	**Exit 91**	**Rolling**	**2**	**PM**	**E**	**3,330**
Exit 91	Exit 92	Rolling	2	PM	D	2,800
Exit 92	Exit 93	Rolling	2	PM	C	2,090
Exit 93	State Line	Rolling	2	PM	C	2,290

Note: Boldface entries denote capacity deficiencies during the peak period.
1 vph – vehicles per hour, including all vehicle types (e.g. passenger cars, trucks, motorcycles, etc.)
2 Weaving area
3 Number of lanes and LOS for 2020 taken from Administrative Final Environmental Impact Statement "Route 11 Corridor" dated December 5, 2002.

As shown in Table 5-2, all northbound and southbound sections located between Exit 54 in Branford and Exit 92 in North Stonington, excluding the existing three-lane sections, operate at LOS E or F in 2025 assuming no widening is performed to accommodate the future traffic demands. Based on the results of this analysis, all of these sections were identified as sections warranting additional capacity.

The northbound and southbound sections of I-95 north of Exit 92 to the Rhode Island state line operate at an acceptable LOS in the design hour. Therefore, these sections will not be widened and will remain two lanes in each direction.

5.3.3 Engineering Considerations for Widening

The next step in the mainline analysis process was to develop design criteria for the widened typical section. Once the dimensions of the conceptual typical section were determined, the study team developed strategies for implementing the widening in each of the mainline sections that have an identified need for additional capacity.

Typical Roadway Cross Section

Figure 5-1 illustrates the typical six-lane cross sections that were utilized to evaluate the feasibility of the mainline widening concept. The two cross sections that are presented apply to each of the two basic strategies that were employed to accommodate the additional lane. These two strategies, which are shoulder widening and median widening, will be discussed in further detail below.

The typical cross sections were designed to meet or exceed *1999 Connecticut Highway Design Manual* (HDM) and 2001 AASHTO design standards for travel lane widths and clear zone widths. The recommended mainline travel lane width is 12 feet. The minimum desirable clear zone width is 30 feet for a typical 1:4 side slope with no guiderail.

The minimum inside and outside shoulder width recommended in the HDM for a three-lane facility with high truck volumes is 12 feet. However, for the purposes of this study, the Connecticut Department of Transportation (ConnDOT) recommended the use of a 14 foot shoulder width along the entire I-95 corridor within the study area, including along the existing three-lane sections. The additional shoulder width is intended to ensure public safety during an incident management situation by facilitating the unimpeded response of emergency vehicles. In addition, the 14 foot shoulder width will aid traffic flow during normal maintenance operations conducted along the roadway.

ConnDOT also recommended a 10 foot wide concrete median barrier be provided in areas where positive barrier protection is needed for the separation of northbound and southbound traffic. The 10 foot barrier is designed to accommodate bridge piers, overhead lighting poles and overhead sign structures within the limits of the barrier without the need to locally reduce the shoulder width in order to provide for these features.

Shoulder Widening

One strategy utilized by the study team for incorporating the mainline widening improvement concept was *shoulder widening*. This strategy refers to the provision for widening beyond the outside shoulder of the existing roadway cross section. Shoulder widening can potentially cause significant impacts to abutting right-of-way and building structures, environmental resources and adjacent roadway facilities, including interchange ramps and frontage roads. This course of action was considered only where the existing median width can not accommodate widening into the median.

The shoulder widening strategy was implemented in two distinct geographical areas along the I-95 corridor. These areas will be referred to throughout the remaining text as Area 1 and Area 2 (Area 3 is another distinct geographical area that will be discussed separately below). Area 1 is geographically defined as the section of roadway located between the southern project limit at Exit 54 in Branford and the Connecticut River just north of Exit 69 in Old Saybrook. This portion of roadway typically consists of two northbound and southbound lanes separated by an existing concrete median barrier. Area 2 is geographically defined as the section of I-95 located between the Connecticut River just south of Exit 70 in Old Lyme and the Thames River near Exit 84 in New London. This portion of roadway typically consists of two northbound and southbound lanes separated by a narrow grassed median.

Because the existing median in Areas 1 and 2 is relatively narrow, it was necessary to accommodate the mainline widening beyond the outside shoulder utilizing the shoulder widening strategy.

Median Widening

Where there is sufficient space in the existing median to accommodate the additional pavement width for the mainline widening improvement concept, a *median widening* strategy was used. This strategy refers to the provision for widening beyond the inside shoulder into the median of the existing roadway cross section. Median widening typically causes no impacts to abutting right-of-way since the median space is owned by the State of Connecticut. Impacts to adjacent interchange ramps and frontage roads are also minimal when this strategy is utilized.

The median widening strategy was implemented in Area 3 along the I-95 corridor. Area 3 is geographically defined within the study corridor as the section of roadway located between the Thames River just south of Exit 85 and the northern project limit at the Rhode Island state line. This portion of roadway typically consists of two northbound and southbound lanes separated by a relatively wide natural median.

Other Engineering Considerations

Several other major components of the overall design strategy were considered independent of which widening strategy was employed to accommodate the mainline widening typical section. General design assumptions were developed to establish a consistent design approach to the feasibility analysis. A brief discussion of the other major engineering considerations and design assumptions used by the study team to complete the feasibility analysis is provided below:

- **Bridge Structures** – The three major multi-span structures and their approaches, including the Baldwin Bridge over the Connecticut River, the Gold Star Bridge over the Thames River and the Groton Reservoir structure, will not require any modification because these structures currently carry six or more travel lanes. The Leetes Island Road structure at Exit 56, which was recently reconstructed in 2003, and the Cross Road structure at Exit 81, which is currently under construction and scheduled for completion in 2005, also will not require any modification because these overpass structures provide sufficient vertical and lateral clearance to accommodate the widened section. In addition, it was assumed that several structures located in Areas 2 and 3 will not require any modification because these structures currently overpass existing six-lane sections of I-95. All other major bridge structures and box culverts affected by the mainline widening were assumed to be completely reconstructed for purposes of estimating construction costs and impacts associated with the widening concept. This assumption provides a worst-case scenario for likely structure costs to be incurred when the widened facility is constructed. A summary table presenting the locations and areas of all the affected bridge structures is provided in the appendix.

- **Cut and Fill Slopes** – Typical cut and fill slopes as recommended in the HDM were used to determine slope limits for the mainline widening concepts along the I-95 corridor. Fill slopes range from 1:6 (V:H) to a maximum of 1:2 depending on the height of the fill section. Earth cut slopes beyond the clear zone are a maximum of 1:2. Rock cut slopes, assumed to be 2:1, were used solely in major rock cut areas. Although significant portions of the existing corridor utilize curb and guiderail to reduce slope impacts, it was assumed for purposes of determining conservative slope limits and associated environmental and right-of-way impacts that modifications to the typical slope treatments would be limited. However in some particularly sensitive and constrained areas, 1:2 fill slopes and retaining wall structures were utilized to prevent impacts to abutting properties and environmental resources. Future design phases will consider the use of curb, guiderail, steeper slopes and retaining walls in all environmentally sensitive and physically constrained areas to help minimize the impacts associated with the mainline widening concept.

- **Widening of Existing Shoulders** – The existing sections with three or more travel lanes in each direction typically have four foot inside and 10 foot outside shoulders. Because the recommended typical section utilizes 14 foot shoulders, it was assumed that these areas would be reconstructed to incorporate the wider shoulder widths to provide continuity through the study corridor. It was also assumed that this reconstruction would include full-depth reconstruction of the mainline lanes as well as the shoulders in order to provide a conservative cost estimate for likely future rehabilitation needs when the widened shoulders are implemented. Future design phases will consider pavement recycling and other cost-effective pavement rehabilitation strategies to help minimize the overall costs associated with this work.
- **Environmental Resources** – Impacts to environmental resources, including freshwater and field wetlands, tidal wetlands, water bodies, and socio-economic and cultural resources, are important considerations in evaluating the feasibility of the mainline widening improvement concept. Locations of all pertinent environmental resources located within the study area were previously identified in Chapter 4. A qualitative and quantitative evaluation of the impacts to these resources will be presented in Section 5.3.4.
- **Land Use** – Impacts to abutting properties and building structures are also important considerations in evaluating the feasibility of the mainline widening improvement concept. A qualitative evaluation of the impacts to the adjacent land uses will be presented in Section 5.3.4. In addition, an estimate of the right-of-way impact areas and costs associated with the entire project will be presented and discussed in further detail in Section 5.6.
- **Route 11 Construction** – It is anticipated that the planned Route 11 improvements will be in place prior to the implementation of the mainline widening concept. This project, which is currently undergoing environmental review, includes the reconstruction of the I-95/I-395/Route 11 interchange located between Exit 74 and Exit 81 in the towns of East Lyme and Waterford. The widened section matches the six lane section along I-95 that is proposed under the Route 11 project in this area.
- **Rest Areas/Weigh Stations** – Several public rest areas and state police-operated weigh stations are located within the study area. Where possible, access to these facilities has been maintained in conjunction with the mainline widening. However, where it was not possible to maintain the existing facility, a potential alternate site for the facility has been recommended. Impacts to the existing rest areas and weigh stations are evaluated in Section 5.3.4.
- **Park and Ride Lots** – An inventory conducted by ConnDOT identified 19 existing Park and Ride facilities at 18 interchanges within the study corridor. In conjunction with this inventory, ConnDOT also identified potential sites for future lots to both mitigate impacts to existing spaces caused by the recommended improvements and to provide for expansion of the Park and Ride program. Impacts to the existing Park and Ride facilities and the recommended sites for new lots are presented in Section 5.4.
- **Interchange Improvements** – In areas where a shoulder widening strategy was implemented to accommodate the mainline widening concept, significant modifications to the mainline and ramp connections were necessary to match the outside edge of the additional travel lane. Other geometric improvements including provisions for standard acceleration and deceleration lanes were provided in all interchange locations in conjunction with the mainline capacity improvements. Interchange improvements are discussed and presented in detail in Section 5.4.

5.3.4 Analysis of Mainline Widening Concept

The final step in the mainline analysis process was to assess the overall feasibility, environmental impacts, transportation benefits and construction costs associated with the widening concept. The overall feasibility and environmental impacts are discussed in this section. A detailed cost analysis showing the estimated roadway, bridge, right-of-way and environmental mitigation costs for each mainline section is presented in Section 5.6. Interchange improvements and their associated impacts and costs will be presented and discussed in detail in Section 5.4.

5.3.4.a Overall Feasibility

Figure 5-2 (Sheets 1 to 124) presents the mainline widening concept overlaid on 200-scale existing aerial mapping of the I-95 corridor within the study area (Figure 5-2i (Sheets 1 to 4), which precedes Figure 5-2, provides a sheet index). Bridge structures, cut and fill slope limits, wetlands and approximate existing right-of-way boundaries are also shown. In general, the mainline widening improvement concept can be accommodated within the existing I-95 right-of-way in all three major geographic areas. This means minimal amounts of additional rights-of-way would need to be acquired in order to accommodate the mainline widening improvements. In isolated areas where the approximate slope limits extend beyond the existing right-of-way boundaries, it is likely additional refinements of the side slope and edge treatments during final design could minimize or eliminate right-of-way impacts in some of these areas.

5.3.4.b Area 1 – Exit 54 to Connecticut River (Exit 69)

The mainline in Area 1 typically consists of two northbound and southbound lanes separated by an existing concrete median barrier. The inside and outside shoulders, which are approximately 12 feet wide, were upgraded under previous safety improvement projects completed in this section. The section of roadway located within the Exit 69 interchange area and terminating at the Baldwin Bridge consists of three travel lanes in each direction. The conceptual typical section with a 10 foot wide median barrier and 14 foot wide shoulders is transitioned through this area to match the existing cross section at the bridge.

As discussed previously, mainline widening is accommodated beyond the outside shoulder in this section due to the absence of available space in the median. The overall increase in roadway width to provide six travel lanes and 14 foot shoulders is approximately 40 feet. That is, approximately 20 feet of new pavement is required beyond the outside shoulders of both the northbound and southbound lanes. In addition, 45 bridge structures require replacement to provide sufficient width, or sufficient vertical and lateral clearance, to accommodate the mainline widening. Four major culverts also require replacement to accommodate the widening.

Access ramps to two rest areas located on the northbound and southbound sides of I-95 between Exit 61 and Exit 62 in the Town of Madison are maintained so that operations at both areas are relatively unaffected by the widening. Access to the Welcome Center located on the southbound side of I-95 between Exit 65 and Exit 66 in the Town of Westbrook can not be maintained due to site constraints at its existing location.

Environmental Evaluation – Area 1

(Note: For simplicity in reporting areas of impacts and for consistency with the presentation of recommended improvement concepts, the environmental impacts along the mainline sections are presented with the analysis of the mainline widening improvement concept in this section of the report. The environmental impacts within the interchange areas are presented with the analysis of the interchange improvement concepts in Section 5.4.3. A summary of environmental impacts in both the mainline and interchange areas is presented in Section 5.5.)

Environmental impacts associated with the mainline sections in Area 1 are provided below. Impacts are summarized in Table 5-3 and described in more detail for each section. Wetland impacts from the proposed widening total almost 16 acres, 15.6 acres of freshwater and 0.4 acres of tidal wetlands. Eighteen perennial and five intermittent streams are crossed by the highway and construction impacts such as culverting and stream relocation can be expected. Four of the sections contain state-listed threatened or endangered plant or animal species that were identified by CTDEP. As the widening can generally be accommodated within the existing right-of-way, no major land takings or impacts to structures or properties are anticipated.

Table 5-3
Environmental Impact Summary for Area 1

Section		Wetland Impacts (Acres)		Stream Impacts		Threatened & Endangered Species
From	To	Freshwater	Tidal	Perennial	Intermittent	
Exit 54	Exit 55	2.0	0	2	0	none
Exit 55	Exit 56	0.0	0	1	0	none
Exit 56	Exit 57	4.4	0	5	0	none
Exit 57	Exit 58	0.0	0	0	0	none
Exit 58	Exit 59	0.4	0	0	0	none
Exit 59	Exit 60	0.2	0.3	1	0	state threatened/special concern birds
Exit 60	Exit 61	0.5	0	0	0	none
Exit 61	Exit 62	0.6	0	1	1	none
Exit 62	Exit 63	1.7	0	3	3	none
Exit 63	Exit 64	2.4	0.1	1	1	state special concern plant
Exit 64	Exit 65	1.9	0	3	0	state special concern invertebrate
Exit 65	Exit 66	0.8	0	0	0	none
Exit 66	Exit 67	0.1	0	0	0	none
Exit 67	Exit 69	0.6	0	1	0	state threatened bird
Totals		**15.6**	**0.4**	**18**	**5**	-

Air quality impacts within Area 1 are expected to be comparable from section to section. During construction, locally elevated levels of air contaminants are expected to occur on a temporary basis due to emissions from internal combustion engines in heavy-duty construction vehicles and equipment, from fugitive dust generated by construction activities, and from wind re-entrainment of dust from any cleared and openly exposed surfaces. The relative extent of resulting impacts will be a function of the number of pieces of equipment in use, the nature of the activities (e.g. clearing, blasting, excavation, grading, etc.), the size of area being cleared and widened at any one time, and the construction duration in any given section. Potential air quality impacts during the post-construction, or "operational," phase of the project are expected to be less than for a no-build condition since the road widening and any interchange reconfigurations should reduce congestion and thereby reduce corresponding vehicle idling and travel times within and through any given section.

Potential noise impacts are evaluated relative to existing conditions in the context of the number and proximity of sensitive receivers, primarily residences, and with due compliance to FHWA noise abatement criteria. Area 1 mainline sections contain 49 potential noise-sensitive areas as shown in Figure 5-2 (Sheets 1 to 124). Effects of this project would vary primarily based on changes in volumes, speed, and alignment between existing, 2025 no-build and 2025 build conditions. While noise levels also depend greatly on the vehicular fleet composition, specifically the heavy vehicle fractions, the project is not likely to materially affect this. Over the length of mainline Area 1, the project may change these noise sensitive parameters near a large number of sensitive receivers, causing increased noise levels, and potentially causing impacts. Of the concerns, speed increases are the most likely to affect sound levels, with changes in proximity due to highway widening being next in importance. Generally, the additional capacity provided by the project would result in greater speeds than in the no-build condition – but the extent and sense of any speed changes from existing conditions (which is the basis for comparison), would vary between sections. Given the nature of the work, noise during construction would be elevated – sometimes materially, but in all cases temporarily. This is an annoyance that is impossible to avoid, but which can be mitigated by adhering to State specifications for equipment, using temporary noise containment structures or barriers, where feasible, providing warning to the community for particularly onerous portions of the work, and controlling work hours.

- **Exit 54 to Exit 55 –** Portions of eight freshwater wetlands, totaling 2.0 acres, would be affected by widening in this section. The existing bridge over the Branford River would be widened by 36 linear feet and the widening would alter 320 linear feet of Pisgah Brook. A total of 1,400 linear feet of floodplain associated with these two water bodies would be impacted along the toe of slope. Approximately 600 feet of this section is within the boundaries of the Coastal Zone although the project would not impact any coastal resources. The Branford River Wildlife Area is a potential Section 4(f) property adjacent to the right-of-way for a distance of 200 feet. It would be unaffected by the proposed widening of I-95. Unsurveyed areas with a high to moderate archeological potential are present in this section. This section contains five potential noise-sensitive areas consisting of four single family residential areas and one townhouse area.
- **Exit 55 to Exit 56 –** Implementation of widening in this section would affect 25 feet of an unnamed, perennial stream. Impacts to other environmental resources would be minimal.
- **Exit 56 to Exit 57 –** Twenty-one freshwater wetlands, including several ponds and unnamed streams on either side of I-95 would sustain a total of 4.4 acres of impacts. Approximately 471 linear feet of stream courses (Hoadley Creek and four unnamed, perennial streams) would be altered and the project would encroach on floodplains along the toes of slope for 900 linear feet of floodplain area that is crossed by the right-of-way. Two community wells are located 500 feet north of I-95 on Granite Road. Numerous Prime and Statewide Important farmland soil areas are encountered but they are in areas already within the existing highway right-of-way. Unsurveyed areas with a high to moderate archeological potential are present in this section. This section contains seven potential noise-sensitive areas consisting of several single family residences.
- **Exit 57 to Exit 58 –** Approximately 130 feet of this section traverses an aquifer protection area (Guilford wellfield) and there are two active farms adjacent to the right-of-way. No impacts are expected to either resource. This section contains two potential noise-sensitive areas consisting of single family residences. Impacts to other environmental resources would be minimal.
- **Exit 58 to Exit 59 –** Roadway widening would have minor impacts (0.4 acres) to portions of three freshwater wetlands. This section also crosses 200 feet of the Guilford wellfield aquifer protection area.

The Guilford Historic Town Center Historic District is adjacent to the south side of the right-of-way for a distance of 1,800 feet, the entire length of the section. No direct impact to the historic district is anticipated. Impacts are limited to potential visual and noise impacts at the southern boundary of the historic district. Two active farms, one on either side of the highway, are adjacent to the right-of-way. Because the widening does not extend beyond the existing right-of-way, no impacts to these resources are expected. This section contains two potential noise-sensitive areas consisting of single family residences.

- **Exit 59 to Exit 60 –** There are three wetlands located along the right-of-way that would be impacted by new construction. Two are tidal wetlands associated with the East River. Approximately 0.3 acres of tidal wetlands and 0.2 acres of freshwater wetlands would be filled to accommodate the widening. The East River, which is tidally influenced, is spanned by 40 feet of the highway and 50 linear feet would also be affected. There are 2,400 feet of floodplain associated with the East River that is crossed by this section. An 8,000 foot portion of the section is within the Coastal Zone. Tidal wetland resources are located on both sides of the right-of-way for a span of approximately 900 feet. Three areas of potential endangered species habitat are found along the section. The areas on the southern (western) end of the section in Guilford contain one threatened and one state special concern bird species. According to CTDEP, neither species should be affected by the project. There is one active farm north of the right-of-way and numerous encounters with Prime and Statewide Important farm land soils. None of these farm resources would be impacted since no construction outside the right-of-way is anticipated. A small portion of the town of Guilford's Dudleytown Historic District is adjacent to the north of the highway. No direct impact to the historic district is anticipated. Impacts are limited to potential visual and noise impacts at the southern boundary of the historic district. Another potential Section 4(f) resource is the East River Wildlife Area, 800 feet of which parallels the north side of the highway. Unsurveyed areas with a high to moderate archeological potential are present in this section.

- **Exit 60 to Exit 61 –** Roadway widening would have minor impacts to portions of two freshwater wetland areas (approximately 0.5 acre). Game Farm Pond is located adjacent and south of the right-of-way and two community wells are located 200 feet south of the right-of-way. Approximately 1,600 feet of this section is located within the Coastal Zone Boundary. This section contains two potential noise-sensitive areas consisting of single family residences to the south.

- **Exit 61 to Exit 62 –** The widening would impact portions of five freshwater wetlands, totaling almost 0.6 acres. Fence Creek and one unnamed intermittent stream are crossed. Approximately 105 linear feet of these watercourses would be affected by proposed construction. The highway crosses the Rettich wellfield aquifer protection area for a distance of 2,000 feet. There are no public wells within 500 feet. The I-95 southbound rest area has been reported in the CTDEP Site Discovery and Assessment and the Leachate and Wastewater Discharge databases. A commercial parcel adjacent to the right-of-way has been reported in the leaking underground storage tank tracking system, the PCB Activity database system, and the FIFRA/TSCA system. This section contains five potential noise-sensitive areas consisting of single family residences.

- **Exit 62 to Exit 63 –** A total of 1.7 acres at 14 wetlands would be affected by the widening. Six unnamed streams would be affected for a total of 315 linear feet of perennial and 280 linear feet of intermittent stream impacts. Approximately 1,000 linear feet of floodplain along the toes of the slope, and 700 feet of the Rettich wellfield aquifer protection area are crossed by the highway. Approximately 6,500 linear feet of the highway is located within the Coastal Zone Boundary. Unsurveyed areas of high to moderate archeological potential that could be directly impacted are present in this section. This section contains seven potential noise-sensitive areas consisting of single family residences.

- **Exit 63 to Exit 64 –** Direct impacts to seven freshwater wetlands (2.4 acres) and two tidal wetlands (0.1 acres) totaling 2.5 acres along this section would result from the highway widening. The existing bridge over the Menunketesuck River would be widened by 40 feet, and 95 linear feet of one unnamed intermittent stream would be affected. Floodplain area (400 linear feet) associated with the river is crossed by the highway. No public water supply wells are within 500 feet of the highway, although the right-of-way crosses 2,000 feet of the Clinton wellfield aquifer protection area. Approximately 4,000 feet of the right-of-way is located within the Coastal Zone Boundary. Three areas of potential endangered species habitat are found along the section. One area includes a state-listed plant of special concern in the area of the Menunketesuck River. According to CTDEP, "the use of best management practices with special attention to erosion and siltation control should prevent indirect negative affects to the species." CTDEP-owned land is adjacent and north of the right-of-way that provides water access to the Menunketesuck River. The areas north and south of current I-95 and west of Menunketesuck River are considered unsurveyed areas of high to moderate archeological potential that could be directly impacted. This section contains eight potential noise-sensitive areas consisting of single family residences.
- **Exit 64 to Exit 65 –** Ten freshwater wetlands totaling 1.9 acres would be affected by the widening. Gatchen Creek is located within the right-of-way and south of the highway. It parallels the highway for a distance of approximately 1,000 feet. Two unnamed perennial streams cross the right-of-way and approximately 460 linear feet of these streams would be affected. Approximately 800 linear feet of floodplain area is located along the toes of slope of the highway. Approximately 3,000 feet of this section is within the Coastal Zone, although no coastal zone resources have been identified within or adjacent to the right-of-way. One active farm is located north of the right-of-way and would be unaffected by the project. A potential Section 4(f) property, the Cockaponset State Forest, is adjacent to the north side of the right-of-way for a distance of 1,000 feet. One area of potential endangered species habitat is found along the section. The area south of the section contains one state special concern invertebrate species. According to CTDEP, the "…invertebrate species is associated with freshwater wetlands. If freshwater wetlands are going to be impacted during the course of improvements in Westbrook this species may be impacted too." Unsurveyed areas of high to moderate archeological potential that could be directly impacted are present in this section. This section contains five potential noise-sensitive areas consisting of single family residences.
- **Exit 65 to Exit 66 –** Portions of four freshwater wetlands (0.8 acres) and one vacant parcel outside the present right-of-way would be impacted by encroachment due to widening the highway. Privately owned open space, the YMCA's Valley Shore facility, is located north of the right-of-way. This section contains one potential noise-sensitive area consisting of single family residences.
- **Exit 66 to Exit 67 –** Roadway widening would have minor impacts to portions of two freshwater wetlands (approximately 0.1 acre). Minor encroachment to almost 1,000 feet of vacant privately owned land occurs south of the right-of-way. Unevaluated architectural resources that could be potentially impacted are located at Hill Road #2 and Elm Street (north side) at Exit 67. This section contains three potential noise-sensitive areas consisting of single family residences.
- **Exit 67 to Exit 69 –** The Exit 68 northbound on-ramp to I-95 and the I-95 southbound off-ramp will be eliminated. New ramps at Exit 67 at Route 154 will replace these ramps. A total of 0.6 acres at six wetlands would be affected by highway widening and reconfiguration. Ragged Rock Creek is crossed by the existing highway; about 30 feet of this waterway would be culverted. Approximately 1,400 feet of the right-of-way is located within the Coastal Zone. One area of potential state threatened species habitat is found along the section. The area south of the highway in Ragged Rock Creek contains a habitat for one state threatened bird species. According to CTDEP, "if Ragged Rock Creek is going to be impacted by

erosion, sedimentation or siltation discharged, or if there are to be polluted runoff such as chemicals or fertilizer discharged into the river, resulting from this project that can contaminate the water then the species may be impacted." Eliminating the Exit 68 ramps would result in access impacts for local businesses and residences. Unsurveyed areas of high to moderate archeological potential that could be directly impacted are present in this section. This section contains two potential noise-sensitive areas consisting of single family residences.

5.3.4.c Area 2 – Connecticut River (Exit 70) to Thames River (Exit 84)

The I-95 mainline in Area 2 typically consists of two northbound and southbound lanes separated by a narrow grassed median. The existing inside and outside shoulder widths are typically 4 feet and 10 feet, respectively, although they vary slightly in some locations along the section. The section of roadway located within the Exit 70 interchange area beginning at the Baldwin Bridge and terminating at the Lieutenant River structure consists of three travel lanes in each direction. The existing section at the Baldwin Bridge is transitioned to the conceptual typical section with a 10 foot wide median barrier and 14 foot wide shoulders through this area.

As discussed previously, mainline widening is accommodated beyond the outside shoulder in Area 2 due to the absence of available space in the median. The overall increase in roadway width to provide six travel lanes and 14 foot shoulders is approximately 50 feet. That is, approximately 25 feet of additional pavement is required beyond the outside shoulders of both the northbound and southbound lanes. In addition, 15 bridge structures require replacement to provide sufficient width, or sufficient vertical and lateral clearance, to accommodate the mainline widening. Three major culverts also require replacement to accommodate the widening.

The planned Route 11 construction project, which is currently undergoing environmental review, is located within the limits of Area 2. It is anticipated that the Route 11 improvements will be in place prior to the widening in this section. In order to match the mainline widening to the three-lane sections of I-95 proposed for the Route 11 project in the area of the Route 11/I-395/I-95 interchange, it is necessary to modify the mainline alignment near both the southern and northern limits of that project. This requires the reconstruction of a short section of both Route 11 project limits to provide an appropriate transition to the mainline widening improvement concept. In general, there are no additional impacts associated with the slight realignment of the mainline in these locations.

Mainline alignment modifications are also required in the Exit 82/82A area in the Town of Waterford to accommodate the mainline widening, existing frontage roads and interchange improvement concepts in this area. Because the majority of impacts occur beyond the limits of the frontage road systems, they are discussed in detail in Section 5.4.3 Analysis of Interchange Improvement Concepts.

The section of roadway located north of Exit 82A to the Thames River consists of three lanes in the northbound and southbound directions. This area requires a continuation of the 14 foot shoulders that are transitioned to match the existing cross section just south of the interchange ramps for Exit 84.

Access to two weigh stations, which are located on the northbound and southbound sides of I-95 between Exit 81 and Exit 82 in the Town of Waterford, can not be maintained due to existing site constraints that are compounded by the mainline widening. Potential relocation sites for the two weigh stations were identified by

the study team in the Town of Stonington. The potential weigh station sites, which are illustrated on Figure 5-2 (Sheet 112 of 124), are located between Exit 91 and Exit 92.

Environmental Evaluation – Area 2

Environmental impacts for the mainline sections in Area 2 are provided below. Impacts are summarized in Table 5-4 and described in more detail for each section. Wetland impacts from the proposed widening total 6.7 acres of freshwater wetlands and no tidal wetlands. Eight perennial streams are crossed by the right-of-way and direct impacts can be expected. None of the sections contain Federal or State listed threatened or endangered plant or animal species as identified by CTDEP. As the widening can generally be accommodated within existing right-of-way, no major land takings or impacts to structures or properties are anticipated.

Table 5-4
Environmental Impact Summary for Area 2

Section		Wetland Impacts (Acres)		Stream Impacts		Threatened & Endangered Species
From	To	Freshwater	Tidal	Perennial	Intermittent	
Exit 70	Exit 71	6.5	0	7	0	none
Exit 72	Exit 73	0.1	0	1	0	none
Exit 73	Exit 74	0.1	0	0	0	none
Totals		**6.7**	**0**	**8**	**0**	-

Air quality impacts within Area 2 are expected to be comparable from section to section. During construction, locally elevated levels of air contaminants are expected to occur on a temporary basis due to emissions from internal combustion engines in heavy-duty construction vehicles and equipment, from fugitive dust generated by construction activities, and from wind re-entrainment of dust from any cleared and openly exposed surfaces. The relative extent of resulting impacts will be a function of the number of pieces of equipment in use, the nature of the activities (e.g. clearing, blasting, excavation, grading, etc.), the size of area being cleared and widened at any one time, and the construction duration in any given section. Potential air quality impacts during the post-construction, or "operational," phase of the project are expected to be less than for a no-build condition since the road widening and any interchange reconfigurations should reduce congestion and thereby reduce corresponding vehicle idling and travel times within and through any given section.

Potential noise impacts are evaluated relative to existing conditions in the context of the number and proximity of sensitive receivers, primarily residences, and with due compliance to FHWA noise abatement criteria. Area 2 mainline sections contain two potential noise-sensitive areas as shown in Figure 5-2 (Sheets 1 to 124). Effects of this project would vary primarily based on changes in volumes, speed, and alignment between existing, 2025 no-build and 2025 build conditions. While noise levels also depend greatly on the vehicular fleet composition, specifically the heavy vehicle fractions, the project is not likely to materially affect this. Over the length of mainline Area 2, the project may change these noise sensitive parameters near a large number of sensitive receivers, causing increased noise levels, and potentially causing impacts. Of the concerns, speed increases are the most likely to affect sound levels, with changes in proximity due to highway widening being next in importance. Generally, the additional capacity provided by the project would result in greater speeds than in the no-build condition – but the extent and sense of any speed changes from existing conditions (which is the basis for comparison), would vary between section. Given the nature of the work, noise during construction would be elevated – sometimes materially, but in all cases temporarily. This is an annoyance that is impossible to avoid, but which can be mitigated by adhering to State specifications for equipment, using temporary noise

containment structures or barriers, where feasible, providing warning to the community for particularly onerous portions of the work, and controlling work hours.

- **Exit 70 to Exit 71 –** The mainline widening would affect 34 freshwater wetland areas for a total of approximately 6.5 acres. This section crosses seven watercourses; three named (Black Hall, Sawmill, and Armstrong Rivers) and four unnamed perennial streams. The stream lengths that would be impacted total 605 feet and range from 45 feet to 185 linear feet. Minor floodplain encroachment along 600 linear feet at the toe of slope would occur along the section. Approximately 6,000 feet of the section falls within the Coastal Zone, although no coastal zone resources would be directly impacted by roadway widening. One area of potential endangered species habitat is located along the section. Unsurveyed areas of high to moderate archeological potential that could be directly impacted are present in this section. This section contains one potential noise-sensitive area consisting of a single family residence.
- **Exit 72 to Exit 73 –** Mainline widening would impact approximately 0.1 wetland acres at three wetland areas in this section. One stream, Brides Brook, would be impacted for approximately 140 feet. Approximately 200 feet of the Brides Lake wellfield aquifer protection area is crossed by the right-of-way. There are no public wells within 500 feet of the right-of-way. There would be no impacts to farmland soils or active farms, although one farm is located adjacent to and north of the right-of-way. The Gates Correctional Facility is located to the south and adjacent to the highway. Approximately 1,200 feet of the section's right-of-way borders the correctional facility. Because the correctional facility is the predominant land use in Census Tract 716101, Block Groups 2 and 4, the ethnic and income make-up of the prison population qualifies these block groups as potential Environmental Justice areas. This section contains one potential noise-sensitive area consisting of single family residences.
- **Exit 73 to Exit 74 –** There would be relatively few environmental impacts within this section. Two wetlands totaling approximately 0.1 acres would be affected by the widening and 2,000 feet of the Gorton's Pond wellfield aquifer protection area would be crossed, although no public wells are located within 500 feet of the right-of-way.

5.3.4.d Area 3 – Thames River (Exit 85) to Rhode Island State Line

The I-95 mainline in Area 3 typically consists of two northbound and southbound lanes separated by a wide natural median. However, the section of roadway located between the Gold Star Bridge and Exit 88 consists of three travel lanes in each direction. The existing inside and outside shoulder widths in both areas are typically four feet and 10 feet, respectively.

As discussed previously, mainline widening in the two-lane sections within Area 3 is accommodated within the existing median. The overall increase in the pavement width of each barrel to provide three travel lanes and 14 foot shoulders is approximately 26 feet. That is, approximately 22 feet of additional pavement is required on the median side, and 4 feet of additional pavement is required on the outside of both the northbound and southbound lanes. The existing three-lane section of I-95 located between the Gold Star Bridge and Exit 88 requires the incorporation of 14 foot inside and outside shoulders. In addition, 28 bridge structures require replacement to provide sufficient width, or sufficient vertical and lateral clearance, to accommodate the mainline widening. One major culvert also requires replacement to accommodate the widening.

Access to the Scenic Overlook located on the northbound side of I-95 between Exit 89 and Exit 90 in the Town of Groton is maintained. Because the majority of the mainline widening occurs on the median side of the roadway, the overlook area is relatively unaffected by the widening.

As discussed in Section 5.3.2, future traffic demands on I-95 north of Exit 92 do not warrant the need for a third travel in either the northbound or southbound directions. Therefore, the northbound lane reduction occurs at the Exit 92 northbound off-ramp where the additional lane is dropped as an exit-only lane. Similarly, the southbound lane addition begins at Exit 92 where the southbound on-ramp continues ahead as a travel lane.

Environmental Evaluation – Area 3

Environmental impacts for the mainline sections in Area 3 are provided below. Impacts are summarized in Table 5-5 and described in more detail for each section. Wetland impacts from the proposed widening total 6.4 acres of freshwater wetlands and no tidal wetlands. Five perennial and 5 intermittent streams are crossed by the right-of-way and direct impacts can be expected. One of the sections contains a state-listed threatened or endangered plant species as identified by CTDEP. As the widening can generally be accommodated within existing right-of-way, no major land takings or impacts to structures or properties are anticipated.

Table 5-5
Environmental Impact Summary for Area 3

Section		Wetland Impacts (Acres)		Stream Impacts		Threatened & Endangered Species
From	To	Freshwater	Tidal	Perennial	Intermittent	
Exit 88	Exit 89	0.1	0	2	0	state special concern plant
Exit 89	Exit 90	0	0	1	0	none
Exit 90	Exit 91	0.3	0	1	3	none
Exit 91	Exit 92	6.0	0	1	2	none
Totals		**6.4**	**0**	**5**	**5**	**-**

Air quality impacts within mainline Area 3 are expected to be comparable from section to section. During construction, locally elevated levels of air contaminants are expected to occur on a temporary basis due to emissions from internal combustion engines in heavy-duty construction vehicles and equipment, from fugitive dust generated by construction activities, and from wind re-entrainment of dust from any cleared and openly exposed surfaces. The relative extent of resulting impacts will be a function of the number of pieces of equipment in use, the nature of the activities (e.g. clearing, blasting, excavation, grading, etc.), the size of area being cleared and widened at any one time, and the construction duration in any given section. Potential air quality impacts during the post-construction, or "operational," phase of the project are expected to be less than for a no-build condition since the road widening and any interchange re-configurations should reduce congestion, thereby reducing corresponding vehicle idling and travel times within and through any given section.

Potential noise impacts are evaluated relative to existing conditions in the context of the number and proximity of sensitive receivers, primarily residences, and with due compliance to FHWA noise abatement criteria. Area 3 mainline sections contain 14 potential noise-sensitive areas as shown in Figure 5-2 (Sheets 1 to 124). Effects of this project would vary primarily based on changes in volumes, speed, and alignment between existing, 2025 no-build and 2025 build conditions. While noise levels also depend greatly on the vehicular fleet composition, specifically the heavy vehicle fractions, the project is not likely to materially affect this. Over the length of mainline Area 3, the project may change these noise sensitive parameters near a large number of sensitive

receivers, causing increased noise levels, and potentially causing impacts. Of the concerns, speed increases are the most likely to affect sound levels, with changes in proximity due to highway widening being next in importance. Generally, the additional capacity provided by the project would result in greater speeds than in the no-build – but the extent and sense of any speed changes from existing conditions (which is the basis for comparison), would vary between sections. Given the nature of the work, noise during construction would be elevated – sometimes materially, but in all cases temporarily. This is an annoyance that is impossible to avoid, but which can be mitigated by adhering to State specifications for equipment, using temporary noise containment structures or barriers, where feasible, providing warning to the community for particularly onerous portions of the work, and controlling work hours.

- **Exit 88 to Exit 89** – Minimal impact to four freshwater wetlands (0.1 acre) would result from the proposed widening. Fishtown, Eccleston and Fort Hill Brooks are crossed by the highway along the northern (eastern) end of this section with approximately 128 linear feet of these waterways expected to be impacted. One area of state listed plant species of special concern is located further to the south (west) of this section in an area that has not been proposed for re-design or widening. Should work be conducted in this area, CTDEP would require "the use of best management practices with special attention to erosion and siltation control" to "prevent indirect negative affects to the species." Impacts to other environmental resources would be minimal. This section contains four potentially noise sensitive areas consisting of single family residences.

- **Exit 89 to Exit 90** – There would be no impacts to wetland resources in this section. The highway crosses the Mystic River, which is tidal at this location. The existing Mystic River Bridge would be widened by 36 feet. Approximately 3,000 feet of this section is within the Coastal Zone in the vicinity of the Mystic River. This portion of the river is classified as an estuarine embayment by the Coastal Zone Management program and 200 feet of this resource would be spanned by the additional 36 foot bridge width. A scenic overlook on the northbound side of I-95 provides views toward Mystic Seaport. This section contains three potential noise-sensitive areas consisting of single family residences.

- **Exit 90 to Exit 91** – Portions of four freshwater wetlands totaling 0.2 acres would be impacted by new construction. Approximately 18 linear feet of the Pequotsepos Brook and 36 linear feet of three unnamed intermittent streams would be impacted by the right-of-way. The existing bridge over Copps Brook would be widened by 36 feet. The Dean's Mill and Palmer Reservoirs are located north and south of the right-of-way. These reservoirs are connected by Copps Brook. The widening concept shows no encroachment into the reservoirs or the small floodplain area associated with them. Approximately 6,000 feet of the right-of-way is located within a GA quality groundwater area that is associated with the reservoirs. A larger floodplain area, 1,500 linear feet (measured along the toe of slope) associated with Stony Brook, is located further to the east. Conceptual plans indicate widening to the north away from the floodplain area. This would result in minimal impact to the floodplain. One farm is located 200 feet south of the right-of-way. This section contains five potential noise-sensitive areas consisting of single family residences.

- **Exit 91 to Exit 92** – The proposed widening would impact portions of fifteen freshwater wetlands, totaling almost 6.0 acres. According to the conceptual plans, some wetlands over an acre in size would be backfilled. Most of these wetlands are located within the median and would be affected by backfilling into the median area. Anguilla Brook is crossed by the highway but no impacts are expected. Approximately 670 feet of two unnamed intermittent streams would be affected to accommodate the widening. The right-of-way passes over 3,000 feet of the Pawcatuck River sole source aquifer. Numerous encounters with Prime and Statewide Important farmland soils occur and two active farms are adjacent to the right-of-way. However, no impacts to farmland resources are expected from the widening, as all new construction is

expected to be within existing right-of-way. Unsurveyed areas of high to moderate archeological potential that could be directly impacted are present in this section. This section contains two potential noise-sensitive areas consisting of single family residences.

5.3.5 Mainline Operations Summary – Year 2025 Build Condition

The mainline traffic operations resulting from the mainline widening improvements described in the previous section were analyzed using the same methods used to perform the traffic analyses presented in Chapters 2 and 3. The results of this analysis are illustrated on Figure 5-3 and are presented below in Table 5-6. The level of service (LOS) for both the 2025 build and no-build conditions are shown in the table to illustrate the operational improvements derived from the addition of a third travel lane in areas where additional capacity is needed in the design year to accommodate future traffic demands.

Table 5-6
Freeway Section Analysis — Summary of 2025 Build Condition

Section		Terrain	Number of Lanes	Peak Hour	Level of Service[1]	2025 Volumes (vph)[2]
From	To					
Northbound						
Exit 54	**Exit 55**	**Level**	**3**	**PM**	**F (F)**	**5,200**
Exit 55	**Exit 56**	**Level**	**3**	**PM**	**F (F)**	**5,160**
Exit 56	Exit 57	Level	3	PM	D (F)	4,960
Exit 57	Exit 58	Level	3	PM	D (F)	4,820
Exit 58	Exit 59	Level	3	PM	D (F)	4,510
Exit 59	Exit 60	Rolling	3	PM	D (F)	4,520
Exit 60	Exit 61	Rolling	3	PM	D (F)	4,520
Exit 61	Exit 62	Rolling	3	PM	D (F)	4,350
Exit 62	Exit 63	Rolling	3	PM	D (F)	4,300
Exit 63	Exit 64	Rolling	3	PM	D (F)	4,150
Exit 64	Exit 65	Rolling	3	PM	D (F)	4,040
Exit 65	Exit 66	Rolling	3	PM	C (F)	3,910
Exit 66	Exit 67 (Elm St)	Rolling	3	PM	C (E)	3,860
Exit 67 (Elm St)	Exit 67 (Rte 154)	Rolling	3	PM	D (E)	4,120
Exit 67 (Rte 154)	Exit 69	Rolling	3	PM	D (E)	4,710
Exit 69	Exit 70	Rolling	4	PM	D (D)	5,770
Exit 70	Exit 71	Rolling	3	PM	D (F)	4,870
Exit 71	Exit 72	Rolling	3	PM	D (F)	4,670
Exit 72	Exit 73	Rolling	3	PM	D (F)	5,010
Exit 73	Exit 74	Rolling	3	PM	D (F)	4,940
Exit 74	Exit 76	Rolling	3[3]	PM	C[3]	5,410
Exit 76	Exit 81	Rolling	3[3]	PM	D[3]	4,840
Exit 81	**Exit 82**	**Rolling**	**3**	**PM**	**E (F)**	**5,230**
Exit 82	Exit 82A	Rolling	3	PM	D (F)	4,230
Exit 82A	**Exit 83**	**Rolling**	**3**	**PM**	**F (F)**	**5,090**
Exit 83	**Exit 84**	**Rolling**	**4**	**PM**	**F (F)**	**6,440**
Exit 84	**Exit 85**	**Rolling**	**5**	**PM**	**E (E)**	**8,140**
Exit 85	**Exit 86**	**Rolling**	**3**	**PM**	**F (F)**	**6,520**
Exit 86	**Exit 87**	**Rolling**	**3**	**PM**	**E (E)**	**5,170**
Exit 87	**Exit 88**	**Rolling**	**3**	**PM**	**F (F)**	**6,570**
Exit 88	**Exit 89**	**Rolling**	**3**	**PM**	**F (F)**	**6,020**
Exit 89	**Exit 90**	**Rolling**	**3**	**PM**	**E (F)**	**5,330**

Table 5-6
Freeway Section Analysis — Summary of 2025 Build Condition

Section		Terrain	Number of Lanes	Peak Hour	Level of Service[1]	2025 Volumes (vph)[2]
From	To					
Exit 90	Exit 91	Rolling	3	PM	D (F)	4,570
Exit 91	Exit 92	Rolling	3	PM	C (E)	3,720
Exit 92	Exit 93	Rolling	2	PM	D (D)	3,080
Exit 93	State Line	Rolling	2	PM	D (D)	3,160
Southbound						
Exit 54	**Exit 55**	**Level**	**3**	**PM**	**F (F)**	**4,520**
Exit 55	**Exit 56**	**Level**	**3**	**PM**	**F (F)**	**4,330**
Exit 56	Exit 57	Level	3	PM	C (F)	4,110
Exit 57	Exit 58	Level	3	PM	C (F)	4,110
Exit 58	Exit 59	Level	3	PM	C (F)	4,070
Exit 59	Exit 60	Rolling	3	PM	D (F)	3,810
Exit 60	Exit 61	Rolling	3	PM	C (F)	3, 770
Exit 61	Exit 62	Rolling	3	PM	C (F)	3,580
Exit 62	Exit 63	Rolling	3	PM	C (F)	3,710
Exit 63	Exit 64	Rolling	3	PM	C (F)	3,640
Exit 64	Exit 65	Rolling	3	PM	C (F)	3,720
Exit 65	Exit 66	Rolling	3	PM	C (E)	3,430
Exit 66	Exit 67 (Elm St)	Rolling	3	PM	C (E)	3,360
Exit 67 (Elm St)	Exit 67 (Rte 154)	Rolling	3	PM	C (E)	3,600
Exit 67 (Rte 154)	Exit 69	Rolling	3	PM	D (E)	3,910
Exit 69	Exit 70	Rolling	4	PM	C (C)	5,030
Exit 70	Exit 71	Rolling	3	PM	D (F)	4,510
Exit 71	Exit 72	Rolling	3	PM	D (F)	4,340
Exit 72	Exit 73	Rolling	3	PM	D (F)	4,680
Exit 73	Exit 74	Rolling	3	PM	D (F)	4,820
Exit 74	Exit 76	Rolling	3[3]	PM	D[3]	5,180
Exit 76	Exit 81 (Cross Rd)	Rolling	3[3]	PM	D[3]	5,190
Exit 81 (Cross Rd)	Exit 81 (Pkwy North)	Rolling	3	PM	D (F)	4,820
Exit 81 (Pkwy North)	Exit 82	Rolling	3	PM	D (F)	5,060
Exit 82	Exit 82A (Frontage Rd)	Rolling	3	PM	C (F)	3,610
Exit 82A (Frontage Rd)	**Exit 83**	**Rolling**	**3**	**PM**	**F (F)**	**4,760**
Exit 83	**Exit 84**	**Rolling**	**4**	**PM**	**F (F)**	**6,080**
Exit 84	**Exit 85**	**Rolling**	**5**	**PM**	**E (E)**	**8,480**
Exit 85	**Exit 86**	**Rolling**	**4**	**PM**	**E (E)**	**7,180**
Exit 86	**Exit 87 (Rte 1)**	**Rolling**	**3**	**PM**	**E (E)**	**5,430**
Exit 87 (Rte 1)	Exit 87 (Rte 349)	Level	3	PM	D (D)	4,280
Exit 87 (Rte 349)	**Exit 88**	**Rolling**	**3**	**PM**	**E (E)**	**5,040**
Exit 88	Exit 89	Rolling	3	PM	D (D)	4,630
Exit 89	Exit 90	Rolling	3	PM	D (F)	4,350
Exit 90	Exit 91	Rolling	3	PM	C (E)	3,330
Exit 91	Exit 92	Rolling	3	PM	C (D)	2,800
Exit 92	Exit 93	Rolling	2	PM	C	2,090
Exit 93	State Line	Rolling	2	PM	C	2,290

Note: Boldface entries denote capacity deficiencies during the peak period.
1 Levels of service for 2025 no-build conditions shown in parentheses.
2 vph – vehicles per hour, including all vehicle types (e.g. passenger cars, trucks, motorcycles, etc.)
3 Number of lanes and LOS for 2020 taken from Administrative Final Environmental Impact Statement "Route 11 Corridor" dated December 5, 2002.

Northbound Freeway Sections

Of the 36 total sections shown in Table 5-6, 24 will require a third travel lane to provide additional capacity along northbound I-95. The analysis showed that 22 of the 24 widened sections will experience an improved LOS in the evening peak hour. In addition, 19 of these 22 sections will operate acceptably under the peak hour traffic demands at LOS D or better. Overall, 24 of the 36 sections will operate acceptably at LOS D or better should the recommended mainline widening improvements be implemented. This is an improvement over the five sections that would operate acceptably if no capacity improvements are provided.

Southbound Freeway Sections

Of the 38 total sections shown in Table 5-6, 25 will require a third travel lane to provide additional capacity along southbound I-95. The analysis showed that 23 of the 25 widened sections will experience an improved LOS in the evening peak hour. In addition, all of these 23 sections will operate acceptably under the peak hour traffic demands at LOS D or better. Overall, 30 of the 38 sections will operate acceptably at LOS D or better should the recommended mainline widening improvements be implemented. This is an improvement over the eight sections that would operate acceptably if no capacity improvements are provided.

5.4 Interchange Improvement Concepts

As presented in Chapter 2 of this report, approximately half of the interchange ramps located within the project study area currently operate at unacceptable levels of service. In 2025, the fraction of ramps experiencing operational deficiencies would increase to approximately 9 out of every 10 if no capacity or geometric improvements are made to accommodate the future traffic demands. The combination of increasing traffic demands and operational deficiencies at these ramps also affect mainline and secondary roadway operations, leading to serious safety implications in many interchange locations.

In addition, mainline widening to incorporate a third travel lane and 14 foot wide inside and outside shoulders will substantially impact the horizontal and vertical geometries of the existing interchange ramps in many locations. This is mainly the case in Areas 1 and 2 west of the Thames River where the widening will generally be accommodated at the outside shoulder as described in Section 5.3. In some locations, such as Exit 66 in Old Saybrook where the existing ramp geometry is dictated by particularly restrictive site constraints, more substantial realignment of the existing ramp configuration is required to both accommodate the mainline widening, and provide standard horizontal and vertical geometry.

The interchange improvement concepts described in the following sections are developed to provide improved safety and operations for anticipated 2025 traffic demands, as well as accommodate the proposed typical section. These are generalized improvements that will be provided at every interchange.

In addition to these generalized interchange improvements, the study team has evaluated interchange-specific improvements at certain locations that involve more substantial geometric alterations to enhance safety and operations. The process of identifying these locations, and developing and screening improvement concepts at each of these locations, is described in detail in Section 5.4.2. Detailed analyses of both the generalized and interchange-specific improvements for each interchange within the study area are presented in Section 5.4.3.

5.4.1 Generalized Interchange Improvements

The general safety and operational improvements recommended at each interchange are designed to address the existing geometric deficiencies identified previously in Chapter 2 and the future operational deficiencies identified in Chapter 3. These improvements include standardizing acceleration and deceleration (speed-change) lanes, providing standard horizontal and vertical geometry at ramp junctions, and providing adequate intersection capacity and improved intersection geometry at deficient ramp and secondary roadway intersections. Each type of improvement is discussed in detail below.

Speed-Change Lanes

Speed-change lanes are auxiliary lanes utilized by vehicles for accelerating or decelerating as they enter or exit the mainline. Deceleration lanes are designed to provide sufficient length for a vehicle, once removed from the mainline traffic stream, to decelerate to a safe speed for entering the initial ramp curve. Acceleration lanes are designed to provide sufficient length for a vehicle to reach mainline speeds and merge into the mainline traffic stream. When acceleration or deceleration lanes provide less than adequate space for a vehicle to make the necessary speed change, the vehicle must utilize a portion of the mainline to execute the speed change, thus disrupting the flow of through traffic. The combination of nonstandard speed-change lanes and disrupted traffic flow not only results in operational deficiencies at the ramp merge and diverge points, but also results in serious safety concerns for all roadway users.

Review of the existing geometric conditions conducted under Chapter 2 showed that approximately 80% of speed-change lanes throughout the study area are deficient based on 2001 AASHTO design standards. Many of these deficient lanes were designed and constructed in the 1960's and 1970's to meet less stringent criteria. Because of this, lanes meeting the design criteria set forth in 2001 AASHTO have been designed under this study and evaluated for their overall feasibility.

Ramp Junctions

The mainline widening required to accommodate a third travel lane and 14 foot wide inside and outside shoulders significantly affects the existing horizontal and vertical ramp geometries at the mainline and ramp junctions. As a result, it was necessary to evaluate the effects of the widening at each ramp junction and modify the horizontal and vertical alignment of the ramp as required to match the widened section.

Each modified exit ramp junction was designed in accordance with the *1999 Connecticut Highway Design Manual* (HDM), which requires a tapered deceleration lane and exit ramp configuration. In general, the exit curve and corresponding deceleration lane length were designed to accommodate minimum exit speeds of 35 mph. This is in accordance with current AASHTO guidelines that state ramp design speeds should be equal to at least one-half the mainline design speed. However, due to existing site constraints in some locations, the exit ramp curvature was designed to accommodate speeds less than 35 mph. In these cases, extended deceleration lane lengths corresponding to the higher standard speed reduction lengths were provided.

Each modified entrance ramp junction was also designed in accordance with HDM design standards, which require a tapered approach with a minimum parallel acceleration length of 300 feet. In general, the entrance curve and corresponding acceleration lane length were designed to accommodate minimum ramp entrance speeds of 35 mph. Again, due to existing site constraints in some locations, the entrance ramp curvature and acceleration length were designed to accommodate speeds less than 35 mph.

In all cases, the above improvements were designed to minimize impacts to the existing ramp alignment, local landscape and environmental resources.

Weaves

Weaving occurs when merging and diverging vehicles traveling in the same direction are required to cross paths in order to execute moves to and from closely spaced exit and entrance ramps. Several existing weaving sections located within the study area were identified in Chapter 2. The improvement concepts at these locations were designed to minimize the effects of weaving movements on the mainline traffic stream where possible by increasing the separation distance between ramp junctions, by separating the traffic streams or by providing auxiliary lanes connecting closely spaced ramps.

Ramp and Secondary Roadway Intersections

Intersection capacity analyses were performed in Chapter 3 at all signalized and unsignalized ramp and secondary roadway intersections in order to identify deficient locations in the 2025 evening peak hour. Improvement concepts were then developed at each of these locations and re-analyzed to determine their effectiveness in improving future operations.

Recommended improvement concepts at signalized intersections include provisions for signal timing improvements, additional left and right turn lanes, additional through lanes on secondary roadways, increased storage lengths for queued vehicles, standard lane tapers and other geometric improvements. New traffic signals are also recommended at existing unsignalized intersections in many locations to improve intersection LOS, traffic flow and safety. Improvement concepts at unsignalized intersections that do not become signalized also include provisions for additional turn lanes and other geometric improvements to improve intersection LOS.

The generalized improvement concepts, which include intersection, speed-change lane and ramp junction improvements for each interchange within the study area, are illustrated on Figure 5-2 and described in detail in Section 5.4.3. A summary of the future ramp and intersection operations for the 2025 build condition is presented in Section 5.4.4.

5.4.2 Interchange-Specific Improvements

Interchange-specific improvement concepts were developed and evaluated by the study team in 11 interchange areas. The majority of these areas were identified early in the study through the public involvement process. During this process, the study team solicited input from the stakeholders regarding specific areas that currently experience identified safety and operational problems. The 11 interchange areas identified through public involvement include:

- Exit 59 – SR 718 (Goose Lane), Town of Guilford
- Exit 60 – Mungertown Road, Town of Madison
- Exit 62 – SR 450 (Hammonasset Connector), Town of Madison
- Exit 63 – Route 81 (Killingworth Turnpike), Town of Clinton
- Exit 67 – Elm Street, Town of Old Saybrook
- Exits 67/68 – Route 154 (Middlesex Turnpike) and US Route 1, Town of Old Saybrook
- Exit 70 – US Route 1 (Halls Road) and Route 156 (Neck Road), Town of Old Lyme
- Exits 71/72 – Four Mile River Road and SR 449 (Rocky Neck Connector), Towns of Old Lyme and East Lyme
- Exit 74 – Route 161 (Flanders Road), Town of East Lyme
- Exits 81/82/82A – Cross Road, Parkway North, Route 85 (Broad Street) and Frontage Roads, Town of Waterford
- Exit 90 – Route 27, Town of Stonington

The following paragraphs describe the process followed by the study team to develop and evaluate viable concept improvements in each of the 11 locations that would address the identified deficiencies. The specific improvement recommendations are illustrated on Figure 5-2 and are described in detail in Section 5.4.3.

Concept Development/Screening Process

Once the problem areas were identified, the study team initiated development of the preliminary improvement concepts. The first step of the development process consisted of a field evaluation conducted in each area by members of the study team. The field evaluation provided an opportunity for the team to observe the existing physical site conditions and constraints as well as the typical traffic patterns through the area.

The information obtained during the field evaluation phase was then used to recommend potential improvement concepts in each of the eleven areas. The preliminary layouts for these potential improvements were identified and developed at design charrettes conducted by the study team. Attendees of the charrettes included representatives from the Federal Highway Administration, ConnDOT's offices of design, planning, traffic, and safety, district maintenance representatives, and the consultant design team. The preliminary layouts developed at the charrettes typically consisted of several different potential improvement concepts in each area that addressed the problems identified during the public involvement process.

Concepts that incorporated ConnDOT and AASHTO design standards were later developed from these preliminary layouts and presented to the Advisory Committee (AC) for review. The AC members were given the opportunity to review the conceptual improvements, suggest revisions and recommend a preferred improvement concept in each area. Several local outreach meetings were conducted with each of the corridor towns representatives to either identify alternative improvement concepts or to further discuss the concepts

relative to the town's long-term development plans. In most cases, this screening process narrowed the number of alternative improvement concepts in each of the eleven areas to one or two preferred concepts.

Refinement of Improvement Concepts

The preferred improvement concepts recommended by the AC members during the initial screening process were further refined to better determine the transportation benefits, impacts and costs associated with each concept. This refinement involved assuming capacity requirements and lane usage along the ramps and secondary roadways within each area. Qualitative evaluations based on these assumptions were performed to determine the transportation-related benefits derived from the revised traffic patterns and redistributed traffic volumes.

In addition, slope limits were determined to identify significant areas of environmental and right-of-way impacts. A preliminary evaluation of the environmental and right-of-way impacts was also conducted so that additional refinements to the preliminary horizontal and vertical alignments could be made to minimize these impacts.

When the refinement phase was completed, a preliminary construction cost estimate for the entire study area was developed. This estimate, which was exclusive of right-of-way and environmental mitigation costs, included all roadway and bridge structure costs associated with the mainline widening improvements, generalized interchange improvements, and the interchange-specific improvements in the identified problem areas.

The refined improvement concepts were then presented with preliminary construction cost estimates to the AC members for their review and concurrence. Any additional recommendations made by the committee at this time were considered and incorporated into the improvement concepts where appropriate.

ConnDOT also conducted an exhaustive internal review of the interchange improvement concepts and their associated construction cost estimates. ConnDOT's review weighed the transportation and safety-related benefits derived from each improvement against the overall cost and impacts. The results of this cost-benefit analysis were used to recommend several modifications to the preferred improvement concepts.

5.4.3 Analysis of Interchange Improvement Concepts

The interchange improvement concepts, which consist of both generalized improvements and interchange-specific improvements as described above, were developed to address the safety and operational deficiencies identified in Chapter 2, as well as specific problems identified through the public outreach process. The overall feasibility, economic cost, environmental impacts and overall transportation benefits associated with these improvements have been analyzed and a summary of this analysis is provided on the following fact sheets. Fact sheets were developed for each interchange within the study area and provide a brief description of the interchange improvements, a list of issues and solutions associated with each interchange area, and a summary table for the estimated construction costs. Environmental impacts in the interchange areas are discussed in greater detail in the section following the fact sheets. In addition, near-term improvements have been identified for many of the interchange areas and are noted on the fact sheets. Chapter 6 provides further discussion regarding these recommended near-term improvements.

Exit 54 – SR 740 (Cedar Street), Town of Branford

Exit 54 is a diamond interchange located in the Town of Branford at the southern (western) limit of the project study area. This interchange provides access to both local residential development in the area and significant commercial development along Cedar Street and US Route 1, which is located just south of Exit 54. The existing northbound off-ramp and southbound on-ramp define the northern (eastern) limits of ConnDOT's current New Haven Harbor Crossing Corridor Improvements, Contract D project along the I-95 corridor. This project, scheduled for completion in 2004, will provide a third general purpose travel lane in the northbound and southbound directions.

Figure 5-2 (Sheet 1 of 124) presents the recommended long-term improvement concept at Exit 54. Improvements to all four ramp termini and Cedar Street are being constructed under the current ConnDOT project. As a result, the improvement concept at this interchange is limited to providing standard acceleration and deceleration lanes and minor geometric improvements to the ramp merge and diverge areas at the northbound on-ramp and southbound off-ramp. The gore nose at the southbound off-ramp is shifted north along I-95 to provide adequate deceleration length to the back of the traffic queue in the design hour.

Issues

- Poor LOS along NB and SB I-95
- Poor LOS at NB on-ramp merge and SB off-ramp diverge
- Nonstandard acceleration and deceleration lane lengths at NB on-ramp and SB off-ramp junctions
- High accident location
- Poor LOS at intersection of NB ramps and Cedar Street
- Poor LOS at intersection of SB ramps and Cedar Street
- Poor LOS at intersection of Cedar Knolls Drive and Cedar Street
- Poor LOS at intersection of Cedar Street and US Route 1

Solutions

- Provide mainline widening to three lanes NB and SB through interchange area
- Standardize NB acceleration and SB deceleration lanes to improve safety and operations at ramp merge and diverge locations
- Signalize intersection of Cedar Knolls Drive and Cedar Street to improve intersection operations
- Confirm that lane usage at NB ramps, SB ramps and US Route 1 intersections with Cedar Street being reconstructed under current ConnDOT project meet anticipated 2025 traffic demands

Construction Costs (2004 $)

Roadway	$ 5,100,000
Bridge Structures	$ 6,500,000
Right-of-Way	$ 25,000
Environmental Mitigation (0.32 acres)	$ 60,000
Other	$ 4,915,000
Total	**$ 16,600,000**

Near-Term Improvement Opportunities

- Acceleration lane improvements at the NB on-ramp are low priority
- Signal timing/phasing modifications at the intersection of US Route 1 and Cedar Street are low priority
- Signalization of the intersection of Cedar Street and Cedar Knolls Drive is low priority

Exit 55 – US Route 1 (East Main Street), Town of Branford

Exit 55, located in the Town of Branford, provides access to both local residential development in the area and several commercial developments along US Route 1. Route 139 (North Branford Road) is located off US Route 1 just north of Exit 55 and provides access to North Branford from I-95. An existing Park & Ride lot is located on the southbound side of US Route 1 opposite the northbound off-ramp intersection and provides parking space for approximately 70 vehicles.

Figure 5-2 (Sheet 5 of 124) presents the recommended long-term improvement concept at Exit 55. Right-turn lanes are provided on the northbound and southbound off-ramp approaches to US Route 1 and additional northbound and southbound travel lanes are provided along US Route 1 to improve intersection capacities through this area. Standard acceleration and deceleration lanes are also provided at each ramp junction with I-95.

Issues

- Poor LOS along NB and SB I-95
- Poor LOS at all ramp merge and diverge locations
- Nonstandard acceleration and deceleration lane lengths at all ramp junctions
- Poor LOS at intersection of NB ramps and US Route 1
- Poor LOS at intersection of SB ramps and US Route 1

Solutions

- Continue mainline widening to three lanes NB and SB through interchange area
- Standardize all acceleration and deceleration lanes to improve safety and operations at ramp merge and diverge locations
- Provide right-turn lane on NB off-ramp approach to US Route 1
- Provide right-turn lane on SB off-ramp approach to US Route 1
- Provide an additional NB and SB travel lane along US Route 1 through interchange area
- Improve traffic signal timing/phasing at NB and SB ramp intersections with US Route 1

Construction Costs (2004 $)

Roadway	$ 12,900,000
Bridge Structures	$ 6,400,000
Right-of-Way	$ 500,000
Environmental Mitigation (0.5 acres)	$ 100,000
Other	$ 8,500,000
Total	**$ 28,400,000**

Near-Term Improvement Opportunities

- Acceleration lane improvements at the NB on-ramp are medium priority
- Acceleration lane improvements at the SB on-ramp are low priority
- Intersection improvements at the SB ramps intersection with US Route 1 are low priority

Other Considerations

- Relocate the existing Park & Ride lot to mitigate the loss of 70 existing spaces

Exit 56 – Leetes Island Road, Town of Branford

Exit 56 is a newly reconstructed interchange located in the Town of Branford that provides access to both commercial and industrial development located along East Industrial Road and Leetes Island Road. US Route 1 is located just north of Exit 56 and provides direct connections to Route 139 (North Branford Road) and Route 22 (Norton Hill Road) in the area. An existing Park & Ride lot is located on the northbound side of Leetes Island Road just south of the northbound on-ramp and provides parking space for approximately 40 vehicles.

Figure 5-2 (Sheet 7 of 124) presents the recommended long-term improvement concept at Exit 56. The improvement concept at this location primarily consists of providing standard acceleration and deceleration lanes at each substandard ramp junction. Intersection and secondary roadway improvements completed in 2003 under a separate ConnDOT project provide sufficient intersection capacity for 2025 peak hour volumes at this interchange. In addition, the Leetes Island Road overpass was reconstructed under this previous project and provides sufficient lateral and vertical clearance to accommodate future widening of the mainline to six lanes.

Issues

- Poor LOS along NB and SB I-95
- Poor LOS at NB and SB ramp merge and diverge locations
- Nonstandard acceleration and deceleration lane lengths at NB ramp junctions and SB on-ramp from Leetes Island Road

Solutions

- Continue mainline widening to three lanes NB and SB through interchange area
- Standardize all deficient acceleration and deceleration lanes to improve safety and operations at ramp merge and diverge locations

Construction Costs (2004 $)

Roadway	$ 7,500,000
Bridge Structures	$ 0
Right-of-Way	$ 25,000
Environmental Mitigation (0.91 acres)	$ 180,000
Other	$ 3,095,000
Total	**$ 10,800,000**

Near-Term Improvement Opportunities

- Acceleration and deceleration lane improvements at the SB on-ramp from Leetes Island Road and the NB off-ramp are medium priority
- Acceleration lane improvements at the NB on-ramp are low priority

Other Considerations

- No impacts to the existing Park & Ride lot

Exit 57 – US Route 1 (Boston Post Road), Town of Guilford

Exit 57, located in the Town of Guilford, provides access to US Route 1. Several commercial developments are located off US Route 1 in this area and local residential development is also nearby. An existing Park & Ride lot is located on the southbound side of US Route 1 adjacent to the southbound on-ramp and provides parking space for approximately 20 vehicles.

Figure 5-2 (Sheet 14 of 124) presents the recommended long-term improvement concept at Exit 57. The improvement concept primarily consists of providing standard acceleration and deceleration lanes at each ramp junction with I-95 and minor intersection improvements. Separate right and left turn lanes are provided on the southbound and northbound off-ramp approaches to US Route 1 and US Route 1 is widened to provide a northbound left-turn lane to the northbound on-ramp.

Issues

- Poor LOS along NB and SB I-95
- Poor LOS at all ramp merge and diverge locations
- Nonstandard acceleration and deceleration lane lengths at all ramp junctions
- Poor LOS at intersection of NB ramps and US Route 1
- Poor LOS at intersection of SB ramps and US Route 1

Solutions

- Continue mainline widening to three lanes NB and SB through interchange area
- Standardize all acceleration and deceleration lanes to improve safety and operations at ramp merge and diverge locations
- Provide right-turn lane on NB off-ramp approach to US Route 1
- Widen US Route 1 to provide NB left-turn lane to NB on-ramp
- Provide right-turn lane on SB off-ramp approach to US Route 1

Construction Costs (2004 $)

Roadway	$ 8,300,000
Bridge Structures	$ 7,400,000
Right-of-Way	$ 700,000
Environmental Mitigation (0.42 acres)	$ 80,000
Other	$ 6,720,000
Total	**$ 23,200,000**

Near-Term Improvement Opportunities

- Acceleration and deceleration lane improvements at the NB and SB ramps are low priority

Other Considerations

- No impacts to the existing Park & Ride lot

Exit 58 – Route 77 (Church Street), Town of Guilford

Exit 58 is located in the Town of Guilford and provides access to Route 77. This exit also provides access to US Route 1 located off Route 77 to the south and to the Shore Line East railroad station located approximately 1.5 miles south of the interchange off Route 77. Existing Park & Ride lots are located on the northbound and southbound sides of Route 77 within the interchange and provide parking space for approximately 158 vehicles.

Figure 5-2 (Sheet 16 of 124) presents the recommended long-term improvement concept at Exit 58. The improvement concept primarily consists of providing standard acceleration and deceleration lanes at each ramp junction with I-95 and secondary roadway and ramp intersection improvements. Northbound and southbound right-turn lanes are provided on Route 77 at the northbound and southbound ramp intersections. Route 77 is also widened to provide left-turn lanes at each of these intersections to improve intersection capacities and operations through the interchange area.

Issues

- Poor LOS along NB and SB I-95
- Poor LOS at all ramp merge and diverge locations
- Nonstandard acceleration and deceleration lane lengths at all ramp junctions
- Poor LOS at intersection of NB ramps and Route 77

Solutions

- Continue mainline widening to three lanes NB and SB through interchange area
- Standardize all acceleration and deceleration lanes to improve safety and operations at ramp merge and diverge locations
- Signalize intersection of SB ramps and Route 77
- Improve signal timing/phasing at NB ramps intersection with Route 77
- Provide NB right-turn lane on Route 77 to NB on-ramp
- Provide SB right-turn lane on Route 77 to SB on-ramp
- Widen Route 77 to provide left-turn lanes to NB and SB on-ramps

Construction Costs (2004 $)

Roadway	$ 7,000,000
Bridge Structures	$ 6,800,000
Right-of-Way	$ 1,000,000
Environmental Mitigation (0.47 acres)	$ 90,000
Other	$ 6,010,000
Total	**$ 20,900,000**

Near-Term Improvement Opportunities

- Acceleration and deceleration lane improvements at the SB ramps are low priority

Other Considerations

- Impacts to the Park & Ride lots result in approximately 55 lost spaces

Exit 59 – SR 718 (Goose Lane), Town of Guilford

Exit 59, located in the Town of Guilford, provides access to both local residential development in the area and significant commercial development along US Route 1 and Goose Lane. This interchange also provides access to the Yale-New Haven Hospital Shoreline Medical Center that was recently constructed on Goose Lane. The Town of Guilford, through the public outreach process of this study, has also noted that a considerable volume of local traffic destined for Madison via US Route 1 utilizes Exit 59 due to the limited northbound and southbound access at Exit 60 located in Madison. An existing Park & Ride lot is located on the southbound side of Goose Lane within the interchange and provides parking space for approximately 58 vehicles.

Figure 5-2 (Sheet 19 of 124) presents the recommended long-term improvement concept at Exit 59. The improvement concept relocates the northbound ramps to intersect US Route 1 in a button-hook configuration approximately 800 feet west of the existing US Route 1, Goose Lane and Soundview Road intersection. The location of this intersection aligns with the Wendy's restaurant commercial drive located on the northbound side of US Route 1 to form a four-legged signalized intersection. This configuration is designed to eliminate the operational problems caused by the existing location of the northbound ramps intersection. Southbound traffic queuing on Goose Lane at the intersection of Goose Lane and US Route 1 interferes with the operation of the northbound off-ramp, which is located approximately 100 ft to the north, causing significant delays. Widening is required on US Route 1 to accommodate additional turn lanes and an additional eastbound and westbound travel lane in this area. Intersection improvements are also provided at the intersections of the southbound ramps and Goose lane; Goose Lane and Clapboard Hill Road; and Goose Lane and US Route 1 in order to improve operations through this area.

One other improvement concept was evaluated at Exit 59. This concept relocated the northbound off-ramp to US Route 1 as described above, however the northbound on-ramp was maintained at its existing location. The ultimate consolidation of the northbound ramps at one location is preferred because the complete elimination of the closely spaced northbound ramps and US Route 1 intersections maximizes the transportation-related benefits in this area.

Issues

- Poor LOS along NB and SB I-95
- Poor LOS at all ramp merge and diverge locations
- Nonstandard acceleration and deceleration lane lengths at NB off-ramp and SB ramp junctions
- High accident location at US Route 1, Goose Lane and Soundview Road intersection
- Poor LOS at intersection of SB ramps and Goose Lane
- Poor LOS at intersection of Goose Lane and Clapboard Hill Road
- Poor LOS at intersection of US Route 1, Goose Lane and Soundview Road
- Inadequate separation distance between NB ramps and US Route 1 intersections with Goose Lane

Solutions

- Continue mainline widening to three lanes NB and SB through interchange area
- Standardize all deficient acceleration and deceleration lanes to improve safety and operations at ramp merge and diverge locations
- Signalize intersection of SB ramps and Goose Lane
- Improve intersection geometry of SB off-ramp approach to Goose Lane and provide right-turn lane
- Widen Goose Lane to provide NB left-turn lane and SB right-turn lane to SB on-ramp
- Signalize intersection of Goose Lane and Clapboard Hill Road
- Reconfigure NB ramps and relocate NB ramps intersection to US Route 1
- Provide EB and WB left-turn lanes and WB right-turn lane on US Route 1 at NB ramps intersection
- Provide additional EB and WB travel lanes along US Route 1 through interchange area
- Provide NB left-turn lane and additional NB travel lane on Soundview Road at US Route 1 intersection
- Provide SB right-turn lane on Goose Lane at US Route 1 intersection
- Improve traffic signal timing/phasing at intersection of US Route 1 and Goose Lane

Exit 59 – SR 718 (continued)

Construction Costs (2004 $)

Roadway	$ 9,300,000
Bridge Structures	$ 3,800,000
Right-of-Way	$ 5,000,000
Environmental Mitigation (1.0 acre)	$ 200,000
Other	$ 5,600,000
Total	**$ 23,900,000**

Near-Term Improvement Opportunities

- Relocation of the NB off-ramp is a high priority interchange improvement
- Acceleration lane improvements at the SB on-ramp are low priority
- Deceleration lane improvements at the NB off-ramp are low priority
- Intersection improvements at the US Route 1, Goose Lane, Soundview Road intersection are high priority
- Intersection improvements at the SB ramps intersection with Goose Lane are low priority

Other Considerations

- No impacts to the existing Park & Ride lot
- Relocation of the Department of Transportation's salt shed is required. Potential relocation site identified in the vicinity of the existing NB off-ramp which is to be removed.
- Potential realignment or intersection geometry improvements at the Boston Street approach to US Route 1 are recommended for consideration in conjunction with near or long-term improvements along US Route 1.

Exit 60 – Mungertown Road, Town of Madison

Exit 60 is an existing half-diamond interchange located in the Town of Madison. The interchange consists of a northbound on-ramp and southbound off-ramp that provide access from I-95 to primarily local residential development in the area. Mungertown Road via Exit 60 also provides access to US Route 1 located to the south of the interchange.

Figure 5-2 (Sheets 22 and 23 of 124) presents the recommended long-term improvement concept at Exit 60. The improvement concept at this location provides a northbound off-ramp and southbound on-ramp at Wildwood Avenue located approximately one half mile west of Mungertown Road. The addition of these ramps creates a full-service, split diamond interchange at Exit 60 in this area. A signed route directing motorists from one half of the interchange to the other can be provided from Wildwood Avenue to Mungertown Road via Green Hill Road and Nortontown Road. An alternative connection can be provided via US Route 1, however potential low clearance issues at the railroad overpass on Mungertown Road would need to be addressed.

The addition of the ramps at Wildwood Avenue results in fewer impacts than completing the diamond interchange at Mungertown Road. The Town of Guilford in cooperation with the Town of Madison requested that full access be accommodated at Exit 60 to help relieve congestion at Exit 59 created by motorists traveling to and from North Madison and Killingworth.

No other major improvement concepts were considered by the study team at this location.

Issues

- Poor LOS along NB and SB I-95
- Poor LOS at ramp merge and diverge locations
- Nonstandard acceleration and deceleration lane lengths at NB on-ramp and SB off-ramp junctions
- Significant traffic demand at Exit 59 in the Town of Guilford caused by limited access at Exit 60

Solutions

- Continue mainline widening to three lanes NB and SB through interchange area
- Standardize acceleration and deceleration lanes to improve safety and operations at ramp merge and diverge locations
- Provide NB off-ramp and SB on-ramp at Wildwood Avenue to create a full-service interchange at Exit 60

Construction Costs (2004 $)

Roadway	$ 12,200,000
Bridge Structures	$ 3,900,000
Right-of-Way	$ 30,000
Environmental Mitigation (3.61 acres)	$ 720,000
Other	$ 6,650,000
Total	**$ 23,500,000**

Near-Term Improvement Opportunities

- Acceleration and deceleration lane improvements at the NB on-ramp and SB off-ramp are low priority

Exit 61 – Route 79 (Durham Road), Town of Madison

Exit 61 is located in the Town of Madison and provides access to Route 79 (Durham Road). This exit also provides access to US Route 1 located off Durham Road to the south and to the Shore Line East railroad station in Madison located south of the interchange off Bradley Road. An existing Park & Ride lot is also located on the southbound side of Route 79 within the interchange and provides parking space for approximately 197 vehicles.

Figure 5-2 (Sheets 25 and 26 of 124) presents the recommended long-term improvement concept at Exit 61. Right-turn lanes are provided on the southbound off-ramp approach, Woodland Road approach and Old Route 79 approaches to Route 79. A new traffic signal is provided at the northbound ramp intersection and southbound left-turn lanes are provided on Route 79 at the southbound ramp, northbound ramp and Old Route 79 intersections. An additional northbound travel lane is also provided along Route 79 to improve intersection capacities through this area.

Issues

- Poor LOS along NB and SB I-95
- Poor LOS at ramp merge and diverge locations
- Nonstandard acceleration and deceleration lane lengths at NB off-ramp and SB ramp junctions
- Poor LOS at intersection of NB ramps and Route 79
- Poor LOS at intersection of SB ramps and Route 79
- Poor LOS at intersection of Route 79 and Woodland Road
- Poor LOS at intersection of Route 79 and Park & Ride lot drive

Solutions

- Continue mainline widening to three lanes NB and SB through interchange area
- Standardize deficient acceleration and deceleration lanes to improve safety and operations at ramp merge and diverge locations
- Improve intersection geometry and signalize intersection of NB ramps and Route 79
- Provide right-turn lane on SB off-ramp approach to Route 79
- Improve signal timing/phasing at SB ramps intersection with Route 79 and coordinate with new traffic signal at NB ramps
- Widen Route 79 to accommodate additional NB travel lane and SB left-turn lanes to SB on-ramp, NB on-ramp, Old Route 79
- Provide right-turn lane on Woodland Road approach to Route 79
- Provide right-turn lane on Old Route 79 approach to Route 79

Construction Costs (2004 $)

Roadway	$ 10,500,000
Bridge Structures	$ 2,500,000
Right-of-Way	$ 450,000
Environmental Mitigation (0.61 acres)	$ 120,000
Other	$ 5,830,000
Total	**$ 19,400,000**

Near-Term Improvement Opportunities

- Deceleration lane improvements at the NB off-ramp are low priority
- Acceleration and deceleration lane improvements at the SB ramps are low priority
- Signalization of the NB ramps intersection with Route 79 is low priority

Other Considerations

- Potential Park & Ride lot expansion for approximately 50 new spaces can be accommodated to mitigate the loss of approximately 80 existing spaces

Exit 62 – SR 450 (Hammonasset Connector)/Hammonasset State Park, Town of Madison

Exit 62 is located in the Town of Madison and provides direct access to Hammonasset State Park via SR 450 (Hammonasset Connector). US Route 1, located south of Exit 62, is also accessible from Hammonasset Connector.

Figure 5-2 (Sheet 29 of 124) presents the recommended long-term improvement concept at Exit 62. The improvement concept realigns the southbound ramps in a button-hook configuration. The reconfigured ramps intersect Duck Hole Road approximately 900 feet east of the intersection of Duck Hole Road and Hammonasset Connector. The elimination of the southbound ramps intersection from Hammonasset Connector and the new traffic signal at the Duck Hole Road and northbound ramps intersections improve traffic operations along the connector. A westbound right-turn lane is provided on Duck Hole Road at the intersection with Hammonasset Connector. Auxiliary lanes are also provided in both directions along I-95 between the rest areas and Exit 62 ramps in order to improve weaving operations.

The other improvement concept considered at Exit 62 relocated the southbound ramps intersection opposite New Road and provided a cul-de-sac for Duck Hole Road near the existing Hammonasset River crossing. This concept was ultimately deemed infeasible due primarily to the significant volume of traffic carried by Duck Hole Road.

Issues

- Poor LOS along NB and SB I-95
- Poor LOS at ramp merge and diverge locations
- Nonstandard acceleration and deceleration lane lengths at all ramp junctions
- Nonstandard spacing between ramps for NB and SB rest areas and ramps for Exit 62
- Poor LOS at intersection of SB ramps and Hammonasset Connector
- Closely spaced intersections of Duck Hole Road and SB ramps along Hammonasset Connector
- Intersection of NB off-ramp offset from intersection of NB on-ramp along Hammonasset Connector

Solutions

- Continue mainline widening to three lanes NB and SB through interchange area
- Standardize acceleration and deceleration lanes to improve safety and operations at ramp merge and diverge locations
- Provide auxiliary lane between NB rest area on-ramp and NB Exit 62 off-ramp
- Provide auxiliary lane between SB Exit 62 on-ramp and SB rest area off-ramp
- Reconfigure SB ramps and relocate SB ramps intersection to Duck Hole Road to eliminate intersection along Hammonasset Connector
- Signalize intersection of Duck Hole Road and Hammonasset Connector
- Provide WB right-turn lane on Duck Hole Road at Hammonasset Connector
- Realign NB off-ramp to eliminate offset from NB on-ramp and improve NB on-ramp intersection geometry

Construction Costs (2004 $)

Roadway	$ 7,000,000
Bridge Structures	$ 10,500,000
Right-of-Way	$ 35,000
Environmental Mitigation (0.10 acres)	$ 20,000
Other	$ 7,345,000
Total	**$ 24,900,000**

Other Considerations

- Potential new Park & Ride lot can be accommodated on the EB side of New Road providing approximately 100 new spaces
- Potential new Park & Ride lot can be accommodated on the EB side of Duck Hole Road where the existing SB ramps are removed providing approximately 100 new spaces

Exit 63 – Route 81 (Killingworth Turnpike), Town of Clinton

Exit 63, located in the Town of Clinton, provides access to local residential development in the area and numerous commercial developments along Route 81. This exit also provides access to US Route 1 located to the south and to the Shore Line East railroad station in Clinton also located south of the interchange off Route 81. Morgan High School and Clinton Crossing outlet mall are located along Route 81 immediately north of the interchange. An existing Park & Ride lot is located on the southbound side of Route 81 within the interchange providing parking space for approximately 135 vehicles.

Figure 5-2 (Sheet 34 of 124) presents the recommended long-term improvement concept at Exit 63. The improvement concept consists of relocating the northbound off-ramp intersection with North High Street approximately 200 feet southwest of its existing location. This improves intersection operations by increasing the separation distance between the successive double left-turning movements from the northbound off-ramp to North High Street and Route 81. The ramp relocation also provides additional storage space for queuing vehicles on North High Street at the Route 81 intersection. The improvement concept at this interchange also consists of providing a northbound left-turn lane on Route 81 at North High Street and providing southbound right-turn lanes on Route 81 at the southbound ramp and North High Street intersections. A right-turn lane is provided on the northbound off-ramp approach to North High Street. An additional southbound travel lane is also provided along Route 81 to improve intersection capacities through this area.

Several other major improvement concepts were evaluated by the study team at Exit 63, each of which focused on eliminating or improving the operations of the successive double left turning movements from the northbound off-ramp to North High Street and to Route 81. These improvements considered relocating Glenwood Road over I-95 to intersect with North High Street and providing button-hook northbound ramps west of Route 81; relocating North High Street over I-95 to intersect with Glenwood Road and relocating the northbound off-ramp to directly intersect Route 81; and replacing the signalized intersection of Route 81, North High Street and the northbound ramps with a two-lane roundabout. These concepts were generally rejected due to the overall estimated construction costs, the severity of environmental impacts and the extent of right-of-way requirements.

Issues

- Poor LOS along NB and SB I-95
- Poor LOS at ramp merge and diverge locations
- Nonstandard acceleration and deceleration lane lengths at all ramp junctions
- Poor LOS at intersection of NB on-ramp, Route 81 and North High Street
- Poor LOS at intersection of SB ramps and Route 81
- Poor LOS at intersection of Route 81 and Glenwood Road
- Inadequate separation distance between intersection of NB off-ramp and North High Street and intersection of North High Street and Route 81
- Successive double left-turns from NB off-ramp to North High Street to NB Route 81

Solutions

- Continue mainline widening to three lanes NB and SB through interchange area
- Standardize acceleration and deceleration lanes to improve safety and operations at ramp merge and diverge locations
- Relocate NB off-ramp intersection with North High Street approximately 200 feet southwest of existing location
- Provide right-turn lane on NB off-ramp approach to North High Street
- Provide NB left-turn lane and SB right-turn lane on Route 81 to North High Street
- Provide SB right-turn lane on Route 81 to SB on-ramp
- Provide additional SB travel lane along Route 81 through interchange area

Exit 63 – Route 81 (Continued)

Construction Costs (2004 $)

Roadway	$ 10,700,000
Bridge Structures	$ 5,800,000
Right-of-Way	$ 3,000,000
Environmental Mitigation (2.31 acres)	$ 460,000
Other	$ 7,040,000
Total	**$ 27,000,000**

Near-Term Improvement Opportunities

- Acceleration and deceleration lane improvements at the NB ramps are low priority
- Signal timing/phasing improvements at the NB on-ramp intersection with Route 81 are low priority
- Intersection improvements at the SB ramps intersection with Route 81 are low priority

Other Considerations

- Minor impacts to the existing Park & Ride lot will not result in lost parking spaces
- Positive barrier protection is recommended along the east side of the Park & Ride lot adjacent to Route 81 to channel pedestrians leaving the lot to the crosswalks that cross Route 81 at Glenwood Road and the high school driveway
- Recommended consideration given to combining the Ethan Allen furniture store drive with a full-access Clinton Crossing drive to eliminate the store access located on Route 81 immediately north of the SB ramps intersection with Route 81

Exit 64 – Route 145 (Horse Hill Road), Town of Westbrook

Exit 64 is located in the Town of Westbrook and provides access to primarily residential development in the area via Route 145 (Horse Hill Road). Route 145 south of Exit 64 connects to SR 625 which links to the Grove Beach section of Westbrook. An existing Park & Ride lot is located on the northbound side of Route 145 immediately south of the northbound on-ramp and provides parking space for approximately 23 vehicles.

Figure 5-2 (Sheet 38 of 124) presents the recommended long-term improvement concept at Exit 64. New traffic signals are provided on Route 145 at the northbound and southbound ramp intersections to improve traffic operations through the interchange area. Right-turn lanes are also provided on the northbound and southbound off-ramp approaches to Route 145 and Route 145 is widened to accommodate northbound and southbound left-turns lanes at the ramp intersections. The alignment of Route 145 is shifted slightly to the east to accommodate a southbound right-turn lane while minimizing impacts to a residential property located in the northwest quadrant of the intersection of Route 145 and the southbound ramps. Separate southbound left and right turn lanes are also provided on Route 145 at the intersection of Old Clinton Road to improve operations.

Issues

- Poor LOS along NB and SB I-95
- Poor LOS at ramp merge and diverge locations
- Nonstandard acceleration and deceleration lane lengths at all ramp junctions
- Poor LOS at intersection of SB ramps and Route 145
- Poor LOS at intersection of Route 145 and Old Clinton Road

Solutions

- Continue mainline widening to three lanes NB and SB through interchange area
- Standardize acceleration and deceleration lanes to improve safety and operations at ramp merge and diverge locations
- Signalize intersection of NB ramps and Route 145
- Provide right-turn lane on NB off-ramp approach to Route 145
- Provide NB right-turn lane on Route 145 to NB on-ramp
- Signalize intersection of SB ramps and Route 145
- Provide right-turn lane on SB off-ramp approach to Route 145
- Provide SB right-turn lane on Route 145 to SB on-ramp
- Widen Route 145 to accommodate NB and SB left-turn lanes to NB and SB on-ramps
- Provide separate SB left and right turn lanes on Route 145 at intersection of Old Clinton Road

Construction Costs (2004 $)

Roadway	$ 9,200,000
Bridge Structures	$ 3,200,000
Right-of-Way	$ 40,000
Environmental Mitigation (0.86 acres)	$ 170,000
Other	$ 5,290,000
Total	**$ 17,900,000**

Near-Term Improvement Opportunities

- Acceleration and deceleration lane improvements at the NB ramps and SB off-ramp are low priority
- Intersection improvements at the NB and SB ramps intersections with Route 145 are high priority

Other Considerations

- Relocate the existing Park & Ride lot and provide approximately 50 new spaces to mitigate the loss of 23 existing spaces

Exit 65 – Route 153 (Essex Road), Town of Westbrook

Exit 65, located in the Town of Westbrook, provides access to Route 153 (Essex Road) and US Route 1 located to the south. This exit also provides access to the Westbrook Tanger Outlet Center and the Shore Line East railroad station in Westbrook, both located off Route 153 south of the interchange. An existing Park & Ride lot is also located off Flat Rock Place immediately south of the northbound on-ramp and provides parking space for approximately 50 vehicles.

Figure 5-2 (Sheet 43 of 124) presents the recommended long-term improvement concept at Exit 65. The lane configurations at the ramp intersections with Route 153 remain unchanged. However, standard acceleration and deceleration lanes are provided at each ramp connection with I-95. The gore nose at the southbound off-ramp is shifted north along I-95 to provide adequate deceleration length to the back of the traffic queue in the design hour.

Issues

- Poor LOS along NB and SB I-95
- Poor LOS at ramp merge and diverge locations
- Nonstandard acceleration and deceleration lane lengths at SB on-ramp and NB ramp junctions

Solutions

- Continue mainline widening to three lanes NB and SB through interchange area
- Standardize deficient acceleration and deceleration lanes to improve safety and operations at ramp merge and diverge locations
- Modify traffic signal timing/phasing at ramp intersections with Route 153

Construction Costs (2004 $)

Roadway	$ 6,600,000
Bridge Structures	$ 4,900,000
Right-of-Way	$ 25,000
Environmental Mitigation (1.01 acres)	$ 200,000
Other	$ 4,975,000
Total	**$ 16,700,000**

Near-Term Improvement Opportunities

- Acceleration and deceleration lane improvements at the NB ramps are low priority
- Acceleration lane improvements at the SB on-ramp are low priority

Other Considerations

- Minor impacts to the existing Park & Ride lot will result in a loss of approximately 20 parking spaces

Exit 66 – Route 166 (Spencer Plain Road), Town of Old Saybrook

Exit 66 is located in the Town of Old Saybrook and provides access to residential, commercial and industrial development along Route 166 (Spencer Plain Road). Route 166 connects US Route 1 located to the south and Route 153 located to the northwest.

Figure 5-2 (Sheet 46 of 124) presents the recommended long-term improvement concept at Exit 66. The improvement concept primarily consists of providing standard acceleration and deceleration lanes at each ramp junction with I-95 and secondary roadway and ramp intersection improvements. Right-turn lanes are provided on the northbound and southbound off-ramp approaches to Route 166 and Route 166 is widened to accommodate a northbound left-turn lane at the northbound ramp intersection. This widening requires the replacement of the bridge structure over the Amtrak/Providence and Worcester Railroad.

Issues

- Poor LOS along NB and SB I-95
- Poor LOS at ramp merge and diverge locations
- Nonstandard acceleration and deceleration lane lengths at NB off-ramp and SB ramp junctions
- Poor LOS at intersection of NB ramps and Route 166
- Poor LOS at intersection of SB ramps and Route 166
- Short-radius horizontal curvature on NB on-ramp and SB on-ramp

Solutions

- Continue widening to three lanes NB and SB through interchange area
- Standardize deficient acceleration and deceleration lanes to improve safety and operations at ramp merge and diverge locations
- Signalize intersection of NB ramps and Route 166
- Provide right-turn lane on NB off-ramp approach to Route 166
- Signalize intersection of SB ramps and Route 166
- Provide right-turn lane on SB off-ramp approach to Route 166
- Widen Route 166 to accommodate NB left-turn lane to NB on-ramp
- Slightly realign NB and SB ramps to accommodate minimum horizontal curvature

Construction Costs (2004 $)

Roadway	$ 8,900,000
Bridge Structures	$ 2,500,000
Right-of-Way	$ 250,000
Environmental Mitigation (2.81 acres)	$ 560,000
Other	$ 4,790,000
Total	**$ 17,000,000**

Near-Term Improvement Opportunities

- Deceleration lane improvements at the SB off-ramp are low priority

Other Considerations

- Realign a portion of a local roadway to accommodate the SB ramps realignment and to maintain access to residential properties
- Reconstruct the Route 166 bridge over the Amtrak/Providence and Worchester Railroad to accommodate the additional left-turn lane

Exit 67 – Elm Street, Town of Old Saybrook

Exit 67 is an existing split interchange located in the Town of Old Saybrook. The southern (western) half of the interchange consists of a northbound on-ramp and southbound off-ramp that provide access to and from Elm Street. The northern (eastern) half of the interchange consists of a northbound off-ramp and two southbound on-ramps that access Route 154. Due to the nature of the improvement concepts in these two locations, the specific improvements at Elm Street and Route 154 are presented under separate headings in the following discussion.

Figure 5-2 (Sheet 49 of 124) presents the recommended long-term improvement concept at Exit 67 (Elm Street). The improvement concept provides a northbound off-ramp to Ingham Hill Road and a southbound on-ramp from Elm Street to create a full-service diamond interchange at this location. The northbound off-ramp intersects Ingham Hill Road approximately 700 ft west of the intersection of Ingham Hill Road and Elm Street. In order for the FHWA to endorse the construction of a full-diamond interchange at Elm Street, low clearance issues associated with the existing Amtrak bridge over Elm Street south of the intersection must be addressed to eliminate potential safety concerns at this location. The local municipality would be responsible for committing the funds to reconstruct this bridge to current design standards.

No other major improvement concepts were considered by the study team at this location.

Issues

- Poor LOS along NB and SB I-95
- Poor LOS at ramp merge and diverge locations
- Nonstandard acceleration lane length at NB on-ramp junction
- Poor LOS at intersection of NB on-ramp, Ingham Hill Road and Elm Street

Solutions

- Continue widening to three lanes NB and SB through interchange area
- Provide NB off-ramp and SB on-ramp to create full-service diamond interchange
- Standardize acceleration and deceleration lanes to improve safety and operations at ramp merge and diverge locations
- Signalize intersection of NB on-ramp, Ingham Hill Road and Elm Street
- Signalize intersection of SB ramps and Elm Street
- Widen Elm Street to accommodate NB left-turn lanes to Ingham Hill Road and SB on-ramp

Construction Costs (2004 $)

Roadway	$ 8,600,000
Bridge Structures	$ 4,600,000
Right-of-Way	$ 400,000
Environmental Mitigation (3.32 acres)	$ 660,000
Other	$ 5,440,000
Total	**$ 19,700,000**

Near-Term Improvement Opportunities

- Acceleration lane improvements at the NB on-ramp are low priority

Exit 67 – Route 154 (Middlesex Turnpike), Town of Old Saybrook
Exit 68 – US Route 1 (Boston Post Road), Town of Old Saybrook

Exit 67 is an existing split interchange located in the Town of Old Saybrook. The southern (western) half of the interchange consists of a northbound on-ramp and southbound off-ramp that provide access to and from Elm Street. The northern (eastern) half of the interchange consists of a northbound off-ramp and two southbound on-ramps that access Route 154. Due to the nature of the improvement concepts in these two locations, the specific improvements at Elm Street and Route 154 are presented separately. Exit 68 consists of a northbound on-ramp from US Route 1 and a southbound off-ramp to US Route 1 via Springbrook Road. Both Exit 67 and Exit 68 function to provide access to residential development in the area and commercial development concentrated along US Route 1.

Figure 5-2 (Sheet 51 and 53 of 124) presents the recommended long-term improvement concept at Exit 67 (Route 154) and Exit 68. The improvement concept at Exit 67 (Route 154) reconfigures the existing ramps to provide a full-service diamond interchange at this location. The provisions for a northbound on-ramp and a southbound off-ramp serve to replace the existing ramps at Exit 68. These ramps are eliminated due to a combination of factors including the northbound and southbound weaves between Exits 68 and 69 and site constraints at the existing Exit 68 ramp locations created by the addition of a third lane and the proximity of Exit 69.

Other improvement concepts considered at these interchanges included a single-point diamond interchange (SPDI) to minimize environmental and right-of-way impacts at Exit 67 (Route 154) and the reconfiguration of the existing ramps at Exit 68. The SPDI design was eliminated from further consideration due to operational and maintenance concerns. The reconfigured ramps at Exit 68 were eliminated from further investigation due to the extent of right-of-way impacts the reconfigured ramps caused to numerous residential and commercial properties in the area.

Issues

- Poor LOS along NB and SB I-95
- Poor LOS at all ramp merge and diverge locations at both exits
- Nonstandard acceleration and deceleration lane lengths at all Exit 67 (Route 154) ramp junctions
- Poor LOS at intersection of NB off-ramp and Route 154
- Nonstandard interchange spacing SB and weaving sections NB and SB between Exit 68 and Exit 69

Solutions

- Continue widening to three lanes NB and SB through interchange area
- Provide NB on-ramp and SB off-ramp to create full-service diamond interchange at Exit 67 (Route 154)
- Standardize acceleration and deceleration lanes to improve safety and operations at deficient ramp merge and diverge locations
- Signalize intersection of NB ramps and Route 154
- Signalize intersection of SB ramps and Route 154
- Eliminate NB on-ramp and SB off-ramp at Exit 68
- Improve intersection geometry at Springbrook Road and Boston Post Road intersection

Exits 67 and 68 (continued)

Construction Costs (2004 $)

Roadway	$ 10,700,000
Bridge Structures	$ 4,700,000
Right-of-Way	$ 50,000
Environmental Mitigation (2.67 acres)	$ 530,000
Other	$ 6,420,000
Total	**$ 22,400,000**

Near-Term Improvement Opportunities

- Acceleration and deceleration lane improvements at the SB on-ramp from SB Route 154 and the NB off-ramp are low priority
- Signalization of the NB off-ramp intersection with Route 154 is low priority

Other Considerations

- With the elimination of Exit 68, signing modifications will be required to direct US Route 1 traffic to and from Exit 67 at Route 154. Currently, traffic is directed to and from I-95 through Exit 68 to accommodate crossing of the Connecticut River over the Baldwin Bridge. As a result of the signing modifications, Boston Post Road located between Route 154 and Exit 68 will no longer be designated US Route 1.

Exit 69 – Route 9, Town of Old Saybrook

Exit 69 is a freeway-to-freeway interchange connecting I-95 and Route 9. This interchange is located immediately west of the Connecticut River in the Town of Old Saybrook.

Figure 5-2 (Sheet 54 of 124) presents the recommended long-term improvement concept at Exit 69. The improvement concept consists of providing standard acceleration and deceleration lane lengths and standard geometry at the ramp junctions for the northbound off-ramp and southbound on-ramp.

Several major improvement concepts were investigated by the study team at Exit 69 that were subsequently rejected for a variety of reasons including the extent of additional right-of-way impacts, cost, aesthetic considerations and overall feasibility. Each of these improvement concepts focused on providing a freeway-to-freeway interchange with high-speed ramps in order to improve operations within the interchange.

Issues

- Poor LOS at NB on-ramp merge
- Poor LOS at SB ramp merge and diverge locations

Solutions

- Standardize ramp merge and diverge geometry
- Standardize SB acceleration lane and NB deceleration lane to improve safety and operations at ramp merge and diverge locations

Construction Costs (2004 $)

Roadway	$ 6,800,000
Bridge Structures	$ 4,100,000
Right-of-Way	$ 0
Environmental Mitigation (0 acres)	$ 0
Other	$ 4,600,000
Total	**$ 15,500,000**

Near-Term Improvement Opportunities

- Deceleration lane improvements at the NB off-ramp are low priority

Other Considerations

- Existing three-lane section begins immediately south (west) of Exit 69 therefore no widening is required through the interchange area
- Transition from 14 foot inside and outside shoulder widths to existing shoulder widths at the Baldwin Bridge through the interchange area

Exit 70 – US Route 1/Route 156, Town of Old Lyme

Exit 70 is a split diamond interchange located immediately east of the Connecticut River in the Town of Old Lyme. The southern (western) half of the diamond consists of a northbound off-ramp and southbound on-ramp that provide access to and from Route 156 and US Route 1. The northern (eastern) half of the diamond is located in the historic district of Old Lyme and consists of a northbound on-ramp and southbound off-ramp that provide access to and from US Route 1 and Lyme Street. An existing Park & Ride lot is located on the northbound side of Route 156 opposite the southbound on-ramp and provides parking space for approximately 50 vehicles.

Figure 5-2 (Sheets 56 and 58 of 124) presents the recommended long-term improvement concept at Exit 70. The improvement concept at this interchange maintains the existing split diamond configuration, however approximately 500 feet of Old Bridge Road is improved and slightly realigned with US Route 1 to create a four-legged intersection with Route 156. The southbound on-ramp is also realigned in a button-hook configuration to intersect the improved section of Old Bridge Road. This realignment eliminates the southbound on-ramp and Route 156 intersection so that traffic destined for southbound I-95 from US Route 1 is directed straight across Route 156. Currently, this traffic from US Route 1 is required to make a left turn onto Route 156 and then a right turn onto the ramp, which is located approximately 250 feet south of US Route 1. The improvement concept is targeted at eliminating the operational problems associated with these closely spaced intersections.

The northern ramps at Lyme Street and US Route 1 are also slightly realigned to provide adequate sight distance and queuing distance at the intersection of Lyme Street and US Route 1.

Two other improvement concepts were also considered at this location. Both concepts focused on providing full-service access at Route 156 in order to eliminate the ramps at Lyme Street. Both concepts were subsequently eliminated from further consideration due to extensive impacts to existing residential properties located in the vicinity of the northbound off-ramp intersection with Route 156.

Issues

- Poor LOS along NB and SB I-95
- Abrupt NB lane reduction immediately south of Lieutenant River crossing
- Poor LOS at NB off-ramp and SB ramp merge and diverge locations
- Nonstandard acceleration and deceleration lane lengths at NB on-ramp and SB off-ramp junctions
- High accident location
- Intersection of SB on-ramp and Route 156 offset from intersection of US Route 1 and Route 156
- Poor LOS at intersection of SB on-ramp and Route 156
- Poor LOS at intersection of US Route 1 and Route 156
- Poor LOS at intersection of SB off-ramp and US Route 1

Solutions

- Continue widening to three lanes NB and SB through interchange area and across Lieutenant River to eliminate “bottleneck” effect
- Standardize acceleration and deceleration lanes to improve safety and operations at deficient ramp merge and diverge locations
- Realign SB on-ramp with US Route 1 to eliminate offset intersections and improve LOS
- Modify signal timing at NB off-ramp and Route 156 intersection to improve capacity and LOS
- Provide additional EB left-turn lane on US Route 1 (Halls Road) at Lyme Street/SB off-ramp intersection
- Provide SB right-turn lane on US Route 1 (Boston Post Road) at Lyme Street/SB off-ramp intersection
- Widen Lyme Street/US Route 1 (Boston Post Road) to accommodate NB left-turn lane to US Route 1 (Halls Road)

Exit 70 – US Route 1/Route 156 (continued)

Construction Costs (2004 $)

Roadway	$ 13,100,000
Bridge Structures	$ 15,400,000
Right-of-Way	$ 2,400,000
Environmental Mitigation (3.12 acres)	$ 620,000
Other	$ 11,780,000
Total	**$ 43,300,000**

Near-Term Improvement Opportunities

- Acceleration and deceleration lane improvements at the NB on-ramp and the SB off-ramp are high priority
- Signal timing/phasing improvements at the SB on-ramp intersection with Route 156 are low priority
- Signal timing/phasing improvements at the SB off-ramp intersection with US Route 1/Lyme Street are low priority

Other Considerations

- No impacts to the existing Park & Ride lot
- Potential new Park & Ride lot can be accommodated on the SB side of Route 156 where the existing SB on-ramp is removed providing approximately 50 new spaces
- Relocate the pedestrian/bike path north of Old Bridge Road and provide a connection to the potential new Park & Ride lot
- Construct a retaining wall between the SB lanes and US Route 1 (Halls Road) to minimize ROW impacts

Exit 71 – Four Mile River Road, Town of Old Lyme
Exit 72 – Rocky Neck State Park/SR 449 (Rocky Neck Connector), Town of East Lyme

Exit 71 is located in the towns of Old Lyme and East Lyme. This interchange provides access to several industrial developments along Four Mile River Road and Hatchetts Hill Road in the area. An existing Park & Ride lot is located on the northbound side of Four Mile River Road immediately north of the Exit 71 southbound off-ramp. Exit 72 is a trumpet interchange located several hundred feet north (east) of Exit 71 in the Town of East Lyme. Exit 72 provides access to Rocky Neck State Park via SR 449 (Rocky Neck Connector). Because the operations of both interchanges are significantly influenced by their proximity to each other, they have been considered an interchange "system" for the purposes of conducting this study and are presented together in the following discussion.

Figure 5-2 (Sheets 65 and 66 of 124) presents the recommended long-term improvement concept at Exit 71 and Exit 72. The improvement concept incorporates a "scissors ramp" configuration in both the northbound and southbound directions to eliminate the mainline weaves between the two interchanges. In this configuration, northbound traffic to Rocky Neck Connector exits with northbound traffic to Four Mile River Road south (west) of Exit 71 and crosses over the northbound on-ramp from Four Mile River Road thus separating individual entering and exiting traffic movements. Similarly, southbound traffic to Four Mile River Road exits with southbound traffic to Rocky Neck Connector north (east) of Exit 72 and crosses over the southbound on-ramp from Rocky Neck Connector.

Numerous other improvement concepts were evaluated at this location, all of which addressed the safety and operational concerns associated with the mainline weaving conditions between the two interchanges. One concept considered eliminating access to Four Mile River Road via Exit 71 by removing the existing ramps. This concept was rejected by the study team because a significant volume of truck traffic would be forced to re-route across low volume roadways in order to access industrial developments along Four Mile River Road. Several other concepts incorporated northbound and southbound collector-distributor (CD) roads to remove the weaving conditions from the mainline. These concepts were later rejected on the basis that the scissors ramp configurations completely removed the weaving conditions between the interchanges, whereas the CD road configurations simply relocated the weaving conditions off the mainline.

Issues

- Poor LOS along NB and SB I-95
- Nonstandard interchange spacing NB and SB
- Weaving sections NB and SB
- Nonstandard acceleration and deceleration lane lengths at Exit 71 SB on-ramp and NB ramp junctions
- Nonstandard acceleration and deceleration lane lengths at Exit 72 NB on-ramp and SB ramp junctions
- High accident location
- Poor LOS at intersection of Rocky Neck Connector and Route 156

Solutions

- Continue widening to three lanes NB and SB through interchange area
- Standardize acceleration and deceleration lanes to improve safety and operations at deficient ramp merge and diverge locations
- Construct combined NB and SB off-ramps for Exits 71 and 72 to eliminate mainline weaving conditions
- Provide additional SB left-turn lane on Rocky Neck Connector at intersection of Route 156

Exits 71 and 72 (continued)

Construction Costs (2004 $)

Roadway	$ 28,800,000
Bridge Structures	$ 10,600,000
Right-of-Way	$ 200,000
Environmental Mitigation (7.01 acres)	$ 1,400,000
Other	$ 15,500,000
Total	**$ 56,500,000**

Near-Term Improvement Opportunities

- Acceleration lane improvements at the Exit 71 SB on-ramp are high priority
- Acceleration lane improvements at the Exit 72 NB on-ramp are medium priority

Other Considerations

- No impacts to the existing Park & Ride lot at Exit 71
- Construct a retaining wall between the NB lanes and Hatchetts Hill Road to minimize impacts
- Construct a retaining wall between the NB lanes and the combined Exit 71/72 off-ramp to minimize impacts
- Construct a retaining wall between the SB lanes and the combined Exit 72/71 off-ramp to minimize impacts

Exit 73 – Society Road, Town of East Lyme

Exit 73 is a low-volume interchange located in the Town of East Lyme that provides access to local residential developments in the area.

Figure 5-2 (Sheet 70 of 124) presents the recommended long-term improvement concept at Exit 73. The improvement concept at this interchange consists of relocating the northbound off-ramp to a location south (west) of the Society Road overpass and providing a new intersection with Society Road. The relocation of this ramp is required due to site constraints at the existing ramp location caused by the addition of a third mainline lane in the northbound direction.

No other major improvements concepts were considered by the study team in this location.

Issues

- Poor LOS along NB and SB I-95
- Poor LOS at all ramp merge and diverge locations
- Nonstandard acceleration and deceleration lane lengths at all ramp junctions

Solutions

- Continue widening to three lanes NB and SB through interchange area
- Standardize acceleration and deceleration lanes to improve safety and operations at all ramp merge and diverge locations
- Relocate NB off-ramp

Construction Costs (2004 $)

Roadway	$ 12,300,000
Bridge Structures	$ 1,800,000
Right-of-Way	$ 25,000
Environmental Mitigation (0.46 acres)	$ 90,000
Other	$ 5,885,000
Total	**$ 20,100,000**

Near-Term Improvement Opportunities

- Acceleration and deceleration lane improvements at the NB on-ramp, NB off-ramp and SB on-ramp are medium priority

Exit 74 – Route 161 (Flanders Road), Town of East Lyme

Exit 74 is located in the Town of East Lyme and functions as an important link between I-95 and numerous commercial developments located along Route 161 (Flanders Road) in this area. Two existing Park & Ride lots are located near the northbound on-ramp and provide parking space for approximately 68 vehicles. Exit 74 abuts the southern (western) limit of the planned Route 11 construction project that includes the reconstruction of the I-395/I-95 interchange and provides three NB and SB travel lanes along I-95 between Exit 74 and Exit 81.

Figure 5-2 (Sheet 73 of 124) presents the recommended long-term improvement concept at Exit 74. The improvement concept at this interchange provides standard horizontal curvature for the southbound ramps. The alignment of the ramps and their intersection with Route 161 maximize the separation distance between intersections along Route 161 while maintaining consistency with the Town of East Lyme's plan for future development. This concept maintains the northbound off-ramp at its existing location and shifts the northbound on-ramp intersection approximately 50 feet south to accommodate the addition of a third northbound lane. These improvements are consistent with the planned Route 11 improvements in this area.

Several other improvement concepts were developed at this interchange that focused on maximizing the separation distance between intersections along Route 161 in order to improve traffic flow through the area. All of the concepts utilized similar southbound ramp improvements as described above, however a variety of northbound ramp and secondary road configurations were explored. These concepts were generally rejected for a combination of reasons including limited feasibility of the improvements and limited benefits derived from complex alignments.

Issues

- Poor LOS along NB and SB I-95
- Nonstandard acceleration and deceleration lane lengths at all ramp junctions
- Nonstandard horizontal curvature on SB ramps
- Poor LOS at intersection of NB off-ramp, Route 161 and King Arthur Drive

Solutions

- Continue widening to three lanes NB and SB through interchange area
- Standardize acceleration and deceleration lanes to improve safety and operations at all ramp merge and diverge locations
- Realign SB ramps to improve geometry and increase separation distance between intersections along Route 161
- Signalize intersection of SB ramps and Route 161
- Improve intersection geometry and traffic signal timing/phasing at intersection of NB off-ramp and Route 161

Construction Costs (2004 $)

Roadway	$ 7,500,000
Bridge Structures	$ 7,600,000
Right-of-Way	$ 2,800,000
Environmental Mitigation (1.52 acres)	$ 300,000
Other	$ 6,600,000
Total	**$ 24,800,000**

Near-Term Improvement Opportunities

- Acceleration and deceleration lane improvements at the NB on-ramp, NB off-ramp and SB off-ramp are medium priority
- Acceleration lane improvements at the SB on-ramp are high priority

Other Considerations

- Relocate the existing Park & Ride lot and provide approximately 100 new to mitigate the loss of 68 existing spaces
- Potential new Park & Ride and/or Information Center can be accommodated where the existing SB ramps are removed

Exit 81 – Cross Road, Town of Waterford
Exit 82 – Route 85 (Broad Street), Town of Waterford
Exit 82A – Frontage Road, Town of Waterford and City of New London

Exits 81, 82 and 82A are located in the Town of Waterford between the northern (eastern) limit of the planned Route 11/I-395/I-95 interchange improvement project and the Thames River. Because the operations of these interchanges are significantly influenced by their proximity to each other, they have been considered an interchange "system" for the purposes of conducting this study and are presented together in the following discussion.

Exit 81 at Cross Road, which provides access to a number of commercial developments located along Parkway North and Parkway South in the area, is being reconstructed under a current ConnDOT improvement project. Planned for completion in 2005, the reconstructed interchange will provide northbound buttonhook ramps to a realigned Parkway South and maintain the existing slip ramps to and from I-95. These slip ramps include the northbound on-ramp and southbound off-ramp both located in the vicinity of the northbound and southbound weigh stations, and the southbound on-ramp from Parkway South located just west of Cross Road. It should be noted that the new overpass structure being constructed under this project provides sufficient lateral and vertical clearance to accommodate future widening of the mainline to six lanes.

Exit 82 at Route 85 functions as an important link between I-95 and major commercial development in the area including a number of shopping malls located north along Route 85. This exit also provides access to downtown Waterford from I-95.

Exit 82A links I-95 to the northbound and southbound frontage roads, providing access to a number of commercial developments and downtown New London.

Figure 5-2 (Sheets 81 through 85 of 124) presents the recommended long-term improvement concept at Exits 81, 82 and 82A. The improvement concept within this interchange system eliminates the existing northbound and southbound mainline weaves between Exit 82 and Exit 82A by extending the frontage road system to Route 85 and relocating direct access to and from I-95 and the frontage roads. The northbound frontage road off-ramp is relocated upstream to a point south (west) of Route 85 such that traffic is removed from I-95 onto a frontage road serving Route 85 and Vauxhall Street. To replace existing access to southbound I-95 from Vauxhall Street, buttonhook ramps are provided at Vauxhall Street to the southbound frontage road system, which intersects Route 85 at grade. A two-way frontage road is provided west of Route 85 connecting to the existing Parkway North facility. A pair of buttonhook ramps linking Parkway North to southbound I-95 is located between existing Exit 81 and Route 85. These ramps replace the southbound off-ramp to Parkway North and the southbound on-ramp from Route 85. Access to Vauxhall Street from the northbound frontage road is eliminated because the existing and projected design traffic volumes do no warrant provisions for access at this location. Slip ramps to and from southbound I-95 and a slip ramp to northbound I-95 are located along the southbound and northbound frontage roads to control traffic volumes along the frontage road system.

In developing the improvement concept for this interchange system, the study team was able to consider the Town of Waterford's plans for future development in the area and assure that the design of the concept improvements would not preclude identified improvements in the Town's plan. These identified improvements include the potential extension of Parkway South to Route 85 and the potential for an alternative connection between Parkway North and Route 85.

Issues

- Poor LOS along NB and SB I-95
- Substandard acceleration and deceleration lane lengths at Exit 81 NB on-ramp and SB off-ramp junctions (near weigh stations)
- Nonstandard acceleration and deceleration lane lengths at Exit 82 ramp junctions
- Nonstandard acceleration and deceleration lane lengths at Exit 82A ramp junctions
- Nonstandard interchange terminal spacing NB and SB between Exit 82 and Exit 82A
- Poor LOS in weaving section SB between Exit 82A and Exit 82
- Poor LOS at intersection of NB ramps and Route 85 at Exit 82
- Poor LOS at intersection of US Route 1 and Vauxhall Street
- Poor LOS at intersection of US Route 1 and Route 85

Exits 81, 82 and 82A (continued)

Solutions

- Continue widening to three lanes NB and SB through interchange areas
- Standardize acceleration and deceleration lanes to improve safety and operations at ramp merge and diverge locations
- Extend frontage road system to Route 85 to eliminate the mainline weaves between Exit 82 and Exit 82A
- Extend Parkway north to Route 85 and provide access between SB I-95 and Parkway North
- Relocate NB on-ramp at Exit 82 to west side of Route 85 to eliminate SB left-turn movement at this intersection
- Provide two travel lanes in each direction along Route 85 through the Exit 82 NB ramps intersection
- Provide a SB right-turn lane at the intersection of Route 85 and the NB ramps at Exit 82
- Eliminate access to Vauxhall Street from the NB frontage road near Exit 82A
- Provide EB right-turn lane and additional WB through lane at intersection of US Route 1 and Vauxhall Street
- Widen US Route 1 to provide NB and SB left-turn lanes at intersection of US Route 1 and Route 85
- Widen Route 85 to provide left and right-turn lanes in WB and EB directions at intersection of Route 85 and US Route 1

Construction Costs (2004 $)

Roadway	$ 40,100,000
Bridge Structures	$ 22,400,000
Right-of-Way	$ 13,775,000
Environmental Mitigation (4.11 acres)	$ 820,000
Other	$ 26,105,000
Total	**$ 103,200,000**

Near-Term Improvement Opportunities

- Extension of Parkway North to Route 85 and construction of SB ramps at Exit 81 are low priority interchange improvements
- Relocation of the NB ramps at Exit 82 is a high priority interchange improvement
- Acceleration and deceleration lane improvements at the Exit 81 SB ramps are medium priority
- Acceleration lane improvements at the Exit 81 NB on-ramp are low priority
- Acceleration lane improvements at the Exit 82 NB on-ramp are low priority
- Deceleration lane improvements at the Exit 82A NB off-ramp are low priority
- Signal timing/phasing modifications at the SB ramps intersection with Route 85 are high priority
- Signal timing/phasing modifications at the intersection of US Route 1 and Route 85 are high priority
- Signal timing/phasing modifications at the NB ramps intersection with Route 85 are low priority

Other Considerations

- Provide a retaining wall along the north side of the SB frontage road off-ramp to Vauxhall Street to minimize impacts to the hotel in this area
- Provide a cul-de-sac at the northern end of Vauxhall Street Extension
- Potential new Park & Ride lot can be accommodated at Exit 81 adjacent to the NB off-ramp providing approximately 100 new spaces

Exit 83 – US Route 1 / Route 32 / Frontage Roads, City of New London
Exit 84 – Route 32, City of New London

Exits 83 and 84 are located just west of the Thames River in the City of New London. Exit 83 provides access to northbound I-95 from southbound Route 32, the south frontage road and Briggs Street in downtown New London. Exit 83 also provides access to the north frontage road and US Route 1 from southbound I-95. Exit 84 provides access to northbound I-95 from downtown New London and connects southbound I-95 to Route 32. Because no major interchange improvements are being recommended at either of these interchanges, they are presented together in this section.

Figure 5-2 (Sheet 86 of 124) presents the long-term improvement concept at Exit 83. Essentially, the recommended improvements are limited to reconstructing the existing ramp connections to I-95 in conjunction with the mainline reconstruction in this area with no major geometric improvements being made to the ramps or ramp junctions. No mainline or ramp improvements are required in the vicinity of Exit 84. The mainline reconstruction stops west of this interchange at the southern (western) limits of the viaduct approaches to the Gold Star Bridge.

Issues

- Poor LOS along NB and SB I-95 through interchange area
- Poor LOS at all ramp merge and diverge locations

Solutions

- Provide standard merge and diverge geometry where required

Construction Costs (2004 $)

Roadway	$ 3,400,000
Bridge Structures	$ 0
Right-of-Way	$ 0
Environmental Mitigation (0 acres)	$ 0
Other	$ 1,400,000
Total	**$ 4,800,000**

Other Considerations

- No mainline widening improvements are being recommended through the interchange area to improve either mainline capacity or the capacity and operations at the merge and diverge locations because both the NB and SB sections already consist of three or more travel lanes in this area

Exit 85 – US Route 1, Town of Groton
Exit 86 – Route 184, Town of Groton
Exit 87 – US Route 1 / Route 349, Town of Groton

Exits 85, 86 and 87 are located just east of the Thames River in the Town of Groton. Exit 85 provides access to US Route 1 from I-95. Exit 86 provides access to northbound Route 184 and Route 12 from northbound I-95, and access to southbound I-95 from Route 184 and Route 12. Exit 87 provides full access to Route 349 and US Route 1. All three interchanges serve primarily commercial and residential development in this area. Because no major interchange improvements are being recommended at any of these three interchanges, they are presented together in this section.

Figure 5-2 (Sheets 89 through 92 of 124) presents the long-term improvement concepts at Exits 85, 86 and 87. Essentially, the recommended improvements are limited to reconstructing the existing ramp connections to I-95 in conjunction with the mainline reconstruction in this area with no major geometric improvements being made to the ramps or ramp junctions. The mainline reconstruction resumes just west of Exit 85 at the northern (eastern) limits of the approaches to the Gold Star Bridge and consists of providing 14 foot inside and outside shoulders along the mainline sections.

Issues

- Poor LOS along NB and SB I-95 through interchange area except NB between Exits 86 and 87
- Poor LOS at all ramp merge and diverge locations except SB off-ramp to US Route 1 at Exit 87
- Poor LOS at intersection of US Route 1 and Bridge Street

Solutions

- Provide standard merge and diverge geometry where required
- Modify traffic signal timing/phasing at intersection of US Route 1 and Bridge Street

Construction Costs (2004 $)

Roadway	$ 12,300,000
Bridge Structures	$ 15,900,000
Right-of-Way	$ 0
Environmental Mitigation (0 acres)	$ 0
Other	$ 11,800,000
Total	**$ 40,000,000**

Other Considerations

- No mainline widening improvements are being recommended through the interchange area to improve either mainline capacity or the capacity and operations at the merge and diverge locations because both the NB and SB sections already consist of three or more travel lanes in this area

Exit 88 – Route 117 (North Road), Town of Groton

Exit 88 is located in the Town of Groton and provides access to Route 117 (North Road) and commercial and residential development in the area. North Road also provides access to US Route 1 to the south and Route 184 to the north of the interchange. An existing Park & Ride lot is located on the northbound side of Route 117 just north of the interchange.

Figure 5-2 (Sheet 95 of 124) presents the recommended long-term improvement concept at Exit 88. The improvement concept at this interchange provides a double right-turn lane on the northbound off-ramp approach to US Route 1 to improve the LOS at this intersection. In addition, a southbound left-turn lane to the southbound on-ramp is provided on US Route 1 and a right-turn lane is provided on the southbound off-ramp approach to US Route 1. The turning roadway connecting northbound US Route 1 to the southbound on-ramp is removed to provide a potential site for a new Park & Ride lot in this area.

Issues

- Poor LOS along NB and SB I-95 through interchange area
- Poor LOS at all ramp merge and diverge locations
- Nonstandard acceleration and deceleration lane lengths at all ramp junctions
- Poor LOS at intersection of NB ramps and US Route 1

Solutions

- Standardize acceleration and deceleration lanes to improve safety and operations at ramp merge and diverge locations
- Provide double right-turn lanes on NB off-ramp approach to US Route 1
- Provide right-turn lane on SB off-ramp approach to US Route 1
- Provide SB left-turn lane on US Route 1 to SB on-ramp
- Remove turning roadway connecting northbound US Route 1 to SB on-ramp and improve intersection geometry

Construction Costs (2004 $)

Roadway	$ 7,400,000
Bridge Structures	$ 7,200,000
Right-of-Way	$ 0
Environmental Mitigation (0 acres)	$ 0
Other	$ 6,200,000
Total	**$ 20,800,000**

Near-Term Improvement Opportunities

- Acceleration and deceleration lane improvements at the NB and SB ramps are low priority

Other Considerations

- No mainline widening improvements in addition to the recommended shoulder widening improvements are being recommended through the interchange area to improve either mainline capacity or the capacity and operations at the merge and diverge locations because both the NB and SB sections already consist of three travel lanes in this area
- Potential new Park & Ride lot can be accommodated on the NB side of US Route 1 within the interchange providing approximately 80 new spaces

Exit 89 – SR 614 (Allyn Street/Mystic Street), Town of Groton

Exit 89, located in the Town of Groton, provides access to SR 614 and primarily local residential development. Exit 89 also provides access to development along the west bank of the Mystic River and Mystic Harbor. SR 614 intersects US Route 1 to the south and Route 184 to the north of the interchange.

Figure 5-2 (Sheet 100 of 124) presents the recommended long-term improvement concept at Exit 89. This improvement concept provides traffic signals at the northbound and southbound ramp intersections with SR 614 to improve the LOS at these intersections. In addition, SR 614 is widened to accommodate southbound left-turn lanes to the northbound and southbound on-ramps. A right-turn lane is also provided on the southbound off-ramp approach to SR 614. An auxiliary lane is provided between the northbound on-ramp from Exit 89 and the northbounds off-ramp to the Scenic Overlook to mitigate the effects of the weave condition on the mainline.

Issues

- Poor LOS along NB and SB I-95 through interchange area
- Poor LOS at all ramp merge and diverge locations
- Substandard acceleration and deceleration lane lengths at NB on-ramp and SB ramp junctions
- Mainline weaving conditions between NB on-ramp and NB off-ramp to Scenic Overlook
- Poor LOS at intersection of NB ramps and SR 614
- Poor LOS at intersection of SB ramps and SR 614

Solutions

- Continue widening to three lanes NB and SB through interchange area
- Standardize acceleration and deceleration lanes to improve safety and operations at ramp merge and diverge locations
- Provide auxiliary lane between Exit 89 and Scenic Overlook to improve weaving operations
- Signalize intersection of NB ramps and SR 614 and improve intersection geometry
- Signalize intersection of SB ramps and SR 614
- Provide right-turn lane on SB off-ramp approach to SR 614
- Widen SR 614 to provide SB left-turn lanes to NB on-ramp and SB on-ramp

Construction Costs (2004 $)

Roadway	$ 5,800,000
Bridge Structures	$ 6,700,000
Right-of-Way	$ 0
Environmental Mitigation (0.30 acres)	$ 60,000
Other	$ 5,240,000
Total	**$ 17,800,000**

Near-Term Improvement Opportunities

- SB acceleration lane improvements are low priority
- Signalization of the NB ramps intersection with SR 614 is low priority
- Signalization of the SB ramps intersection with SR 614 is low priority

Exit 90 – Route 27 (Greenmanville Road/White Hall Avenue), Town of Stonington

Exit 90 is located in the Town of Stonington and provides access to commercial development and recreational attractions in the area via Route 27. These attractions include Mystic Aquarium, Old Mystik Village and Mystic Seaport. Route 27 also intersects Route 234 to the north and US Route 1 to the south of the interchange.

Figure 5-2 (Sheet 103 of 124) presents the recommended long-term improvement concept at Exit 90. The primary improvement at this interchange addresses the need to discourage northbound motorists who are exiting I-95 from utilizing Coogan Boulevard to access Mystic Aquarium. This is aimed at reducing the number of accidents at the intersection of Route 27 and Coogan Boulevard, which is a high accident location. Access to the aquarium is provided directly across from the northbound off-ramp approach to Route 27. This improvement concept provides a two-lane northbound exit and improved overhead destination signage to reduce driver confusion at critical decision points and provide ample opportunity for motorists to maneuver to the correct lane for their destination.

A separate ConnDOT project planned for completion in 2004 will provide a new traffic signal and southbound left-turn lane at the intersection of Route 27 and the southbound ramps. The improvement concept at Exit 90 provides additional intersection geometry improvements and a right-turn lane on the southbound off-ramp approach to Route 27 at this location.

Issues

- Poor LOS along NB and SB I-95 through interchange area
- Poor LOS at all ramp merge and diverge locations
- Nonstandard acceleration and deceleration lane lengths at NB off-ramp and SB ramp junctions
- Mainline weaving conditions between NB on-ramp from Scenic Overlook and NB off-ramp
- Poor LOS at intersection of NB ramps and Route 27
- Poor LOS and high accident location at intersection of Route 27 and Coogan Boulevard

Solutions

- Continue widening to three lanes NB and SB through interchange area
- Standardize acceleration and deceleration lanes to improve safety and operations at ramp merge and diverge locations
- Provide auxiliary lane between Scenic Overlook and NB off-ramp to improve weaving operations
- Provide two-lane exit to NB off-ramp and eliminate one through-lane at NB off-ramp approach to Route 27
- Provide overhead destination signing improvements along auxiliary lane and NB off-ramp to reduce driver confusion at decision points
- Provide WB double right-turn lane on Coogan Boulevard approach to Route 27
- Provide NB right-turn lane on Route 27 at NB ramps intersection
- Improve intersection geometry at intersection of Route 27 and SB ramps and provide right-turn lane on SB off-ramp approach to Route 27

Exit 90 – Route 27 (continued)

Construction Costs (2004 $)

Roadway	$ 6,900,000
Bridge Structures	$ 4,300,000
Right-of-Way	$ 1,000,000
Environmental Mitigation (0 acres)	$ 0
Other	$ 4,700,000
Total	**$ 16,900,000**

Near-Term Improvement Opportunities

- Provide a two-lane exit and supplemental overhead destination signage in conjunction with a review of the existing overhead destination signage at the NB off-ramp. These are recommended high priority interchange improvements
- Acceleration lane improvements at the SB on-ramp are high priority
- Deceleration lane improvements at the SB off-ramp are low priority.
- Signal timing/phasing improvements at the intersection of Route 27 and Coogan Boulevard are high priority
- Signal timing/phasing improvements at the NB off-ramp intersection with Route 27 is low priority

Exit 91 – Route 234 (Pequot Trail), Town of Stonington

Exit 91, located in the Town of Stonington, provides access to Route 234, Taugwonk Road, and primarily residential development in the area. Taugwonk Road provides access to Route 184 to the north and Route 234 provides access to US Route 1 to the east of the interchange. An existing Park & Ride lot is located on the southbound side of Taugwonk Road immediately south of the southbound ramps intersection and provides parking for approximately 38 vehicles.

Figure 5-2 (Sheet 109 of 124) presents the recommended long-term improvement concept at Exit 91. The improvement concept primarily consists of providing standard acceleration and deceleration lanes at each ramp junction with I-95 and secondary roadway and ramp intersection improvements. A left-turn lane is provided on the northbound off-ramp approach to Route 234. In addition, Taugwonk Road is widened to provide a southbound left-turn lane at the Route 234 and northbound off-ramp intersection.

Issues

- Poor LOS along NB and SB I-95
- Poor LOS at NB diverge and SB merge locations
- Nonstandard acceleration and deceleration lane lengths at all ramp junctions
- Poor LOS at intersection of NB off-ramp and Route 234

Solutions

- Continue widening to three lanes NB and SB through interchange area
- Standardize acceleration and deceleration lanes to improve safety and operations at ramp merge and diverge locations
- Provide left-turn lane on NB off-ramp approach to Route 234
- Improve intersection geometry at the Route 234 and Taugwonk Road intersection
- Provide SB left-turn lane on Taugwonk Road to Route 234

Construction Costs (2004 $)

Roadway	$ 6,900,000
Bridge Structures	$ 3,600,000
Right-of-Way	$ 0
Environmental Mitigation (0.26 acres)	$ 50,000
Other	$ 4,350,000
Total	**$ 14,900,000**

Near-Term Improvement Opportunities

- Acceleration and deceleration lane improvements at the NB and SB ramps are low priority
- Signal timing/phasing improvements at the Route 234, Taugwonk Road and NB off-ramp intersection are high priority

Other Considerations

- No impacts to the existing Park & Ride lot

Exit 92 – Route 2 / Route 49, Towns of Stonington and North Stonington

Exit 92 is a split diamond interchange located in the towns of Stonington and North Stonington. The southern (western) half of the diamond consists of a northbound off-ramp and southbound on-ramp that provide access to and from Route 2. The northern (eastern) half of the diamond consists of a northbound on-ramp and southbound off-ramp that provide direct access to and from Route 49 and indirect access to and from Route 2 via Route 617. Route 2 provides access to Foxwoods Casino located to the north of the interchange. A rest area and Park & Ride lot are also located in the vicinity of Exit 92. The Park & Ride lot provides parking space for approximately 250 vehicles.

Figure 5-2 (Sheet 116 through 118 of 124) presents the long-term improvement concept at Exit 92. The southern half of the interchange defines the northern terminus of the mainline widening improvements. The southbound on-ramp continues ahead as the third southbound travel lane and the third northbound travel lane ends at the northbound off-ramp as an exit only lane. No other major long-term improvements are recommended under this study beyond the limits of the mainline widening improvements. However, ConnDOT is evaluating potential improvements to the ramp intersections with Route 2 under the planned Route 2/Route 2A/Route 32 project as part of an on-going project.

Issues

- Poor LOS at NB ramp diverge
- Nonstandard acceleration and deceleration lane lengths at all ramp junctions
- High accident location
- Poor LOS at intersection of NB off-ramp and Route 2
- Poor LOS at intersection of SB on-ramp and Route 2
- Poor LOS at intersection of SB off-ramp and Route 49

Solutions

- Standardize ramp merge and diverge geometry at NB off-ramp and SB on-ramp
- Recommend near-term acceleration and deceleration lane improvements at all ramp junctions
- Improve traffic signal timing/phasing at intersection of NB off-ramp and Route 2
- Improve traffic signal timing/phasing at intersection of SB on-ramp and Route 2
- Improve traffic signal timing/phasing at intersection of SB off-ramp and Route 49

Construction Costs (2004 $)

Roadway	$	900,000
Bridge Structures	$	0
Right-of-Way	$	0
Environmental Mitigation (0 acres)	$	0
Other	$	500,000
Total	**$**	**1,400,000**

Near-Term Improvement Opportunities

- Acceleration and deceleration lane improvements at the NB and SB ramps are high priority
- Signal timing/phasing improvements at the SB on-ramp intersection with Route 2 is low priority
- Additional analysis recommended to evaluate potential guide signing improvements

Other Considerations

- No impact to the existing Park & Ride lot
- Potential Park & Ride lot expansion for approximately 80 new spaces can be accommodated in vicinity of the existing lot area
- Current ConnDOT project planned for Routes 2 / 2A / 32 to address intersection deficiencies at NB and SB ramps at Route 2

Exit 93 – Route 216, Town of North Stonington

Exit 93 is located in the Town of North Stonington immediately south (west) of the Rhode Island state line at the northern (eastern) limit of the project study area. This exit provides access to Route 216 and local commercial and industrial development in the area including a truck stop located just north of the interchange at the intersection of Route 216 and Route 184. An existing Park & Ride lot is located along southbound Route 184 immediately east of the intersection of Route 184 and Route 216 and provides parking space for approximately 43 vehicles.

No long-term improvements are recommended at Exit 93. However, several concepts were evaluated during the course of this study to address the operational problems at the intersection of Route 216 and Route 184 caused by the proximity of the northbound ramps to the intersection and the significant volume of large trucks accessing the truck stop in this area. One concept considered the relocation of the northbound ramps to directly intersect Route 184 in button-hook configurations such that the existing tight maneuvers to these ramps would be eliminated. Another concept, which was recommended by the Town of North Stonington, considered incorporating a roundabout at the intersection of Route 216 and Route 184 to improve operations. Both of these concepts were subsequently rejected because the low traffic volumes, minor operational deficiencies and lack of safety issues at this intersection did not warrant the need to make unnecessary and costly improvements.

Recent improvements were completed by district maintenance forces to improve the intersection geometry at the Exit 93 northbound off-ramp intersection with Route 216. These improvements included increasing the guiderail offset to the outside edge of pavement in order to provide additional pavement surface to accommodate the right-turning movements of trucks from the northbound off-ramp to Route 216.

Issues

- Nonstandard acceleration and deceleration lane lengths at all ramp junctions
- Poor LOS at intersection of Route 216 and Route 184

Solutions

- Recommend near-term acceleration and deceleration lane improvements at NB off-ramp and SB ramp junctions

Near-Term Improvement Opportunities

- Acceleration and deceleration lane improvements at the NB off-ramp and SB ramps are low priority
- Additional analysis recommended to evaluate potential guide signing improvements

Other Considerations

- No impact to the existing Park & Ride lot

Environmental Evaluation – Interchange Improvement Concepts

A summary of the environmental impacts for the interchange sections is provided below. Interchange sections include both mainline widening within the limits of the interchange sections as well as any proposed ramp reconfigurations. Impacts are summarized in Table 5-7 and described in more detail for each section. Wetland impacts from the proposed widening total 32 acres of freshwater wetlands and 6 acres of tidal wetlands. Thirty-one perennial and 6 intermittent streams are crossed by the right-of-way and construction impacts can be expected. Five of the sections contain a state listed threatened or endangered plant or animal species as identified by the CTDEP. As several of the interchange improvements can not be accommodated within existing right-of-way, land use impacts would include 29 displaced structures and 99 property impacts. Historic resource (and Section 4(f)) impacts would occur at Interchange 70. Roadway redesign would require property alterations to the Florence Griswold Museum grounds and the Old Lyme Historic District. There is potential for archeological impacts at Exit 62.

Air quality impacts within the interchanges are expected to be generally comparable from section to section, varying principally as a function of traffic volumes at each. Localized air quality may improve where interchanges are eliminated (i.e. Exit 68) or ramps removed. Also, where new ramps are constructed (i.e. Exit 60, Exit 67) localized air quality may be temporarily affected by construction activities. During construction, locally elevated levels of air contaminants can be expected on a temporary basis due to emissions from internal combustion engines in heavy-duty construction vehicles and equipment, from fugitive dust generated by construction activities, and from wind re-entrainment of cleared and openly exposed surfaces. The relative extent of resulting impacts will be a function of the number of pieces of equipment in use, and the size of area being cleared and constructed at any one time. Potential air quality impacts during the post-construction, or "operational," phase of the project are expected to be less than for a no-build condition since the interchange reconfigurations should reduce congestion and corresponding vehicle idling and travel times within and through any given interchange.

Potential noise impacts are evaluated relative to existing conditions in the context of the number and proximity of sensitive receivers, primarily residences. In total, there are 80 potential noise-sensitive areas within the interchange sections as shown in Figure 5-2 (Sheets 1 to 124). Effects of this project would vary primarily based on changes in volumes, speed, and alignment between existing, 2025 no-build and 2025 build conditions. While noise levels also depend greatly on the vehicular fleet composition, specifically the heavy vehicle fractions, the project is not likely to materially affect this. Over its length, the project would change these noise sensitive parameters near a large number of sensitive receivers, causing increased noise levels, and potentially causing impacts. Of the concerns, speed increases are the most likely to affect sound levels, with changes in alignment at specific interchanges being next in importance. Generally, the additional capacity provided by the project would result in greater speeds than in the no-build condition – but the extent and sense of any speed changes from existing conditions (which is the basis for comparison), would vary between sections. Some of the I-95 interchanges (i.e., Exits 59, 60, and 67 (Elm Street)) are subject to the greatest changes in alignment, increasing possible changes in noise and resulting in potential impacts. Given the nature of the work, noise during construction would be elevated – sometimes materially, but in all cases temporarily. This is an annoyance that is impossible to avoid, but which can be mitigated by adhering to State specifications for equipment, using temporary noise containment structures or barriers, where feasible, providing warning to the community for particularly onerous portions of the work, and controlling work hours.

Table 5-7
Environmental Impact Summary for Interchange Improvement Concepts

Section	Wetland Impacts (acres)		Stream Impacts		Threatened or Endangered Species	Land Use Impacts	
	Freshwater	Tidal	Perennial	Intermittent		Displaced	Property Impacts
Exit 54	0.3	0	0	0	none	0	1
Exit 55	0.5	0	1	0	none	0	0
Exit 56	0.9	0	0	0	none	0	1
Exit 57	0.4	0	1	0	none	0	1
Exit 58	0.5	0	1	0	state threatened and special concern birds	0	7
Exit 59	1.0	0	3	0	state threatened and special concern birds	0	20
Exit 60	2.6	1.0	2	0	none	0	4
Exit 61	0.6	0	0	1	none	0	8
Exit 62	0.1	0.1	1	0	none	0	1
Exit 63	2.3	0	0	0	none	0	7
Exit 64	0.9	0	1	0	state special concern plant and bird	0	0
Exit 65	0.2	0.8	1	0	none	0	1
Exit 66	2.8	0	1	1	none	0	4
Exit 67 (Elm St)	0.7	2.6	3	0	none	0	8
Exit 67 (Rte 154)	2.7	0	2	0	none	0	2
Exit 69	0	0	0	0	none	0	0
Exit 70	1.8	1.3	2	0	state special concern plant and invertebrate	2	10
Exit 71/72	7.0	0	3	2	none	0	5
Exit 73	0.5	0	2	2	none	0	0
Exit 74	1.5	0	1	0	none	4	4
Exit 81, 82, 82A	4.1	0	2	0	none	23	15
Exit 84	0	0	0	0	none	0	0
Exit 85, 86, 87	0	0	0	0	state special concern plant	0	0
Exit 88	0	0	2	0	none	0	0
Exit 89	0.3	0	1	0	none	0	0
Exit 90	0	0	0	0	none	0	0
Exit 91	0.3	0	1	0	none	0	0
Exit 92	0	0	0	0	none	0	0
Exit 93	0	0	0	0	none	0	0
Totals	**32.0**	**5.8**	**31**	**6**	**-**	**29**	**99**

- **Exit 54 –** Portions of three freshwater wetlands would be impacted by new construction (less than 0.3 acres). Encroachment associated with widening the ramps would result in minor property impacts to one residence. Potential unevaluated architectural resources are present in this section, but no direct impacts are anticipated. There are two potential noise-sensitive areas at this interchange consisting of single family residences and a mobile home park.
- **Exit 55 –** Approximately one-half acre from four separate wetlands would be impacted by the widening of I-95. Minor (100 feet) impacts to an unnamed perennial stream may result. North of the highway the Branford River Wildlife Area, a potential Section 4(f) resource, abuts the right-of-way for 2,800 feet adjacent to the southbound on-ramp at Exit 55. No impacts are expected from the proposed mainline widening as presently designed. Potential environmental risk sites include two gas stations adjacent to the right-of-way that have been reported for leaking underground storage tanks. There are four potential noise-sensitive areas at this interchange consisting of single family residences and townhouses.
- **Exit 56 –** Portions of seven wetland areas (including six drainage swales) totaling 0.9 acres would be affected by the proposed widening. There would be one minor property impact as slope limits would encroach on the ConnDOT maintenance facility on Leetes Island Road. Environmental risk sites adjacent to the Exit 56 right-of-way include two gas stations with reported leaking underground storage tanks and the ConnDOT facility, which is listed in the CT Leachate and Wastewater Discharge Location database. Potential unevaluated architectural resources are present in this section, but no direct impacts are anticipated. Unsurveyed areas of high to moderate archeological potential that could be directly impacted are present in this section. There is one potential noise-sensitive area at this interchange consisting of single family residences.
- **Exit 57 –** The widening would impact portions of seven freshwater wetlands, totaling 0.4 acres. Spinning Mill Brook bisects the right-of-way and 340 linear feet of the brook would be impacted by ramp reconfiguration. Approximately 500 linear feet of floodplain (measured along the highway) associated with Spinning Mill Brook is within this section. Minor property impacts to one residential property are required to improve the geometry of the southbound off-ramp. There are two potential noise-sensitive areas at this interchange consisting of single family residences.
- **Exit 58 –** Roadway widening would have minor impacts on portions of two freshwater wetlands (one-half acre). The highway crosses the West River and approximately 40 linear feet would be affected by widening activities. Approximately 300 linear feet of floodplain are associated with the West River where crossed by the highway. The right-of-way also crosses 3,550 feet of the Guilford wellfield aquifer protection area. The Guilford Historic Town Center Historic District abuts the south side of the right-of-way for a distance of 3,000 feet. No direct impact to the historic district is anticipated. Impacts are limited to potential visual and noise impacts at the northern boundary of the historic district. A potential Section 4(f) resource, the Guilford Jr. High School playfields, also borders the south side of the right-of-way along the northbound on-ramp. Because the highway widening does not extend beyond existing right-of-way, no impacts to these resources are expected. The area northeast of the interchange contains one threatened and one state special concern bird species. According to CTDEP, neither species should be affected by the project. Minor property impacts to three businesses and four residential properties would result from widening Church Street. There are five potential noise-sensitive areas at this interchange consisting of single family residences.

- **Exit 59** – This section includes the relocation of the I-95 northbound on and off-ramps at Exit 59. These ramps are relocated approximately 500 feet west of the existing ramps and would be constructed on existing ConnDOT property at the Guilford maintenance facility. Northbound I-95 access and egress would move from SR 718 (Goose Lane) to US Route 1.

  Portions of five wetland areas totaling approximately one acre would be affected by the proposed widening and ramp reconfiguration. Three unnamed perennial streams would be affected for a total of 425 linear feet including one stream that is within the area of the proposed on and off-ramps. Approximately 600 linear feet of floodplain is crossed by the highway. This section includes 2,000 feet of highway that is within the Coastal Zone, as well as the area to be used for the new on and off-ramps. The area to the east of the interchange contains one threatened and one state special concern bird species. According to CTDEP, neither species should be affected by the project.

  The soils at the ConnDOT maintenance facility are considered Prime and Statewide Important farmland soils. However, they are already dedicated to non-farm (transportation) use. A small portion of the Guilford Historic Town Center Historic District (500 feet) is adjacent to the south side of the right-of-way west of this exit. There would be major property impacts to the ConnDOT maintenance facility. The salt storage shed would be displaced to accommodate the ramps, although the land is presently owned by the State. The adjacent restaurant property does not appear to be affected by the interchange improvement concept. In order to accommodate the new ramp locations, Boston Post Road would be widened from two to four lanes. This would result in right-of-way impacts to 15 business properties. Goose Lane would be widened from two to three lanes to improve access to the southbound on and off-ramps. One residential and four business properties would be affected. Environmental risk sites that are within the new right-of-way include the ConnDOT facility, which is listed in the CT Leachate and Wastewater Discharge Location database as well as having been reported for a leaking underground storage tank. There is one potential noise-sensitive area at this interchange consisting of single family residences.

- **Exit 60 –** Approximately 3.6 acres of wetlands at eight wetland areas would be impacted by the widening of I-95. These areas include six freshwater (2.6 acres) and two tidal (1.0 acre) wetlands. The greatest impact would be to accommodate new ramps at Wildwood Avenue. Neck River and Bailey Creek are crossed by the right-of-way and approximately 140 feet of these perennial streams would be affected by construction. Also, 600 linear feet of floodplain associated with Neck River are crossed by the highway. Approximately 1,700 feet of highway is within the Coastal Zone. Minor property impacts to four residential properties would be required to accommodate the two new ramps at Wildwood Avenue. Potential unevaluated architectural resources are present in this section, but no direct impacts are expected. Unsurveyed areas of high to moderate archeological potential that could be directly impacted are present in this section. There are eight potential noise-sensitive areas at this interchange consisting of single family residences and a residential care facility.

- **Exit 61 –** The widening would impact portions of four wetlands totaling 0.6 acres. An unnamed intermittent stream crosses under both the northbound and southbound ramps and 60 linear feet of this stream course would be impacted. The interchange improvements would also encroach on the commuter parking lot and the Madison Senior Center, with a potential loss of parking spaces at each location. Minor impacts to four commercial and two residential properties would also result from the proposed reconstruction of the interchange. Potential unevaluated architectural resources are present in this section, but no direct impacts are anticipated. There are four potential noise-sensitive areas at this interchange consisting of single family residences.

- **Exit 62 –** Minimal impact to four wetlands (three tidal and one freshwater) totaling 0.1 acres would result from the reconfiguration of Exit 62. The existing bridge over the Hammonasset River would be widened by 40 feet. Minimal floodplain area (200 linear feet measured along the highway) is associated with the river. The highway would pass through 3,300 feet of the Rettich wellfield aquifer protection area. The right-of-way includes 1,700 feet of the Coastal Zone Boundary. No new right-of-way would be required to accommodate the reconfiguration, although minor impacts to one residential property would result from the reconfiguration. The proposed build alternative would potentially have minimal direct impacts on one potentially eligible archaeological site (Site 27-9). However, this site may have been previously destroyed by construction of the existing I-95 bridge over the Hammonasset River. The build alternative would involve filling of nearby areas to the west of River Road and cutting of nearby areas to the east of the river. The potential impacts of these construction activities on Site 27-9 could be mitigated as follows: the site could be field checked by a qualified archaeologist to see if any of the site remains intact. If the site is intact, it could be marked for avoidance during construction activities. If avoidance is not possible, mitigation measures should be developed in coordination with the Connecticut State Archaeologist or SHPO. Unsurveyed areas of high to moderate archeological potential that could be directly impacted are also present in this section. There are two potential noise-sensitive areas at this interchange consisting of single family residences.
- **Exit 63 –** Moderate highway reconfiguration is proposed for this section. Existing northbound ramps are realigned and a roundabout is incorporated on Route 81. Portions of eight freshwater wetlands totaling 2.3 acres would be impacted by the proposed reconfiguration of this interchange. Approximately 700 linear feet of floodplain and 4,600 feet of the Clinton wellfield aquifer protection area are crossed by the highway. The highway crosses 3,600 feet of the Coastal Zone. Roadway widening of Route 81 would result in property encroachment impacts to four businesses and the Clinton High School on Route 81. Two residences on North High Street would also be affected. Unevaluated architectural resources that could be potentially impacted are located at Route 81 and North High Street. Direct impacts are not anticipated. Unsurveyed areas of high to moderate archeological potential that could be directly impacted are present in this section. There are six potential noise-sensitive areas at this interchange consisting of single family residences.
- **Exit 64 –** Roadway widening would have minor impacts to portions of seven freshwater wetlands (approximately 0.9 acres). Gatchen Creek is located east of Exit 64 and 60 feet of the brook would be impacted by widening within the right-of-way. Approximately 1,200 feet of floodplain associated with Gatchen Creek is crossed by the highway. Approximately 1,700 feet of the highway is located within the Coastal Zone, although no coastal resources would be affected by the widening. There are no anticipated direct impacts to archeological resources. Two areas of potential state listed species habitat are found along the section. One area includes a state listed plant species of special concern in the area of the Menunketesuck River. According to CTDEP, “the use of best management practices with special attention to erosion and siltation control should prevent indirect negative affects to the species.” The area near the Menunketesuck River also contains one state special concern bird species. According to CTDEP, “if the Menunketesuck River is going to be impacted by erosion, sedimentation or siltation discharges, or if there are to be polluted runoff such as chemicals or fertilizer discharged into the river resulting from this project that can contaminate the water, then the species may be impacted.” Potential unevaluated architectural resources are present in this section, but no direct impacts are anticipated. There are three potential noise-sensitive areas at this interchange consisting of single family residences.

- **Exit 65 –** Approximately 0.8 acres of tidal wetlands (at three locations) and 0.2 acres of a freshwater wetland would be filled by widening the highway. The tidal wetland resources are part of the Patchogue River. The highway would be widened for a distance of 50 feet at this location. There is approximately 300 linear feet of Patchogue River floodplain in the section. The section also includes 2,300 feet within the Coastal Zone. There would be minor impact to one residential property due to highway widening. Potential unevaluated architectural resources are present in this section, but no direct impacts are anticipated. Unsurveyed areas of high to moderate archeological potential that could be directly impacted are present in this section.

- **Exit 66 –** Portions of ten freshwater wetlands totaling 2.8 acres would be affected by widening this section of I-95. Cold Spring Brook and the northbound on and off-ramps for I-95 pass under the highway. Approximately 70 feet of this brook would be impacted by construction. Further to the north (east) of the interchange, 80 feet of an unnamed perennial stream would be culverted to accommodate the widening. Minor floodplain encroachment along 400 linear feet of highway would occur with the widening. Minor encroachment impacts to four properties (one residential, one business and two vacant) outside the right-of-way would occur to accommodate mainline widening and the slight realignment of the northbound and southbound ramps. Potential unevaluated architectural resources are present in this section, but no direct impacts are anticipated.

- **Exit 67 (Elm Street) –** Major interchange ramp reconfigurations are proposed for this section. A new northbound off-ramp to Ingham Hill Road and a new southbound on-ramp are added at Exit 67 (Elm Street) and the existing northbound on-ramp and southbound off-ramp at this location are modified.

  A total of 3.3 acres at nine wetlands (five freshwater and four tidal) would be impacted by highway widening and interchange reconfiguration. One major impact would be to 2.6 acres of tidal marsh east of Elm Street to accommodate a longer northbound on-ramp. The remaining impacts would be to freshwater wetlands (totaling 0.7 acres). Fishing Brook and two unnamed perennial streams are crossed by the right-of-way totaling 245 linear feet of impact. Approximately 1,500 linear feet of floodplain is impacted including the filling of more than two acres of floodplain to accommodate the widening north of Exit 67. Approximately 4,200 feet of the highway is located in the Coastal Zone and over two acres of tidal marsh would be filled. Reconfiguring Exit 67 would require new right-of-way to accommodate the northbound on-ramp and the two new ramps at Elm Street. Minor property impacts outside the existing right-of-way would affect two businesses and six residences. Potential unevaluated architectural resources are present in this section, but no direct impacts are anticipated. Unsurveyed areas of high to moderate archeological potential that could be directly impacted are present in this section. There are two potential noise-sensitive areas at this interchange consisting of single family residences.

- **Exit 67 (Route 154) and Exit 68 –** Major interchange ramp reconfigurations are proposed for this combined section. Exit 68 is eliminated, a new southbound off-ramp and northbound on-ramp are added at Route 154 and the existing southbound on-ramp and northbound off-ramp at Exit 67 are realigned.

  A total of five freshwater wetlands with 2.7 acres would be modified by highway widening and reconfiguration, the largest of which would be the loss of 2.2 acres in order to construct a new northbound on-ramp for Exit 67. Oyster River and one unnamed perennial stream are crossed by the highway, impacting about 180 linear feet of the waterways. Floodplain impacts include 2,000 linear feet of right-of-way. The Connecticut Valley Railroad State Park Trail crosses under I-95 just west of Exit 67. Widening I-95 would require replacement of this bridge. Reconfiguring Exit 67 would require new right-of-way to

accommodate the northbound on-ramp. This land is vacant wetland. Minor property impacts (one residential and one vacant) would result from the proposed work. Potential unevaluated architectural resources are present in this section, but no direct impacts are anticipated. Unsurveyed areas of high to moderate archeological potential that could be directly impacted are present in this section.

- **Exit 69 –** No wetlands or streams would be modified by highway widening in this section. Floodplain impacts include 600 linear feet of right-of-way. Approximately 2,300 feet of the highway is located in the Coastal Zone. Multiple encounters with potential areas of state listed species habitat occur around Exit 69 adjacent to the Connecticut River. National Register Historic Sites include the Jedidiah Dudley and the John Whittlesey Jr. houses. Both properties are outside the right-of-way and no direct impact to the historic properties is anticipated. Impacts are limited to potential visual and noise impacts. Potential unevaluated architectural resources are present in this section, but no direct impacts are anticipated. There are four potential noise-sensitive areas at this interchange consisting of single family residences.

- **Exit 70 –** Portions of 11 wetlands totaling 3.1 acres would be impacted by the reconfiguration of Exit 70 and the mainline widening through the interchange area. Four of the wetland areas (1.3 acres) are tidal wetlands associated with the Lieutenant River and the remainder (1.8 acres) are freshwater wetlands. One river and one perennial stream would be crossed. There are two non-community wells within 500 feet of the right-of-way. The entire section, approximately 6,600 feet, is within the Coastal Zone. The entire section passes through multiple locations that have been identified as areas of potential state listed species. The area south of Exit 70 adjacent to the Connecticut River includes a state listed invertebrate of special concern. According to CTDEP, "If the Great Island marshes are going to be impacted by erosion, sedimentation or siltation discharges, or if there are to be polluted runoff such as chemicals or fertilizer discharged into the river resulting from this project that can contaminate the water, then this species may be impacted." The section also includes a state listed plant of special concern located to the south of Exit 70. According to CTDEP, "the use of best management practices with special attention to erosion and siltation control should prevent indirect negative affects to the species."

  As currently configured, three sites of cultural resources would be adversely impacted by the proposed improvements. The right-of-way bisects the Old Lyme Historic District and the proposed reconfiguration on the north side of I-95 will require the taking of land associated with the Florence Griswold Museum and the Old Lyme Inn properties, resulting in direct impacts as well as noise and visual impacts to the historic district. One business property north of I-95 and three properties south of I-95 would receive minor property impacts due to backfilling for the realigned roadways. Because historic resources qualify as Section 4(f) resources, there would also be Section 4(f) impacts. Based on the conceptual design, approximately 20,000 square feet of direct impact to the Florence Griswold Museum grounds and 13,000 square feet of direct impact to the Old Lyme Inn grounds, as well as additional indirect impacts due to the highway's proximity to these areas will result.

  A substantial reconfiguration of the southbound on-ramp at Exit 70 is proposed. Additional right-of-way extending approximately 250 feet north of the existing right-of-way will be needed to accommodate the reconfigured ramp that provides southbound access. Two single family residences north of I-95 would be displaced and new access would be provided to five residential properties off of Route 156. Potential unevaluated architectural resources are present in this section. Unsurveyed areas of high to moderate archeological potential that could be directly impacted are present in this section. There are four potential noise-sensitive areas at this interchange consisting of single family residences.

- **Exits 71 and 72 –** Portions of twenty-one freshwater wetlands totaling approximately 7.0 acres would be impacted by the proposed roadway interchange and mainline improvements. Surface water impacts include approximately 310 feet of Four Mile River and 50 feet of Three Mile River and minor impacts to three unnamed streams (one perennial and two intermittent). Approximately 400 linear feet of floodplain associated with Four Mile River would be encroached upon by widening the highway and modifying the exit ramps. There are four non-community wells within 500 feet of this section and 4,000 feet of the Brides Lake wellfield aquifer protection area is traversed by the highway. Property impacts to five businesses due to encroachment that extends beyond the existing right-of-way would result from the project. Unsurveyed areas of high to moderate archeological potential that could be directly impacted are present in this section.

- **Exit 73 –** Minimal impacts to twelve freshwater wetland areas totaling 0.5 acres would result from the proposed widening and interchange reconfiguration. The highway crosses one named stream, Beaver Dam Brook, and three unnamed streams, two of which are intermittent. In total, 60 linear feet of perennial and 390 linear feet of intermittent watercourse will be culverted. This section traverses two aquifer protection areas, Brides Lake wellfield (3,000 feet) and Gorton's Pond wellfield (300 feet). One active farm is located north of the right-of-way but no impacts are expected. The Gates Correctional Facility is located to the south adjacent to the highway. Approximately 4,600 feet of this section's right-of-way borders the correctional facility. Because it is the predominant land use in Census Tract 716101, Block Groups 2 and 4, the ethnic and income make-up of the prison population qualifies these block groups as potential environmental justice areas. Unsurveyed areas of high to moderate archeological potential that could be directly impacted are present in this section. There are two potential noise-sensitive areas at this interchange consisting of single family residences.

- **Exit 74 –** Portions of five freshwater wetlands totaling approximately 1.5 acres would be impacted along this section. The existing Pattagansett River Bridge would be widened by approximately 40 feet. Approximately 800 linear feet of the associated floodplain would be traversed. There are no public wells within 500 feet of the right-of-way although the section crosses 3,400 feet of an aquifer protection area associated with the Gorton's Pond wellfield. Substantial land use impacts would result from the proposed reconfiguration of the interchange. Four properties (2 residential and 2 businesses) would be displaced; one residential property's access would be impacted; and three minor property encroachments would result. New right-of-way, extending approximately 300 feet north of the existing right-of-way, would be required in order to accommodate the reconfigured ramps to and from southbound I-95. Unsurveyed areas of high to moderate archeological potential include the area to be graded south of I-95 immediately west of the Pattagansett River, the new ramp north of I-95 west of Route 161 and grading along this new ramp (from parking lot's west edge through grassy driving range to cluster of buildings on south). One environmental risk site, which has been reported for a leaking underground storage tank, is immediately adjacent to the south end of the right-of-way on Route 161. There are two potential noise-sensitive areas at this interchange consisting of single family residences.

- **Exits 81, 82 and 82A –** Substantial impacts to wetland resources could result from the proposed widening as portions of 22 freshwater wetland areas, totaling 4.1 acres, would be impacted by the highway's widening and ramp reconfiguration. A total of 535 linear feet of water course associated with Jordan Brook and Nevins Brook would be affected by the widening. A public water supply reservoir, Lake Brandegee, is located north of the right-of-way near Exit 82A. Substantial land use impacts can be expected based on the conceptual design (new on and off-ramps for Exit 81 and a reconfigured ramp at Exit 82). As many as 19 residential properties and three businesses would be displaced. Residential properties would be displaced on Gilead Road, Route 85, and Lois Avenue south of Exit 82 and off of Vauxhall Street on both sides of Exit 82A. The displaced businesses include an abandoned motel site on Harvey Avenue north of Exit 82 and two business properties on Route 85. Property encroachments beyond the right-of-way to accommodate the widening would also affect one cemetery located on Parkway South and potentially the relocated water tower east of Exit 82. There would be access and property impacts to one business property on Vauxhall Street and a Town of Waterford pumping station on Harvey Avenue. Property impacts associated with earthwork operations would affect four residences and seven businesses. The proposed improvements at the intersection of Coleman and Broad Street, south of the right-of-way, would displace one building and likely involve additional minor property impacts. Unevaluated architectural resources that could be potentially impacted are located at the south side of the interchange and unevaluated architectural resources at Vauxhall Road appear to be directly impacted by the proposed ramps. Unevaluated architectural resources on Vauxhall Street Extension at the north side of the interchange also appear to be directly impacted by the proposed ramps for Exit 82A. Unsurveyed areas of high to moderate archeological potential that could be directly impacted are present in this section.

  Seven hazardous waste spill incidents have been recorded within the right-of-way. Approximately 3,000 feet of the 13,100 foot length of this section is with the city of New London. This portion of the right-of-way is within Census Tract 690100, Block Group 3 (north of the right-of-way) and Census Tract 690300, Block Group 4 (south of the right-of-way). Census data indicates that these areas contain populations with the ethnic and income make-up that could qualify the block groups as potential Environmental Justice areas. There are fourteen potential noise-sensitive areas at this interchange consisting of single family residences.

- **Exit 83 –** Minimal environmental impacts are associated with this section. Approximately 200 linear feet of the section are located within the Coast Zone. An historic property, Winthrop Mill, is located under the I-95 bridge as it elevates prior to crossing the Thames River. This portion of the right-of-way is within Census Tract 690100, Block Group 1 - 3 and Census Tract 690300, Block Group 1 south of the right-of-way. Census data indicates that these areas contain populations with the ethnic and income make-up that could qualify the block groups as potential Environmental Justice areas.

- **Exits 85, 86, 87 –** No wetland or water resources would be impacted by new construction. Approximately 400 feet of Poquonnock Reservoir is crossed by the highway. Minimal impact to this reservoir is expected as the highway consists of three lanes in each direction at this location. The section crosses approximately 600 feet of the Coastal Zone. One area of potential state listed species habitat, a state listed special concern plant species habitat, is found along the section in the area of the Poquonnock Reservoir. According to CTDEP "the use of best management practices with special attention to erosion and siltation control should prevent indirect negative affects to the species." There are six potential noise-sensitive areas at this interchange consisting of single family residences.

- **Exit 88 –** Two water resources, Hatching House Brook and Fort Hill Brook, are crossed by this section. There would be approximately 30 linear feet of Fort Hill Brook impacted by the proposed widening. Approximately 1,400 feet of Poquonnock Reservoir is crossed by the existing highway. However, since no major widening is proposed along this section, no construction impacts are expected. There is one potential noise-sensitive area at this interchange consisting of single family residences.
- **Exit 89 –** A portion of one freshwater wetland would be impacted by new construction (0.3 acres). Approximately 100 feet of Bindloss Brook is crossed by the existing highway north (east) of Exit 89. One area of potential state listed species habitat is found along the section.
- **Exit 90 –** There are no wetland or water resource impacts in this section. Approximately 1,000 feet of the right-of-way is within the Coastal Zone. There is one encounter with prime farmland soils but no right-of-way impact to these resources is expected. The Whitehall Mansion historic property is located 250 feet north of the Exit 90 interchange. The property is outside the right-of-way and no direct impact is anticipated. Impacts are limited to potential visual and noise impacts. There are two potential noise-sensitive areas at this interchange consisting of single family residences.
- **Exit 91 –** Portions of four freshwater wetlands totaling 0.3 acres would be impacted by the project. Approximately 20 linear feet of Stony Brook would be culverted by the highway. There would be minimal impacts to other environmental resources in this section. Potential unevaluated architectural resources are present in this section, but no direct impacts are anticipated. There are two potential noise-sensitive areas at this interchange consisting of single family residences.
- **Exit 92 –** Most of this section would remain unchanged with no new construction taking place. The highway passes over the Shunock River and 9,000 feet of the Pawcatuck River sole source aquifer. Several encounters with Prime and Statewide Important farmland soils occur and two active farms are adjacent to the right-of-way, but no impacts to farmland resources are expected. Potential unevaluated architectural resources are present in this section, but no direct impacts are anticipated. There are two potential noise-sensitive areas at this interchange consisting of a single family residence and a recreational vehicle park
- **Exit 93 –** No new construction would take place in this section. The existing highway passes over 4,700 feet of the Pawcatuck River sole source aquifer.

Park and Ride Lot Summary

Table 5-8 summarizes the anticipated impacts to the 19 existing Park and Ride facilities located within the I-95 study corridor. Locations that are suitable for potential relocation or expansion opportunities are also shown in the table. Expansion would consist of enlarging existing lots and relocation would consist of constructing new lots where no facilities currently exist. The cost of mitigating impacts by relocating or expanding existing lots is approximately $3.64 million.

Table 5-8
Park and Ride Lot Summary (Number of Parking Spaces Indicated)

Lot Location	Existing Capacity	Approx. Impacts	Relocation/ Expansion	Net Total	Reloc./Expansion Cost (2004 $)[1]	Recommended Action/ Comments
Exit 55	70	70	70	70	$350,000	Relocate lot
Exit 56	40	0	0	40	N/A	
Exit 57	20	0	0	20	N/A	
Exit 58	158	55	0	103	N/A	Two lots at this location
Exit 59	58	0	0	58	N/A	
Exit 61	197	80	50	167	$150,000	Expand existing lot
Exit 62	N/A	N/A	200	200	$1,000,000	Provide two new lots
Exit 63	135	0	0	135	N/A	
Exit 64	23	23	50	50	$250,000	Relocate lot
Exit 65	50	20	0	30	N/A	
Exit 70	50	0	50	100	$250,000	Provide new lot
Exit 71	28	0	0	28	N/A	
Exit 74	68	68	100	100	$500,000	Provide new lot
Exit 81	N/A	N/A	100	100	$500,000	Provide new lot
Exit 88	46	0	80	126	$400,000	Provide new lot
Exit 91	39	0	0	39	N/A	
Exit 92	227	0	80	307	$240,000	Expand existing lot
Exit 93	43	0	0	43	N/A	
Totals	**1337**	**316**	**780**	**1801**	**$3,640,000**	

1 The approximate cost shown is based on assumed costs of $5,000 per relocated space and $3,000 per expanded space in accordance with ConnDOT guidelines.

5.4.4 Interchange / Intersection Operations Summary – Year 2025 Build Condition

The interchange and intersection traffic operations resulting from the improvement concepts described in the previous section were analyzed using the same methods used to perform the traffic analyses presented in Chapters 2 and 3. The results of these analyses for ramp operations, weaves, and signalized and unsignalized intersections are illustrated on Figure 5-3 (Sheets 1 to 13) and Figure 5-4 (Sheets 1 to 13) and are discussed in detail below.

5.4.4.a Ramp Operations

The results of the freeway merge and diverge analysis based on the 2025 build conditions are presented in Table 5-9 and are illustrated on Figure 5-3. Compared to the ramp operations analysis conducted in Chapter 3 for the 2025 no-build conditions, the addition of a third travel lane and the standardization of the acceleration and deceleration lane lengths show a marked improvement in future ramp operations.

Table 5-9
Ramp Merge/Diverge Analysis – Summary of 2025 Build Condition

Ramp	Ramp Volume	Terrain	Peak Hour	Level of Service	Density (pc/mi/ln)
Northbound					
Exit 54 On	**730**	**Level**	**PM**	**E**	**38**
Exit 55 Off	**540**	**Level**	**PM**	**F**	**42**
Exit 55 On	**500**	**Level**	**PM**	**E**	**35**
Exit 56 Off	700	Level	PM	D	35
Exit 56 On	500	Level	PM	D	33
Exit 57 Off	**500**	**Rolling**	**PM**	**F**	**40**
Exit 57 On	**360**	**Rolling**	**PM**	**E**	**35**
Exit 58 Off	610	Rolling	PM	D	33
Exit 58 On	300	Rolling	PM	D	31
Exit 59 Off	**600**	**Rolling**	**PM**	**F**	**39**
Exit 59 On	610	Rolling	PM	C	27
Exit 60 Off	270	Rolling	PM	D	32
Exit 60 On	270	Rolling	PM	D	28
Exit 61 Off	490	Rolling	PM	D	32
Exit 61 On	320	Rolling	PM	C	27
Exit 62 Off	470	Rolling	PM	C	24
Exit 62 On	420	Rolling	PM	C	25
Exit 63 Off	**750**	**Rolling**	**PM**	**E**	**37**
Exit 63 On	600	Rolling	PM	C	27
Exit 64 Off	460	Rolling	PM	D	32
Exit 64 On	350	Rolling	PM	C	27
Exit 65 Off	550	Rolling	PM	D	33
Exit 65 On	420	Rolling	PM	C	28
Exit 66 Off	410	Rolling	PM	D	33
Exit 66 On	280	Rolling	PM	D	29
Exit 67 (Elm St) Off	170	Rolling	PM	C	27
Exit 67 (Elm St) On	430	Rolling	PM	D	29
Exit 67 (Rte 154) Off	360	Rolling	PM	D	29
Exit 67 (Rte 154) On	950	Rolling	PM	D	31
Exit 69 Off	**270**	**Rolling**	**PM**	**E**	**37**
Exit 69 On	**1,330**	**Rolling**	**PM**	**F**	**39**
Exit 70 Off	**1,210**	**Rolling**	**PM**	**F**	**44**
Exit 70 On	**310**	**Rolling**	**PM**	**F**	**39**
Exit 71/72 Off	610	Rolling	PM	D	32
Exit 71 On	410	Rolling	PM	D	29
Exit 72 On	**340**	**Rolling**	**PM**	**E**	**39**
Exit 73 Off	140	Rolling	PM	D	34
Exit 73 On	70	Rolling	PM	D	34
Exit 74 Off	**420**	**Rolling**	**PM**	**F**	**50**
Exit 74 On	**890**	**Rolling**	**PM**	**F**	**37**
Exit 76 Off	1,580	Rolling	PM	D[1]	-
Exit 76 On	1,010	Rolling	PM	D[1]	-
Exit 81 (Cross Rd) Off	**300**	**Rolling**	**PM**	**F**	**45**
Exit 81 (Parkway South) On	690	Rolling	PM	D	31

Table 5-9
Ramp Merge/Diverge Analysis – Summary of 2025 Build Condition

Ramp	Ramp Volume	Terrain	Peak Hour	Level of Service	Density (pc/mi/ln)
Exit 82 (Frontage Rd) Off	1,000	Rolling	PM	D	33
Exit 82A (Frontage Rd) On	200	Rolling	PM	C	23
Exit 83 Off	**350**	**Rolling**	**PM**	**F**	**55**
Exit 83 On	**1,700**	**Rolling**	**PM**	**F**	**42**
Exit 84 On	**1,700**	**Rolling**	**PM**	**F**	**49**
Exit 85 Off	**1,620**	**Rolling**	**PM**	**F**	**48**
Exit 86 Off	**1,350**	**Rolling**	**PM**	**F**	**44**
Exit 87 Off	**350**	**Rolling**	**PM**	**F**	**51**
Exit 87 On	**1,750**	**Rolling**	**PM**	**F**	**42**
Exit 88 Off	**1,020**	**Rolling**	**PM**	**F**	**39**
Exit 88 On	**470**	**Rolling**	**PM**	**F**	**41**
Exit 89 Off	**1,030**	**Rolling**	**PM**	**F**	**38**
Exit 89 On	340	Rolling	PM	C	28
Exit 90 Off	1,210	Rolling	PM	C	20
Exit 90 On	450	Rolling	PM	C	28
Exit 91 Off	950	Rolling	PM	D	31
Exit 91 On	100	Rolling	PM	C	27
Exit 92 Off	**1,180**	**Rolling**	**PM**	**F**	**41**
Exit 92 On	540	Rolling	PM	D	32
Exit 93 Off	**270**	**Rolling**	**PM**	**E**	**36**
Exit 93 On	350	Rolling	PM	D	32
Southbound					
Exit 54 Off	**880**	**Level**	**PM**	**E**	**38**
Exit 55 Off	**490**	**Level**	**PM**	**E**	**39**
Exit 55 On	680	Level	PM	D	31
Exit 56 (Industrial Rd) Off	**450**	**Level**	**PM**	**E**	**35**
Exit 56 (Leetes Island Rd) On	670	Level	PM	D	30
Exit 57 Off	**340**	**Rolling**	**PM**	**E**	**35**
Exit 57 On	340	Rolling	PM	D	31
Exit 58 Off	410	Rolling	PM	D	33
Exit 58 On	450	Rolling	PM	D	30
Exit 59 Off	340	Rolling	PM	D	32
Exit 59 On	600	Rolling	PM	D	28
Exit 60 Off	230	Rolling	PM	D	29
Exit 60 On	270	Rolling	PM	D	27
Exit 61 Off	**270**	**Rolling**	**PM**	**E**	**35**
Exit 61 On	460	Rolling	PM	C	27
Exit 62 Off	520	Rolling	PM	D	33
Exit 62 On	390	Rolling	PM	B	17
Exit 63 Off	600	Rolling	PM	D	35
Exit 63 On	670	Rolling	PM	C	25
Exit 64 Off	420	Rolling	PM	D	30
Exit 64 On	340	Rolling	PM	C	26
Exit 65 Off	**310**	**Rolling**	**PM**	**E**	**35**
Exit 65 On	600	Rolling	PM	C	27
Exit 66 Off	270	Rolling	PM	D	33

Table 5-9
Ramp Merge/Diverge Analysis – Summary of 2025 Build Condition

Ramp	Ramp Volume	Terrain	Peak Hour	Level of Service	Density (pc/mi/ln)
Exit 66 On	410	Rolling	PM	C	27
Exit 67 (Elm St) Off	430	Rolling	PM	D	32
Exit 67 (Elm St) On	190	Rolling	PM	C	26
Exit 67 (Rte 154) Off	**810**	**Rolling**	**PM**	**E**	**36**
Exit 67 (Rte 154) On	500	Rolling	PM	D	29
Exit 69 Off	1,530	Rolling	PM	D	30
Exit 69 On	410	Rolling	PM	D	30
Exit 70 Off	**250**	**Rolling**	**PM**	**F**	**46**
Exit 70 On	770	Rolling	PM	D	29
Exit 71 On	170	Rolling	PM	C	28
Exit 72/71 Off	**680**	**Rolling**	**PM**	**F**	**42**
Exit 72 On	340	Rolling	PM	D	31
Exit 73 Off	250	Rolling	PM	D	33
Exit 73 On	110	Rolling	PM	D	32
Exit 74 Off	**770**	**Rolling**	**PM**	**F**	**42**
Exit 74 On	410	Rolling	PM	D	33
Exit 76 Off	1,400	Rolling	PM	D[1]	-
Exit 76 On	1,390	Rolling	PM	D[1]	-
Exit 81 (Cross Rd) On	370	Rolling	PM	D	30
Exit 81 (Parkway North) Off	780	Rolling	PM	B	15
Exit 81 (Parkway North) On	540	Rolling	PM	D	28
Exit 82 (Frontage Rd) On	1,450	Rolling	PM	C	24
Exit 82A (Frontage Rd) Off	1,150	Rolling	PM	D	32
Exit 83 Off	**1,350**	**Rolling**	**PM**	**F**	**42**
Exit 84 Off	**2,400**	**Rolling**	**PM**	**F**	**51**
Exit 85 On	**1,300**	**Rolling**	**PM**	**F**	**54**
Exit 86 On	**1,750**	**Rolling**	**PM**	**F**	**50**
Exit 87 (Rte 349) Off	**410**	**Rolling**	**PM**	**F**	**47**
Exit 87 (Rte 1) Off	350	Rolling	PM	D	30
Exit 87 On	**1,150**	**Rolling**	**PM**	**F**	**43**
Exit 88 Off	**340**	**Rolling**	**PM**	**F**	**42**
Exit 88 On	**750**	**Rolling**	**PM**	**E**	**36**
Exit 89 Off	**350**	**Rolling**	**PM**	**E**	**38**
Exit 89 On	630	Rolling	PM	D	34
Exit 90 Off	**390**	**Rolling**	**PM**	**E**	**38**
Exit 90 On	1,410	Rolling	PM	D	30
Exit 91 Off	100	Rolling	PM	D	32
Exit 91 On	630	Rolling	PM	C	25
Exit 92 Off	340	Rolling	PM	C	23
Exit 92 On	1,050	Rolling	PM	D	31
Exit 93 Off	410	Rolling	PM	C	27
Exit 93 On	210	Rolling	PM	C	26

Note: Boldface entries denote capacity deficiencies during the peak period.
1 LOS for 2020 taken from Administrative Final Environmental Impact Statement "Route 11 Corridor" dated December 5, 2002.

Northbound Ramps

Of the 65 total northbound ramp junctions shown in Table 5-9, 47 are located in areas where a third travel lane is required to provide additional capacity along northbound I-95. The analysis showed that 36 of these 47 merge and diverge areas will experience an improved LOS in the evening peak hour. In addition, 31 of these 47 areas will operate at acceptable levels under the peak hour traffic demands at LOS D or better. Overall, 38 of the 65 northbound ramp junction areas will operate acceptably at LOS D or better should the recommended mainline and interchange improvements be implemented. This is an improvement over the four areas that will operate at acceptable levels if no improvements are provided.

Southbound Ramps

Of the 66 total southbound ramp junctions shown in Table 5-9, 48 are located in areas where a third travel lane is required to provide additional capacity along northbound I-95. The analysis showed that 39 of these 48 merge and diverge areas will experience an improved LOS in the evening peak hour. In addition, 32 of these 48 areas will operate at acceptable levels under the peak hour traffic demands at LOS D or better. Overall, 46 of the 66 southbound ramp junction areas will operate acceptably at LOS D or better should the recommended mainline and interchange improvements be implemented. This is an improvement over the ten areas that will operate at acceptable levels if no improvements are provided.

5.4.4.b Weaves

The results of the weaving sections analysis based on the 2025 build condition are presented in Table 5-10 and are illustrated on Figure 5-3. Due to the recommended improvement concepts at several interchanges, the following weaving sections are eliminated in the 2025 build condition:

- Northbound between Exits 68 and 69
- Northbound between Exits 71 and 72
- Southbound between Exits 69 and 68
- Southbound between Exits 72 and 71
- Southbound between Exits 82A (Frontage Road on-ramp) and 82

In addition, although the northbound weaving sections located between Exit 89 and the Scenic Overlook and between the Scenic Overlook and Exit 90 were not included in the 2025 no-build analysis, an analysis of these areas is included here because concerns were raised during the development of the improvement concepts regarding the effects of these weaves on mainline operations.

Table 5-10
Weaving Sections Analysis – Summary of 2025 Build Condition

Section Description	Weave Length (ft)	Peak Hour	Level of Service	Density (pc/mi/ln)
Northbound				
Exit 82A to Exit 83	2400	PM	C	23
Exit 89 to Scenic Overlook	1550	PM	C	25
Scenic Overlook to Exit 90	1850	PM	D	28

5.4.4.c Signalized Intersections

The results of the signalized intersection analysis based on the 2025 build condition are presented in Table 5-11 and are illustrated on Figure 5-4. Due to the 2025 traffic demands, signalization of the following unsignalized intersections is recommended to improve intersection capacity and reduce delay in the build condition:

- SR 740 (Cedar Street) at Cedar Knolls Drive
- Clapboard Hill Road at SR 718 (Goose Lane)
- Exit 61 northbound ramps at Route 79 (Durham Road)
- Exit 58 southbound ramps at Route 77 (Church Street)
- Exit 64 northbound ramps at Route 145
- Exit 64 southbound ramps at Route 145
- Exit 66 northbound ramps at Route 166
- Exit 66 southbound ramps at Route 166
- Exit 67 (Elm Street) northbound on-ramp at Elm St/Ingham Hill Rd
- Exit 67 (Elm Street) southbound ramps at Elm Street
- Exit 67 (Route 154) northbound ramps at Route 154
- Exit 67 (Route 154) southbound ramps at Route 154
- Exit 89 southbound ramps at SR 614
- Exit 89 northbound ramps at SR 614
- Exit 88 northbound ramps at Route 117 (North Rd)

As shown in Table 5-11, the recommended intersection improvements provide a LOS D or better at all of the signalized intersections included in the study in the 2025 build condition. These improvements include signal timing and phasing improvements, additional left and right turn lanes, additional through lanes on secondary roadways, increased storage lengths for queued vehicles and other geometric improvements.

Table 5-11
Signalized Intersection Analysis – Summary of 2025 Build Condition

Signalized Intersection	Peak Hour	Level of Service	V/C[1]	Delay[2]
Exit 54 NB Ramps at SR 740 (Cedar St)	PM	A	0.68	6
Exit 54 SB Ramps at SR 740 (Cedar St)	PM	B	0.84	18
SR 740 (Cedar St) at Cedar Knolls Dr	PM	A	0.62	3
US Rte 1 (Main St) at SR 740 (Cedar St)	PM	C	0.90	29
Exit 55 NB Ramps at US Rte 1 (East Main St)	PM	A	0.72	9
Exit 55 SB Ramp at US Rte 1 (East Main St)	PM	A	0.72	8
Exit 57 NB Ramps at US Rte 1 (Boston Post Rd)	PM	B	0.74	14
Exit 58 NB Ramps at Rte 77 (Church St)	PM	B	0.74	14
Exit 58 SB Ramps at Rte 77 (Church St)	PM	B	0.78	12
Exit 59 NB Ramps at US Rte 1 (Boston Post Rd)	PM	B	0.81	19
Exit 59 SB Ramps at SR 718 (Goose Lane)	PM	A	0.77	8
US Rte 1 at SR 718 (Goose Lane)	PM	C	0.90	21
Clapboard Hill Rd at SR 718 (Goose Lane)	PM	A	0.63	7
Exit 61 NB Ramps at Rte 79 (Durham Rd)	PM	A	0.55	4
Exit 61 SB Ramps at Rte 79 (Durham Rd)	PM	A	0.70	8
Rte 79 (Durham Rd) at Old Rte 79/Woodland Rd	PM	A	0.67	7
Exit 62 NB Ramps at SR 450 (Hammonasset Connector)	PM	B	0.70	17

Table 5-11
Signalized Intersection Analysis – Summary of 2025 Build Condition

Signalized Intersection	Peak Hour	Level of Service	V/C[1]	Delay[2]
Exit 62 SB Ramps at Duck Hole Rd	PM	B	0.61	11
Duck Hole Rd at SR 450 (Hammonasset Connector)	PM	B	0.63	12
Exit 63 SB Ramps at Rte 81 (Killingworth Turnpike)	PM	B	0.90	14
Rte 81 (Killingworth Turnpike) at Glenwood Rd	PM	A	0.78	9
Exit 64 NB Ramps at Rte 145	PM	B	0.63	10
Exit 64 SB Ramps at Rte 145	PM	B	0.62	14
Rte 145 at Old Clinton Rd	PM	B	0.78	13
Exit 65 NB Ramps at Rte 153 (Essex Rd)	PM	B	0.89	12
Exit 65 SB Ramps at Rte 153 (Essex Rd)	PM	B	0.69	12
Rte 153 at Norris Ave/Flat Rock Pl (Westbrook Mall Entrance)	PM	C	0.89	28
Exit 66 NB Ramps at Rte 166	PM	A	0.59	8
Exit 66 SB Ramps at Rte 166	PM	A	0.56	8
Exit 67 (Elm St) NB On-Ramp at Elm St/Ingham Hill Rd	PM	A	0.66	9
Exit 67 (Elm St) SB Ramps at Elm St	PM	B	0.59	16
Exit 67 (Rte 154) NB Ramps at Rte 154	PM	A	0.69	4
Exit 67 (Rte 154) SB Ramps at Rte 154	PM	B	0.79	12
Exit 70 NB Off-Ramp at Rte 156 (Neck Rd)	PM	B	0.79	17
Exit 70 SB On-Ramp at Rte 156/US Rte 1 (Halls Rd)	PM	B	0.75	11
Exit 70 SB Off-Ramp at US Rte 1(Boston Post Rd)	PM	C	0.79	24
SR 449 (Rocky Neck Connector) at Rte 156	PM	B	0.57	12
Exit 74 NB Off-Ramp at Rte 161 (Flanders Rd)	PM	B	0.89	17
Exit 74 SB Ramps at Rte 161 (Flanders Rd)	PM	B	0.79	13
Exit 81 SB Ramps at Parkway North	PM	B	0.59	11
Exit 82 NB Ramps at Rte 85 (Broad St)	PM	A	0.70	7
Exit 82 SB Ramps at Rte 85 (Hartford Tpke)	PM	B	0.91	17
US Rte 1 (Coleman St) at Rte 85 (Broad St)	PM	D	0.56	42
Vauxhall St at US Rte 1 (Coleman St)	PM	B	0.82	11
US Rte 1 at Bridge St	PM	B	0.85	11
Exit 88 NB Ramps at Rte 117 (North Rd)	PM	C	0.78	20
Exit 88 SB Ramps at Rte 117 (North Rd)	PM	B	0.73	12
Exit 89 NB Ramps at SR 614	PM	B	0.79	17
Exit 89 SB Ramps at SR 614	PM	A	0.65	9
Exit 90 NB Ramps at Rte 27 (White Hall Ave)	PM	B	0.84	26
Exit 90 SB Ramps at Rte 27 (White Hall Ave)	PM	C	0.93	30
Rte 27 (White Hall Ave) at Coogan Blvd	PM	B	0.93	20
Exit 91 NB Ramps at Rte 234 (Pequot Trail)	PM	B	0.74	17
Exit 92 NB Off-Ramp at Rte 2 (Liberty St)	PM	B	0.87	16
Exit 92 SB On-Ramp at Rte 2 (Liberty St)	PM	B	0.69	11
Exit 92 SB Off-Ramp at Rte 49 (Pendleton Hill Rd)	PM	B	0.55	15

1 V/C - Volume to Capacity Ratio
2 Delay - Average stopped delay to all vehicles entering the intersection in seconds per vehicle.

5.4.4.d Unsignalized Intersections

The results of the unsignalized intersection analysis based on the 2025 build condition are presented in Table 5-12 and are illustrated on Figure 5-4. As shown in Table 5-12, the recommended intersection improvements provide a LOS D or better at 19 of the 21 unsignalized intersections included in the study in the 2025 build condition. These improvements mainly included additional left and right turn lanes, increased storage lengths for queued vehicles and other geometric improvements.

Table 5-12
Unsignalized Intersection Analysis – Summary of 2025 Build Condition

Unsignalized Intersections	Movement	Demand[1]	Delay[2]	Level of Service
Exit 57 SB Ramps at US Rte 1 (Boston Post Rd)	**Westbound Left**	**70**	**38**	**E**
	Westbound Right	270	18	C
	Westbound		22	C
	Southbound	30	9	A
Rte 77 at Commuter Lot Drive	Northbound	10	9	A
	Eastbound	**20**	**40**	**E**
	Southbound	0	10	A
Exit 58 NB Off-Ramp at North River St	Westbound	80	9	A
	Northbound	110	15	B
Exit 60 SB Off-Ramp at Mungertown Rd	Northbound	50	8	A
	Westbound	230	15	C
Exit 60 SB Off-Ramp at Mungertown Rd (continued)	Eastbound	80	9	A
Exit 60 NB Off-Ramp at Wildwood Ave	Eastbound	270	18	C
Exit 60 NB On-Ramp at Fort Path Rd	Northbound	70	10	B
Mungertown Rd at Fort Path Rd	Westbound	40	10	A
	Southbound	90	8	A
Rte 79 at Commuter Lot Drive	Westbound Left	10	21	C
	Westbound Right	20	24	C
	Westbound		23	C
	Southbound	10	13	B
Exit 63 NB Ramps at Rte 81 (Killingworth Tpke)	Roundabout	2,790	8	B
Exit 69 SB Off-Ramp at Essex Rd	Northbound	80	10	B
Exit 71 NB Ramps at Four Mile River Rd	Southbound	220	9	A
	Westbound	130	21	C
Exit 71 SB Ramps at Four Mile River Rd	Northbound	130	8	A
	Westbound	380	33	D
Four Mile River Rd at Hatchetts Hill Rd	Northbound	30	8	A
	Eastbound	220	17	C
Exit 73 SB Ramps at West Society Rd	Northbound		10	A
	Northbound Left	0	9	A
	Northbound Right	250	10	A
Exit 73 NB Ramps at Society Rd	Northbound	140	10	A
Exit 74 NB On-Ramp at Rte 161 (Flanders Rd)	Southbound Left	130	2	C
Exit 90 NB Ramps at Clara Dr (Aquarium)	Northbound	190	13	B

Table 5-12
Unsignalized Intersection Analysis – Summary of 2025 Build Condition

Unsignalized Intersections	Movement	Demand[1]	Delay[2]	Level of Service
Exit 91 SB Ramps at Taugwonk Rd	Westbound Left	80	13	B
Exit 91 SB Ramps at Taugwonk Rd (continued)	Westbound Right	20	10	A
	Westbound		12	B
	Southbound	60	8	A
Exit 93 NB Ramps at Rte 216 (Clark Falls Rd)	Southbound	290	9	A
	Eastbound	270	33	D
Exit 93 SB Ramps at Rte 216 (Clark Falls Rd)	Northbound	410	11	B
Rte 216 (Clark Falls Rd) at Rte 184	Northbound	485	19	C
	Southbound	360	12	B
	Eastbound	540	15	C
	Westbound	566	30	D
	Intersection		22	C

1 Demand is expressed in vehicles per hour, including all vehicle types (e.g. passenger cars, trucks, motorcycles, etc.).
2 Delay - Average stopped delay in seconds per vehicle.

5.5 Environmental Impact Summary

The environmental impacts associated with the mainline widening and interchange improvement concepts presented in Section 5.3.4 and Section 5.4.3 of this report are summarized in Table 5-13. As shown in the table, the recommended improvements impact approximately 67 acres of wetlands, 78 streams and 10 threatened and endangered species. In addition, approximately 145 potential noise-sensitive areas have been identified within the I-95 study area.

Table 5-13
Environmental Impact Summary

Section	Wetland Impacts (Acres)		Stream Impacts		Threatened & Endangered Species	Potential Noise-Sensitive Areas
	Freshwater	Tidal	Perennial	Intermittent		
Area 1 – Exit 54 to Connecticut River (Exit 69)						
Mainline	15.6	0.4	18	5	4	49
Interchanges	16.5	4.5	17	2	3	44
Area 2 –Connecticut River (Exit 70) to Thames River (Exit 84)						
Mainline	6.7	0	8	0	0	2
Interchanges	14.9	1.3	10	4	1	22
Area 3 – Thames River (Exit 85) to Rhode Island State Line						
Mainline	6.4	0	5	5	1	14
Interchanges	0.6	0	4	0	1	14
Totals	**60.7**	**6.2**	**62**	**16**	**10**	**145**

5.6 Conceptual Construction Cost Estimate

A detailed construction cost estimate for the mainline and interchange improvement concepts presented previously in this chapter was developed in accordance with Connecticut Department of Transportation (ConnDOT) and Federal Highway Administration (FHWA) guidelines for preliminary cost estimating.

Table 5-14 presents a summary of the estimated construction costs for each mainline and interchange section within the study area. Costs developed for each section consist of roadway, bridge, right-of-way and environmental mitigation costs associated with the mainline widening and interchange and intersection improvements within each section. These costs were estimated using unit pricing information developed by ConnDOT and are presented in both 2004-dollars and program year-dollars (based on the anticipated year of expenditure) that are adjusted for inflation. A cost associated with the relocation of existing utilities was also developed by ConnDOT for the entire study area. The total cost adjusted for inflation to implement the recommended improvement concepts is approximately $1.57 billion.

Additional details regarding the specific components of the estimate, and the methodology and assumptions used to develop the construction cost estimate are provided in the following section.

5.6.1 Estimating Methodology and Assumptions

A brief discussion of the major assumptions and methodologies used to develop the conceptual construction cost estimate shown in Table 5-14 is provided below:

- **Full-Depth Reconstruction** – It was assumed that full-depth reconstruction is required in all pavement areas where the existing pavement edges or roadway alignments are modified. This includes the entire I-95 mainline where additional pavement width is being provided. Interchange ramps and secondary roads also require full-depth reconstruction within the modified pavement edges as shown on Figure 5-2. Full-depth reconstruction consists of replacing the existing pavement structure with new aggregate base material and *Superpave* bituminous concrete pavement. This assumption provides a worst-case scenario for likely costs to be incurred when the improvements are constructed. Future design phases will consider pavement reclamation, recycling, pavement overlays and other cost-effective pavement rehabilitation strategies where appropriate to help minimize the overall costs associated with the improvements. In addition, a life cycle cost analysis will be performed during subsequent design phases to determine which pavement type, *Superpave* or Portland cement concrete, will provide the most cost-effective mainline pavement design over the design life of the improvements.

Table 5-14
Conceptual Construction Cost Estimate Summary – Improvement Concepts

Section	Length (mi)	Estimated Construction Costs (2004 $)						Anticipated Year of Expenditure	Annual Inflation Rate	Adjusted Cost
		Roadway	Bridge Structures	Right-of-Way	Environ. Mitigation	Other[1]	Total			
Area 1 – Exit 54 to Connecticut River (Exit 69)										
Exit 54	0.45	$5,100,000	$6,500,000	$25,000	$60,000	$4,915,000	$16,600,000	2014 ~ 2016	2.75%	$22,400,000
Exits 54 to 55	1.09	$9,400,000	$6,600,000	$25,000	$400,000	$6,675,000	$23,100,000	2014 ~ 2016	2.75%	$31,100,000
Exit 55	0.96	$12,900,000	$6,400,000	$500,000	$100,000	$8,500,000	$28,400,000	2014 ~ 2016	2.75%	$38,300,000
Exits 55 to 56	0.22	$2,300,000	$2,800,000	$0	$0	$2,100,000	$7,200,000	2014 ~ 2016	2.75%	$9,700,000
Exit 56	0.86	$7,500,000	$0	$25,000	$180,000	$3,095,000	$10,800,000	2014 ~ 2016	2.75%	$14,600,000
Exits 56 to 57	2.25	$20,700,000	$5,100,000	$25,000	$890,000	$10,885,000	$37,600,000	2014 ~ 2016	2.75%	$50,700,000
Exit 57	0.68	$8,300,000	$7,400,000	$700,000	$80,000	$6,720,000	$23,200,000	2014 ~ 2016	2.75%	$32,100,000
Exits 57 to 58	0.22	$2,500,000	$2,800,000	$0	$0	$2,200,000	$7,500,000	2014 ~ 2016	2.75%	$10,400,000
Exit 58	0.70	$7,000,000	$6,800,000	$1,000,000	$90,000	$6,010,000	$20,900,000	2014 ~ 2016	2.75%	$28,900,000
Exits 58 to 59	0.35	$2,400,000	$0	$0	$80,000	$1,020,000	$3,500,000	2014 ~ 2016	2.75%	$4,800,000
Exit 59	0.80	$9,300,000	$3,800,000	$5,000,000	$200,000	$5,600,000	$23,900,000	2014 ~ 2016	2.75%	$33,100,000
Exits 59 to 60	0.77	$6,100,000	$11,300,000	$40,000	$90,000	$7,370,000	$24,900,000	2014 ~ 2016	2.75%	$34,500,000
Exit 60	1.40	$12,200,000	$3,900,000	$30,000	$720,000	$6,650,000	$23,500,000	2016 ~ 2018	2.75%	$33,400,000
Exits 60 to 61	0.49	$3,800,000	$2,700,000	$0	$90,000	$2,710,000	$9,300,000	2016 ~ 2018	2.75%	$13,200,000
Exit 61	0.78	$10,500,000	$2,500,000	$450,000	$120,000	$5,830,000	$19,400,000	2016 ~ 2018	2.75%	$27,600,000
Exits 61 to 62	1.04	$10,000,000	$4,100,000	$0	$110,000	$5,790,000	$20,000,000	2016 ~ 2018	2.75%	$28,500,000
Exit 62	0.63	$7,000,000	$10,500,000	$35,000	$20,000	$7,345,000	$24,900,000	2016 ~ 2018	2.75%	$35,400,000
Exits 62 to 63	1.22	$10,100,000	$1,600,000	$0	$350,000	$4,950,000	$17,000,000	2016 ~ 2018	2.75%	$24,200,000
Exit 63	0.93	$10,700,000	$5,800,000	$3,000,000	$460,000	$7,040,000	$27,000,000	2016 ~ 2018	2.75%	$39,500,000
Exits 63 to 64	1.42	$15,400,000	$5,900,000	$25,000	$500,000	$8,875,000	$30,700,000	2016 ~ 2018	2.75%	$44,900,000
Exit 64	0.68	$9,200,000	$3,200,000	$40,000	$170,000	$5,290,000	$17,900,000	2016 ~ 2018	2.75%	$26,200,000
Exits 64 to 65	1.74	$14,800,000	$4,300,000	$25,000	$370,000	$8,005,000	$27,500,000	2016 ~ 2018	2.75%	$40,200,000
Exit 65	0.59	$6,600,000	$4,900,000	$25,000	$200,000	$4,975,000	$16,700,000	2016 ~ 2018	2.75%	$24,400,000
Exits 65 to 66	0.61	$4,700,000	$0	$35,000	$160,000	$2,005,000	$6,900,000	2018 ~ 2020	2.75%	$10,400,000
Exit 66	0.74	$8,900,000	$2,500,000	$250,000	$560,000	$4,790,000	$17,000,000	2018 ~ 2020	2.75%	$25,500,000
Exits 66 to 67 (Elm)	0.73	$7,100,000	$3,800,000	$25,000	$0	$4,575,000	$15,500,000	2018 ~ 2020	2.75%	$23,300,000
Exit 67 (Elm)	0.82	$8,600,000	$4,600,000	$400,000	$660,000	$5,440,000	$19,700,000	2018 ~ 2020	2.75%	$29,600,000
Exits 67 (Rte 154)	0.77	$10,700,000	$4,700,000	$50,000	$530,000	$6,420,000	$22,400,000	2018 ~ 2020	2.75%	$33,600,000
Exits 67 (Rte 154) to 69	0.60	$5,900,000	$4,500,000	$0	$130,000	$4,170,000	$14,700,000	2018 ~ 2020	2.75%	$22,100,000
Exit 69	0.73	$6,800,000	$4,100,000	$0	$0	$4,600,000	$15,500,000	2018 ~ 2020	2.75%	$23,300,000

Table 5-14
Conceptual Construction Cost Estimate Summary – Improvement Concepts

Section	Length (mi)	Estimated Construction Costs (2004 $)						Anticipated Year of Expenditure	Annual Inflation Rate	Adjusted Cost
		Roadway	Bridge Structures	Right-of-Way	Environ. Mitigation	Other[1]	Total			
Area 2 – Connecticut River (Exit 70) to Thames River (Exit 84)										
Exit 70	1.23	$13,100,000	$15,400,000	$2,400,000	$620,000	$11,780,000	$43,300,000	2012 ~ 2014	2.75%	$55,300,000
Exits 70 to 71	2.70	$23,500,000	$3,800,000	$25,000	$1,290,000	$11,285,000	$39,900,000	2012 ~ 2014	2.75%	$50,900,000
Exits 71 and 72	1.83	$28,800,000	$10,600,000	$200,000	$1,400,000	$15,500,000	$56,500,000	2010 ~ 2012	2.75%	$70,200,000
Exits 72 to 73	0.45	$3,700,000	$3,100,000	$0	$30,000	$2,770,000	$9,600,000	2010 ~ 2012	2.75%	$11,900,000
Exit 73	1.25	$12,300,000	$1,800,000	$25,000	$90,000	$5,885,000	$20,100,000	2010 ~ 2012	2.75%	$25,000,000
Exits 73 to 74	0.39	$3,100,000	$0	$0	$30,000	$1,370,000	$4,500,000	2010 ~ 2012	2.75%	$5,600,000
Exit 74	0.64	$7,500,000	$7,600,000	$2,800,000	$300,000	$6,600,000	$24,800,000	2010 ~ 2012	2.75%	$30,800,000
Exits 81, 82 and 82A	3.28	$40,100,000	$22,400,000	$13,775,000	$820,000	$26,105,000	$103,200,000	2012 ~ 2014	2.75%	$135,400,000
Exit 83	0.51	$3,400,000	$0	$0	$0	$1,400,000	$4,800,000	2012 ~ 2014	2.75%	$6,300,000
Area 3 – Thames River (Exit 85) to Rhode Island State Line										
Exits 85, 86 and 87	2.04	$12,300,000	$15,900,000	$0	$0	$11,800,000	$40,000,000	2020 ~ 2022	2.75%	$65,200,000
Exit 88	1.12	$7,400,000	$7,200,000	$0	$0	$6,200,000	$20,800,000	2020 ~ 2022	2.75%	$33,900,000
Exits 88 to 89	1.82	$11,000,000	$0	$25,000	$20,000	$4,555,000	$15,600,000	2020 ~ 2022	2.75%	$25,400,000
Exit 89	0.68	$5,800,000	$6,700,000	$0	$60,000	$5,240,000	$17,800,000	2018 ~ 2020	2.75%	$27,500,000
Exits 89 to 90	0.54	$3,700,000	$15,600,000	$0	$0	$8,100,000	$27,400,000	2018 ~ 2020	2.75%	$42,300,000
Exit 90	0.8	$6,900,000	$4,300,000	$1,000,000	$0	$4,700,000	$16,900,000	2018 ~ 2020	2.75%	$26,100,000
Exits 90 to 91	2.11	$12,400,000	$13,400,000	$0	$50,000	$10,750,000	$36,600,000	2018 ~ 2020	2.75%	$56,500,000
Exit 91	0.74	$6,900,000	$3,600,000	$0	$50,000	$4,350,000	$14,900,000	2020 ~ 2022	2.75%	$23,600,000
Exits 91 to 92	2.90	$17,800,000	$3,600,000	$0	$1,190,000	$8,910,000	$31,500,000	2020 ~ 2022	2.75%	$50,000,000
Exit 92	0.15	$900,000	$0	$0	$0	$500,000	$1,400,000	2020 ~ 2022	2.75%	$2,200,000
Exits 54 to 92 (Utilities)	-	-	-	-	-	$7,000,000	$7,000,000	2016 ~ 2018	2.75%	$10,000,000
Totals	**50.45**						**$1,109,800,000**			**$1,570,000,000**

- **Replacement/Reconstruction of Affected Bridge Structures** – It was assumed that three major multi-span structures and their approaches, including the Baldwin Bridge over the Connecticut River, the Gold Star Bridge over the Thames River and the Groton Reservoir structure, will not require modifications as discussed in Section 5.3.3. The Leetes Island Road structure at Exit 56, which was recently reconstructed in 2003, and the Cross Road structure at Exit 81, which is currently under construction and scheduled for completion in 2005, also will not require modifications because these overpass structures provide sufficient vertical and lateral clearance to accommodate the widened section. In addition, it was assumed that several structures located in Areas 2 and 3 will not require modifications. All other major bridge structures and box culverts affected by the mainline widening were assumed to be completely reconstructed for purposes of estimating construction costs. This assumption provides a worst-case scenario for likely structure costs to be incurred when the widened facility is constructed. A summary table presenting the locations and areas of all the affected bridge structures is provided in the appendix.
- **Year of Expenditure and Escalation Factor** – ConnDOT and FHWA estimating guidelines require construction cost estimates in current-year dollars be inflated by an escalation factor to better reflect the actual costs of projects in the anticipated year of expenditure. In accordance with ConnDOT guidelines, the assumed annual escalation factor is 2.75%. The anticipated year of expenditure for each section shown in Table 5-14 is the approximate year in which construction will be at the mid-point of completion based on the long-term implementation plan presented in Section 6.3.2.
- **Utilities** – Any major anticipated utility impacts within the study area have been identified. In accordance with FHWA estimating guidelines, costs associated with relocating these impacted utilities are included in the construction cost estimate.
- **Right-of-Way** – Any major right-of-way impacts associated with the mainline widening and interchange improvements have been identified and their areas have been calculated. In accordance with FHWA estimating guidelines, costs associated with each property acquisition are included in the construction cost estimate for each section.
- **Environmental Mitigation** – Any major wetland impacts associated with the mainline widening and interchange improvements have been identified and their areas have been calculated. In accordance with FHWA estimating guidelines, direct and indirect costs associated with mitigating these impacts are included in the construction cost estimate for each section.

5.7 Managed Lane Feasibility Analysis

As part of this study, an in-depth evaluation was conducted to determine the potential effectiveness of a managed, or *value-priced*, lane in the I-95 corridor between Exit 54 in Branford and the Rhode Island state line. Value-pricing is a generic term for congestion-related charges imposed on new lanes constructed for additional capacity in a corridor where a free facility of the same functional class already exists. A barrier-separated managed lane would be located parallel to the existing highway in both the northbound and southbound directions and entrance and exit points would be strategically located throughout the corridor. Motorists would be charged a variable fee to use the managed lane based on time savings. These fees would be collected automatically utilizing electronic toll collection technology.

The *Feasibility of Managed ('Value-Priced') Lanes* report located in the appendix provides a complete evaluation of the potential effectiveness of a managed lane in the study area. The analysis concluded that motorists on a facility with one managed lane and two general purpose lanes would experience more total delay than motorists on a facility with three general purpose lanes. Furthermore, the additional cost to construct the managed lanes was estimated to be approximately $600 million more than the cost to construct a third general purpose lane in each direction. Over their lifetime, the managed lanes would only generate enough revenue to offset approximately one-fifth of this *additional* cost. In general, it was concluded that a managed lane facility located within the study area would be less effective in addressing the anticipated future traffic demands than the recommended widening improvements. This is primarily due to the absence of a clear operational benefit to the average user resulting from the managed lane, as well as the overall cost and environmental impacts associated with the wider managed lane typical section.

6
Implementation Plan

Chapter 5 presented the long-term improvement concepts developed for the I-95 mainline and interchanges located within the study area. These improvements were designed to address the identified corridor deficiencies, improve capacity in the design year, and provide for future growth to year 2025. In addition to these long-term improvements, there is potential to implement numerous near-term improvement projects to address existing mainline, interchange and intersection deficiencies along the corridor. This chapter identifies these near-term improvement concepts and provides a recommended strategy for implementing both the near-term and long-term improvements. This implementation plan includes a prioritization of recommended improvements based on identified needs and anticipated environmental and right-of-way impacts. The implementation plan also outlines a recommended construction sequence based on priority, estimated costs and funding availability.

6.1 Overview of Recommended Improvements

The recommended improvement concepts presented in the previous chapter are consistent with the goals and objectives of this study. These goals, which are discussed in detail in Section 1.2, include:

- Preserving and improving the capacity of I-95
- Addressing each interchange's unique operating conditions and placement in the overall system
- Enhancing arterial street system operations
- Providing for future growth

The mainline widening and interchange improvements developed by the study team to meet the study objectives listed above and presented thus far are *long-term improvement concepts*. The overall complexity, construction costs, schedule, and level of environmental and right-of-way impacts associated with these improvements are characteristic of large-scale construction projects that typically require considerable amounts of time to design and build. The study team has recognized that while these projects are in the early stages of planning and development, the potential exists for smaller-scale projects to be initiated and constructed in the near-term to help meet the study objectives and address immediate corridor needs. These *near-term improvement concepts* can be designed and implemented in a relatively short period of time at a relatively low cost with only minor right-of-way and environmental impacts as compared to the long-term improvements. The following is a brief

summary of the long-term improvement recommendations presented in Chapter 5 and an overview of the types of potential near-term improvements that were evaluated by the study team.

Recommended Long-Term Improvement Concepts

The recommended long-term improvements consist of mainline capacity improvements along I-95 and safety and operational improvements at the interchanges and intersections located along the study corridor. Mainline capacity improvements include widening the existing two-lane sections where future capacity deficiencies are anticipated to provide a third travel lane and 14 foot shoulders. The recommended interchange improvements consist of both generalized improvements and interchange-specific improvements. Generalized improvements include standardizing acceleration and deceleration lanes, providing standard horizontal and vertical geometry at ramp junctions, and providing adequate intersection capacities and levels of service at ramp and secondary roadway intersections. Interchange-specific improvements include major ramp reconfigurations at particular interchanges that were identified through the study's public outreach program as requiring specialized attention.

Potential Near-Term Improvement Concepts

The potential near-term improvements identified by the study team predominantly consist of safety and operational improvements at the mainline and ramp junctions and at the ramp and secondary roadway intersections. The ramp junction improvements include standardizing acceleration and deceleration lanes where these improvements can be accommodated with minimal impacts to existing right-of-way and environmental resources. The intersection improvements include providing additional turn lanes and signalization upgrades in deficient locations where potential impacts will be minimal.

The near-term improvements also consist of several moderately complex interchange ramp reconfigurations and median improvements in locations that were identified by the study team as requiring immediate attention. The interchange improvements, although typically involving more impacts and higher construction costs than the other near-term improvements, are considerably less complex and less expensive than the long-term recommendations at the same locations. The improvements at these interchanges are compatible with the long-term recommendations, however they provide significant transportation-related benefits in the near-term. The median improvements consist of reconstructing the existing grassed median located between Exit 70 and Exit 75 to incorporate wider paved shoulders and concrete median barrier.

6.2 Near-Term Improvement Program

The near-term improvement program in the following sections provides a recommendation for specific improvement projects that can be initiated immediately to address the needs of the I-95 corridor. The implementation of these projects is based on the priority assigned to each improvement, the availability of funding, and the environmental permitting and right-of-way requirements of the projects.

6.2.1 Speed-Change Lanes

Nonstandard acceleration and deceleration lanes located throughout the study corridor provide less than adequate length for vehicles to make the necessary speed changes required to enter and exit the mainline traffic stream. As a result, vehicles must utilize a portion of the mainline to execute the speed change, thus disrupting the flow of through traffic. The disruptions in traffic flow where nonstandard speed-change lanes are located result in both operational deficiencies at the ramp merge and diverge points, and safety concerns for all roadway users.

Review of the existing geometric conditions conducted in Chapter 2 showed that approximately 80% of the acceleration and deceleration lanes throughout the study area are deficient based upon 2001 AASHTO and ConnDOT HDM design standards. An evaluation of the deficient locations revealed that more than half are candidates for near-term improvement projects based upon the criteria established by the study team. Candidate projects were defined as those that can be implemented without modifying existing bridge structures or without causing significant environmental impacts. In addition, all candidate improvements can be accommodated within the existing right-of-way. The recommended improvements in the candidate locations consist of providing standard deceleration or acceleration lanes to accommodate a safe transition to or from the existing ramp design speeds.

The deficient locations that were identified as candidates for near-term improvements were prioritized by the study team based upon safety and operational considerations and identified need. Ramp junctions located within high accident locations are considered high priority improvements. Locations identified through the public outreach program as recognized safety or operational hazards are also considered high priority improvements. Medium priority ramp junctions are located where both the existing mainline level of service (LOS) and the existing ramp merge or diverge LOS are deficient (LOS E or F). All other candidate locations are low priority improvements.

Table 6-1 summarizes the near-term improvement potential and priority given to each of the interchange ramps located within the I-95 study corridor. Shaded locations in the table are not near-term improvement candidates. An explanation is provided under the comments section in the table for the locations not meeting the near-term improvement criteria. The approximate construction cost associated with providing a fully-reconstructed, standardized speed-change lane is shown for each improvement candidate. These costs were developed in accordance with ConnDOT and FHWA guidelines for preliminary cost estimating and include major roadway items, minor roadway items, incidentals, contingencies, preliminary engineering and lump sum items where appropriate. The estimated construction cost for all of the recommended improvements in 2004-dollars is approximately $12.36 million. It should be noted that these near-term improvement recommendations are typically not compatible with the long-term improvement concepts in most locations. As a result, it will be necessary to reconstruct the near-term improvements in order to fully accommodate the long-term, mainline widening improvement concept.

Table 6-1
Prioritization of Near-Term Speed-Change (Acceleration/Deceleration) Lane Improvements

Location	Estimated Ramp Speed[1] (mph)	Speed-Change Lane			Estimated Construction Cost (2004 $)	Priority (Low, Med, High)	Comments
		Existing Length (ft)	Standard Length (ft)	Deficiency (ft)			
Northbound							
Exit 54 On	35	400	1230	830	$320,000	Low	
Exit 55 Off	50	200	340	140	-	-	Bridge impacts
Exit 55 On	45	500	820	320	$160,000	Med	
Exit 56 Off	45	100	390	290	$130,000	Med	
Exit 56 On	40	450	1000	550	$230,000	Low	
Exit 57 Off	50	150	340	190	$100,000	Low	
Exit 57 On	25	500	1420	920	$350,000	Low	
Exit 58 Off	50	200	340	140	-	-	Culvert impacts
Exit 58 On	40	500	1000	500	-	-	Bridge impacts
Exit 59 Off	45	100	390	290	$130,000	Low	
Exit 59 On	50	700	580	N/A	-	-	Existing length exceeds standard length
Exit 60 On	35	525	1230	705	$280,000	Low	
Exit 61 Off	40	200	440	240	$120,000	Low	
Exit 61 On	50	600	580	N/A	-	-	Existing length exceeds standard length
Exit 62 Off	50	150	340	190	-	-	Bridge impacts
Exit 62 On	35	575	1230	655	-	-	Bridge impacts
Exit 63 Off	50	150	340	190	$100,000	Low	
Exit 63 On	40	480	1000	520	$220,000	Low	
Exit 64 Off	50	250	340	90	$70,000	Low	
Exit 64 On	40	350	1000	650	$260,000	Low	
Exit 65 Off	50	225	340	115	$80,000	Low	
Exit 65 On	40	1000	1230	230	$130,000	Low	
Exit 66 Off	35	>340	340	N/A	-	-	Existing auxiliary lane - no improvement potential
Exit 66 On	20	375	1520	1145	-	-	Bridge impacts
Exit 67 (Elm St) On	35	650	1230	580	$240,000	Low	
Exit 67 (Rte 154) Off	35	225	490	265	$120,000	Low	
Exit 68 On	50	-	-	-	-	-	Lane ahead location - no improvement required
Exit 69 Off	45	300	390	90	$70,000	Low	

Table 6-1
Prioritization of Near-Term Speed-Change (Acceleration/Deceleration) Lane Improvements

Location	Estimated Ramp Speed[1] (mph)	Speed-Change Lane			Estimated Construction Cost (2004 $)	Priority (Low, Med, High)	Comments
		Existing Length (ft)	Standard Length (ft)	Deficiency (ft)			
Exit 69 On	40	-	-	-	-	-	Lane ahead location - no improvement required
Exit 70 Off	50	-	-	-	-	-	Exit only lane - no improvement required
Exit 70 On	40	600	1000	400	$180,000	High	
Exit 71 Off	35	100	490	390	-	-	Bridge impacts
Exit 71 On	35	<1230	1230	N/A	-	-	Existing auxiliary lane - no improvement potential
Exit 72 Off	45	>390	390	N/A	-	-	Existing auxiliary lane - no improvement potential
Exit 72 On	35	650	1700	1050	$390,000	Med	Standard length factored for 3.5% upgrade
Exit 73 Off	40	100	440	340	$150,000	Med	
Exit 73 On	35	425	1230	805	$310,000	Med	
Exit 74 Off	40	150	440	290	$130,000	Med	
Exit 74 On	35	700	1230	530	$220,000	Med	
Exit 75 Off	40	650	440	N/A	-	-	Existing length exceeds standard length
Exit 75 On	35	350	1230	880	$340,000	Med	Additional analysis required; See Section 6.2.3.a
Exit 76 Off	50	440	340	N/A	-	-	Existing length exceeds standard length
Exit 80 On	35	725	1230	505	$220,000	Low	
Exit 81 Off	25	550	550	N/A	-	-	Existing length equals standard length
Exit 81 On	25	1000	1420	420	$190,000	Low	
Exit 82 Off	40	450	440	N/A	-	-	Existing length exceeds standard length
Exit 82 On	35	550	1230	680	$270,000	Low	Potential auxiliary lane to Exit 82A off-ramp
Exit 82A Off	45	350	390	40	$50,000	Low	
Exit 82A On	50	>580	580	N/A	-	-	Existing auxiliary lane - no improvement potential
Exit 83 Off	45	>390	390	N/A	-	-	Existing auxiliary lane - no improvement potential
Exit 83 On	50	-	-	-	-	-	Lane ahead location - no improvement required
Exit 84 On	25	-	-	-	-	-	Lane ahead location - no improvement required
Exit 85 Off	50	340	340	N/A	-	-	Existing length equals standard length
Exit 86 Off	50	-	-	-	-	-	Exit only lane - no improvement required
Exit 87 Off	35	500	490	N/A	-	-	Existing length exceeds standard length
Exit 87 On	50	1100	580	N/A	-	-	Existing length exceeds standard length
Exit 88 Off	45	150	390	240	$120,000	Low	

Table 6-1
Prioritization of Near-Term Speed-Change (Acceleration/Deceleration) Lane Improvements

Location	Estimated Ramp Speed[1] (mph)	Speed-Change Lane			Estimated Construction Cost (2004 $)	Priority (Low, Med, High)	Comments
		Existing Length (ft)	Standard Length (ft)	Deficiency (ft)			
Exit 88 On	45	650	820	170	$110,000	Low	
Exit 89 Off	50	340	340	N/A	-	-	Existing length equals standard length
Exit 89 On	45	600	820	220	-	-	Bridge impacts
Exit 90 Off	50	275	340	65	-	-	Bridge impacts
Exit 90 On	35	4500	1230	N/A	-	-	Existing length exceeds standard length
Exit 91 Off	50	300	340	40	$50,000	Low	
Exit 91 On	45	500	820	320	$160,000	Low	
Exit 92 Off	45	250	470	220	$110,000	High	3.0% downgrade
Exit 92 On	50	100	580	480	$210,000	High	
Exit 93 Off	50	200	410	210	$110,000	Low	Standard length factored for 3.0% downgrade
Exit 93 On	45	575	820	245	-	-	Bridge impacts
Southbound							
Exit 54 Off	45	100	390	290	-	-	Bridge impacts
Exit 55 Off	40	225	440	215	-	-	Bridge impacts
Exit 55 On	45	400	820	420	$190,000	Low	
Exit 56 Off	30	520*	520	N/A	-	-	*Recent construction - assumed standard length
Exit 56 On (1)	40	575	1000	425	$190,000	Med	
Exit 56 On (2)	30	1350*	1350	N/A	-	-	*Recent construction - assumed standard length
Exit 57 Off	50	200	410	210	$110,000	Low	Standard length factored for 3.0% downgrade
Exit 57 On	25	525	1420	895	$340,000	Low	
Exit 58 Off	45	150	390	240	$120,000	Low	
Exit 58 On	35	500	1230	730	$290,000	Low	
Exit 59 Off	50	175	340	165	-	-	Bridge impacts
Exit 59 On	45	525	820	295	$150,000	Low	
Exit 60 Off	50	225	340	115	$80,000	Low	
Exit 61 Off	45	250	390	140	$80,000	Low	
Exit 61 On	20	625	1520	895	$340,000	Low	
Exit 62 Off	35	100	490	390	-	-	Bridge impacts
Exit 62 On	20	325	1520	1195	-	-	Bridge impacts

Table 6-1
Prioritization of Near-Term Speed-Change (Acceleration/Deceleration) Lane Improvements

Location	Estimated Ramp Speed[1] (mph)	Speed-Change Lane			Estimated Construction Cost (2004 $)	Priority (Low, Med, High)	Comments
		Existing Length (ft)	Standard Length (ft)	Deficiency (ft)			
Exit 63 Off	35	150	490	340	-	-	Bridge impacts
Exit 63 On	35	560	1230	670	-	-	Bridge impacts
Exit 64 Off	50	300	340	40	$50,000	Low	
Exit 64 On	40	475	1000	525	-	-	Bridge impacts
Exit 65 Off	50	400	340	N/A	-	-	Existing length exceeds standard length
Exit 65 On	40	450	1000	550	$230,000	Low	
Exit 66 Off	40	325	440	115	$80,000	Low	
Exit 66 On	20	450	1520	1070	-	-	Bridge impacts
Exit 67 (Elm St) Off	50	475	340	N/A	-	-	Existing length exceeds standard length
Exit 67 (Rte 154) On (1)	35	600	1230	630	$260,000	Low	
Exit 67 (Rte 154) On (2)	20	325	1520	1195	-	-	Bridge impacts
Exit 68 Off	45	>390	390	N/A	-	-	Existing auxiliary lane - no improvement potential
Exit 69 Off	50	-	-	-	-	-	Exit only lane - no improvement required
Exit 69 On	35	<1230	1230	N/A	-	-	Existing auxiliary lane - no improvement potential
Exit 70 Off	35	100	390	290	$130,000	High	
Exit 70 On	45	-	-	-	-	-	Lane ahead location - no improvement required
Exit 71 Off	50	>340	340	N/A	-	-	Existing auxiliary lane - no improvement potential
Exit 71 On	40	625	1000	375	$180,000	High	
Exit 72 Off	35	100	490	390	-	-	Bridge impacts
Exit 72 On	35	<1230	1230	N/A	-	-	Existing auxiliary lane - no improvement potential
Exit 73 Off	35	150	490	340	-	-	Bridge impacts
Exit 73 On	35	550	1230	680	$270,000	Med	
Exit 74 Off	20	480	690	210	$110,000	Med	Standard length factored for 3.5% downgrade
Exit 74 On	20	275	1520	1245	$450,000	High	Identified through public outreach as high priority
Exit 75 Off	35	300	490	190	$100,000	Med	Additional analysis required; See Section 6.2.3.a
Exit 75 On	35	50	2030	1980	-	-	Culvert impacts
Exit 76 On	50	1100	580	N/A	-	-	Existing length exceeds standard length
Exit 80 Off	40	550	440	N/A	-	-	Existing length exceeds standard length
Exit 81 Off	25	450	550	100	$70,000	Med	

Table 6-1
Prioritization of Near-Term Speed-Change (Acceleration/Deceleration) Lane Improvements

Location	Estimated Ramp Speed[1] (mph)	Speed-Change Lane			Estimated Construction Cost (2004 $)	Priority (Low, Med, High)	Comments
		Existing Length (ft)	Standard Length (ft)	Deficiency (ft)			
Exit 81 On	35	825	1230	405	$190,000	Med	
Exit 82 Off	40	>440	440	N/A	-	-	Existing auxiliary lane - no improvement potential
Exit 82 On	35	750	615	N/A	-	-	Standard length factored for 5.0% downgrade
Exit 82A On	35	<1230	1230	N/A	-	-	Existing auxiliary lane - no improvement potential
Exit 83 Off	50	-	-	-	-	-	Exit only lane - no improvement required
Exit 84 Off	50	-	-	-	-	-	Exit only lane - no improvement required
Exit 85 On	25	-	-	-	-	-	Lane ahead location - no improvement required
Exit 86 On	50	-	-	-	-	-	Lane ahead location - no improvement required
Exit 87 Off (1)	50	800	340	N/A	-	-	Existing length exceeds standard length
Exit 87 Off (2)	50	560	340	N/A	-	-	Existing length exceeds standard length
Exit 87 On	35	1400	1230	N/A	-	-	Existing length exceeds standard length
Exit 88 Off	35	350	490	140	$80,000	Low	
Exit 88 On	25	850	1420	570	$240,000	Low	
Exit 89 Off	35	275	490	215	-	-	Bridge impacts
Exit 89 On	25	275	1420	1145	$420,000	Low	
Exit 90 Off	35	300	490	190	$100,000	Low	
Exit 90 On	25	850	1420	570	$240,000	High	Identified through public outreach as high priority
Exit 91 Off	35	275	490	215	$110,000	Low	
Exit 91 On	25	750	1420	670	$270,000	Low	
Exit 92 Off	stop	525	615	90	$70,000	High	
Exit 92 On	35	100	630	530	$220,000	High	Existing taper entrance to climbing lane; 3.0% upgrade
Exit 93 Off	50	240	340	100	$70,000	Low	
Exit 93 On	40	100	230	130	$100,000	Low	Existing taper entrance to climbing lane; 3.1% upgrade

Subtotal – High Priority	$1,790,000
Subtotal – Medium Priority	$2,760,000
Subtotal – Low Priority	$7,810,000
Total Cost of Improvements	**$12,360,000**

Note: Shaded entries are not candidates for near-term improvement projects.
1 Ramp speeds were estimated from existing ramp geometry as determined from aerial photography.

6.2.2 Intersections

Intersection capacity analyses were performed and discussed in Chapters 2 and 3 at all signalized and unsignalized ramp and secondary roadway intersections as well as at several other intersections located throughout the corridor. The analyses conducted and discussed in Chapter 3 were used to identify deficient intersections in the 2025 design hour. Long-term improvement recommendations were then made to address these deficiencies. Similarly, the analyses conducted and discussed in Chapter 2 were used to identify deficient intersections in the 2002 design hour. Intersections that were identified as being deficient in the 2002 existing condition, or those that were identified as being high accident locations, were determined to be candidates for near-term improvement projects by the study team. The recommended improvements at the candidate intersections consist of providing signalization at unsignalized intersections, modifying existing traffic signal timings and phasings, and/or providing additional turn lanes where possible with minimal impacts. It is anticipated that signal timing and phasing modifications can be implemented by internal ConnDOT staff and local maintenance forces.

The locations that were identified as candidates for near-term intersection improvements were prioritized by the study team based upon safety and operational considerations. High accident intersections are considered high priority improvement projects. Intersections experiencing saturated conditions with level of service E or F, but which are not high accident locations, are considered low priority improvement projects.

Table 6-2 provides a summary of the recommended improvements and lists the priority assigned to each of the candidate intersections located within the I-95 study corridor. The estimated construction cost associated with providing the improvements for each candidate intersection is also shown. These costs were developed in accordance with ConnDOT and FHWA guidelines for preliminary cost estimating and include major roadway items, minor roadway items, incidentals, contingencies, preliminary engineering and lump sum items where appropriate. The estimated construction cost for all of the recommended intersection improvements in 2004-dollars is approximately $1.64 million. The intersections where new turn lanes are recommended are illustrated on Figure 6-1 (Sheets 1 to 4). These near-term intersection improvement recommendations are compatible with the long-term improvement concepts in most locations. As a result, it will not be necessary to modify or reconstruct the majority of the near-term improvements in order to fully accommodate the long-term intersection improvement concepts.

Table 6-2
Prioritization of Near-Term Intersection Improvements

Intersection	Existing LOS	Recommended Improvements	Proposed LOS	Estimated Cost (2004 $)	Priority (Low, High)	Comments
Signalized						
US Rte 1 at Cedar Street	F	Signal timing/phasing modifications	E	$1,500	Low	Intersection within limits of current DOT improvement project
Exit 55 SB Ramps at US Rte 1	F	Signal timing/phasing modifications; Separate EB left and right turn lanes	D	$160,000	Low	
US Rte 1 at SR 718	C	Signal timing/phasing modifications; Increase red/yellow time	D	$1,500	High	High accident location; LOS decreases due to increased red/yellow time
Exit 63 NB On-Ramp at Rte 81	F	Signal timing/phasing modifications	B	$1,500	Low	
Exit 63 SB Ramps at Rte 81	F	Signal timing/phasing modifications; Re-stripe EB left/thru and right turn lanes	C	$2,000	Low	
Exit 70 SB On-Ramp at Rte 156	F	Signal timing/phasing modifications	A	$1,500	Low	
Exit 70 SB Off-Ramp at US Rte 1	F	Signal timing/phasing modifications	E	$1,500	Low	Additional EB left turn lane required to provide LOS D
Exit 82 NB Ramps at Rte 85	E	Signal timing/phasing modifications	E	$1,500	Low	Additional EB left turn lane required to provide LOS D
Exit 82 SB Ramps at Rte 85	F	Signal timing/phasing modifications; Increase red/yellow time	C	$1,500	High	High accident location
US Route 1 at Route 85	F	Signal timing/phasing modifications; Increase red/yellow time	D	$1,500	High	High accident location
Exit 90 NB Off-Ramp at Rte 27	F	Signal timing/phasing modifications	C	$1,500	Low	
Rte 27 at Coogan Boulevard	F	Signal timing/phasing modifications; Increase red/yellow time	D	$1,500	High	High accident location
Exit 91 NB Off-Ramp at Rte 234	E	Signal timing/phasing modifications; Increase red/yellow time	B	$1,500	High	High accident location
Exit 92 SB On-Ramp at Rte 2	F	Signal timing/phasing modifications	B	$1,500	Low	
Unsignalized						
Cedar Street at Cedar Knolls Dr	F	Signalization	C	$140,000	Low	
Exit 59 SB Ramps at SR 718	E	Signalization; Separate EB left and right turn lanes	B	$220,000	Low	Minor wetland impacts
Exit 61 NB Ramps at Rte 79	F	Signalization	C	$140,000	Low	
Exit 64 NB Ramps at Rte 145	E	Signalization; Separate EB left and right turn lanes	A	$320,000	High	Identified through public outreach as high priority based on sightline restrictions
Exit 64 SB Ramps at Rte 145	F	Signalization; Separate WB left and right turn lanes	B	$220,000	High	Identified through public outreach as high priority; Minor wetland impacts

Table 6-2
Prioritization of Near-Term Intersection Improvements

Intersection	Existing LOS	Recommended Improvements	Proposed LOS	Estimated Cost (2004 $)	Priority (Low, High)	Comments
Exit 67 NB Off-Ramp at Rte 154	F	Signalization	A	$140,000	Low	
Exit 89 NB Ramps at SR 614	F	Signalization	B	$140,000	Low	
Exit 89 SB Ramps at SR 614	F	Signalization	B	$140,000	Low	

Subtotal – High Priority	$547,500
Subtotal – Low Priority	$1,092,500
Total Cost of Improvements	**$1,640,000**

6.2.3 Interchanges

The long-term interchange-specific improvement concepts presented previously in Section 5.4.2 were designed to address identified safety and operational problems that currently exist at several interchanges in the project area. The study team evaluated the improvements in these areas for the potential to recommend the full-build interchange improvement or a portion of the improvement as a near-term project. Candidate projects were defined as those that could provide transportation-related benefits while functioning independently of the overall improvement concept. Prioritization of the candidate near-term projects was based upon the apparent severity of the existing conditions and the perceived urgency to address these conditions at each location. The priority assigned to each project is included in the detailed project descriptions below.

Exit 59 – SR 718 (Goose Lane), Town of Guilford

The long-term improvement concept at this location relocates the northbound ramps to intersect US Route 1 in a button-hook configuration approximately 800 feet west of the existing US Route 1, Goose Lane and Soundview Road intersection. This configuration is designed to eliminate the operational problems caused by the existing location of the northbound ramps intersection. Currently, southbound traffic queuing on Goose Lane at the intersection of Goose Lane and US Route 1 interferes with the operations of the northbound off-ramp, which is located approximately 100 feet north, causing significant delays. Recent signalization of the northbound ramps intersection on Goose Lane is expected to improve operations in this area, however the close spacing of these intersections remains an undesirable condition.

The recommended near-term improvement concept illustrated on Figure 6-2 (Sheet 1 of 7) relocates the northbound off-ramp to the location proposed for the long-term improvement while maintaining the existing northbound on-ramp. The off-ramp, which is transitioned from the existing two-lane section in this area, directly impacts the ConnDOT salt shed and maintenance facility located on the southbound side of US Route 1. Approximately 0.23 acres of wetlands are also directly impacted by the improvements. This near-term improvement concept is considered high priority due to the identified need to improve operations at the existing intersections of the northbound ramps and US Route 1with Goose Lane. The recent opening of the Yale-New Haven Hospital Shoreline Medical Center on Goose Lane also contributes to the need for high-priority improvements at this interchange.

Exit 81 – Parkway North, Town of Waterford

The long-term improvement concept in the area of Exits 81, 82 and 82A eliminates the existing northbound and southbound mainline weaves between Exit 82 and Exit 82A by extending the frontage road system to Route 85 and relocating direct access to and from I-95 and the frontage roads. Part of the overall improvement includes extending Parkway North to Route 85 and replacing both the southbound off-ramp to Parkway North at Exit 81 and the southbound on-ramp from Route 85 at Exit 82.

The recommended near-term improvement illustrated on Figure 6-2 (Sheets 2 through 4 of 7) consists of providing this component of the overall long-term improvement concept. The existing Parkway North facility is extended easterly to Route 85 and a pair of button-hook ramps located between existing Exit 81 and Route 85 links Parkway North to southbound I-95. This configuration replaces the southbound off-ramp to Parkway North and the southbound on-ramp from Route 85. The existing southbound off-ramp to Parkway North at Exit 81 has been identified as a major safety hazard by local authorities due to the nonstandard exit geometry of the ramp and the high volume of traffic utilizing the ramp to access commercial development in the area.

Approximately 0.80 acres of wetlands are directly impacted by the recommended improvements at Exit 81. Right-of-way impacts in this area are limited because the State of Connecticut owns the majority of the land and the residential structures impacted by the improvements.

Currently, this near-term improvement concept is considered low priority. However, the future prioritization is dependent upon the Town of Waterford's development plan to provide an access road to Parkway North via Route 85. Implementation of the town's plan will create an immediate need for this project to be implemented due to the influx of traffic it will bring to the area.

Exit 82 – Route 85 (Broad Street), Town of Waterford

As discussed above, the long-term improvement concept in the area of Exits 81, 82 and 82A eliminates the existing northbound and southbound mainline weaves between Exit 82 and Exit 82A by extending the frontage road system to Route 85 and relocating direct access to and from I-95 and the frontage roads. Part of the overall improvement includes reconfiguring the northbound ramps at Route 85 such that the southbound left-turn movement onto the existing northbound on-ramp is eliminated.

The recommended near-term improvement illustrated on Figure 6-2 (Sheets 5 and 6 of 7) consists of providing this component of the overall long-term improvement concept. The northbound off-ramp, which is transitioned from the existing two-lane section in this area, is realigned to provide sufficient area for the northbound on-ramp to be relocated as an inside loop-ramp between I-95 and the realigned off-ramp. In addition, an auxiliary lane is provided between the relocated on-ramp and the existing frontage road off-ramp at Exit 82A due to the short spacing between the ramps. By relocating the on-ramp to the west side of Route 85, southbound traffic along Route 85 bound for northbound I-95 is required to make a right turn to the on-ramp. The existing left turn to the on-ramp is creating severe backups at this intersection during peak hours due to high traffic volumes generated by numerous shopping malls and other commercial development in the area.

The existing right shoulder on the Route 85 overpass is wide enough to accommodate the additional northbound acceleration lane without requiring major bridge structure modifications. However, the reconfiguration of the ramps requires substantial right-of-way takings including the acquisition of several residential homes in the area. In addition, approximately 0.23 acres of wetlands are directly impacted by the recommended improvements. Despite these impacts, this project is designated a high priority due to the recognized immediate need to alleviate the traffic congestion in this area caused by queued southbound left-turning traffic on Route 85.

A sub-component of the near-term improvement recommendation described above is a recommendation to review the existing advance guide signage located along the southbound lanes of Route 85. A comment received during a public information meeting held in September 2004 suggested that inadequate signing may be contributing to the congested conditions that commonly occur at the intersection of Route 85 and the northbound ramps at Exit 82. Potential signing improvements could include the placement of signs along southbound Route 85 that direct traffic destined for northbound I-95 to utilize the left lane. This will better position vehicles for access to the left turn lane farther upstream so that fewer vehicles will be required to change lanes in the vicinity of this intersection. These signs could be placed as far north as the Crystal Mall access to Route 85. It is recommended that this review, including the implementation of any signing improvements, be conducted concurrently with the permitting and design phases of the overall near-term improvement recommendation at Exit 82. These signs will serve as a temporary, but immediate improvement until construction of the overall near-term improvement is complete.

Exit 90 – Route 27 (Greenmanville Road/White Hall Avenue), Town of Stonington

The long-term improvement concept at this location addresses the need to discourage motorists who are exiting northbound I-95 from utilizing Coogan Boulevard to access Mystic Aquarium. This concept is aimed at reducing the traffic demand and the number of accidents at the intersection of Route 27 and Coogan Boulevard. The long-term improvement concept provides a two-lane northbound exit and improved overhead destination signage to reduce driver confusion at critical decision points and provide ample opportunity for motorists to maneuver to the correct lane for their destination.

The near-term improvement concept at Exit 90 illustrated on Figure 6-2 (Sheet 7 of 7) consists of widening the existing northbound deceleration lane and ramp to provide a two-lane exit beginning immediately north (east) of the Mystic River structure. The additional exit lane in conjunction with advance overhead destination signage improvements is intended to provide the same type of benefits as the long-term improvement concept by reducing driver confusion and providing more opportunity for motorists to maneuver to the correct lane for their destination. The improvement concept also recommends a review of the existing destination signage for Mystic Seaport and Mystic Aquarium to identify potential signing improvements that will also better direct motorists to their destinations. Potential improvements could include modifications to the existing overhead destination signage located over the off-ramp. This is a high priority improvement that will supplement the recent Mystic Seaport signing improvements that were implemented in the area by Department of Transportation's Office of Maintenance at the request of Mystic Seaport representatives.

6.2.3.a Additional Analysis Requirements

The public participation component of this study, which is discussed in detail in Chapter 7, provided a significant amount of feedback from the public that influenced the development of the final corridor recommendations. However, some of this feedback identified areas with particular deficiencies that could not be adequately addressed in time for improvement recommendations to be incorporated into this study. Additional analysis will be required in these areas so that effective solutions can be developed to address the identified deficiencies.

Exits 92 & 93 – Route 2/Route 49/Route 216/Route 184, Towns of Stonington/North Stonington

A comment received from a concerned citizen subsequent to a public information meeting held in September 2004 suggested that inadequate signing may be contributing to an unnecessary volume of through-traffic along Route 184 in North Stonington. The citizen was concerned about the effects this traffic has on the safety of local residents and local traffic, which often includes school buses that make frequent stops along this route. The primary target of potential signing improvements would be casino patrons who are accessing I-95 from Exit 93 via Route 184.

The near-term recommendation at Exit 92 and Exit 93 consists of conducting an inventory of existing destination guide signs in the vicinity of these interchanges and implementing potential signing improvements that will divert unnecessary traffic from Route 184. Potential signing improvements may include the installation of signs along southbound I-95 directing motorists destined for Foxwoods Casino to Exit 92, and the installation of signs along southbound Route 2 directing motorists to northbound I-95 via Route 49 and Exit 92. These improvements are a high priority and consequently, it is recommended that further investigation of near-term signing modifications in this area be initiated upon completion of this study.

Table 6-3 provides a summary of the recommended near-term interchange improvements and lists the priority assigned to each of the interchanges. The estimated construction cost associated with providing the improvements at each interchange is also shown. These costs were developed in accordance with ConnDOT and FHWA guidelines for preliminary cost estimating and include roadway, right-of-way and wetland mitigation costs. Minor roadway items, incidentals, contingencies, preliminary engineering and lump sum items are also included in the estimate. The estimated construction cost for all of the recommended interchange improvements in 2004-dollars is approximately $13.76 million. It should be noted that the near-term improvement recommendations are typically compatible with the long-term improvement concepts and only minor modifications will be required to complete the conversion to the long-term improvements.

Table 6-3
Prioritization of Near-Term Interchange Improvements

Interchange	Estimated Cost (2004 $)	Priority (Low, High)	Comments
Exit 59, NB Off-Ramp at US Rte 1	$2,010,000	High	ConnDOT salt shed relocation; Minor wetland impacts
Exit 82, NB Ramps at Rte 85	$4,800,000	High	Major right-of-way impacts; Minor wetland impacts
Exit 90, NB Off-Ramp at Rte 27	$450,000	High	No impacts; Cost includes potential improvements
Exits 92 / 93, Additional Analysis	TBD[1]	High	Identified through public outreach
Exit 81, SB Ramps at Parkway North	$6,500,000	Low	Minor right-of-way impacts; Major wetland impacts

Subtotal – High Priority	$7,260,000
Subtotal – Low Priority	$6,500,000
Total Cost of Improvements	**$13,760,000**

1 TBD – To Be Determined. The construction costs associated with these improvements will be based upon the recommendations developed from the additional analysis that is required as described in Section 6.2.3.a.

6.2.4 Median Improvements

A narrow grassed median separates the northbound and southbound lanes of I-95 beginning near the northern (eastern) limit of Exit 70 and extending approximately 8.25 miles north to the northern (eastern) limit of Exit 75. The inside paved shoulders generally range in width between two and four feet in this area. The grassed median ranges between 12 to 16 feet in width so that the entire median area including shoulders is approximately 20 feet wide. Nonstandard metal beam guide rail extends along the center of the median through this section.

Because the available space between the inside lanes and the guide rail is limited, a safety hazard is created during routine grass mowing operations in the median. These operations require the partial closure of a small section of the inside travel lane in the vicinity of the maintenance equipment as it progresses along the median. The narrowing of the travel lanes creates a “bottleneck” behind the mowing operation under typical traffic conditions resulting in compromised safety of both the maintenance crews and the traveling public.

The near-term improvement concept in this area consists of reconstructing the existing median to provide wider paved inside shoulders and standard concrete median barrier separation between opposing lanes of traffic. The recommended typical section for the median improvements is shown in Figure 6-3. As illustrated in the figure, five-foot wide inside shoulders and a ten-foot wide median barrier are provided. Improvements to the existing drainage system located along the median are anticipated in conjunction with the reconstruction. These

improvements to the median are consistent with the long-term improvement concept in this area and will typically not require subsequent reconstruction when the long-term improvements are implemented.

The near-term median improvements are considered a high priority project due to the immediate safety needs that the improvements address. The estimated construction cost associated with providing the recommended improvements in 2004-dollars is approximately $13.4 million. No major environmental or right-of-way impacts are anticipated.

6.2.5 Near-Term Implementation Plan

Table 6-4 provides a summary of the near-term improvement program described in the previous sections. The improvement categories (i.e. speed-change lanes, median improvements, intersections, and interchanges) and the prioritized improvements under each category are listed in order of the recommended order of implementation. It is assumed that the implementation of the near-term improvement recommendations will be primarily dependent upon the priority assigned to each improvement. High priority improvements will be implemented first to address the most urgent safety and operational deficiencies identified in the study corridor. Implementation of medium and low priority improvements will follow accordingly. In addition, improvements that directly benefit mainline operations, and consequently the most users, will be implemented first and those benefiting interchange and secondary roadway operations will follow. On this basis, the acceleration and deceleration lane improvements are the recommended highest priority projects because the safe and efficient operation of ramp merge and diverge locations affects both mainline and ramp operations. These improvements in turn will benefit the highest volume of users.

Table 6-4
Summary of Near-Term Improvement Program

Improvement	Estimated Cost (2004 $)	Relative Impacts	Comments
Speed-Change Lanes			
High Priority	$1,790,000	Low	High accident locations or identified problem areas
Medium Priority	$2,690,000	Low	Operational deficiencies on mainline and at ramp junctions
Low Priority	$7,880,000	Low	No major operational/safety issues; Progress upon funding
Median Improvements			
Exits 70 to 75 – High Priority	$13,400,000	Low	No major impacts; Progress immediately
Intersections			
High Priority	$547,500	Low	High accident locations or identified problem areas
Low Priority	$1,092,500	Low	Deficient intersection capacities; Progress upon funding availability
Interchanges			
Exit 59 – High Priority	$2,010,000	Med	Minor right-of-way impacts; Minor wetland impacts
Exit 82 – High Priority	$4,800,000	High	Major right-of-way impacts; Minor wetland impacts
Exit 90 – High Priority	$450,000	Low	No major impacts; Progress immediately
Exits 92 / 93 – High Priority	TBD[1]	TBD[1]	Progress immediately to determine improvement requirements
Exit 81 – Low Priority	$6,500,000	High	Minor right-of-way impacts; Major wetland impacts

Subtotal – High Priority	$22,997,500
Subtotal – Medium Priority	$2,690,000
Subtotal – Low Priority	$15,472,500
Total Cost of Program	**$41,160,000**

1 TBD – To Be Determined. The construction costs and impacts associated with these improvements will be based upon the recommendations developed from the additional analysis that is required as described in Section 6.2.3.a.

Although ideally the implementation of the near-term improvement program will be dictated by the overall priority assigned to each project, it is likely that the actual implementation of the program will be influenced by funding availability, right-of-way requirements and environmental permitting requirements where applicable. To expedite the implementation process and minimize the affects of these other influences, it is recommended that the following occur upon completion of this study to initiate the near-term improvement program:

- Begin preliminary design of the highest priority improvements
- Begin securing funds for construction
- Initiate the environmental permitting process where permits will be required

By initiating the near-term improvement program immediately upon completion of this study, it is anticipated that construction of the more substantial improvements will begin by 2008. In addition, implementation of the lesser improvements – which include signal timing modifications and lane striping changes – can potentially begin immediately to improve conditions in the corridor. Figure 6-4 illustrates the near-term implementation plan and provides anticipated dates for design and construction broken down into three phases based on priority.

It should be noted that each location identified as a near-term improvement candidate has independent utility. As such, it will be possible to implement any number of improvements under a single construction contract (for example, the southbound acceleration lane improvements at Exit 74 or all speed-change lane improvements could be considered a single project). This factor may be critical if funding availability is limited as the design of these projects is completed.

6.3 Long-Term Improvement Program

In order to execute the implementation of the overall long-term improvement recommendations, it is necessary to divide the improvements into smaller, less complex projects that can be designed, permitted, funded and constructed within a reasonable time-frame. These smaller projects are then prioritized on the basis of identified need and implemented in a logical sequence of construction. The long-term improvement program presented in the following sections has been developed to divide and prioritize the full-build improvements and recommend a plan for the implementation of these improvements.

6.3.1 Prioritization Strategy

The study team evaluated the results of the mainline operation analyses for the 2002 existing condition (Chapter 2) and the 2025 no-build condition (Chapter 3) to identify the corridor sections that will have the most immediate need for capacity improvements as the traffic demand along I-95 increases to its anticipated 2025 levels. The study team then assigned priority to each of these sections based on the level of need established for each section.

The evaluation of the mainline operation analyses presented a clear indication that those mainline and interchange sections located in Area 2 of the I-95 corridor (the three main geographic areas of the corridor are defined in Section 5.3.3) will experience the most congested travel conditions in 2025 and therefore, are in most need of capacity improvements. This need is best defined by the average volume-to-capacity (V/C) ratio within Area 2, which is 1.14 in the design year. Those sections located in Area 1, which has an average V/C ratio of

0.86, and Area 3, which has an average V/C ratio of 0.75, will experience the second and third most congested travel conditions, respectively.

Based on the study team's evaluation of the mainline operations analyses, the recommended improvements have been prioritized such that those improvements within Area 2 are highest priority, those within Area 1 are next highest priority and those within Area 3 are lowest priority.

Having established the basic priority of the three major geographic areas of the project, the study team then grouped several series of mainline and interchange sections within each area. This was done to determine the limits for smaller-scale projects that can potentially be progressed as independent phases of the full-build improvement recommendation. For the purposes of this study, it is assumed that these *sub-projects* would be approximately 4 to 6 miles in length and cost less than $150 million (in 2004-dollars) to construct. The priority assigned to each of these projects is mainly dependent upon a logical sequence of construction that will minimize segmentation of the corridor as the projects are progressed. This sequence of construction is the basis for the long-term implementation plan presented in the following section.

6.3.2 Long-Term Implementation Plan

The long-term implementation plan presented in Table 6-5 and illustrated in Figure 6-5 was developed by the study team to provide a recommended sequence of construction for the long-term corridor improvement concepts. This plan considers the priority assigned to each section based on the future needs and deficiencies of the corridor, the sizes and estimated construction costs of assumed sub-projects, and the logical order of implementation of each sub-project that will minimize segmentation of the corridor. Segmentation can occur, for example, along a highway where a typical two-lane roadway section is interrupted by segments of roadway with three lanes. The merging of traffic at the points where lane reductions occur can cause a "bottleneck" effect in the traffic stream thus negatively affecting traffic operations and creating safety concerns within the corridor. The order of implementation of each sub-project within each section is described in detail below. The potential effect of permitting requirements on the recommended implementation plan is discussed in Section 6.4.3.

Area 2 – Highest Priority

Area 2 is geographically defined within the study area as the section of I-95 located between the Connecticut River just south of Exit 70 in Old Lyme and the Thames River near Exit 84 in New London. The recommended order of implementation of the sub-projects within Area 2 is:

1. Exit 71 to Exit 74 (terminating at the southern limit of the Route 11 project)
2. Exit 70 to Exit 71 (excluding Exit 71)
3. Exit 81 to Exit 83 (beginning at the northern limit of the Route 11 project)

The study team identified the sub-project that incorporates the improvement concepts at Exit 71 and Exit 72 as the highest priority project within Area 2. This designation is based on the severity of the existing mainline weaving conditions between the interchanges. Because no near-term recommendations are appropriate in this area to alleviate the operational and safety issues associated with the weaving conditions, it is recommended that these issues be addressed as part of the first long-term improvements to be constructed in the study area. These improvements will terminate at the southern limit of the Route 11 project and match the three-lane sections proposed under that project.

In order to eliminate the segmentation created by the transition from the existing three-lane sections near Exit 70 to the existing two-lane sections and back to the proposed three-lane sections at Exit 71, it is recommended that the section between Exit 70 and Exit 71 be completed as the next highest priority project. Similarly, to eliminate the two-lane sections located between the northern limit of the Route 11 project near Exit 81 and the three-lane sections near Exit 83, it is recommended that this section be completed last, but prior to the implementation of the Area 1 improvements. It is anticipated that the recommended near-term improvements in this area will alleviate the most urgent safety and operational issues until the long-term recommendations are implemented.

Area 1 – Medium Priority

Area 1 is geographically defined within the study area as the section of I-95 located between the southern project limit at Exit 54 in Branford and the Connecticut River just north of Exit 69 in Old Saybrook. The recommended order of implementation of the sub-projects within Area 1 is:

1. Exit 54 to Exit 57 (beginning at the northern limit of the New Haven Harbor Crossing Corridor Improvements, Contract D, and excluding Exit 57)
2. Exit 57 to Exit 60 (excluding Exit 60)
3. Exit 60 to Exit 63 (excluding Exit 63)
4. Exit 63 to Exit 65 (including Exit 65)
5. Exit 65 to Exit 69

The study team identified the sub-project that matches into ConnDOT's current New Haven Harbor Crossing Corridor Improvements, Contract D, as the highest priority project within Area 1. Contract D, which is scheduled for completion in 2005, will provide three-lane sections that terminate at the northbound off-ramp and southbound on-ramp at Exit 54 in Branford. In order to avoid further segmentation of the corridor between Exit 54 and Area 2, it is recommended that the sub-project between Exit 54 and Exit 57 be constructed first. The remaining sub-projects will be implemented from south to north through Area 1 of the I-95 corridor. Upon completion of the section located between Exit 65 and Exit 69, the study corridor will consist of three-lane sections between Exit 54 and Exit 88.

Area 3 – Lowest Priority

Area 3 is geographically defined within the study area as the section of I-95 located between the Thames River just south of Exit 85 and the northern project limit at the Rhode Island state line. The recommended order of implementation of the sub-projects within Area 3 is:

1. Exit 89 to Exit 91 (excluding Exit 91)
2. Exit 91 to Exit 92
3. Exit 85 to Exit 89 (excluding Exit 89)

The study team identified the sub-project that matches into the existing three-lane section just south of Exit 89 as the highest priority project within Area 3. It is recommended that the construction of the three-lane sections be completed to Exit 92 prior to the completion of the sub-project located between Exit 85 and Exit 89. This project provides the recommended 14 foot wide inside and outside shoulders in conjunction with the reconstruction of the existing three-lane sections in this area. Because this sub-project is not a capacity improvement project, it is recommended that it be constructed last in the study corridor.

Table 6-5
Long-Term Implementation Plan

	Sub-Project	MM	to	MM	Length (mi)	Estimated Cost (2004 $)	Anticipated Year of Expenditure	Annual Inflation Rate	Adjusted Cost	Priority	Comments
Area 2 - Connecticut River to Thames River											
1	Exit 71 to Exit 74	82.86	-	87.42	4.56	$115,500,000	2010 ~ 2012	2.75%	$143,500,000	High	Highest priority, initiate first
2	Exit 70 to Exit 71	78.93	-	82.86	3.93	$83,200,000	2012 ~ 2014	2.75%	$106,200,000	High	Excludes Exit 71
3	Exit 81 to Exit 83	89.68	-	93.47	3.79	$108,000,000	2012 ~ 2014	2.75%	$141,700,000	High	
Area 1 - Branford to Connecticut River											
4	Exit 54 to Exit 57	53.17	-	59.00	5.83	$123,700,000	2014 ~ 2016	2.75%	$166,800,000	Med	Excludes Exit 57
5	Exit 57 to Exit 60	59.00	-	62.52	3.52	$103,900,000	2014 ~ 2016	2.75%	$143,800,000	Med	Excludes Exit 60
6	Exit 60 to Exit 63	62.52	-	68.08	5.56	$114,100,000	2016 ~ 2018	2.75%	$162,300,000	Med	Excludes Exit 63
7	Exit 63 to Exit 65	68.08	-	73.44	5.36	$119,800,000	2016 ~ 2018	2.75%	$175,200,000	Med	Includes Exit 65
8	Exit 65 to Exit 69	73.44	-	78.44	5.00	$111,700,000	2018 ~ 2020	2.75%	$167,800,000	Med	
Area 3 - Thames River to Rhode Island											
9	Exit 89 to Exit 91	99.78	-	103.91	4.13	$98,700,000	2018 ~ 2020	2.75%	$152,400,000	Low	Excludes Exit 91
10	Exit 91 to Exit 92	103.91	-	107.70	3.79	$47,800,000	2020 ~ 2022	2.75%	$75,800,000	Low	
11	Exit 85 to Exit 89	94.70	-	99.78	4.98	$76,400,000	2020 ~ 2022	2.75%	$124,500,000	Low	Excludes Exit 89; Lowest Priority
Total Cost of Improvement Program (Including $10 million for utility relocations)									**$1,570,000,000**		

6.4 Environmental Considerations/Permitting Strategy

To provide an overview of the anticipated environmental documentation and permitting needs, this section describes the regulatory framework, lists relevant guidance documents specific to Federal-Aid highway construction in Connecticut, and provides a complete list of permits that may be required to implement the project elements based on the feasibility study-level environmental analysis conducted to date.

6.4.1 Regulatory Framework

The 58-mile Feasibility Study corridor has been broken into 50 discrete sections, including 29 interchange sections and 21 mainline sections. Implementation of the long-term improvement concepts described in Chapters 5 and 6, and the near-term improvement program described in Chapter 6, would be subject to State and Federal environmental regulations. The overarching environmental policy is the National Environmental Policy Act (NEPA) of 1969 (42 U.S.C. 4321) and the corresponding State policy, Connecticut Environmental Policy Act (CEPA). The nature of the improvements and the associated potential environmental impacts will determine the extent of NEPA/CEPA environmental documentation required. NEPA allows three types of environmental documents to be used depending on the potential impacts of the project.

A. *Categorical Exclusion* (CE) checklists are used where anticipated project impacts are clearly minor, such as landscaping or construction of a bus passenger shelter.
B. *Environmental Assessments* (EAs) are prepared for projects that do not qualify for a CE but do not clearly rise to the level of requiring an Environmental Impact Statement. Environmental Assessments typically result in a Finding of No Significant Impact (FONSI) but occasionally may prompt an EIS.
C. An *Environmental Impact Statement* (EIS) is required for projects with the potential for significant environmental impacts.

Impacts associated with the various I-95 improvements would vary in the type of NEPA/CEPA document required. For example, a simple lane addition that does not extend beyond the existing right-of-way and that does not impact any wetlands may be adequately addressed by a Categorical Exclusion (CE), while a ramp reconfiguration that impacts homes and tidal wetlands may require an EA/FONSI or EIS.

In terms of the environmental process as would be applied to the I-95 corridor improvements, it is anticipated that fiscal constraints will necessitate prioritization of corridor improvements that would extend over many years. Each individual sub-project as described in Sections 6.2 and 6.3 would be documented and permitted separately. The environmental documentation would reference and build on the current feasibility study, and could begin prior to or coincident with preliminary design. Site specific data collection and impact analysis would be conducted in support of the individual environmental documents and permits (e.g., soil sampling to determine spoils management requirements, and flagging and surveying wetlands to accurately quantify impacts) The associated coordination with the regulatory agencies would set the stage for the permit process, which would be completed later in design. Any public informational and public participation requirements would be assessed early in the NEPA/CEPA study, based on potential impacts, public interest, and in accordance with ConnDOT's *A Guide for Public Outreach* (November 1995) which describes recommended practices for public and municipal coordination and outreach.

Implementation of this project will require several permits, certifications, and technical reviews, at various Federal and State levels of jurisdiction. The following Federal environmental statutes and Executive Orders must be considered relative to the improvements:

A. National Environmental Policy Act (NEPA) of 1969, (42 U.S.C. 4321) (At the State level, the Connecticut Environmental Policy Act (CEPA) is the functional equivalent of the Federal NEPA, and largely mirrors the process.)
B. Department of Transportation Act of 1966, Section 4(f) (49 U.S.C. 303)
C. Coastal Zone Management Act (CZM) of 1972 (16 U.S.C. 1451)
D. Protection of Wetlands (E.O. 11990)
E. Floodplain Management and Protection (E.O. 11988)
F. Endangered Species Act of 1973 (16 U.S.C. 1531)
G. Fish and Wildlife Coordination Act of 1956 (16 U.S.C. 661)
H. Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. 1855)
I. Clean Water Act of 1977 (33 U.S.C. 1251)
J. National Historic Preservation Act of 1966, Section 106 (16 U.S.C. 470)
K. Protection and Enhancement of the Cultural Environment (E.O. 11593)
L. Farmlands Protection Policy Act of 1981 (7 U.S.C. 4201)
M. Clean Air Act Amendments of 1990 (42 U.S.C. 7401)
N. Noise Control Act of 1972 (42 U.S.C. 4331)
O. Uniform Relocation Assistance and Real Property Acquisitions Act of 1970 (42 U.S.C. 4601)
P. Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations (E.O. 12898)
Q. Native American Graves Protection and Repatriation Act of 1990 (23 U.S.C. 3001)

The lead Federal agency funding the implementation of the improvements would be the Federal Highway Administration (FHWA). FHWA's Connecticut Division Operations Plan (September 30, 1997) lists the following Regulations and Guides as 'the primary resources that regulate and guide the NEPA process in the FHWA Connecticut Division Office' (excluding NEPA and the Executive Orders listed above):

A. Preservation of the Nation's Wetlands issued August 24, 1978 (DOT Order 5660.1A)
B. Floodplain Management and Protection (DOT Order 5650.2)
C. FHWA Mission Statement
D. FHWA Environmental Policy Statement (1994)
E. Environmental Impact and Related Procedures (23 CFR 771)
F. Procedures for Abatement of Highway Traffic Noise and Construction Noise (23 CFR 772)
G. Mitigation of Environmental Impacts to Privately Owned Wetlands (23 CFR 777)
H. FHWA Environmental Guidebook
I. Guidance for Preparing and Processing Environmental and 4(f) Documents, dated October 30, 1987 (Technical Advisory (TA) 6640.8A)
J. Connecticut Programmatic Categorical Exclusion Agreement
K. Connecticut Programmatic Wetland Finding

One of FHWA's duties is oversight and approval of any access modification to the interstate system. FHWA's review of proposed improvements must be coordinated with the overall NEPA review.

6.4.2 Potential Environmental Permits/Compliance Requirements

Compliance with most of the regulations and guidelines listed above would be achieved during the NEPA/CEPA process. Generally following but overlapping the NEPA process is the permit process, which would result in the following specific permits, as applicable for each individual project. (A description of the resource-related permits [Air, Wetlands, Farmland, etc.] is provided in the applicable sections of Chapter 4.)

A. Section 404 Wetland Permit, for the discharge of all dredged or fill materials into waters of the U.S. (Administered by U.S. Army Corps of Engineers, with veto authority retained by US EPA)
B. Section 10 of the Rivers and Harbors Act of 1899 (for construction of any structure in, on, or over navigable waters, excavating or depositing material into those waters, or any other work affecting the course, location, or capacity of such waters) (administered by USACOE)
C. U.S. Coast Guard Bridge Permit (General Bridge Act of 1946) (administered by USCG)
D. Clean Air Act Conformity Determination (determined by FHWA)
E. Hazardous Materials Regulations (administered by EPA under the Resource Conservation and Recovery Act (RCRA) and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA))
F. Magnuson-Stevens Fishery Conservation and Management Act (FHWA to determine compliance based on consultation with National Marine Fisheries Service)
G. Section 106 Coordination/ Historic Preservation Memorandum of Agreement (coordination with the State/Tribal Historic Preservation Office)
H. Section 4(f) Determination (determined by FHWA)
I. Coastal Management Consistency Concurrence (including Coastal Flood Hazard Area impact considerations) (Determined by CTDEP)
J. Water Quality Certification under Section 401 of the Federal Clean Water Act (granted by CTDEP)
K. Connecticut Inland Wetlands and Watercourses and/or Tidal Wetlands Permits or General Permit for Water Resources Construction Activities (granted by CTDEP)
L. Air Quality Indirect Source Permit (any new interchange service, or any new highway on a new location, or any new lane, greater than a mile in length and connecting either signalized intersections or expressway interchanges will require a permit from CTDEP)

6.4.3 Schedule and Cost Implications

The I-95 corridor improvements would be implemented with consideration given to transportation and safety needs, logical sequencing of construction (as discussed in Section 6.3), the complexity of the environmental documents needed, and the monetary and environmental (both natural and social) costs. Highly necessary improvements that would yield large transportation benefits and require minimal environmental documentation requirements (a CE and programmatic-type permits) and minimal expense would likely be implemented first. Improvements that would yield similarly large transportation benefits but with more complex documentation needs and greater costs might be somewhat lower priority, while elements yielding only moderate benefits and requiring extensive NEPA documents and individual permits, at relatively large costs might be assigned lowest priority.

Wetland impact permits are granted at both the State and Federal levels, and typically have considerable impact on project cost and schedule. In addition to the design and construction costs associated with avoiding and minimizing wetland impacts (lengthening structures, providing retaining walls, etc.) and providing compensation for unavoidable wetland losses, there may be lengthy processing times. The approximate processing time for a Tidal and/or Inland Wetland Permit from CTDEP oftentimes is greater than a year. Depending on impact thresholds, these permits can be in the form of Programmatic General Permits or Individual Permits. For example, in order to qualify for coverage under the Corps' GP-41 Programmatic General Permit (for Connecticut), a project must have wetland impacts under one acre, and have no permanent fill in tidal wetlands, among other considerations. If the proposed impacts are less than 5,000 square feet, the project may qualify under Category 1 (Non-reporting/minimal impacts).

Hazardous Materials regulations can also result in substantial cost increases where special materials disposal methods are necessary. During the permitting and design phase, testing would reveal any 'Areas of Environmental Concern' (AOEC) that might require special handling.

6.5 Other Considerations

In addition to such factors as project priority, size, cost, and environmental permitting requirements which can affect the implementation of the long-term improvement concepts, the study team has identified several other notable issues that should be considered early in the planning and design stages that could influence the overall implementation plan. These other considerations are described in detail below:

- **Construction Sequencing** – Each individual sub-project identified in the long-term implementation plan will be constructed over multiple construction seasons due to their size and complexity. In addition, each sub-project involves full-depth reconstruction of the mainline, replacement of bridge structures, and interchange and intersection improvements which will affect the travel patterns of thousands of motorists during construction. For these reasons, careful consideration to the sequencing of construction of each sub-project will be required to maintain mobility through the corridor and ensure the safety of the traveling public while facilitating efficient construction of these projects. The overall sequencing will involve both the sequencing issues associated with multiple phases of individual sub-projects and the sequencing of adjacent sub-projects in the corridor. Some of the more important aspects to consider include the maintenance of interchange access, the effects of changing roadway profiles to provide standard vertical clearances for bridge structures, and temporary erosion and sedimentation control.
- **Disposal of Contaminated Materials –** The median areas and areas adjacent to the outside edge of pavement are potentially contaminated with lead from the exhaust of vehicles passing through the corridor. Although this contamination is typically very low level, groundwater standards in certain towns dictate the potential for on-site use or disposal of this material. Because it is typically expensive to ship this material off-site and pay for replacement material in towns where it is not acceptable to utilize this material, consideration should be given to beneficial on-site uses elsewhere in the corridor, preferably within the limits of project under consideration.
- **Waste/Borrow Transfer Sites –** Although many of the sub-projects identified in the long-term implementation plan are “waste” projects – meaning that an excess of excavated material generated during construction will need to be wasted or disposed of – there are several projects that will require fill material for construction. Where feasible and logical considering the overall implementation plan, these “borrow”

projects should be constructed last. By constructing these areas last, it will be possible to locate and permit certain sites on these projects where waste material for other projects can be stored and used for fill in the future. The utilization of these waste/borrow transfer sites can provide substantial cost savings on these projects since borrow material would be available on-site and would not need to be purchased from another location.

7
Products of Public Participation

The public participation component of this study was a cornerstone of the overall study process. Public involvement was initiated during the study's early stages with the formation of the Advisory Committee and was encouraged throughout the study through various outreach initiatives. The continuous involvement of the Advisory Committee, local municipalities and the general public, among others, provided the study team with intimate knowledge of the I-95 corridor, and helped identify specific deficiencies and develop solutions to address these deficiencies. In this capacity, public participation played an integral role in the development of the final corridor recommendations.

7.1 Outreach Program

The public outreach program developed for this study can essentially be divided into two components. One component of the program consisted of outreach to key transportation stakeholders in the southeast Connecticut region. The other component consisted of outreach to the general public. Input was solicited from both constituents at critical project milestones in the form of meetings, and throughout the study by way of the project website and toll-free hotline.

7.1.1 Key Stakeholders

A *stakeholder* in the region was defined for the purposes of this study as a representative from a municipality, government agency, business or other group with interest in the I-95 southeast corridor. The Advisory Committee (AC), which was established during the initial stages of the project and guided the study process, consisted of 30 such *stakeholders*.

Outreach to the key stakeholders was carried out in six AC meetings and 34 formal local outreach meetings. AC meetings were used as a forum for AC members to review and provide comments on technical documents and recommendations presented by the study team at critical decision points during the process. Local outreach meetings were used to solicit specific information from local municipalities and other key entities in the study area regarding existing deficiencies, current and future development plans and other critical issues along the I-95 corridor.

Several of the AC and local outreach meetings provided a hands-on opportunity for attendees to explore and develop potential improvement concepts together while arriving at a consensus for the most effective solution to an identified transportation-related problem. In addition, stakeholders at these meetings were encouraged to voice their opinions about which direction the study should take and about what issues should be emphasized. Such participation resulted in the comprehensive *Transit Service Enhancements Analysis* and the *Managed-Lane Feasibility Analysis* that are discussed in Chapter 5.

7.1.2 General Public

The daily lives and travel patterns of so many people who live in the southeast Connecticut region are affected by the operations of the I-95 corridor. For this reason, it was critical for the study team to develop a means of on-going communication with the general public so that the findings and recommendations of this study could be reviewed by the people who are most affected. Outreach to the general public was established and carried out in several capacities in an effort to maximize the availability of study information and provide an opportunity for people to share their insight and freely express their opinions on the subject.

A project website (http://www.i95southeastct.org) was established early in the study to serve as the primary means of communication between the study team and the general public. Content on the website was periodically updated throughout the study to provide current project information including schedules, meeting minutes, and report text and graphics. The website made it possible for the public to submit comments directly to the study team at any time. A toll-free hotline (800-236-0794) was also established allowing the public to conveniently obtain study information and provide comments. Calls were received throughout the course of the study giving callers an opportunity to communicate their concerns directly to key project personnel.

In addition to providing report information on the project website, report text and graphics were published in the corridor libraries at two critical milestones in the development of the study recommendations. The first publication introduced the existing and future transportation and environmental conditions analysis. The second, which was published in both the corridor libraries and town halls, made the *Draft Final Report* available for public review and comment prior to the finalization of the improvement recommendations.

Public information meetings were another important source of project information for the general public. In total, two rounds of meetings consisting of three meetings each were conducted to coincide with the completion of both the existing and future conditions analysis and the *Draft Final Report.* One public information meeting was conducted in each of the three geographic areas (the three main geographic areas of the corridor are defined in Section 5.3.3) during each round. These meetings were informal open-house meetings where the study team presented the preliminary findings and corridor recommendations and then solicited input from the public for consideration in the development of the final recommendations. The public was encouraged to discuss their concerns one-on-one with members of the study team as well as provide written comments on postage-paid comment forms available at these meetings.

The public information meetings were publicized extensively and well in advance to provide early notice to the public and encourage attendance. The first round of meetings was advertised in two major daily newspapers as well as locally on flyers posted at the corridor town halls. In response to mediocre attendance at the first round of meetings, publicity for the second round of meetings followed a much more aggressive advertising campaign. The meetings were advertised in 11 weekly shoreline papers in addition to two major daily newspapers. A Department of Transportation press release and direct contact with several reporters led to wide media coverage of the publication of the *Draft Final Report* and the subsequent public information meetings. A public access television program was also taped and aired along the corridor to publicize the meetings.

7.2 Sources of Feedback

As discussed briefly in the previous section, several readily-accessible means of contacting the study team and providing feedback were available to the general public. The majority of feedback was received during open discussion and one-on-one conversations with concerned citizens during public information meetings. The study team noted numerous concerns and suggestions during these discussions that ultimately influenced the final improvement recommendations.

In addition, dozens of comment forms made available at the public information meetings were returned to the study team. Each comment was reviewed and incorporated into the final recommendations where appropriate. Several letters and phone calls, as well as numerous website comments were also received and given consideration in the development of the study recommendations. Written comments received by the study team are included in the appendix of this report.

7.3 Public Recommendations and Concerns

The final improvement recommendations that were presented in Chapters 5 and 6 of this report are indicative of the success of the extensive public outreach program employed throughout the study. In working with key stakeholders and listening to feedback from the general public, the study team was able to incorporate numerous recommendations that were direct products of the public outreach program. Some of these recommendations, which range from basic signing improvements to complete interchange improvements, are highlighted below.

7.3.1 Long-Term Improvement Recommendations

Several key recommendations of the long-term improvement program presented in Section 5.4 of this report were products of the public participation process. The following examples illustrate the role that public involvement played in the development of these recommendations:

- **Exit 60, Madison** – This is an existing half-diamond interchange consisting of a northbound on-ramp and southbound off-ramp that provide partial access to Mungertown Road. The original long-term improvement concept at this location was limited to providing standard acceleration and deceleration lanes at the existing ramps. However, at the request of Guilford town officials, a series of local outreach meetings was scheduled with Madison town officials to discuss additional improvements at this interchange aimed at relieving congestion at Exit 59 in Guilford. The final recommendation at Exit 60,

which completes the existing interchange by providing a northbound off-ramp and southbound on-ramp at Wildwood Avenue, was developed in these meetings.

- **Exit 63, Clinton** – Numerous concepts were developed at this location to both eliminate the successive double left turning movements from the northbound off-ramp and improve traffic operations along Route 81. One recommendation, which caused minimal property impacts and required provisions for a cul-de-sac at the north end of North High Street, relocated the northbound off-ramp to directly intersect Route 81 opposite the northbound on-ramp. It was noted in a local outreach meeting with town officials that North High Street provides a critical bypass for local traffic around the heavily congested US Route 1 and Route 81 intersection. A cul-de-sac would consequently divert a significant volume of traffic through this intersection exacerbating the existing congestion. As a result of discussions at this meeting, the concept was abandoned in favor of the recommended improvement concept that maintains the North High Street connection to Route 81.

- **Exit 67, Old Saybrook** – This is an existing split interchange consisting of a northbound on-ramp and southbound off-ramp at Elm Street, and a northbound off-ramp and two southbound on-ramps at Route 154. The original improvement concept reconfigured the interchange at Route 154 to provide full access and maintained the existing ramp configuration at Elm Street. Based on a request from a town selectman, the study team developed a concept that provides a full-service interchange at Elm Street. The final recommendation provides a southbound on-ramp from Elm Street and a northbound off-ramp to Ingham Hill Road in addition to the existing ramps.

- **Exit 69, Old Saybrook** – The existing ramps to and from Route 9 at this interchange provide relatively low speed, indirect connections to I-95 hampering traffic flow and affecting operations within the interchange. To address these issues, the study team developed a concept to reconfigure the ramps and provide a high-speed, freeway-to-freeway interchange. However, this concept was subsequently rejected by town officials due to noise and aesthetic concerns associated with the recommended improvements.

- **Exits 71 and 72, Old Lyme/East Lyme** – The close proximity of these two interchanges is a safety concern in the I-95 corridor. Originally, the study team considered the closure of Exit 71 at Four Mile River Road to effectively eliminate these safety concerns. Subsequent local outreach meetings with the towns of Old Lyme and East Lyme revealed that this closure would be infeasible considering the restrictions it would impose on local emergency access and local truck access to an industrial development in this area. As a result, the final recommendation incorporates a reconfiguration of the two interchanges that both eliminates the major safety concerns and maintains full access at these locations.

- **Exit 73, East Lyme** – The initial recommendation called for the closure of this interchange in conjunction with the implementation of the long-term improvements. However, town officials rejected this recommendation indicating that, although this is one of the lowest volume interchanges in the I-95 corridor, it is vital to the future development plans of the town. As a result, the final recommendation maintains full access to Society Road despite site constraints that required the relocation of the northbound off-ramp.

- **Exits 81-82A, Waterford/New London** – Several local outreach meetings were conducted with officials from the Town of Waterford and the City of New London to gain a consensus for the final improvement recommendation in this area. The original concept developed by the study team, which focused on extending the existing frontage road system south (west) to meet Parkway North and South, evolved into a concept that all parties agreed would both provide the needed transportation-related improvements and maintain consistency with future development plans in Waterford and New London. As an example of this evolution, the notion of extending the south frontage road to Parkway South was abandoned in favor

of maintaining the existing Parkway South facility. This was done to accommodate the request of Waterford officials to avoid impacting an area marked for development.

7.3.2 Near-Term Improvement Recommendations

Several key recommendations of the near-term improvement program presented in Section 6.2 of this report were also products of the public participation process. The following examples illustrate the role that public involvement played in the development of these recommendations:

- **Exit 64, Westbrook** – In response to a one-on-one discussion with a citizen during a public information meeting, the near-term intersection improvement recommendation to signalize the ramp intersections with Route 145 was changed from a low priority to a high priority designation. The citizen identified a sightline restriction for traffic entering Route 145 that creates a safety concern at these intersections.
- **Exit 74, East Lyme** – The existing southbound on-ramp acceleration lane is deficient by approximately 1245 feet and was initially categorized a low priority improvement recommendation. However, during a local outreach meeting, East Lyme officials noted that existing operating conditions experienced at this location warrant immediate attention to improve both operations and safety. As a result, the near-term acceleration lane improvement recommendation was changed from a low priority to a high priority designation.
- **Exit 82, Waterford** – Although the recommended improvements at this interchange do not generally meet the criteria established by the study team for near-term improvement project candidates, the recommendations are included in the near-term improvement program as a result of public involvement. The immediate need to improve operations at the intersection of the northbound ramps and Route 85 by relocating the northbound ramps was identified during an AC meeting. Consequently, and despite the right-of-way and environmental impacts associated with the improvements, the near-term recommendation is designated a high priority. In addition, the study recommends a review of the existing signing in this area in response to concerns expressed by a citizen at a public information meeting that poor signing could be contributing to the existing intersection deficiencies.
- **Exit 89, Groton –** At a public information meeting held in May 2003, a concerned citizen requested the erection of a yield sign on the northbound on-ramp to replace a sign that had previously been damaged and removed. ConnDOT maintenance forces responded promptly to the request and implemented the first near-term improvement resulting from this study.
- **Exit 90, Stonington** – The existing southbound on-ramp acceleration lane is deficient by approximately 570 feet and was initially categorized a low priority improvement recommendation. However, during a local outreach meeting, Stonington officials noted that existing operating conditions experienced at this location warrant immediate attention to improve both operations and safety. As a result, the near-term acceleration lane improvement recommendation was changed from a low priority to a high priority designation.
- **Exits 92-93, North Stonington** – A review of the existing guide signage at these interchanges was included as a near-term recommendation based on feedback received from a concerned citizen at a public information meeting held in September 2004. This citizen noted that signing for southbound traffic from Rhode Island does not effectively direct traffic destined for Foxwoods Casino south along I-95 to Exit 92.

7.3.3 Common Concerns

As illustrated in the previous sections, many of the comments the study team received throughout the public participation process influenced the development of the near and long-term recommendations of this study. An additional number of comments also highlighted several common concerns among the general public that deserve particular attention and further clarification. A summary of these common concerns with additional explanation is provided below:

- **Exit 75 Northbound On-Ramp** – Geometric deficiencies in this area are creating an existing safety concern as indicated by a number of concerned citizens. In particular, the northbound on-ramp from US Route 1 is closely followed by a left exit to I-395. The short distance between these ramps requires motorists destined for I-395 who enter I-95 on the right from US Route 1 to immediately cross two lanes of northbound traffic to exit on the left to I-395. The abruptness of this weaving maneuver adversely affects through-traffic operations and creates a safety concern for the traveling public.

  Because this weave is eliminated under the planned Route 11 project, which for the purposes of this study is assumed to be in place prior to the implementation of the long-term improvement program, no long-term improvement recommendations were developed to address these identified deficiencies. However, in response to public comments, the study team assessed the near-term feasibility of closing the Exit 75 ramps to improve conditions along I-95 in this area.

  It is anticipated that under existing traffic conditions, closure of the Exit 75 northbound on-ramp from US Route 1 would redistribute approximately 350 vehicles to Exit 74 at Route 161 in the design hour. Another 50 vehicles would be redistributed to the Exit 80 northbound on-ramp from Gurley Road. The redistribution of 350 vehicles to the northbound on-ramp at Exit 74 would result in approximately 430 vehicles making a southbound left turn from Route 161 to the northbound on-ramp in the design hour.

  A signalized double left-turn lane would be required at this location to accommodate this increased traffic volume. Currently, Route 161 in the vicinity of Exit 74 consists of two northbound and two southbound travel lanes. The addition of two southbound turn lanes would require widening of Route 161 beneath the existing I-95 overpass. In order to provide sufficient lateral clearance for the widened roadway, this overpass would need to be lengthened a minimum of 22 feet. Because reconstruction of the existing structure would be necessary, this alternative does not meet the criteria for a near-term improvement project.

  Although closure of the Exit 75 northbound on-ramp is not a feasible option in the near-term, the geometric deficiencies and resulting operational and safety concerns at this location will be eliminated under the planned Route 11 project.

- **Noise Abatement** – The noise evaluation of the future build condition performed as part of this study was limited to identifying potential noise-sensitive areas. These areas are shown in Figure 5-2 (Sheets 1 to 124) and are generally defined as residential dwellings located within 300 feet of the widened roadway. During the preliminary design stages of the long-term improvement projects, Federal and State environmental documentation requirements under NEPA and CEPA will require the completion of a detailed noise analysis in any area identified as potentially noise-sensitive. This noise analysis will determine which areas meet the criteria for noise abatement measures to mitigate the potential noise level increases associated with the improvements. Several factors are considered in this determination

including proximity of a receptor to the highway, noise levels at the receptor, potential noise reduction at the receptor, and cost effectiveness of a barrier system.

- **Truck Traffic** – Upon implementation of the third travel lane, truck and bus traffic will generally be prohibited from utilizing the left lane. This will provide a consistent opportunity for passenger cars to pass heavy vehicles and will help alleviate the effects of variable truck speeds on traffic operations in rolling terrain and throughout the corridor.

- **Toll Collection** – Current Federal legislation does not permit states to collect tolls along interstate highways that are maintained with Federal funds. Therefore, the use of tolls to either fund potential improvements or help reduce traffic demand on I-95 is not a feasible alternative at this time without forfeiting Federal aid. It is possible that with the reauthorization of TEA-21, which at the time of this publication is pending approval in Congress, the restriction on interstate toll collection will be lifted. At such time, toll collection on I-95 could be a legitimate consideration for State officials.

- **Transit Enhancements** – ConnDOT is continually undertaking various transit initiatives to enhance and improve transit services in southeastern Connecticut and throughout the State. Recently, Amtrak introduced high-speed *ACELA Express* passenger rail service between Boston and Washington, D.C and the level of Amtrak inter-city train service in Connecticut has been increased by over 30%. In addition, Shore Line East (SLE) commuter rail service, Commuter Connection and Paratransit bus systems, and Rideshare opportunities represent a significant State transit funding investment and form a vital part of the regional transportation system. The State's transit funding for SLE alone represents approximately $6 million in operating subsidy per year, plus capital expenditures. In addition, a recent investment of $600,000 created 200 additional parking spaces at the Old Saybrook, Madison and Branford SLE stations.

  Currently, more than $30 million in transit improvements are programmed or planned for implementation in the southeast corridor. These projects include constructing 500 new parking spaces for SLE by 2006, as well as upgrading stations with high-level platforms. The Transportation Strategy Board (TSB) is also considering several new candidate transit projects in the southeast corridor that could include the purchase of additional rail cars for Shore Line East and buses for the Norwich-New London area. In addition, the TSB is sponsoring the Southeastern Connecticut Council of Government's (SCCOG) Intermodal Connections Study. The SCCOG study will seek to define the transit needs and opportunities for system revisions to guide regional and local transit development.

- **Wetland Mitigation** – The impacts to existing wetlands associated with the near and long-term improvement recommendations will total approximately 67 acres. In order to obtain wetland permits through the environmental regulatory agencies, the State will be required to mitigate these impacts by creating wetland areas to replace those lost during construction.

- **Schedule** – The long-term improvement plan presented in Chapter 6 reflects the relative amount of time required to complete the necessary steps leading up to the construction of the improvement recommendations, given the availability of adequate funds. These steps include environmental documentation, technical design, and environmental permitting. Considering the magnitude and complexity of the long-term improvement recommendations, it is unlikely that any long-term projects will be scheduled for completion before 2012.

- **Obsolete Improvements** – For the purposes of this study, improvement recommendations were developed to meet year 2025 traffic demands. The selection of this design year was based on federal design guidelines that recommend the design year for a project be set 20 years beyond the estimated time

of completion (ETC) of the project. With the anticipated ETC for this study being 2005, the design year was set at 2025. As individual long-term improvement projects move into preliminary design phases, the design year of each project will be updated to reflect the anticipated ETC of that project. The improvement recommendations will be revised accordingly to meet the projected traffic demands of the updated design year. This will ensure that these improvements will not become obsolete soon after construction.

7.4 Continued Involvement

Although this study specifically detailed the needs, impacts and costs associated with the implementation of both the near-term and long-term improvement recommendations, it is important to emphasize to the public the overall intent of this study. The final study report is intended to serve as a "road map" from which State and local officials and Department of Transportation personnel can make informed decisions regarding the future prioritization and programming of transportation improvements in the I-95 southeast corridor. It is not intended to be a set of construction plans from which to begin building improvements.

As such, there will be many opportunities for continued public involvement as the study recommendations progress into the preliminary and final stages of implementation. Public hearings and public information meetings will accompany the environmental permitting and technical design phases of all projects that result from the proposed recommendations. Much like the public outreach program was a cornerstone of this study and was instrumental in defining the I-95 southeast corridor improvement recommendations, it is anticipated that active public participation will play an instrumental role in the successful completion of these future projects.