1

Introduction

The Connecticut Department of Transportation (CTDOT), the Valley Council of Governments (VCOG), and Council of Governments of Central Naugatuck Valley (COGCNV) completed this study to evaluate deficiencies and define transportation improvement needs along the Route 8 corridor from Seymour to Waterbury just south of I-84 (Interchanges 22 to 30). The corridor for this Deficiencies/Needs Study spans the communities of Seymour, Beacon Falls, Naugatuck, and Waterbury.

This report documents the findings of this study including the existing conditions assessment; future conditions analyses (projected to the year 2030) with no substantive transportation modifications; the improvement alternatives considered; and the final recommendations and plan of action for the Route 8 study corridor. The recommended plan identifies transportation improvements that may be accomplished in the near term (1-5 years), medium term (5-10 years) as well as those that may require a longer time frame (greater than 10 years).

1.1 Study Goals and Objectives

Key underlying issues and objectives of the Route 8 Deficiencies/Needs Study include the following:

- **Preserve the capacity of Route 8.** The improvement alternatives identified for the Route 8 interchanges must 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**. The study examined opportunities to improve safety conditions within the interchanges and to eliminate and/or consolidate traffic movements through them while maintaining access to the local communities and major attractions.
- **Enhance arterial street system operations.** The tight geometry of the interchanges and proximity of adjacent intersections constrain operations and potentially affect safety along both the arterial street system and Route 8. This study considered options to enhance arterial street system operations, including modifications in

circulation or traffic control at upstream and downstream signalized intersections, and elimination of some ramp movements.

- **Provide for future growth.** The Route 8 system is tremendously important to provide access to existing and developing land uses. Future improvements need to keep open the options for development and accommodate growth in traffic flows, both regionally and locally.

1.2 Study Area

The study area for this study extends along the Route 8 corridor approximately 11 miles from Seymour to Waterbury, just south of I-84. It includes the communities of Seymour, Beacon Falls, Naugatuck, and Waterbury, as depicted in Figure 1-1. There are 9 interchanges within the study area (Exits 22 through 30), which provide access to both local and major regional roadway corridors.

Regionally, Route 8 is a critical north-south corridor traversing as an expressway from I-95 in Bridgeport through Waterbury and Torrington, to CT-44 in Winsted, Connecticut where the road transitions to a two lane principal arterial. The two lane principal arterial portion of Route 8 continues northward through southern Massachusetts to Route 2 in North Adams Massachusetts. Locally (within the Valley and Central Naugatuck Valley regions), Route 8 is the only expressway facility operating in the north-south direction through the Naugatuck Valley. Along its length, Route 8 provides connections with major interstate highways including I-95, I-84, and I-90, and provides access to the Waterbury Branch Line commuter parking facilities and rail service.

Within the study area, Route 8 is a limited access, divided highway that varies from four to five lanes. From Exit 22 to approximately Exit 29, Route 8 is four-lane highway that widens to a five-lane highway between Exit 29 and Exit 30. Between Exit 29 and Nichols Drive, Route 8 northbound carries 3 lanes, while Route 8 southbound carries 2 lanes. Between Nichols Drive and Exit 30, Route 8 northbound carries two lanes and Route 8 southbound carries 3 lanes.

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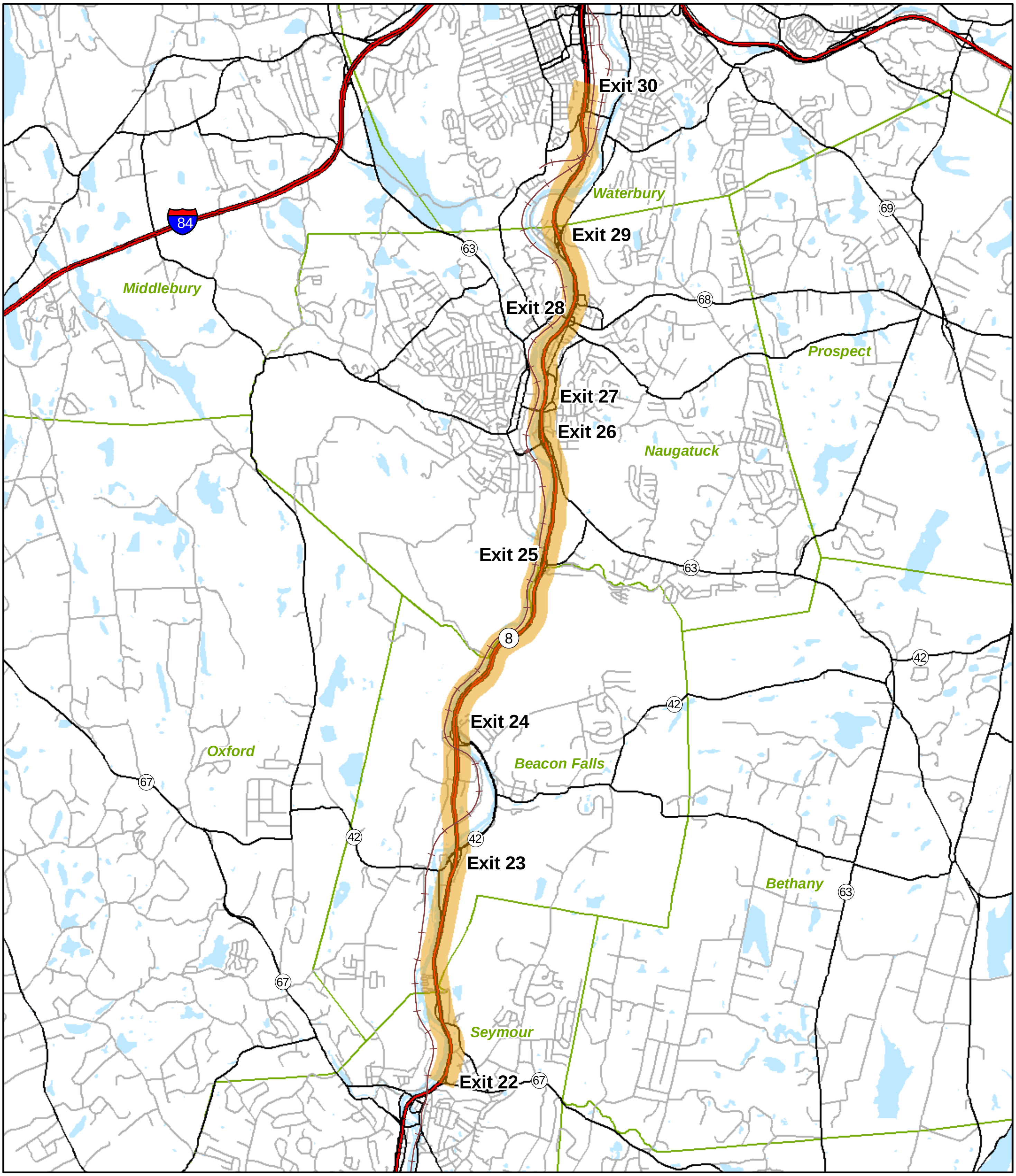

Vanasse Hangen Brustlin, Inc.

Figure 1-1
Route 8 Deficiencies/Needs Study
State Project 124-164
Study Area

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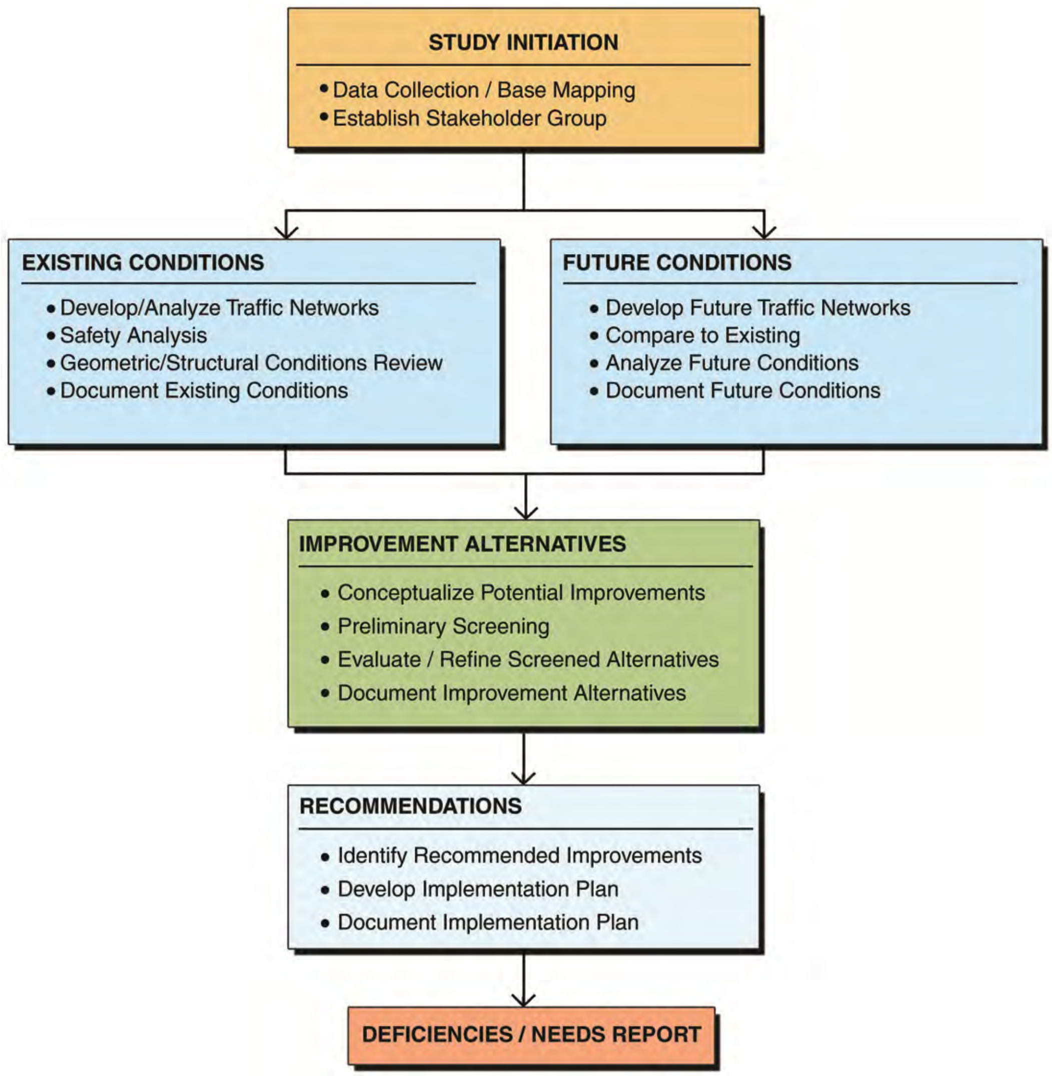
1.3 Study Process

Similar to most engineering and planning studies, a structure or "process" for this study has been established at the onset. The study process, depicted in Figure 1-2 below, provides a general overview of how the study was progressed through this Deficiencies/Needs Study.

Figure 1-2: Study Initiative



1.4 Public Participation

A major component of this study involved public participation. Part of the initial stages of this initiative involved the establishment of a Stakeholders Group (SG) for this study. The SG was comprised of various representatives of federal, state, and municipal agencies, and business or community organizations with an interest in the Naugatuck Valley region or study corridor that were invited to participate by CTDOT and the Regional Planning Agencies. The purpose of the SG was to share information and review all technical documents, and provide direct input on alternatives. Most importantly, the SG helped foster regional cooperation and consensus on the study findings. Through the course of the study, three SG meetings were held at critical milestones.

In addition to the SG meetings, public input was solicited through local outreach meetings. Local outreach meetings were targeted meetings with key stakeholders to discuss specific issues and the viability of solutions. Outreach meetings were held in Seymour, Naugatuck, and Waterbury at several stages in the study process. Two public meetings were held to solicit broader input to the study: midway through the study to overview existing and future conditions and preview alternatives under construction; and, a second to present the draft study recommendations. The public informational meetings were conducted in the early evenings to accommodate work schedules and to encourage attendance. These meetings were publicized extensively and scheduled well in advance to provide early notice to the public. Each public meeting consisted of a brief 30-minute presentation followed by an informal public input session where representatives from CTDOT and VHB were available to answer questions and record public reaction and input.

1.5 Study Team

The "Study Team" consisted of staff from CTDOT and the consultant team. The consultant team involved in the preparation of this document included staff from VHB and Fitzgerald & Halliday, Inc. (FHI). Key study staff included:

<u>CTDOT – Lead Agency</u>

- Ms. Colleen Kissane, Assistant Director, Intermodal Planning
- Mr. David Head, Supervising Planner
- Ms. Melanie Zimyeski, Project Manager
- Ms. Katherine Rattan, Planner

VHB – Lead Consultant

- Ms. Ruth Bonsignore, Project Manager
- Ms. Soujanya Chalumuri, Deputy Project Manager
- Mr. John Kennedy, Traffic Engineering QA-QC
- Mr. Michael Sutton, Task Leader – Engineering
- Mr. Vahid Karimi, Task Leader – Traffic Engineering

FHI – Sub Consultant (Environmental Conditions Assessment)

- Ms. Susan VanBenschoten, Chief Operating Officer
- Mr. Paul M. Stanton, Principal Planner

2

Existing Transportation Conditions

This chapter describes the existing transportation conditions within the study area, including an overview of the study area demographics, existing traffic demands and operations, safety and geometrics, and a summary of the current deficiencies/needs of the corridor. Information is provided specific to Route 8 mainline sections, interchange ramps, and local signalized and unsignalized intersections that have a potential to affect operations on Route 8.

2.1 Study Area Demographics

The study area is comprised of four municipalities with a total 2008 population of about 160,500. The overall study area population is expected to grow moderately from 2008 to 2030, with an overall increase of 4 percent. Regional demographics and journey-to-work statistics for these municipalities are summarized in Table 2-1.

Table 2-1
Study Area Demographics/Trip Generation

Municipality	2008 Population	2030 Projected Population	Change 2008 to 2030 (%)	2008 Journey-to-Work Daily Trip Destinations	2030 Journey-to-Work Daily Trip Destinations	Change 2008 to 2030 (%)
Seymour	14,700	16,900	14.9	3,700	5,500	48.6
Beacon Falls	6,000	7,400	23.3	1,200	1,800	50.0
Naugatuck	32,400	35,900	10.8	9,700	11,800	21.6
Waterbury	107,400	107,400	0.0	43,600	45,900	5.3
	160,500	167,600	4.4	58,200	65,000	11.7

Sources: CTDOT Statewide Travel Model

The population of the Valley and Central Naugatuck Valley Regions is projected to grow to 167,600 people by the year 2030. Population is expected to remain level in Waterbury; however, the remaining municipalities are projected to experience population growth to the year 2030, ranging from 10 to 23 percent with Beacon Falls projected to have the fastest growth rate.

According to the CTDOT Statewide Travel Model, the region currently attracts approximately 58,200 daily work trips. Within the region, Waterbury is the major employment center – attracting almost 44,000 daily work trips. Work trips are expected to increase in all four communities by 2030, ranging from 2,300 in Waterbury to 600 in Beacon Falls.

2.2 Existing Traffic Demand

The traffic volumes presented in this study were developed by CTDOT through an ongoing statewide traffic counting program and supplemented by counts conducted by CTDOT for this study. The traffic volumes are representative of 2008 conditions.

2.2.1 Daily Volumes

Daily traffic volumes were collected by CTDOT for the Route 8 mainline and its interchanges within the study area during 2008. Average annual daily traffic (AADT) volumes for all mainline links are shown in Table 2-2. Traffic volumes range from 48,200 vehicles per day (vpd) between Exits 23 and 24, to 60,500 vpd between Exits 28 and 29.

Table 2-2
Route 8 Average Annual Daily Traffic Volumes (AADT)

Segment	2008 ADT
Exit 22 to 23	55,000
Exit 23 to 24	48,200
Exit 24 to 25	55,500
Exit 25 to 26	53,100
Exit 26 to 27	51,300
Exit 27 to 28	60,100
Exit 28 to 29	60,500
Exit 29 to 30	53,700

Sources: CTDOT Statewide Travel Model

2.2.2 Peak Hour Volumes

While daily data provides an overview of the traffic conditions along Route 8, one focus of this study was to evaluate how the mainline is able to accommodate the fluctuations in daily demands placed upon it. Morning and evening peak hour traffic volumes for mainline segments were provided by CTDOT and are compared to the daily volumes along the corridor in Table 2-3. These peak periods are the focus of the capacity and level of service (LOS) analyses presented in subsequent sections of this report.

Table 2-3
Route 8 Peak Hour Mainline Volumes – 2008 Existing Conditions

	Weekday Morning Peak Hour				Weekday Evening Peak Hour			
Section	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 22 to 23	5,130	9.3	1,540 / 3,590	70% SB	5,710	10.4	3,630 / 2,080	64% NB
Exit 23 to 24	4,560	9.5	1,360 / 3,200	68% SB	5,080	10.5	3,240 / 1,840	64% NB
Exit 24 to 25	5,210	9.4	1,670 / 3,540	68% SB	5,800	10.5	3,590 / 2,210	62% NB
Exit 25 to 26	4,870	9.2	1,660 / 3,210	66% SB	5,620	10.6	3,290 / 2,330	59% NB
Exit 26 to 27	4,760	9.3	1,830 / 2,930	62% SB	5,520	10.8	3,190 / 2,330	58% NB
Exit 27 to 28	5,450	9.1	2,130 / 3,320	61% SB	6,380	10.6	3,490 / 2,890	55% NB
Exit 28 to 29	5,250	8.7	2,330 / 2,920	56% SB	6,170	10.2	3,300 / 2,870	53% NB
Exit 29 to 30	4,750	8.8	2,150 / 2,600	55% SB	5,680	10.6	3,030 / 2,650	53% NB
Averages		9.2		63% SB		10.5		59% NB

Source: CTDOT

As Table 2-3 indicates, morning and evening peak hour volumes generally represent between 8 and 11 percent of the daily volumes. Morning peak hour volumes are about 14 percent lower than evening peak hour volumes, ranging from 4,560 vehicles per hour (vph) (between Exits 23 and 24) to 5,450 vph (between Exits 27 and 28). Evening peak hour volumes range from 5,080 vph (between Exits 23 and 24) to 6,380 vph (between Exits 27 and 28).

The directional flow of traffic is heavier in the southbound direction in the morning for all segments. On average, 63 percent of the morning peak hour traffic is southbound. In the evening, the opposite occurs; traffic is heavier (59 percent of the total evening traffic) in the northbound direction.

Traffic activity at interchange locations significantly influences Route 8 corridor operations. In the morning peak travel direction (i.e., southbound), ramp demand varies from 80 vehicles per hour at the Exit 27 on-ramp to 620 vph at the Exit 28 on-ramp. In the evening, northbound ramp demand varies from 130 vph at the Exit 27 off-ramp to 710 vph at the Exit 22 off-ramp.

The degree of ramp usage also influences Route 8 operations by creating "turbulence" in traffic flow on the mainline. Turbulence occurs when there is a mixture of through traffic with merging, diverging, or weaving traffic. The higher the percent of merging, diverging, or weaving traffic as a portion of total traffic, the greater the turbulence. For an on-ramp, the proportion of downstream mainline traffic (including the on-ramp traffic) that just entered the mainline traffic stream indicates the degree of merging activity. For an off-ramp, the proportion of upstream mainline traffic (including the off-ramp traffic) that exits from the mainline indicates the degree of diverging activity. This varies along the corridor from 4.1 percent (Exit 27 northbound) to 26.1 percent (Exit 22 northbound).

2.2.3 Surface Street Traffic Volumes

Along with the traffic volumes collected on the Route 8 mainline and its interchanges, CTDOT collected morning and evening peak hour traffic volumes at 13 additional intersections throughout the study area. The locations were selected due to their proximity to Route 8, or their potential to influence future improvement alternatives. Later sections of this report address the operational characteristics at each of these locations.

2.2.4 Trucks

To quantify truck volumes on Route 8, a vehicle classification study was conducted. Vehicle classification counts taken over several days on the Route 8 mainline were analyzed. These counts were conducted in both directions between Exits 22 and 23 and between Exits 29 and 30.

Table 2-4 presents the observed data. The detailed classification data were aggregated into three broad vehicle types: cars, light trucks, and heavy trucks. Cars consisted of all passenger vehicles, motorcycles, and two-axle pick-up trucks. Light trucks consisted of buses and single unit trucks with more than four tires. Heavy trucks were all trucks with one or more trailers.

The percentage of trucks (light and heavy) in the total traffic stream varies from 5 to 7 percent. As a percent of total traffic, the segment of Route 8 between Exits 22 and 23 consistently carried a higher percentage of trucks than the segment of Route 8 between Exits 29 and 30.

Table 2-4
Vehicle Classification Study Results

Count Location	Study Period
Between Exits 22 and 23 NB[a]	
Cars*	93%
Light Trucks**	4%
Heavy Trucks***	3%
Between Exits 22 and 23 SB[a]	
Cars	93%
Light Trucks	4%
Heavy Trucks	3%
Between Exits 29 and 30 NB[b]	
Cars	95%
Light Trucks	2%
Heavy Trucks	3%
Between Exits 29 and 30 SB[c]	
Cars	93%
Light Trucks	4%
Heavy Trucks	3%

a Source: Classification data collected by CTDOT Bureau of Policy and Planning in February 2002
b Source: Classification data collected by CTDOT Bureau of Policy and Planning in November 1998
c Source: Classification data collected by CTDOT Bureau of Policy and Planning in September 1998
* "Cars" include FHWA Classes 1, 2, and 3 (including motorcycles and light pick-up trucks).
** "Light Trucks" include FHWA Classes 4, and 5 (buses and two-axle trucks with more than 4 tires).
*** "Heavy Trucks" include FHWA Classes 6 or greater (trucks with more than two axles).

2.2.5 Mainline Speeds

Using the floating car method, speed observations were conducted along the mainline Route 8 in the study area. The purpose of this analysis was to determine the prevailing vehicle speeds through different segments of Route 8 during peak and off-peak weekday periods. For each direction, three observations of the study area corridor were taken during three periods of the day; morning peak period from 7 AM to 8 AM, midday period from 11:30 AM to 12:30 PM, and evening peak period from 4:30 PM to 5:30 PM. An observer recorded travel speeds along the corridor while maintaining the speed of the adjacent traffic stream.

Posted speed limits on Route 8 in the study area vary from 50 to 55 mph. Between Exits 22 and 25, and Exits 29 and 30, the posted speed limit is 55 mph. Between Exits 26 and 27, the posted speed limit is 50 mph. The lower speed limit is the result of horizontal and vertical roadway curvature, and closely spaced interchanges.

The speed data indicate that average northbound and southbound speeds were approximately 70 mph in the morning peak period, 70 mph in the evening peak period and 66 mph in the midday peak period. Highest speeds were observed between Exits 24 and 25, with 78 mph in the northbound direction during the midday. In the morning and evening periods, speeds were notably different in each direction for a specific segment, indicating a more dense traffic flow in the peak direction of travel. Typically, speeds lowered to between 60 and 65 mph in the peak directions of travel. Speeds between Exits 26 and 27 dropped to 65 mph and below during both peaks indicative of the more constrained geometry in both directions, although still operating in excess of the posted speed limit. Throughout the corridor, speeds in the off-peak direction were consistently above 65 mph.

2.3 Geometrics

Route 8 in Connecticut is a 67-mile state highway running north-south from Bridgeport through Waterbury to the Massachusetts border. The study section of Route 8 begins at interchange 22 and extends north approximately 11 miles to interchange 30. Within the study area, Route 8 is a four-lane, bi-directional freeway/expressway which travels through the towns of Seymour, Beacon Falls, Naugatuck, and Waterbury and is known as the Ansonia-Derby-Shelton Expressway. Route 8 follows the Naugatuck Valley and generally the Naugatuck River, which is a tributary to the Housatonic River.

The original Route 8 in Connecticut was constructed during the early 1920s, from the present day intersection of Route 1 and Route 110 in Stratford to the Massachusetts border. In the mid to late 1950s, a project to relocate Route 8 was initiated to create a controlled access expressway on new rights-of-way. This reconstruction of Route 8 occurred over a period of approximately 35 years with various sections opening in stages. In Naugatuck, the expressway between Exit 26 and Exit 29 opened in 1960. In Seymour, the expressway between Exit 19 and Exit 22 opened in 1962. The section of Route 8 between Exit 22 and Exit 26 was planned to run along the Naugatuck River valley through Naugatuck State Forest. Aesthetic and environmental preservation were major concerns and required careful planning and design. As a result, this section of Route 8 did not open until 1982.

The original construction of the highway mainline and interchange elements were designed to the standards and anticipated traffic volumes of the time. These standards have evolved over time and travel demands have increased significantly; as a result, the highway now has several geometric and safety deficiencies. Geometric deficiencies increase the potential for safety problems and, therefore, the mainline and all of the interchanges were evaluated with regard to their conformance to current design standards.

2.3.1 Methodology/Review of Geometrics

Based on multiple field visits and review of available record plans, the existing geometry of the Route 8 mainline and interchanges within the study area was evaluated. CTDOT provided record plans with dates ranging between the early 1960s to the early 1980s for interchanges 22 to 26. In addition, existing aerial photography was used to further assess the existing geometric conditions.

Along Route 8, within the eight interchanges between Exit 22 and Exit 29, there are 28 ramps (14 on-ramps and 14 off-ramps). Included in a separate planning study,[1] Exit 30 has 4 ramps (2 on-ramps and 2 off-ramps). These ramps provide access between Route 8 and the local roadways and state highway system.

The Route 8 mainline was evaluated to determine the adequacy of the existing horizontal and vertical alignments, cross-sectional elements, lane configuration, sight distances and roadside features. The posted speed limit along the study corridor is 55 miles per hour (mph) with one exception of 50 mph between Exits 26 and 27 through downtown Naugatuck. Based on information obtained from record plans, it appears that a design speed of 60 mph was used for the majority of the mainline; however, in the vicinity of Exit 22, the record plans indicate a design speed of 50 mph even though this section of road has a posted speed limit of 55 mph. (Refer to Tables 2-6 and 2-7 below for posted and design speeds throughout the study area.) For this study, it is assumed that future improvements will be based on a design speed of 60 mph. Table 2-5 summarizes the design criteria for various design speeds for comparison purposes.

Table 2-5
Route 8 - Mainline Design Criteria

Design Element	55 mph Design Speed	60 mph Design Speed	65 mph Design Speed
Lane Width	12’	12’	12’
Shoulder Width – Right	10’	10’	10’
Shoulder Width – Left (Note 1)	8’	8’	8’
Cross Slope – Travel Lane	1.5 to 2.0%	1.5 to 2.0%	1.5 to 2.0%
Cross Slope – Shoulder	4.0 to 6.0 %	4.0 to 6.0 %	4.0 to 6.0 %
Right of Way Width	Existing	Existing	Existing
Roadside Clear Zone (Note 2)	26’	30’	30’
Stopping Sight Distance	495’	570’	645’
Decision Sight Distance (Note 3)	1135’	1280’	1365’
Minimum Radius (e = 6%)	1065’	1340’	1665’
Super-elevation	6.0%	6.0%	6.0%
Horizontal Sight Distance (Note 4)	28’	32’	34’
Maximum Grade	4.0%	4.0%	4.0%
Vertical Curve, K Value, Crest	114	151	193
Vertical Curve, K Value, Sag	115	136	157
Vertical Clearance	16’ 3”	16’ 3”	16’ 3”

Source: CTDOT Highway Design Manual, December 2003.
Note 1 Figure 5A. Assumes that this is not considered a High Volume / High Incident Management Freeway which requires 12’ left shoulder
Note 2 Figure 13-2A
Note 3 Isolated locations along mainline crest vertical curve approaching off ramp
Note 4 Assumes sight distance is greater than length of curve. Refer to section 8-2.04.02

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1 For further information, see the I-84/Route 8 Waterbury Interchange Needs Study, prepared by Wilbur Smith Associates for the Connecticut Department of Transportation, 2009.

2.3.2 Mainline Geometry Review

The Route 8 mainline was evaluated for compliance with the design criteria listed in Section 2.3.1. Tables 2-6 and 2-7 present the results of the mainline evaluation for design elements that appear to be non-compliant with current design standards. It is assumed that future design efforts would further evaluate these elements and may recommend appropriate corrective measures.

Table 2-6
Route 8 - Mainline Geometry Compliance - Northbound

Location	Mile Marker	Posted/ Design Speed (mph)	Shoulder Width (Right)	Shoulder Cross-Slope	Shoulder Width (Left)	Roadside Clear Zone	Decision Sight Distance	Minimum Radius
Northbound								
Exit 22 Off Ramp	0							
		55/50	Yes	No**	No	Yes	Yes	No
Exit 22 On Ramp	0.5							
		55/50	Yes	No**	Yes*	No***	Yes	Yes
Exit 23 Off Ramp	2.5							
		55/60	Yes	No**	Yes*	Yes	Yes	Yes
Exit 24 On Ramp	3.8							
		55/60	Yes	No**	Yes	Yes	Yes	Yes
Exit 25 Off Ramp	5.5							
		55/60	Yes	No**	Yes	Yes	Yes	Yes
Exit 25 On Ramp	5.8							
		55/60[1]	Yes	No**	Yes	Yes	Yes	Yes
Exit 26 Off Ramp	6.8							
		50/60	Yes	No**	No	Yes	Yes	Yes
Exit 26 On Ramp	7.0							
		50/60	Yes*	No**	No	Yes	Yes	No
Exit 27 On Ramp	7.3							
		50/60	No	No**	No	Yes	Yes	Yes
Exit 27 Off Ramp	7.4							
		55/60[2]	Yes	No**	No	Yes	Yes	Yes
Exit 28 Off Ramp	7.8							
		55/60	Yes*	No**	No	Yes	Yes	Yes
Exit 28 On Ramp	8.4							
		55/60	Yes	No**	Yes	No***	Yes	Yes
Exit 29 Off Ramp	8.8							
		55/60	Yes	No**	Yes	No***	Yes	Yes
Exit 29 On Ramp	9.1							

* Compliant in general area except on bridge structures.
** Not compliant in areas of super elevation on high side of roadway
*** Unprotected street lighting poles in clear zone.
1 Posted Speed limit is 50 mph beginning approximately ½ mile south of Exit 26 off ramp.
2 Posted Speed limit is 50 mph until approximately ¼ mile north of Exit 27 on ramp.

Both the right and left shoulders were reviewed and evaluated in the field. In particular, the left shoulder width was observed to be non-compliant in several locations. Typically, the non-compliant left shoulder width was observed on existing bridge structures with a varying width of 2 to 6 feet.

Generally, the right shoulder width was found to meet design guidelines, with only isolated areas that could be considered sub-standard.

A possible rollover hazard exists between Exits 24 and 25 in Beacon Falls where 'truck rollover' signs are posted on Route 8 southbound. In this area, the Route 8 mainline closely follows the Naugatuck River and, as such, includes a relatively curvilinear alignment. While the horizontal curvature appears to meet design criteria, the shoulder rollover on the high side of the superelevated curve appears too steep. Many locations appear to exceed CTDOT standards of a maximum algebraic difference of 7% between the cross slope of the travel lane and the cross slope of the shoulder. A potential for rollover exists in these areas if trucks (or other vehicles) stray into the shoulder area.

Table 2-7
Route 8 – Mainline Geometry Compliance - Southbound

Location	Mile Marker	Posted/ Design Speed (mph)	Shoulder Width (Right)	Shoulder Cross-Slope	Shoulder Width (Left)	Roadside Clear Zone	Decision Sight Distance	Minimum Radius
Southbound								
Exit 29 Off Ramp	0							
		55/60	No	No**	No	No***	No	Yes
Exit 29 On Ramp	0.3							
		55/60	Yes	No**	No	No***	Yes	Yes
Exit 28 Off Ramp	0.5							
		55/60	Yes	No**	No	Yes	Yes	Yes
Exit 28 On Ramp	1.1							
		55/60	Yes	No**	No	Yes	Yes	Yes
Exit 27 On Ramp	1.6							
		55/60	No	No**	No	Yes	Yes	Yes
Exit 27 Off Ramp	1.7							
		55/60	Yes*	No**	No	Yes	Yes	No
Exit 26 Off Ramp	2.0							
		55/60	Yes	No**	Yes	Yes	Yes	Yes
Exit 26 On Ramp	2.2							
		55/60	Yes	No**	Yes	Yes	Yes	Yes
Exit 25 Off Ramp	3.1							
		55/60	Yes	No**	Yes	Yes	Yes	Yes
Exit 25 On Ramp	3.4							
		55/60	Yes	No**	Yes	Yes	Yes	Yes
Exit 24 Off Ramp	5.0							
		55/60	Yes	No**	Yes*	Yes	Yes	Yes
Exit 23 On Ramp	6.5							
		55/60	Yes	No**	Yes	No***	No	Yes
Exit 22 Off Ramp	8.4							
		55/50	No	No**	No	Yes	Yes	No
Exit 22 On Ramp	8.9							

* Compliant in general area except on bridge structures.
** Not compliant in areas of superelevation on high side of roadway
*** Unprotected but breakaway street lighting poles in clear zone.

Concrete median barriers were observed along the majority of the study area. Generally, the concrete median barriers appear to be in fair condition; however, they may not meet current traffic barrier standards with regard to shape, height and anchoring.

Roadside clear zones were observed to be generally compliant. There were isolated areas where highway lighting poles were exposed. Most highway light poles and all overhead signs within the clear zone are protected by guide rail. Existing light poles within the clear zone and not protected by guide rail are acceptable if they are a 'break-away' design.

Decision sight distance is a concern in isolated instances. These instances were observed in the field under the following conditions:

- A crest vertical curve along the Route 8 mainline
- A horizontal curve along the Route 8 mainline
- An off ramp tangent to the Route 8 mainline with a down gradient

There are three horizontal curves that appear to be non-compliant for a 60 mph design speed in the Exit 22 area. Record plans of 1962 indicate that the design speed in this area is in fact 50 mph even though the current posted speed limit is 55 mph. These horizontal curves are located on bridge structures on the elevated section of the expressway. The curves are likely the result of physical constraints including the Naugatuck River and the Seymour business district. (See also later discussion in Section 2.6.3, Review of Route 8 Accident Locations.)

2.3.3 Ramp Geometry

The horizontal geometry of each of the on-ramps was used to determine an existing design speed. Typically, this design speed is controlled by the minimum horizontal radius on the ramp. Based on the speed differential between the design speed of the ramp and the Route 8 mainline, a minimum acceleration length can be determined. The on-ramp geometry is summarized in Table 2-8.

Table 2-8
Route 8 On-ramp Locations - Geometric Assessment

Location	Design Speed (mph)	AASHTO / CTDOT Minimum Acceleration Length (Ft.) 60 mph Design Speed	65 mph Design Speed	Actual	Comments
Exit 22 Northbound	50	300	370	450 Ft.	Compliant
Exit 22 Southbound	50	300	370	350 Ft.	Compliant for 60 mph Design Speed Only
Exit 23 Southbound	50	300	370	460 Ft.	Compliant
Exit 24 Northbound	50	300	370	470 Ft.	Compliant
Exit 25 Northbound	50	300	370	430 Ft.	Compliant
Exit 25 Southbound	50	300	370	240 Ft.	Acceleration length shorter than current standards
Exit 26 Northbound	50	300	370	325 Ft.	Compliant for 60 mph Design Speed Only
Exit 26 Southbound	45	420	600	385 Ft.	Acceleration length shorter than current standards
Exit 27 Northbound	40	550	770	425 Ft.[1]	Acceleration / Weaving length shorter than current standards
Exit 27 Southbound	50	300	370	365 Ft.[1]	Compliant for 60 mph Design Speed Only
Exit 28 Northbound	50	300	370	455 Ft.	Compliant
Exit 28 Southbound	50	300	370	500 Ft.	Compliant
Exit 29 Northbound	50	300	370	380 Ft.	Compliant
Exit 29 Southbound	45	420	600	630 Ft.	Compliant

Source: AASHTO (American Association of State Highway and Transportation Officials) Green Book and CTDOT Highway Design Manual, December 2003.
Design Speed based on governing geometric controls
[1] Weave lane

Each off-ramp was also evaluated to determine if adequate deceleration length is provided. Deceleration length is based on the speed differential between the design speed of the first governing geometric control of the off-ramp and the design speed of the mainline. Additionally, AASHTO design standards provide a general rule of thumb that the design speed for an off-ramp should not be less than one-half the design speed of the mainline highway.

Off-ramp lengths were also evaluated where a traffic signal or stop control is located at the base of the ramp. The length of the 95th percentile queue was subtracted from the total length of the ramp beginning at the first governing geometric control. A comparison was made between the remaining length of the ramp and the distance required to decelerate from the design speed to a stop condition. This evaluation shows where storage lengths on the off-ramps are inadequate. The results of the off-ramp assessment are summarized in Table 2-9. An overall summary of the mainline and ramp geometric analysis results are depicted on Figure 2-1.

Table 2-9
Route 8 Off-Ramp Locations -- Geometric Assessment

			AASHTO / CTDOT Minimum Deceleration Length (Ft.)						
Location	Posted Speed mph)	Design Speed (mph)[1]	60 mph to Design Speed (Ft.)	(Actual)[2]	Design Speed to 0 mph (Ft)	Ramp Length (Ft.)	Estimated Queue [3]	Remaining Ramp Length (Ft)	Comments
Exit 22 NB	N/P	35	405	(300)	280	470	444	26	Queue + deceleration length greater than ramp length Deceleration length less than current standards
Exit 22 SB	30	50	240	(100)	435	1125	314	811	
Exit 23 NB	30	50	240	(140)	435	1220	51	1169	Deceleration length less than current standards
Exit 24 SB	35	45	300	(330)	385	2370	62	2308	
Exit 25 NB	30	50	240	(220)	435	940	141	799	Deceleration length less than current standards
Exit 25 SB	30	50	240	(450)	435	1235	120	1115	
Exit 26 NB	25	40	350	(290)	320	705	430	275	Queue + deceleration length greater than ramp length Deceleration length less than current standards
Exit 26 SB	25	50	240	(165)	435	865	136	729	Deceleration length less than current standards
Exit 27 NB	25	50	240	See note 4	435	300	32	268	Weave lane insufficient.
Exit 27 SB	N/P	40	350	See note 4	320	880	325	555	Weave lane insufficient
Exit 28 NB	30	40	350	(150)	320	1150	396	754	Deceleration length less than current standards
Exit 28 SB	30	45	300	See note 5	385	1285	73	1212	
Exit 29 NB	25	40	350	(225)	320	550	66	484	
Exit 29 SB	25	45	300	(585)	385	825	36	789	

Source: AASHTO Green Book and CTDOT Highway Design Manual, December 2003.
1 Design Speed based on first governing geometric control.
2 Values in parenthesis are actual values measured from GIS data.
3 Queue Length based on 2008 morning and afternoon peak 95% queue.
4 Deceleration lane part of weave lane between Exit 27 and Exit 28
5 Deceleration lane part of auxiliary lane between Exit 28 and Exit 29
N/P Not Posted

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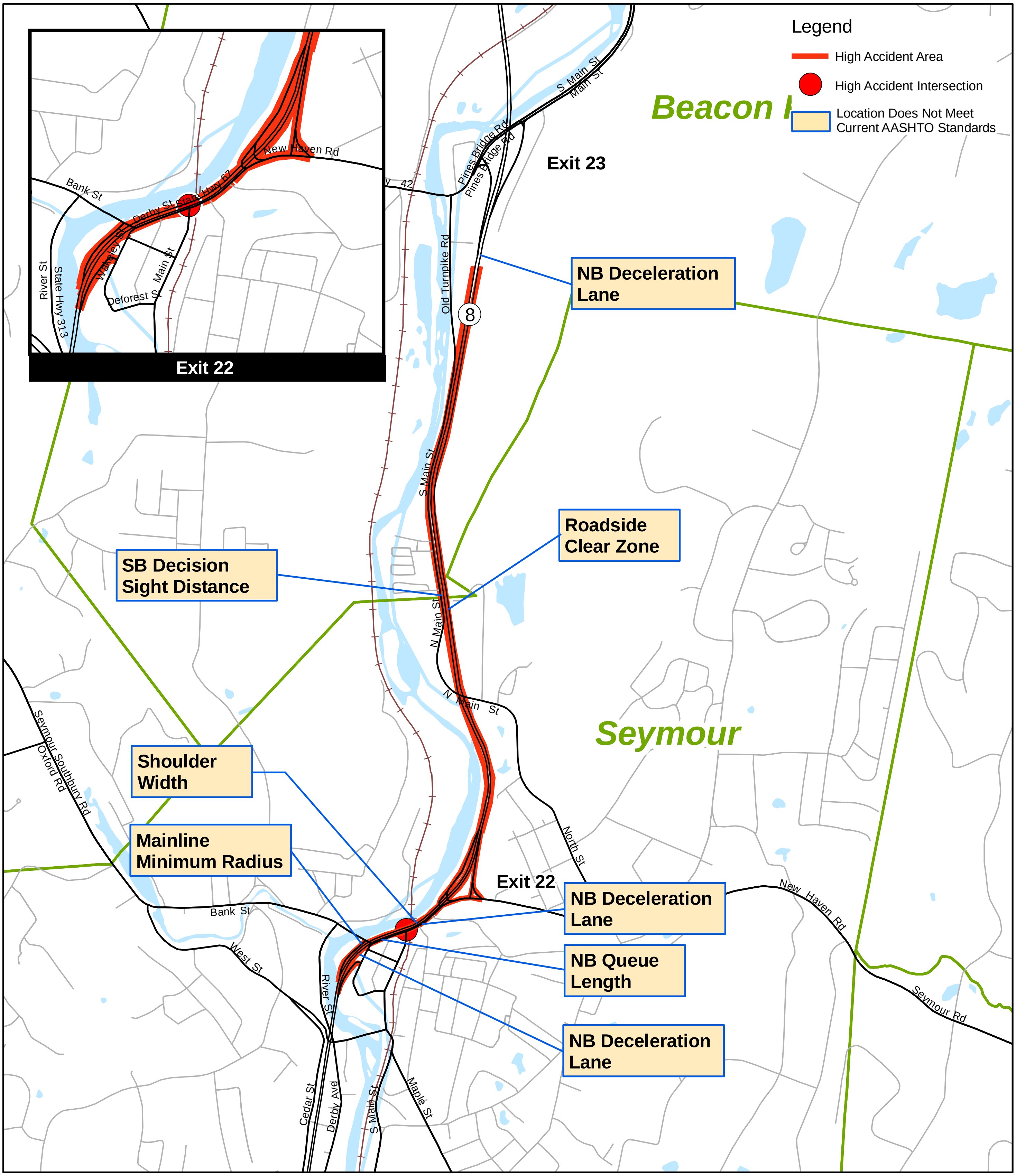

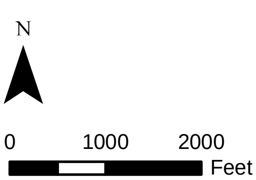

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Figure 2-1 (Sheet 1 of 3)
Route 8 Deficiencies/Needs Study
State Project 124-164
Corridor Geometric and
Safety Review

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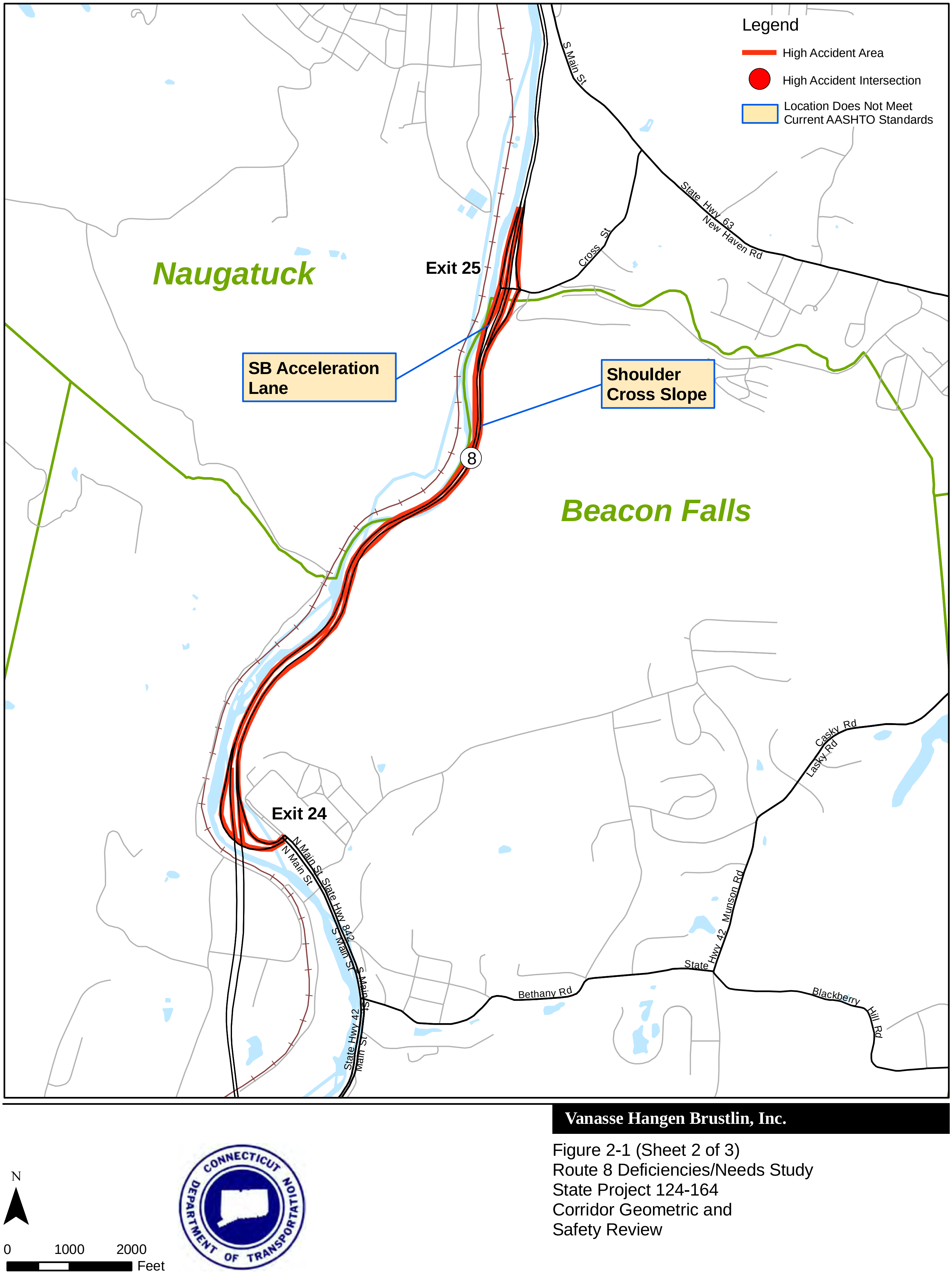

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Figure 2-1 (Sheet 2 of 3)
Route 8 Deficiencies/Needs Study
State Project 124-164
Corridor Geometric and
Safety Review

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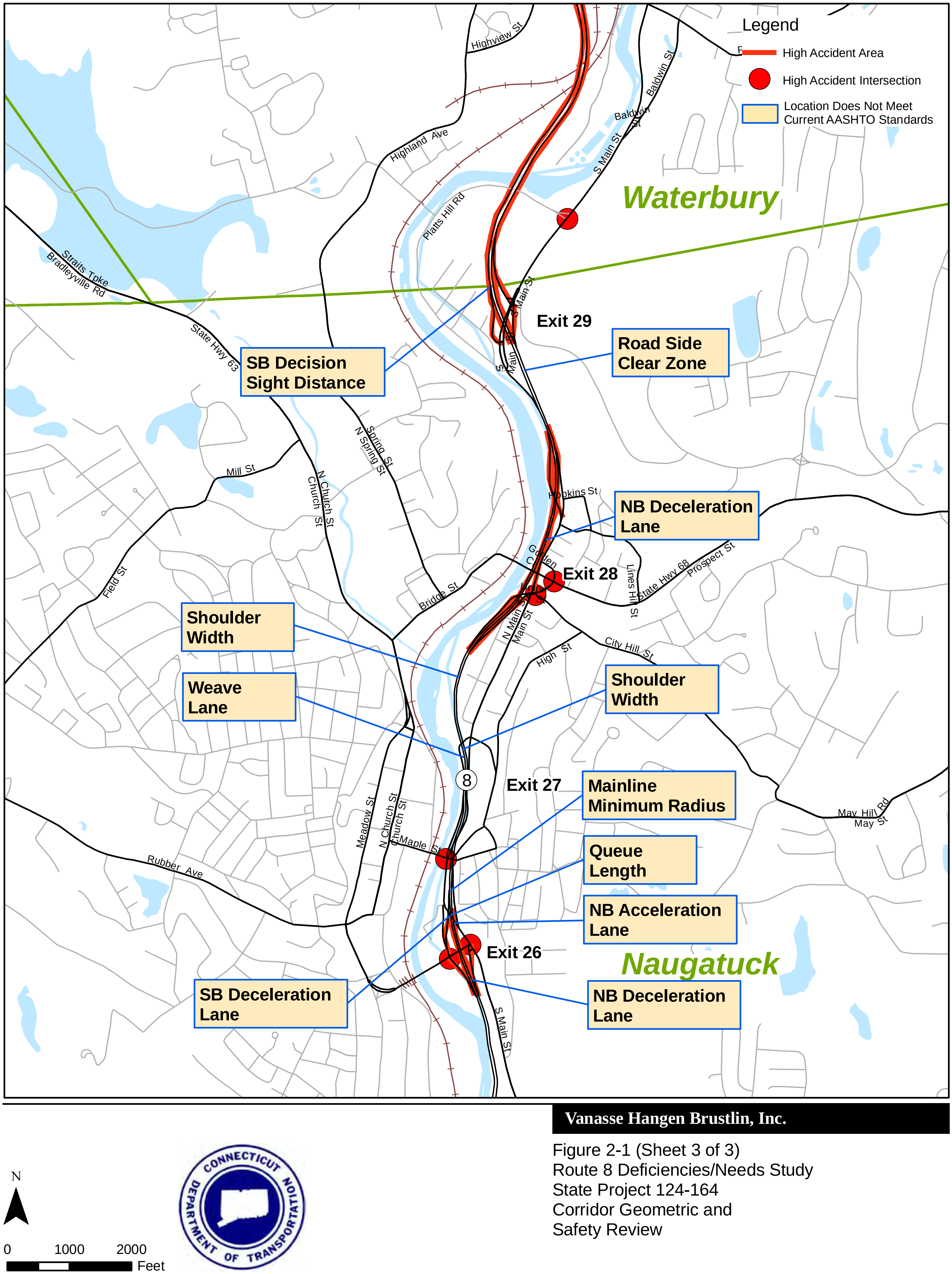

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Figure 2-1 (Sheet 3 of 3)
Route 8 Deficiencies/Needs Study
State Project 124-164
Corridor Geometric and
Safety Review

2.4 Structural Conditions Review

The study section of Route 8 contains numerous bridge structures required to carry the roadway through a large number of interchanges, over waterway crossings, and crossings both over and under local roads and railroad tracks. Most of the bridges were built in the mid-1960s with a few built in the early 1980s. Many of the older bridges were rehabilitated in the late 1980s to early 1990s.

The Route 8 corridor bridge structures are constructed of a variety of materials and in a variety of configurations. In general, the majority of the Route 8 bridges consist of steel stringers/girders over cast-in-place concrete substructures. Bridge structures supporting local roadways over Route 8 consist of a greater variety of structure types, including post-tensioned precast concrete box beams and steel trapezoidal box girders. The Route 8 bridge structures are summarized in Table 2-10.

A study of the deficiencies of the Route 8 bridge structures can be summarized into two categories. Bridges that are deficient: 1) due to the poor operation of the bridge structures with respect to roadway geometry, traffic flow, and associated safety issues; and 2) due to poor physical condition of the structures.

2.4.1 Operational Conditions

A number of the bridge structures along the study section have geometric and operational conditions that do not meet present design standards. These deficiencies encompass a range of criteria, including horizontal and vertical clearance over and under intersecting structures as well as traffic safety related items. Many bridges have traffic safety features that do not meet current AASHTO standards, including bridge railings, transitions, and approach guardrails. A summary of the operational deficiencies found on study area bridge structures is shown on Table 2-11.

Table 2-10
Route 8 - Bridge Structure Summary

Structure #	Facility Carried By Structure	Feature Intersected	Mile Point	Year Built	Year Reconstructed	Structure Type
00587	Route 8	Rte 313 & Naugatuck River	18.20	1961	1994	Steel Stringer/Multibeam or Girder
00588	Route 8	Rte 67, Metro North & Ramp 49	18.49	1962	1994	Steel Stringer/Multibeam or Girder
02074	Route 8	Rimmon Brook	19.30	1949	-	Concrete Culvert
04382	SR 721-N. Main St	Route 8	0.83	1981	-	Steel Stringer/Multibeam or Girder
04383	Route 8	Rte 42 & Naugatuck River	21.01	1981	-	Steel Continuous Stringer/Multibeam or Girder
04384	Route 8	Metro North RR & Private Rd	21.29	1981	-	Prestressed Concrete Stringer/Multibeam or Girder
04385	Lopus Road	Route 8	4.10	1981	-	Prestressed Concrete Box Beams or Girders - Multiple
04386	Route 8 Southbound	Metro North & Naugatuck River	21.97	1981	-	Prestressed Concrete Box Beams or Girders - Single or Spread
04387	Route 8 Northbound	Metro North & Naugatuck River	21.97	1981	-	Prestressed Concrete Box Beams or Girders - Single or Spread
04388	Route 8	Cotton Hollow Road	24.04	1981	-	Steel Stringer/Multibeam or Girder
04389	Route 8 & Ramps 139,140	Beacon Hill Brook	24.02	1981	-	Concrete Continuous Culvert
00590	Route 8	Route 63	25.23	1960	1990	Steel Stringer/Multibeam or Girder
00591	Route 8	SR 709 South Main Street	25.33	1960	1991	Steel Stringer/Multibeam or Girder
00592A	Route 8	Maple & Oak St, Ramp 063	25.51	1960	1990	Steel Stringer/Multibeam or Girder
00592B	Route 8 Ramp 063	No Notable Feature	26.39	1960	1990	Steel Stringer/Multibeam or Girder
00593	Route 8	Route 8 Ramp 064	25.87	1960	1999	Steel Stringer/Multibeam or Girder
00594	Route 8	Southbound Ent Ramp At Union	26.39	1960	1989	Steel Stringer/Multibeam or Girder
00595	Route 8	Fulling Mill Brook	26.46	1960	1989	Steel Stringer/Multibeam or Girder
00596	Route 68	Naugatuck River, Route 8,Metro North Railroad,SR710	0.45	1960	-	Prestressed Concrete Stringer/Multibeam or Girder
00597	Route 8	Route 8 Ramp 069	26.70	1960	1990	Steel Stringer/Multibeam or Girder
03175	Route 8	SR 847 (S Main Street)	27.25	1965	1995	Steel Stringer/Multibeam or Girder
03176	Route 8 Southbound	Naugatuck River, Local Roads	27.67	1966	-	Steel Continuous Stringer/Multibeam or Girder
03177	Route 8 Northbound	Naugatuck River,Local Roads	27.67	1966	-	Steel Continuous Stringer/Multibeam or Girder
03178	Route 8 Southbound	Metro North Railroad	28.03	1966	1995	Steel Continuous Stringer/Multibeam or Girder
03179	Route 8 Northbound	Metro North Railroad	28.06	1966	-	Steel Continuous Stringer/Multibeam or Girder
03180	Route 8 Southbound	Nichols Drive	28.52	1965	1995	Steel Continuous Stringer/Multibeam or Girder
03181	Route 8 Northbound	Nichols Drive	28.53	1965	1995	Steel Stringer/Multibeam or Girder
03182	Seventh Street	Route 8	29.33	1965	-	Steel Stringer/Multibeam or Girder
03183A	Route 8 Northbound	Fifth Street	29.17	1965	-	Steel Stringer/Multibeam or Girder
03183B	Route 8 Southbound	Fifth Street	29.17	1965	-	Steel Stringer/Multibeam or Girder
03184A	Route 8 Northbound	Porter Street	29.01	1965	-	"Other" Stringer/Multibeam or Girder
03184B	Route 8 Southbound	Porter Street	29.33	1965	-	Steel Stringer/Multibeam or Girder
03185	Route 8 Northbound	Washington Avenue	29.45	1965	1990	Steel Stringer/Multibeam or Girder
03186	Route 8 Southbound	Washington Avenue	29.45	1965	1990	Steel Stringer/Multibeam or Girder
03187	Route 8 Southbound	Bank St & South Leonard St	29.56	1965	-	Steel Stringer/Multibeam or Girder
03188	Route 8 Northbound	Bank St So. Leonard St.	29.57	1966	-	Steel Stringer/Multibeam or Girder

Source: CTDOT and National Bridge Inspection Standards (NBIS)

Table 2-11
Route 8 - Bridge Operational Conditions Summary[1]

Structure #	Structural Evaluation	Deck Geometry	Under Clearances, Vert. and Hor.	Approach Roadway Alignment	Traffic Safety Deficiencies
00587	6	5	3	5	No Safety Deficiencies
00588	6	5	3	8	No Safety Deficiencies
02074	6	N	N	8	No Safety Deficiencies
04382	6	6	6	7	No Safety Deficiencies
04383	6	9	7	8	Bridge Railings, Transitions, and Approach Guardrails
04384	6	9	5	8	No Safety Deficiencies
04385	6	6	5	8	Railings and Transitions
04386	6	9	5	8	Transitions, and Approach Guardrails
04387	6	9	3	8	Transitions, and Approach Guardrails
04388	7	9	5	8	No Safety Deficiencies
04389	6	N	N	8	No Safety Deficiencies
00590	5	9	3	8	No Safety Deficiencies
00591	6	9	4	8	Transitions
00592A	5	5	3	8	No Safety Deficiencies
00592B	6	7	N	6	No Safety Deficiencies
00593	7	9	3	8	No Safety Deficiencies
00594	7	9	3	8	No Safety Deficiencies
00595	6	9	N	8	Bridge Railings, Transitions, Approach Guardrails, and Approach Guardrail Ends
00596	4	9	3	3	Transitions, Approach Guardrails, and Approach Guardrail Ends
00597	6	9	3	8	Transitions
03175	6	9	5	8	Railings and Transitions
03176	5	6	N	8	Railings and Transitions
03177	6	6	3	8	No Safety Deficiencies
03178	5	6	9	8	Bridge Railings, Transitions, and Approach Guardrail Ends
03179	5	4	N	8	Bridge Railings, Transitions, and Approach Guardrail Ends
03180	5	9	6	8	No Safety Deficiencies
03181	6	5	5	8	No Safety Deficiencies
03182	6	4	5	5	Transitions, Approach Guardrails, and Approach Guardrail Ends
03183A	7	6	4	8	Railings and Transitions
03183B	7	6	4	8	Railings and Transitions
03184A	7	6	4	8	Railings and Transitions
03184B	7	6	4	8	Railings and Transitions
03185	6	6	4	8	Transitions
03186	6	6	6	8	Transitions
03187	6	6	4	8	Bridge Railings, Transitions, Approach Guardrails, and Approach Guardrail Ends
03188	6	5	5	8	Bridge Railings, Transitions, Approach Guardrails, and Approach Guardrail Ends

Source: CTDOT and NBIS
Note: N denotes "Not Applicable"
1 Based on inspection reports, plans and data provided by CTDOT as of January 2010.

2.4.2 Physical Conditions

CTDOT performs routine inspections of all bridge structures, typically every two (2) years. Based on the information contained within the latest inspection reports, most of the bridges contained in the study section are in fair to satisfactory condition. The main structural components of the bridges had ratings varying from a 5 (fair condition) up to 7 (good condition). A summary of the physical condition of the bridge structures can be found on Table 2-12.

Table 2-12
Route 8 - Bridge Physical Conditions Summary[1]

Structure #	Deck	Superstructure	Substructure	Operating Rating (Tons)	Inventory Rating (Tons)
00587	7	6	7	96.2	57.5
00588	6	6	6	95.3	57.2
02074	N	N	N	58.0	34.0
04382	7	6	6	98.2	86.3
04383	6	7	6	76.4	45.6
04384	7	6	6	67.5	39.7
04385	6	6	6	98.2	98.2
04386	7	7	6	98.2	62.1
04387	6	6	6	98.4	59.1
04388	7	7	7	98.2	60.5
04389	N	N	N	57.5	33.7
00590	7	5	7	93.3	55.6
00591	7	6	7	76.5	45.9
00592A	6	6	5	76.4	45.6
00592B	7	6	6	90.3	53.6
00593	7	7	7	110.9	66.0
00594	6	7	7	86.3	51.6
00595	7	8	6	98.2	60.5
00596	7	4	6	71.4	41.7
00597	7	7	6	96.2	57.5
03175	6	6	6	83.1	49.9
03176	6	5	6	80.5	48.3
03177	6	6	6	80.4	47.6
03178	6	5	6	66.8	40.0
03179	6	5	6	65.5	38.7
03180	7	5	7	93.3	55.6
03181	7	6	6	83.1	49.9
03182	6	6	6	98.2	61.5
03183A	6	8	7	96.0	57.7
03183B	6	8	7	96.0	57.7
03184A	6	7	7	92.3	55.6
03184B	6	8	7	98.2	64.5
03185	6	7	6	71.0	42.7
03186	6	7	6	98.2	59.5
03187	6	6	6	74.4	44.6
03188	6	6	6	91.3	54.6

Source: CTDOT and NBIS
Note: N denotes "Not Applicable"
1 Based on inspection reports, plans and data provided by CTDOT as of January 2010.

Given that corridor bridges were built between 1949 and the early 1980s, with some rehabilitated in the early 1990s, it is highly probable that the bridges will require rehabilitative or reconstruction work to maintain their structural adequacy to 2030. Considering only the physical condition of the bridge structures, the following rehabilitative actions could be required:

- Concrete deck replacement
- Elimination/reduction of deck joints
- New membrane waterproofing and roadway pavement
- Cleaning and painting of structural steel
- Rehabilitation or replacement of bridge bearings
- Rehabilitation of concrete substructure elements

In addition, while some of these bridges have undergone seismic retrofits in the recent past, further analysis is required to determine if they comply with current AASHTO requirements.

2.5 Existing Traffic Operations

The next step in the study process was to evaluate the operations of the study area roadway system. This analysis provides a technical assessment of the operational qualities of the ramps, freeways, weaving sections, and intersections using the procedures documented in the *2000 Highway Capacity Manual* (HCM) during peak traffic demand periods. The traffic analyses were conducted using the 2008 morning and evening peak hour traffic volumes, as previously discussed, 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 Route 8 study area roadways assigns a level of service (LOS) rating for each specific segment, intersection, or area of roadway analyzed. Level of service 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.

The HCM does not present a recommended 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."

2.5.1 Methodology/Criteria

As stated, the criteria used to evaluate the Route 8 roadway capacity were based on the methodology presented in the HCM. The HCM presents various methods for evaluating traffic operations for various types of roadway facilities. The criteria presented in the HCM are based on 50 years of research into traffic operations and traffic flow and are considered by the traffic engineering community as the tool of choice for analyzing traffic operations. The HCM is broken into a number of chapters that evaluate different transportation facilities. Specifically for the Route 8 study, the following chapters were considered in the evaluation of the study area transportation facilities:

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

All of these chapters were used to define the operating conditions for the various traffic conditions experienced along Route 8 and the study area roadways. The following sections provide a summary of the existing conditions for various study area facilities.

2.5.2 Mainline Operations

The procedures for analyzing the operational conditions of the Route 8 mainline are based on analysis procedures presented in Chapter 23 (Basic Freeway Segments) of the HCM. The HCM procedure uses a number of factors, including the traffic volumes on the analysis segment, the number of lanes in the analysis section, the width of those lanes, the percentage of trucks in the traffic stream, the lateral clearance to obstructions alongside the road, the free-flow speed on the analysis segment, the terrain of the segment, and the driver population (primarily commuters, or some mix of recreational and commuter).

Levels of service 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 segment where vehicles are operating at free-flow speeds, vehicle maneuverability is relatively unimpeded, and densities are less than 10 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 is possible with diligence, and densities are between 16 and 24 pc/mi/ln. At LOS E, the freeway segment is operating at capacity, maneuverability is severely restricted, and densities are highly variable due to potential volatility of the congestion but are greater than 37 pc/mi/ln. At LOS F, the traffic volume on the freeway segment exceeds the capacity of that segment.

The results of the freeway segment analysis under existing traffic conditions are summarized in Table 2-13 and illustrated on Figures 2-2 and 2-3 for the existing peak morning and evening peak hour traffic conditions, respectively.

Northbound Freeway Segments

During the morning peak hour, the northbound direction of Route 8 is currently operating at an acceptable level of service C or better on all analyzed segments.

During the evening peak hour, seven of the nine segments studied are experiencing some congestion. The Route 8 segments from Exit 22 to Exit 29 are operating at LOS D. The remaining two segments between Exit 29 and Exit 30 (the two-lane segment and the three-lane segment) are operating at a LOS C or better.

Southbound Freeway Segments

During the morning peak hour, four of the nine southbound segments of Route 8 studied are currently experiencing some congestion. The segments from Exit 22 to Exit 23, Exit 24 to Exit 26 and Exit 27 to Exit 28 are operating at a LOS D. The remaining segments are operating at a LOS C or better.

During the evening peak hour, all southbound segments of Route 8 southbound were found to be operating at LOS C or better with little to no delays along the mainline.

Table 2-13
Summary of Route 8 Freeway Segment Analysis – 2008 Existing Conditions

Segment Description		Terrain	Number of Lanes*	Peak Hour	2008 Volumes (vph)	Density (pc/mi/ln)	Level of Service
Route 8 Northbound							
From	To						
Exit 22	Exit 23	Level	2	AM	1540	12.2	B
				PM	3630	31.6	D
Exit 23	Exit 24	Level	2	AM	1360	10.8	A
				PM	3240	26.7	D
Exit 24	Exit 25	Rolling	2	AM	1670	13.4	B
				PM	3590	34.7	D
Exit 25	Exit 26	Rolling	2	AM	1660	13.9	B
				PM	3290	30.0	D
Exit 26	Exit 27	Rolling	2	AM	1830	15.8	B
				PM	3190	29.1	D
Exit 27	Exit 28	Rolling	2	AM	2130	18.4	C
				PM	3490	33.6	D
Exit 28	Exit 29	Rolling	2	AM	2330	20.1	C
				PM	3300	30.6	D
Exit 29	Exit 30	Rolling	2 Lane Segment	AM	2150	17.3	B
				PM	3030	25.9	C
Exit 29	Exit 30	Rolling	3 Lane Segment	AM	2150	11.5	B
				PM	3030	16.3	B
Route 8 Southbound							
Exit 30	Exit 29	Rolling	3 Lane Segment	AM	2600	14.3	B
				PM	2650	14.6	B
Exit 30	Exit 29	Rolling	2 Lane Segment	AM	2600	21.7	C
				PM	2650	22.2	C
Exit 29	Exit 28	Rolling	2	AM	2920	25.1	C
				PM	2870	24.5	C
Exit 28	Exit 27	Rolling	2	AM	3320	29.9	D
				PM	2890	24.2	C
Exit 27	Exit 26	Rolling	2	AM	2930	25.9	C
				PM	2330	20.1	C
Exit 26	Exit 25	Rolling	2	AM	3210	29.3	D
				PM	2330	20.1	C
Exit 25	Exit 24	Rolling	2	AM	3540	34.5	D
				PM	2210	19.0	C
Exit 24	Exit 23	Level	2	AM	3200	25.7	C
				PM	1840	14.2	B
Exit 23	Exit 22	Level	2	AM	3590	31.3	D
				PM	2080	16.7	B

Source: VHB Inc. and CTDOT
vph Vehicles per hour
Density is expressed in passenger vehicles/hour/lane.

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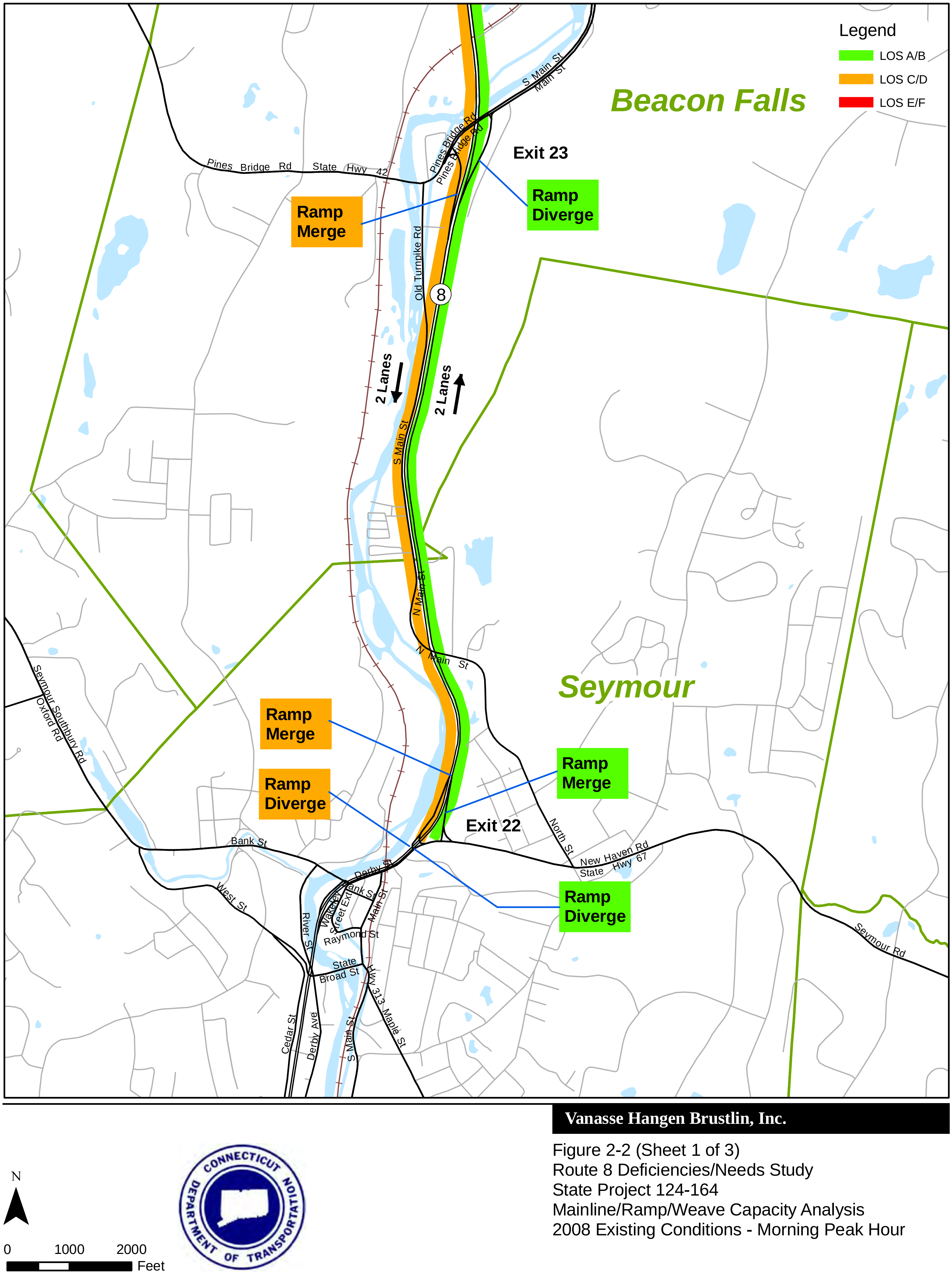

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Figure 2-2 (Sheet 1 of 3)
Route 8 Deficiencies/Needs Study
State Project 124-164
Mainline/Ramp/Weave Capacity Analysis
2008 Existing Conditions - Morning Peak Hour

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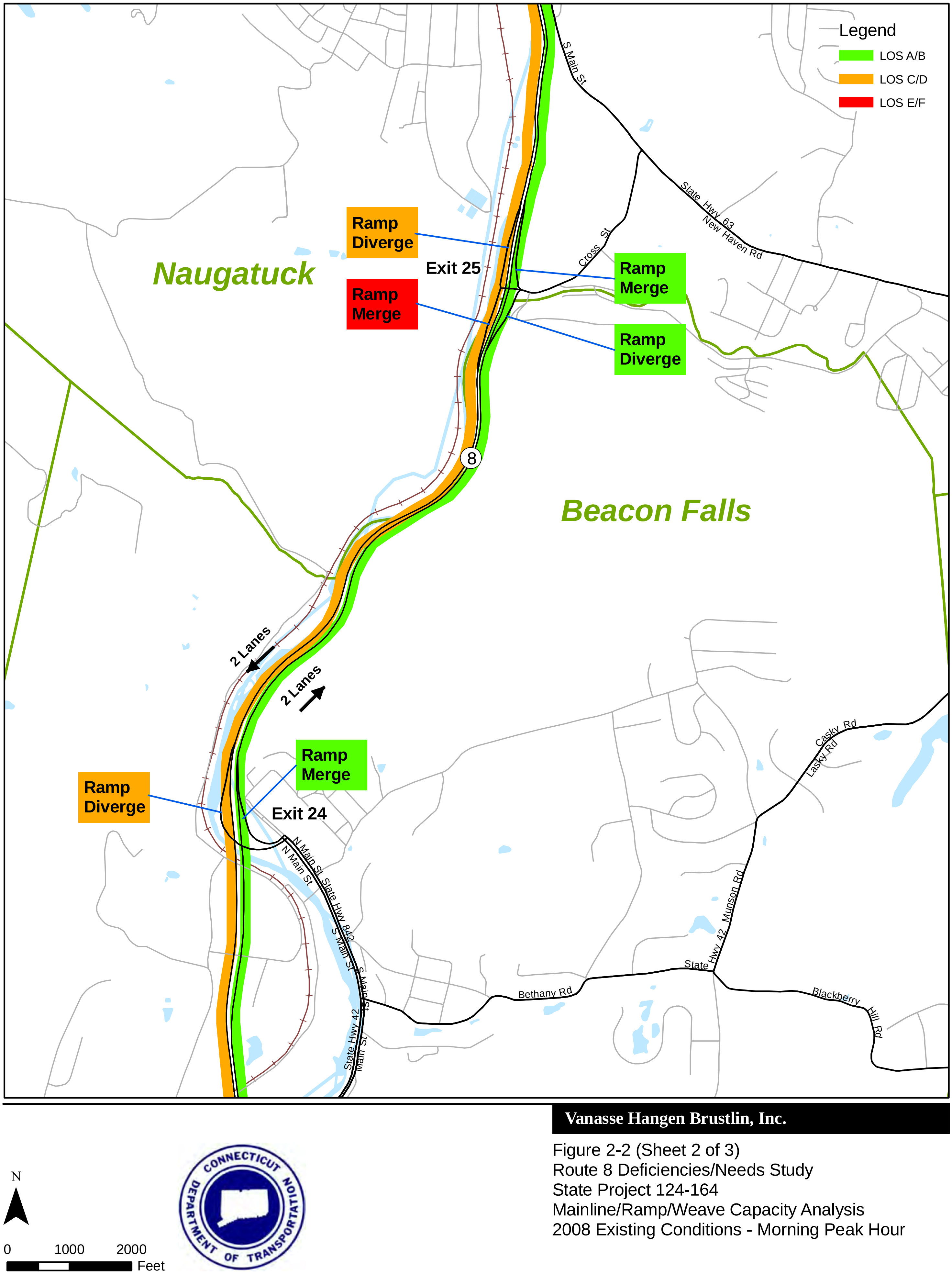

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Figure 2-2 (Sheet 2 of 3)
Route 8 Deficiencies/Needs Study
State Project 124-164
Mainline/Ramp/Weave Capacity Analysis
2008 Existing Conditions - Morning Peak Hour

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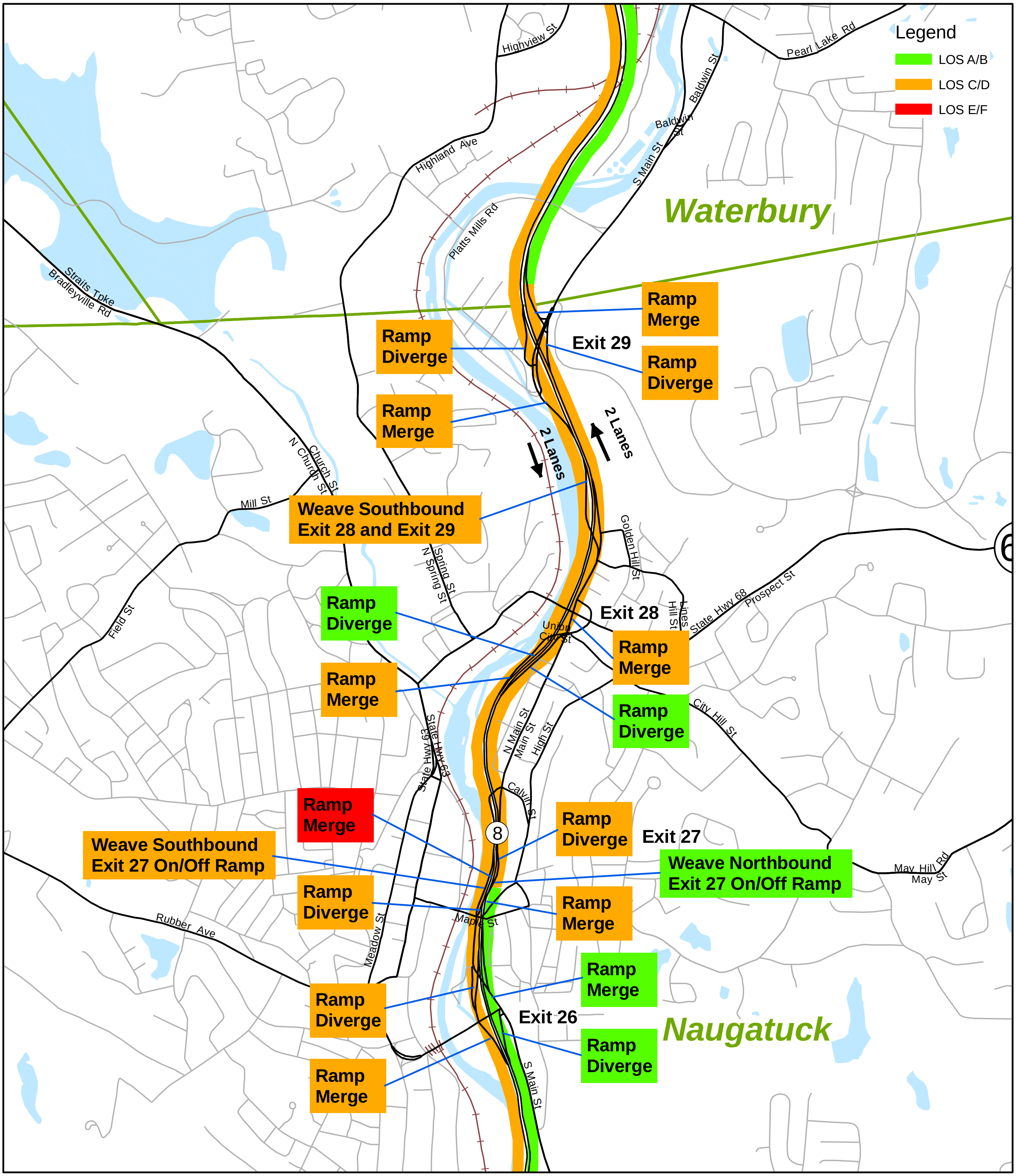

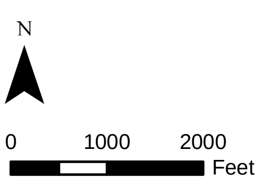

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Figure 2-2 (Sheet 3 of 3)
Route 8 Deficiencies/Needs Study
State Project 124-164
Mainline/Ramp/Weave Capacity Analysis
2008 Existing Conditions - Morning Peak Hour

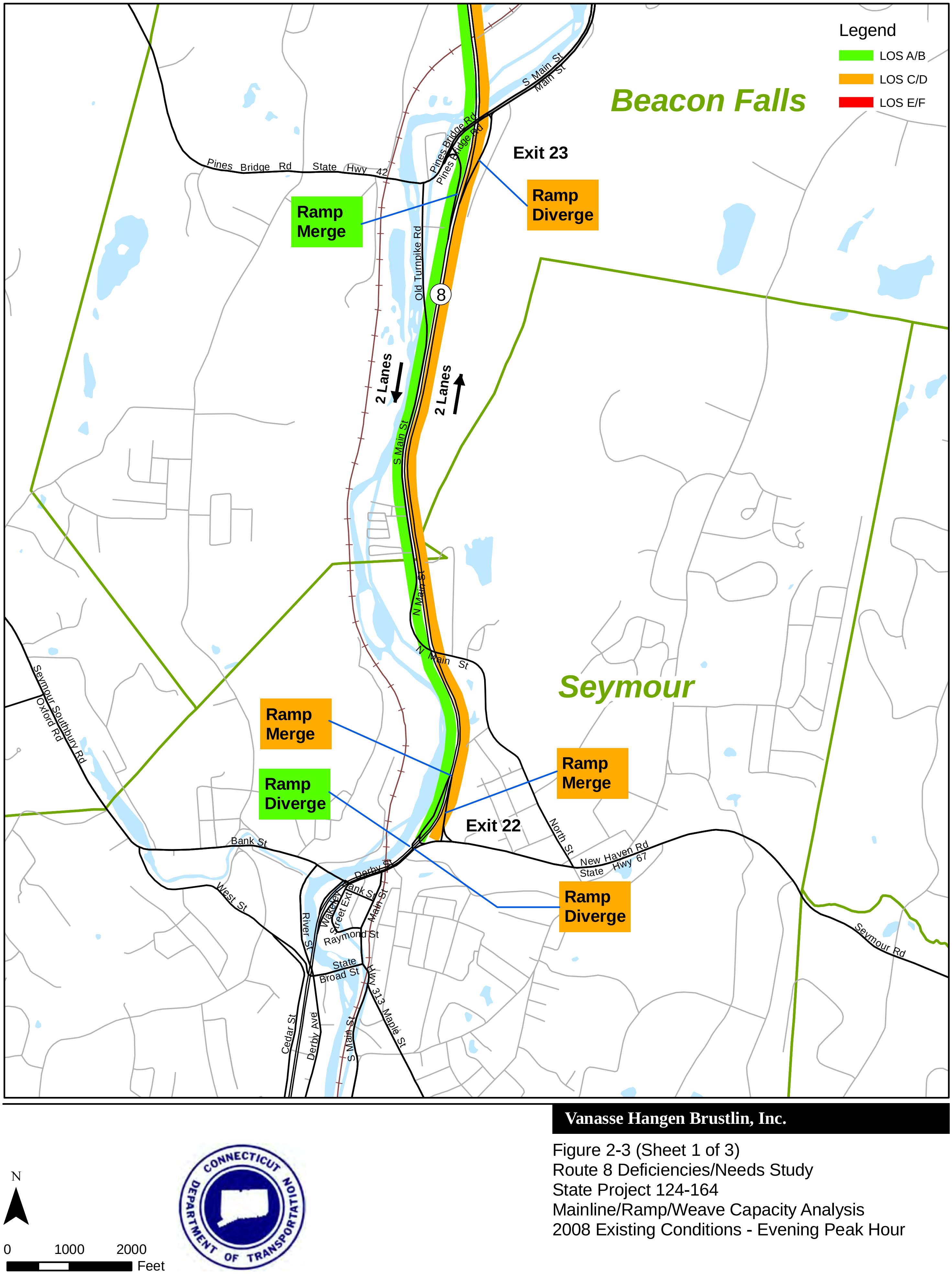

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Figure 2-3 (Sheet 1 of 3)
Route 8 Deficiencies/Needs Study
State Project 124-164
Mainline/Ramp/Weave Capacity Analysis
2008 Existing Conditions - Evening Peak Hour

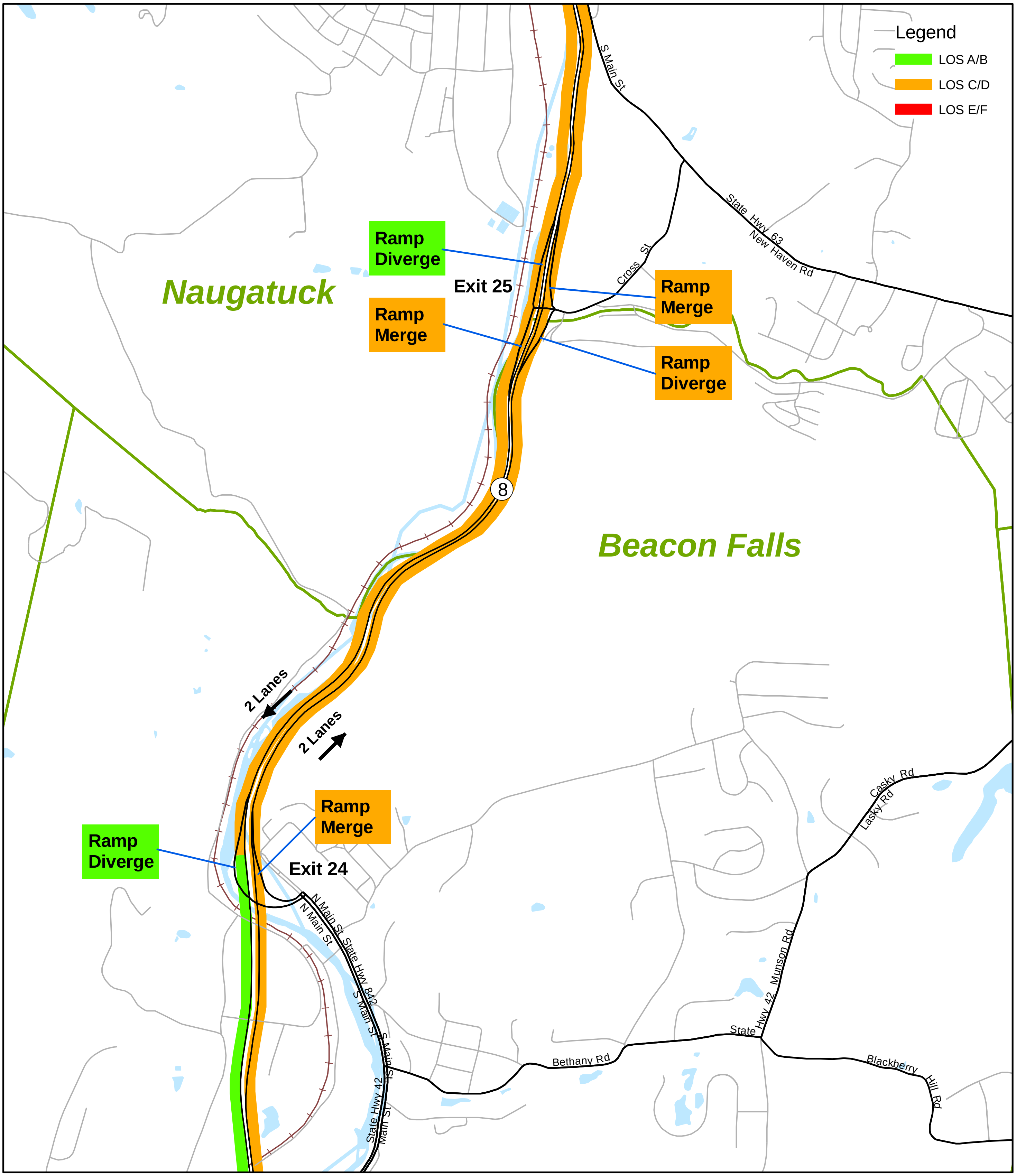

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Figure 2-3 (Sheet 2 of 3)
Route 8 Deficiencies/Needs Study
State Project 124-164
Mainline/Ramp/Weave Capacity Analysis
2008 Existing Conditions - Evening Peak Hour

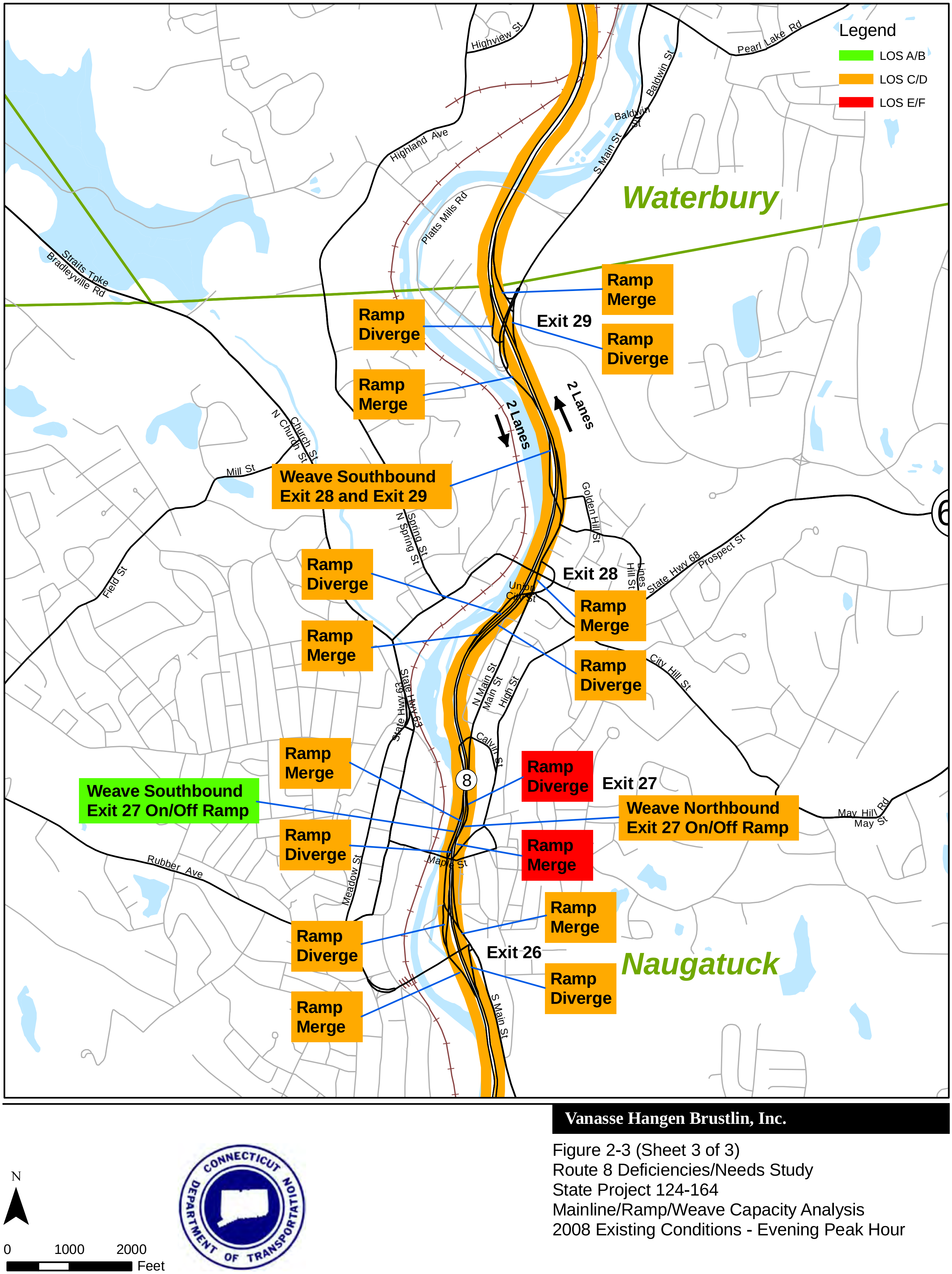

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Figure 2-3 (Sheet 3 of 3)
Route 8 Deficiencies/Needs Study
State Project 124-164
Mainline/Ramp/Weave Capacity Analysis
2008 Existing Conditions - Evening Peak Hour

2.5.3 Ramp Operations

The procedures for analyzing the operational conditions of highway ramps are based on the analysis procedures outlined in Chapter 25 of the HCM. The procedures focus on the interaction between freeway mainline through traffic and merging and diverging traffic to / from the ramps. These analyses consider a number of factors including the length and taper of acceleration/deceleration lanes, free-flow vehicle speeds along the freeway, and sight distances. 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 lane (in the case of a right side exit) in order to exit the freeway. This action causes some turbulence to the overall traffic stream as vehicles shift lanes and slow their speed in preparation for the off-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 approximately 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 represent 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.

While often confused, it is also important to note that ramp analyses do not evaluate the weaving conditions created by ramp operations along many freeway exits. For example, the ramp analysis does not evaluate the factors involved where an on-ramp is immediately followed downstream by an off-ramp (such as Route 8 northbound at Exit 27). This condition is evaluated as part of the weaving analysis presented later in this report. All ramps analyzed were right side ramps. The results of the Route 8 ramp analyses are shown in Table 2-14 and are also summarized in Figures 2-2 and 2-3.

Table 2-14
Route 8 Ramp Level of Service Analysis Summary – 2008 Existing Conditions

	Northbound Ramps									Southbound Ramps							
	Weekday Morning Peak Hour				Weekday Evening Peak Hour					Weekday Morning Peak Hour				Weekday Evening Peak Hour			
	Ramp Volume (vph)	Speed	Density	LOS	Ramp Volume (vph)	Speed	Density	LOS		Ramp Volume (vph)	Speed	Density	LOS	Ramp Volume (vph)	Speed	Density	LOS
Exit 22 on-ramp	350	62	15.0	B	650	56	33.1	D	Exit 22 on-ramp	490	60	26.0	C	550	61	20.2	C
Exit 22 off-ramp	420	57	11.3	B	710	56	28.6	D	Exit 22 off-ramp	600	56	28.6	D	500	57	15.0	B
Exit 23 off-ramp	180	58	12.7	B	390	57	30.8	D	Exit 23 on-ramp	390	56	32.1	D	240	61	19.0	B
Exit 24 on-ramp	310	61	16.9	B	350	54	34.9	D	Exit 24 off-ramp	340	57	31.8	D	370	57	17.7	B
Exit 25 on-ramp	130	62	16.4	B	200	57	31.7	D	**Exit 25 on-ramp**	470	55	35.1	E	200	60	22.9	C
Exit 25 off-ramp	140	58	15.6	B	500	57	31.8	D	Exit 25 off-ramp	140	58	27.6	C	320	57	17.3	B
Exit 26 on-ramp	410	61	17.8	B	460	58	29.7	D	Exit 26 on-ramp	510	58	28.9	D	340	61	21.3	C
Exit 26 off-ramp	240	57	13.4	B	560	57	26.1	C	Exit 26 off-ramp	230	57	27.0	C	340	57	20.1	C
Exit 27 on-ramp	350	60	24.0	C*	430	53	>35	E*	**Exit 27 on-ramp**	80	55	>35	E*	70	58	31.4	D*
Exit 27 off-ramp	50	58	24.14	C*	130	58	>35	E*	Exit 27 off-ramp	470	57	32.0	D*	630	56	25.8	C*
Exit 28 on-ramp	500	60	23.9	C	380	56	33.1	D	Exit 28 on-ramp	620	58	30.1	D	520	60	26.4	C
Exit 28 off-ramp	300	57	18.6	B	570	56	29.1	D	Exit 28 off-ramp	220	57	25.5	B*	500	57	22.3	C*
Exit 29 on-ramp	180	61	22.6	C	240	58	30.8	D	Exit 29 on-ramp	520	59	29.0	D*	380	59	28.7	D*
Exit 29 off-ramp	360	57	20.6	C	510	57	29.1	D	Exit 29 off-ramp	200	57	23.0	C	160	57	24.0	C

Note: Boldface ramps indicate locations where ramp is currently operating at LOS E during one or both peak hours.
* Capacity of this segment of Route 8 is affected by the weaving condition that is present (see Table 2-10 and the related discussion).
a Speed is expressed in miles per hour
b Density is expressed in passenger vehicles/hour/lane
c LOS -- Level of service

Route 8 Northbound Ramps

During the morning peak hour, the on and off-ramps along the northbound direction of Route 8 are generally operating at acceptable levels throughout the study corridor. All 14 of the analyzed ramps are operating at a LOS C or better. As mentioned, traffic is not as significant in the northbound direction in the morning as it is during the evening peak hour.

During the evening peak hour, 13 of the 14 ramp termini analyzed are operating under congested conditions (LOS D or E). In particular, the ramps at Exit 27 along northbound Route 8 are operating at a LOS E. There are no ramps operating at a LOS F. It should be noted that the Exit 27 ramps also create a weaving segment that is further analyzed in Table 2-15. Discussions with local officials confirm that the ramps at these locations typically consist of difficult merging and diverging conditions during the evening peak hours with occasional queuing occurring on the on-ramp during the evening peak period. Additionally, the ramps at Exits 22, 23, 24, 25, 26 (on-ramp), 28 and 29 are operating at LOS D under evening peak conditions and occasional queuing conditions occur during these time periods. The Exit 26 off-ramp operates at a LOS C.

Route 8 Southbound Ramps

During the morning peak hour, 9 of the 14 ramp termini analyzed are operating under congested conditions (LOS D or E). During the evening peak hour, 2 of the 14 ramp terminals (Exits 27 and 29) analyzed are operating under congested conditions (LOS D). The remaining ramps operate at LOS C or better.

During the evening peak hour, 2 of the 14 ramp termini analyzed are operating under congested conditions. The on-ramps at Exits 27 and 29 along southbound Route 8 are operating at a LOS D. The remaining Route 8 ramps operate at a LOS C or better.

2.5.4 Weaves

The procedure for analyzing the operational conditions of interchange ramps is based on analysis procedures presented in Chapter 24 (Weaving Areas) of the HCM. A weaving movement is defined as the interaction between the crossing of two or more traffic streams traveling in the same direction without the aid of traffic control devices. There are several weaving areas along Route 8 that require a significant amount of driver awareness as vehicles are simultaneously accelerating into the mainline freeway from the on-ramp while other vehicles are decelerating from the mainline freeway to the off-ramp.

The HCM procedure 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 a merge area is closely followed by a diverge area, or when an on-ramp is closely followed by 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.

The traffic volumes in the weaving section (weaving and non-weaving), the length and configuration of the section, and free-flow vehicle speeds are the critical inputs used to arrive at the LOS of the weaving section. LOS is reported jointly for weaving vs. non-weaving vehicles; however, it is acknowledged that in some scenarios non-weaving vehicles may achieve higher quality levels of operations than weaving vehicles.

The three study area locations where weaving conditions are experienced along Route 8 are discussed in detail below.

- ***Route 8 Northbound between Exit 27 on-ramp and the Exit 27 off-ramp*** – This weave is created when traffic destined for the Exit 27 off-ramp traveling northbound on Route 8 conflicts with the traffic entering Route 8 from the Exit 27 on-ramp. The traffic entering the Route 8 mainline from Exit 27 does so in one lane. The short distance between the Exit 27 on-ramp and off-ramp exacerbates this condition by limiting the distance for all weaving vehicles to maneuver. Additionally, the high volume of traffic entering the Route 8 mainline from Exit 27, particularly during the evening peak period (approximately 430 evening peak hour vehicles) creates a difficult weaving condition for the Exit 27 off-ramp traffic (130 vehicles during the evening peak hour).
- ***Route 8 Southbound between Exit 27 on-ramp and the Exit 27 off-ramp*** – This weave is created when traffic destined for the Route 8 southbound Exit 27 off-ramp conflicts with the traffic entering Route 8 from the Exit 27 on-ramp. Again, the short distance between the Exit 27 on-ramp and off-ramp magnifies the weaving condition by limiting the maneuvering distance for all weaving vehicles.
- ***Route 8 Southbound between Exit 28 and Exit 29*** – This weave is created when traffic originating from the Route 8 Southbound Exit 29 on-ramp attempts to merge with mainline Route 8 traffic and conflicts with traffic attempting to exit Route 8 via the Exit 28 off-ramp.

The results of these analyses are shown in Table 2-15 and Figures 2-2 and 2-3.

In the morning, all weaves analyzed operate at LOS C or better. In the evening, the northbound weave section at Exit 27 operates at a LOS D with congestion noted. The southbound weave sections operate at LOS C or better during the evening peak period.

Table 2-15
Route 8 Weaving Sections Level of Service Analysis Summary
2008 Existing Conditions

Weave Location	Number of Lane Changes for Weaving Traffic	Weekday Morning Peak Hour		Weekday Evening Peak Hour	
		Density*	LOS**	Density	LOS
Route 8 NB Between Exit 27 On Ramp and Exit 27 Off Ramp	1	18.3	B	33.7	D
Route 8 SB Between Exit 27 On Ramp and Exit 27 Off Ramp	1	26.7	C	23.9	B
Route 8 SB Between Exits 28 and 29	1	26.5	C	25.9	C

* Density is expressed in passenger vehicles/hour/lane.
** LOS – Level of Service.

2.5.5 Intersections

The procedures for analyzing the operational conditions of signalized and unsignalized intersections are based on analysis procedures presented in Chapter 16 (Signalized Intersections) and Chapter 17 (Unsignalized Intersections) of the HCM. Level of service designation is reported differently for signalized and unsignalized intersections.

For signalized intersections, level of service is defined in terms of delay, which is a measure of driver discomfort and frustration, fuel consumption, and lost travel time. Specifically, level of service criteria are stated in terms of the average control delay per vehicle for a 15-minute analysis period.

For unsignalized intersections, the analysis 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 main street 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 movements from the side street. The level of service for each movement is calculated by determining the number of gaps that are available in the conflicting traffic stream. Based upon 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 additional intersections within the study area that are adjacent to the Route 8 mainline and potentially impacted by traffic entering onto or exiting from Route 8.

The results of the intersection analysis under existing traffic volume conditions are summarized in Table 2-16 for signalized intersections and Table 2-17 for unsignalized locations. Figures 2-4 and 2-5 present graphical representatives of signalized intersection analyses. The tables and figures locate the intersections within the study area that were evaluated and show the existing AM and PM peak hour levels of service. The following paragraphs summarize the locations that are operating at saturated levels (LOS E or LOS F):

Signalized Intersections

- At Exit 22, the intersection of Route 67 with Route 115 is operating at a LOS E during the PM peak hour.
- At Exit 26, the intersection of the northbound Route 8 ramps, SR 709 and Route 63 is operating at a LOS F during the AM peak hour.
- At Exit 28, the intersection of Route 68 and SR 723 is operating at a LOS E during the PM peak hour.

Unsignalized Intersections

- At Exit 22, the eastbound approach of the intersection of the northbound off-ramp with Wakeley Street is operating at a LOS F during the PM peak hour. Operation can further be impacted by Wakeley Street operations approaching the signalized intersection at Bank Street.

Table 2-16
Signalized Intersection Level of Service Summary
2008 Existing Conditions

Signalized Intersections	Time Period	2008 Existing Conditions		
		LOS*	V/C**	Delay***
Exit 22 SB Off Ramp at Route 67	Morning Peak Hour	B	0.76	16.9
	Evening Peak Hour	C	0.94	26.9
Route 67 at Exit 22 SB On Ramp	Morning Peak Hour	B	0.49	12.9
	Evening Peak Hour	B	0.68	18.6
Route 67 at Route 115	Morning Peak Hour	C	0.66	23.4
	Evening Peak Hour	E	0.91	76.0
Route 313 at Pearl Street	Morning Peak Hour	B	0.67	15.3
	Evening Peak Hour	B	0.56	13.1
Route 313 (Broad Street) at Route 115	Morning Peak Hour	B	0.42	11.0
	Evening Peak Hour	B	0.69	15.8
Route 313 at West Street	Morning Peak Hour	B	0.75	15.2
	Evening Peak Hour	C	0.93	33.6
Exit 23 NB Off Ramp at Route 42	Morning Peak Hour	A	0.58	6.5
	Evening Peak Hour	A	0.42	7.2
Route 42 (South Main Street) at Route 42 (Bethany Road)	Morning Peak Hour	B	0.37	15.5
	Evening Peak Hour	B	0.44	12.0
Route 63 at Cross Street	Morning Peak Hour	B	0.41	11.1
	Evening Peak Hour	B	0.62	13.7
Exit 26 NB Off Ramp at SR 709	Morning Peak Hour	C	0.75	25.7
	Evening Peak Hour	F	1.01	>80
Exit 26 SB Off Ramp at Route 63	Morning Peak Hour	A	0.37	9.5
	Evening Peak Hour	A	0.39	9.3
Exit 27 SB Off Ramp/NB On Ramp at Maple Street	Morning Peak Hour	C	0.60	24.4
	Evening Peak Hour	D	0.89	43.9
Exit 28 NB Off/SB On Ramp at SR 710	Morning Peak Hour	B	0.72	16.9
	Evening Peak Hour	C	0.85	25.5
Route 68 at SR 723	Morning Peak Hour	D	1.02	37.8
	Evening Peak Hour	E	1.18	63.8
SR 847 at Platts Mill Road	Morning Peak Hour	A	0.23	7.4
	Evening Peak Hour	A	0.31	7.6
SR 847 at Sheridan Road	Morning Peak Hour	A	0.27	5.9
	Evening Peak Hour	A	0.29	6.7

Source: Vanasse Hangen Brustlin, Inc.
Note: Boldface intersections operate at LOS E or F during one or both peak periods.
* Level of Service
** Volume to Capacity Ratio
*** Delay = Average control delay to all vehicles entering the intersection in seconds / vehicle.

Table 2-17
Unsignalized Intersection Level of Service Summary
2008 Existing Conditions

Unsignalized Intersections	Time Period	2008 Existing Conditions Demand*	Delay**	LOS***
Exit 22 NB On Ramp at Route 67	Morning			
	-- Eastbound	1090	5.5	A
	Evening			
	-- Eastbound	1360	11.8	B
Route 115 at Route 313 (Maple Street)	Morning			
	-- Southbound	750	7.9	A
	-- Northwestbound	230	10.9	B
	Evening			
	-- Southbound	610	6.3	A
	-- Northwestbound	440	17.1	C
Exit 22 NB Off Ramp at Wakeley Street	Morning			
	-- Southbound	80	3.8	A
	-- Eastbound	420	15.5	C
	-- Westbound	40	9.4	A
	Evening			
	-- Southbound	100	3.8	A
	-- Eastbound	710	>50	F
	-- Westbound	50	10.8	B
Exit 22 SB Off-Ramp at Route 67	Morning			
	-- Eastbound	300	21.8	C
	Evening			
	-- Eastbound	320	31.2	D
Exit 23 SB On Ramp at Route 42	Morning			
	-- Southwestbound Left	280	8.5	A
	-- Southeastbound	0	0	A
	Evening			
	-- Southwestbound Left	160	8.7	A
	-- Southeastbound	0	0.0	A
South Main Street at Depot Street	Morning			
	-- Northbound	153	3.1	A
	-- Northeastbound	60	14.2	B
	Evening			
	-- Northbound	220	2.2	A
	-- Northeastbound	130	15.4	C
Exit 24 NB On/SB Off Ramp at North Main Street	Morning			
	-- Northwestbound	297	7.6	A
	-- Eastbound	340	12.5	B
	Evening			
	-- Northwestbound	340	7.6	A
	-- Eastbound	370	13.4	B

Table 2-17 (Cont'd.)
Unsignalized Intersection Level of Service Summary
2008 Existing Conditions

		2008 Existing Conditions		
Unsignalized Intersections	Time Period	Demand*	Delay**	LOS***
Exit 25 SB Ramps at Cross Street	Morning			
	-- Southbound	140	9.6	A
	-- Westbound	470	13.9	B
	Evening			
	-- Southbound	320	10.9	B
	-- Westbound	200	9.8	A
Exit 25 NB Ramps at Cross Street	Morning			
	-- Northbound	140	9.7	A
	Evening			
	-- Northbound	500	20.5	C
SR 709 at Hotchkiss Street	Morning			
	-- Northbound	260	0.7	A
	-- Eastbound	40	11.2	B
	Evening			
	-- Northbound	440	1.1	A
	-- Eastbound	80	13.9	B
Exit 26 NB On Ramp at SR 709	Morning			
	-- Northwestbound	670	0.0	A
	-- Southbound	190	0.0	A
	Evening			
	-- Northwestbound	900	0.0	A
	-- Southbound	250	0.0	A
Exit 27 Ramps at North Main Street	Morning			
	-- Eastbound	0	0.0	A
	-- Westbound	40	9.3	A
	Evening			
	-- Eastbound	10	10.9	B
	-- Westbound	40	10.2	B
SR 723 at SR 710†	Morning			
	-- Northbound	180	10.3	B
	-- Southbound	330	13.2	B
	-- Westbound	380	12.4	B
	Evening			
	-- Northbound	170	10.8	B
	-- Southbound	600	33.8	D
	-- Westbound	320	13.3	B
Exit 28 SB Off Ramp at SR 710	Morning			
	-- Northbound	500	15.3	C
	-- Southbound	70	8.6	A
	-- Southeastbound	220	9.6	A
	Evening			
	-- Northbound	370	14.4	B
	-- Southbound	70	9.5	A
	-- Southeastbound	500	15.0	C

Table 2-17 (Cont'd.)
Unsignalized Intersection Level of Service Summary
2008 Existing Conditions

Unsignalized Intersections	Time Period	2008 Existing Conditions Demand*	Delay**	LOS***
Exit 29 SB On Ramp at SR 847	Morning			
	-- Eastbound Left	200	13.2	B
	Evening			
	-- Eastbound Left	100	11.6	B
Exit 29 SB Off Ramp at SR 847	Morning			
	-- Eastbound	200	13.9	B
	Evening			
	-- Eastbound	160	13.1	B
Exit 29 NB On Ramp at SR 847†	Morning			
	-- Northbound	200	1.8	A
	-- Northwestbound	50	14.8	B
	-- Northwestbound Right	310	11.6	B
	Evening			
	-- Northbound	150	2.3	A
	-- Northwestbound	70	14.5	B
	-- Northwestbound Right	440	12.4	B

Note: Boldface intersections operate at LOS E or F during one or both peak periods
† Flashing beacon signalized intersection analyzed as stop-controlled.
* Demand in vehicles per hour.
** Delay = Average control delay in seconds per vehicle.
*** Level of Service.

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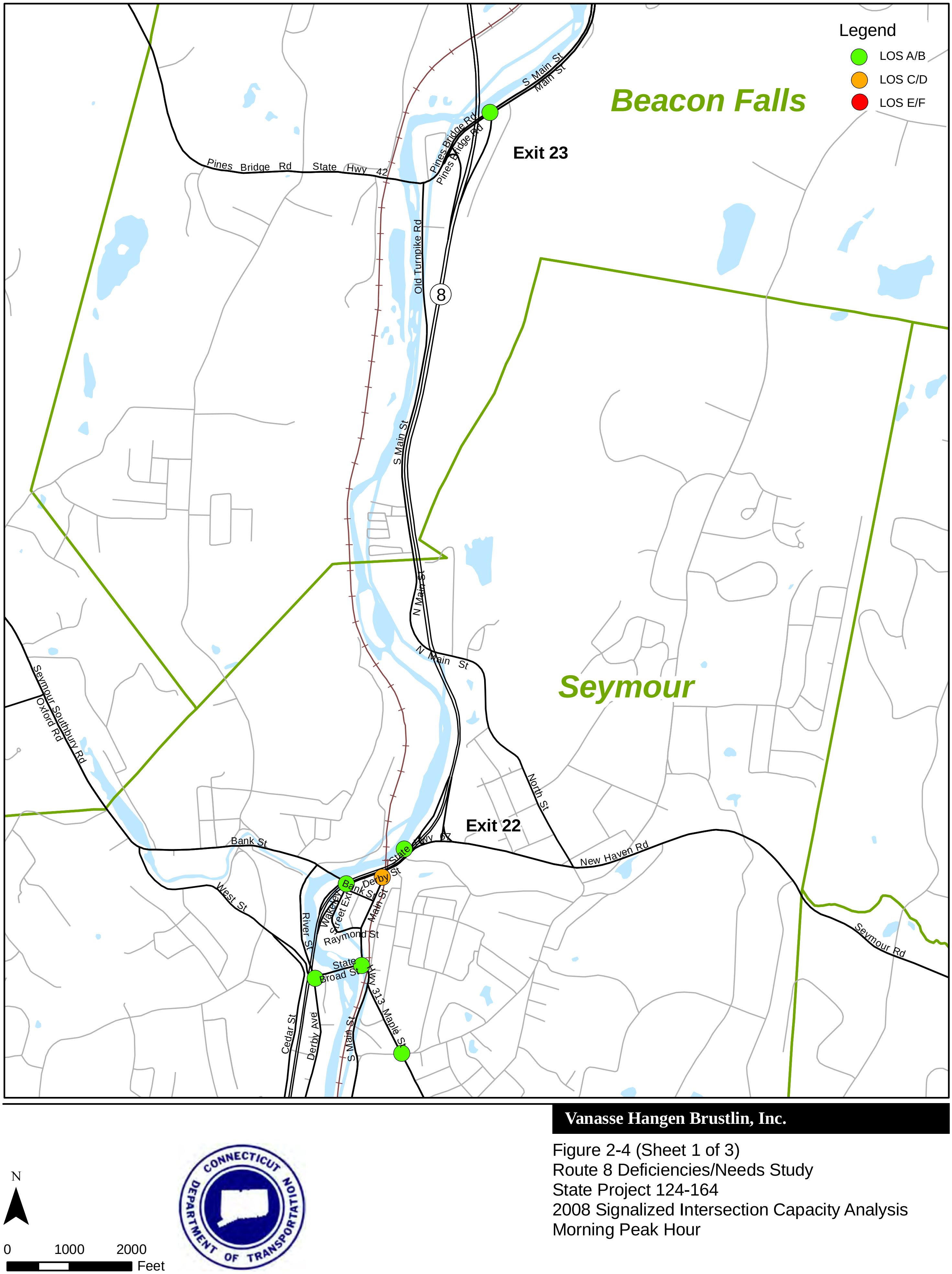

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Figure 2-4 (Sheet 1 of 3)
Route 8 Deficiencies/Needs Study
State Project 124-164
2008 Signalized Intersection Capacity Analysis
Morning Peak Hour

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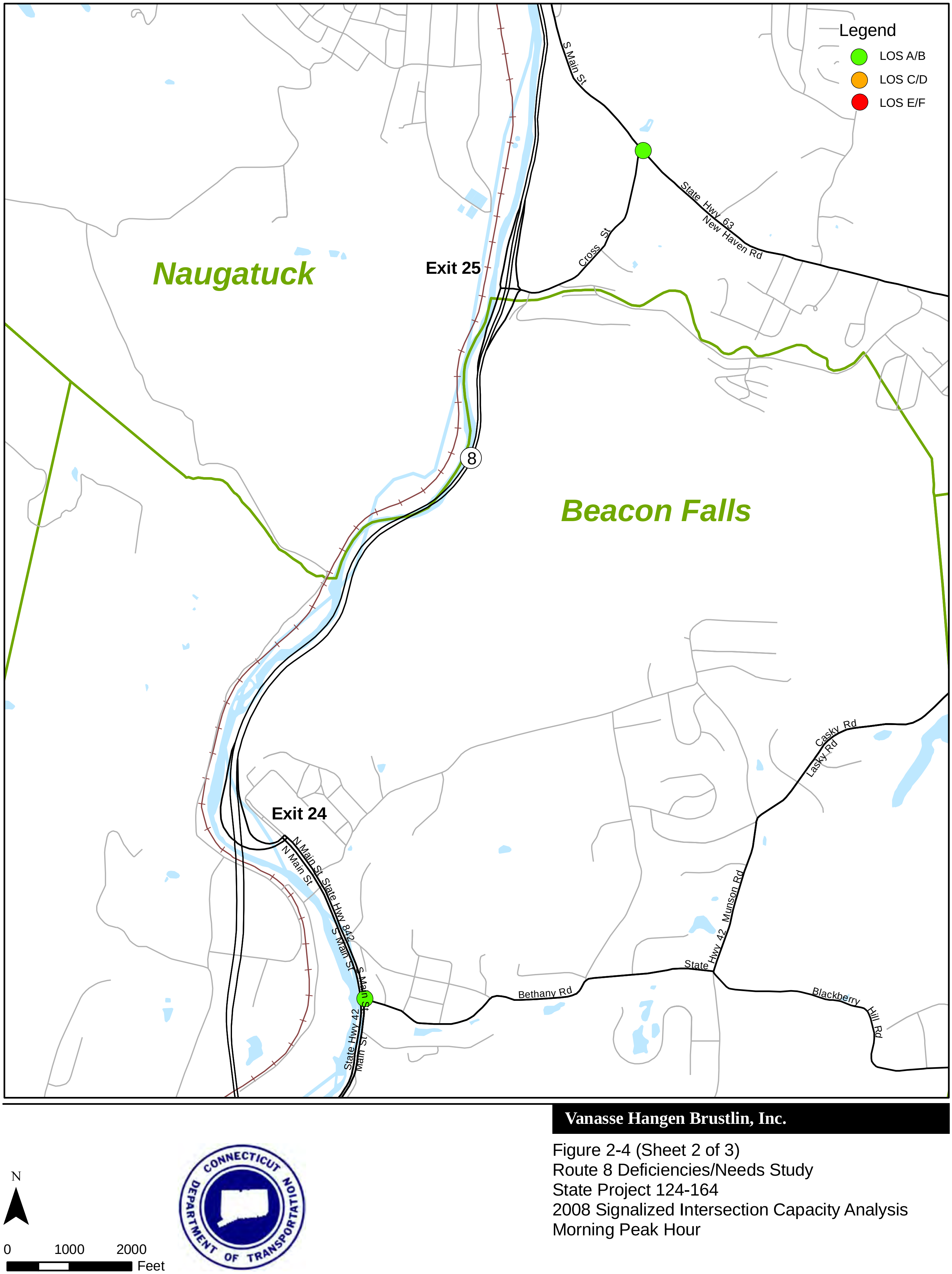

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Figure 2-4 (Sheet 2 of 3)
Route 8 Deficiencies/Needs Study
State Project 124-164
2008 Signalized Intersection Capacity Analysis
Morning Peak Hour

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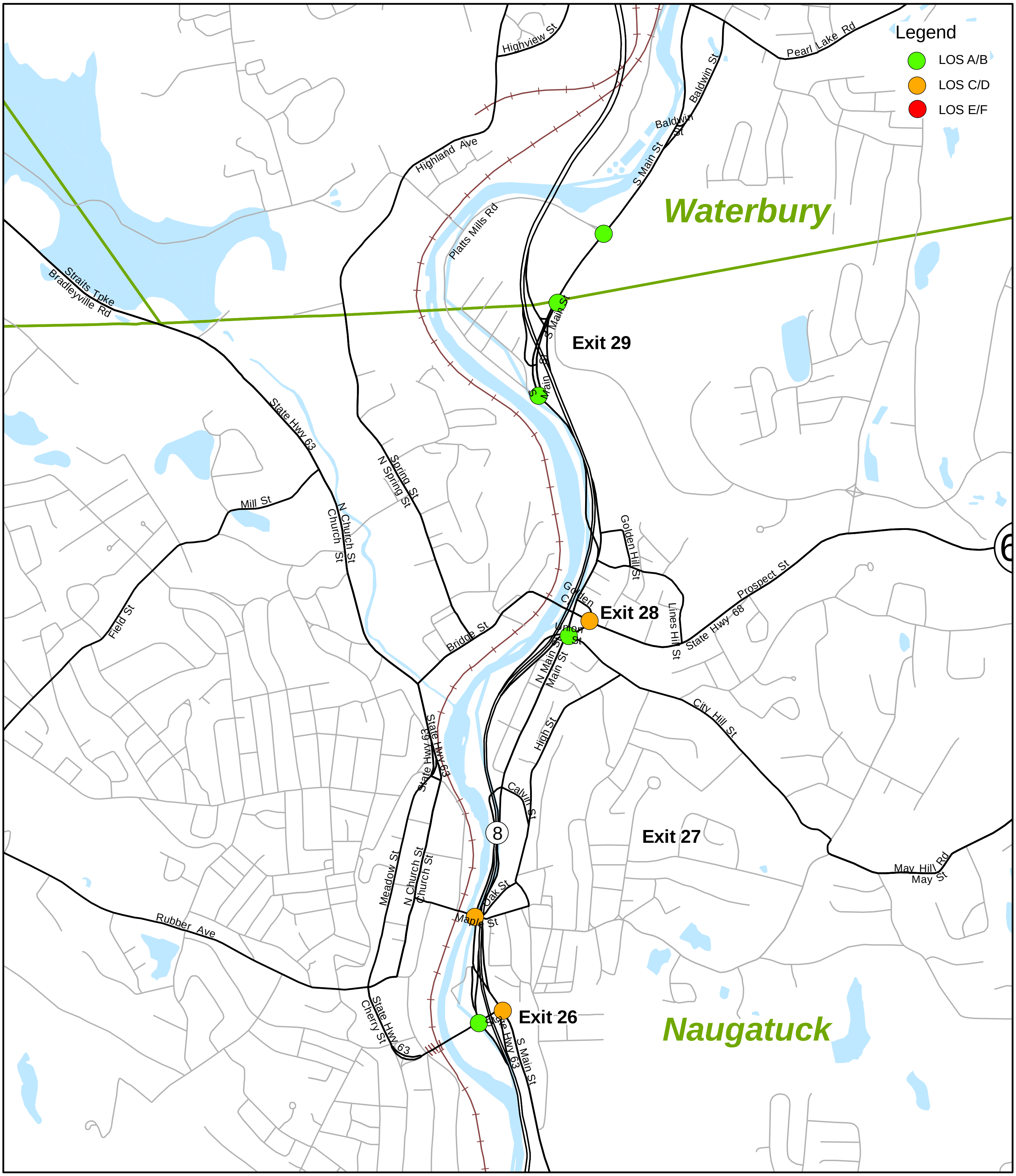

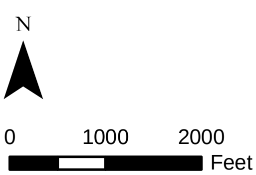

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Figure 2-4 (Sheet 3 of 3)
Route 8 Deficiencies/Needs Study
State Project 124-164
2008 Signalized Intersection Capacity Analysis
Morning Peak Hour

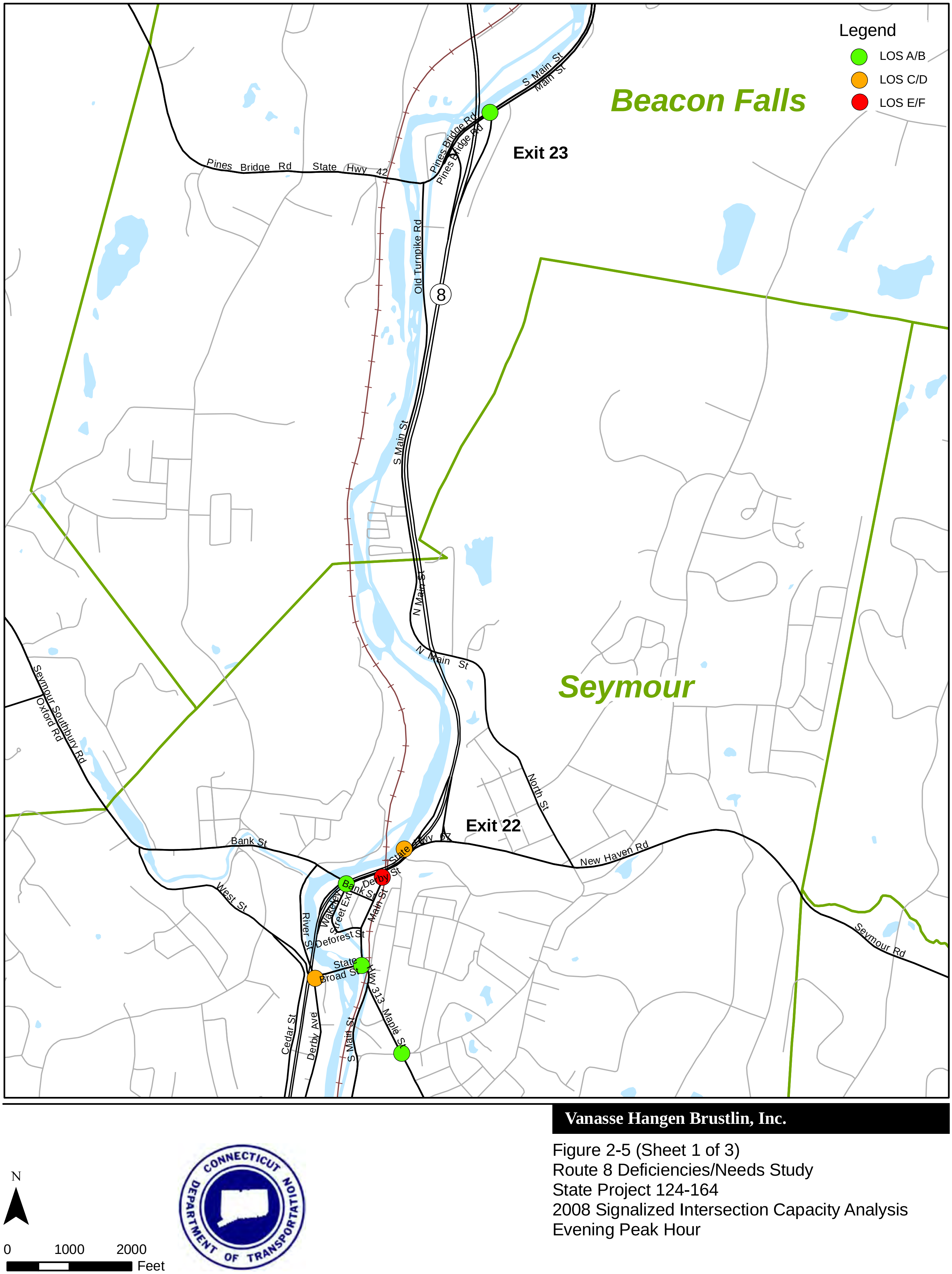

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Figure 2-5 (Sheet 1 of 3)
Route 8 Deficiencies/Needs Study
State Project 124-164
2008 Signalized Intersection Capacity Analysis
Evening Peak Hour

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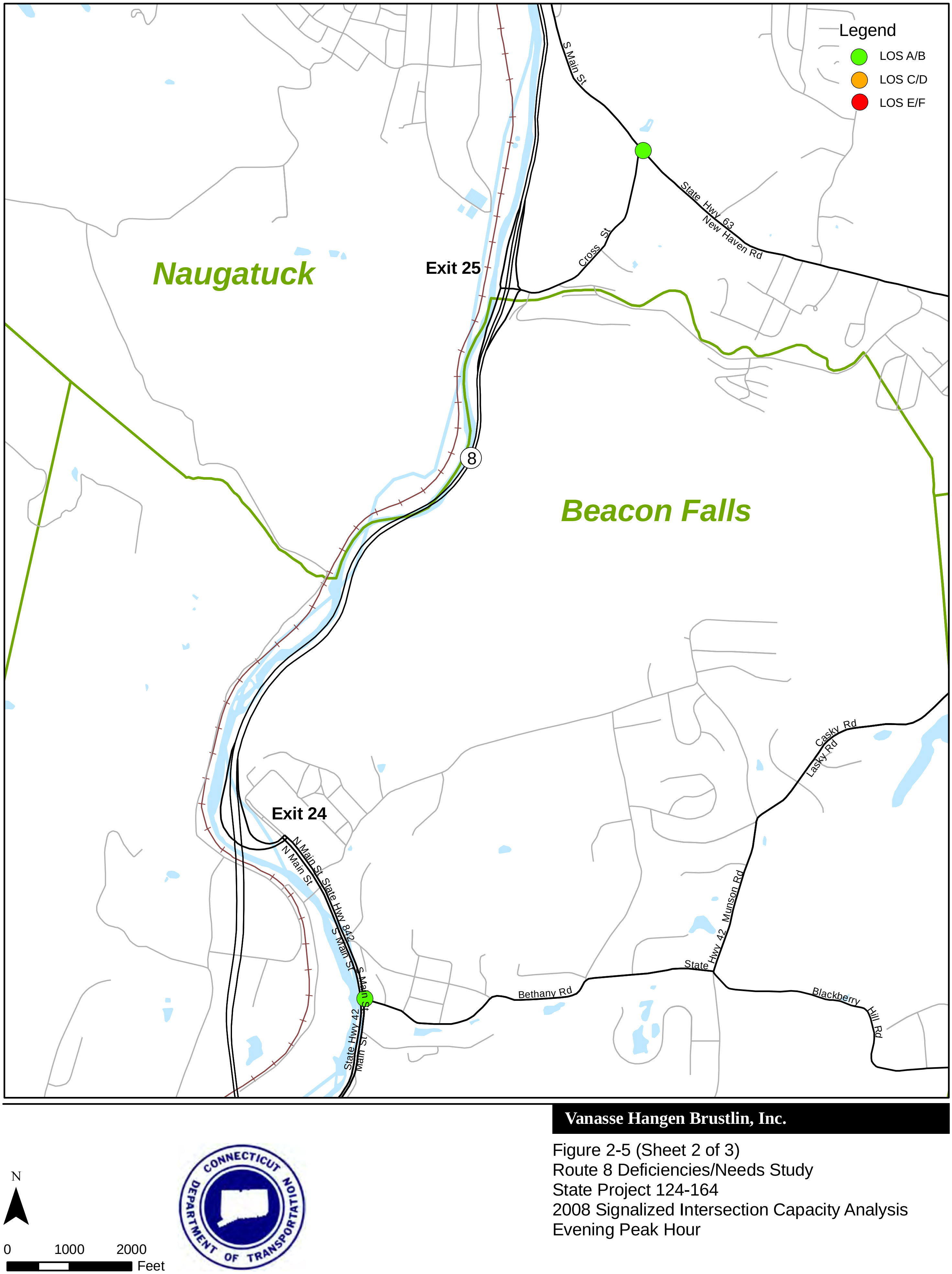

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Figure 2-5 (Sheet 2 of 3)
Route 8 Deficiencies/Needs Study
State Project 124-164
2008 Signalized Intersection Capacity Analysis
Evening Peak Hour

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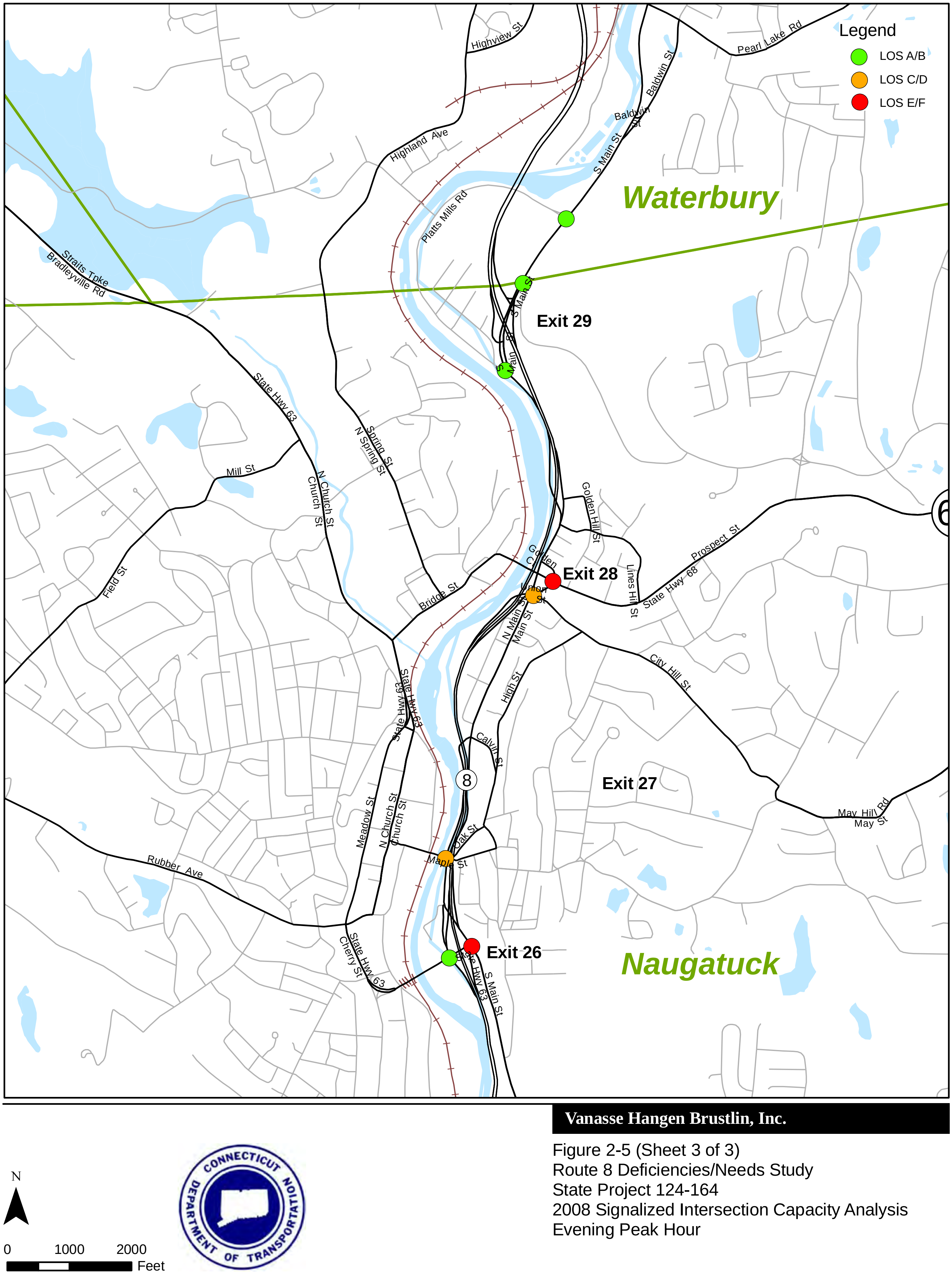

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Figure 2-5 (Sheet 3 of 3)
Route 8 Deficiencies/Needs Study
State Project 124-164
2008 Signalized Intersection Capacity Analysis
Evening Peak Hour

2.6 Safety Analysis

A safety analysis was conducted for the Route 8 corridor within the study area limits to determine if the traffic demands being placed on the roadway combined with the geometric conditions of the roadways or ramps have resulted in unsafe operating conditions.

2.6.1 Methodology

The safety analysis was based on an examination of accident information on the roadway and a comparison to statewide averages for similar type facilities. The sources of the data are the CTDOT Traffic Accident Surveillance Report (TASR) and the CTDOT Traffic Accident Viewing System (TAVS). The TASR database compiles statewide crash data on a three-year basis. The database is broken into roadway segments by mile posts (MP), mainly (on an expressway such as Route 8) the segment of roadway between interchanges and the segment of roadway that makes up the interchange. The mileage segments used in the TASR were analyzed for this study. The database calculates actual accident rates for every roadway link and intersection on state numbered roadways. Historically, CTDOT also calculated a critical accident rate for each location based upon the type of roadway or intersection, traffic volume, and vehicle miles of travel on the roadway. The ratio of the actual accident rate to the critical accident rate was then calculated. If this ratio (RA/RC) was higher than one and the number of accidents in a three-year period was greater or equal to fifteen, then the location was identified as a potential candidate for a safety study. VHB used historic RA/RC ratios from prior TASR databases as a guide as to which intersections might warrant a safety review. Those intersections, as well as any segment of roadway or intersection that experienced 30 or more accidents for the three-year study period, were given a detailed examination. The TAVS summarizes the accident data into categories useful for analysis, such as accident type, type of vehicles involved, contributing factor and direction, to name a few.

2.6.2 Quantitative Data

Safety data for Route 8 was provided by CTDOT for the period January 1, 2005 to December 31, 2007, which represents the most recent three-year period available. During this time period, 873 accidents occurred in the study area as shown in Table 2-18. These data included all reported accidents with property damage greater than $1,000 or personal injury. A review of these data indicates that there are twelve locations along Route 8 within the study limits that experienced more than thirty accidents over the three-year period studied. These locations were previously identified on Figure 2-1.

Table 2-18
Total Study Area Accidents by Year

	2005	2006	2007	Total
Total Accidents	296	303	274	873

Of the 873 accidents that occurred within the study area for the period of January 1, 2005 to December 31, 2007, there were a total of 1,335 vehicles involved. As noted in Table 2-19, 1,110 (83.2%) of vehicles involved were automobiles, 117 (8.8%) were single unit trucks, 37 (2.8%) were passenger vans, and 31 (2.3%) were tractor semi-trailers.

Table 2-19
Vehicle Classification for Accidents in Study Area*

Vehicle Type	2005	2006	2007	Total	Percent of Total Vehicles
Automobile	375	385	350	1110	83.2%
Single Unit Truck	37	45	35	117	8.8%
Passenger Van	14	16	7	37	2.8%
Tractor Semi-Trailer	10	12	9	31	2.3%

Source: VHB Inc. and CTDOT
* Vehicles classifications with more than 1 percent of total are listed.

Detailed accident summaries for all roadway segments within the study can be found in Tech Memo # 1. The data reveals that of the 873 accidents that occurred within the study area (MP 18.24 to 29.81), more than half (483) were categorized as "Fixed Object" accidents. This type of accident can often be attributed to inadequate shoulder widths and/or speeds too fast for the conditions. Deficiencies identified in mainline and ramp geometry appear to be contributing to accidents along the corridor as also referenced in Figure 2-1 and elaborated upon in Section 2.6.3 Review of Route 8 Accident Locations of this report.

It should also be noted that within the study area, 35 percent of the accidents within the three-year period occurred under wet road surface conditions. This statistic is 14 percent higher than for the entire stretch of Route 8 and more than similar facilities in the state as compared in Table 2-20. The data suggests that weather plays a particularly important role in travel conditions along the corridor.

Table 2-20
Road Surface Conditions* for Accidents in Study Area

	Other	Snow	Dry	Wet
Route 8 Study Area	5%	9%	51%	*35%*
Route 8	4%	8%	67%	21%
Interstate 95	2%	5%	77%	16%
Interstate 91	2%	6%	71%	21%
Interstate 84	4%	7%	65%	24%

Source: VHB Inc. and CTDOT
*. Data taken for accidents which occurred between January 1, 2007 and December 31, 2007
** Study area is MP 18.24 to 29.81

The category of "contributing factor" within accident reports, as summarized in Table 2-21, is helpful to determine why the accidents occurred and can be instructive about mitigative measures that may be beneficial in the future. Of the 873 accidents that occurred, 266 of them (30.5%) were categorized as "Speed Too Fast for Conditions," 169 (19.4%) were in the "Driver Lost Control" category, 148 (17.0%) were attributed to the "Following Too Closely" category, and 94 (10.8%) were the result of an "Improper Lane Change."

Table 2-21
Contributing Factors for Accidents in Study Area*

Contributing Factor	2005	2006	2007	Total	Percent of Total Accidents
Speed Too Fast for Conditions	89	101	76	266	30.5%
Driver Lost Control	47	53	69	169	19.4%
Following Too Closely	53	51	44	148	17.0%
Improper Lane Change	29	37	28	94	10.8%

Source: VHB Inc. and CTDOT
* Contributing Factors with more than 10 percent of total are listed.

2.6.3 Review of Route 8 Accident Locations

Among the twelve locations along the study corridor that experienced greater than 30 accidents during the three-year period reviewed, four of them had a RA/RC values of more than 1.0 on the 2002-2004 TASR list and three of these are located in and around the Exit 22 interchange. A brief description of the locations of concern is provided in the following paragraphs.

Exit 22

The first three high accident locations make up the Exit 22 interchange in Seymour. The Exit 22 interchange is a split interchange containing the northbound off-ramp and southbound on-ramp in the southern portion and the northbound on-ramp and southbound off-ramp in the northern portion. Within the entire Exit 22 interchange area (MP 18.24 to 19.13), there were a total of 238 accidents over the three-year study period. Of the 238 accidents, 83 (35%) occurred on the Route 8 northbound mainline, 105 (44%) occurred on the Route 8 southbound mainline, 15 (6%) occurred on the Exit 22 northbound off ramp, 9 (4%) occurred at the Exit 22 southbound on ramp, 3 (1%) occurred on the northbound on ramp, and 5 (2%) occurred on the southbound off ramp. The remaining 8 percent occurred on either near the local road near the interchange or at undefined locations.

About 60 percent (144) of the 238 accidents were fixed object type collisions, generally indicative of the tight geometry through the interchange. Of the 144 fixed object accidents, 89 (62%) were categorized as "Speed Too Fast for Conditions" and 103 (72%) occurred under wet road surface conditions. Further examination also revealed that there were a total of 45 (19%) rear-end accidents, including 28 which occurred on the southbound mainline (23 of which were attributed to "Following Too Closely".) This could be the result of slowing traffic conditions as vehicles travel southbound through this area or to the short acceleration and deceleration areas for both the southbound ramps.

Mainline between Exits 22 and 23

The mainline segment between interchange 22 and 23 (MP 19.14 to 20.59) in Beacon Falls revealed 31 accidents over the three-year period of which 65 percent were categorized as "Fixed Object" collisions. Of the 20 "Fixed Object" accidents, 16 of them (80%) occurred on the southbound mainline, and eight of these were attributed to "Speed Too Fast for Conditions." This mainline segment of Route 8 is relatively straight with a downgrade in the southbound direction. The accidents in the southbound direction are likely attributed to drivers operating at high speeds and losing control of their vehicles.

Exit 24

Route 8 at Exit 24 (MP 22.05 to 22.48) in Beacon Falls experienced 30 accidents over the three-year study period; 11 of these (37%) were categorized as "Fixed Object" accidents (9 occurring in the southbound direction).

Mainline between Exit 24 and 25

Route 8 between interchanges 24 and 25 (MP 22.49 to 23.72) in Beacon Falls experienced 38 accidents that included 27 (71%) involving fixed objects (14 of which involved striking the guide rail). The data also indicate that 9 accidents (24%) had a contributing factor categorized as "Driver Lost Control" and 7 (18%) were categorized as "Speed Too Fast for Conditions." This is the section of Route 8 that features multiple "S" curvatures of the roadway as it follows the Naugatuck River. Presently, sections of the roadway contain double chevron signs to warn motorists of the serpentine alignment. It should be noted that CTDOT implemented a safety improvement project along this segment in late 2005/early 2006 to install the warning signage and improve pavement friction. Accidents have decreased from 15 in 2005 to 9 in 2007.

Exit 25

The seventh high accident location is the interchange for Exit 25 (MP 23.72 to 24.48) in Beacon Falls. The interchange consists of a northbound on-ramp and a northbound off-ramp. The data revealed that 55 accidents occurred on Route 8 during the three year study period, of which 24 (43%) were categorized as "Fixed Object" accidents. Also, twenty percent of accidents occurred at intersections with the local road where 10 of the eleven reported accidents were rear end collisions. These accidents could be attributed to traffic congestion as drivers negotiate the local roadway network in the area of the interchanges or short ramp lengths.

Exits 26 and 27

Route 8 in the vicinity of Exit 26 and 27 (MP 24.99 to 25.98) in Naugatuck experienced 134 accidents over the three-year period reviewed. Of these, 79 (59%) were categorized as "Fixed Object" accidents, which again is indicative of the tight geometry through these interchanges, and 23 (17%) were categorized as "Read End" accidents. Forty percent of the 134 accidents were attributed to speed. There were 19 (14%) accidents, seven of which were rear end collisions, that occurred at the intersections to the local roads.

Exit 28

The segment of Route 8 at the interchange of Exit 28 (MP 26.68 to 26.98) in Naugatuck experienced 34 accidents over the three-year study period; of which more than half (19) occurred on the mainline. Eight of the 34 (24%) occurred at the intersection of a local road, five of which (63%) were categorized as "Rear End" collisions. This could be attributed to congestion in and around the interchange along the local roadway network or short ramp lengths.

Exit 29

Route 8 at the interchange of Exit 29 (MP 26.99 to 27.68) in Naugatuck experienced 60 accidents over the three-year study period. The leading contributing factor was "Following Too Closely" attributed to 17 (28%) accidents.

Mainline between Exits 29 and 30

The Route 8 segment between the interchanges for Exits 29 and 30 (MP 27.69 to 29.89) in Waterbury experienced 63 accidents from 2005 to 2007. Almost half of these (31) were categorized as "Fixed Object" collisions, and 16 (25%) were categorized as "Sideswipe" collisions.

Exit 30

The final roadway segment that experiences high-accident frequency is the northern portion of Exit 30 (MP 29.49 to 29.81) in Waterbury. This location consists of a northbound on-ramp and a southbound off-ramp. A total of 54 accidents occurred at this location, of which 37 (69%) were categorized as "Fixed Object" accidents. There were 20 (37%) accidents with a contributing factor of "Speed Too Fast for Conditions."

2.6.4 Local Intersections

Part of the safety review included local intersections in the vicinity of Route 8. A summary of these intersections, which were also reviewed for the three-year period (2005-2007), is provided in Table 2-22.

The locations with the highest incidents of accidents included:

- Route 67 (North Main Street) at Route 115 (Main Street) in Seymour (22 accidents)
- S.R. 709 (South Main St.) at Route 63 and Route 8 NB Off-Ramp in Naugatuck (25 accidents)
- Route 63 at Route 8 SB Ramps in Naugatuck (11 accidents)
- S.R. 709 (South Main St.) at Maple Street in Naugatuck (10 accidents)
- S.R. 723 (Union Street) at City Hill Street Connector (14 accidents)
- Route 68 (Prospect Street) at S.R. 723 (Union Street and Golden Court) in Naugatuck (18 accidents), and
- S.R. 847 (South Main Street) at Platts Mill Road in Waterbury

These locations were further reviewed during the improvement alternatives (Chapter 6) phase of the study.

Table 2-22
Accident Summary for Local Intersections*
(2005 to 2007)

Location	Number of Accidents	Rear End	Sideswipe	Fixed Object	Angle	Turn Into	Backing
Seymour							
Route 67 (N. Main St.) at Route 115 (Main St.)	22	21	1	0	0	0	0
Route 115 (S. Main St.) at Route 313 (Maple St.)	6	2	0	1	0	2	1
S.R. 728 (Derby Ave.) at Route 313 and West St.	10	3	0	0	1	5	1
Route 115/313 (S. Main St.) at Route 115 (Main St.) and Route 313 (Broad St.)	4	2	0	0	0	2	0
Route 313 (Maple St.) at Pearl St.	7	1	0	0	2	4	0
Beacon Falls							
North Main Street at S. Main St.	-	-	-	-	-	-	-
Route 42 (S. Main St./Bethany St.) at S. Main St. #2	5	2	0	1	0	2	0
Route 63 (New Haven Rd.) at Cross St.	11	8	0	1	0	2	0
Naugatuck							
S.R. 709 (South Main St.) at Route 63 and Route 8 NB Off-Ramp	25	8	1	2	5	9	0
Route 63 at Route 8 SB On/Off Ramps	11	6	0	0	2	2	1
S.R. 709 (Main St.) in the vicinity of Hotchkiss St. and Connector to Route 8 SB	9	2	1	1	2	1	0
S.R. 709 (South Main St.) at Maple Street	10	5	1	0	1	3	0
Route 68 (Prospect St.) at S.R. 723 (Union St. and Golden Ct.)	18	14	1	0	0	3	0
S.R. 723 (Union St.) at City Hill St. Connector	14	6	0	3	1	4	0
S.R. 710 (N. Main St.) at S.R. 723 (Golden Ct.)	7	3	0	1	0	3	0
Waterbury							
S.R. 847 (Waterbury Rd./S. Main St.) at Sheridan Dr.	3	1	0	0	0	2	0
S.R. 847 (S. Main St.) at Platts Mill Rd.	18	15	0	1	0	2	0

Source: VHB Inc. and CTDOT
*. Accident data includes accidents involving property damages greater than $1,000 or those resulting in a personal injury.

2.7 Multi- Modal Transportation Services

Concurrent with this corridor study, the Connecticut Department of Transportation (in cooperation with the South West Regional Planning Agency, Greater Bridgeport Regional Planning Agency, Council of Governments of the Central Naugatuck Valley, and the Valley Council of Governments) is preparing a companion Needs and Feasibility Study for improvements to transit service along the 27-mile Waterbury Branch Line corridor of the New Haven rail line. The results of this study will identify potential service and infrastructure improvements for the corridor. The summary of existing transit services in the Route 8 corridor provided in this report is taken from this study. For more details, refer to the *Waterbury and New Canaan Branch Lines Needs and Feasibility Study, Existing Conditions Technical Memorandum, Volume I, October 2008.*

2.7.1 Metro North Railroad

Metro-North Railroad operates service between New Haven and Grand Central Terminal on the New Haven Line, Connecticut's busiest commuter rail line. Three branch lines feed into the New Haven Line: the New Canaan Branch, the Danbury Branch, and the Waterbury Branch. The Waterbury Branch runs parallel to the Route 8 corridor.

In 2008, eight southbound and seven northbound trains operate daily Monday through Friday along the Waterbury Branch between Waterbury and Bridgeport with stops at Naugatuck, Beacon Falls, Seymour, Ansonia, and Derby-Shelton. All of these runs, whether terminating or beginning at Bridgeport, are scheduled to connect with mainline trains heading to or from Stamford and New York City. Travel time is approximately 55 minutes between Bridgeport and Waterbury and 145 minutes between Waterbury and Grand Central.

Currently, there are two southbound trains during morning peak period (4:00 AM to 8:00 AM) from Waterbury to Grand Central (with a transfer at Stamford and at Bridgeport) and two northbound trains leaving Bridgeport during the evening peak period (5:30 PM to 8:30 PM).

According to data collected by CTDOT, total ridership on the Waterbury Branch is 144 passengers for the morning peak period, of which over 90 percent (131) transfer to the New Haven Mainline for continued commute toward New York City.

The 2008 Connecticut Rail Ridership report showed that the Waterbury Branch grew a 53 percent (or 4.0 percent annually) for the period from 1996 to 2007.

Freight service on the Waterbury Branch is provided by the Providence and Worcester (P&W) Railroad between Milford and Derby and the Pan Am Railway

(Springfield Terminal Railway/Guilford/Boston & Maine) between Derby and Waterbury.

2.7.2 Park and Ride Facilities

A 2009 parking inventory and utilization was completed by CTDOT at each of the stations along the Waterbury Branch. A total of 450 parking spaces are provided along this rail line, as presented in Table 2-23.

Table 2-23
Waterbury Branch Parking

Station Location	Ownership	Capacity (spaces)	Peak Utilization (%)
Waterbury	State	150	31 vehicles (21%)
Naugatuck	Town	125	45 vehicles (36%)
Beacon Falls	State	28	14 vehicles (50%)
Seymour	Town	22	33 vehicles (150%)
Ansonia	State/Town	50	22 vehicles (44%)
Derby/Shelton	Town	75	45 vehicles (60%)
Totals		450 spaces	190 vehicles (42%)

Source: CTDOT 2009

There are also three Park and Ride lots in the vicinity of the Route 8 study corridor. Their locations and utilization, based on a survey by CTDOT in the early spring of 2007, are as shown in Table 2-24.

Table 2-24
Route 8 Corridor Park and Ride Lots

Town	Location	Capacity (spaces)	Peak Utilization (%)
Waterbury	Route 8, Exit 29/ So. Main Street	156	76 %
Naugatuck	Route 8, Exit 25/ Cotton Hollow Rd	125	64 %
Seymour	Route 8, Exits 19-20/ Lower Derby Ave	28	16 %
Totals		176 spaces	45 %

Source: CTDOT 2007

2.7.3 Transit

Several transit agencies provide bus service within the Route 8 study area, including:

CT Transit Bus Service – Waterbury Region

As of 2008, CT Transit operates 23 primary bus routes in the City of Waterbury with extensions into the surrounding towns, including two routes (the N1 and N2) that extend southerly into Naugatuck. Bus service is generally provided Monday through Saturday with more limited service on Sundays. The Naugatuck routes operate Monday through Friday, with no weekend service. CT Transit also operates Route "J" which links Waterbury with the City of New Haven. The central hub point, which allows for transfers between virtually all routes, is located at Exchange Place (Waterbury Green) in the downtown area of the City. The Waterbury Division also operates ADA paratransit services in the Waterbury area seven days a week, excluding holidays, through a contract with the Northeast Transportation Company.

Valley Transit Bus Service – Valley Region

The Towns of Shelton, Derby, Ansonia and Seymour are served by the Valley Transit District which provides a variety of transit services ranging from contract services to senior centers and other community agencies, work trips to major employers and door-to-door (dial-a-ride) services for individuals. A regional fixed route bus lines operate within the Valley Transit District, provided by CT Transit, links downtown New Haven to Orange (Derby Turnpike), Derby, Shelton, Ansonia, and Seymour, with stops at the Derby, Ansonia, and Seymour train stations.

Greater New Haven Transit District (GNHTD)

GNHTD provides paratransit service for the elderly and disabled, but not the general public. Membership for the Regional Rides or Dial-A-Ride program is open to any individual currently residing in one of the member towns of Ansonia, Derby, East Haven, Guilford, Hamden, Madison, Milford, New Haven, North Branford, North Haven, Orange, Seymour, Shelton, Wallingford, Waterbury, West Haven and Woodbridge.

Rideshare Services

One rideshare service provider, Rideworks, offers information about carpooling, vanpooling, public transit, walking, bicycling, and private shuttles in the Route 8 study area. They do not operate any transit services. Rideworks, based in New Haven, serves commuters in New Haven County, including the towns of Waterbury, Naugatuck, Beacon Falls, and Seymour.

2.7.4 Bicycle and Pedestrian Access

Existing bicycle and pedestrian facilities were examined in the interchange areas of the study corridor. Bicycle facilities as defined here include marked lanes for bicycle use, off-road paths, and roadway routes designated by the CTDOT for bicycle travel within the state. Pedestrian facilities include sidewalks and crosswalks. The existing bicycle and pedestrian facilities were identified through windshield inspections and review of the Statewide Bicycle Route Map (CTDOT, 2002). The observed facilities are described by town in the paragraphs below.

Seymour - Exit 22

Exit 22 is the Route 8 interchange with Route 67 (New Haven Road) in downtown Seymour. There are some sidewalks and crosswalks in the vicinity of the interchange, but there are also gaps in the network. The sidewalk along the north side of Route 67 extends west across the Naugatuck River bridge, but it ends at the Route 8 northbound on-ramp to the east. On the south side of Route 67, the sidewalk is discontinuous as some blocks have sidewalks while others do not. Wakeley Street, which is also part of this interchange system, has sidewalks for most of its length. Crosswalks are located at the two major intersections, the Route 67/Wakeley Street/Route 8 southbound on-ramp intersection and the Route 67/Franklin Street/River Street intersection, in this vicinity.

The commercial areas on either side of the Naugatuck River are well connected by continuous sidewalks along the north side of Route 67, as well as crosswalks at the major intersections. There is a lack of pedestrian connectivity between the commercial and residential areas along Route 67 east of the interchange and the rest of downtown Seymour. Pedestrians were observed walking along the Route 67 shoulder in this area during a field visit (February 20, 2009).

Route 67 is sufficiently wide for bicycle access, though there are no specific bicycle facilities or signage in the interchange area.

The primary pedestrian-bicyclist destinations in and near the study corridor in Seymour are regarded to be:

- The commercial area along Route 67 just east of the Exit 22 interchange and the surrounding residential streets;
- The commercial area along Route 67 and side streets that comprise the downtown;
- The train station on Main Street; and,
- The Stop & Shop grocery store and other businesses on the west side of Route 8 and the Naugatuck River.

Seymour - Exit 23

Exit 23 is the Route 8 interchange with Route 42 (South Main Street) in Beacon Falls. The vicinity of the interchange is sparsely developed, with a single small residential enclave just west of Route 8. Bicycle access on Route 42 is available with wide shoulders, though no designated bicycle facilities or signage exist. There are no significant pedestrian or bicycle destinations near this interchange, and as such, pedestrian-bicycle activity is likely minimal.

Beacon Falls - Exit 24

Exit 24 is the Route 8 interchange with North Main Street in Beacon Falls. North Main Street is a two-way street divided by a median, with a mix of land uses. Most of North Main Street has sidewalks, and there are crosswalks at the intersection with Burton Street and in front of a commercial plaza. Pedestrian destinations and demands are along North Main Street, where existing sidewalks and crosswalks provide sufficient pedestrian connectivity.

There is on-street parking along North Main Street that was observed to be largely unused, so the street thus affords a wide shoulder for bicycle use; although, no specific bicycle facilities are present.

Naugatuck - Exit 25

Exit 25 is the Route 8 interchange with Cross Street in Naugatuck. A ball field, St. James Cemetery, and low density residential uses are located on the east side of the interchange with the Naugatuck River located to the west. There are no sidewalks or crosswalks in the vicinity of this interchange. Pedestrian-bicycle activity is likely minimal in this area due to lack of close-by destinations and limited roadway network.

Cross Street dead-ends at the Naugatuck River, where there is some evidence of pedestrian access to the river bank. The logical pedestrian desire line in this area is between the ball field located on the northern side of Cross Street and the residential area to the south, as well as access from the residential area to the Naugatuck River itself.

Naugatuck - Exit 26

Exit 26 is the Route 8 interchange with Route 63 (South Main Street Extension) in Naugatuck. There are no sidewalks along South Main Street in the vicinity of the interchange. There is a sidewalk along the north side of the Route 63 bridge across the Naugatuck River. The intersection of Route 63 and Route 8 is signalized but has no crosswalks.

There are no identifiable pedestrian or bicycle destinations or desire lines near this interchange, and as a result, pedestrian-bicycle activity is likely minimal. There are a few businesses along the east side of South Main Street, but no side streets connecting to the residential neighborhood to the east. There are baseball fields along the Naugatuck River along the west side of Route 8; however, they are access via Hotchkiss Street to the north, not from Route 63.

Route 63 is sufficiently wide for bicycle access, though no specific bicycle facilities are present.

Naugatuck - Exit 27

Exit 27 is the Route 8 interchange with North Main Street, South Main Street, and Maple Street in Naugatuck. The northbound entrance ramp and the southbound exit ramp are located at the southern end of the interchange near Maple Street, while the northbound exit ramp and the southbound entrance ramp are located at the northern end of the interchange, near North Main Street.

To the north, the intersection of North Main Street and the Route 8 ramps is located just outside a small business district. Linden Park, with its basketball and tennis courts and numerous playing fields, is located adjacent to this interchange to the west. A short bikepath is located within Linden Park which will someday be integrated within the overall Naugatuck Greenway (see later discussion). There is a sidewalk along the west side of North Main Street in the vicinity of the interchange, but there are no crosswalks. The sidewalk continues up the southbound entrance ramp, adjacent to Linden Park, and connects to an elevated pedestrian walkway along the western side of Route 8. The elevated walkway ends at Maple Street to the south where it connects to the sidewalks on Maple Street and South Main Street.

To the south, the intersection of South Main Street, Maple Street and the Route 8 ramps is located in a commercial area with residential areas nearby. The western leg of the intersection is a bridge across the Naugatuck River, connecting to the commercial area and train station along the western side of Route 8 and the river. This intersection is signalized and has full crosswalks and sidewalks. The primary pedestrian desire line is along Maple Street and across the bridge, connecting residential and business areas on the east side of the river with residential, businesses and transit on the west side. The streets in this area are somewhat narrow and have no designated bicycle facilities.

Naugatuck - Exit 28

Exit 28 is the Route 8 interchange with North Main Street in Naugatuck and provides access to Route 68 (Prospect Street). The northbound exit ramp and southbound entrance ramp intersect North Main Street just south of Route 68. The northbound entrance ramp and southbound exit ramp intersect North Main Street a few blocks north of Route 68.

North Main Street has a mix of commercial land uses, with a residential neighborhood to the east. To the north, North Main Street dead-ends at the Route 8 northbound entrance ramp. Most of North Main Street has sidewalks near the interchange.

To the south, the intersection of North Main Street, City Hall Street, and the Route 8 ramps has crosswalks on two legs and provides a connection to a pedestrian bridge across the Naugatuck River. North of Route 68, there are no crosswalks across North Main Street; however, there are no pedestrian destinations immediately adjacent to this area.

North Main Street has a wide shoulder in the interchange area, though no designated bicycle facilities are present. Route 68, which crosses Route 8 south of Exit 28, is a designated state bicycle route. It is designated a "recommended route," which is considered the most safe and convenient category of state bicycle route.

Waterbury - Exit 29

Exit 29 is the Route 8 interchange with South Main Street on the border between Naugatuck and Waterbury. West of Route 8 is a residential neighborhood, and east of Route 8 along Main Street is a small commercial and industrial enclave. No sidewalks or crosswalks are present.

The primary pedestrian desire line is between the residential area west of Route 8 and the commercial/industrial areas to the east; however, pedestrian and bicycle activity is likely minimal as the design of the interchange, particularly the placement of embankments and the complexity of intersections, lengthens walking distances along this desire line and discourages walking.

Waterbury - Exit 30

Exit 30 is a complex interchange between Route 8 and several streets in Waterbury. Leonard Street and Charles Street run parallel to Route 8 on the east and west sides, respectively. This is a dense, urban area, with a residential neighborhood, several churches and a school on the west side of Route 8, and a largely industrial area on the east side. There are sidewalks along Leonard and Charles Streets in varying conditions and not all local intersections have crosswalks.

The northbound exit ramp joins the local street network at the intersection of Leonard Street and Fifth Street, while the southbound entrance ramp is accessed via Charles Street just south of Fifth Street. There are no crosswalks at either intersection. To the north, Leonard and Charles Streets merge to become Riverside Street (north of Bank Street). The Route 8 northbound entrance ramp is accessed via Leonard Street just north of Washington Avenue. A sidewalk exists on the east side of Leonard Street to Washington Avenue (where it ends) and on both sides of

Washington Avenue as it travels under Route 8. A crosswalk exists only on the southern leg of the Leonard Street/ Washington Street intersection.

The southbound exit ramp joins the local street network at the intersection of Riverside Street, Washington Avenue, and Charles Street. Pedestrian access is generally poor through this intersection. The primary pedestrian desire lines are within the residential neighborhoods to the west of Route 8, and via the east-west streets that cross under Route 8 and connect the residential neighborhoods with the industrial/commercial areas to the east.

Naugatuck River Greenway

Within the Route 8 corridor is the Naugatuck River Greenway, designated by the Connecticut Department of Environmental Protection in 2001. The Greenway extends 42-miles along the Naugatuck River from Derby to Torrington. The Greenway is envisioned to include a multi-use trail intended to provide for non-motorized transportation and access to recreational opportunities. The entire Naugatuck River Greenway is also identified as a trail of statewide significance in the Connecticut Recreational Trails Plan. The concept of the Greenway is generally understood and broadly supported; however, its implementation has been fairly slow and incremental, to date, through a series of independent municipal projects.

The municipalities and regional planning agencies along the corridor have been actively promoting the regional nature of the project and a regional Naugatuck River Greenway Committee is organized to help advance the project and achieve connectivity across municipal boundaries. Concurrent with this study, the Central Naugatuck Valley Council of Governments commissioned a route location study for approximately 22-miles of the greenway corridor within Beacon Falls, Naugatuck, Waterbury, Watertown, and Thomaston. The purpose of this study is to determine the route of the Greenway through the Central Naugatuck Valley region. This study is essentially a continuation of an ongoing design effort to define the Greenway along its 7.1 miles through the City of Waterbury, including in the vicinity of Interchange 30. This corridor study and its recommendations were coordinated with the Greenway efforts.

2.8 Intelligent Transportation Systems (ITS)

The Connecticut Department of Transportation has been at the forefront in the deployment of intelligent transportation systems to better manage traffic conditions and provide up-to-the-minute traveler information throughout the state. The Route 8 study corridor has been instrumented in recent years with the following technology:

Mainline Traffic Monitors (7 locations)

- Naugatuck – North of North Main Street (northbound)
- Naugatuck – North of Waterbury Road (southbound)
- Waterbury – South of Nichols Drive (northbound)
- Waterbury – North of Nichols Drive (both directions)
- Waterbury – Washington Avenue (both directions)

CTDOT is testing a new type of detector along the corridor (RTMS – EIS Side fire detectors) that monitors volume and estimate speed.

Variable Message Signs

- Portable sign northbound in Naugatuck, north of Cotton Hollow Road
- Permanent sign mounted northbound in Waterbury, south of Exit 30

Traffic Cameras (7 locations)

- Northbound, north of Cotton Hollow Road
- Northbound, north of North Main Street (Exit 28/29)
- Southbound, north of Waterbury Road (Exit 29)
- Northbound, south of Nichols Drive (Exits 29/30)
- Northbound, north of Nichols Drive (Exits 29/30)
- Southbound at Washington Avenue
- Southbound at Riverside Drive

Digital data from these cameras is downloaded and sent back to the Traffic Operations Center at CTDOT's Newington headquarters. Fiber interconnect exists along the Route 8 corridor from Waterbury through Naugatuck, but there is still a missing link along I-84 east of Waterbury.

CTDOT is doing extensive weather monitoring and has 14 sites throughout the state. These generally include in-road sensors and cabinets. The Roadway Weather Information Systems (RWIS) technology is made by SSI-Kyoti, which was recently bought out by Vaisala. The weather sensors generally trigger one of two variable message sign responses: "Slippery Conditions Possible," or "Slippery Conditions, Use Caution," depending on temperature reading.

There are two weather sensors at Exit 22. These are mounted on the east side of the road with one located on the bridge and one subsurface in the pavement. Originally, there were four sensors at this location, but two were lost during a recent repaving project.