

Chapter 3

EXISTING ENVIRONMENTAL CONDITIONS

As part of this study, environmental resources we identified, such as farmlands, environmental risk sites, wetlands, important fisheries and wildlife habitat, rare and endangered species, watercourses, wells, and aquifers, floodplains, public water supplies and surface water, public 4(f) and 6(f) lands and air and noise impacts.

3.1 Wetland and Surface Water Resources

Much of the Study Area is characterized by palustrine forested wetlands, including riparian corridors of the major streams and rivers. Palustrine wetlands include most non-tidal wetlands and are dominated by trees, shrubs, persistent emergent plants, emergent mosses, and/or lichens. Wetlands of this type also include the small, shallow, permanent, or intermittent water bodies often called ponds. Palustrine wetlands may be situated shoreward of lakes, or river channels, on river floodplains, in isolated catchments, or on slopes. Numerous wet drainage ways and open stream channels are also common throughout the Study Area. These are primarily associated with highway drainage systems and other recently constructed developments.

The majority of wetlands in the Study Area, based on soil types, are considered to have poor to very poorly drained soils, excluding alluvial and floodplain wetlands associated with rivers and streams. Larger wetland systems occur within the town of Middlebury between Kissawaug Road and I-84. Another larger expanse of wetlands area is located south of Leonard Road in Middlebury. Actual wetland sizes and characteristics will be further evaluated following the development of project alternatives.

3.2 Floodplains

There are floodplain areas associated with the Eightmile Brook between Middlebury and Southbury and extending along the western border of Oxford. Within Southbury, floodplains are associated with the Pomperaug River, a tributary to the Housatonic River. In the southern portion of Middlebury, there are floodplains associated with Long Meadow Pond. To the east of Route 63, along the Middlebury/Waterbury border, there are floodplains associated with Hop Brook Lake and tributaries to Hop Brook Lake and Hop Brook. In the northern portion of the Study Area within Waterbury, there are floodplains associated with the Naugatuck River.

3.3 Groundwater Resources

A limited number of surface waters have been classified. The Pomperaug River is classified as Class B, suitable for recreation uses. Bullet Hill Brook, a tributary of the Pomperaug River in the vicinity of Interchange 15, has a surface water classification of B/A. Eightmile Brook in Middlebury is classified as A. Hop Brook and Long Meadow Brook, within Middlebury, are classified as Class A, meaning they are a potential drinking water supply, provide fish and wildlife habitat, and are suitable for recreational use.

3.4 Rare, Threatened, and Endangered Species

Within Southbury, four species of state Special concern were noted to potentially occur. Additionally, the CTDEP noted numerous state listed species (mostly plants) may be located just north of the Pomperaug River in Southbury. Alternatives developed within this area will require an additional review of the CTDEP Natural Diversity Database. The initial database query is not a substitute for comprehensive on-site survey that may be required when specific project alternatives are determined.

3.5 Farmland Soils

Lands that qualify as Prime Farmland or Additional Farmland of Statewide Importance occur as pockets throughout the I-84 corridor. Prime farmland soils exist adjacent to I-84 within the central portion of Southbury and throughout Middlebury. The most common occurrences of important farmland soils adjacent to the highway corridor are in areas where soils are derived from glacial outwash sediments. However, within the Study Area, particularly within Waterbury, much of the Prime Farmlands mapped in 1965 has been developed, according to 1995 Connecticut Department of Environmental Protection (CTDEP) land use maps. Developed areas no longer qualify as important farmlands. These developed farmland areas were subsequently excluded from this analysis.

3.6 Noise Sensitive Areas

The potentially affected portions of Southbury generally are low-density single family residential areas with scattered homes on large lots. Some commercial land uses are found in the area, particularly around exit 15, may value visibility over noise abatement. An existing noise barrier shields Southbury Middle School, located on the north side of I-84 at Peter Road.

The portions of the town of Middlebury close to I-84 include a combination of very low-density single-family residential land uses and some corporate properties (office park) with pockets of commercial use.

The portions of the city of Waterbury proximate to I-84 include many single family and multiple-family properties in a higher concentration than the other communities, along with substantial areas of commercial use; institutions such as hospitals, schools and cemeteries are also found within this area. Much of the I-84 corridor is currently at a different grade than the surrounding areas (either high above the community on bridge structures, or else much lower than the surrounding terrain).

In the mid-eighties, the DOT monitored noise along segments of Interstate 84. The result of this analysis was an inventory of locations that were candidates for a noise abatement program. Several of these locations have been identified within the WOW corridor. Table 3.1 lists the eight retrofit locations identified by ConnDOT along I-84 within the project limits.

Table 3.1
Potential Noise Barrier Locations Along I-84

Town	Location
Southbury	Skyview Drive
Southbury	Stony Corner Road
Southbury	Church Street
Middlebury	Shaddock Road
Waterbury	Ponham Street
Waterbury	Plank Road
Waterbury	Country Club Road
Waterbury	Sidney Street

3.7 Air Quality

The findings from the air quality demonstrate that, in general, the emissions associated with traffic are estimated to decrease from 1999 to 2025. This reduction comes primarily from improvements in emissions reduction technology, inspection-maintenance programs, and alternative fuel vehicles.

For Carbon Monoxide (CO) and Volatile Organic Compounds (VOCs), total emissions for each year are somewhat higher during the PM peak than during the AM peak. This can be attributed to higher congestion in the PM peak hour; with resultant lower speeds, emission rates increase. However, with Nitrogen Oxides (NO_x), emission rates increase with increased speeds, so the PM peak hour emissions are actually lower from the lower speeds caused by the congestion.

3.8 Environmental Risk Sites

Nine potential risk sites were identified to contain hazardous material and are listed in Table 3.2. The potential existence of other environmental risk sites within the Study Area will need to be further evaluated on a site-by-site basis once alternatives are identified.

Table 3.2
Potential Environmental Risk Sites in the I-84 Corridor

EPA ID	Type of Service	Location	City
CTD001839679	Industrial Cleaning Systems	Christian Road	Oxford
CTD049589294	Metal Finishers	Christian Road	Oxford
CTD001166008	Industrial	South Main Street	Waterbury
CTD018860551	Lighting and Electrical	Bank Street	Waterbury
CTD052710829	Screw Machine Products	South Main Street	Waterbury
CTD067072355	Flexible Metal Products	South Main Street	Waterbury
CTD067072371	Metal Wire and Tubing	Bank Street	Waterbury
CTD981898521	Electrical Utility Service	Jackson Street	Waterbury
CTD981063431	Chemical Supplier	East Aurora Street	Waterbury

Source: U. S. Environmental Protection Agency

3.9 Important Fisheries and Wildlife Habitat

Wildlife habitat in the Study Area occurs within the mosaic of urban, suburban, and rural/undeveloped lands. In urban areas, wildlife species likely to occur include squirrels and birds tolerant of urban conditions (e.g., pigeons, robins, blackbirds, grackles, house finches). In suburban areas, there is a greater diversity of birds (e.g., bluejays, sparrows, chickadees, turkey) and mammals (e.g., raccoon, moles, chipmunks, deer), and common amphibians and reptiles that occur in backyards and ponds (bullfrog, green frog, rat snake, garter snake, red-backed salamander). In rural areas, even more wildlife diversity included larger mammals (e.g., shrew, fox, coyote), birds (woodpeckers, hawks, bluebirds, and many other songbirds) and amphibians (salamanders and frogs) and reptiles (turtles and snakes) in suitable habitats.

3.10 Historic and Archaeological Resources

Approximately six historic sites are in close proximity to (within 500 feet) of I-84 or the arterial roads that provide access to the interstate. It is also notable that 17 of the historic sites listed are in the vicinity of downtown Waterbury. It can be anticipated that only three of those 17 sites have potential to be affected by project alternatives. Table 3.3 lists the historic sites in the study corridor.

Table 3.3
Historic Resources in the vicinity of I-84
West to East Along the Corridor

Site Name	Location
Southbury	
Southbury Historic District #1	Main Street from Old Waterbury Road north to the Woodbury town line
Russian Village Historic District	Kiev Drive and Russian Village Drive
South Britain Historic District	Bounded by East Flat Hill Road, Hawkins, Library, and Middle Roads
Hurley Road Historic District	Hurley Road
Bullet Hill School	Main Street and Seymour Road
Rueben Curtis House	1770 Bucks Hill Road
Middlebury	
Middlebury Center Historic District	Bounded by Library Road, North and South Streets, and Whitmore Road
Tranquility Farm	Route 64
Nathaniel Richardson House	Kelly Road
Waterbury	
Waterbury Brass Mill Site	Idylwood Avenue in Hamilton Park
Hamilton Park	Bounded by Silver Street, E. Main Street, Idylwood Avenue, Plank Road, and the Mad River
Overlook Historic District	Bounded by Helca Street, Farmington and Columbia Blvd., Cables Avenue and Clowes Terrace, Lincoln, and Fiske Streets
Hillside Historic District	Bounded by Woodlawn Terrace, West Main Street and Willow Street
Wilby High School	260 Grove Street
George S. Abbott Building	235 N. Main Street
Waterbury Clock Company	North Elm, Cherry Streets, and Cherry Avenue
Elton Hotel	16-30 W. Main Street
Matthews and Willard Factory	16 Cherry Avenue
John Kendrick House	119 W. Main Street
Downtown Waterbury Historic District	Bounded by East Main, West Main, Meadow, and Elm Streets
Palace Theater	86-110 East Main Street
Enoch Hibbard House and George Granniss House	33 & 41 Church Street
Waterbury Union Station	389 Meadow Street
Waterbury Municipal Center Complex	195 Grand Street
Bank Street Historic District	207-231 Bank Street
Riverside Cemetery	Riverside Street, between Sunnyside and Summit Streets

Source: CT Historical Commission, SHPO

There are numerous reported archeological sites within or adjacent to the study corridor. These are sites that have been documented with the Office of the State Archeologist for Connecticut and/or the Connecticut Historical Commission. Specific locations of these sites are not provided by these agencies, to protect the integrity of the site and avoid potential loss of artifacts. Of the sites identified, only one has been listed on the National Register of Historic Places. It is an archeological site associated with the Waterbury Brass Mill National Register historic site.

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

Sites that qualify as Section 4(f) properties include a substantial number (26) of historic sites on the National Register of Historic Places and one archeological site within the study corridor. However, a limited number of those historic sites (about 6) are in immediate proximity (within 500 feet) of I-84 and the arterial roads that provide access to the interstate. Some of the 4(f) resources within the study corridor include municipal parks, state recreation areas, state parks, and the Larkin State Bridal Path

Section 6(f) of the Land and Water Conservation Fund Act (LWCF) states that any lands that were purchased or developed with LWCF funds cannot be “converted” to another use for purposes inconsistent with the Act, without being replaced with other land that is of equal value to the land proposed for conversion. There is one Section 6(f) property within the Study Area. This is the ice skating rink at Hamilton Park.

3.12 Environmental Justice

“Environmental Justice” requires that no federally funded project should be implemented in such a way as to result in disproportionately high and adverse effects on disadvantaged, minority, and/or low-income populations. The goal of Environmental Justice is expressed in Executive Order 12898 titled *Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations*. 1990 U.S. Census data was reviewed as the primary means of evaluating potential environmental justice issues in the Study Area. Table 3.4 compares the levels of low income, elderly, and minority populations in the communities that fall partially within the Study Area, as compared with the COGCNV region and the State of Connecticut.

With the exception of Waterbury, the communities within the Study Area have a lower percentage of low income and minority populations than the CNV region overall and the State of Connecticut in general as demonstrated in Table 3.4. In Waterbury there are some residential areas in close proximity (500 feet or less) to the south side of I-84, in the vicinity of Interchange 22. The housing in these neighborhoods predominantly consists of aging two and three family homes on small lots. Some of these neighborhoods are home to lower income residents. Although the other communities in the Study Area have a high percentage of elderly population, generally these residents are not low income. They are less likely to be disadvantaged and of concern in terms of Environmental Justice. However, the data does not reflect characteristics of individual census blocks (smaller geographic areas).

Table 3.4
Comparison of Environmental Justice Factors - I-84 Needs Deficiencies

Area	Total Pop. 1990	Median Household Income	% Age 65 Or Older	% Below Poverty Level	% Non-white
Southbury	15,818	\$47,335	27%	1.9%	2%
Middlebury	6,145	\$49,524	16%	3.5%	2%
Oxford	8,685	\$54,448	1%	1.7%	2%
Waterbury	108,961	\$30,553	16.5%	12.1%	21%
COGCNV Region	261,081	Not available	15%	6.5%	11%
Connecticut	3,287,116	\$41,721	14%	6.8%	13%

Source: 1990 U.S. Census

3.13 Commercially Important Natural Resources

Commercially important natural resources include sand and gravel or other mined resources and forestry products. There are no mining operations or lumber harvesting operations within the study corridor.

3.14 Visual/Aesthetic Resources

Visual and aesthetic resources are generally considered to include natural areas, ridgelines, parks, historic sites and/or neighborhoods, and aesthetic streetscapes. Information on the locations of aesthetic visual resources within the study corridor was obtained from the plans of conservation and development for the communities, as well as a field review of the corridor.

While ridgelines of significance have not been documented within the communities, the plans of development note that scenic wooded hillsides are an important part of the character of the communities. The Town of Middlebury is characterized in the *Plan of Development* (May, 1990) by a series of ridges and valleys generally running north to south. The town of Southbury also has a series of wooded hillsides that provides vistas of the rural countryside. The plan of development notes, “the essential and desirable character of the town is founded on open space”. Other aesthetic visual resources of note in the study corridor include the following:

- Scenic vista from Interstate 84 of the central Naugatuck valley from Interchange 17 west to Interchange 13.
- The Westover School campus in Middlebury.
- The Middlebury Town Hall complex, located on one of the ridgelines within the I-84 corridor in Middlebury.
- Scenic vistas that occur along Old Waterbury Road.
- Saint Anne’s Church in Waterbury on East Clay Street.
- The monument and sculptures that adorn the Town Green in Waterbury on West Main Street.

- The tower, which rises from the Waterbury Republican American newspaper, that is visible throughout much of the City of Waterbury.

3.15 Business Activity and Major Employers

Major employers within the Study Area include retail centers, industrial centers, residential care facilities, schools, municipal governments, and corporate complexes. Some notable large employers (100 or more employees) in the corridor include the following:

- **Southbury**
IBM
Mediplex of Southbury
Southbury Shopping Plaza
- **Middlebury**
General Data Communications
Timex
Uniroyal Chemical
- **Oxford**
Alternatives Inc.
Oxford Industrial Park (surrounding airport)
- **Waterbury**
Brass Mill Center Mall
Cedar Lane Rehabilitation Care Center
City of Waterbury
Macdermid Inc.
Northeast Utilities
Romatic Manufacturing
St. Mary's and Waterbury Hospitals

3.16 Park Lands, Management Areas and Campgrounds

Park lands within the study corridor include urban parks, recreation areas, community play fields, trails, and state recreation areas. These areas of preserved open space provide for passive recreation including walking, bicycling, hiking, horseback riding, field games, and picnicking. Information on open space was obtained from the *City of Waterbury Community Assessment* (1999), the *Central Naugatuck Valley Regional Plan* (COGCNV, 1998), and a database maintained by the COGCNV.

Table 3.5 lists the parks, recreation (management) areas, and campgrounds in the study corridor and notes their size and facilities. Of the resources listed, seven are in close proximity (within 500 feet) of Interstate 84 and/or the arterial roads that serve the interstate.

Table 3.5
Preserved Open Space in the I-84 Study Area

Open Space Area	Size in Acres	Facilities/Amenities
Southbury		
Community House Park	14.5	Play field, basketball, tennis, picnicking
Hidden Pond Park	58	Fishing, hiking
Platt Park	106	Hiking, nature trails
Ewald Town Park	8.5	Softball, walking track
Larkin State Bridal Path		Horseback riding, walking, bicycling
Middlebury		
Bristol Park	N/A	Picnicking, walking
Hop Brook Lake Recreation Area	N/A	Fishing, swimming, hiking, picnicking
Larkin State Bridal Path	N/A	Horseback riding, walking, bicycling
Middlebury Greenway	4.5 miles	Walking, bicycling, roller-blading
Meadowview Park	N/A	Softball, fishing, walking, playground, Greenway connector
Quassy Amusement Park	20	Rides, swimming, picnic area
Oxford		
Larkin State Bridal Path		Horseback riding, walking, bicycling
Kettletown State Park	488	Camping, fishing, swimming, hiking, picnicking
Southford Falls State Park	120	Fishing, swimming, hiking, picnicking
Waterbury		
City Mills	7.5	Basketball, softball, soccer, playgrounds
Chase Park	10.8	Basketball, softball, tennis, playground, gymnasium
The Town Green	2.2	Picnicking, walking
Hamilton Park	93	Basketball, baseball/soccer, tennis, ice skating
Waterbury Country Club		Golf
Washington Park	34	Baseball, soccer, tennis, gymnasium

Source: City of Waterbury, COGCNV

3.17 Museums and Cultural Resources

There are two museums in the corridor. One is the Mattatuck Museum located opposite the Town Green on West Main Street in Waterbury. It focuses on Connecticut artists. The other is Old Town Hall Historical Museum on Route 172 in Southbury. Other cultural resources in the include parks, historic resources, libraries, tourist destinations, and schools. Libraries, tourist destinations, cemeteries, and schools in the Study Area include the following (generally west to east):

- Pine Hill Cemetery;
- Southbury Public Library;
- Pomperaug Elementary School;
- Middlebury Public Library;
- Pomperaug High School;
- Long Meadow Elementary School;
- Rochambeau Elementary School;
- Westover School;

- Silas Bronson Public Library in Waterbury;
- Teikyo Post College;
- Naugatuck Valley Community College;
- The Holy Land (tourist destination); and,
- Riverside Cemetery.

Chapter 4

ALTERNATIVES EVALUATION

One goal of this Needs and Deficiencies Study is to compare a full range of transportation alternatives and evaluate their performance over a long range planning period. This evaluation is intended to consider the ability of these alternatives to accomplish defined transportation objectives, as well as their relative potential effects on the natural and social environment. Since transportation improvements usually have both positive and negative impacts, they must be weighed by decision makers and the public at-large to determine what combination of alternative strategies will provide the greatest benefit. A well-conceived transportation program for the study area could not only enhance the potential for regional economic development, but may also offer opportunities to improve the environment, and reinforce community linkages.

Because this Needs and Deficiencies Study considers a range of alternatives, the performance and impacts will vary over the evaluation period. This chapter presents a brief description of the level of improvement and the range of transportation improvements that is being considered in this evaluation. Subsequent chapters place these improvement alternatives in the context of the I-84 WOW corridor and evaluate their performance relative to the defined goals and objectives.

4.1 Level of Improvements

Level of Improvement (LOI) is intended to characterize the degree to which full construction or reconstruction is anticipated within the improvement alternative. Ranging from maintenance to “full build” alternatives, the LOI will dictate the type and degree of positive and negative impacts anticipated. The cost of even a “preservation of the mobility” approach can be quite substantial. Programs incorporating bridge or viaduct reconstruction often exceed \$100 million. Costs of this magnitude must be carefully considered before alternatives to increase capacity are ruled out.

A first cut of defining Transportation Alternatives (TAs) involved generalizing improvements in to three broad categories. They are described and evaluated in the remainder of this chapter.

4.2 Screening Methodology

The Transportation Alternatives formulated for the initial evaluation within the I-84 WOW Needs and Deficiencies Study were intended to address transportation deficiencies identified early in the study process. They were not intended to represent the final solution or for that matter to limit future consideration of additional strategies. Each of the alternatives were screened based on the transportation benefit that they provided, their environmental and social impacts, and their preliminary cost. The alternatives that provided the greatest benefit with the least amount of impact and cost were selected and brought before the Advisory Committee and the public for concurrence.

Following the evaluation of these preliminary improvement strategies, elements from several of the TAs were selected for further environmental and engineering evaluation. The themes from which the alternatives were grouped included:

- TA 1- No Build (Existing And Committed)
- TA 2 - Transportation System Management, Transit Operations, & Transportation Demand Management Transit Operations
- TA 3 – Freeway and Interchange Reconstruction

4.3 TA 1- No Build (Existing And Committed)

The No Build package (TA 1) constitutes the base case condition for the evaluation of transportation improvements. No Build generally includes existing and committed projects, along with the normal maintenance and operation of the transportation system over the forecast period. The details of TA 1 were presented in Technical Report 1, the Existing and Future Conditions Report, which analyzed the future performance of this TA.

4.4 TA 2 - Transportation System Management, Transit Operations, & Transportation Demand Management Transit Operations

Figure 4.1 illustrates some of the strategies associated with TA 2, and Table 4.1 summarizes the improvement strategies that could be included in TA 2. Given the general nature of TSM, TDM, and Transit Operation Alternatives, these improvements are to be distributed throughout the corridor. TSM improvements would include traffic operations and safety improvements applicable in many areas of the corridor. TDM improvements will be focused on areas of internal travel demand such as Waterbury's downtown or shopping areas such as Main Street South in Southbury. Transit Operations improvements are suggested to make modifications within the context of the existing transit route system. Improvements such as the enhancement of express and local bus services are also included within this category.

Given the small-scale, localized nature of TA 2 improvements, a definitive list of improvement sites cannot be defined at this stage. Instead, typical locations and improvements have been identified for comparative evaluation. Final improvements may vary from those targeted in this analysis.

TSM, TDM and Transit Operations improvements are usually implemented within the right-of-way and are less capital intensive than other transportation improvement alternatives, but taken in aggregate, the cost associated with TA 2 would be significant. The success of the program especially the TDM segment depends in large measure on the voluntary cooperation of the public and private sector. The various potential alternatives are as follows:

Table 4.1
TA 2: TSM, TDM, and TO

<i>Transportation System Management (TSM)</i>
Directional / Wayfinding Signage
Safety Enhancements
Intersection Improvements
Arterial Signal System Coordination
Intelligent Transportation Systems (ITS)
Sidewalks
Pedestrian Crossings & Separation
Bicycle Shared Lanes
Multi-purpose Paths
<i>Transit Operations</i>
Express Service Expansion
Additional Local Service
<i>Transportation Demand Management (TDM)</i>
Employer Ridesharing Subsidy
Employer Flex Hours
Peak Hour Pricing
Transit Discounts
Land Use Regulation - Mixed Use
Land Use - Transit Friendly
Land Use - Access Management
On-Street Parking Control
CBD Parking Control
Park and Ride Lots
<i>Maintenance and Operations</i>

Safety Enhancements

Safety improvements are an important part of the overall approach to transportation systems management. Five segments of I-84 had accident rates high enough to be listed on ConnDOT's 1995-1997 SLOSS (Suggested List of Surveillance Sites).

Some of the potential alternative solutions for these segments are as follows:

- Extension of truck climbing lanes, providing shoulders at truck climbing lanes (part of an existing ConnDOT project), and consideration of a truck rest area could reduce accidents between Interchanges 15 and 17.
- Improve the directional signage at Interchange 17 (Route 63) help reduce driver confusion in this area. Also, improving the intersection at Chase Parkway and Route 64 could reduce serious accidents at this area.

- Further study of the reconstruction of I-84 at the Route 8 interchange to remove the left hand exits and complex weaving patterns. Additionally, the installation of overhead variable message signs would alert traffic to peak hour congestion.

Intersection Operational Improvements

Several intersections in the I-84 WOW study area have been identified as having severe operational deficiencies. As part of the TSM strategy each of these intersections will need to be upgraded to meet acceptable standards for handling traffic. Some of the potential improvement solutions may include adding exclusive left turn lanes and signal phases, improving signal timing and coordination, adding lanes, grade separation, updating of signal and improving striping and signing. Some of the intersections that could benefit from additional lanes or signal timing include South Britain Road and Main Street South, Main Street South and Main Street North, Old Waterbury Road and Route 188, and Route 188 and I-84 Westbound Ramps.

Arterial Signal Coordination

This technique could improve travel times on principal arterial streets. Through coordinated traffic signal timing, vehicles will maintain a uniform speed and encounter as few red traffic signals as possible. The result is that motorists will experience fewer delays. In addition to the congestion between intersections, the possibility of queuing along the I-84 ramps could also be reduced. Some of the locations identified for arterial signal coordination are South Britain Road, Route 6/67, Route 188, and Route 63.

Intelligent Transportation Systems (ITS)

Possible ITS solutions in the I-84 West of Waterbury corridor include Advanced Traveler Information Systems (ATIS) and Incident Management. Through ATIS, information can be provided to motorists by means of Variable Message Signs (VMS) and Highway Advisory Radio (HAR), as well as before they start their trip, either through a phone number, or a website, or both. Incident management is the rapid detection and response to any incident with the potential to reduce traffic flow. Motorists and Closed Circuit Television (CCTV) cameras detect incidents and an operator at a Traffic Operations Center (TOC) can determine what action is needed and dispatch appropriate personnel. The operator can then use the Advanced Traveler Information Systems to quickly notify motorists of the incident, so that they can choose alternate routes.

One of the major causes of traffic delays is non-recurring congestion, caused by construction, accidents, or other unusual incidents. Information will be provided to motorists by means of VMS and HAR. Information can also be made available to motorists before they start their trip, either through a phone number, or a website, or both.

Typically, an incident will occur on one route, while parallel routes will be unaffected. Unless they have accurate, up-to-date information, motorists will be unable to avoid these incidents, and will incur unnecessary delays.

Incident management is the rapid detection and response to any incident with the potential to reduce traffic flow. A common means of incident detection is cellular phone calls from motorists who observe an incident. According to the *ITS Strategic Plan*, this system works well. However, in order to confirm these reports, and help determine the appropriate response, an additional system is proposed. The surveillance of I-84 by a set of CCTV cameras would fulfill this function. These cameras would be connected to monitors at a TOC, where an operator can confirm that an incident has taken place, determine what is needed to clear the incident, and dispatch appropriate personnel and equipment to deal with it. The operator can then use the Advanced Traveler Information Systems to quickly notify motorists of the incident, so that they can choose alternate routes.

Another Incident Management facet recommended by the *ITS Strategic Plan* is the Connecticut Highway Assistance Motorist Patrols, or CHAMP. These are light trucks, staffed by Department of Transportation employees, equipped to handle minor traffic incidents without the dispatch of additional equipment. They can provide a motorist with gasoline, a jump-start, a battery, push a stalled auto out of the traffic stream, or assist in changing a tire. They can remove debris from the right-of-way, and set up signs for accident and detour routes. Additionally, they observe traffic conditions and report to the operators at the TOC. CHAMP patrols already exist on I-95 and on I-91, and the *ITS Strategic Plan* urges their expansion to I-84. Nationwide, Highway Service Patrols have proven to be extremely popular in many urban areas, and have proven invaluable in building public support for ITS projects.

Transportation Demand Management

In most portions of the I-84 WOW study area, the existing pattern of land use and the relative availability of parking (in comparison with larger metropolitan areas) favor the use of single-occupant vehicles (SOVs). Even workers within the regional core - Downtown Waterbury - utilize an SOV more commonly than any other mode. The 1990 census reports that 76 percent of Waterbury residents drove alone, while only 15 percent utilized carpools, or vanpools and three percent used public transportation. The remaining six percent either walked or bicycled to work, or worked at home. For outlying employment centers, the proportion of commuters driving alone is even greater, reaching 85 percent in Southbury, Middlebury and Oxford combined. Of these communities, nine percent carpool, less than one percent use public transit, and the remaining five percent walk, bike, or work at home.

Market rate parking costs in Downtown Waterbury range from approximately \$40-60 monthly for parking garages. Most metered lots have a cost of twenty-five cents for each 20 minutes, usually with a limit of three hours. However, many of the Downtown employees, including most State of Connecticut employees, have free parking provided to them. Elsewhere within the study area, almost all employee parking is provided for free.

Based on past regional and nationwide experience, the adoption of a high-profile TDM initiative at an individual employer can result in an increase in use of High Occupancy modes of up to 20 percent. Because HOV travel still represents a minority of travel in most work sites (especially for suburban and non-CBD locations), the total impact on congestion or modal split would be proportionately lower. A voluntary employer-based program implies that participation will be substantially less than 100 percent. Current corporate participation rates (the number of firms

participating versus the total number of area businesses) are in the range of one percent of all employers and ten percent of all employees.

Park and Ride Lots

Park and Ride Lots are designed to encourage carpooling and reduce the number of vehicles on the road during peak hours. The eight park and ride lots found within the study area are listed in Table 2.3 in Chapter 2 of this report.

In a memorandum entitled *Commuter Parking Lot Facilities in the Central Naugatuck Valley Region, Occupancy Analysis and Recommendations* by the COGCNV dated December 27th, 2000, recommendations were given on the potential expansion of commuter lots. The COGCNV study confirmed that the Route 63 lot in Middlebury exceeds its capacity on average. Since ConnDOT considers commuter parking lots at or above 75 percent of their capacity to be sites for potential expansion, this was the only lot that met that criterion.

In addition, the study concluded that driver awareness of commuter parking lots along Interstate 84 is needed. The installation of “Park & Ride” signage along I-84 and Route 8 could encourage the use of such facilities.

Congestion Management Strategy Report

Federal regulations require every state and metropolitan planning organization to establish a congestion management system (CMS) as part of its overall transportation planning program. The CMS proposed for the State of Connecticut and the Central Naugatuck Valley includes a requirement to prepare a special strategy report for each area or corridor with significant congestion. The purpose of the report is to identify and evaluate appropriate congestion mitigation strategies.

The I-84 WOW Needs and Deficiencies Study will serve the function of a CMS strategy report. As such, the Needs and Deficiencies will: (1) identify and thoroughly assess congestion in the corridor, and (2) identify and fully evaluate all appropriate congestion mitigation strategies. The study will use appropriate performance measures to both assess congestion and evaluate the effectiveness of mitigation strategies. Performance measures will be selected from the list of measures specified in Connecticut’s CMS guidelines.

Transit Operations

Improvements to transit operations could include a new express bus service on I-84 with loops into major centers of population within the study area. A conceptual service was evaluated as a transportation alternative to evaluate its feasibility.

To survey the need for additional transit service in the corridor, several of the activity centers connected by the conceptual transit route were contacted to determine the current transit use or need. Heritage Village provides their own transportation for residents. Mini-bus shuttles are available for rides to local activities and appointments. For longer excursions, Heritage Village rents motor coaches approximately monthly to attend events throughout New England. The

towns of Southbury, Middlebury and Oxford all provide handicapped and senior shuttle, which run on various days of the week for shopping and doctors appointments. The Southbury Training School also utilizes their own buses to accommodate scheduled trips. In addition to these services, the Waterbury Hospital provides a B-well shuttle for patients who need a ride to doctors appointments. Based on the conversations with these organizations, it appears that the transit needs of these populations are being adequately served by the existing on-call shuttle services.

In order to attract riders that are not transit-dependant, the conceptual transit route must have a competitive travel time with the existing transportation facilities in the study area. If a bus service ran on existing I-84 mixed with other traffic, the travel time would be the same as the other vehicles plus the delays due to stops for passenger drop-off and pick-up. Therefore, in order to be competitive with I-84, an exclusive lane or facility would have to be constructed.

Based on the low numbers of transit-dependant households and the low population density in the study corridor, the conceptual transit route would have low ridership unless congestion on I-84 significantly increased and an exclusive facility could be constructed. For these reasons, providing additional transit service beyond Waterbury did not prove feasible.

4.5 TA 3 – Freeway and Interchange Reconstruction

Reconstruction improvements include adding a general-purpose lane to the freeway in each direction as well as reconstruction of left entrance and exit ramps, completion of partial interchanges and consolidation of split interchanges. Illustrated on [Figures 4.2, 4.3, and 4.4](#) are the strategies associated with TA 3.

Additional General Purpose Lane Alternative

This improvement would consist of constructing an additional twelve-foot lane in each direction, and a twelve-foot inside shoulder. The additional lane would be continuous between the Housatonic River and Interchange 18. Segments where there is an existing climbing lane would consist of four lanes where the outer lane would remain a climbing lane. Every effort would be made to achieve and maintain a twelve-foot outside shoulder for safety reasons (ConnDOT is currently adding shoulders to climbing lanes between Interchanges 13 and 16). At some locations where the elevation differential between the eastbound and westbound alignment is great, retaining structures may need to be constructed. At the east end of the corridor near Interchange 18, right-of-way restrictions may require that inside and outside shoulders be reduced to minimize or eliminate impacts on adjoining property.

HOV Lanes

High Occupancy Vehicle (HOV) lanes were considered as a potential utilization of the additional lane alternative; however, they proved ineffective in reducing congestion on the interstate in the studies performed to the east and west of this corridor. Within the WOW corridor, development patterns are characterized by small pockets of commercial/industrial land uses that do not support the employment densities necessary for HOV facilities to be successful. In addition, connectivity to Downtown Waterbury would present considerable challenges due to the existing

structural constraints in the area as well as the left hand entrance and exit ramp configurations that exist on I-84.

Interchange Improvement Alternatives

Based on workshops with ConnDOT and the study team, and meetings with the region, towns and city; a set of interchange improvements were developed to address the deficiencies identified at various locations along the corridor. The following paragraphs describe the proposed alternatives at each interchange. Conceptual illustrations of these alternatives are included in Technical Memorandum # 2.

Interchange 13 in Southbury is the westernmost interchange within the WOW study corridor. It forms a partial interchange just east of the Housatonic River, serving trips to and from the west. This interchange has two mainline lanes along I-84 in the eastbound and westbound directions. The on and off ramps to and from I-84 are single lane ramps. In the future year 2025 with increase in traffic volumes, the off-ramp to Fish Rock Road and I-84 eastbound junction operates at LOS F during the weekday evening peak hour condition. In the westbound direction, the on-ramp from Oakdale Road and I-84 junction operates at LOS F during the weekday morning peak hour condition.

The preliminary alternatives for this interchange were as follows:

- Complete the interchange so that traffic to and from all directions is served. In the westbound direction, the existing westbound entrance ramp would be replaced by new westbound entrance ramps in a buttonhook configuration terminating at a realigned Oakdale Manor Road. In the eastbound direction, the existing eastbound exit ramp would remain in the same location while a new eastbound entrance ramp would be constructed at the same point on Fish Rock Road. This alternative would likely require the overpass structure for River Road to be modified. The new ramp configuration would also allow for the inclusion of a commuter parking lot on either the eastbound or westbound side.
- Increase the turning radius of the westbound entrance ramp at Oakdale Manor Road. As it exists today, truck traffic heading east on Oakdale Manor Road attempting to enter the westbound ramp must encroach upon the westbound lanes to make a wide enough turn to access the ramp. Increasing to a standard 50-foot radius at this skewed approach will prevent this from occurring and improve safety. This alternative also has the potential for inclusion of a commuter parking facility.

Interchange 14 in Southbury has full directional access to and from Route 172. This interchange has two mainline lanes and single lane entrance and exit ramps along I-84 in the eastbound and westbound directions. In the future year 2025 with an increase in traffic volume, the eastbound entrance and exit ramp junctions with I-84 operate at LOS F during the weekday evening peak hour condition. The westbound entrance and exit ramp junctions with I-84 operate at LOS F during the weekday morning peak hour conditions. During the weekday evening peak hour, the South Britain Road and I-84 westbound exit ramp junction operates at LOS F. It has been determined that the lack of storage space between the westbound off ramp and Main Street South

along with the heavy right hand turn movement at this intersection creates a queuing problem at this ramp terminus.

The potential alternatives at this interchange were as follows:

- Improve operations by realigning the westbound exit ramp with the westbound entrance ramp. This alteration provides additional space between the ramp and Main Street South and forms a single signalized intersection where two un-signalized intersections previously existed. The relocation of the westbound exit ramp terminus raised the issue of sight distance from the northbound approach of Route 172. Preliminary calculations and site investigation determined that sight and stopping distance is adequate based on the ramp relocation.
- Realign Lakeside Road to form a perpendicular intersection with Georges Hill Road. This would reinforce Georges Hill as the major movement through this intersection and improve operations. The use of Lakeside by traffic towing boats should be considered if this alternative is to be advanced. Since Lakeside Road starts at the bottom of a hill, some vehicles towing heavy loads may have difficulty climbing the grade if they are forced to stop at the new intersection.

Interchange 15 is the primary access to the Town of Southbury. It provides full directional access to and from Route 6. Major commercial development in this area makes it the most heavily utilized interchange in Southbury. The configuration consists of two mainline lanes and single lane entrance and exit ramps along I-84 in the eastbound and westbound directions; however, in the westbound direction due to the presence of a climbing lane, there are three mainline lanes along I-84 just west of the on ramp from Route 6/Route 67 and the IBM Drive. Under the future year 2025 condition, the eastbound entrance and exit ramps from Route 67 operate at LOS F during the weekday evening peak hour, while the westbound entrance and exit ramps operate at LOS F during the weekday morning peak hour condition.

The preliminary alternatives for this interchange were as follows:

- Provide a bypass lane that diverges from the existing westbound frontage road just west of the intersection with Route 6 to alleviate the congestion at the Route 6 and Main Street South intersection. The bypass road would terminate at Bullet Hill Road just opposite the IBM westbound entrance ramp. This road could provide some relief to the Route 6 and Main Street South intersection by allowing traffic destined for Main Street South to use the bypass instead of the congested intersection.
- Carry the truck-climbing lane through the interchange area so that trucks and automobiles are not forced into a difficult weave near the eastbound exit ramp. This modification would likely involve the reconstruction of the I-84 bridge over Route 6.

Interchange 16 provides full directional access to and from Route 188 in Southbury. While these ramps are important to development in Southbury, they also serve development in Middlebury and Oxford. Interchange 16 also provides an important linkage to Oxford Airport. This interchange has two mainline lanes and single lane entrance and exit ramps along I-84 in the

eastbound and westbound directions. With increase in traffic volumes in the future year 2025, the eastbound entrance and exit ramps from Route 188 operate at LOS F during the weekday evening peak hour under future year condition, while the westbound entrance and exit ramps operate at LOS E and LOS F respectively during the weekday morning peak hour condition.

The preliminary alternatives for this interchange were as follows:

- Relocate the westbound exit and entrance ramps further east onto Route 188 in Middlebury. While the exact location and configuration of these ramps have not been precisely determined, relocation could help alleviate the congestion problem at the existing location and provide better access to development in Middlebury. Of course, such a modification could have negative impacts on property as well as to the Pomperaug High School.
- Increase the sub-standard radius ramp for the eastbound exit. A typical DOT radius under current standards would be 275 feet. Such an improvement would be aimed at safety, since the tighter radius requires a more rapid deceleration for vehicles exiting the highway. The eastbound entrance ramp would merge with the interstate at the same location as it does today.
- Realign Old Waterbury Road and Route 188 to intersect at approximately 180 feet to the north of the existing intersection. The realignment would provide the benefits of increasing the storage space between the existing westbound exit ramps while also improving sight distance at the intersection.
- Extend the acceleration lane from the westbound entrance ramp to provide additional merge distance for vehicles entering the interstate. Currently, vehicles are forced into a truck-climbing lane with little distance to merge safely.

New Interchange Between 16 and 17 - The Town of Oxford could potentially benefit from a more direct linkage to Oxford Airport and its surrounding development. Currently, access to this area is served by Interchange 16 along Route 188 and finally by an airport access road. If development in Middlebury and Oxford exceeds the State's forecast for zones in these towns, a new interchange alternative should be revisited.

The potential interchange would serve the airport in Oxford, the industrial area in the northern portion of Oxford, and the Middlebury industrial area. According to the "Plan of Development for Oxford, Connecticut" adopted in April 1991, Oxford has 1500 acres of industrially zoned property available for immediate development. If all of this property were to be developed in the next 25 years, the traffic could potentially exceed the capacity of Interchange 16.

Interchange 17 possesses some of the worst operational deficiencies in the WOW corridor. Due to the physical layout of the interchange, the eastbound entrance and exit ramps are accessed from Route 64 while the westbound entrance and exit ramps are accessed via Route 63. This split interchange configuration creates heavy congestion at the intersection of these two routes. Under the future year 2025 condition, the eastbound entrance and exit ramps from Route 63/Route 64 operate at LOS F during the weekday evening peak hour, while the westbound

entrance and exit ramps from Route 63 operate at LOS F during the weekday morning peak hour condition. In addition, the westbound off-ramp to Route 64 operates at LOS F during the weekday evening peak hour condition.

The preliminary alternatives at this interchange were as follows:

- Construct a full diamond-type ramp configuration with full directional access at Route 63. To handle the increase in traffic on Route 63, the road would be widened and realigned to approach the 63/64 intersection from the east rather than from the south. The existing Route 63 leg of the intersection (with the steep grade) would be terminated along with the existing Route 64 leg. The new intersection would consist of three legs, the east and west being the predominant movement, and would receive the additional green time from the terminated southern leg. The traffic using Route 64 east of the intersection would now be diverted to Route 63 by a newly constructed connector road between the two routes. Access to the existing Route 63 would still be possible and the residences along that road would be protected under this alternative.
- Provide full directional access to and from the interstate by constructing a connector road to Route 63 from the existing eastbound entrance and westbound exit ramps. Route 63 along with the Route 63/64 intersection would need major upgrades to handle the increase in traffic. Chase Parkway would also be realigned to merge with Route 64 without the intersection at the existing ramps. This alternative would not eliminate any of the legs at the Route 63/64 intersection.

Interchange 18 has two mainline lanes and single lane entrance and exit ramps along I-84 in the eastbound and westbound directions. However, in the westbound direction I-84 includes a truck-climbing lane at the Highland Avenue off ramp junction. Under the future year condition, all freeway ramp junctions operate at LOS E or worse during the weekday morning and evening peak hours.

The preliminary alternatives at this interchange were as follows:

- Improve the radius of curvature of the westbound exit ramp to Highland Avenue and West Main Street. The existing ramp is less than the 275-foot radius that is required under current standards.
- Consolidate the eastbound exit and entrance ramps to Chase Parkway and remove the Highland entrance ramp to I-84 eastbound. The new relocated entrance ramp would likely become two lanes to handle the additional traffic diverted from the Highland Avenue ramp.
- Widen the bridge carrying Chase Parkway over the interstate to accommodate additional left turn lanes at both ends. This would help alleviate the congestion at these intersections.
- Construct a two-way connector road between West Main Street and Highland Avenue and improve the I-84 exit ramp to a standard radius. The new westbound exit ramp would tee into the connector road at a new signalized intersection. This would allow for the passage of traffic between Highland and West Main Street.

Interchanges 19 – 21 - The conceptual alternatives for Interchanges 19 through 21 are included for the purpose of exploring the potential for a major bridge reconstruction. The benefits of these improvements have not been quantified in this analysis, but are discussed qualitatively to begin the thinking process on the future of this facility.

Interchanges 19, 20, and 21 constitute the series of ramps and interconnections that make up the ‘Mixmaster’ structure in Downtown Waterbury. The bridge structures for the eastbound and westbound viaducts are stacked vertically, rather than in a more conventional arrangement where the opposing roadways are parallel to each other. This section of I-84 experiences numerous operational, structural, and safety deficiencies. Some of these are as follows:

- Left hand exit from I-84 eastbound to Route 8 northbound;
- Left hand entrance to I-84 eastbound from Route 8 southbound;
- Left hand entrance to I-84 westbound from Route 8 northbound;
- Left hand entrance to I-84 westbound from Bank Street;
- Substandard weave section between I-84 eastbound entrance from Route 8 south to Meadow Street Exit ramp;
- Substandard weave section between I-84 westbound entrance from Route 8 north to Highland Street Exit ramp;
- High accident location I-84 at Route 8, Meadow Street Interchange (Interchange 21);
- Two lane stretch of I-84 eastbound between exit to Route 8 northbound and entrance from Route 8 southbound; and
- Poor structural rating on main span over Naugatuck River (will be upgraded by ConnDOT).

This structure was completed in the mid-1960’s and no longer has the capacity to support the growth in traffic over the past forty years. While it is possible to maintain the structure so that it meets federal safety standards, it provides a major constraint to traffic flow on I-84 west of Hartford. While the rest of I-84 is upgraded to three lanes in each direction, Waterbury will continue to see gridlock conditions (especially eastbound) if some of these operational deficiencies are not addressed. To help visualize the complexity of the situation, [Figure 4.5](#) has been color coded to identify the various components of this interchange.

[Figure 4.6](#) is a conceptual layout of some of the possibilities that might address the deficiencies. This illustration is not intended to be a recommendation for future improvements. It merely explores the potential for some changes that can provide some benefit to the transportation system and the City of Waterbury as well. No traffic impacts, environmental impacts, or capital costs have been quantified. The highlights of this plan are as follows:

- A new I-84 westbound structure would be constructed that runs parallel to, and at the same elevation of, the existing eastbound structure to carry I-84 through traffic – a short segment of existing I-84 westbound upstream of the entrance ramp from Route 8 southbound would be eliminated;
- The existing I-84 westbound structure would remain functional to handle traffic destined for Route 8 or Downtown Waterbury;

- A collector/distributor (CD) road would be constructed parallel to I-84 eastbound to handle traffic movement to Route 8 north and south and also to Downtown Waterbury – this road would eventually tie into the at-grade intersection at Bank Street and continue along Market Square to the entrance ramp at Interchange 22;
- Each of the left hand entrance and exit ramps would be replaced by right hand ramps; and
- I-84 eastbound would maintain three lanes throughout the interchange.

While no formal transportation improvement is to be evaluated in this study, the recommendation in this case would be to investigate the interchange area in greater detail in a future study.

4.6 Transportation Evaluation

Mainline Capacity Analysis

In order to assess the capacity along I-84 with the additional lane in each direction, a freeway analysis was performed during the weekday morning and evening peak hour conditions. The results of the analysis are shown in Tables 4.2 and 4.3. The following tables also indicate the number of lanes in each direction and the traffic volumes along I-84 for the weekday morning and evening peak hour conditions. East of Interchange 19, no additional lanes have been proposed, primarily due to the fact that the interchange with Route 8 is constrained to widening and three lanes currently exist east of the interchange. For this reason, the LOS does not improve for these segments for the Build scenario.

Table 4.2
Freeway Analysis Summary – Build Scenario (Eastbound Direction)

SECTION ALONG I-84	Number of Lanes		Traffic Volumes	Level of Service	
	No Build	Build		No-Build	Build
Between Int. 13 and Int. 14	2	3	2790(4730)	D(F)	C(E)
Between Int. 14 and Int. 15	2	3	2930(4390)	D(F)	C(D)
Between Int. 15 and Int. 16	2	3	2580(4180)	D(F)	C(D)
Between Int. 16 and Int. 17	2	3	2890(4300)	D(F)	C(D)
Between Int. 17 and Int. 17	2	3	2490(3670)	D(E)	C(D)
Between Int. 17 and Int. 18	2	3	3700(4940)	E(F)	D(E)
Between Int. 18 and Int. 19	2	3	4140(5350)	F(F)	D(E)
Between Int. 19 and Int. 20 *	2	2	3390(4460)	E(F)	E(F)
Between Int. 20 and Int. 21 *	4	4	7230(7990)	F(F)	F(F)
Between Int. 21 and Int. 22 *	3	3	6310(7720)	F(F)	F(F)
Between Int. 22 and Int. 23 *	3	3	5200(5940)	E(E)^	E(E)^

X(X) Represents LOS for AM peak hour. PM Peak LOS shown in parenthesis.

^ Analysis used a Peak Hour Factor (PHF) of 0.95 during the P.M. peak hour.

* No additional lanes have been proposed for these segments – need to analyze in separate study.

As indicated in the table, in the eastbound direction the additional lane along I-84 shows improvement in levels of service between Interchanges 13 and 19 from the no-build to build condition. The level of service does not change from the no-build condition east of Interchange 19 along I-84. It is important to note that wherever there is a climbing lane along I-84, the analysis was conducted for the worst-case scenario assuming that the climbing lane does not

exist along that section. The results of the capacity analysis are graphically represented in [Figures 4.7 and 4.8](#).

In the eastbound direction, it was assumed for this analysis that the additional lane would be dropped at Interchange 19. Therefore, east of Interchange 19, the number of lanes along I-84 would be similar to existing conditions.

Table 4.3
Freeway Analysis Summary – Build Scenario (Westbound Direction)

SECTION ALONG I-84	Number of Lanes		Traffic Volumes	Level of Service	
	No Build	Build		No-Build	Build
Between Int. 13 and Int. 14	2	3	4420(3500)	F(E)	E(D)
Between Int. 14 and Int. 15	2	3	4170(3580)	F(F)	D(D)
Between Int. 15 and Int. 16	2	3	3850(3220)	E(E)	D(C)
Between Int. 16 and Int. 17	2	3	3940(3490)	F(E)	D(D)
Between Int. 17 and Int. 17	2	3	3340(3090)	E(E)	C(C)
Between Int. 17 and Int. 18	2	3	4210(4630)	F(F)	D(E)
Between Int. 18 and Int. 19 *	4	4	5530(6290)	E(E)	E(E)
Between Int. 19 and Int. 20 *	3	3	3300(4490)	D(E)	D(E)
Between Int. 20 and Int. 21 *	5	5	6150(8040)	D(E)	D(E)
Between Int. 21 and Int. 22 *	3	3	6310(7430)	F(F)	F(F)
Between Int. 22 and Int. 23 *	3	3	5160(6070)	E(E)^	E(E)^

X(X) Represents LOS for AM peak hour. PM Peak LOS shown in parenthesis.

^ Analysis used a Peak Hour Factor (PHF) of 0.95 during the P.M. peak hour.

* No additional lanes have been proposed for these segments – need to analyze in separate study.

As indicated in the table, all sections of I-84 between Interchanges 13 and 19 will operate at LOS E or better with the additional lane in the westbound direction for the weekday morning and evening peak hour conditions.

Weaving Analysis

For the purpose of this analysis, it was assumed that the additional lane in the eastbound and westbound directions along I-84 would begin in the vicinity of Interchange 18. Because the improvements east of Interchange 18 would need to be studied in greater detail and recommendations at this area are not presented as part of this study, the critical weaving movements identified in the Existing and Future Conditions Report remain unaffected.

Freeway-Ramp Analysis

A freeway-ramp analysis was conducted for the weekday morning and evening peak hour conditions to observe the effect of an adding a general-purpose lane in each direction along I-84. Additionally, the TA3 scenario consists of providing interchange improvements at several locations along the corridor. The following table provides freeway and ramp volumes at each interchange that were used for analysis purposes. The results of the freeway-ramp analysis are provided in Table 4.4.

Table 4.4
Freeway Ramp Analysis Summary

INTERCHANGE on I-84	Eastbound Direction				Westbound Direction			
	Traffic Volumes		Level of Service		Traffic Volumes		Level of Service	
	Freeway	Ramp	No Build	Build	Freeway	Ramp	No Build	Build
Interchange 13								
Off Ramp to Fish Rock Road	2800(4820)	80(170)	C(F)	B(D)	-	-	-	-
On Ramp from Fish Rock Road	2720(4650)	70(80)	-	B(C)	-	-	-	-
Off Ramp to Oakdale Road	-	-	-	-	4420(3500)	50(70)	-	C(C)
On Ramp from Oakdale Road	-	-	-	-	4370(3430)	100(60)	F(D)	C(C)
Interchange 14								
Off Ramp to Lakeside Road	2790(4730)	210(660)	C(F)	B(D)	-	-	-	-
On Ramp from Georges Hill Road	2580(4070)	350(320)	D(F)	C(C)	-	-	-	-
Off Ramp to South Britain Road	-	-	-	-	4170(3580)	400(330)	F(F)	C(C)
On Ramp From South Britain Road	-	-	-	-	3770(3250)	650(230)	F(D)	C(C)
Interchange 15								
Off Ramp to Route 67	2930(4390)	850(980)	D(F)	C(D)	3850(3220)	890(580)	F(D)	C(C)
On Ramp from Route 67/I.B.M Drive	2080(3410)	500(770)	C(F)	B(D)	2960(2640)	1210(940)	F(D)	D(C)
Interchange 16								
Off Ramp to Route 188	2580(4180)	180(350)	C(F)	B(C)	3940(3490)	480(540)	F(D)	C(C)
On Ramp from Route 188	2400(3830)	490(470)	D(F)	C(C)	3460(2950)	390(270)	E(D)	C(C)
Interchange 17								
Off Ramp to Route 63	2890(4300)	400(630)	D(F)	B(C)	-	-	-	-
On Ramp from Route 64	2490(3670)	1210(1270)	D(F)	C(D)	-	-	-	-
Off Ramp to Route 64	-	-	-	-	4210(4630)	870(1540)	F(F)	C(D)
On Ramp from Route 63	-	-	-	-	3340(3090)	600(400)	F(D)	C(C)
Interchange 18								
<i>Consolidated Ramp Alternative</i>								
Off Ramp to Chase Parkway	3700(4940)	400(540)	E(F)	C(D)	-	-	-	-
On Ramp from Chase Parkway	3300(4400)	1440(1620)	F(F)	C(F)	-	-	-	-
Off Ramp to Main St./Highland Ave.	-	-	-	-	5530(6290)	1660(1930)	E(F)	E(F)
On Ramp from Chase Parkway	-	-	-	-	3870(4360)	340(270)	F(F)	C(C)
<i>Connector Road Alternative</i>								
Off Ramp to Chase Parkway	3700(4940)	400(540)	E(F)	C(D)	-	-	-	-
On Ramp from Chase Parkway	3300(4400)	840(950)	F(F)	D(E)	-	-	-	-
Off Ramp to Main St./Highland Ave.	-	-	-	-	5530(6290)	1660(1930)	E(F)	E(F)
On Ramp from Chase Parkway	-	-	-	-	3870(4360)	340(270)	F(F)	C(C)

Table 4.4 - continued
Freeway Ramp Analysis Summary

INTERCHANGE on I-84	Eastbound Direction				Westbound Direction			
	Traffic Volumes		Level of Service		Traffic Volumes		Level of Service	
	Freeway	Ramp	No Build	Build	Freeway	Ramp	No Build	Build
Interchange 19 *								
Off Ramp to Sunnyside Ave./Route 8 SB	4140(5350)	610(550)	C(D)	C(C)	-	-	-	-
Off Ramp to Route 8 NB	3530(4800)	740(1010)	D(F)	C(D)	-	-	-	-
On Ramp from Highland Ave.	2790(3790)	600(670)	D(F)	D(F)	-	-	-	-
On Ramp from Route 8 SB	-	-	-	-	3980(5100)	1550(1190)	E(F)	E(F)
Interchange 20 *								
Off Ramp to Route 8 SB	-	-	-	-	6150(8040)	1300(1550)	F(F)	F(F)
Off Ramp to Route 8 NB	-	-	-	-	4850(6690)	1550(2200)	D(F)	D(F)
On Ramp from Route 8 SB	3390(4460)	2260(2050)	F(F)	F(F)	-	-	-	-
On Ramp from Route 8 NB	5650(6510)	1580(1480)	F(F)	F(F)	3300(4490)	680(610)	F(F)	F(F)
Interchange 21 *								
Off Ramp to Meadow St.	7230(7990)	600(410)	F(F)	F(F)	6310(7430)	800(530)	F(F)	F(F)
Off Ramp to South Main St.	6630(7580)	800(760)	F(F)	F(F)	-	-	-	-
On Ramp from Meadow St.	5830(6820)	480(900)	F(F)	F(F)	-	-	-	-
On Ramp from Bank St. (Left)	-	-	-	-	5510(6900)	200(340)	E(F)	E(F)
On Ramp from Bank St. (Right)	-	-	-	-	5710(7240)	440(800)	F(F)	F(F)
Interchange 22 *								
Off Ramp to Frontage Road	6310(7720)	1110(1780)	F(F)	F(F)	-	-	-	-
Off Ramp to Union St.	-	-	-	-	5160(6070)	500(500)	D(F)	D(F)
On Ramp from Union St.	-	-	-	-	4660(5570)	1650(1860)	F(F)	F(F)
Interchange 23 *								
Off Ramp to Hamilton Ave.	-	-	-	-	5410(6390)	250(320)	F(F)	F(F)
On Ramp from Hamilton Ave.	5200(5940)	700(970)	E(F)	E(F)	-	-	-	-

* Note: Interchanges 19 through 23 do not improve from the No Build condition since the additional lane ends at Interchange 18.
() Denotes PM data.

As indicated in the table above, with the additional general-purpose lane along I-84 in both directions, all freeway-ramp junctions between Interchanges 13 and 17 operate at LOS D or better during the weekday morning and evening peak hour conditions.

At Interchange 18, the eastbound off ramp junctions operate at LOS D or better during the weekday morning and evening peak hour directions. Under the Consolidated Ramp Alternative, the Highland Avenue on-ramp is removed, and therefore the on-ramp from Chase Parkway has a higher volume as compared to the Connector Road Alternative. The new eastbound on-ramp from Chase Parkway under the first Alternative would operate at LOS C and LOS F respectively for the weekday morning and evening peak hour conditions; however, under the second Alternative, the eastbound on-ramp from Chase Parkway would operate at LOS D and LOS E respectively. It is important to note that under the first Alternative, the eastbound on-ramp from Chase Parkway is assumed to be a two-lane ramp to handle the increase in traffic.

In the westbound direction at Interchange 18, the off-ramp junction will operate at LOS E and LOS F during the weekday morning and evening peak hour conditions respectively. This is due to the fact that an additional lane would be provided along I-84 in the westbound direction west of Interchange 18. For this reason, the westbound on-ramp junction will improve to LOS C when compared to the No-Build condition (LOS F).

In the eastbound direction, it is assumed that the additional lane will be dropped after the interchange and therefore, east of Interchange 18 will have no improvement in levels of service beyond the No-Build condition. In the westbound direction, all freeway-ramp junctions east of Interchange 18 will not show improvements in levels of service since the additional lane begins west of this interchange.

Intersection Analysis

Level of service analysis at intersections affected by these improvements was conducted for the weekday morning and evening peak hour conditions. For this analysis it was assumed that I-84 would consist of an additional lane in the eastbound and westbound directions from Interchange 13 to 18. Table 4.5 presents the results of the intersection analysis by interchange alternative.

Table 4.5
Intersection Analysis – Build Scenario

INTERSECTION	No Build		Build	
	AM	PM	AM	PM
Interchange 13				
I-84 WB Ramps and Oakdale Road	-	-	A	A
I-84 EB Ramps and Fish Rock Road	B	C	B	C
Interchange 14				
South Main St. and South Britain Rd.	E	F	E	F
South Britain Road and I-84 WB Ramps	D	F	B	B
S. Britain Rd. and I-84 EB Ramps	B	F	B	C
Lakeside Rd. and Georges Hill Road	-	-	B	B
Interchange 15				
I-84 EB Ramps and Rt. 6/Rt. 67	B	C	C	C
I-84 WB Ramps and Rt. 6/Rt. 67	E	D	E	E
N. Main St. and Old Waterbury Rd./Heritage Road	F	E	F	E
Main Street and Southford Rd./Shopping Plaza	F	F	F	F
Rt. 487/Rt. 67 and Community House Road	C	D	C	D
Interchange 16				
<i>With Relocated Westbound Ramps</i>				
I-84 EB Ramps and Route 188	E	C	E	C
I-84 WB Ramps and Route 188	D	D	B	B
Old Waterbury Road and Route 188	F	F	F	F
<i>With Realigned Old Waterbury Road</i>				
I-84 EB Ramps and Route 188	E	C	E	C
I-84 WB Ramps and Route 188	D	D	D	D
Old Waterbury Road and Route 188	F	F	F	F

Table 4.5 – continued
Intersection Analysis – Build Scenario

INTERSECTION	No Build		Build	
	AM	PM	AM	PM
Interchange 17				
<i>With Full Interchange at Rt. 63, Realignment of Rt. 63, and new Connector Road</i>				
I-84 EB Off Ramp and Rt. 63	B	B	B	C
I-84 WB Off Ramp and Chase Parkway/Route 63	F	F	C	C
Route 63 and Route 64	F	F	B	C
Route 63 and Connector Road	-	-	C	D
<i>With Connector Road to Route 63</i>				
I-84 EB Off Ramp and Route 63	B	B	B	B
Connector Road and Route 63	F	F	C	C
Route 63 and Route 64	F	F	C	D
Interchange 18				
<i>With Consolidated Eastbound Ramps</i>				
I-84 EB Off Ramp and Chase Parkway	B	C	C	D
Chase Parkway and W. Main Street	F	F	C	C
Chase Parkway and Country Club Road	F	E	C	C
<i>With Connector Road</i>				
I-84 EB Off Ramp and Chase Parkway	B	C	B	C
W. Main St. and Connector Rd.	F	F	C	D
I-84 WB Off Ramp and Connector Road	-	-	A	A
Highland Ave. and Connector Road	F	F	C	C

Bold-faced letters indicate un-signalized intersection.

4.7 Environmental Evaluation

A preliminary environmental evaluation was made of the alternatives under consideration for the I-84 WOW study area. This evaluation looked at environmental constraints that would need to be studied further for the selected action(s) during the environmental process for project implementation under the National Environmental Policy Act (NEPA), and the Connecticut Environmental Policy Act (CEPA). The analysis also took into consideration the social and historical impacts that were potential to any of the alternatives. Each of the alternatives evaluated in the study have been given a rating of either ‘no significant impact’, ‘minor impact’, or ‘major impact’ for each of the constraints.

At this stage of planning, a simple qualitative evaluation of anticipated environmental constraints has been made, using secondary-source data such as GIS data, aerial mapping, and USGS topographic mapping. Under the NEPA and CEPA processes, it would be expected that a more rigorous investigation would be made into existing conditions and anticipated impacts using field review and more intensive data collection.

As part of any environmental evaluation, the study considers both a “No-Build” alternative as well as “Build” alternatives. The No-Build Alternative would assume that no action is taken in the study area other than maintenance of existing facilities and implementation of currently programmed actions. For the five interchanges that are evaluated below, the No-Build Alternative would be expected to have a negligible effect, if any, on most environmental

constraints, since no action would be taken. The one exception is air quality, where the No-Build alternative could potentially have adverse effects on air quality due to increased congestion and delay, compared to build alternatives, which would improve traffic operations.

Table 4.6 shows a comparative representation of the potential environmental impacts associated with each alternative. Potential impacts were ranked into broad qualitative categories: “Minor Impact,” “Major Impact,” and “No/Insignificant Impact.”

4.8 Preliminary Construction Cost Estimates

Costs for each construction element of TAs 2 and 3 were estimated based on unit costs derived from similar planning project assessments. Capital cost items such as pavement, earthwork, structures, drainage, and other miscellaneous improvements were estimated for each alternative and subtotaled. Costs for contingencies and incidentals were added to this to get order of magnitude cost estimates for each type of improvement. Items such as right of way acquisitions and environmental mitigation efforts were not included in the costs due to the preliminary nature of these estimates.

The costs developed for the screening process were based on general assumptions regarding topographical constraints and feasible constructability. Due to these assumptions, conservative factors were used to derive the costs. Since these costs were “order of magnitude” estimates, they were used as a rough guideline for comparing the relative investments of each preliminary alternative improvement. More detailed cost estimates were developed for the alternatives that resulted from the screening process, and are included in Chapter 5 of this document.

4.9 Preliminary Screening

Each of the alternative improvements was evaluated based on their ability to address the initial Goals and Objectives of the study. Issues such as congestion mitigation, environmental impact, and preliminary cost were considered by ConnDOT, COGCNV, the AC, and corridor communities and over the course of the project preferences for several of the alternatives became apparent. In many cases, it was requested that the study team refine select alternatives in order to mitigate some of these issues and improve the solution. That process constitutes the next chapter in this report.

The following text contains a qualitative review of how each TA addressed the stated goals of the project.

Goal 1: Congestion Reduction

Congestion reduction includes eliminating operational or physical constraints on I-84 and arterials, reducing vehicle hours of travel during peak periods, and utilizing ITS strategies to more efficiently manage transportation services and demand. TA 1 is neutral or strongly negative in meeting the objectives associated with congestion reduction. TA 2 is neutral or generally supportive. TA 3 (Interchange Improvements) and TA 3 (Additional Lane) are generally supportive or strongly supportive.

Table 4.6
Ranking of Potential Environmental Impacts

Alternatives	Prime or Statewide Important Farmland Soil Impacts	Environmental Risk Sites	State Wetland Soils	Threatened and Endangered Species	Wells, Aquifers and Public Water Supplies	Floodplains	Surface Waters	Parks and Recreations	Archeological	Historic Locations (4(f))	Air Quality Impacts	Sensitive Noise Receptors	Right of Way Acquisitions
Alternative 13	-	-	-	x	-	-	-	✓	-	-	✓	-	-
Alternative 14	✓	-	-	✓	x	-	-	-	✓	-	-	-	-
Alternative 15	✓	-	-	✓	x	x	-	-	-	-	-	✓	-
Alternative 16A	x	-	✓	-	✓	✓	x	-	-	-	-	✓	✓
Alternative 16B	-	-	✓	-	-	-	-	-	-	-	-	-	-
Alternative 17A	✓	-	x	-	-	x	x	-	-	-	-	✓	x
Alternative 17B	✓	-	✓	-	-	x	✓	-	-	-	-	-	x
Alternative 18A	✓	-	x	-	-	-	-	-	-	-	-	-	✓
Alternative 18B	✓	-	x	-	-	-	-	-	-	-	-	-	✓
No Build	-	-	-	-	-	-	-	-	-	✓	-	-	-
Add-a-lane	-	-	-	-	✓	✓	✓	-	-	-	-	✓	-

Ranking of Potential Impacts

✓ = Minor Impacts x = Major Impacts - = No/Insignificant Impacts

Goals 2: Public Health and Safety

The goal of enhancing public health and safety within the corridor comes in many forms. The objectives defined to support this goal focus principally on the reduction in accidents and potential hazards, the reduction of truck-related accidents, the control of traffic speeds, the elimination or reduction of unsafe physical conditions, the reduction of mobile source air quality emissions, and the reduction in noise impacts on sensitive receptors. The safety of the traveling public in both motorized and non-motorized vehicles and the health and safety of adjoining property owners is of paramount importance.

TA 1 is expected to generally result in deterioration in all categories evaluated. Continued increase in demand and congestion will increase accidents, emissions and noise. TA 2 will have a generally positive impact on controlling speed and reducing emissions, a strongly positive impact on reducing accidents and neutral impact on truck accidents, physical upgrades and noise. TA 3 (Interchange Improvements) will generally benefit public health and safety in almost all categories. TA 3 (Interchange Improvements) (Additional Lane) is strongly supportive of most of the objectives, such as accident reduction, control of speeds, and physical roadway conditions, but is expected to be neutral in terms of emissions.

Goal 3: Economic Development

There are four objectives that have been defined to support the goal of continued regional and statewide economic growth and development. TA 1 is generally negative for economic development, while TA 2 is completely neutral. TA 3 (Interchange Improvements) and TA 3 (Additional Lane) are supportive, with TA 3 (Interchange Improvements) being generally supportive and TA 3 (Additional Lane) being strongly supportive.

Goal 4: Community Livability and Quality of Life

There are six objectives defined as a means to measure transportation influence on community livability and quality of life. While TA 1 is supportive of avoiding most environmental impacts, it is neutral or negative for all the other community livability objectives, such as air and noise impacts and improving traffic flow. TA 2 provides generally supportive short-term action without the likelihood of impact on environmental resources. TA 3 (Interchange Improvements) and TA 3 (Additional Lane), because they focus on improved freeway operations, capacity, and management, would have a generally beneficial or neutral impact. The exception is in the avoidance of impacts to environmental resources, in which both would have a negative impact.