# ENVIRONMENTAL IMPACTS

The estimated environmental impacts that may result with implementation of any of the alternatives or the preferred alternative are discussed and compared in the following sections. For purposes of impact minimization and mitigation planning, certain analyses of the preferred alternative were performed in more detail or by utilizing data or methods that have become available since publication of the DEIS in 1999. Because the preferred alternative is a variation developed from the original alternatives through the extensive minimization and coordination process described in Sections 3 and 7, these differences do not affect comparisons of the original alternatives.

## 5.1 TRAFFIC AND TRANSPORTATION

### 5.1.1 ALTERNATIVE TRANSPORTATION STRATEGIES

A total of 14 potential transportation improvement alternatives, plus the no build alternative, were presented in Section 3.3 of this document and are evaluated herein. The preferred alternative, a variation of one of the original 14 alternatives, was presented in Section 3.4. Some of the alignments were developed in an effort to minimize specific environmental impacts. However, for purposes of evaluating their effectiveness with respect to transportation issues, these alternatives, regardless of alignment, would fulfill the same specific transportation objective (i.e., all of the full build new expressway alignments begin and end in the same locations and would, ostensibly, accommodate virtually identical volumes of through traffic). Therefore, in order to evaluate anticipated traffic conditions and safety deficiencies relative to specific transportation strategies, the fourteen potential improvement alternatives were grouped based on transportation-related factors. For transportation evaluation purposes, the alternative strategies consist of TSM, TDM/transit, $W_{(4)}$, the full build expressway alternatives and the partial build expressway alternatives. The preferred alternative is also a full build expressway alternative and would provide the same traffic operations as the other full build expressway alternatives. Note that for purposes of analyzing operational efficiency, implementation of all TSM recommendations would approximate conditions after widening shoulders and adding lanes as proposed under the $W_{(2)}$ alternative.

Future daily traffic volumes and AM and PM peak hour traffic volumes for each alternative strategy are presented, herein. Conditions at signalized and unsignalized intersections and specific roadway segments are also presented. Future traffic conditions at the I-95/I-395/U.S. Route 1 interchange with the preferred alternative are provided in detail for freeway segments, ramps, and intersections.

Traffic forecasts used in this analysis were reviewed for the 2006 Reevaluation of the DEIS (Appendix A) by the ConnDOT traffic forecasting division. Traffic volumes projected for 2020 were assessed in light of recent (2004) automated traffic recorder counts collected at several locations on Routes 82 and 85. A comparison of the 2004 counts with the forecasts provided in the following analysis determined that the traffic volume increases projected are consistent with current recorded volumes; therefore, the analysis using 1998 data remains valid for use in this FEIS (ConnDOT Memorandum, 2007).

5.1.1.1 *Route 82 and 85 Four-Lane Widening Alternatives*: Future traffic volumes were forecasted for the year 2020 based upon the travel demand model process. In an effort to gain an understanding of the impact of the Route 82 and Route 85 four-lane widening alternative on travel patterns in the area, Table 5-1 presents a volume comparison between the 2020 no build and 2020 Route 82 and Route 85 four-lane widening alternative at select locations.

TABLE 5-1
VOLUME COMPARISON: FOUR-LANE WIDENING VS NO BUILD

| LOCATION | 2020 ADT | | 2020 AM PEAK HOUR | | 2020 PM PEAK HOUR | |
|---|---|---|---|---|---|---|
| | NO BUILD | 4-LANE | NO BUILD | 4-LANE | NO BUILD | 4-LANE |
| Rt. 82 e/o Rt. 11 | 11,800 | 12,600 | 990 | 1,080 | 1,420 | 1,530 |
| Rt. 82 w/o Rt. 11 | 4,600 | 4,600 | 330 | 330 | 430 | 430 |
| Rt. 82 e/o Rt. 85 | 7,000 | 7,000 | 530 | 530 | 560 | 560 |
| Rt. 85 s/o Rt. 82 | 16,800 | 17,600 | 1,620 | 1,710 | 2,220 | 2,330 |
| Rt. 85 n/o Rt. 82 | 6,000 | 6,000 | 510 | 510 | 790 | 790 |
| Rt. 85 n/o Rt. 161 | 21,600 | 22,400 | 1,640 | 1,730 | 2,210 | 2,320 |
| Rt. 85 s/o Turner Rd. | 15,100 | 15,700 | 1,250 | 1,320 | 1,670 | 1,760 |
| Rt. 85 n/o Industrial Dr. | 15,500 | 16,100 | 1,390 | 1,460 | 1,760 | 1,850 |
| Rt. 85 n/o Cross Rd. | 29,400 | 30,000 | 2,220 | 2,290 | 3,210 | 3,300 |
| Rt. 85 n/o I-95 | 40,800 | 41,400 | 2,400 | 2,470 | 4,450 | 4,540 |
| Rt. 161 n/o Walnut Hill | 6,600 | 6,800 | 620 | 640 | 820 | 840 |
| Rt. 161 n/o Mayfield | 9,000 | 9,200 | 780 | 800 | 910 | 930 |
| Rt. 161 s/o Egret | 13,200 | 13,400 | 950 | 970 | 1,380 | 1,400 |
| Rt. 161 n/o I-95 | 17,200 | 17,400 | 1,250 | 1,270 | 1,840 | 1,860 |

As indicated in the above table, traffic volumes will, for the most part, increase following the widening of Routes 82 and 85 when compared to the no build condition. Year 2020 ADT volumes are depicted on Figure 5-1.

An evaluation of operating conditions at the study area intersections was performed for the four-lane widening alternative. The analyses were conducted for the AM and PM peak hours at both signalized and unsignalized intersections. Tables 5-2 and 5-3 summarize the results of the analysis.

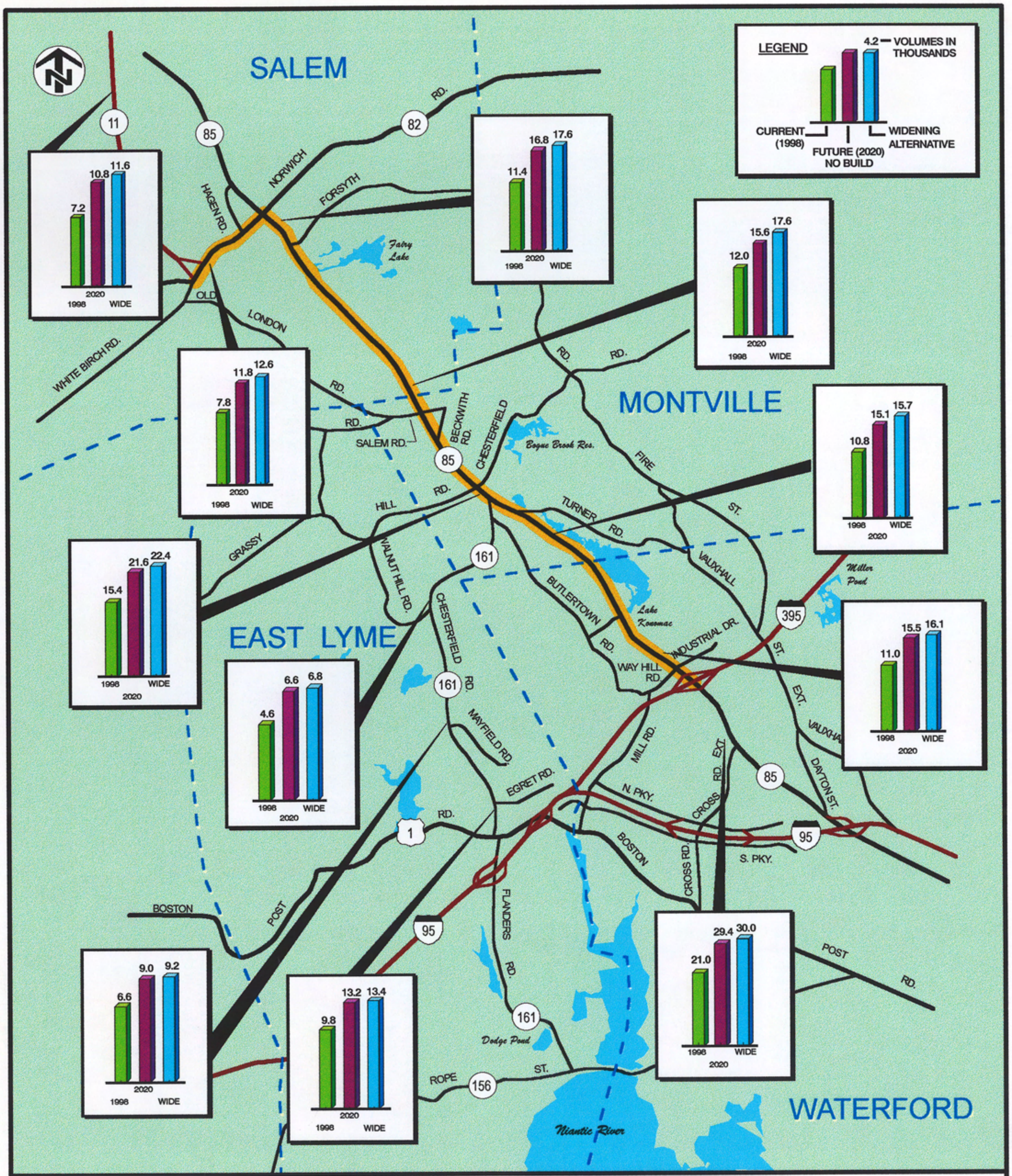
As indicated in the summary in Table 5-2, five of the signalized intersections would operate at unacceptable levels of service (LOS E or F) following completion of the four-lane widening alternative. These substandard intersections include:

- Route 85/Route 82
- Route 85/Route I-95 Northbound ramps
- Route 85/Route I-95 Southbound ramps
- Cross Road Extension/Parkway North
- Cross Road/Parkway South

Figure 5-2 summarizes the results of the signalized intersection analysis.

Eight unsignalized intersections would operate unacceptably with the four-lane widening alternative, including:

- Route 85/Forsyth Road
- Route 82/Route 11 Off-Ramp
- Route 85/Salem Turnpike/Beckwith Road
- Route 85/Turner Road
- Route 85/Route I-395 Northbound Ramps
- Route 161/Route I-95 Southbound Ramps
- U.S. Route 1/Route I-95 Southbound Off-Ramp
- Route 161/Egret Road

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ROUTE 82/85/11
ENVIRONMENTAL IMPACT STATEMENT (EIS)

IN THE TOWNS OF
EAST LYME, MONTVILLE, SALEM AND WATERFORD

## ROUTE 85 FOUR-LANE WIDENING ALTERNATIVE
## EXISTING AND FUTURE TRAFFIC VOLUMES

**Figure 5-1**

TABLE 5-2
2020 FUTURE CAPACITY ANALYSIS - FOUR LANE WIDENING ALTERNATIVE - SIGNALIZED INTERSECTIONS

| TOWN | INTERSECTION | 2020 FUTURE AM PEAK HOUR | | | 2020 FUTURE PM PEAK HOUR | | |
|---|---|---|---|---|---|---|---|
| | | LOS [1] | DELAY [2] | V/C [3] | LOS [1] | DELAY [2] | V/C [3] |
| Salem | Route 85/Route 82 | D | 29.2 | 0.926 | F | * [4] | * |
| Montville | Route 85/Grassy Hill/Chesterfield Rd. | B | 8.0 | 0.716 | B | 6.8 | 0.687 |
| Montville | Route 85/Route 161 | B | 5.3 | 0.557 | B | 9.1 | 0.708 |
| Waterford | Route 85/I-395 (southbound ramps) | B | 13.9 | 0.591 | B | 11.8 | 0.668 |
| Waterford | Route 85/Douglas Lane | B | 5.6 | 0.637 | B | 8.8 | 0.866 |
| Waterford | Route 85/Cross Road Extension | B | 10.4 | 0.795 | B | 11.8 | 0.874 |
| Waterford | Route 85/Dayton Place | A | 0.7 | 0.371 | A | 4.2 | 0.689 |
| Waterford | Route 85/I-95 (southbound ramps) | B | 10.2 | 0.650 | F | * | * |
| Waterford | Route 85/I-95 (northbound ramps) | C | 18.3 | 0.897 | F | * | * |
| Waterford | Cross Road Ext./Parkway North | B | 11.3 | 0.632 | F | 65.0 | 1.122 |
| Waterford | Cross Road/Parkway South | B | 9.9 | 0.600 | F | * | * |
| East Lyme | Route 161/I-95 (northbound ramps) | B | 7.1 | 0.461 | B | 10.5 | 0.810 |
| East Lyme | Route 161/U.S. Route 1 | B | 14.9 | 0.760 | D | 38.3 | 1.248 |

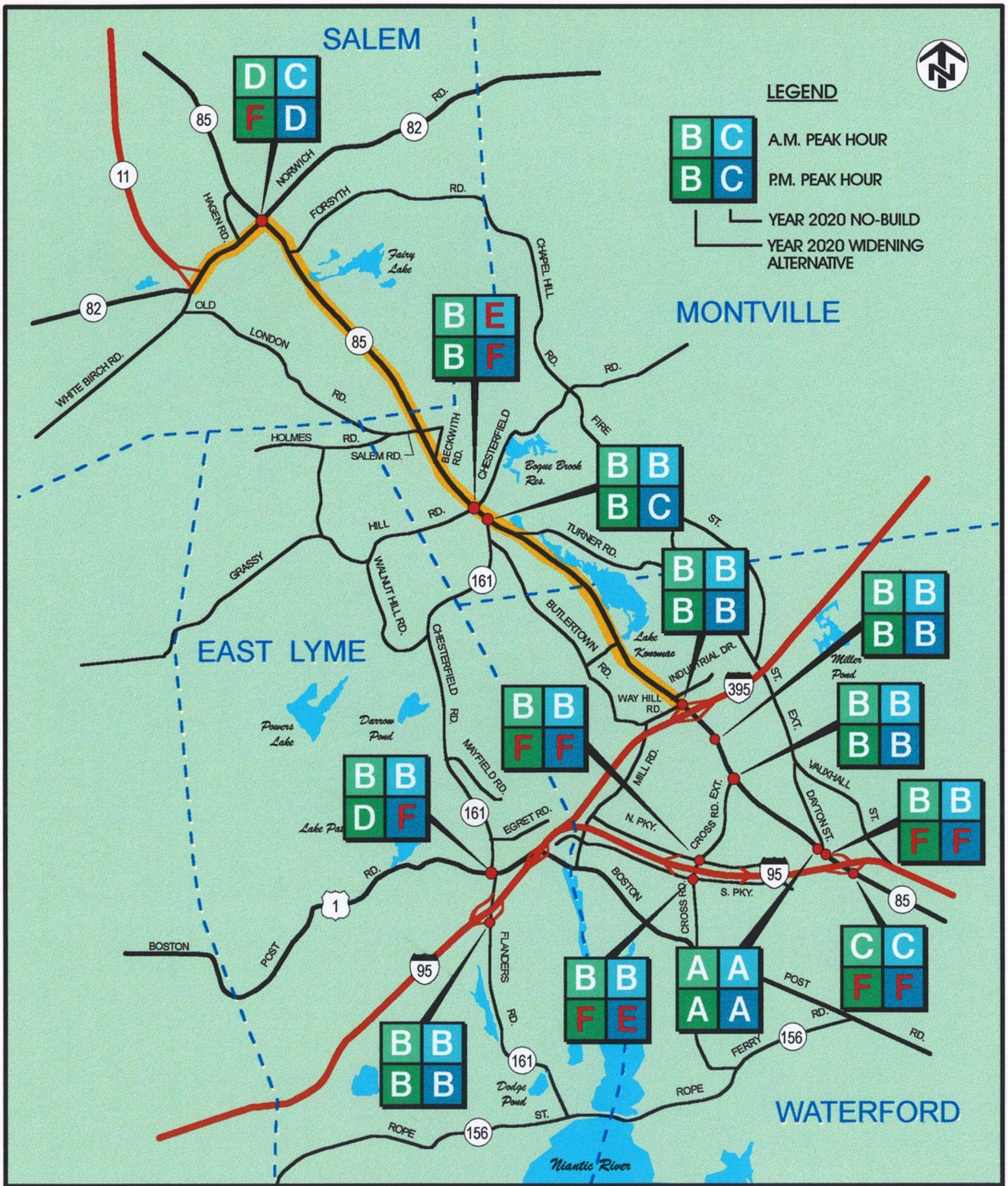
Source: Wilbur Smith Associates

(1) LOS - Level of service (A: best conditions through F: worst conditions)
(2) Delay - Seconds per Vehicle (amount of time a vehicle is stopped at the intersection)
(3) V/C -Volume-to-capacity ratio
(4) * - Delay greater than 999.99 seconds per vehicle

TABLE 5-3
2020 FUTURE CAPACITY ANALYSIS - FOUR LANE WIDENING ALTERNATIVE - UNSIGNALIZED INTERSECTIONS

| TOWN | INTERSECTION | 2020 FUTURE AM PEAK HOUR | | | 2020 FUTURE PM PEAK HOUR | | |
|---|---|---|---|---|---|---|---|
| | | LOS [1] | DELAY[2] | DEMAND[3] | LOS [1] | DELAY[2] | DEMAND[3] |
| Salem | Route 85/Forsyth Road | D | 26.9 | 50 | F | 253.7 | 40 |
| Salem | Route 82/Hagen Road | C | 16.1 | 4 | C | 18.5 | 6 |
| Salem | Route 82/Route 11 on-ramp | A | 4.5 | 80 | B | 5.4 | 80 |
| Salem | Route 82/Route 11 off-ramp | F | 58.8 | 590 | F | 45.1 | 820 |
| Montville | Route 85/Salem Tpke./Beckwith Road | E | 38.3 | 2 | C | 15.1 | 31 |
| Montville | Route 85/Turner Road | E | 33.1 | 40 | F | 135.9 | 40 |
| Waterford | Route 85/I-395 (northbound ramps) | F | 825.6 | 140 | F | * [4] | * |
| Waterford | Route 85/Way Hill/Industrial Drive | C | 13.4 | 50 | C | 18.9 | 42 |
| East Lyme | Route 161/I-95 (southbound ramps) | B | 9.2 | 307 | F | 230.7 | 670 |
| East Lyme | U.S. Route 1/I-95 (northbound ramps) | C | 11.7 | 660 | C | 15.8 | 360 |
| East Lyme | U.S. Route 1/I-95 (southbound off-ramp) | C | 12.1 | 440 | F | 547.1 | 1000 |
| East Lyme | U.S. Route 1/I-95 (southbound on-ramp) | C | 13.7 | 290 | B | 8.7 | 170 |
| East Lyme | Route 161/Egret Road | E | 30.3 | 70 | F | 54.0 | 32 |
| East Lyme | Route 161/Mayfield Terrace | C | 12.7 | 35 | C | 13.9 | 8 |
| East Lyme | Route 161/Walnut Hill Road | A | 3.9 | 72 | B | 5.3 | 31 |

Source: Wilbur Smith Associates
[1] LOS - Level of service (A: best conditions through F: worst conditions)
[2] Delay - Seconds per vehicle (amount of time a vehicle is stopped at the intersection)
[3] Demand - Minor movement peak hour volume
[4] * - Delay greater than 999.99 seconds per vehicle




Note: Results are Based on 1994 Highway Capacity Manual

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IN THE TOWNS OF
EAST LYME, MONTVILLE, SALEM AND WATERFORD

**SIGNALIZED INTERSECTIONS - FOUR-LANE WIDENING ALTERNATIVE CAPACITY ANALYSIS**

**Figure 5-2**

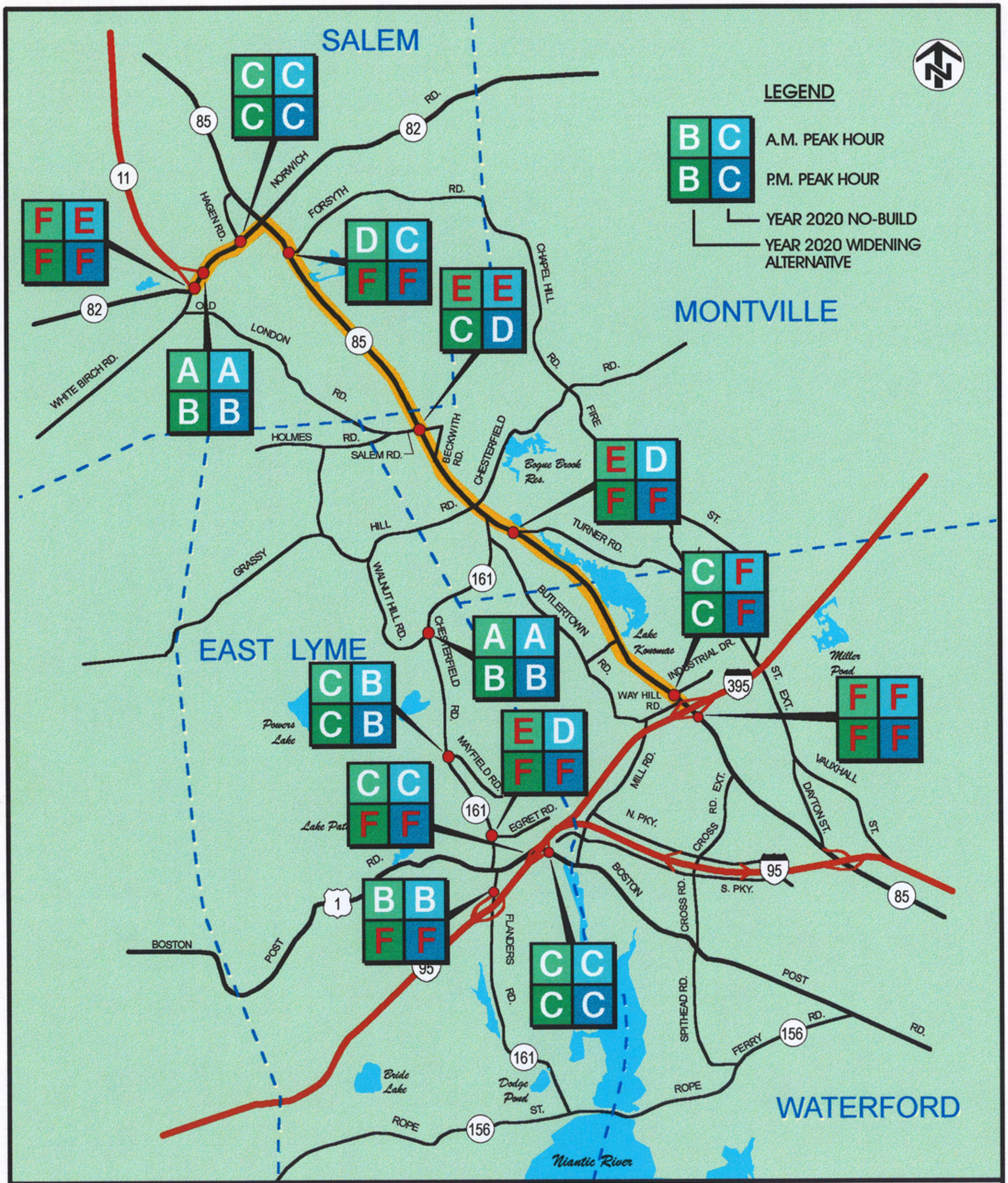
*Some of the unsignalized intersections would be expected to experience longer delays when compared to the no build condition...*
*Motorists attempting to enter the main flow of traffic on Route 85, not only from side streets, but also from commercial and residential driveways, would likely experience longer delays.*

Figure 5-3 summarizes the results of the unsignalized intersection analysis. It should be noted that the capacity analysis results do not account for completion of any of the TSM improvements described in section 5.1.1.1. Implementation of the previously mentioned TSM strategies would allow two intersections to be removed from the "substandard" lists, above. These two locations, Route 85/Route 82 and the Route 82/Route 11 off-ramp, would experience acceptable operating conditions following the addition of turning lanes at Route 85/Route 82 (Salem Four Corners) and installation of a traffic signal at the Route 11 off-ramp.

Some of the unsignalized intersections would be expected to experience longer delays when compared to the no build condition. This increase in delay is caused by the attraction of new motorists to the Route 85 corridor as result of improved travel conditions created by the widening. Motorists attempting to enter the main flow of traffic on Route 85, not only from side streets, but also from commercial and residential driveways, would likely experience longer delays. A tendency by drivers to attempt a turn into traffic with less than safe separation distances from oncoming traffic may also lead to an increase in accident frequency.

Roadway segment volume-to-capacity ratios were estimated for Routes 85, 82, and 161 during the 2020 AM and PM peak hours. The capacity of each roadway segment was based upon *Highway Capacity Manual* planning level capacities. The results are presented on Figure 5-4.

Roadway segment capacity and safety would increase substantially following the widening of Route 85 from Route 82 intersection to just north of the I-395 interchange. Volume-to-capacity ratios would decline to less than 0.40 for all segments of Route 85 except south of I-395 where over capacity conditions are estimated. Route 161 traffic volumes are projected to approach capacity in the vicinity of U.S. Route 1.




Note: Results are Based on 1994 Highway Capacity Manual

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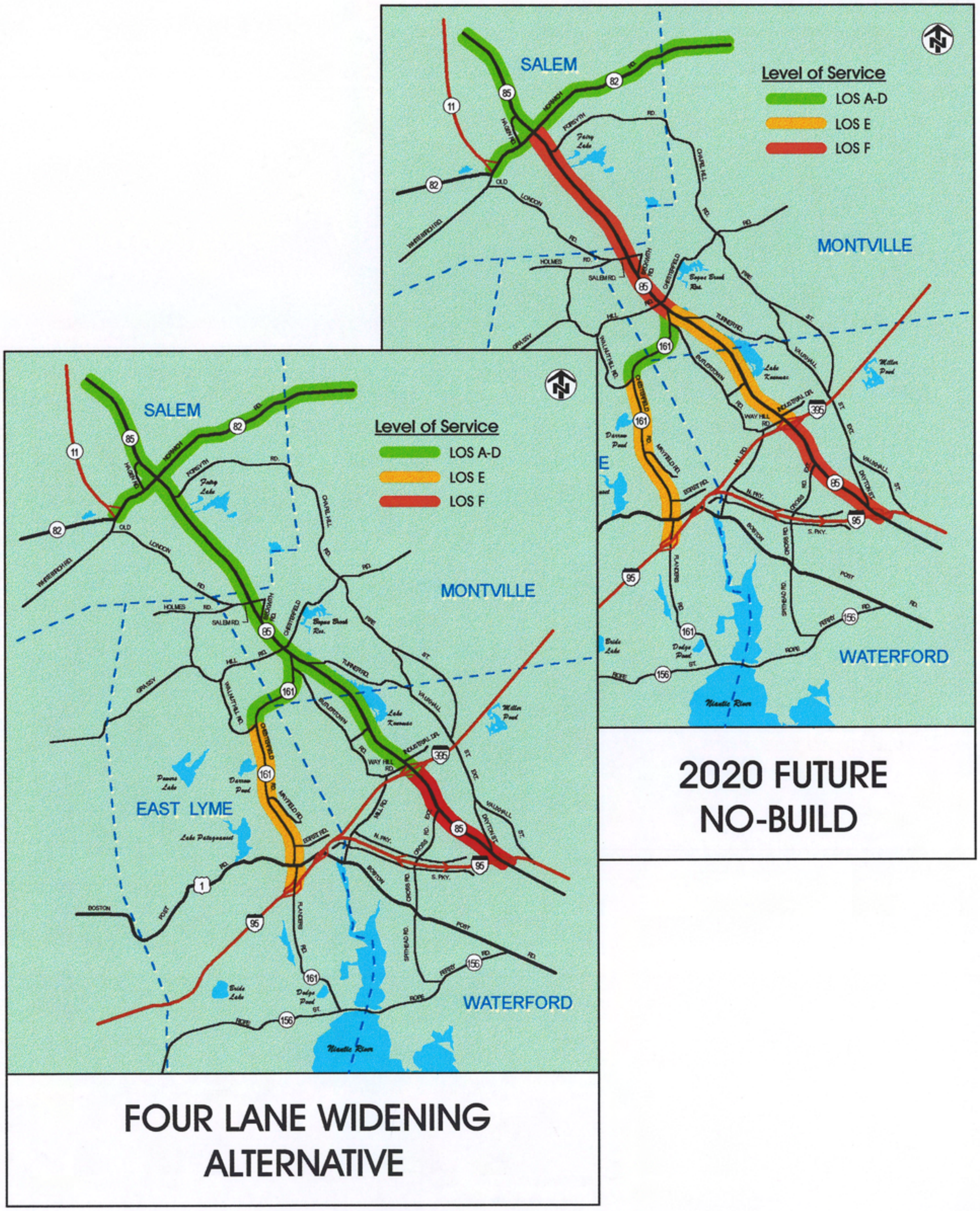
## UNSIGNALIZED INTERSECTIONS - FOUR-LANE WIDENING ALTERNATIVE CAPACITY ANALYSIS

Figure 5-3

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ROUTE 82/85/11
ENVIRONMENTAL IMPACT STATEMENT (EIS)

IN THE TOWNS OF
EAST LYME, MONTVILLE, SALEM AND WATERFORD

**EFFECTS OF IMPROVEMENT ON LOS OF EXISTING ROADS**

**Figure 5-4**

5.1.1.2 *TSM Alternative*: The following describes TSM improvements that were considered for the 2020 future year for intersections on Route 85 between I-395 and Route 82, and on Route 82 between Route 85 and Route 11.

- ROUTE 82/ROUTE 11 OFF-RAMP: Based upon forecasted traffic volumes, this location will likely meet the traffic signal warrants contained in FHWA's *Manual on Uniform Traffic Control Devices*. Accordingly, it is assumed that traffic signals will be required in the future.

- ROUTE 85/ROUTE 82: Widen the northbound Route 85 approach to consist of an exclusive left-turn lane, a shared through/left turn lane, and an exclusive right-turn lane. Widen the westbound Route 82 approach to consist of an exclusive left-turn lane and a shared through/right lane. Additionally, traffic signal, signing and pavement marking modifications would be required.

- ROUTE 85/GRASSY HILL ROAD/CHESTERFIELD ROAD: Left turn lanes should be provided on Route 85 to improve future safety and operating conditions.

- ROUTE 85/ROUTE 161: To improve future safety and operating conditions, a left turn lane should be provided on the northbound Route 85 approach.

For the intersections receiving TSM improvements, Route 82/Route 11, Route 85/Route 82, Route 85/Grassy Hill Road/Chesterfield Road, and Route 85/ Route 161, acceptable levels of service (LOS C or better) are expected. Roadway segment volume-to-capacity ratios are not expected to substantially change when compared to the year 2020 no build conditions (Figure 4-13 and Tables 4-12 and 4-13). Spot safety improvements and intersection TSM improvements will not substantially alter roadway segment capacity. In 2020, traffic volumes are expected to approach or exceed roadway capacity on Route 85 and on portions of Route 161.

5.1.1.3 *TDM/Transit Alternative*: Implementation of TDM and transit strategies would be expected to have little, if any, effect upon roadway capacity. Further analysis of this alternative was undertaken as part of the Community-sensitive Upgrade Study, discussed in Section 3.4.2. TDM measures found to be most feasible for the corridor area were ridesharing, flexible work hours and telecommuting, but these would have limited potential for reducing traffic volumes and improving LOS, particularly during summer peak hours.

A trip reduction analysis was performed for potential TDM strategies. Results showed that TDM strategies could provide a combined travel demand reduction of approximately 2% or less on total daily traffic, and would not have a measurable affect on roadway capacity in this corridor. Moreover, these strategies are not enforceable by ConnDOT and require voluntary compliance by the public. Though use of alternatives to SOV travel has gained in popularity, it is considered to have limited potential in this corridor.

5.1.1.4 *New Location - Full Build Alternatives*: Based upon the travel demand model process, future traffic volumes were forecasted for the year 2020 (Figure 5-5).

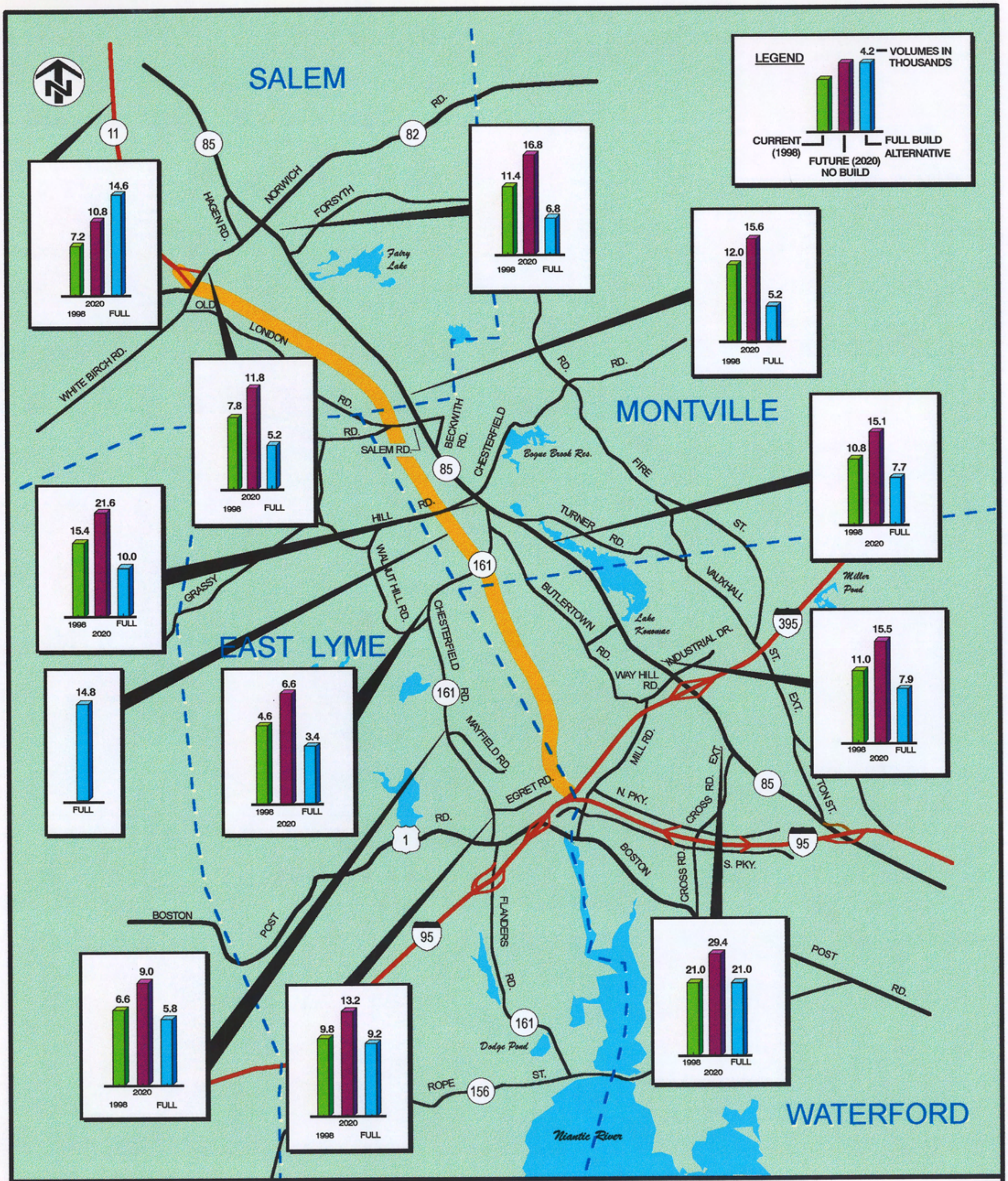
Table 5-4 presents a volume comparison between the 2020 no build and 2020 full build alternatives, including the preferred alternative, at select locations as a means of evaluating the impact of the full build alternatives on travel patterns in the corridor area.

TABLE 5-4
VOLUME COMPARISON: FULL BUILD EXPRESSWAY VS NO BUILD

| LOCATION | 2020 ADT | | 2020 AM PEAK HOUR | | 2020 PM PEAK HOUR | |
|---|---|---|---|---|---|---|
| | NO BUILD | FULL BUILD | NO BUILD | FULL BUILD | NO BUILD | FULL BUILD |
| Rt. 82 e/o Rt. 11 | 11,800 | 5,200 | 990 | 450 | 1,420 | 580 |
| Rt. 82 w/o Rt. 11 | 4,600 | 5,000 | 330 | 430 | 430 | 520 |
| Rt. 82 e/o Rt. 85 | 7,000 | 6,200 | 530 | 500 | 560 | 520 |
| Rt. 85 s/o Rt. 82 | 16,800 | 6,800 | 1,620 | 620 | 2,220 | 750 |
| Rt. 85 n/o Rt. 82 | 6,000 | 6,000 | 510 | 510 | 790 | 790 |
| Rt. 85 n/o Rt. 161 | 21,600 | 10,000 | 1,640 | 790 | 2,210 | 880 |
| Rt. 85 s/o Turner Rd. | 15,100 | 7,700 | 1,250 | 690 | 1,670 | 740 |
| Rt. 85 n/o Industrial Dr. | 15,500 | 7,900 | 1,390 | 750 | 1,760 | 790 |
| Rt. 85 n/o Cross Rd. | 29,400 | 21,000 | 2,220 | 1,610 | 3,210 | 2,200 |
| Rt. 85 n/o I-95 | 40,800 | 35,800 | 2,400 | 2,040 | 4,450 | 3,950 |
| Rt. 161 n/o Walnut Hill | 6,600 | 3,400 | 620 | 260 | 820 | 330 |
| Rt. 161 n/o Mayfield | 9,000 | 5,800 | 780 | 410 | 910 | 450 |
| Rt. 161 s/o Egret | 13,200 | 9,200 | 950 | 560 | 1,380 | 750 |
| Rt. 161 n/o I-95 | 17,200 | 33,100 | 1,250 | 2,470 | 1,840 | 3,190 |

An evaluation of operating conditions at the study area intersections was performed for the full build expressway alternative. The analyses were conducted for the AM and PM peak hours at both signalized and unsignalized intersections. Tables 5-5 and 5-6 summarize the results of the analysis.

As indicated in the summary Table 5-5, three signalized intersections will operate at unacceptable levels of service following completion of the full build alternative.

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IN THE TOWNS OF
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**FULL BUILD ALTERNATIVE**
**EXISTING AND FUTURE TRAFFIC VOLUMES**

Figure 5-5

TABLE 5-5
2020 FUTURE CAPACITY ANALYSIS - FULL BUILD EXPRESSWAY ALTERNATIVE - SIGNALIZED INTERSECTIONS

| TOWN | INTERSECTION | 2020 FUTURE AM PEAK HOUR | | | 2020 FUTURE PM PEAK HOUR | | |
|---|---|---|---|---|---|---|---|
| | | LOS [(1)] | DELAY[(2)] | V/C[(3)] | LOS [(1)] | DELAY[(2)] | V/C[(3)] |
| Salem | Route 85/Route 82 | B | 13.8 | 0.641 | C | 18.8 | 0.651 |
| Montville | Route 85/Grassy Hill/Chesterfield Rd. | B | 8.8 | 0.574 | B | 8.0 | 0.577 |
| Montville | Route 85/Route 161 | A | 4.7 | 0.439 | B | 5.4 | 0.458 |
| Waterford | Route 85/I-395 (southbound ramps) | B | 11.6 | 0.408 | B | 10.1 | 0.453 |
| Waterford | Route 85/Douglas Lane | B | 5.1 | 0.499 | B | 6.3 | 0.683 |
| Waterford | Route 85/Cross Road Extension | B | 8.3 | 0.628 | B | 10.7 | 0.672 |
| Waterford | Route 85/Dayton Place | A | 0.5 | 0.211 | A | 2.8 | 0.485 |
| Waterford | Route 85/I-95 (southbound ramps) | B | 8.6 | 0.490 | C | 21.3 | 0.980 |
| Waterford | Route 85/I-95 (northbound ramps) | B | 13.5 | 0.786 | D | 26.4 | 1.104 |
| Waterford | Cross Road Ext./Parkway North | B | 12.7 | 0.693 | F | * [(4)] | * |
| Waterford | Cross Road /Parkway South | B | 10.9 | 0.674 | F | * | * |
| East Lyme | Route 161/I-95 (northbound ramps) | B | 11.0 | 0.566 | C | 18.2 | 0.933 |
| East Lyme | Route 161/U.S. Route 1 | F | * | * | F | * | * |

Source: Wilbur Smith Associates

[(1)] LOS - Level of service (A: best conditions through F: worst conditions)
[(2)] Delay - Seconds per vehicle (amount of time a vehicle is stopped at the intersection)
[(3)] V/C - Volume-to-capacity ratio
[(4)] * - Delay greater than 999.99 seconds per vehicle

TABLE 5-6
2020 FUTURE CAPACITY ANALYSIS - FULL BUILD EXPRESSWAY ALTERNATIVE - UNSIGNALIZED INTERSECTIONS

| TOWN | INTERSECTION | 2020 FUTURE AM PEAK HOUR | | | 2020 FUTURE PM PEAK HOUR | | |
|---|---|---|---|---|---|---|---|
| | | LOS [1] | DELAY [2] | DEMAND [3] | LOS [1] | DELAY [2] | DEMAND [3] |
| Salem | Route 85/Forsyth Road | B | 5.5 | 50 | B | 6.1 | 40 |
| Salem | Route 82/Hagen Road | B | 5.3 | 4 | B | 5.0 | 6 |
| Salem | Route 82/Route 11 on-ramp | B | 6.9 | 130 | B | 8.3 | 170 |
| Salem | Route 82/Route 11 off-ramp | B | 5.7 | 80 | B | 6.4 | 160 |
| Montville | Route 85/Salem Tpke./Beckwith Road | B | 7.5 | 2 | A | 4.5 | 31 |
| Montville | Route 85/Turner Road | B | 8.0 | 40 | B | 9.2 | 40 |
| Waterford | Route 85/I-395 (northbound ramps) | D | 27.0 | 110 | E | 31.6 | 130 |
| Waterford | Route 85/Way Hill/Industrial Drive | C | 13.4 | 50 | C | 18.9 | 42 |
| East Lyme | Route 161/I-95 (southbound ramps) | F | * [4] | 720 | F | * | 1720 |
| East Lyme | U.S. Route 1/I-95 (northbound ramps) | N/A | N/A | N/A | N/A | N/A | N/A |
| East Lyme | U.S. Route 1/I-95 (southbound off-ramp) | N/A | N/A | N/A | N/A | N/A | N/A |
| East Lyme | U.S. Route 1/I-95 (southbound on-ramp) | N/A | N/A | N/A | N/A | N/A | N/A |
| East Lyme | Route 161/Egret Road | C | 10.3 | 70 | C | 12.1 | 32 |
| East Lyme | Route 161/Mayfield Terrace | B | 6.5 | 35 | B | 6.5 | 8 |
| East Lyme | Route 161/Walnut Hill Road | A | 3.4 | 72 | A | 3.5 | 31 |
| East Lyme | Route 11/Route 161 East Ramp | A | 4.6 | 140 | B | 5.7 | 160 |
| East Lyme | Route 11/Route 161 West Ramp | A | 4.5 | 180 | B | 5.4 | 260 |

Source: Wilbur Smith Associates
(1) LOS - Level of service (A: best conditions through F: worst conditions)
(2) Delay - Seconds per vehicle (amount of time a vehicle is stopped at the intersection)
(3) Demand - Minor movement peak hour volume
(4) * -Delay greater than 999.99 seconds per vehicle
N/A - Volumes not available

These substandard intersections include:

- Cross Road Extension/Parkway North
- Cross Road/Parkway South
- U.S. Route 1/Route 161

Figure 5-6 summarizes the signalized intersection analysis results.

Unsignalized intersections at two locations will operate unacceptably:

- Route 85/Route I-395 Northbound Ramps
- Route 161/Route I-95 Southbound Ramps

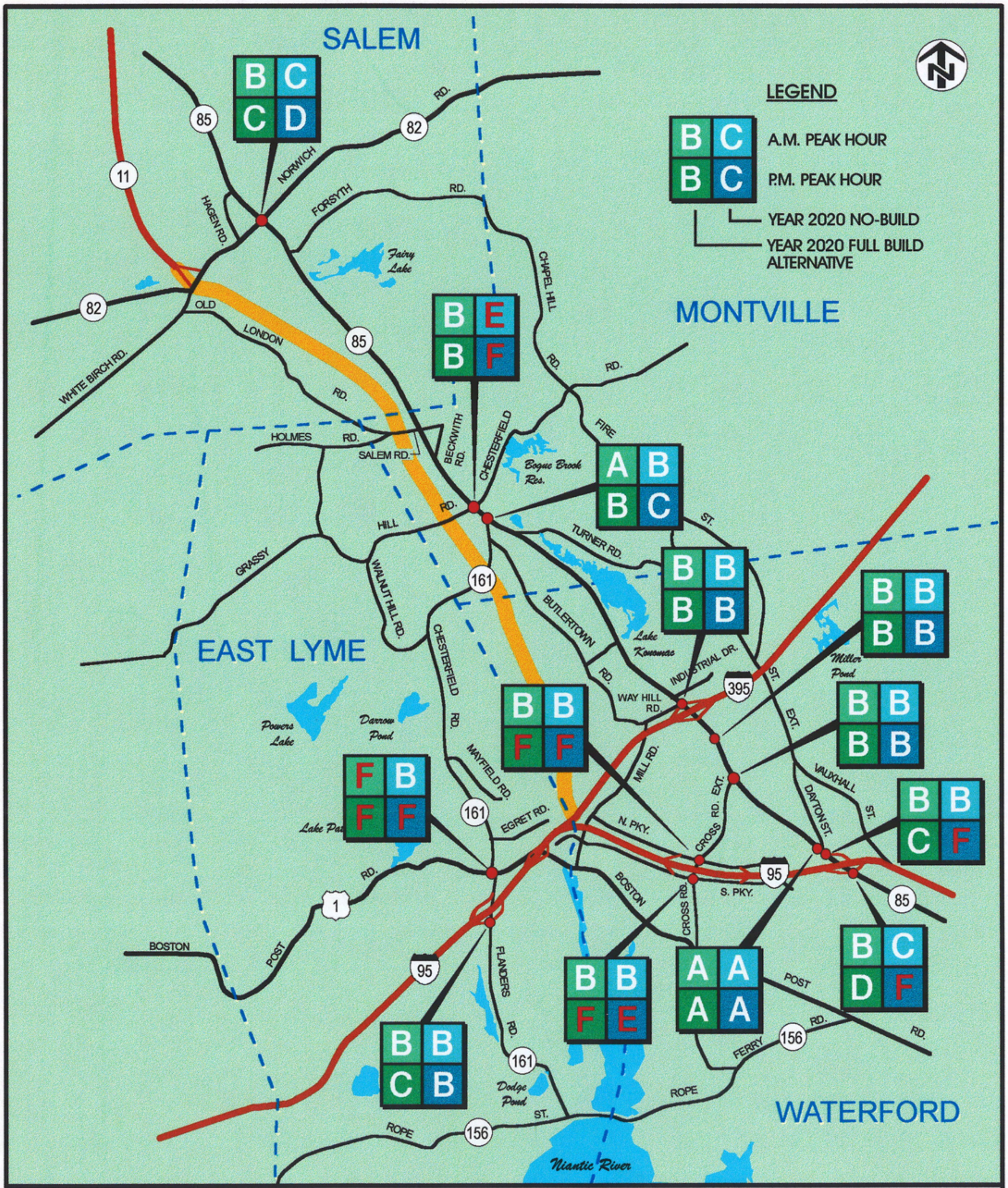
Figure 5-7 summarizes the unsignalized intersection analysis results.

Roadway segment volume-to-capacity ratios were estimated for Routes 85, 82, and 161 during the 2020 AM and PM peak hours. The capacity of each roadway segment was based upon *Highway Capacity Manual* planning level capacities. The results are presented on Figure 5-8.

The full build expressway would divert a considerable amount of traffic from Route 85. This shift in traffic results in acceptable operating condition on Route 85 north of I-395. In addition, the reduction in traffic would help to reduce opportunities for accidents. South of I-395, poor operating conditions are forecasted, but when compared to the no build condition, traffic volumes would decrease, and therefore benefits would be realized. Additionally, Route 161 volumes are also forecasted to approach capacity in the vicinity of U.S. Route 1, although the volumes would decline when compared to the no build condition if the full build expressway alternative were implemented. Traffic for the two-lane full build scenario was projected to have the same volume as the four-lane scenario. As a result, the performance measures, such as existing service on the existing road system, would be the same for either the two-lane or four-lane full build alternatives.

5.1.1.5 *New Location - Partial Build Alternatives*: Based upon the travel demand model process, future traffic volumes were forecasted for the year 2020 for the partial build alternative. Year 2020 Average Annual Daily Traffic volumes are depicted on Figure 5-9. Table 5-7 presents a volume comparison between the 2020 no build and 2020 partial build alternative at select locations. The table illustrates the impact the partial build alternative would have on travel patterns in the area.

An evaluation of operating conditions at the study area intersections was performed for the partial build alternative. The analyses were conducted for the AM and PM peak hours at both signalized and unsignalized intersections.




Note: Results are Based on 1994 Highway Capacity Manual

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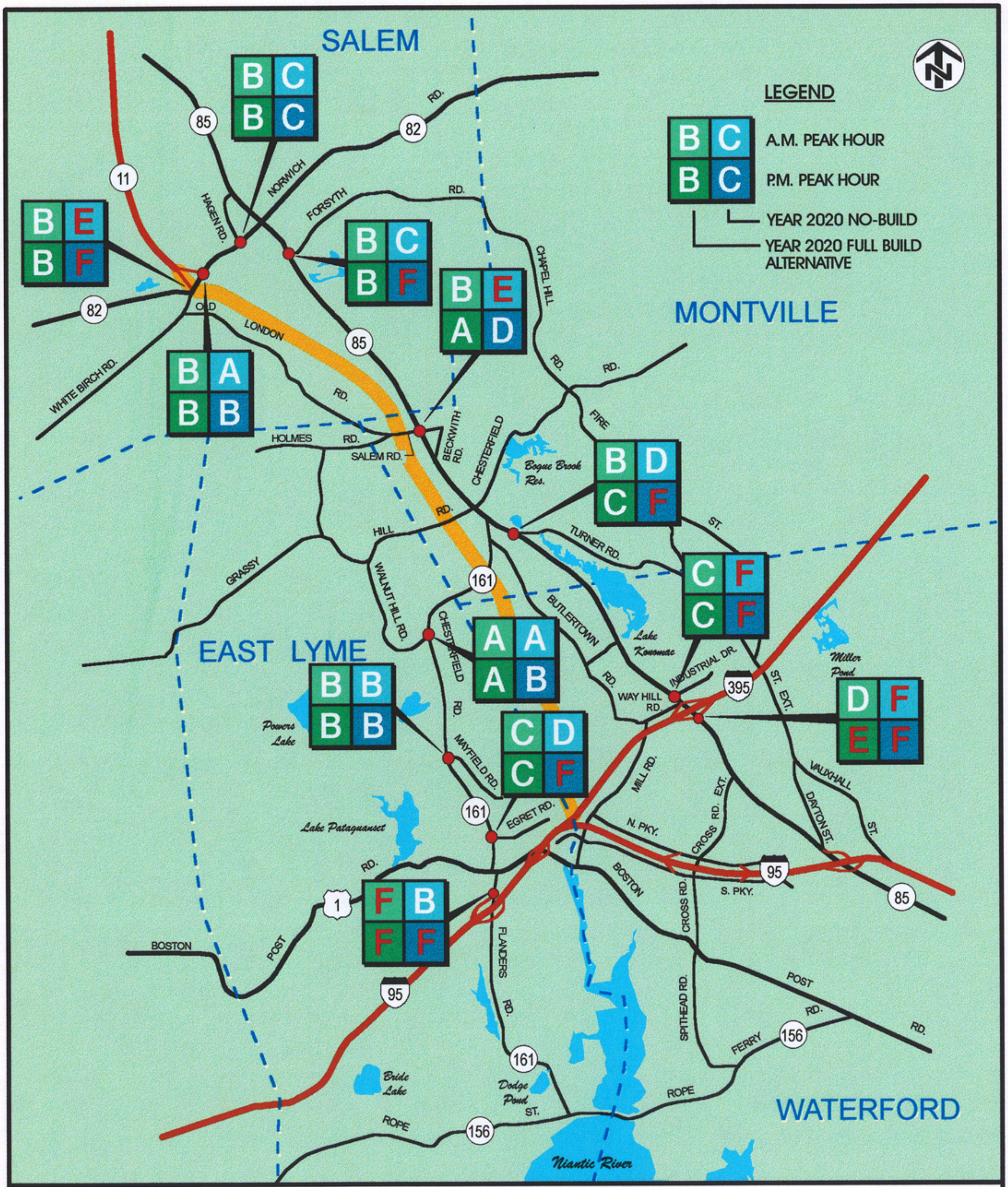
ROUTE 82/85/11
ENVIRONMENTAL IMPACT STATEMENT (EIS)
IN THE TOWNS OF
EAST LYME, MONTVILLE, SALEM AND WATERFORD

**SIGNALIZED INTERSECTIONS**
**FULL BUILD ALTERNATIVE CAPACITY ANALYSIS**

Figure 5-6




Note: Results are Based on 1994 Highway Capacity Manual

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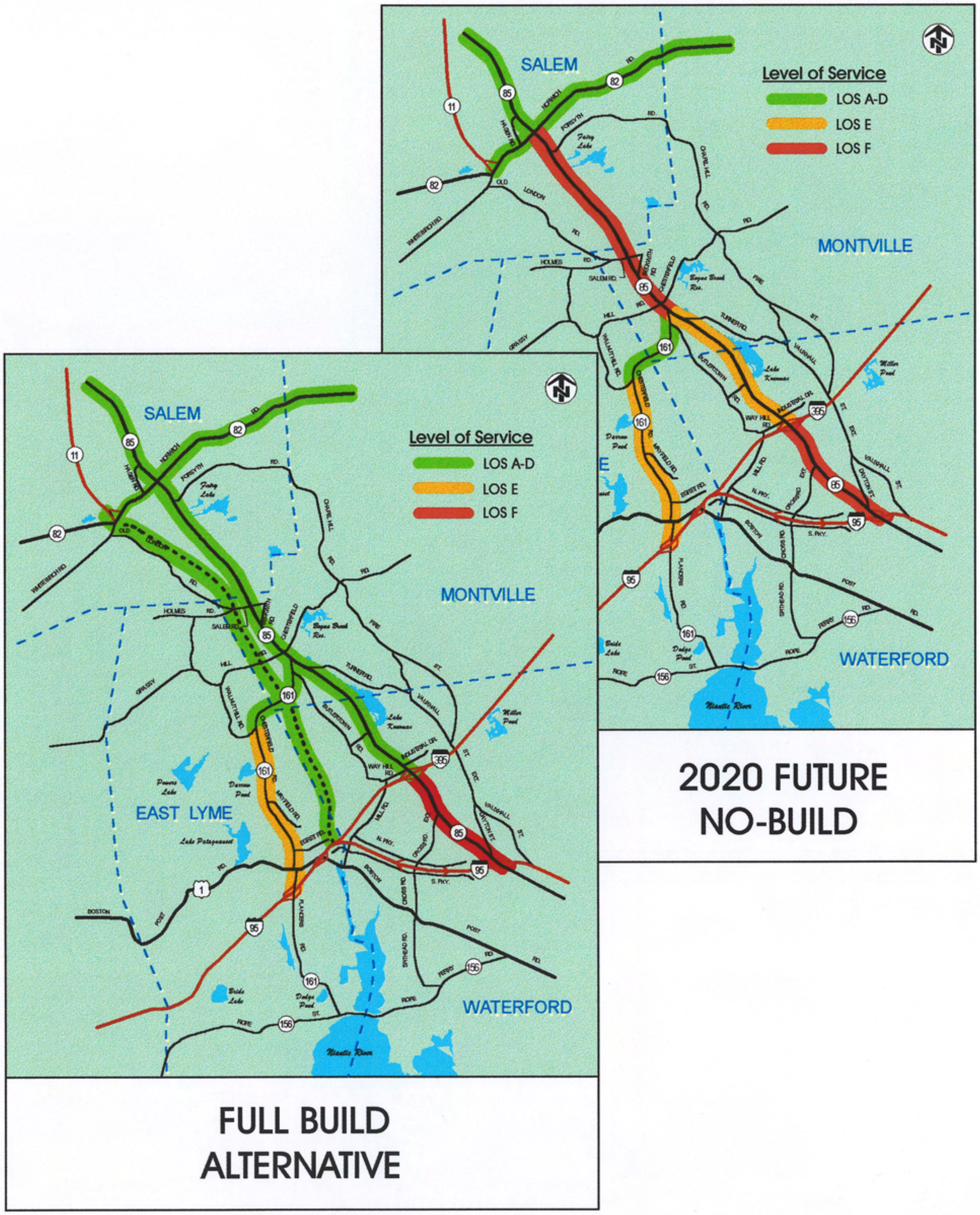
## UNSIGNALIZED INTERSECTIONS FULL BUILD ALTERNATIVE CAPACITY ANALYSIS

Figure 5-7

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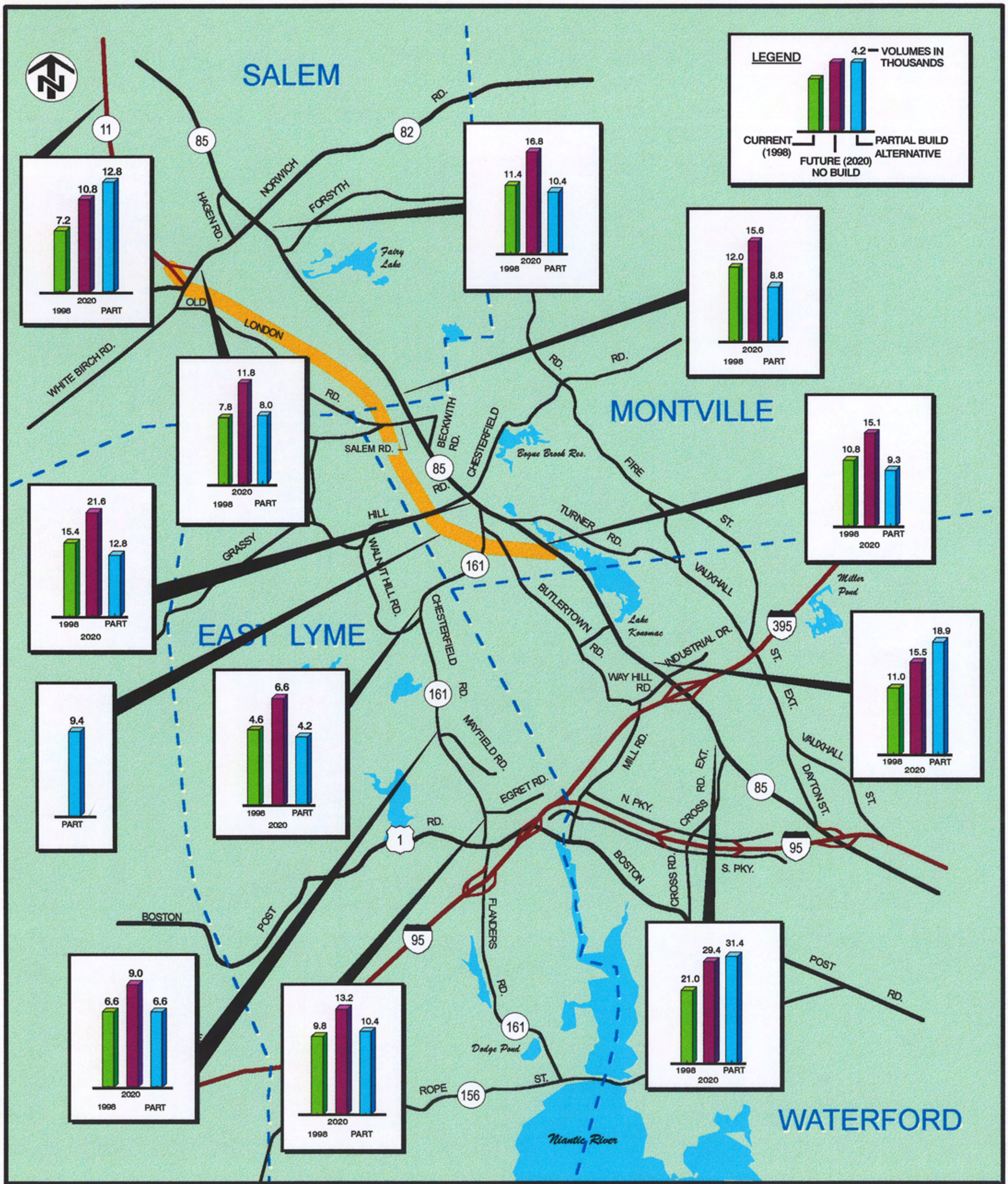
## EFFECTS OF IMPROVEMENT ON LOS OF EXISTING ROADS

**Figure 5-8**

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**PARTIAL BUILD ALTERNATIVE / EXISTING AND FUTURE TRAFFIC VOLUMES**

**Figure 5-9**

TABLE 5-7
VOLUME COMPARISON: PARTIAL BUILD EXPRESSWAY VS NO BUILD

| LOCATION | 2020 ADT | | 2020 AM PEAK HOUR | | 2020 PM PEAK HOUR | |
|---|---|---|---|---|---|---|
| | NO BUILD | PARTIAL BUILD | NO BUILD | PARTIAL BUILD | NO BUILD | PARTIAL BUILD |
| Rt. 82 e/o Rt. 11 | 11,800 | 8,000 | 990 | 690 | 1,420 | 950 |
| Rt. 82 w/o Rt. 11 | 4,600 | 5,000 | 330 | 430 | 430 | 520 |
| Rt. 82 e/o Rt. 85 | 7,000 | 6,200 | 530 | 500 | 560 | 520 |
| Rt. 85 s/o Rt. 82 | 16,800 | 10,400 | 1,620 | 940 | 2,220 | 1,200 |
| Rt. 85 n/o Rt. 82 | 6,000 | 6,000 | 510 | 510 | 790 | 790 |
| Rt. 85 n/o Rt. 161 | 21,600 | 12,800 | 1,640 | 1,020 | 2,210 | 1,210 |
| Rt. 85 s/o Turner Rd. | 15,100 | 9,300 | 1,250 | 850 | 1,670 | 920 |
| Rt. 85 n/o Industrial Dr. | 15,500 | 18,900 | 1,390 | 1,740 | 1,760 | 2,040 |
| Rt. 85 n/o Cross Rd. | 29,400 | 31,400 | 2,220 | 2,550 | 3,210 | 3,390 |
| Rt. 85 n/o I-95 | 40,800 | 43,600 | 2,400 | 2,950 | 4,450 | 4,800 |
| Rt. 161 n/o Walnut Hill | 6,600 | 4,200 | 620 | 320 | 820 | 400 |
| Rt. 161 n/o Mayfield | 9,000 | 6,600 | 780 | 490 | 910 | 530 |
| Rt. 161 s/o Egret | 13,200 | 10,400 | 950 | 680 | 1,380 | 890 |
| Rt. 161 n/o I-95 | 17,200 | 16,400 | 1,250 | 1,210 | 1,840 | 1,800 |

Tables 5-8 and 5-9 summarize the results of the analysis. Under the partial build alternative, four of the signalized intersections would operate at unacceptable levels of service. The substandard intersections include:

- Route 85/Route I-95 northbound ramps
- Route 85/Route I-95 southbound ramps
- Cross Road Extension/Parkway North
- Cross Road/Parkway South

Figure 5-10 summarizes the signalized intersection analysis results.

For unsignalized intersections, five locations would operate unacceptably:

- Route 82/Route 11 off-ramp
- Route 85/Route I-395 northbound ramps
- Route 85/Way Hill Road/Industrial Drive
- Route 161/Route I-95 southbound ramps
- U.S. Route 1/Route I-95 southbound off-ramp

Figure 5-11 summarizes the unsignalized intersection analysis results.

## TABLE 5-8
## 2020 FUTURE CAPACITY ANALYSIS - PARTIAL BUILD EXPRESSWAY ALTERNATIVE - SIGNALIZED INTERSECTIONS

| TOWN | INTERSECTION | 2020 FUTURE AM PEAK HOUR | | | 2020 FUTURE PM PEAK HOUR | | |
|---|---|---|---|---|---|---|---|
| | | LOS [1] | DELAY[2] | V/C[3] | LOS [1] | DELAY[2] | V/C[3] |
| Salem | Route 85/Route 82 | B | 12.0 | 0.635 | B | 13.9 | 0.660 |
| Montville | Route 85/Grassy Hill/Chesterfield Rd. | B | 8.8 | 0.574 | B | 8.0 | 0.577 |
| Montville | Route 85/Route 161 | B | 6.5 | 0.465 | B | 6.5 | 0.459 |
| Waterford | Route 85/I-395 (southbound ramps) | C | 15.3 | 0.668 | B | 12.6 | 0.707 |
| Waterford | Route 85/Douglas Lane | B | 6.1 | 0.675 | B | 12.4 | 0.891 |
| Waterford | Route 85/Cross Road Extension | B | 11.9 | 0.830 | B | 11.8 | 0.891 |
| Waterford | Route 85/Dayton Road | A | 0.7 | 0.382 | A | 4.2 | 0.696 |
| Waterford | Route 85/I-95 (southbound ramps) | C | 17.4 | 0.843 | F | * [4] | * |
| Waterford | Route 85/I-95 (northbound ramps) | E | 49.7 | 1.424 | F | * | * |
| Waterford | Cross Road Ext./Parkway North | B | 12.7 | 0.693 | F | * | * |
| Waterford | Cross Road/Parkway South | B | 10.9 | 0.674 | F | * | * |
| East Lyme | Route 161/I-95 (northbound ramps) | B | 8.3 | 0.457 | B | 14.1 | 0.734 |
| East Lyme | Route 161/U.S. Route 1 | B | 13.7 | 0.688 | D | 25.7 | 1.036 |

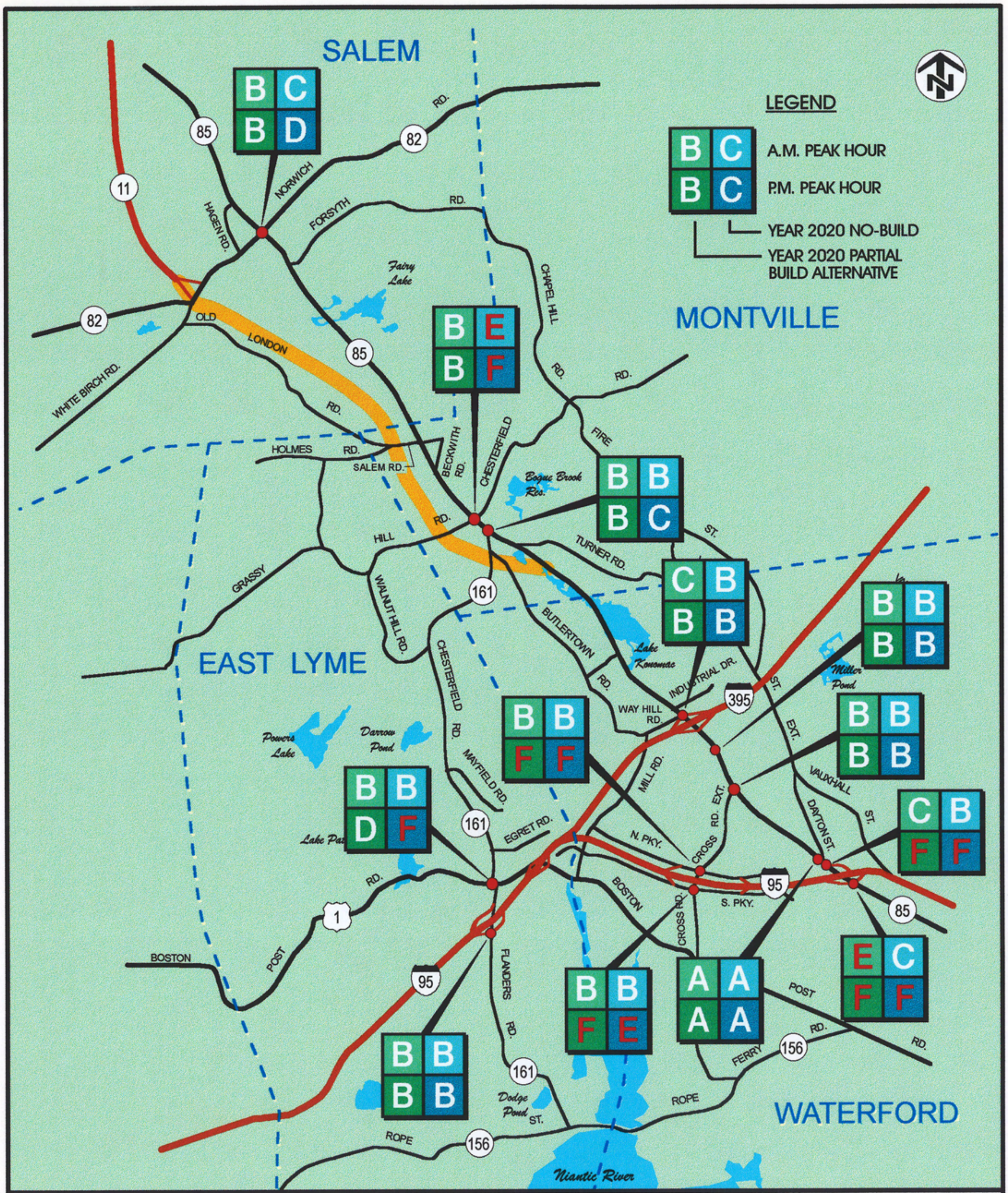
Source: Wilbur Smith Associates

[1] LOS - Level of Service (A: best conditions through F: worst conditions)
[2] Delay - Seconds per vehicle (amount of time a vehicle is stopped at the intersection)
[3] V/C - Volume-to-capacity ratio
[4] * - Delay Greater than 999.99 seconds per vehicle

TABLE 5-9
2020 FUTURE CAPACITY ANALYSIS - PARTIAL BUILD EXPRESSWAY ALTERNATIVE - UNSIGNALIZED INTERSECTIONS

| TOWN | INTERSECTION | 2020 FUTURE AM PEAK HOUR | | | 2020 FUTURE PM PEAK HOUR | | |
|---|---|---|---|---|---|---|---|
| | | LOS [(1)] | DELAY[(2)] | DEMAND[(3)] | LOS [(1)] | DELAY[(2)] | DEMAND[(3)] |
| Salem | Route 85/Forsyth Road | B | 8.3 | 50 | C | 10.2 | 40 |
| Salem | Route 82/Hagen Road | B | 5.3 | 4 | B | 5.0 | 6 |
| Salem | Route 82/Route 11 on-ramp | B | 6.9 | 130 | B | 8.3 | 170 |
| Salem | Route 82/Route 11 off-ramp | C | 16.3 | 290 | E | 42.0 | 410 |
| Montville | Route 85/Salem Tnpk./Beckwith Road | C | 12.5 | 77 | B | 7.0 | 33 |
| Montville | Route 85/Turner Road | C | 10.4 | 40 | C | 12.4 | 40 |
| Waterford | Route 85/I-395 (northbound ramps) | F | * [(4)] | 110 | F | * | 130 |
| Waterford | Route 85/Way Hill/Industrial Drive | F | 339.6 | 50 | F | * | 42 |
| Waterford | Route 11/Route 85 | D | 24.8 | 430 | C | 15.9 | 570 |
| East Lyme | Route 161/I-95 (southbound ramps) | F | * | 780 | F | * | 1780 |
| East Lyme | U.S. Route 1/I-95 (northbound ramps) | B | 5.6 | 191 | B | 9.0 | 251 |
| East Lyme | U.S. Route 1/I-95 (southbound off-ramp) | C | 12.1 | 440 | F | 547.1 | 1000 |
| East Lyme | U.S. Route 1/I-95 (southbound on-ramp) | C | 13.7 | 290 | B | 8.7 | 170 |
| East Lyme | Route 161/Egret Road | C | 13.8 | 70 | C | 15.7 | 32 |
| East Lyme | Route 161/Mayfield Terrace | B | 7.4 | 35 | B | 7.4 | 8 |
| East Lyme | Route 161/Walnut Hill Road | A | 3.5 | 72 | A | 3.8 | 31 |
| East Lyme | Route 11/Route 161 (east ramp) | A | 2.5 | 80 | A | 2.5 | 120 |
| East Lyme | Route 11/Route 161 (west ramp) | A | 3.9 | 180 | A | 4.4 | 260 |

Source: Wilbur Smith Associates
(1) LOS - Level of Service (A: best conditions through F: worst conditions)
(2) Delay - Seconds per vehicle (amount of time a vehicle is stopped at the intersection)
(3) Demand - Minor movement peak hour volume
(4)* Delay Greater than 999.99 Seconds per Vehicle




Note: Results are Based on 1994 Highway Capacity Manual

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ROUTE 82/85/11
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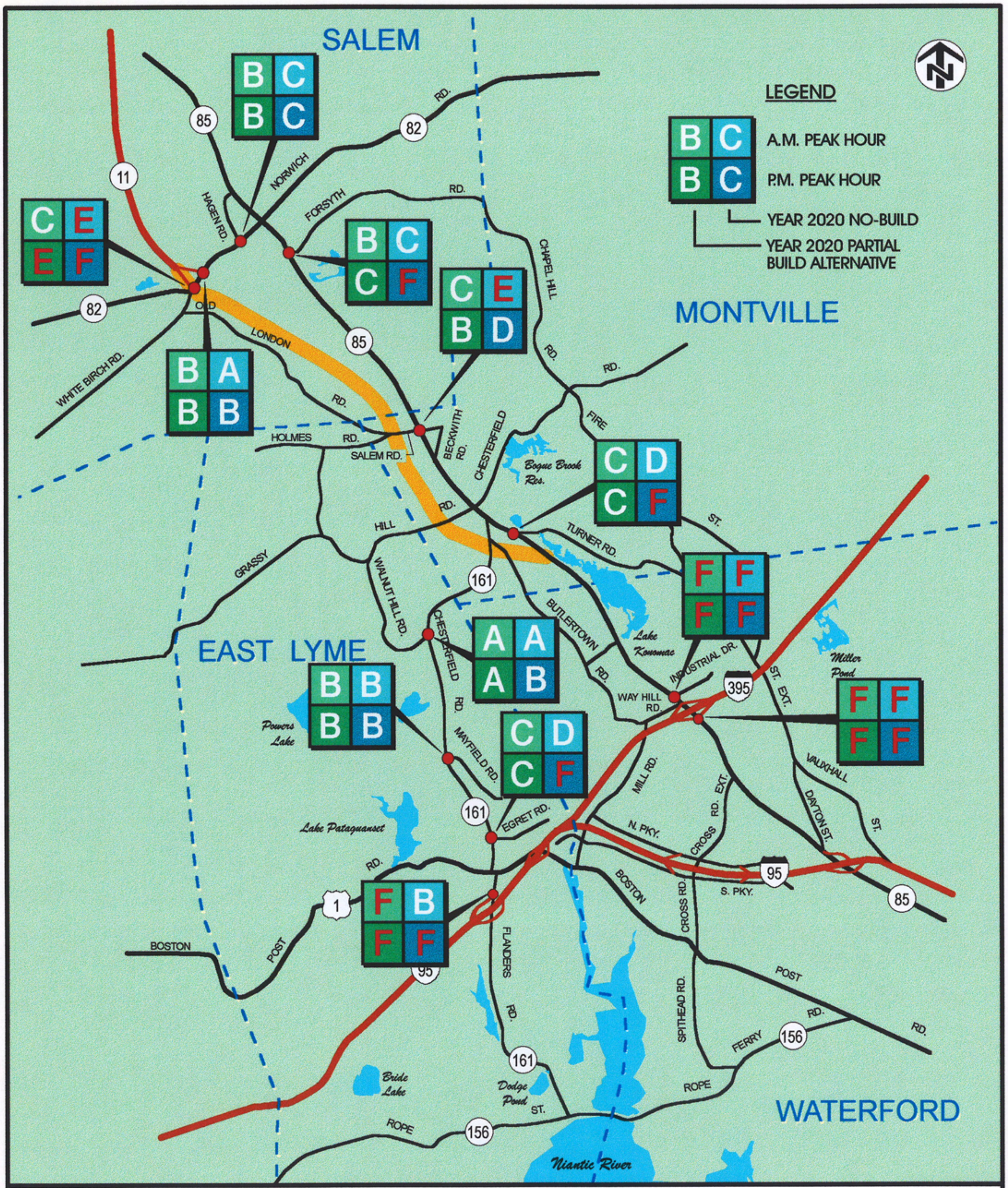
## SIGNALIZED INTERSECTIONS
## PARTIAL BUILD ALTERNATIVE CAPACITY ANALYSIS

Figure 5-10

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Federal Highway Administration
ROUTE 82/85/11
ENVIRONMENTAL IMPACT STATEMENT (EIS)
IN THE TOWNS OF
EAST LYME, MONTVILLE, SALEM AND WATERFORD

## UNSIGNALIZED INTERSECTIONS
## PARTIAL BUILD ALTERNATIVE CAPACITY ANALYSIS

Figure 5-11

Roadway segment volume-to-capacity ratios were estimated for Routes 85, 82, and 161 during the 2020 AM and PM peak hours. The capacity of each roadway segment was based upon *Highway Capacity Manual* planning level capacities. The results are presented on Figure 5-12. The partial build alternative will divert a considerable amount of traffic from Route 85 north of the terminus of Route 11 at Route 82. This shift in traffic results in acceptable operating condition on Route 85 north of the Route 11 terminus, but poor conditions are forecasted south of the terminus. Route 161 traffic volumes are also forecasted to approach capacity in the vicinity of U.S. Route 1.

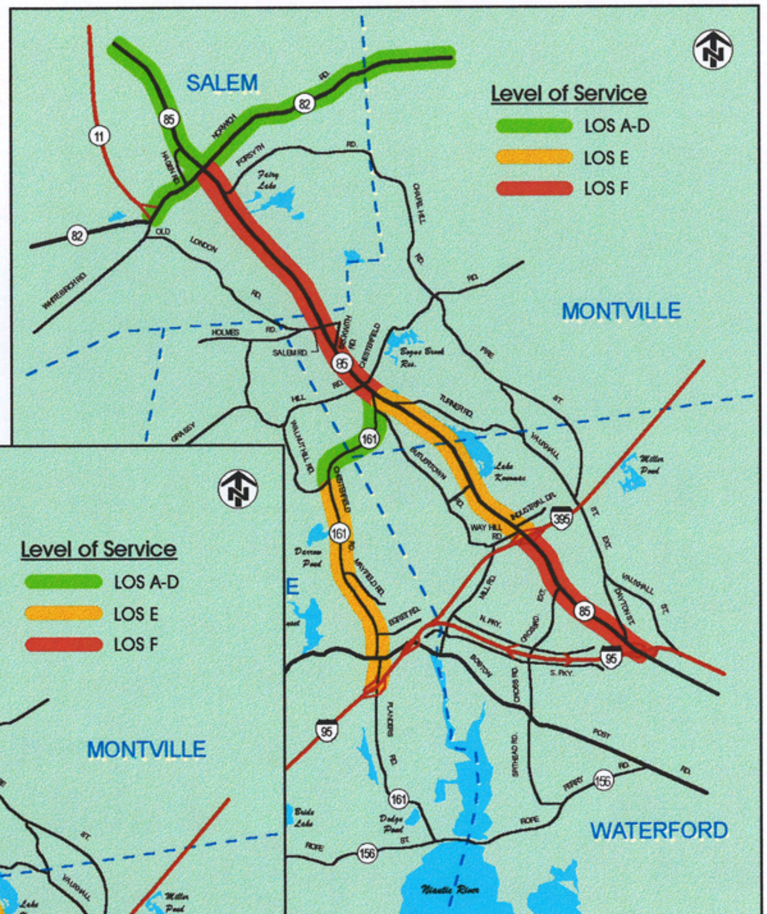
Table 5-10 presents traffic volumes on Route 11 for the 2020 no build condition and each of the alternatives, including the preferred alternative. Traffic volumes are noted at various locations during the AM and PM peak hours and on a daily basis; the varying volume levels for each alternative are depicted.

5.1.1.6 *I-95 Interchange -Preferred Alternative*: In addition to the highway capacity analysis performed for intersections and roadway segments for the alternatives, an analysis was also performed for lanes, ramps and intersections at the proposed interchange of Route 11, I-95 and I-395 for the preferred alternative. This additional analysis was undertaken in 2002 to determine the effects of potential lane and ramp changes on traffic flow in this area.

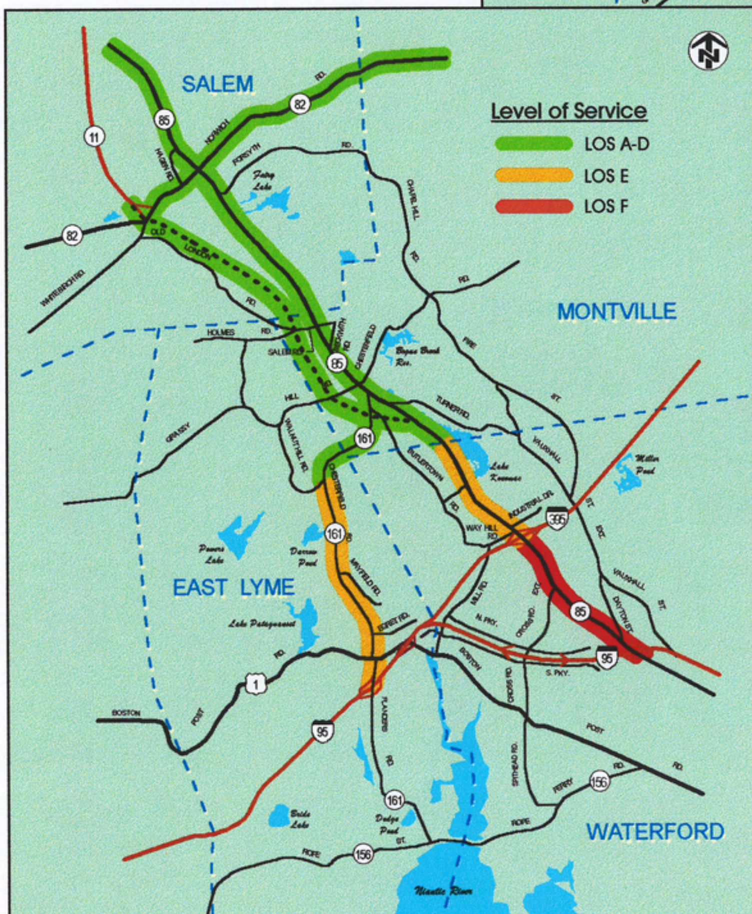
A comparative analysis was made between the proposed new interchange (described in Section 3.4.4) and the existing interchange without the construction of the preferred alternative. The no build condition represents the roadway network under existing conditions, as presented in Section 4.1, while the build condition represents the roadway network with the preferred alternative for the proposed Route 11/I-95/I-395/U.S. Route 1 interchange in place.

Under the 2020 build condition, I-95 would consist of three mainline lanes in each direction from just north of the Interchange 74 (Route 161) off-ramp to the Interchange 81 (Cross Roads Extension) off-ramp in the northbound direction and, from the Interchange 81 (Cross Roads Extension) on-ramp to just south of the Interchange 74 (Route 161) off-ramp in the southbound direction. I-95 would remain two lanes in each direction south of the three-lane transition area at Interchange 74 and north of the three-lane transition area at Interchange 81. LOS on the two-lane segments would not be affected by the proposed configuration. This analysis incorporated improvements being undertaken at Interchange 81 (Cross Roads Extension) under State Project No. 152-138.

*Future Year (2020) Traffic Volumes*: Peak hour traffic volumes in the AM and PM were determined along I-95, I-395, and Route 11, and at key study area intersections, under the 2020 no build and build conditions.




2020 FUTURE NO-BUILD




PARTIAL BUILD ALTERNATIVE

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**EFFECTS OF IMPROVEMENT ON LOS OF EXISTING ROADS**

**Figure 5-12**

TABLE 5-10
ROUTE 11 TRAFFIC VOLUMES

| | 2020 NO BUILD | TDM/TRANSIT | TSM | WIDENING | FULL BUILD EXPRESSWAY | | PARTIAL BUILD EXPRESSWAY | |
|---|---|---|---|---|---|---|---|---|
| | | | | | FOUR-LANE | TWO-LANE | FOUR-LANE | TWO-LANE |
| Rt. 11 n/o Rt. 82 | | | | | | | | |
| Daily (ADT) | 10,800 | 10,800 | 10,800 | 11,600 | 14,600 | 14,600 | 12,800 | 12,800 |
| AM Peak Hour | 980 | 980 | 980 | 1,170 | 1,310 | 1,310 | 1,150 | 1,150 |
| PM Peak Hour | 1,310 | 1,310 | 1,310 | 1,420 | 1,750 | 1,750 | 1,540 | 1,540 |
| Rt. 11 s/o Rt. 82 | | | | | | | | |
| Daily (ADT) | N/A | N/A | N/A | N/A | 14,800 | 14,800 | 13,000 | 13,000 |
| AM Peak Hour | N/A | N/A | N/A | N/A | 1,310 | 1,310 | 1,150 | 1,150 |
| PM Peak Hour | N/A | N/A | N/A | N/A | 1,730 | 1,730 | 1,520 | 1,520 |
| Rt. 11 s/o Rt. 161 | | | | | | | | |
| Daily (ADT) | N/A | N/A | N/A | N/A | 14,000 | 14,000 | 9,400 | 9,400 |
| AM Peak Hour | N/A | N/A | N/A | N/A | 1,270 | 1,270 | 830 | 830 |
| PM Peak Hour | N/A | N/A | N/A | N/A | 1,590 | 1,590 | 1,070 | 1,070 |

Under the build condition, the ramp from I-95 northbound to U.S. Route 1 at Interchange 75 would be eliminated. Therefore, it is anticipated that the traffic would divert to either Interchange 74 (Route 161) or Interchange 81 (Cross Roads Extension). Based on 2020 no build and build peak hour traffic volumes provided at Interchange 74 (Route 161) and the no build peak hour traffic volumes at Interchange 75 (U.S. Route 1), the number of trips that would divert to Interchange 81 (Cross Roads Extension) was calculated for the AM and PM peak hour periods. These diverted trips were then added to the 2020 no build peak hour traffic volumes at Interchange 81 (Cross Roads Extension) to determine the 2020 build condition.

*I-95 Mainline:* The mainline freeway capacity analysis was conducted under the 2020 no build and build conditions along I-95, I-395 and Route 11 during the AM and PM peak hour. The results are summarized in Table 5-11.

TABLE 5-11
2020 FUTURE CAPACITY ANALYSIS– PREFERRED ALTERNATIVE – I-95 MAINLINE
PEAK HOUR[1] TRAFFIC VOLUMES

| FREEWAY SEGMENT | NORTHBOUND | | SOUTHBOUND | |
|---|---|---|---|---|
| | NO BUILD | BUILD | NO BUILD | BUILD |
| I-95 | | | | |
| South of Interchange 74 | E (F) | E (F) | D (F) | D (F) |
| Between Interchange 74 and 75 | F (F) | C (C) | D (F) | B (D) |
| Between Interchange 75 and 76 | F (F) | -- | C (E) | -- |
| Between Interchange 76 and 80 | E (E) | C (D) | C (F) | B (D) |
| Between Interchange 80 and 81 | E (E) | -- | C (F) | -- |
| North of Interchange 81 | D (E) | D (E) | B (F) | C (F) |
| I-395 | | | | |
| North of I-95 | B (B) | B (B) | B (B) | B (B) |
| Route 11 | | | | |
| North of I-395 / I-95 | -- | B (B) | -- | B (B) |

[1] X(X) Represents LOS for AM peak hour. PM Peak LOS shown in parentheses.
-- denotes "not applicable"

Under the 2020 build condition, with an additional lane in each direction, all freeway segments between Interchange 74 (Route 161) and Interchange 81 (Cross Road Extension) would operate at LOS D or better, an improvement over the no build condition. However, the freeway segments just south of Interchange 74 and north of Interchange 81 would continue to operate at LOS

E or LOS F during the 2020 build PM peak hour condition because an additional lane is not provided on those segments.

The freeway segment along I-395, just north of I-95, would operate at LOS B under the 2020 build condition. The segment along Route 11, north of I-95/I-395, would also operate LOS B under the 2020 build condition.

*I-95 Weaving Analysis*: Under the 2020 build condition, the existing weaving movements between Interchange 75 (U.S. Route 1) and Interchange 76 (I-395) would be eliminated. No weaving movements were identified under the 2020 build condition along I-95 in either the northbound or the southbound directions. Therefore, the preferred alternative would have a positive effect by eliminating an existing safety and operational problem.

*I-95 Freeway-Ramp Analysis:* A freeway-ramp junction analysis was conducted along I-95 under the 2020 build conditions during the AM and PM peak hour periods. The results of the freeway-ramp analyses are presented in Table 5-12.

Under the 2020 build condition, the freeway-ramp junctions between Interchange 74 (Route 161) and Interchange 81 (Cross Road Extension) would operate at LOS D or better during the AM peak hour condition. During the PM peak hour most ramp junctions would operate at LOS D or better, but the off-ramp and on-ramp at Route 161 and the on-ramp at U.S. Route 1/Route 11 would operate at LOS F.

In the northbound direction, at the off-ramp to Parkway South, one of the I-95 mainline lanes is dropped resulting in two mainline lanes downstream of the off ramp. This freeway-ramp junction, therefore, cannot be analyzed as a diverge condition. In the case of a lane drop or lane add at a freeway-ramp junction, the freeway segment analysis is considered upstream of the lane drop and downstream of the lane add (HCM). The I-95 segment upstream of the Parkway South off-ramp is expected to operate at LOS C and LOS D, respectively, under AM and PM peak hour conditions. In the southbound direction, the on-ramp from Parkway North provides an additional operational lane on I-95. The I-95 segment downstream of the Parkway North on-ramp is expected to operate at LOS B and LOS D, respectively, under AM and PM peak hour conditions.

The freeway-ramp junctions associated with I-395, Route 11, and the U.S. Route 1 Frontage Road exist only under the 2020 build condition as part of the new roadway configuration. The results of the analyses indicate that the new off and on-ramps along I-395, Route 11, and U.S. Route 1 associated with the proposed roadway configuration would operate at LOS A, B, or C.

TABLE 5-12
2020 FUTURE CAPACITY ANALYSIS– PREFERRED ALTERNATIVE – I-95 FREEWAY RAMPS
2020 PEAK HOUR[1] TRAFFIC VOLUMES

| FREEWAY – RAMP JUNCTION | NORTHBOUND | | SOUTHBOUND | |
|---|---|---|---|---|
| | NO BUILD | BUILD | NO BUILD | BUILD |
| **INTERCHANGE 74 (ROUTE 161)** | | | | |
| Off-ramp to Route 161 | E (F) | D (F) | C (F) | B (D) |
| On-ramp from Route 161 | F (F) | A (B) | C (F) | C (F) |
| **INTERCHANGE 75 (U.S. ROUTE 1)** | | | | |
| Off-ramp to U.S. Route 1 | F (F) | -- | B (F) | -- |
| On-ramp from U.S. Route 1 | F (F) | -- | C (F) | -- |
| **INTERCHANGE 76 (I-395 / ROUTE 11 /U.S. ROUTE 1)** | | | | |
| Off-ramp to I-395 / Route 11 | F (F) | C (D) | -- | -- |
| On-ramp from I-395 / Route 11 | -- | -- | C (F) | B (D) |
| Off-ramp to U.S. Route 1 / Route 11 | -- | -- | -- | B (D) |
| On-ramp from U.S. Route 1 / Route 11 | -- | C (F) | -- | -- |
| **INTERCHANGE 80 (OIL MILL ROAD)** | | | | |
| Off-ramp to Oil Mill Road | -- | -- | B (F) | -- |
| On-ramp from Oil Mill Road | D (D) | -- | -- | -- |
| **INTERCHANGE 81 (CROSS ROAD EXTENSION)** | | | | |
| Off-ramp to Parkway South | D (E) | C (D) [2] | | |
| On-ramp from Parkway North | | | B (F) | B (D) [3] |
| **I-95** | | | | |
| Off-ramp to Route 11 north | -- | B (C) | -- | -- |
| On-ramp from Route 11 south | -- | -- | -- | C (C) |
| **ROUTE 11** | | | | |
| Off-ramp to Route I-95 south | -- | -- | -- | B (B) |
| On-ramp from Route I-95 north | -- | A (B) | -- | -- |
| Off-ramp to U.S. Route 1 Frontage | -- | B (C) | -- | -- |
| On-ramp from U.S. Route 1 Frontage | -- | -- | -- | B (B) |
| **U.S. ROUTE 1 FRONTAGE** | | | | |
| On-ramp from I-395 South | -- | -- | -- | A (B) |
| Off-ramp to I-395 North | -- | B (B) | -- | -- |

[1] X(X) Represents LOS for AM peak hour. PM Peak LOS shown in parenthesis.
-- Denotes "not applicable"
[2] Cannot be analyzed as a diverge due to mainline lane drop at off-ramp at Parkway South; freeway segment analysis upstream of off-ramp is indicative of LOS at this location.
[3] Cannot be analyzed as a merge because on-ramp from Parkway North adds an operational lane on I-95; freeway segment analysis downstream of on-ramp is indicative of LOS at this location.

*I-95 Intersection Analysis:* The LOS analysis was performed at intersections along the I-95 corridor during the AM and PM peak hour conditions under the 2020 build condition.

**Signalized Intersections**

The results of the LOS analyses under the 2020 build AM and PM peak hour periods at key signalized intersections along I-95 are shown in Table 5-13.

TABLE 5-13
2020 FUTURE CAPACITY ANALYSIS – PREFERRED ALTERNATIVE – I-95 SIGNALIZED INTERSECTIONS
2020 PEAK HOUR TRAFFIC VOLUMES

| INTERSECTION | NO BUILD | | BUILD [1] | |
|---|---|---|---|---|
| | AM | PM | AM | PM |
| INTERCHANGE 74 (ROUTE 161) | | | | |
| U.S. Route 1 and Route 161 | C | D | C | E |
| Route 161 and I-95 northbound off-ramp | B | D | C | E |
| INTERCHANGE 75 (U.S. ROUTE 1) | | | | |
| U.S. Route 1 and Frontage Road | -- | -- | A | B |
| INTERCHANGE 81 (CROSS ROAD EXTENSION) | | | | |
| Cross Road Ext. and Parkway North | C | D | C | D |
| Cross Road Ext. and Parkway South | C | D | C | D |

Note: -- Denotes “not applicable”
[1] Build without intersection improvements

The intersection of U.S. Route 1 and Route 161 would operate at LOS C and E during the 2020 build AM and PM peak hour conditions, respectively. It is important to note that the LOS would deteriorate during the PM peak hour from LOS D under the No build condition to LOS E under the build condition. This is due to the diversion of U.S. Route 1 traffic oriented towards Interchange 75 into Interchange 74 with the closing of access between I-95 and U.S. Route 1 from points south of Interchange 75.

Similarly, the intersection of Route 161 and I-95 northbound off-ramp would deteriorate from LOS B to LOS C during the AM peak hour and from LOS D to LOS E during the PM peak hour condition. This is also attributed to the diverted U.S. Route 1 traffic into Interchange 74 from I-95.

The intersection of U.S. Route 1 and Connector/Frontage Road would be a new three-way intersection, under the proposed interchange, that would be signalized. The Connector/Frontage road approach would be a one-way road into the intersection from the north. The Connector/Frontage Road approach from the north would consist of a combination left and through lane and a through lane. The U.S. Route 1 approach from the south would consist of a channelized right turn lane while the U.S. Route 1 approach from the east would consist of two left turn lanes at the intersection. The results of the analysis indicate that this intersection would operate at LOS A and B during the 2020 build AM and PM peak hour conditions, respectively.

The intersection of Cross Road Extension with Parkway North would operate at LOS C and D under the 2020 build AM and PM peak hour conditions, respectively. Similarly, the intersection of Cross Road Extension with Parkway South would operate at LOS C and LOS D under the 2020 build AM and PM peak hour conditions, respectively.

**Unsignalized Intersections**

The results of the LOS analyses under the 2020 build AM and PM peak hour periods at unsignalized intersections are shown in Table 5-14.

TABLE 5-14
2020 FUTURE CAPACITY ANALYSIS – PREFERRED ALTERNATIVE – I-95 UNSIGNALIZED INTERSECTIONS
2020 PEAK HOUR TRAFFIC VOLUMES

| INTERSECTION | NO BUILD | | BUILD [(1)] | |
|---|---|---|---|---|
| | AM | PM | AM | PM |
| INTERCHANGE 74 (ROUTE 161) | | | | |
| Route 161 and I-95 southbound off-ramp | F | F | F | F |
| INTERCHANGE 75 (U.S. ROUTE 1) | | | | |
| U.S. Route 1 north / I-95 southbound on-ramp/u-turn | B | B | -- | -- |
| U.S. Route 1 south / I-95 southbound off-ramp | E | F | -- | -- |
| U.S. Route 1 north / I-95 northbound on-ramp | B | D | -- | -- |

Note: LOS is shown for the critical movement at the intersection.
-- denotes “not applicable”
(1) Build without intersection improvements

The critical movement (left turn from I-95 southbound off-ramp) at the intersection of Route 161 and I-95 southbound ramps would continue to operate at LOS F under the 2020 build condition without improvements. Signalization is proposed for this intersection.

**Proposed Intersection Improvements**

Based on the results of the LOS analyses, the following intersection improvements were evaluated for their ability to provide acceptable levels of service (LOS D or better).

- U.S. Route 1 and Route 161

The intersection of Routes 1 and 161 is expected to operate at LOS C and E under the 2020 build AM and PM peak hour conditions, respectively. The U.S. Route 1 eastbound approach currently consists of a left turn lane, a through lane, and a combination through and right turn lane. The Route 161 northbound approach currently consists of an exclusive left turn lane, a through lane, and an exclusive right turn lane. The suggested improvement consists of re-striping the U.S. Route 1 eastbound combination through and right lane to an exclusive right turn lane and providing an additional left turn lane on Route 161 in the northbound direction at the intersection. With this geometric improvement and signal timing changes, the intersection would operate at LOS C and D under the 2020 build AM and PM peak hour conditions, respectively.

- Route 161 and I-95 Southbound Ramps

This intersection is currently unsignalized and consists of heavy traffic volumes traveling through the intersection, especially during the PM peak hour. With the proposed signalization, this intersection would operate at LOS B and D under the 2020 build AM and PM peak hour conditions, respectively.

- Route 161 and I-95 Northbound Off-Ramp

The intersection of Route 161 and the I-95 northbound off-ramp is expected to operate at LOS C and E under the 2020 build AM and PM peak hour conditions, respectively. The eastbound approach from the I-95 northbound off-ramp currently has a combination left and through lane and an exclusive right turn lane. In the southbound direction, Route 161 consists of a through lane and a combination left and through lane. Based on the results of the LOS analyses, the I-95 northbound off-ramp approach requires an additional left turn lane and Route 161 southbound requires an exclusive left turn lane into King Arthur Drive in order to operate at acceptable LOS (D or better). With this proposed improvement, the intersection would operate at LOS C under the 2020 build AM and PM peak hour conditions.

The capacity analysis for the proposed intersection improvements is summarized in Table 5-15. The proposed improvements resulted in an increase in LOS to D or better; these improvements were incorporated into the preferred alternative (Section 3.4.4).

| TABLE 5-15<br>2020 FUTURE CAPACITY ANALYSIS – PREFERRED ALTERNATIVE – PROPOSED INTERSECTION IMPROVEMENTS ALONG I-95<br>2020 PEAK HOUR TRAFFIC VOLUMES | | | | |
|---|---|---|---|---|
| INTERSECTION | WITHOUT IMPROVEMENTS | | WITH IMPROVEMENTS | |
| | AM | PM | AM | PM |
| U.S. ROUTE 1 AND ROUTE 161<br>(with geometry and signal timing improvements) | C | E | C | D |
| ROUTE 161 AND I-95 SOUTHBOUND RAMPS<br>(with signalized intersection) | F | F | B | D |
| ROUTE 161 AND I-95 NORTHBOUND OFF-RAMP<br>(with geometry and signal timing improvements) | C | E | C | C |

### 5.1.2 PEDESTRIAN AND BICYCLE FACILITIES

Local interests have articulated a desire to construct pedestrian/bicycle trails and/or a "greenway" recreational corridor in conjunction with highway construction on a new location. Planning for the greenway is already underway as a separate effort by the Route 11 Greenway Authority Commission (Route 11 GAC), which was established by Public Act 00-148 (May 26, 2000).

The greenway is being planned as a corridor of open space located generally parallel to the proposed roadway alignment. The central purpose of the greenway concept is to preserve contiguous tracts of undeveloped land to provide walking and biking trails, as well as contiguous wildlife areas, along the corridor. This plan would certainly enhance recreational opportunities in the towns and the region and would represent a positive impact on pedestrian and bicycle facilities.

The level of facility provided would be dictated by many factors including the physical characteristics of the land through which a new roadway would pass. A new roadway would traverse hilly and rocky terrain requiring numerous areas of rock cut that may present difficulties with the placement of a bikeway along a roadway. Provision of a bikeway in the right-of-way would also require a wider footprint for a highway resulting in a greater impact on the wetlands that would be affected by a new alignment alternative as well as the potential acquisition of additional right-of-way. It could also influence the design and cost of bridges that would be incorporated to avoid wetlands. These factors may result in a necessary physical separation of a bikeway from the roadway (or at least a partial separation), for which additional property acquisition may be required and additional impacts to streams, wetlands and wildlife habitats would likely occur. Another option for a bikeway would be one that uses the alternative's right-of-way, combined with existing roadways. The feasibility of a bikeway may be considered during the design phase of the preferred alternative.

Another option that could be considered is the concept of walking trails and wildlife areas. Provision of unpaved hiking trails (also mountain bike and bridal trails) and areas left intact for wildlife use is a concept that would easily blend with the existing environment in the corridor. An extensive network of unpaved woodland trails already exists beginning in the ConnDOT right-of-way and state forest near Shingle Mill Brook in Salem and ending in the abandoned Pember Road area, along the Waterford/East Lyme town line. The full build alternatives may afford the opportunity to secure the necessary land and/or easements from property owners to allow public use of trails and building of new trails. This concept will require public and private efforts and support as well as coordination with various state agencies. It is assumed, for this study, that the towns will not choose to develop, on their own or under separate FHWA funding such as the Enhancement program, greenways or pedestrian/bicycle facilities.

5.1.2.1 *No Build Alternative*: The no build alternative would result in a lack of improvement opportunities for pedestrian and bicycle travel except in those areas where safety improvements are currently proposed. As described in Section 4.1.11, within the corridor, facilities for pedestrians and bicyclists are currently deficient along Route 85. Only meaningful improvements such as including consistently wider shoulders along the roadway and construction of sidewalks or walking paths connecting residential and commercial areas would provide benefits, and these actions are not included in the no build alternative. As traffic volumes increase in the future, these modes of travel may suffer a negative impact without implementation of roadway improvements.

5.1.2.2 *Route 82 and 85 Widening Alternatives*: The widening alternatives provide an opportunity for improvements in pedestrian and bicycle safety on Routes 82 and 85. The proposed $W_{(4)}$ and $W_{(2)}$ variations include a minimum of 2.4 m. (8 ft.) wide shoulders. Only the modified four-lane variation ($W_{(4)}$m) incorporates less than 2.4 m. (8 ft.) shoulders in order to minimize impacts in sensitive areas. The shoulder improvements would allow space for bicycle and pedestrian use. The widening alternatives, and particularly the $W_{(4)}$ and $W_{(2)}$ alternatives, therefore, represent a positive impact with respect to pedestrian and bicycle travel. The beneficial effects are limited, however, by the projected increase in traffic volume and relatively high vehicle speeds on Routes 82 and 85.

Temporary adverse impacts to both pedestrian and bicycle travel would occur along Routes 82 and 85 during construction. Any plans for roadway widening would include specific provisions for the maintenance and protection of traffic, including pedestrian and bicycle traffic, throughout the construction period. Nevertheless, any construction site invariably poses greater opportunities for hazard and risk.

5.1.2.3 *TSM Alternative*: TSM initiatives may provide a beneficial impact in that the nature of the improvements that might be undertaken would focus, primarily, on safety factors. Some minimal, though likely negligible, benefits may occur with this alternative.

5.1.2.4 *TDM/Transit Alternative*: TDM and/or transit initiatives would be expected to provide a beneficial impact. Cyclists and pedestrians would be afforded an additional means of transportation to locations that might not otherwise be accessible or within a reasonable travel distance either on foot or on a bicycle. The safety of pedestrians and bicyclists along existing roads would not be affected.

5.1.2.5 *New Location - Full Build Alternatives*: The various alternatives for a new roadway on a new location, including the preferred alternative, will not have long-term, negative impacts on current pedestrian travel or on the established *Recommended Bicycle Routes* on Old New London Road and Route 161. In fact, these alternatives may provide the greatest opportunity for achieving a positive impact on these facilities if a bicycle/pedestrian facility is included in the recommended action. As discussed above, the full build alternatives may incorporate a recreational pedestrian trail and bikeway, in which case, pedestrian and bicycle opportunities will be greatly enhanced.

There will likely be temporary minor impacts to pedestrians and bicyclists during construction of the highway. For Alternatives 92PD, $E_{(4)}$, $E_{(2)}$, $F_{(4)}$, $F_{(2)}$, $G_{(4)}$, and $G_{(2)}$, the impacted areas would be in the vicinity of the new interchanges at Route 82 and Route 161. Movement through these areas may be temporarily hampered although provisions would be made for maintaining the continuity of all traffic flow during the construction process. Since the new interchange at Route 161 would affect the characteristics of the roadway in that area, the riding environment may be altered, but not impeded, provided appropriate measures are taken to retain or enhance the road for bicycle use.

5.1.2.6 *New Location - Partial Build Alternatives*: Similar to the widening and full build alternatives, the partial build alternatives would have a temporary minor adverse effect on pedestrian and bicycle movement through the corridor at areas under construction. For the $H_{(4)}$ and $H_{(2)}$ alternatives, impacted areas would include the intersection/interchange points at Route 82, Route 161 and Route 85. Bicycle and pedestrian travel along Route 85 may be further degraded by Alternative $H_{(4)}$ or $H_{(2)}$ as a result of the proposed touchdown of Route 11 just south of the Route 161 intersection. Travel through an intersection of this magnitude may be complicated, unappealing or, in the worse case scenario (such as peak periods), hazardous.

The new location section of the partial build alternatives would provide an opportunity for enhancements of pedestrian and bicycle facilities as were described for the full build alternatives.

### 5.1.3 EMERGENCY MANAGEMENT

The type of disaster that would put the greatest traffic burden on the Route 82/85/11 corridor would be a major nuclear accident at Millstone. However, there are several areas of uncertainty with respect to the future importance of the Route 82/85/11 corridor for emergency evacuation purposes. If and when that plant was to cease operation permanently, its emergency planning requirements would be reduced substantially and pressure on the corridor would be lessened. As noted in Section 4.1.12.1, a new host community was designated for Waterford (East Hartford). The Route 82/85/11 corridor continues to be the main evacuation route; however, I-395 north to Route 2 is listed as an alternate. Yet another uncertainty is the effect of future population growth and traffic volumes on the estimated evacuation time estimates prepared by Northeast Utilities, since these estimates were based on current conditions. The following assumes continued operation of Millstone and no further changes in designated host communities.

5.1.3.1 *No Build Alternative*: As evidenced by the traffic analysis under non-emergency conditions, future year traffic volumes in the corridor are expected to rise and level of service to fall. One can logically expect some increase in the amount of time required for evacuation and in the number of intersections at which delays would be expected.

5.1.3.2 *Route 82 and 85 Widening Alternatives*: Any of the widening alternatives would provide some incremental improvement in the ability of the corridor to handle an emergency evacuation. Because of their greater capacity, either of the four-lane alternatives would handle evacuation traffic better than the two-lane option with full shoulders and turning lanes.

5.1.3.3 *TSM Alternative*: Roadway and intersection conditions after implementation of TSM initiatives would provide some incremental improvement in the ability of the corridor to handle an emergency evacuation. Routes 82 and 85 would handle evacuation traffic better than under then no build condition.

5.1.3.4 *TDM/Transit Alternative*: Implementation of TDM and/or transit alternatives would likely have no effect upon planning for or executing emergency evacuation procedures.

5.1.3.5 *New Location - Full Build Alternatives*: These alternatives, including the preferred alternative, provide the greatest advantage in avoiding congestion and delays in the corridor study area during a major evacuation. Since a large proportion of vehicles would originate in New London and Waterford, the alternatives that connect directly with I-95 and I-395 would give the greatest benefit. Any one of them would be a parallel alternative to Route 85, providing greatly increased capacity, especially in the four-lane configurations. Any of these alternatives also would improve conditions at the two intersections in Waterford found to be congested during evacuation modeling, specifically, Route 85 at the I-395 interchange and Route 85 at Cross Road. Local, regional and state officials consider the full build alternative to be very important in emergency evacuation planning and in maintaining the public's trust in emergency preparedness.

5.1.3.6 *New Location - Partial Build Alternatives*: These alternatives would also provide a second highway, parallel to Route 85, which would reduce potential congestion at the intersection of Route 85 at Route 161 in Chesterfield and of Route 85 at Route 82 in Salem, two identified congestion points under normal peak hour conditions. The $H_{(4)}$ alternative would provide additional lanes that would further increase the number of travel lanes over the $H_{(2)}$ option.

# 5.2 NOISE

## 5.2.1 DEVELOPMENT OF CALIBRATED NOISE MODEL

An analysis of the traffic-generated noise was conducted for each of the alternatives to determine if they would adversely impact the sensitive noise receptors adjacent to the study corridor. Field measurements of existing, background noise levels at 51 sensitive noise receptor locations are presented in Table 4-27 and Figure 4-16.

In order to assess the impact of each of the alternative alignments, a calibrated noise model was developed. The calibrated, baseline noise model was performed in accordance with published FHWA noise prediction assessment procedures included in Report No. FHWA-RD-77-108 and using the STAMINA2.0 noise prediction model, the standard model used at the time of this analysis in 1998.

In 2004, FHWA released a new model – Traffic Noise Model (TNM) Version 2.5; earlier versions had been under development since 1998. In a memorandum dated April 14, 2004, FHWA directed that for projects initiated within six months of the memorandum the use of the new model would be required; however, for projects in progress, the model already in use should continue to be used. Therefore, it was not necessary or recommended that this EIS analysis be updated with TNM. Future noise modeling will be undertaken during the design process that will utilize the most up-to-date model available at that time.

Parameters entered into the baseline noise model included existing roadway geometry (for roadways adjacent to receptors), grades, receptor coordinates (x, y, and z), existing traffic volumes and vehicle types, existing roadway speeds, ground/terrain features, and other relevant data.

To achieve calibration, both the roadway traffic volumes, vehicle mixes (car/medium truck/heavy truck) and speeds were adjusted. It should be noted that the noise analysis was conducted to be representative of the *worst case* four-lane alternative for each alignment and did not evaluate the two-lane alignment alternatives for either the full build or partial build scenarios.

The location of the centerlines of the two north and southbound lanes was input into the noise model, representative of the average condition. The noise model was developed utilizing USGS quad maps enlarged to a scale of 1" = 1000'. Superimposed on this enlarged USGS map, were the state plane coordinate grids along with conceptual roadway alignments and approximate noise receptor locations. This composite map was necessary to gain an overall picture of the study area and to assess relative impacts of existing roadway traffic noise on adjacent receptor locations. This feature was especially important in developing the baseline, calibrated 1998 existing noise model.

Impacts associated with the full build alternatives (92PD, $E_{(4)}$, $F_{(4)}$, and $G_{(4)}$) were modeled by overlaying, on the 2020 no build model, each new location full build alternative. The worst case TRANPLAN projections were used, in this case the PM peak hour projections for the full build scenario. In developing volumes for each of the vehicle classifications, it was assumed that trucks would represent 3% of the total projected traffic volume and, of that 3%, 60% would be allocated to medium trucks with the remaining 40% being heavy trucks. The following volumes were used:

Southbound - 921 cars; 17 medium trucks; 12 heavy trucks
Northbound - 727 cars; 14 medium trucks; 9 heavy trucks

The assumptions for the partial build scenario remained the same, except that the following volumes were used:

Southbound - 553 cars; 10 medium trucks; 7 heavy trucks
Northbound - 485 cars; 9 medium trucks; 6 heavy trucks

### 5.2.2 NOISE IMPACT ASSESSMENT – ALTERNATIVES

The results of the noise impact analysis are shown on Table 5-16 for each of the 51 noise receptor locations. This table summarizes the existing, measured noise levels at each receptor, the 2020 no build condition noise levels and the predicted noise levels associated with each of the 2020 design year full build and partial build alternatives. The preferred alternative is analyzed separately in Section 5.2.3. The criteria for noise abatement were defined previously in Section 4.2.1.1.

The results of the noise impact analysis indicate that Alternative $H_{(4)}$, the partial build alternative, would have the most impact on area receptors because it intersects, rather than parallels, Route 85 to a southern point of terminus at I-95/I-395. The receptors approaching or exceeding the NAC under current conditions and under no build projected conditions in 2020 are indicated in Section 4.2.3. The receptors exceeding current conditions are shown together with the receptors that would be impacted *in addition* to these, after implementation of the various alternatives, on Table 5-17.

TABLE 5-16
NOISE IMPACT ANALYSIS SUMMARY [(1)]

| RECEPTOR SITE NUMBER | LOCATION | LAND USE TYPE | 1998 EXISTING MEASURED NOISE LEVEL $L_{eq}$ (dBA) | PREDICTED NOISE LEVELS – DESIGN YEAR 2020 – $L_{eq}$ (dBA) | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | NO BUILD, TSM, TDM/TRANSIT, $W_{(4)}$, $W_{(4)}M$, $W_{(2)}$ | 92PD | $E_{(4)}$ | $F_{(4)}$ | $G_{(4)}$ | $H_{(4)}$ |
| 1 | 66 Route 82 | Residential/ Commercial | 69* | 66* | 68* | 68* | 68* | 68* | 68* |
| 2 | 54 Route 85 | Residential | 63 | 60 | 63 | 63 | 63 | 63 | 63 |
| 3 | 209 Route 85 | Residential | 64 | 69* | 69* | 69* | 69* | 69* | 69* |
| 4 | Rest Area on Route 85 | Park | 70* | 72* | 72* | 72* | 73* | 72* | 72* |
| 5 | 412 Route 85 | Residential | 69* | 68* | 68* | 68* | 69* | 68* | 68* |
| 6 | 487 Route 85 | Residential | 62 | 61 | 61 | 61 | 62 | 61 | 61 |
| 7 | 1830 Route 85 at Salem Tnpk | Residential | 66* | 70* | 70* | 70* | 70* | 70* | 70* |
| 8 | 1605 Route 85 | Residential | 70* | 75* | 75* | 75* | 75* | 76* | 75* |
| 9 | 1596 Route 85 (Motel/Convenience Store) | Commercial | 66 | 71* | 71* | 71* | 71* | 72* | 71* |
| 10 | Fox Hollow Rd./Route 85 | Residential | 58 | 59 | 59 | 59 | 59 | 59 | 59 |
| 11 | 1394 Route 85 | Residential | 69* | 69* | 69* | 69* | 69* | 69* | 69* |
| 12 | 1214 Route 85 | Residential | 72* | 76* | 76* | 76* | 76* | 76* | 76* |
| 13 | Lakes Pond Church, Rt. 85 | Church | 59 | 63 | 63 | 63 | 63 | 63 | 63 |
| 14 | 1081Route 85 | Residential | 70* | 71* | 71* | 71* | 71* | 71* | 73* |
| 15 | Oakdell Motel on Route 85 | Commercial | 64 | 65 | 64 | 64 | 64 | 64 | 68* |
| 16 | 964 Route 85 | Residential | 66* | 64 | 64 | 64 | 64 | 64 | 67* |

TABLE 5-16
NOISE IMPACT ANALYSIS SUMMARY [1]

| RECEPTOR SITE NUMBER | LOCATION | LAND USE TYPE | 1998 EXISTING MEASURED NOISE LEVEL $L_{eq}$ (dBA) | PREDICTED NOISE LEVELS – DESIGN YEAR 2020 – $L_{eq}$ (dBA) | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | NO BUILD, TSM, TDM/TRANSIT, $W_{(4)}$, $W_{(4)}M$, $W_{(2)}$ | 92PD | $E_{(4)}$ | $F_{(4)}$ | $G_{(4)}$ | $H_{(4)}$ |
| 17 | Route 85 (near Crystal Mall) | Residential | 72* | 76* | 79* | 76* | 76* | 76* | 76* |
| 18 | 105 Beckwith Hill Drive | Residential | 43 | 46 | 49 | 66** | 57 | 55 | 58 |
| 19 | 21 Chester Court | Residential | 51 | 50 | 52 | 63 | 62 | 53 | 59 |
| 20 | Skyline Drive | Residential | 53 | 54 | 59 | 59 | 57 | 54 | 61 |
| 21 | Fawn Run (at cul-de-sac) | Residential | 46 | 46 | 47 | 56 | 70** | 70** | 69** |
| 22 | 10 Holmes Road | Residential | 46 | 51 | 61 | 63 | 53 | 52 | 58 |
| 23 | 35 Salem Turnpike | Residential | 52 | 57 | 60 | 59 | 57 | 57 | 61 |
| 24 | 40 Daisy Hill Drive | Residential | 41 | 49 | 65 | 55 | 50 | 51 | 58 |
| 25 | 39 Daisy Hill Drive | Residential | 42 | 47 | 74** | 58 | 49 | 51 | 56 |
| 26 | 984 Grassy Hill Road | Residential | 52 | 49 | 62 | 65 | 50 | 52 | 62 |
| 27 | 947 Grassy Hill Road | Residential | 47 | 54 | 73** | 74** | 54 | 56 | 72** |
| 28 | 480 Route 161 | Residential | 55 | 60 | 62 | 62 | 60 | 61 | 63 |
| 29 | East off Silver Falls Road at top of drive | Residential | 47 | 51 | 73** | 73** | 51 | 56 | 58 |
| 30 | 18 Silver Falls Road | Residential | 60 | 61 | 63 | 63 | 61 | 61 | 63 |
| 31 | 13 Gurley Road | Residential | 70* | 74* | 71* | 71* | 71* | 71* | 75* |
| 32 | Cemetery off of Route 85 | Cemetery | 69* | 73* | 73* | 73* | 73* | 73* | 74* |

TABLE 5-16
NOISE IMPACT ANALYSIS SUMMARY (1)

| RECEPTOR SITE NUMBER | LOCATION | LAND USE TYPE | 1998 EXISTING MEASURED NOISE LEVEL $L_{eq}$ (dBA) | PREDICTED NOISE LEVELS – DESIGN YEAR 2020 – $L_{eq}$ (dBA) | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | NO BUILD, TSM, TDM/TRANSIT, $W_{(4)}$, $W_{(4)}M$, $W_{(2)}$ | 92PD | $E_{(4)}$ | $F_{(4)}$ | $G_{(4)}$ | $H_{(4)}$ |
| 33 | Route 85 between Nos. 1422 and 1461 | Residential | 70* | 68* | 68* | 68* | 68* | 68* | 71* |
| 34 | 71 Oil Mill Road | Residential | 59 | 68* | 65 | 65 | 65 | 65 | 71* |
| 35 | Oil Mill Road, north of No. 71 | Residential | 61 | 70* | 67* | 67* | 67* | 67* | 73* |
| 36 | Gurley Road, south of No. 13 | Residential | 61 | 71* | 68* | 68* | 68* | 68* | 73* |
| 37 | Fawn Run (west of cul-de-sac) | Residential | 43 | 46 | 47 | 54 | 67** | 67** | 67** |
| 38 | 38 Holmes Road | Residential | 41 | 42 | 46 | 47 | 62** | 57** | 56** |
| 39 | 31 Holmes Road | Residential | 52 | 43 | 48 | 49 | 74** | 74** | 65 |
| 40 | 40 Grassy Hill Road | Residential/ Farm | 53 | 45 | 46 | 47 | 61 | 50 | 52 |
| 41 | 13 Grassy Hill Road | Residential | 47 | 47 | 50 | 50 | 51 | 60 | 49 |
| 42 | 16 Cardinal Road | Residential | 44 | 45 | 48 | 48 | 49 | 54 | 47 |
| 43 | Butlertown Road | Commercial | 56 | 56 | 56 | 57 | 56 | 59 | 57 |
| 44 | 1 Walnut Hill Road | Residential | 56 | 61 | 61 | 61 | 66* | 63 | 61 |
| 45 | 325 Route 161 | Residential | 54 | 55 | 55 | 55 | 63 | 74** | 55 |

TABLE 5-16
NOISE IMPACT ANALYSIS SUMMARY [(1)]

| RECEPTOR SITE NUMBER | LOCATION | LAND USE TYPE | 1998 EXISTING MEASURED NOISE LEVEL $L_{eq}$ (dBA) | PREDICTED NOISE LEVELS – DESIGN YEAR 2020 – $L_{eq}$ (dBA) | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | NO BUILD, TSM, TDM/TRANSIT, $W_{(4)}$, $W_{(4)}M$, $W_{(2)}$ | 92PD | $E_{(4)}$ | $F_{(4)}$ | $G_{(4)}$ | $H_{(4)}$ |
| 46 | Aces High Campground | Campground | 53 | 56 | 56 | 56 | 58 | 58 | 56 |
| 47 | Westchester Road | Residential | 49 | 50 | 51 | 51 | 56 | 58 | 57 |
| 48 | 16 Westchester Road | Residential | 48 | 47 | 49 | 49 | 54 | 57 | 49 |
| 49 | Grassy Hill Road | Residential/ Farm | 35 | 41 | 42 | 43 | 61** | 49 | 43 |
| 50 | Cemetery (corner of Route 161 and Route 85) | Cemetery | 57 | 62 | 62 | 62 | 62 | 63 | 62 |
| 51 | Silver Falls Road | Residential | 46 | 50 | 66** | 66** | 51 | 55 | 64** |

Source: MGI/VN
(1) Noise analysis for the 1998 alternatives; the preferred alternative is analyzed separately in Section 5.2.3
* Noise level is an “absolute impact”, approaching (within 1dBA) or exceeding the NAC of 67 dBA
** Noise level is a “relative impact”, exceeding the existing condition by 15 dBA or more

TABLE 5-17
NOISE IMPACT ANALYSIS – FUTURE NOISE LEVELS APPROACHING OR EXCEEDING NAC [1]

| RECEPTOR SITE NUMBER | LOCATION | LAND USE TYPE | CURRENTLY APPROACHES OR EXCEEDS NAC (1998) | PREDICTED NOISE LEVELS – DESIGN YEAR 2020 – $L_{eq}$ (dBA) | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | NO BUILD, TSM, TDM/TRANSIT, $W_{(4)}$, $W_{(4)}M$, $W_{(2)}$ | 92PD | $E_{(4)}$ | $F_{(4)}$ | $G_{(4)}$ | $H_{(4)}$ |
| 1 | 66 Route 82 | Residential/ Commercial | ✓ | **66*** | **68*** | **68*** | **68*** | **68*** | **68*** |
| 3 | 209 Route 85 | Residential | | **69*** | **69*** | **69*** | **69*** | **69*** | **69*** |
| 4 | Rest Area on Route 85 | Park | ✓ | **72*** | **72*** | **72*** | **73*** | **72*** | **72*** |
| 5 | 412 Route 85 | Residential | ✓ | **68*** | **68*** | **68*** | **69*** | **68*** | **68*** |
| 7 | 1830 Route 85 at Salem Tnpk | Residential | ✓ | **70*** | **70*** | **70*** | **70*** | **70*** | **70*** |
| 8 | 1605 Route 85 | Residential | ✓ | **75*** | **75*** | **75*** | **75*** | **76*** | **75*** |
| 9 | 1596 Route 85 | Commercial | ✓ | **71*** | **71*** | **71*** | **71*** | **72*** | **71*** |
| 11 | 1394 Route 85 | Residential | ✓ | **69*** | **69*** | **69*** | **69*** | **69*** | **69*** |
| 12 | 1214 Route 85 | Residential | ✓ | **76*** | **76*** | **76*** | **76*** | **76*** | **76*** |
| 14 | 1081Route 85 | Residential | ✓ | **71*** | **71*** | **71*** | **71*** | **71*** | **73*** |
| 15 | Oakdell Motel on Route 85 | Commercial | | 65 | 64 | 64 | 64 | 64 | **68*** |
| 16 | 964 Route 85 | Residential | ✓ | 64 | 64 | 64 | 64 | 64 | **67*** |
| 17 | Route 85 (near Crystal Mall) | Residential | ✓ | **76*** | **79*** | **76*** | **76*** | **76*** | **76*** |
| 18 | 105 Beckwith Hill Drive | Residential | | 46 | 49 | **66**** | 57 | 55 | 58 |
| 21 | Fawn Run (at cul-de-sac) | Residential | | 46 | 47 | 56 | **70**** | **70**** | **69**** |

TABLE 5-17
NOISE IMPACT ANALYSIS – FUTURE NOISE LEVELS APPROACHING OR EXCEEDING NAC [1]

| Receptor Site Number | Location | Land Use Type | Currently Approaches or Exceeds NAC (1998) | Predicted Noise Levels – design Year 2020 – $L_{eq}$ (dBA) | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | No Build, TSM, TDM/Transit, $W_{(4)}$, $W_{(4)}M$, $W_{(2)}$ | 92PD | $E_{(4)}$ | $F_{(4)}$ | $G_{(4)}$ | $H_{(4)}$ |
| 25 | 39 Daisy Hill Drive | Residential | | 47 | **74**** | 58 | 49 | 51 | 56 |
| 27 | 947 Grassy Hill Road | Residential | | 54 | **73**** | **74**** | 54 | 56 | **72**** |
| 29 | East off Silver Falls Road | Residential | | 51 | **73**** | **73**** | 51 | 56 | 58 |
| 31 | 13 Gurley Road | Residential | ✓ | **74*** | **71*** | **71*** | **71*** | **71*** | **75*** |
| 32 | Cemetery off of Route 85 | Cemetery | ✓ | **73*** | **73*** | **73*** | **73*** | **73*** | **74*** |
| 33 | Route 85, No. 1422 - 1461 | Residential | ✓ | **68*** | **68*** | **68*** | **68*** | **68*** | **71*** |
| 34 | 71 Oil Mill Road | Residential | | **68*** | 65 | 65 | 65 | 65 | **71*** |
| 35 | Oil Mill Road, north of No.71 | Residential | | **70*** | **67*** | **67*** | **67*** | **67*** | **73*** |
| 36 | Gurley Road, south of No. 13 | Residential | | **71*** | **68*** | **68*** | **68*** | **68*** | **73*** |
| 37 | Fawn Run (west of cul-de-sac) | Residential | | 46 | 47 | 54 | **67**** | **67**** | **67**** |
| 39 | 31 Holmes Road | Residential | | 43 | 48 | 49 | **74**** | **74**** | 65 |
| 44 | 1 Walnut Hill Road | Residential | | 61 | 61 | 61 | **66*** | 63 | 61 |
| 45 | 325 Route 161 | Residential | | 55 | 55 | 55 | 63 | **74**** | 55 |
| 51 | Silver Falls Road | Residential | | 50 | **66**** | **66**** | 51 | 55 | 64** |

Source: MGI/VN
[1] Receptors where projected noise level approaches or exceeds criteria for one or more alternatives; values approaching (within 1dBA) or exceeding the NAC of 67 dBA are indicated in bold; the preferred alternative is analyzed separately in Section 5.2.3 using an updated set of noise receptors.
* Noise level an "absolute impact", approaching (within 1dBA) or exceeding the NAC of 67 dBA
** Noise level a "relative impact", exceeding the existing condition by 15 dBA or more

Of 51 receptors, 14 currently approach or exceed NAC and 22 would do so as a result of implementation of one or more of the alternatives.

5.2.2.1 *No Build Alternative*: The no build scenario was modeled by increasing the 1998 baseline calibrated volumes at a rate of 3% per year for 22 years (1998 through 2020); this resulted in expanding the baseline traffic volumes by a factor of 1.66. The results of the 2020 no build analysis indicate that the noise levels on average increase only two dBA comparing the 1998 existing, calibrated baseline noise levels with the 2020 no build levels.

5.2.2.2 *Route 82 and 85 Widening Alternatives*: Each of the widening alternatives ($W_{(4)}$, $W_{(4)}$m and $W_{(2)}$) represent modest increases to capacity and enhancements over existing LOS, especially at intersections, facilitating through traffic movement and decreasing overall delay. The noise impact associated with these improvements is nominal, and is representative of the traffic increases expected for the no build condition. Therefore, the results of the noise impact analysis conducted for the no build condition represents the impacts associated with the widening alternatives as well.

5.2.2.3 *TSM Alternatives*: Similar to the widening alternatives, implementation of TSM improvements would also be representative of the no build condition with respect to noise levels and would also be considered nominal.

5.2.2.4 *TDM/Transit Alternatives*: TDM and transit initiatives would have a negligible effect on traffic volumes and, therefore, noise levels. Any differences in background noise levels, as compared with the no build and widening alternatives, would be unmeasurable; impacts would be considered negligible.

5.2.2.5 *New Location - Full Build Alternative*: In many cases, construction of a new expressway on new location would afford little or no relief from noise levels experienced on Routes 82 and 85, both now and in the future no build condition. No changes or only slight decreases in noise levels are predicted at approximately one-half of the receptors analyzed for the full build expressways in comparison to the future no build scenario.

For the full build alternatives on new ground, new NAC exceedances would occur in the central or western portions of the study corridor proximal to a new expressway (Table 5-12) with noise levels increasing by approximately 7 dBA on average. Of the noise receptors analyzed, new NAC exceedances arising from traffic traveling on the 92PD alternative would occur at seven sites located on Route 85 (site 3), Daisy Hill Drive (site 25), Grassy Hill Road (site 27), Silver Falls Road (sites 29 and 51), Oil Mill Road (site 35), and Gurley Road (site 36). The greatest impacts are expected at Daisy Hill Drive, Grassy Hill Road, and Silver Falls Road where noise levels would range from

16 to 27 dBA higher than the future no build alternative at these locations. The noise increases predicted at Route 85 (site 3), Oil Mill Road (site 35) and Gurley Road (site 36) are common to all of the full build expressway alternatives as these receptor locations are found at the proposed beginning and end of the expressways, regardless of alignment.

Noise impacts for Alternative $E_{(4)}$ would be similar to 92PD, with new NAC exceedances also predicted at seven locations: Route 85 (site 3), Beckwith Hill Drive (site 18), Grassy Hill Road (site 27), Silver Falls Road (sites 29 and 51), Oil Mill Road (site 35), and Gurley Road (site 36). More substantial increases in noise levels of approximately 20 dBA over the future no build condition are anticipated at sites on Beckwith Hill Drive, Grassy Hill Road, and Silver Falls Road.

New noise impacts caused by implementation of the F or G alignments would occur in the western part of the corridor in relatively rural areas. Seven new NAC exceedances associated with the $F_{(4)}$ alignment include locations on Route 85 (site 3), Fawn Run (sites 21 and 37), Holmes Road (site 39), Walnut Hill Road (site 44), Oil Mill Road (site 35), and Gurley Road (site 36). Noise level increases of 20 to 30 dBA over the future no build condition could be expected at sites on Fawn Run and Holmes Road.

Alternative $G_{(4)}$ would have noise impacts in areas similar to Alternative $F_{(4)}$; seven new NAC exceedances would be likely at locations on Route 85 (site 3), Fawn Run (sites 21 and 37), Holmes Road (site 39), Oil Mill Road (site 35), Gurley Road (site 36), and Route 161 (site 45). Increases in noise level ranging between 15 and 30 dBA beyond the future no build scenario are predicted at locations on Fawn Run, Holmes Road, and Route 161.

5.2.2.6 <u>*New Location - Partial Build Alternative*</u>: Alternative $H_{(4)}$ is expected to have noise level increases averaging 7 dBA above the future no build condition at approximately two-thirds of the receptor sites analyzed. Approximately one-third of the locations studied would experience nominal decreases or no change in noise volumes as compared to the no build alternative. Nine new NAC exceedances could be anticipated should the $H_{(4)}$ alternative be implemented. Sites on Route 85 (sites 3 and 15), Fawn Run (sites 21 and 37), Grassy Hill Road (site 27), Silver Falls Road (site 51), Oil Mill Road (sites 34 and 35), and Gurley Road (site 36) would experience noise levels exceeding NAC standards. Noise increases of approximately 15 to 24 dBA could be expected at sites on Fawn Run, Grassy Hill Road, and Silver Falls Road.

### 5.2.3 NOISE IMPACT ASSESSMENT - PREFERRED ALTERNATIVE

An updated noise impact analysis and a mitigation modeling analysis was performed in 2002 for preferred alternative $E_{(4)}$m-V3 using data developed in 1998 for the alternatives, aerial survey mapping obtained in 1999, and field review.

5.2.3.1 *Sensitive Noise Receptors*: A new set of potential noise receptors were identified for preferred alternative $E_{(4)}$m-V3 based upon their location within 91.5 m. (300 ft.) of the proposed alignment. This distance is used per ConnDOT noise policy because noise abatement does not achieve a measurable benefit for receptors located farther than this distance. In this case, all sensitive receptors were defined under Category B (Section 4, Table 4-28).

Twenty-six sensitive receptors were evaluated. This set of receptors is different that those evaluated for the 1998 alternatives. The receptor locations are identified in Table 5-18 and are shown on figures provided in Appendix B.

Of the 26 sensitive receptors, 14 are clustered south of the I-95/I-395 interchange (receptors 14 to 27) and two are grouped north of the interchange (receptors 11 and 12). Three of the receptors, 31 through 33 are situated within 91.5 m. (300 ft.) of proposed minor improvements on U.S. Route 1, south of I-95. These receptors were not analyzed further because they are located on U.S. Route 1 where noise mitigation is not practicable. Receptor 34 is a motel on Route 161 (Flanders Road), and the remaining receptors are individual residences located along the preferred alignment. As residential development is continuing to occur in proximity to the proposed alignment, additional receptors may be identified during subsequent project phases and would be evaluated during project design.

Noise level data from the analysis in Section 4.2 were used, as available, to describe existing conditions at the 26 receptor locations. Field measured data, taken during June and July of 1998, were available for receptors 1, 2, 5, 11, and 12. For receptors 14 - 27, field measurements from 1998 were taken within close proximity of the receptors and were interpolated to represent existing noise level conditions at each receptor location.

Existing noise level data were not available for receptors 7 and 34, as they were not located in close enough proximity to any of the other receptors to reasonably extrapolate noise levels from earlier field-collected data. Receptor 7 did not exist in 1998 and Receptor 34 was a new location added after improvements were proposed for the intersection of Route 161 and the I-95 northbound ramp (Section 5.1.1). Instead, existing conditions were approximated for these two locations using the highway noise model to simulate traffic on surrounding roadways. In addition, existing noise level data were not available for receptor 10 because the property was not accessible.

**TABLE 5-18**
**NOISE RECEPTOR LOCATIONS – PREFERRED ALTERNATIVE**

| RECEPTOR | ADDRESS |
|---|---|
| 1 | 105 Beckwith Hill Drive, Salem |
| 2 | 10 Holmes Road, Montville |
| 05 | 47 Daisy Hill Drive, Montville |
| 7 | 516 Flanders Road, Montville |
| 10 | 51 Grouse Circle, East Lyme |
| 11 | 82 Oil Mill Road, Waterford |
| 12 | 74 Oil Mill Road, Waterford |
| 13 | 21 Gurley Road, Waterford |
| 14 | 11 Gurley Road, East Lyme |
| 15 | 15-17 Gurley Road, East Lyme |
| 16 | 18 Gurley Road, East Lyme |
| 17 | 24 Gurley Road, East Lyme |
| 18 | Gurley Road, East Lyme |
| 19 | 26-28 Gurley Road, East Lyme |
| 20 | 30 Gurley Road, East Lyme |
| 21 | 32 Gurley Road, East Lyme |
| 22 | 33 Gurley Road, East Lyme |
| 23 | 34 Gurley Road, East Lyme |
| 24 | 36 Gurley Road, East Lyme |
| 25 | 39 Gurley Road, East Lyme |
| 26 | 40 Gurley Road, East Lyme |
| 27 | 45 Gurley Road, East Lyme |
| 31 | 39 Boston Post Road, East Lyme |
| 32 | 40-44 Boston Post Road, East Lyme |
| 33 | 46 Boston Post Road, East Lyme |
| 34 | 269 Flanders Road, East Lyme |

Note: See Appendix B for locations

Because there are few roads in the vicinity of this receptor, reasonable estimation of noise levels was not possible and, therefore, noise levels for the no build condition could not be modeled for this receptor location. The noise level used to represent existing conditions at this receptor was assumed based on the average of no build noise conditions at other similar receptors.

5.2.3.2 *Noise Impact Analysis*: Noise levels were predicted for receptors 1 – 33 using FHWA's STAMINA highway noise model. The program considers characteristics of the source-receptor path by including the effects of intervening barriers, topography, trees, and atmosphere absorption. Because Receptor 34 was added at a later date, as noted above, FHWA's TNM 2.0 (latest available in 2002) was used to model this receptor because STAMINA was no longer compatible with advanced computer operating systems. Results were comparable with those obtained with STAMINA.

Noise levels were calculated for all receptors for existing conditions, 2020 no build conditions, and 2020 build conditions with implementation of the preferred alternative. Peak hour traffic data were used and a ratio was applied to estimate the number of cars (97%), medium trucks (2%) and heavy trucks (1%) in the traffic mix. The analysis assumed speed limits of 105 km per hour (km/hr) (65 mph) for the preferred alternative, I-95, and I-395; 72 km/hr (45 mph) for Route 161; and 48 km/hr (30 mph) for residential streets.

Coordinates from the 1999 aerial survey photogrammetry were used to model the roadway and the receptors. Each receptor was modeled at about 3 m. (9.8 ft.) from the building, between the building and the proposed roadway. A receptor height of 1.5 m. (5 ft.) above ground elevation was used. This provides a more accurate representation of the noise path between the roadway and the receptor. When the receptor was located below the level of the roadway, a height of zero meters was incorporated in the model to represent the edge of the roadway embankment.

Table 5-19 summarizes the results for all modeled receptors. Noise levels at six receptors required consideration of noise mitigation measures in accordance with FHWA NAC and ConnDOT policy. Four of these receptors (14, 15, 18 and 22) were within the clustered group (14-27) located along I-95. Receptors in this group benefit from the relocation of I-95 to the north, which would increase the distance between the noise source and the receptor. Predicted 2020 noise levels would be less than existing levels at these receptor locations; nevertheless, mitigation was considered because levels still approached NAC dBA limits. Similarly, at receptor 13, a minimal change was noted, however, NAC limits would be exceeded. An increase of 15 dBA was noted at receptor 1.

Based on these data, the effectiveness of noise barriers to mitigate noise impacts was considered at three locations. Noise barriers were modeled for receptor 1, receptor 13, and, collectively, for receptors 14 through 27.

Receptor 34 was not considered for mitigation, as there was no projected increase in noise associated with the preferred alternative. Further, this receptor is a commercial property situated on a hill above I-95 that depends on line-of-sight visibility with I-95 and would not benefit economically or physically from a noise barrier. Finalization of mitigation for this location will be determined during roadway design.

TABLE 5-19
NOISE MODELING RESULTS – PREFERRED ALTERNATIVE
AND POTENTIAL CANDIDATES FOR NOISE MITIGATION

| RECEPTOR | EXISTING CONDITIONS LEQ(H) | 2020 NO BUILD LEQ(H) | 2020 BUILD LEQ(H) | CHANGE (2020 NO BUILD TO 2020 BUILD) | CONSIDERATION OF NOISE MITIGATION REQUIRED |
|---|---|---|---|---|---|
| **1** | **43 (1)** | **46 (1)** | **61** | **15** | **YES (3)** |
| 2 | 46 (1) | 51 (1) | 63 (1) | 12 | NO |
| 5 | 41 (1) | 49 (1) | 55 (1) | 6 | NO |
| 7 | 42 | 43 | 50 | 7 | NO |
| 10 (2) | 45 | 45 | 52 | 7 | NO |
| 11 | 61 (1) | 64 | 64 | 0 | NO |
| 12 | 61 (1) | 65 | 64 | -1 | NO |
| **13** | **72** | **74** | **73** | **-1** | **YES (4)** |
| **14** | **71** | **73** | **66** | **-7** | **YES (4)** |
| **15** | **73** | **75** | **68** | **-7** | **YES (4)** |
| 16 | 67 | 69 | 65 | -4 | NO |
| 17 | 68 | 70 | 65 | -5 | NO |
| **18** | **72** | **74** | **67** | **-7** | **YES (4)** |
| 19 | 68 | 69 | 65 | -4 | NO |
| 20 | 68 | 69 | 64 | -5 | NO |
| 21 | 68 | 70 | 64 | -6 | NO |
| **22** | **81** | **83** | **67** | **-16** | **YES (4)** |
| 23 | 69 | 70 | 64 | -6 | NO |
| 24 | 69 | 71 | 64 | -7 | NO |
| 25 | 80 | 82 | 65 | -17 | NO |
| 26 | 70 | 72 | 63 | -9 | NO |
| 27 | 73 | 75 | 59 | -16 | NO |
| 34 | 76 | 77 | 77 | 0 | NO |

Receptors shown in **bold** indicate those considered for noise mitigation

Receptors 31-33 were not analyzed because mitigation would not be practicable on U.S. Route 1.

(1) Data were taken from Tables 4-27 and 5-17

(2) Assumed values for both existing and 2020 no build conditions – access not granted on site

(3) Project increases noise > 15 dBA

(4) Predicted noise levels would approach NAC of Leq(h) 67 dBA

### 5.2.4 MITIGATION MEASURES

Until preliminary design plans are developed, a precise mitigation program cannot be specified. However, measures that would likely be used to reduce the noise impacts associated with construction of a new roadway might include the following: construction of noise walls, earthen berms, possible changes to the roadway design, and/or condemnation and purchase of private property.

The more detailed assessment of specific mitigation strategies would be based on roadway cross sections, profile grades, cut slopes, typical sections, detailed topographic data, and other pertinent information. Abatement, if warranted, will be assessed and provided in accordance with the *Connecticut Department of Transportation Highway Traffic Noise Impact Analysis and Abatement Policies and Procedures* (July 1997).

*Noise Barrier Evaluation – Preferred Alternative*

The effectiveness of noise barriers in mitigating noise impacts was evaluated for the six receptors using the FHWA OPTIMA model. OPTIMA calculates noise barrier effectiveness and cost based on the acoustic output from STAMINA.

Noise mitigation was evaluated for the receptor locations where predicted noise exceeded FHWA NAC. Title 23 of the Code of Federal Regulations Part 772 (*Procedures for Abatement of Highway Traffic Noise and Construction Noise*) requires a highway traffic noise study for the potential impacts of projects that are proposed in areas with noise-sensitive land. FHWA NAC require evaluation of mitigation wherever a project results in an average equalized peak hour noise level (Leq(h)) approaching 67 dBA (within 1 dBA) or results in an increase of 15 dBA or more. The difference between the predicted noise levels under 2020 build and 2020 no build conditions was used to assess the need for mitigation (Table 5-19).

A barrier was considered effective if it would reduce sound levels by a minimum of 7 dBA for receptors in the first row (closest) and at the center of a proposed noise barrier system and at least 3 dBA for receptors that are within the affected area and the 91.5 m. (300 ft.) limit. Barrier sections were limited to a maximum height of 6.7 m. (22 ft.) because barriers in excess of that height are subject to wind forces, which make their construction and long-term stability problematical. Barriers that would meet the abatement criteria specified above were considered cost effective if they met the cost/benefit ratio index as outlined in ConnDOT noise policy (1997). The cost of a barrier was estimated using an updated average per sq. ft. cost of $19.

The noise abatement criteria and the cost/benefit ratio index are used as a guideline for determining where noise barriers would be effective and should be specified in design. However, ConnDOT may waive the cost benefit requirement, as deemed appropriate.

### *Noise Modeling Results*

Mitigation modeling results for each receptor location are shown in Table 5-20.

TABLE 5-20
NOISE MITIGATION MODELING RESULTS – PREFERRED ALTERNATIVE

| | 2020 NO BUILD (LEQ(H)) | 2020 BUILD (LEQ(H)) | 2020 BUILD W/ NOISE BARRIER (LEQ(H)) | BARRIER INSERTION LOSS [1] (LEQ(H)) |
|---|---|---|---|---|
| RECEPTOR 1 | 46 | 61 | 59 | -2 |
| RECEPTOR 13 | 74 | 73 | 65 | -8 |
| RECEPTORS 14 - 27 | | | | |
| 14 | 73 | 66 | 58 | -8 |
| 15 | 75 | 68 | 58 | -10 |
| 16 | 69 | 65 | 58 | -7 |
| 17 | 70 | 65 | 59 | -6 |
| 18 | 74 | 67 | 59 | -8 |
| 19 | 69 | 65 | 59 | -6 |
| 20 | 69 | 64 | 58 | -6 |
| 21 | 70 | 64 | 59 | -5 |
| 22 | 83 | 67 | 59 | -8 |
| 23 | 70 | 64 | 59 | -5 |
| 24 | 71 | 64 | 59 | -5 |
| 25 | 82 | 65 | 60 | -5 |
| 26 | 72 | 63 | 60 | -3 |
| 27 | 75 | 59 | 57 | -2 |

[1] the reduction in dBA that would be perceived at the receptor after construction of a noise barrier

*Receptor 1*: Predicted traffic noise levels would increase from 46 to 61 dBA Leq(h) at receptor 1. The elevation of this receptor is 10 m. (33 ft.) above the proposed roadway. Because of this difference in elevation, barrier design may not be feasible for this receptor. The traffic noise barrier analysis indicates that a noise barrier would not provide the minimum reduction in noise levels at this receptor. Construction of a 6 m. (20 ft.) noise barrier would provide minimal mitigation, as it would result in a reduction of only 2 dBA at the receptor. Construction of a noise barrier with an estimated length of 272 m. (892 ft.), and total area of 1,632 sq. m. (17,840 sq. ft.) at $19 per sq. ft. would cost approximately $338,960. Based on the estimated cost, noise abatement is not feasible at this location. The predicted noise level at this receptor is 61 Leq(h) without mitigation, which is considerably lower than the NAC (67 Leq(h)).

*Receptors 14 – 27*: Traffic noise levels for receptors 14 through 27 would vary under 2020 build conditions between 59 and 69 dBA Leq(h). Under existing conditions, all receptors in this group exceed the NAC. Predicted noise levels under 2020 build conditions continue to exceed NAC at several of these receptors. No location would experience traffic noise levels in excess of 15 dBA over the existing noise climate.

A traffic noise barrier for these receptors would be approximately 580 m. (1,900 ft.) in length and have an average height of 6 m. (20 ft.). The barrier would provide reductions in the range of 2 to 3 dBA for receptors 26 and 27. Receptors 16, 17, 19, 20, 21, 23, 24, and 25 would achieve reductions of 5 to 7 dBA. Receptors 14, 15, 18, and 22 would achieve reductions of 8 to 10 dBA with construction of a noise barrier. The noise barrier would cost approximately $722,000, which would be just over $50,000 per receptor. Traffic noise abatement is therefore reasonable and feasible at this location.

*Receptor 13*: A third noise barrier was modeled for receptor 13, located adjacent to I-95, west of receptors 14–27, modeled above. Predicted noise levels at the structure on this property would exceed 67 dBA under both the build and no build conditions.

Similar to receptors 14–27, the proposed new interchange would not increase noise levels at this receptor. However, since predicted noise levels would continue to exceed NAC under the build condition, noise mitigation measures were evaluated. Results of the modeling indicate that a barrier can be used to effectively reduce noise levels for this structure. A barrier established at a height of 3 m. (10 ft.) was incorporated into the model, resulting in a noise level below 66 dBA. This modeled barrier would be 3,600 sq. ft. in area, which, at an average cost of $19 per sq. ft. would cost $68,000. Although the estimated cost for construction of a barrier slightly exceeds the established cost effectiveness criteria for noise mitigation, extenuating circumstances would be considered during project design. The modeling results are approximate and the exact dimensions of a barrier for this area would be determined during the roadway design process.

In summary, noise barriers were determined to be practicable at receptors 13, and 14 – 27. Specific conditions, such as new residences constructed along the roadway alignment, will be reassessed during the roadway design process. It is possible that any changes in the location or elevation of the roadway may affect the mitigation modeling results and thus the location where barriers would be effective. The noise analysis will be updated at that time using FHWA TNM Version 2.5 (or the latest version).

# 5.3 AIR QUALITY

## 5.3.1 MESOSCALE ANALYSIS

The mesoscale analysis was used to calculate the change in daily VOC, $NO_x$ and CO emissions within the study corridor that would be associated with the various expressway alternatives. The mesoscale analysis for the DEIS alternatives compares the pollutant burden associated with the no build alternative to those of the build alternatives for the year 2020, the design year for the project. An updated mesoscale analysis for the preferred alternative is provided in Section 5.3.1.3. The study area for the mesoscale analysis includes 25 municipalities that could be affected by implementation of the alternatives (i.e., only the area where the emissions are subject to change as a result of the project are included in the analysis). The extension of Route 11 is identified in SCCOG's Long Range Transportation Plan, which identifies transportation improvements needed over a 20-year period. The project has not yet been included in the Transportation Improvement Plan (TIP), a five-year implementation plan, because of the unpredictability of the NEPA environmental review schedule.

The mesoscale analysis takes into account the length of the roadway and average daily traffic volumes for the $O_3$ season (summer) and travel speeds. Travel speeds used for the expressway alternatives were held constant from the no build alternative, although it is assumed that the overall study area travel speeds will increase (thereby increasing $NO_x$) due to reduction in levels of congestion resulting from the proposed alignment alternatives. Maintaining constant speeds simulates a "worst-case" condition with no credit taken for any improvements in travel speed or reductions in delay.

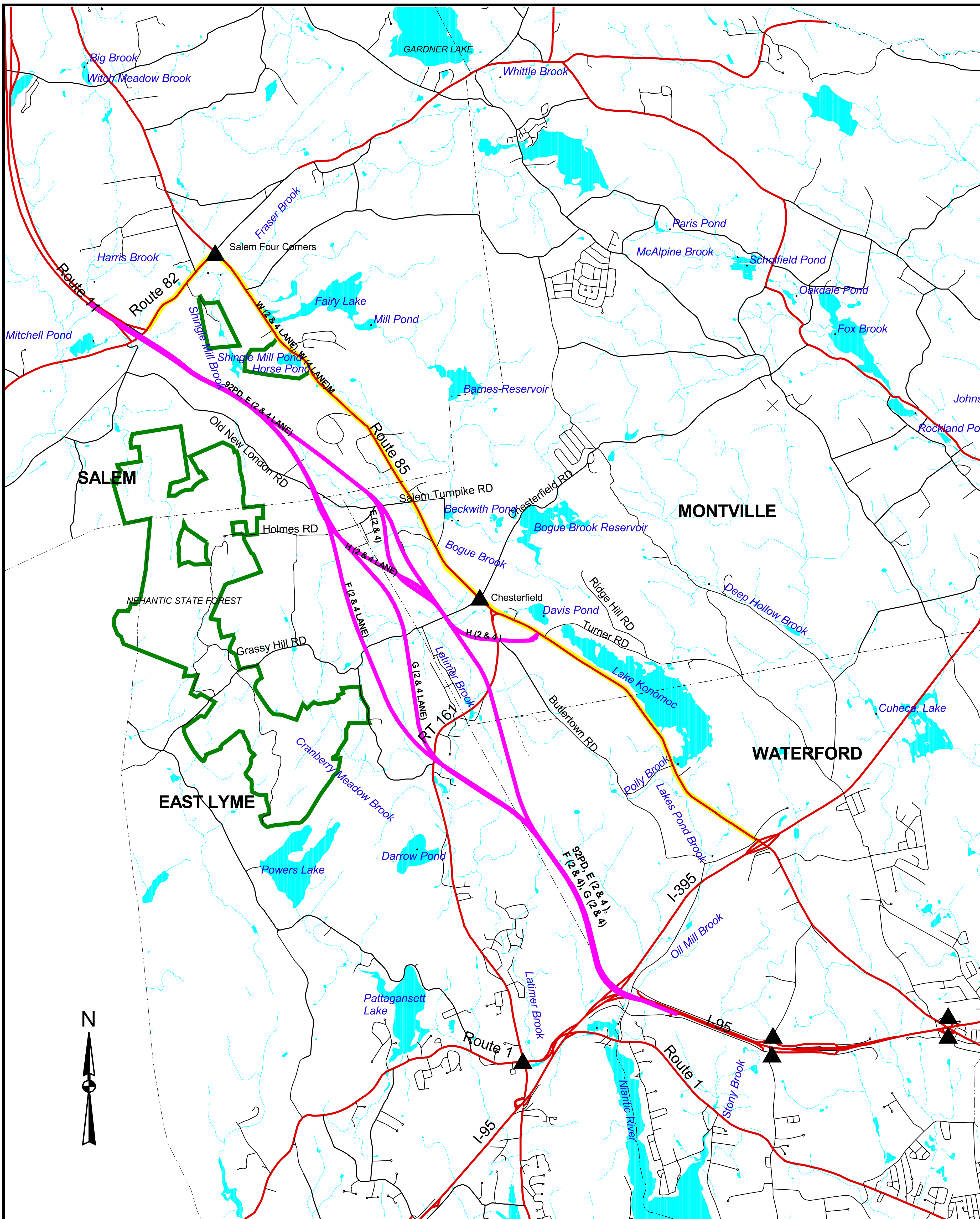
5.3.1.1 *Model Inputs and Calculations*: The mesoscale study was prepared using VMT loads, vehicle mixes, and thermal state assumptions developed by ConnDOT. Emission factors for VOCs, $NO_x$ and CO were estimated for the DEIS Alternatives in 1998 using the EPA MOBILE5b model, the most current model available at the time of the analysis. An updated analysis was performed for the preferred alternative in 2006 using EPA's latest model, MOBILE6.2 (see Section 5.3.1.3). $NO_x$ and VOCs are most problematic when they lead to ozone formation, which is favored by direct sunlight, hence these pollutants are typically most problematic in the summer. CO emissions, however, are more problematic in the winter.

5.3.1.2 *Comparison of Impacts*: Emissions burdens were calculated for the three studied pollutants for the DEIS Alternatives in the year 2020, and then compared to the future year no build alternative. Table 5-21 demonstrates that

TABLE 5-21
2020 FUTURE MESOSCALE POLLUTANT EMISSIONS

| ALTERNATIVE | VOCs (tons/day) | VOCs (kg/day) | VOCs difference from no build (%) | $NO_x$ (tons/day) | $NO_x$ (kg/day) | $NO_x$ difference from no build (%) | CO (tons/day) | CO (kg/day) | CO difference from no build (%) |
|---|---|---|---|---|---|---|---|---|---|
| DEIS Alternatives[1] | | | | | | | | | |
| No Build | 2.92 | 2,651 | -- | 8.46 | 7,670 | -- | 16.6 | 15,057 | -- |
| $W_{(4)}$, $W_{(4)}$m | 2.91 | 2,642 | -0.33 | 8.45 | 7,662 | -0.10 | 16.6 | 15,037 | -0.13 |
| $W_{(2)}$,TSM, TDM/Transit | 2.92 | 2,651 | 0 | 8.46 | 7,670 | 0 | 16.6 | 15,057 | 0 |
| 92PD, $E_{(4)}$, $E_{(2)}$,$F_{(4)}$, $F_{(2)}$, $G_{(4)}$, $G_{(2)}$, | 2.91 | 2,641 | -0.34 | 8.50 | 7,711 | 0.53 | 16.5 | 14,972 | -0.56 |
| $H_{(4)}$, $H_{(2)}$ | 2.91 | 2,639 | -0.45 | 8.48 | 7,689 | 0.25 | 16.5 | 14,980 | -0.51 |
| Preferred Alternative[2] | | | | | | | | | |
| No Build | 3.62 | 3,282 | -- | 4.65 | 4,210 | -- | n/a | n/a | n/a |
| $E_{(4)}$m-V3 | 3.61 | 3,271 | -0.31 | 4.66 | 4,219 | 0.22 | n/a | n/a | n/a |

(1) Analysis for DEIS alternatives based on MOBILE5b emissions factors.
(2) Analysis for preferred alternative based on MOBILE6.2 emissions factors.
n/a Not analyzed for mesoscale with MOBILE6.2, see microscale analysis.




LEGEND

- Air Quality Analysis Intersections
- Waterbodies and Streams
- Widening/Upgrade RT 82/85 Alternatives
- Expressway Alternatives
- State Forest

State of Connecticut Department of Transportation
Federal Highway Administration

ROUTE 82/85/11
ENVIRONMENTAL IMPACT STATEMENT (EIS)

IN THE TOWNS OF
EAST LYME, MONTVILLE, SALEM AND WATERFORD

STATE PROJECT #120-81

**AIR QUALITY MICROSCALE ANALYSIS INTERSECTIONS**

Notes:

Sources:
Air Quality: Maguire Group
Hydrology: CTDEP Natural Resources
Center GIS Database 1994

2500 0 2500 5000 Feet
500 0 500 1000 1500 Meters
1:60000 Scale: 1" = 5000'

July 1998

**Figure 5-13**

there is very little difference in emissions between the build and no build alternatives. All of the new location and widening alternatives would result in less emissions for VOCs than the no build alternative with Alternative H having the least VOCs emissions. All of the build alternatives on a new location would result in slightly higher $NO_x$ emissions, as compared with the no build alternative. The widening, TSM and TDM/Transit alternatives would result in the same or slightly lower $NO_x$ emissions as compared with the no build.

As with the ozone precursors, differences in CO emissions between the improvement alternatives and the no build scenario are negligible. All of the new location alternatives and the $W_{(4)}$ alternative would result in slightly lower CO emissions. The relatively small difference in pollutant emissions can be attributed to the following: 1) the study area is large, containing 25 towns, many of which are only minimally affected by Route 82/85/11 travel patterns; and, 2) the VMT difference between each alternative is very small.

5.3.1.3 *Preferred Alternative*: The mesoscale analysis was updated for preferred alternative $E_{(4)}$m-V3 using emissions factors based on EPA's latest model, MOBILE6.2. The analysis compares VOC and NOx emissions for the no build and preferred alternatives in 2020. CO emissions were updated in the microscale analysis. All others methods were the same as those described above for the DEIS alternatives. The results for the preferred alternative, as shown in Table 5-21, are consistent with those of the DEIS alternative. The build alternative will have slightly lower VOC emissions while NOx emissions will be slightly higher; both differences are negligible.

The project has been assessed as part of the regional and statewide air quality conformity review. A DEP indirect source air quality permit will be prepared during the design phase of project development.

### 5.3.2 MICROSCALE ANALYSIS - PARAMETERS AND METHODOLOGY

A microscale analysis of the worst case CO from motor vehicles concentrations has been conducted for both years 1998 and 2020 at 28 receptor sites at seven intersections within the study corridor (Figure 5-13). The air quality analysis was conducted in accordance with accepted practice for microscale analyses and focused on specific locations within the study area immediately adjacent to the proposed alignment alternatives to be investigated, specifically, those intersections that were currently functioning or are projected to function at a LOS E or F denoting diminished capacity and corresponding diminished air quality. The intersections that met these criteria were:

- Route 85 with Grassy Hill Road/Chesterfield Road
- Route 85 with I-95 northbound ramps
- Route 85 with I-95 southbound ramps

- Route 85 with Route 82
- Parkway North with Cross Road Extension
- Parkway South with Cross Road
- Route 161 with U.S. Route 1

The microscale analysis compared the 1998 existing pollutant concentrations at potentially sensitive locations located adjacent to the study intersections with the 2020 no build and build alternatives and the NAAQS. CO is the principal pollutant of concern for transportation projects because tailpipe emissions can cause localized, elevated CO conditions. A worst-case approach was taken with respect to meteorological conditions. Factors considered include wind speed, atmospheric stability, receptor height, surface roughness, mixing height and ambient air temperature. The analysis was conducted for the following scenarios: 1998 existing conditions; 2020 no build; 2020 four-lane widening alternative; 2020 full build; 2020 partial build; and 2020 preferred alternative.

5.3.2.1 *Air Quality Receptor Site Selection:* Air receptor sites along the area roadways were chosen at locations where existing and projected levels of service were the worst. The methodologies outlined in the EPA's *Guidelines for Modeling Carbon Monoxide From Roadway Intersections* were followed to determine the location of the air quality receptor sites locations. Receptor sites were chosen at a point 3 m. (10 ft.) from the nearest travel lane since this location would be representative of the worst pollutant concentrations that would be emitted from queued vehicles approaching signalized intersections.

5.3.2.2 *Methodology:* Motor vehicle emission rates were calculated for the DEIS alternatives in 1998 using the EPA's MOBILE5b emissions model, the most current model available at the time of the analysis. MOBILE5b input parameters were provided by DEP for the 1998 base year and the projected 2020 build year. Output CO values for free-flow and idle emission values from the MOBILE5b were used as input values for the CAL3QHC Version 2.0 model, which was used to determine the localized CO concentrations at the seven signalized intersections. Vehicle emission rates were updated in 2006 for the preferred alternative using EPA's latest model, MOBILE6.2 (see Section 5.3.3.7).

A worst-case approach was taken for most meteorological conditions. Three-hundred and sixty degree wind directions were analyzed at one degree intervals to determine the direction of the highest CO concentrations. Other factors included a wind speed of one (1) meter per second; an atmospheric stability class of D; a receptor height of 1.8 m. (5.9 ft.); a surface roughness of 108 cm. (suburban value); a mixing height of 1,000 m. (3,280 ft.) and an ambient air temperature ranging from 18$^{o}$F (minimum) to 44$^{o}$F (maximum) based on the default parameters provided by DEP.

Traffic data used as input for the CAL3QHC model was obtained from the traffic analysis (HCS LOS analysis) conducted as part of this study. ConnDOT traffic volume projections developed utilizing the TRANPLAN regional traffic model was supplemented by traffic field data and manual/ATR counts conducted to determine 1998 existing AM/PM peak volumes and LOS.

Intersection geometry was obtained from USGS base mapping as well as measurements obtained in the field denoting lane arrangements, widths and arrival/departure/queue volumes, lane widths and delay values were obtained from the HCS analysis runs as well.

Modeling was done for the one-hour condition for intersections and free-flow sites. Conservative background concentrations of 3.0 ppm and 5.0 ppm (for 8-hr and 1-hr) were assumed, since there are no CO receptors in the area. These values, which accounted for CO sources outside the study area, were used in the absence of site specific monitored data for eight-hour predictions. Also, a persistence factor of 0.7 was used to convert peak one-hour modeled values to peak eight-hour modeled CO values. Note that the conversion was done before background values for each averaging period were added. Upon determining the one-hour and eight-hour period concentrations, the background CO levels are added to the output to reflect the actual conditions.

The microscale analysis compares the impacts associated with the no build alternative to the anticipated air quality impacts at sensitive air receptor sites adjacent to intersections for each of the individual build alternatives. Impacts are estimated for the various alternatives based on the traffic projections. The results represent the 2020 projected CO levels at the three receptors with the highest modeled concentrations for the alternative expressway alignments.

### 5.3.3 MICROSCALE ANALYSIS - COMPARISON OF IMPACTS

The results of the microscale analysis indicate that there will be no exceedances for the one-hour and the eight-hour NAAQS for each of the scenarios investigated, including the preferred alternative (Tables 5-22 and 5-23). In general, CO levels will continue to decline as newer vehicles replace older vehicles and stricter emission standards are instituted along with more stringent emission controls being installed on newer vehicles. This effect is evident in decreasing CO levels projected for the one- and eight-hour modeled values. Concentrations do not vary much between scenarios except between the full/partial build as compared with the four-lane widening alternative, which exhibits slightly higher CO levels. This is due to higher travel speeds which can be expected under the full build scenarios resulting in less idle emissions. Idle emissions are generally greater under the four-lane widening alternative, since delay at existing intersections will decrease compared with the 1998 existing/2020 no build scenarios due to increased capacity and improved LOS/decreased delay.

TABLE 5-22

MICROSCALE ANALYSIS SUMMARY[1] - WORST CASE ONE- AND EIGHT-HOUR CO CONCENTRATIONS IN PPM

| CONDITION | INTERSECTION | 1998 EXISTING AM | 1998 EXISTING PM | 2020 NO BUILD AM | 2020 NO BUILD PM | 2020 PARTIAL BUILD AM | 2020 PARTIAL BUILD PM | 2020 FULL BUILD AM | 2020 FULL BUILD PM | 2020 4-LANE WIDENING AM | 2020 4-LANE WIDENING PM |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1Hour CO Levels | Route 82 with Route 85 | 5.2 | 5.2 | 5.1 | 5.1 | 5.0 | 5.0 | 5.0 | 5.0 | 5.1 | 5.2 |
| 8 Hour CO Levels | Route 82 with Route 85 | 3.6 | 3.6 | 3.6 | 3.6 | 3.5 | 3.5 | 3.5 | 3.5 | 3.6 | 3.6 |
| 1Hour CO Levels | Route 161 with U.S. Route 1 | 5.1 | 5.3 | 5.0 | 5.0 | 5.1 | 5.1 | 5.1 | 5.1 | 5.0 | 5.0 |
| 8 Hour CO Levels | Route 161 with Route | 3.6 | 3.7 | 3.5 | 3.5 | 3.6 | 3.6 | 3.6 | 3.6 | 3.5 | 3.5 |
| 1Hour CO Levels | Rt. 85 with Chesterfield/Grassy Hill Rd. | 5.3 | 5.4 | 5.1 | 5.2 | 5.0 | 5.0 | 5.0 | 5.0 | 5.1 | 5.2 |
| 8 Hour CO Levels | Rt. 85 with Chesterfield/Grassy Hill Rd | 3.7 | 3.8 | 3.6 | 3.6 | 3.5 | 3.5 | 3.5 | 3.5 | 3.6 | 3.6 |
| 1Hour CO Levels | Route 85 with I-95 southbound ramps | 5.2 | 5.5 | 5.1 | 5.2 | 5.2 | 5.3 | 5.1 | 5.2 | 5.1 | 5.2 |
| 8 Hour CO Levels | Route 85 with I-95 southbound ramps | 3.6 | 3.9 | 3.6 | 3.6 | 3.6 | 3.7 | 3.6 | 3.6 | 3.6 | 3.6 |
| 1Hour CO Levels | Route 85 with I-95 northbound ramps | 5.3 | 5.6 | 5.1 | 5.2 | 5.1 | 5.2 | 5.1 | 5.2 | 5.1 | 5.2 |
| 8 Hour CO Levels | Route 85 with I-95 northbound ramps | 3.7 | 3.9 | 3.6 | 3.6 | 3.6 | 3.6 | 3.6 | 3.6 | 3.6 | 3.6 |
| 1Hour CO Levels | Cross Rd. Ext. with Parkway South | 5.3 | 5.3 | 5.1 | 5.2 | 5.1 | 5.1 | 5.1 | 5.2 | 5.1 | 5.2 |
| 8 Hour CO Levels | Cross Rd. Ext. with Parkway South | 3.7 | 3.7 | 3.6 | 3.6 | 3.6 | 3.6 | 3.6 | 3.6 | 3.6 | 3.6 |
| 1Hour CO Levels | Cross Rd. Ext. with Parkway North | 5.0 | 5.1 | 5.0 | 5.0 | 5.4 | 5.4 | 5.0 | 5.0 | 5.0 | 5.0 |
| 8 Hour CO Levels | Cross Rd. Ext. with Parkway North | 3.5 | 3.6 | 3.5 | 3.5 | 3.8 | 3.8 | 3.5 | 3.5 | 3.5 | 3.5 |

[1] Analysis based on EPA's MOBILE5b emissions factors

NAAQS Standards: 1-Hour - 35 ppm
8-Hour - 9 ppm

**TABLE 5-23**
**MICROSCALE ANALYSIS SUMMARY – PREFERRED ALTERNATIVE [1]**
**WORST CASE ONE-HOUR & EIGHT-HOUR CO LEVELS IN PPM**

| | | 2020 NO BUILD | | 2020 BUILD | |
|---|---|---|---|---|---|
| CONDITION | INTERSECTION | AM | PM | AM | PM |
| 1Hour CO Levels | Route 82 at Route 85 | 6.0 | 6.2 | 5.5 | 5.6 |
| 8 Hour CO Levels | Route 82 at Route 85 | 3.7 | 3.8 | 3.4 | 3.4 |
| 1Hour CO Levels | Route 161 at U.S. Route 1 | 5.7 | 5.9 | 5.8 | 6.1 |
| 8 Hour CO Levels | Route 161 at U.S. Route 1 | 3.5 | 3.6 | 3.6 | 3.8 |
| 1Hour CO Levels | Route 85 at Chesterfield/Grassy Hill | 5.8 | 5.8 | 5.4 | 5.5 |
| 8 Hour CO Levels | Route 85 at Chesterfield/Grassy Hill | 3.6 | 3.6 | 3.3 | 3.4 |
| 1Hour CO Levels | Route 85 at I-95 southbound ramps | 5.8 | 6.4 | 6.0 | 6.4 |
| 8 Hour CO Levels | Route 85 at I-95 southbound ramps | 3.6 | 4.0 | 3.7 | 4.0 |
| 1Hour CO Levels | Route 85 at I-95 northbound ramps | 5.8 | 6.2 | 5.9 | 6.0 |
| 8 Hour CO Levels | Route 85 at I-95 northbound ramps | 3.6 | 3.8 | 3.6 | 3.7 |
| 1Hour CO Levels | Cross Rd. at Parkway South | 5.7 | 6.1 | 5.8 | 6.3 |
| 8 Hour CO Levels | Cross Rd. at Parkway South | 3.5 | 3.8 | 3.6 | 3.9 |
| 1Hour CO Levels | Cross Rd. ext. at Parkway North | 5.5 | 5.6 | 5.6 | 5.6 |
| 8 Hour CO Levels | Cross Rd. ext. at Parkway North | 3.4 | 3.4 | 3.4 | 3.4 |
| 1Hour CO Levels | U.S. Route 1 at I-95/I-395 southbound ramps | n/a | n/a | 6.5 | 6.5 |
| 8 Hour CO Levels | U.S. Route 1 at I-95/I-395 southbound ramps | n/a | n/a | 4.1 | 4.1 |

(1) Analysis based on EPA's MOBILE6.2 emissions factors
n/a – not applicable

NAAQS Standards: 1-Hour – 35 ppm
8-Hour – 9 ppm

5.3.3.1 *No Build Alternative*: Although the no build alternative would not involve any roadway improvements, CO levels would still decrease. CO levels would decline as newer vehicles replaced older vehicles and stricter emission standards are instituted. In each of the seven intersections modeled for the no build 2020 year, the one-hour and eight-hour AM/PM peak CO levels would decrease or remain the same as compared to existing conditions.

5.3.3.2 *Routes 82 and 85 Widening Alternatives*: The results of the microscale analysis indicate that there would be no exceedances of the one-hour and eight-hour NAAQS for the widening alternatives. In each of the seven intersections modeled, the one-hour and eight-hour AM/PM peak CO levels would decrease or remain the same as compared to existing conditions. This would be due to intersection improvements and the presence of newer vehicles replacing older vehicles and the institution of stricter emission standards. The widening alternative would generally exhibit slightly higher or equal levels of CO compared to the full and partial build alternatives, with the exception of the Route 161/U.S. Route 1 area, which would be lower than those alternatives.

5.3.3.3 *TSM Alternative*: This alternative would be expected to display similar results as the no build and widening alternatives since it would leave much of Routes 82 and 85 with no improvements, with the exception of modifications to four intersections along these roadways. One-hour and eight-hour AM/PM peak CO levels would likely decrease as a result of the intersection improvements.

5.3.3.4 *TDM/Transit Alternative*: Because this alternative does not include any type of roadway or intersection improvements, it would be expected to exhibit similar CO levels as the no build alternative. One-hour and eight-hour AM/PM peak CO levels would likely decrease as a result of the intersection improvements. Newer vehicles replacing older vehicles and the institution of stricter emission standards would also contribute to lower CO levels.

5.3.3.5 *New Location - Full Build Alternatives*: The results of the microscale analysis indicate that there would be no exceedances of the one-hour and eight-hour NAAQS for the new location full build alternatives. In each of the seven intersections modeled, the one-hour and eight-hour AM/PM peak CO levels would decrease or remain the same as compared to existing conditions. This would be due to the limited access nature of the highway, which would have higher running speeds and little or no idle time, and from newer vehicles replacing older vehicles. In general, the new location full build alternative would have the lowest future levels of CO for the one- and eight-hour peaks.

5.3.3.6 *New Location - Partial Build Alternatives*: The results of the microscale analysis indicate that there would be no exceedances of the one hour and the eight hour NAAQS for the new location partial build alternatives. At six of the seven intersections modeled, the one-hour and eight-hour AM/PM peak CO levels would decrease or remain the same as compared to existing conditions. Only one intersection would have higher CO levels than existing conditions, Cross Road Extension at Parkway North, however, the increase is negligible at this location and well below the NAAQS.

5.3.3.7 *Preferred Alternative:* The microscale analysis was updated for preferred alternative $E_{(4)}$m-V3 based on emissions factors using EPA's MOBILE6.2 model. The updated analysis compared the no build and preferred alternatives in 2020. Other than updating the emission factors, the methodology as detailed in Section 5.3.2.2 remains the same.

Also, as a result of changes in the configuration of the proposed Route 11/I-95/I-395 interchange, intersections not previously included in the DEIS microscale analysis, and projected to have a LOS of D or worse in 2020, had to be evaluated. LOS D or worse was projected at the proposed reconfigured and newly signalized intersection of the I-95/I-395 southbound ramp and U.S. Route 1 (Interchange 75) under the 2020 PM build condition. Since this intersection would be affected by the proposed changes to this interchange, this site was included in the re-analysis. Predicted one-hour and eight-hour CO levels are presented in Table 5-23.

The updated microscale analysis indicates that there would be no violations of the one-hour or eight-hour NAAQS for the preferred alternative. Note that values for the 2020 build AM condition for U.S. Route 1 at I-95/I-395 southbound ramps are reported using PM results as worst case, as AM LOS is C or better. The results for the preferred alternative based on MOBILE6.2 are consistent with those of the DEIS full build alternatives using MOBILE5b and typically vary less than 1 ppm.

### 5.3.4 MOBILE SOURCE AIR TOXICS

This FEIS includes a basic analysis of the likely MSAT emission impacts of this project. However, available technical tools do not enable us to predict the project-specific health impacts of the emission changes associated with the alternatives in this FEIS. Due to these limitations, the following discussion is included in accordance with CEQ regulations (40 CFR 1502.22(b)) regarding incomplete or unavailable information:

**Information that is Unavailable or Incomplete.** Evaluating the environmental and health impacts from MSATs on a proposed highway project would involve several key elements, including emissions modeling, dispersion modeling in order to estimate ambient concentrations resulting from the estimated emissions, exposure modeling in order to estimate human exposure to the estimated concentrations, and then final determination of health impacts based on the estimated exposure. Each of these steps is encumbered by technical shortcomings or uncertain science that prevents a more complete determination of the MSAT health impacts of this project.

- **Emissions:** The EPA tools to estimate MSAT emissions from motor vehicles are not sensitive to key variables determining emissions of MSATs in the context of highway projects. While MOBILE 6.2 is used to predict emissions at a regional level, it has limited applicability at the project level. MOBILE 6.2 is a trip-based model--emission factors are projected based on a typical trip of 7.5 miles, and on average speeds for this typical trip. This means that MOBILE 6.2 does not have the ability to predict emission factors for a specific vehicle operating condition at a specific location at a specific time. Because of this limitation, MOBILE 6.2 can only approximate the operating speeds and levels of congestion likely to be present on the largest-scale projects, and cannot adequately capture emissions effects of smaller projects. For particulate matter, the model results are not sensitive to average trip speed, although the other MSAT emission rates do change with changes in trip speed. Also, the emissions rates used in MOBILE 6.2 for both particulate matter and MSATs are based on a limited number of tests of mostly older-technology vehicles. Lastly, in its discussions of PM under the conformity rule, EPA has identified problems with MOBILE6.2 as an obstacle to quantitative analysis.

  These deficiencies compromise the capability of MOBILE 6.2 to estimate MSAT emissions. MOBILE6.2 is an adequate tool for projecting emissions trends, and performing relative analyses between alternatives for very large projects, but it is not sensitive enough to capture the effects of travel changes tied to smaller projects or to predict emissions near specific roadside locations.

- **Dispersion.** The tools to predict how MSATs disperse are also limited. The EPA's current regulatory models, CALINE3 and CAL3QHC, were developed and validated more than a decade ago for the purpose of predicting episodic concentrations of carbon monoxide to determine compliance with the NAAQS. The performance of dispersion models is more accurate for predicting maximum concentrations that can occur at some time at some location within a geographic area. This limitation makes it difficult to predict accurate exposure patterns at specific times at specific highway project locations across an urban area to assess potential health risk. The NCHRP is conducting research on best practices in applying models and other technical methods in the analysis of MSATs. This work also will focus on identifying appropriate methods of documenting and communicating MSAT impacts in the NEPA process and to the general public. Along with these general limitations of dispersion models, FHWA is also faced with a lack of monitoring data in most areas for use in establishing project-specific MSAT background concentrations.

- **Exposure Levels and Health Effects.** Finally, even if emission levels and concentrations of MSATs could be accurately predicted, shortcomings in current techniques for exposure assessment and risk analysis preclude us from reaching meaningful conclusions about project-specific health impacts. Exposure assessments are difficult because it is difficult to accurately calculate annual concentrations of MSATs near roadways, and to determine the portion of a year that people are actually exposed to those concentrations at a specific location. These difficulties are magnified for 70-year cancer assessments, particularly because unsupportable assumptions would have to be made regarding changes in travel patterns and vehicle technology (which affects emissions rates) over a 70-year period. There are also considerable uncertainties associated with the existing estimates of toxicity of the various MSATs, because of factors such as low-dose extrapolation and translation of occupational exposure data to the general population. Because of these shortcomings, any calculated difference in health impacts between alternatives is likely to be much smaller than the uncertainties associated with calculating the impacts. Consequently, the results of such assessments would not be useful to decision makers, who would need to weigh this information against other project impacts that are better suited for quantitative analysis.

***Summary of Existing Credible Scientific Evidence Relevant to Evaluating the Impacts of MSATs.*** Research into the health impacts of MSATs is ongoing. For different emission types, there are a variety of studies that show that some either are statistically associated with adverse health outcomes through epidemiological studies (frequently based on emissions levels found in occupational settings) or that animals demonstrate adverse health outcomes when exposed to large doses.

Exposure to toxics has been a focus of a number of EPA efforts. Most notably, the agency conducted the National Air Toxics Assessment (NATA) in 1996 to evaluate modeled estimates of human exposure applicable to the county level. While not intended for use as a measure of or benchmark for local exposure, the modeled estimates in the NATA database best illustrate the levels of various toxics when aggregated to a national or State level.

The EPA is in the process of assessing the risks of various kinds of exposures to these pollutants. The EPA Integrated Risk Information System (IRIS) is a database of human health effects that may result from exposure to various substances found in the environment. The IRIS database is located at http://www.epa.gov/iris. The following toxicity information for the six prioritized MSATs was taken from the IRIS database *Weight of Evidence Characterization* summaries. This information is taken verbatim from EPA's IRIS database and represents the Agency's most current evaluations of the potential hazards and toxicology of these chemicals or mixtures.

- **Benzene** is characterized as a known human carcinogen.
- The potential carcinogenicity of **acrolein** cannot be determined because the existing data are inadequate for an assessment of human carcinogenic potential for either the oral or inhalation route of exposure.
- **Formaldehyde** is a probable human carcinogen, based on limited evidence in humans, and sufficient evidence in animals.
- **1,3-butadiene** is characterized as carcinogenic to humans by inhalation.

- **Acetaldehyde** is a probable human carcinogen based on increased incidence of nasal tumors in male and female rats and laryngeal tumors in male and female hamsters after inhalation exposure.
- **Diesel exhaust** (DE) is likely to be carcinogenic to humans by inhalation from environmental exposures. Diesel exhaust as reviewed in this document is the combination of diesel particulate matter and diesel exhaust organic gases.
- **Diesel exhaust** also represents chronic respiratory effects, possibly the primary noncancer hazard from MSATs. Prolonged exposures may impair pulmonary function and could produce symptoms, such as cough, phlegm, and chronic bronchitis. Exposure relationships have not been developed from these studies.

There have been other studies that address MSAT health impacts in proximity to roadways. The Health Effects Institute, a non-profit organization funded by EPA, FHWA, and industry, has undertaken a major series of studies to research near-roadway MSAT hot spots, the health implications of the entire mix of mobile source pollutants, and other topics. The final summary of the series is not expected for several years.

Some recent studies have reported that proximity to roadways is related to adverse health outcomes -- particularly respiratory problems[1]. Much of this research is not specific to MSATs, instead surveying the full spectrum of both criteria and other pollutants. The FHWA cannot evaluate the validity of these studies, but more importantly, they do not provide information that would be useful to alleviate the uncertainties listed above and enable us to perform a more comprehensive evaluation of the health impacts specific to this project.

***Relevance of Unavailable or Incomplete Information to Evaluating Reasonably Foreseeable Significant Adverse Impacts on the Environment, and Evaluation of impacts based upon theoretical approaches or research methods generally accepted in the scientific community.*** Because of the uncertainties outlined above, a quantitative assessment of the effects of air toxic emissions impacts on human health cannot be made at the project level. While available tools do allow us to reasonably predict relative emissions changes between alternatives for larger projects, the amount of MSAT emissions from each of the project alternatives and MSAT concentrations or exposures created by each of the project alternatives cannot be predicted with enough accuracy to be useful in estimating health impacts. (As noted above, the current emissions model is not capable of serving as a meaningful emissions analysis tool for smaller projects.) Therefore, the relevance of the unavailable or incomplete information is that it is not possible to make a determination of whether any of the alternatives would have "significant adverse impacts on the human environment."

[1] South Coast Air Quality Management District, Multiple Air Toxic Exposure Study-II (2000); Highway Health Hazards, The Sierra Club (2004) summarizing 24 Studies on the relationship between health and air quality); NEPA's Uncertainty in the Federal Legal Scheme Controlling Air Pollution from Motor Vehicles, Environmental Law Institute, 35 ELR 10273 (2005) with health studies cited therein.

Based on the criteria provided in FHWA's Interim Guidance Memorandum on Air Toxic Analysis in NEPA Documents, dated February 3, 2006, this project is considered to have a low potential for MSAT effects. This guidance may be viewed at:

www.fhwa.dot.gov/environment/airtoxic/020306guidmem.htm

In this FEIS document, a qualitative analysis of MSAT emissions has been provided relative to the various alternatives, and has acknowledged that the four lane widening and new location alternatives may result in increased exposure to MSAT emissions in certain locations, although the concentrations and duration of exposures are uncertain, and because of this uncertainty, the health effects from these emissions cannot be estimated.

As discussed above, technical shortcomings of emissions and dispersion models and uncertain science with respect to health effects prevent meaningful or reliable estimates of MSAT emissions and effects of this project. However, even though reliable methods do not exist to accurately estimate the health impacts of MSATs at the project level, it is possible to qualitatively assess the levels of future MSAT emissions under the project. Although a qualitative analysis cannot identify and measure health impacts from MSATs, it can give a basis for identifying and comparing the potential differences among MSAT emissions-if any-from the various alternatives. The qualitative assessment presented below is derived in part from a study conducted by the FHWA entitled *A Methodology for Evaluating Mobile Source Air Toxic Emissions Among Transportation Project Alternatives*, found at:
www.fhwa.dot.gov/environment/airtoxic/msatcompare/msatemissions.htm

Ongoing research has enabled FHWA to develop a tiered analytical approach to analyzing the effect of transportation projects on MSAT emissions. Methods of analysis are based on the level of potential for MSAT emissions impacts. The Route 82/85/11 project has a low potential for MSAT impacts because it involves rural principal arterials with a design year ADT ranging from 14,800 for the full build alternatives to 22,400 for the widening alternatives, well below the threshold for projects with a high potential for MSATs (140,000 ADT). Because of the low potential for adverse impacts, a qualitative assessment of the likely change in MSAT emissions with the project versus the no build alternative is provided in this FEIS.

#### 5.3.4.1 Mobile Source Air Toxics - Comparison of Impacts

For each alternative, the amount of MSATs emitted would be proportional to the VMT, assuming that other variables such as fleet mix are the same for each alternative. The VMT estimated for each of the widening alternatives is slightly higher than for the no build alternative because the additional capacity increases the efficiency of the roadway and attracts rerouted trips from elsewhere in the transportation network. This increase in VMT would lead to higher MSAT emissions for the widening alternatives, along with a corresponding decrease in MSAT emissions along the parallel routes. The emissions increase is offset somewhat by lower MSAT emission rates due to increased speeds that occur with decreased congestion; according to EPA's MOBILE6 emissions model, emissions of all of the priority MSATs except for diesel particulate matter decrease as speed increases. The extent to which these speed-related emissions decreases will offset VMT-related emissions increases cannot be reliably projected due to the inherent deficiencies of technical models.

Because the estimated VMT under each of the widening alternatives is nearly the same, it is expected there would be no appreciable difference in overall MSAT emissions among these alternatives. Also, regardless of the alternative, emissions would likely be lower than present levels in the design year as a result of EPA's national control programs that are projected to reduce MSAT emissions by 57 to 87 % between 2000 and 2020. Local conditions may differ from these national projections in terms of fleet mix and turnover, VMT growth rates, and local control measures. However, the magnitude of the EPA-projected reductions is so great (even after accounting for VMT growth) that MSAT emissions in the study area are likely to be lower in the future in nearly all cases.

Since the estimated VMT under each of the new location build alternatives, including the preferred alternative, are nearly the same, it is expected there would be no appreciable difference in overall MSAT emissions among these alternatives. Also, regardless of the alternative, emissions would likely be lower than present levels in the design year as a result of EPA's national control programs described above.

Because of the specific characteristics of each of the project alternatives (e.g. traffic diverted from Routes 82 and 85 to the Route 11 extension) there may be localized areas where VMT would increase, and other areas where VMT would decrease. Therefore it is possible that localized increases and decreases in MSAT emissions may occur. The localized increases in MSAT emissions would likely be most pronounced along the new roadway section that would be built under the new location alternatives and would decrease along Routes 82 and 85. This scenario would be reversed under the widening and TSM alternatives. However, even if increases do occur, they will be substantially reduced in the future due to implementation of EPA's vehicle and fuel regulations.

The additional travel lanes contemplated as part of the new location and four lane widening alternatives would have the effect of moving some traffic closer to nearby homes and businesses; therefore, there may be localized areas where ambient concentrations of MSATs could be higher than the no build or two lane widening and TSM alternatives. When a highway is added or widened and, as a result, moves closer to receptors, the localized level of MSAT emissions for the build alternatives could be higher relative to the no build alternative, but this could be offset due to increases in speeds and reductions in congestion (which are associated with lower MSAT emissions). Also, MSATs will be lower in other locations when traffic shifts away from them. However, as discussed above, the magnitude and the duration of these potential increases compared to the no build alternative cannot be accurately quantified due to the inherent deficiencies of current models.

In summary, under the new location build alternatives in the design year it is expected there would be reduced MSAT emissions in the immediate area of the project, relative to the no build alternative, due to the reduced VMT associated with more direct routing, and due to EPA's MSAT reduction programs. In comparing various project alternatives, MSAT levels could be higher in some locations than others, but current tools and science are not adequate to quantify them. However, on a regional basis, EPA's vehicle and fuel regulations, coupled with fleet turnover, will over time cause substantial reductions that, in almost all cases, will cause region-wide MSAT levels to be significantly lower than today.

### 5.3.5 Project-level Conformity Determination

Federal regulations concerning the conformity of transportation projects developed, funded or approved by the USDOT and by metropolitan planning organizations (MPOs) are contained in 40 CFR 93. The preferred alternative (project) is included in the SCCOG's current Long Range Transportation Plan but is not included in their current TIP.

In accordance with 40 CFR 93.115(a), the applicable criteria and procedures for a project which is not from a conforming Transportation Plan are listed in Table 1 of 40 CFR 93.109(b). All of these criteria have been determined to be satisfied for the preferred alternative as follows:

- **Transportation Control Measures (TCMs) –** This project does not interfere with the implementation of any TCM in the current SIP as there are none.

- **Currently Conforming Plan and TIP –** The MPO's current Transportation Plan and the FY 2007-2011 Statewide Transportation Improvement Program (STIP), which incorporates the MPO's current TIP, were determined to be in conformity by FHWA and FTA on September 29, 2006.

- **CO, $PM_{10}$ and $PM_{2.5}$ Hot Spots –** This project is not located in a CO, $PM_{2.5}$ or $PM_{10}$ non-attainment or maintenance area, therefore CO, $PM_{2.5}$ and $PM_{10}$ hot spot analyses were not required for conformity purposes.

- **$PM_{10}$ and $PM_{2.5}$ Control Measures –** There are no $PM_{10}$ or $PM_{2.5}$ control measures in the current SIP.

- **Emissions Budget or Emissions Reduction –** This project has been demonstrated to be consistent with the motor vehicle emissions budgets in the State Implementation Plan as evidenced by ConnDOT's Ozone Air Quality Conformity Determination dated June 2006.

In summary, the preferred alternative has been determined to be in conformity with the Clean Air Act, as amended, pursuant to all applicable EPA regulations currently in effect as of the date of approval of this FEIS.

### 5.3.6 MITIGATION MEASURES

The air quality analyses indicate that no adverse effects on air quality would occur with the preferred alternative.

Mitigation for temporary air quality impacts that may occur during construction is discussed in Section 5.15.