

Merrimack -  
FEE Turnpike Exit 12  
Ramp Study

March 29, 2004

Nashua Regional Planning Commission  
115 Main St., Nashua, New Hampshire

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## CONCLUSIONS

At the request of the Town of Merrimack, NRPC has completed the following study to identify the impacts of the addition of ramps on the north side of FEE Turnpike Exit 12. The following describes those impacts on overall traffic patterns in the community, the operation of specific intersections, on land use, on the environment and on the overall quality of life in the community. Subsequent sections of this report (beginning on page 6) describe in greater detail the impact of the current Exit 12 configuration on traffic in Merrimack, and the technical analysis that was conducted to develop the conclusions that are described below.

### A. Change in Overall Traffic Patterns due to Exit 12 Ramp Development

Table 1, on the following page, shows the over impact on traffic patterns that will occur in Merrimack if the ramps are added to the north side of Exit 12 and traffic continues to increase as expected. These traffic forecasts demonstrate that the addition of ramps on the north side of Exit 12 would have profound impacts on traffic patterns in the town. The following summarizes the anticipated changes in the traffic patterns:

- **Traffic Will Increase on Bedford Road** - The new ramps on the north side of Exit 12 are forecast to attract 33,900 vehicles per day, a very large volume of traffic. Bedford Road will be most impacted by this large volume of new traffic. Traffic will virtually double on Bedford Road west of US 3 Daniel Webster Highway with an increase in the 2025 forecast from 12,400 vehicles per day if the ramps are not constructed to 24,200 vehicles per day if the ramps are constructed. Just west of the FEE Turnpike 2025 forecast traffic will increase from 12,100 vehicles per day if the ramps are not constructed to 17,000 vehicles per day if the ramps are constructed.
- **Traffic will Decrease on Daniel Webster Highway and Back River Road North of Bedford Road** - Addition of the ramps on the north side of Exit 12 will allow traffic from north Merrimack to access the FEE Turnpike for trips to and from Bedford and other points to the north. As a result, there will be a decrease in traffic on US 3 Daniel Webster Highway and on Back River Road north of Bedford Road. In the 2025 if the ramps are not constructed, traffic on Back River Road at the Bedford town line is expected to be 9,400 vehicles per day. If the ramps are constructed, 2025 traffic is forecast to be lower than current traffic volumes at this same location with only 2,800 vehicles per day. Similarly, traffic on US 3 Daniel Webster Highway is forecast to be 17,200 vehicles per day if the ramps are not constructed but 13,100 vehicles per day if the ramps are added to the north side of Exit 12.
- **Traffic Will Increase on Daniel Webster Highway and Joppa Road between Bedford Road and Baboosic Lake Road** - The addition of ramps on the north side of Exit 12 will also have the effect of attracting traffic from central Merrimack that currently uses Exit 11 to instead use Exit 12. As a result, the addition of the ramps on the north side of Exit 12 results in traffic increases on the collector and main local streets in the area between Bedford Road and Baboosic Lake Road. As shown in Table 1 on the following page, in 2025 traffic will increase on US 3 Daniel Webster Highway immediately south of Bedford Road from 18,400 vehicles per day if the ramps are not constructed to 21,100 vehicles per day if the ramps are constructed. On US 3 Daniel Webster Highway just north of Baboosic Lake Road this increase is expected to be even more pronounced. At that location in the 2025 forecast there is expected to be 15,500 vehicles per day if the ramps are not constructed but 24,000 vehicles per day if the ramps are constructed. Similarly, traffic is expected to increase in the 2025

forecast on Joppa Road just north of Baboosic Lake Road from 2,800 vehicles per day if the ramps are not constructed to 3,300 vehicles per day if the ramps are constructed.

**Table 1**  
**Effect of Exit 12 Ramps on Overall Traffic Patterns**

	Recent Traffic Count (year)	2025 Forecast No Build Scenario	2025 Forecast Build Scenario
Proposed Exit 12 north side ramps	NA	NA	33,900
Bedford Rd. over Baboosic Brook	6,000 (1999)	8,600	6,700
Bedford Road just west of FEE Turnpike	11,400 (2001)	12,100	17,000
Bedford Road just west of US 3 Daniel Webster Hwy	NA	12,400	24,200
Existing Exit 12 Ramps total	9,600 (2003)	10,700	10,600
Back River Road at Bedford Town Line	3,000 (2000)	9,400	2,800
US 3 Daniel Webster Hwy north of Bedford Rd.	14,030 (2000)	17,200	13,100
US 3 Daniel Webster Hwy south of Bedford Rd.	16,500 (2000)	18,400	21,100
US 3 Daniel Webster Hwy north of Baboosic Lake Rd	14,500 (2000)	15,500	24,000
US 3 Daniel Webster Hwy south of Baboosic Lake Rd	19,400 (1997)	20,600	15,800
US 3 Daniel Webster Hwy north of Greeley St.	20,200 (2000)	25,000	20,400
Baboosic Lake Road east of FEE Turnpike bridge	11,200 (2001)	13,400	13,600
Joppa Road just north of Baboosic Lake Road	2,659 (1997)	2,800	3,300
Greeley Street just west of FEE Turnpike	19,900 (2000)	30,300	28,700
Turkey Hill Road just north of Amherst Road	7,500 (1997)	12,100	10,100

- Traffic Will Decrease on Daniel Webster Highway and Turkey Hill Road between Baboosic Lake Road and Greeley Street** - The addition of ramps on the north side of Exit 12 will also effect traffic on roads between Baboosic Lake Road and Greeley Street. In this area, traffic will be reduced because traffic that formerly traveled south to Exit 11 to access the FEE Turnpike for longer trips north, can now accomplish the same outcome by traveling north to Exit 12. As a result, 2025 forecast traffic on US 3 Daniel Webster Highway immediately north of Greeley Street will decrease from 25,000 vehicles per day if the ramps are not constructed to 20,400 vehicles per day if the ramps are constructed. Similarly, 2025 traffic forecast on Turkey Hill Road just north of Amherst Road will decrease from 12,100 vehicles per day if the ramps are not constructed 10,100 vehicles per day if the ramps are constructed.

## B. Change in Intersection Operations due to the Development of the Exit 12 Ramps

In 2025, if the ramps are added to the north side of Exit 12, the changes in the traffic patterns that are described above will impact the operations of a number of intersections throughout the north and central parts of Merrimack. Table 2, below, shows the overall effect of the addition of the Exit 12 north side ramps on intersections through out Merrimack.

**Table 2**  
**Effect of Exit 12 Ramps on Intersection Levels of Service**

Study Area Signalized Intersections:	2002 Conditions		2025 Conditions No Exit 12 Ramps		2025 Conditions With Exit 12 Ramps	
	AM Peak LOS	PM Peak LOS	AM Peak LOS	PM Peak LOS	AM Peak LOS	PM Peak LOS
Bedford Rd./Back River Rd./FEE SB On Ramps Exit 12 Overall	B	C	F	F	B	E
Bedford Rd./FEE Off Ramps Exit 12 Overall	B	C	B	F	F	C
Bedford Rd./DW Hwy Overall	C	C	D	D	F	F
Baboosic Lk Rd./DW Hwy Overall	C	C	D	D	F	F
Greeley St./FEE Ramps Exit 11 Overall	B	C	C	C	B	C
Continental Blvd./Amherst Rd./Camp Sargent Rd.	C	C	D	D	D	D
Greeley St./DW Hwy. Overall	B	C	B	C	B	C

- **Bedford Road/FEE Turnpike Southbound On and Off Ramps** - The intersection Level of Service at this intersection will improve due to the fact that the Back River Road leg will have been removed and replaced with the FEE Turnpike southbound off-ramp. During the morning peak, the intersection Level of Service will improve from F to a B and in the afternoon peak the Level of Service will improve from an F to an E.
- **Bedford Road/Back River Road Unsignalized Intersection** - As described earlier, this will be a new intersection created by the realignment of the south end of Back River Road to accommodate the new southbound off-ramp. This intersection will operate at Level of Service F in both the morning and afternoon peak hours.
- **Bedford Road/FEE Turnpike Northbound On and Off Ramps** - This intersection will operate at Level of Service F in the morning peak period due to very heavy traffic on the Bedford Road eastbound left into the new northbound on-ramp, and the Bedford Road westbound right into the same ramp.
- **Bedford Road/US 3 Daniel Webster Highway** - This intersection will operate at Level of Service F in both the morning and afternoon peak periods. This is due to the very heavy traffic volumes on both the Bedford Road eastbound left turn and also on the US 3 Daniel Webster Highway northbound left.
- **Baboosic Lake Road/US 3 Daniel Webster Highway** - This intersection will also operate at Level of Service F in both the morning and afternoon peak hours.

It should be noted that it is possible that all of the above intersection issues that would result from the addition of ramps on the north side of Exit 12 could be addressed with three roadway improvements.

1. Replacement/Widening of the Bedford Road bridge over the FEE Turnpike - The existing Bedford Road Bridge over the FEE Turnpike is three lanes wide. Replacement of this bridge with a five lane wide bridge would allow the

- intersections with the Exit 12 Ramp termini to be improved with turn lanes. This would result in adequate levels of service at the intersections of Bedford Road and the Northbound On and Off Ramps, Bedford Road and the Southbound On and Off Ramps, and Bedford Road and Back River Road.
2. Improvements to the Intersection of Bedford Road and Daniel Webster Highway - Providing an adequate level of service at this intersection would require the following improvements: a) adding a second left turn lane from Bedford Road eastbound to Daniel Webster Highway northbound, b) adding a second left turn lane from Daniel Webster Highway northbound to Bedford Road westbound.
  3. Improvements to the Intersection of Baboosic Lake Road and Daniel Webster Highway - Deficiencies at this intersection could be addressed by the addition of a second left turn lane from Baboosic Lake Road eastbound to Daniel Webster Highway northbound.

The above are preliminary descriptions of possible improvements and do not take into account the cost of the improvements or impact of the improvements on surrounding land uses. Prior to proceeding with any such improvements a full engineering study will be necessary to determine the cost and feasibility of such improvements.

### **C. Changes in Existing Land Use due to the Development of the Exit 12 Ramps**

In addition to the traffic analysis described above a review was conducted to identify any potential impacts on existing land uses. If the town and NH DOT decide to move forward with the development of these ramps, these issues will be full investigated in the preliminary engineering and environmental assessment process. Several potential issues were identified that should be considered:

- The addition of the ramps on the north side of Exit 12 will require realignment of the south end of Back River Road. If sufficient right-of-way is not available along Back River Road this realignment could impact four homes.
- If there is not sufficient right-of-way between the existing FEE Turnpike and Back River Road, an additional 12 homes could be impacted by the addition of the southbound off ramp.
- There is some potential for impact on properties at the end of Priscilla Lane on the east side of the FEE Turnpike.

### **D. Changes in the Environment due to the Development of the Exit 12 Ramps**

A preliminary analysis was also conducted on the impact of this potential project on the environment. The following is a preliminary list of changes that may come about in the environment due to the development of the Exit 12 ramps. If the town and NH DOT decide to move forward with the development of these ramps, these issues will be full investigated in the preliminary engineering and environmental assessment process.

Several potential issues were identified that should be considered:

- No significant natural resources have been identified in the study area.
- The entire study area is served with public water and so well water contamination does not appear to be an issue.

- Increases in stormwater runoff should be considered and pre-treatment investigated due to the potential for this area to impact the Merrimack River and associated wetlands.
- There are several historic structures and a cemetery in the immediate vicinity of the project that could be impacted.
- The construction of this project would result in significant air quality benefit. An air quality analysis conducted by NRPC shows that the addition of these ramps would reduce hydrocarbon emissions by 13.63 kilograms per day and emissions of nitrous oxides by 20.54 kilograms per day. This represents a total decrease in pollutants of 34.17 kilograms per day.

## **E. Changes in the Quality of Life of Merrimack Residents due to the Development of the Exit 12 Ramps**

The traffic analysis conducted for this study using the NRPC Travel Demand model also gives some indication of changes in the quality of life of Merrimack residents that would result from the construction of the ramps on the north side of Exit 12. The model shows that driving by Merrimack residents would decrease by 62,447 miles per day if the ramps were added to the north side of Exit 12. In terms of travel time, this represents a decrease in driving time of 4.26 minutes per person per day for Merrimack residents or 25.9 hours per year per person.

## INTRODUCTION

At the request of the Town of Merrimack, the following study has been developed to provide the public, elected and appointed officials and town staff with information on the likely results for both traffic and also land use and the environment of the addition of the ramps on the north side of Exit 12.

### A. FEE Turnpike Exit 12 Issues

The FEE Turnpike extends north to south through the entire length of the town of Merrimack, New Hampshire. The FEE Turnpike provides a high speed connection from Merrimack to the south to Nashua and locations in Massachusetts and to the north to Manchester and Concord. There are currently two full interchanges and one half interchange providing access to the FEE Turnpike. Exit 10 (in the south portion of Merrimack) and Exit 11 (in the center of town) are full interchanges providing on and off movements for both north and south bound traffic. Exit 12, in the north portion of Merrimack is only a half interchange, with ramps only on the south side of the interchange. This configuration only allows traffic to enter the FEE Turnpike in the southbound direction and to exit the FEE Turnpike in the northbound direction. For residents and businesses in the northern portion of Merrimack, the absence of ramps on the north side of Exit 12 results in considerable out of direction travel. Motorists at the intersection of Bedford Road and U.S. 3 (Daniel Webster Highway) immediately east of Exit 12 who wish to reach destinations north of Merrimack have two choices:

A) They can travel south on Daniel Webster Highway to Exit 11, enter the FEE Turnpike and travel back north. This results in 7.25 miles of travel to arrive at a point on the FEE Turnpike immediately north of Exit 12.

B) The traveler could drive up Daniel Webster Highway into Bedford (where it becomes River Road) and access the FEE Turnpike via the NH 101 interchange. This route is about 1.5 miles longer than the direct route up the FEE Turnpike would be if the ramps on the north side of Exit 12 were present (6.0 miles versus 4.5 miles on the FEE Turnpike). This route is also quite a bit slower due to the fact that traffic travels on D. W. Highway at an average of 35 miles per hour, compared with 70 miles per hour on the FEE Turnpike. Due to both the greater length and slower speed, this route results in a time loss for Merrimack residents of 6.4 minutes per trip

In addition, the absence of ramps on the north side of Exit 12 is perceived to result in traffic diversion to roads north of Bedford Road (D. W. Highway, and Back River Road) as well as south (D. W. Highway, Joppa Road, Turkey Hill Road, Amherst Road and Greeley Street). As a result of these issues, the town of Merrimack Community Development Department has asked the Nashua Regional Planning Commission (NRPC) to conduct a study to determine the traffic impacts associated with the addition of on and off ramps for northbound access at the F.E.E. Turnpike Exit 12.

### B. Study Methodology

This study focused on the following three issues in analyzing the implications of changes to the FEE Turnpike Exit 12 interchange.

1. Existing Traffic Conditions

The first step in the study process for this study identifies existing traffic conditions in the area of Merrimack most effected by potential changes in Exit 12. This was identified

as the area from Greeley Street and Continental Boulevard, north to the Bedford town line. Roads and intersections that serve as town-wide travel paths were identified. Recent traffic volume counts conducted by NRPC were reviewed. In addition, morning and afternoon peak hour turning movement counts were conducted at 13 intersections. A Level of Service analysis (LOS) was then conducted for these intersections to describe the current traffic operations in the study area.

2. Future Traffic Conditions

The future traffic conditions for this study area were then studied based upon traffic projections derived from NRPC's regional traffic model. Two future model scenarios were developed. The "No-Build" scenario estimates future traffic conditions assuming that there are no changes at the Turnpike Exit 12 interchange at Bedford Road. The "Build" scenario estimates future traffic operating conditions assuming that a full interchange is constructed with access to and from the north at the Turnpike Exit 12 interchange. In both cases the expected morning and evening peak hour traffic and turning movements were estimated for the 13 study area intersections. Based on that data, the level-of-service analysis was conducted for both No-Build and Build conditions and compared in order to discern the potential impacts of the completed Exit 12 interchange.

3. Land Use, Environment and Quality of Life

The link between traffic, land use and the environment is an important consideration in the development of any new transportation facility. This portion of the study identified in a general fashion the effect of the addition of ramps on the north side of Exit 12 on surrounding land uses and on the environment. An inventory of existing land use within the study area was conducted in order to estimate the amount of land area available for future development, which impacts the trip generation and distribution elements within the traffic model. In addition, anticipated land use changes and zoning impacts based on the Town's Master Plan were considered in the future modeling analysis.

# EXISTING TRAFFIC CONDITIONS

## A. 24 Hour Traffic Counts

The study area includes thirteen signalized and un-signalized intersections in the northern portion of Merrimack. Figure 1 shows the study area roadway network, which includes Daniel Webster Highway (US 3), Bedford Road, Continental Blvd., Baboosic Lake Road, Wire Road, and Joppa Road.

The 24-hour traffic counts for the study area roads are compiled in this report based upon historic traffic counts taken by NRPC and the NHDOT in 2001, 2002 and 2003. These counts are shown in Figure 2 and are summarized below:

- **F.E.E. Turnpike** - The FEE Turnpike carries the most traffic in the study area with the highest point at 49,000 vehicles per day (vpd), within a 24-hour period northbound and southbound, between exits 10 and 11. The FEE Turnpike volume drops to 47,000 vpd between Exits 11 and 12 and then rises to 48,000 vpd at the Bedford line.
- **Greeley Street** - Greeley Street between US 3 and the F.E.E. Turnpike, carries approximately 20,000 vpd.
- **US 3 (D. W. Highway)** - The traffic volumes on US 3 vary within the study area. The volume on US 3 is approximately 16,000 vpd north of Industrial Blvd, 21,000 vpd north of Greeley St., 16,500 vpd in the vicinity of Bedford Rd., and 14,000 vpd at the Bedford line.
- **Bedford Road** - Bedford Rd. carries 10,000 vpd
- **Baboosic Lake Road** - Baboosic Lake Rd. has 11,000 vpd at its highest point.
- **Industrial Boulevard** - Industrial Boulevard carries 7,200 vpd.
- **Back River Road** - Back River Road has approximately 3,000 vpd.

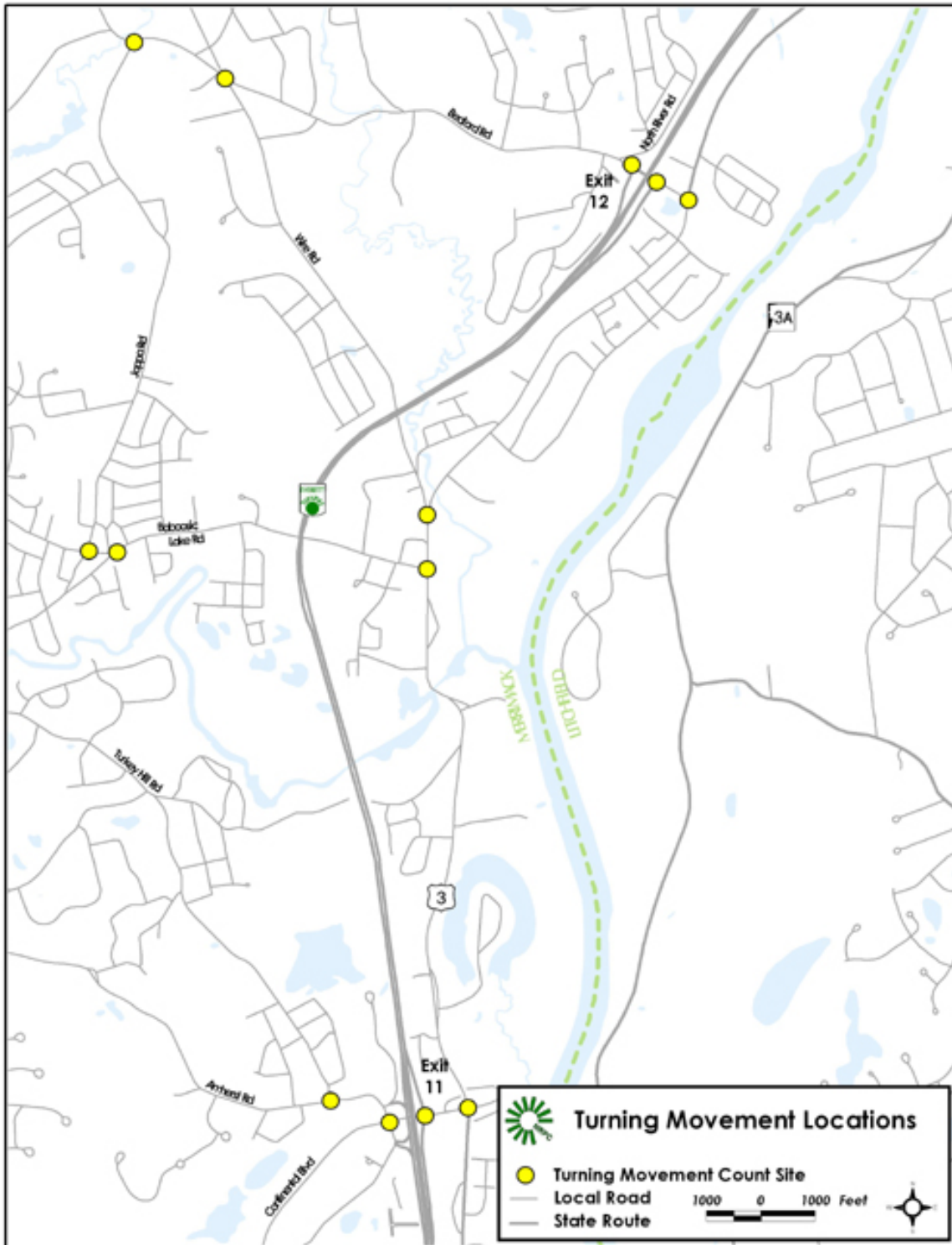
## B. Peak Hour Turning Movement Counts

The Nashua Regional Planning Commission conducted morning and afternoon manual turning movement counts at thirteen intersections within the study area in Merrimack, in order to discern the existing baseline conditions. The counts were performed in the field by NRPC staff between the hours of 7:00 a.m. and 9:00 a.m. in the morning and 4:00 p.m. and 6:00 p.m. in the afternoon during the fall of 2002, and are summarized in 15-minute increments. The intersections include:

- **Bedford Road/Back River Road/Turnpike Exit 12 on ramp** - This intersection is a four-way signalized intersection with the Turnpike southbound on ramp making up the southern segment. This segment is one-way southbound to the Turnpike southbound mainline. Bedford Road provides two lanes on the eastbound approach and two lanes on the westbound approach. Both the eastbound approach and the westbound approach provide an exclusive left turn lane. The eastbound approach has a free right turn with a raised island to channel traffic onto the Turnpike southbound ramp. The Back River Road southbound approach provides two lanes for a combined through left movement and a combined through right movement. The proposed completion of the interchange would require the relocation of Back River Road to be replaced by a ramp from the Turnpike southbound mainline.

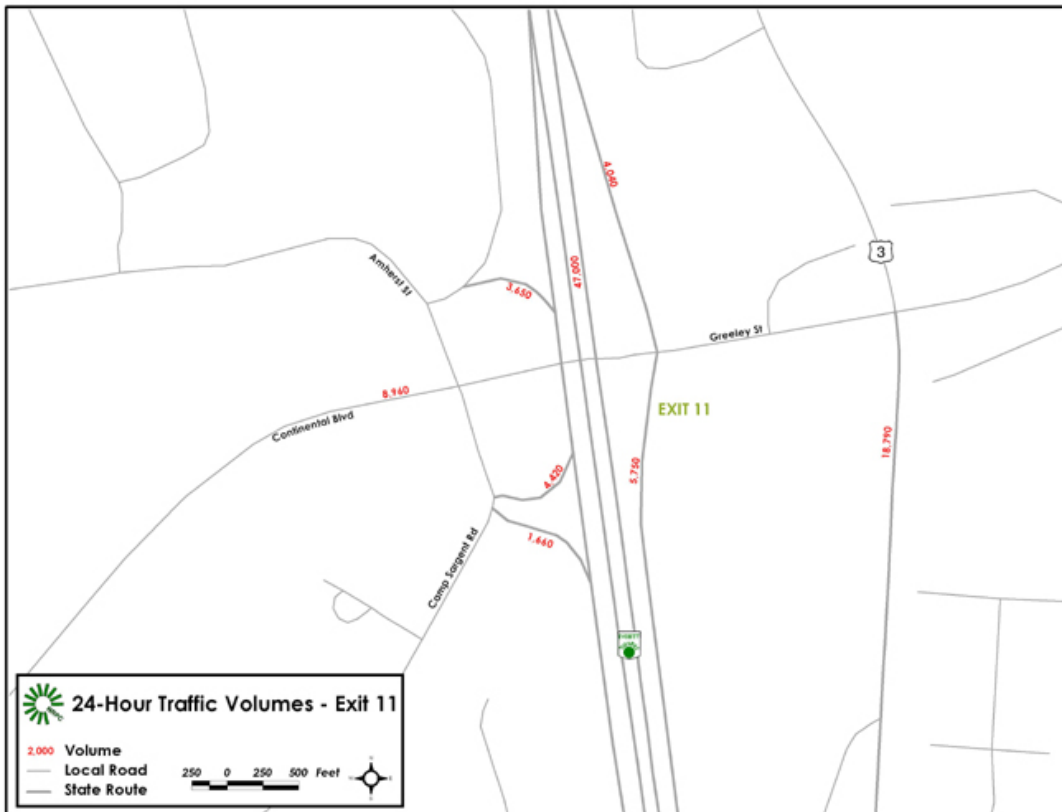
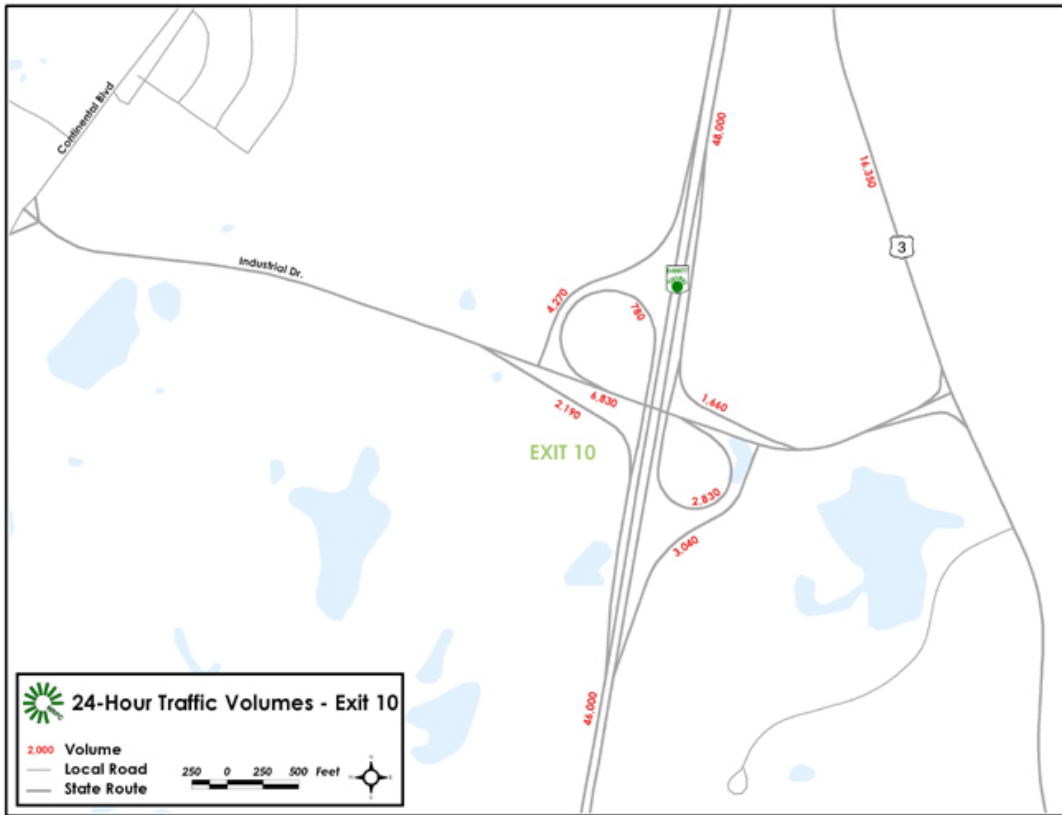
- **Bedford Road/Turnpike Exit 12 off ramp** - The northbound off ramp at the Turnpike Interchange 12 forms a "T" type intersection with Bedford Road. The intersection provides a single through lane on the Bedford Road eastbound and westbound approaches and exclusive right turn and left turn only lanes on the northbound ramp approach.
- **Bedford Road/US 3 Daniel Webster Highway** - Although Bedford Road and Daniel Webster Highway intersect in Merrimack to form a signalized "T" type intersection, the driveway to a convenience store intersects almost directly across from the eastbound Bedford Road approach. The driveway is close enough to the intersection to impact the traffic patterns so that the intersection operates much like a four-way intersection. The Bedford Road eastbound approach provides exclusive right and left turn lanes to the intersection. The Daniel Webster Highway northbound approach contains an exclusive left turn lane and a through lane. The Daniel Webster southbound approach contains an exclusive right turn lane and a through lane.
- **Bedford Road/Joppa Road** - Bedford Road and Joppa Road intersect in Merrimack to form a "T" type stop controlled intersection. The Joppa Road northbound right and left turns are stop sign controlled and divided by a raised traffic island. The Bedford Road eastbound and westbound approaches provide a single approach lane for the major movements.
- **Baboosic Lake Road/Joppa Road** - Baboosic Lake Road and Joppa Road form a four-way intersection in Merrimack. The intersection is stop sign controlled on the northbound and southbound Joppa Road approaches. All four legs of the intersection provide a single approach lane and a lane for exiting the intersection. The intersection is stop controlled on the Joppa Road northbound and southbound approaches.
- **Baboosic Lake Road/US 3 Daniel Webster Highway** - Baboosic Lake Road and Daniel Webster Highway form a signalized "T" type intersection near the traditional town center in Merrimack. The signals also control traffic in and out of a driveway opposite Baboosic Lake for four-way operation. The traffic to and from this drive is minimal and the intersection functions mainly as a "T" intersection during the peak hours and for most of the day. The Baboosic Lake Road eastbound approach contains exclusive left and right turn lanes. The Daniel Webster Highway northbound approach provides an exclusive left turn lane and a through lane. The southbound approach contains a through lane and an exclusive right turn lane.
- **Turkey Hill Road/Amherst Road** - Turkey Hill Road and Amherst Road form a "T" type intersection in Merrimack. The intersection is stop controlled on the Turkey Hill Road southbound approach. All three legs of the intersection provide one approach lane and one lane for exiting the intersection.
- **Turkey Hill Road/Baboosic Lake Road** - Turkey Hill Road forms a "Y" type three-way intersection with Baboosic Lake Road in close proximity to the Joppa Road/Baboosic Road intersection. The intersection is stop controlled on the Turkey Hill road northbound approach. All three legs of the intersection provide a single approach lane and one lane for exiting the intersection.

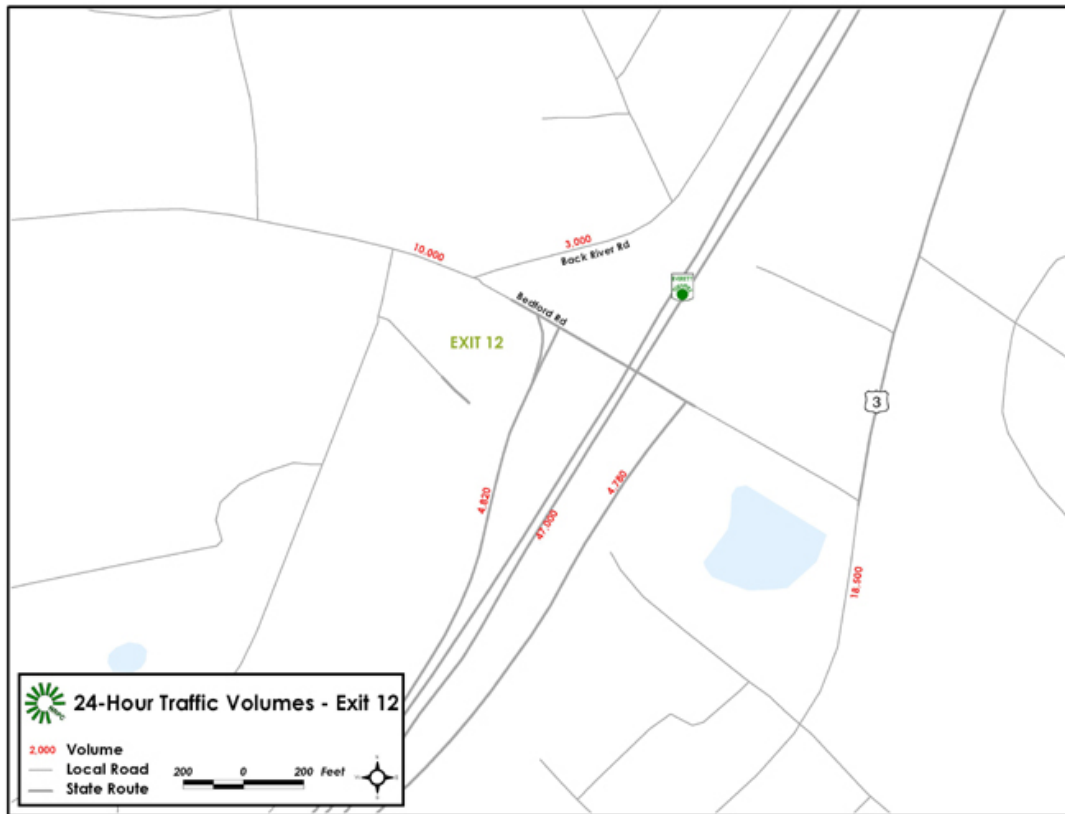
**FIGURE 1**  
**Study Area Road Network and**  
**Turning Movement Count Locations**



Nashua Regional Planning Commission, December 1, 2003

# FIGURE 2 Daily Traffic Volumes



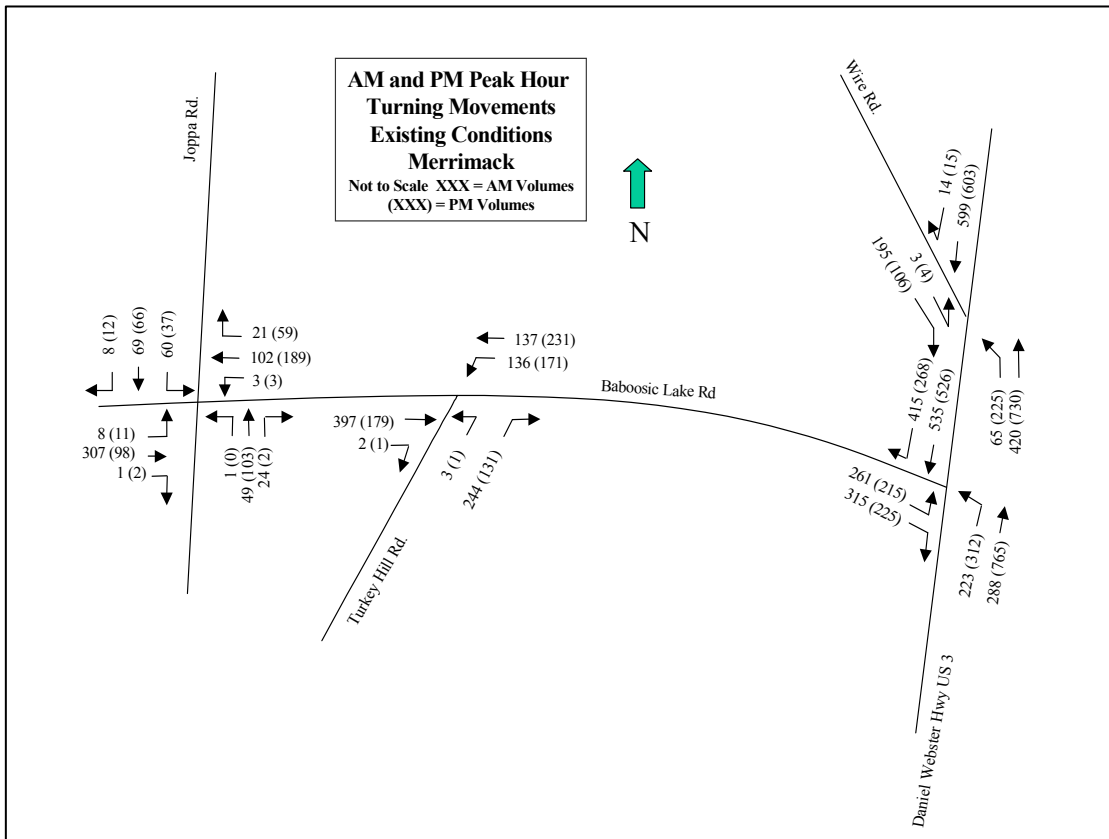
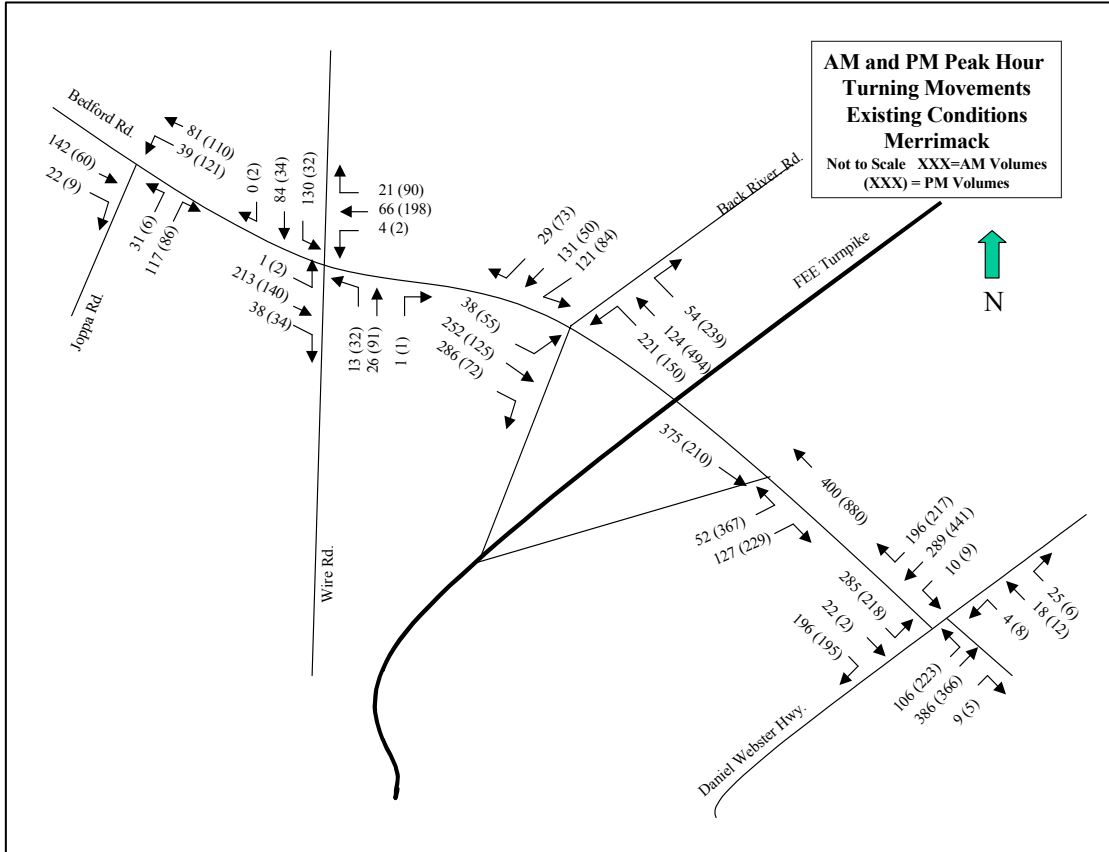


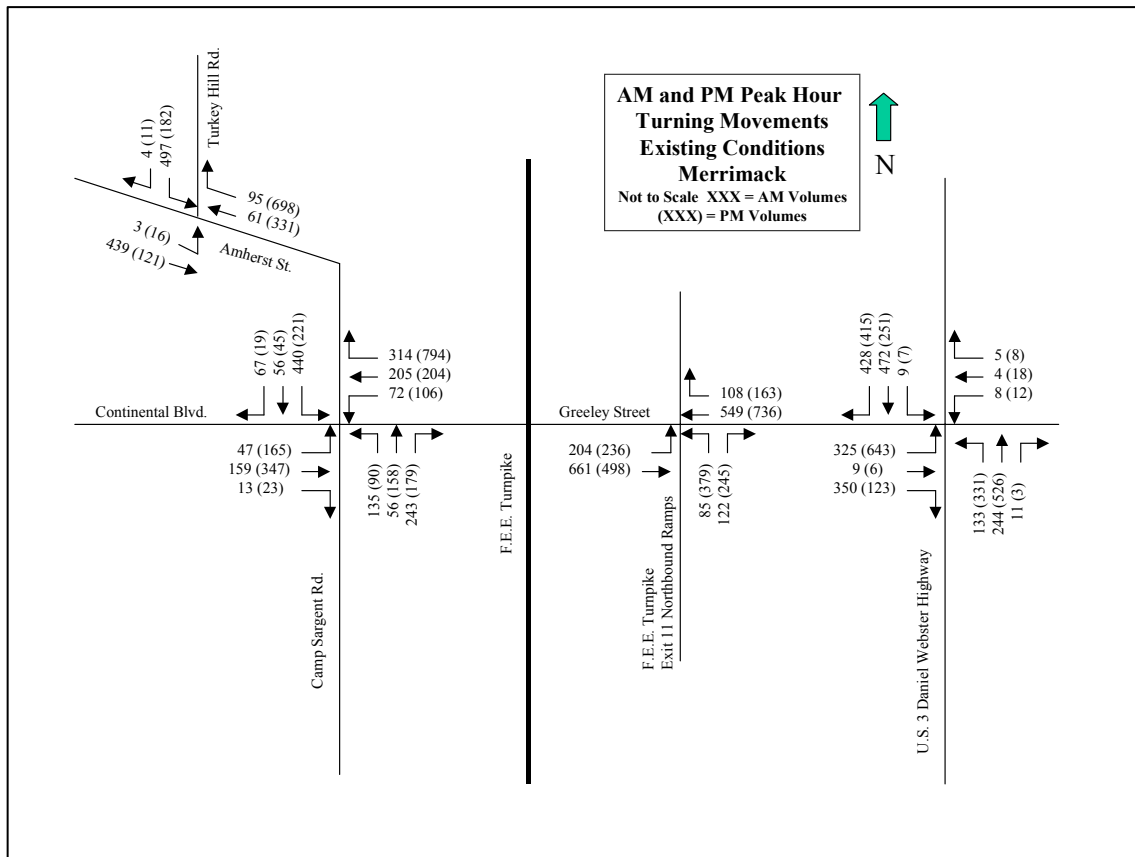
*Nashua Regional Planning Commission, December 1, 2003*

- Wire Road and Daniel Webster Highway** - Wire Road and Daniel Webster Highway intersect just north of Baboosic Lake Road to form a three-way "Y" type intersection. The intersection is stop sign controlled on the Wire Road eastbound approach. The Daniel Webster Highway northbound approach provides two approach lanes including an exclusive left turn lane and a through lane. The Daniel Webster southbound approach and the Wire Road eastbound approach provide one approach lane to the intersection.

Figure 3 summarizes the existing morning and afternoon peak hour turning movements at study area intersections derived from the manual turning movement counts.

### FIGURE 3 AM and PM Peak Turning Movements Existing Conditions (2002)





Nashua Regional Planning Commission, December 1, 2003

### C. Intersection Peak Hour Level of Service Analysis

The NRPC performed level-of-service analysis (LOS) for the morning and afternoon peak hour conditions for the study area intersections. Level-of-service analysis was performed based on the industry standards as described in the Highway Capacity Manual 2000 (HCM), published by the Transportation Research Board. The HCM defines the quality of traffic operations at specific highway facilities (roads, lanes, intersections, and intersection approaches) under specific conditions (peak hour) by a means of "level-of-service." The LOS characterizes the operating conditions on a facility in terms of traffic performance measures related to speed and travel time, freedom to maneuver, traffic interruptions, and comfort and convenience.

The levels-of-service range from "A" (least congested) to "F" (most congested). The following table shows the general definitions of LOS.

**Table 3**

Level of Service	General Operating Conditions
A	Free flow
B	Reasonably free flow
C	Stable flow
D	Approaching unstable flow
E	Unstable flow
F	Forced or breakdown flow

Source: "A Policy on Geometric Design of Highways and Streets", AASHTO

Signalized intersection analysis requires peak hour volumes and traffic conditions, intersection geometrics and lane use, and signal timing and phasing operations as input parameters. The average control delay per vehicle is estimated for each lane group and aggregated for each approach and the intersection as a whole. The LOS is directly related to the control delay value. The LOS criteria for signalized intersections is shown in the following table:

**Table 4**

Level of Service	Control Delay per Vehicle (sec./veh.)
A	$\leq 10$
B	> 10-20
C	> 20-35
D	> 35-55
E	> 55-80
F	> 80

Source: "Highway Capacity Manual 2000", TRB.

Operational analysis at un-signalized (two-way stop controlled) depends upon the understanding of the interaction of drivers on the minor or stop-controlled approach with the drivers on the major street. The LOS for a two-way stop controlled intersection is determined by the computed or measured control delay and is defined for each minor movement. The LOS is not defined for the intersection as a whole. The LOS criteria for un-signalized intersections is shown in the following table:

**Table 5**

Level of Service	Control Delay per Vehicle (sec./veh.)
A	0 - 10
B	10 - 15
C	15 - 25
D	25 - 35
E	35 - 50
F	> 50

Source: "Highway Capacity Manual 2000", TRB.

Level-of-service analysis was performed for both signalized and un-signalized intersections in the study area for the existing 2002 morning and afternoon peak hour conditions. A summary of the existing peak hour LOS analysis for existing conditions is shown in Tables 4 and 5. Figure 4 also summarizes the overall LOS for signalized intersections.

**Table 6**

<b>Study Area Signalized Intersections:</b>	<b>AM Peak Delay (sec.)</b>	<b>AM Peak LOS</b>	<b>PM Peak Delay (sec.)</b>	<b>PM Peak LOS</b>
<b>Bedford Rd./Back River Rd./FEE SB On Ramps Exit 12 Overall</b>	<b>17.2</b>	<b>B</b>	<b>23.5</b>	<b>C</b>
Bedford Rd EB Left Turn	21.3	C	21.6	C
Bedford Rd EB Through	20.6	C	18.5	B
Bedford Rd EB Right Turn	0.1	A	0.0	A
Bedford Rd WB Left Turn	26.8	C	23.5	C
Bedford Rd WB Through	18.1	B	27.1	C
Back River Rd SB All Moves	23.0	C	22.4	C
<b>Bedford Rd/FEE Off Ramps Exit 12 Overall</b>	<b>10.4</b>	<b>B</b>	<b>28.1</b>	<b>C</b>
Bedford Rd EB Through	9.3	A	8.1	A
Bedford Rd WB Through	9.6	A	64.3	E
Exit 12 off Ramp Left Turn	13.7	B	250	C
Exit 12 off Ramp Right Turn	14.8	B	17.0	B
<b>Bedford Rd/DW Hwy Overall</b>	<b>22.5</b>	<b>C</b>	<b>26.3</b>	<b>C</b>
Bedford Rd EB Left and Through	43.4	D	41.5	D
Bedford Rd EB Right Turn	7.1	A	8.3	A
Bedford Rd WB All Moves	15.9	B	18.9	B
DW Hwy NB Left Turn	23.1	C	27.7	C
DW Hwy NB Through and Right	8.6	A	6.9	A
DW Hwy SB Left and Through	25.7	C	45.9	B
DW Hwy SB Right	20.9	C	19.2	B
<b>Baboosic Lk Rd/DW Hwy Overall</b>	<b>29.5</b>	<b>C</b>	<b>23.0</b>	<b>C</b>
Baboosic Lk Rd EB Left Turn	26.4	C	26.8	C
Baboosic Lk Rd EB Right Turn	59.2	E	35.3	D
DW Hwy NB Left Turn	13.6	B	32.7	C
DW Hwy NB Through	7.7	A	17.6	B
DW Hwy SB Through	33.9	C	23.0	C
DW Hwy SB Right	26.8	C	13.5	B
<b>Greeley St/FEE Ramps Exit 11 Overall</b>	<b>17.0</b>	<b>B</b>	<b>28.8</b>	<b>C</b>
Greeley St EB Left Turns	23.3	C	49.2	D
Greeley St EB Through	5.1	A	9.5	A
Greeley St WB Through	26.0	C	28.2	C
FEE Ramps NB Left Turn	32.2	C	33.4	C
FEE Ramps NB Right Turn	10.8	B	37.6	D
<b>Continental Blvd/Amherst Rd/Camp Sargent Rd.</b>	<b>32.4</b>	<b>C</b>	<b>28.9</b>	<b>C</b>
Continental Blvd EB Left Turn	32.5	C	43.1	D
Continental Blvd EB Through	34.8	C	43.8	D
Continental Blvd WB Through	39.1	D	33.0	C

<b>(continued):</b>	<b>Delay (sec.)</b>	<b>LOS</b>	<b>Delay (sec.)</b>	<b>LOS</b>
Continental Blvd WB Right Turn	9.2	A	12.4	B
Camp Sargent Rd NB Left Turn	33.2	C	42.4	D
Camp Sargent Rd NB Through	30.8	C	46.9	D
Camp Sargent Rd NB Right Turn	19.2	B	17.6	B
Amherst Rd SB Left Turn	56.3	E	38.9	D
Amherst Rd SB Through	23.6	C	33.1	C
Amherst Rd SB Right Turn	3.1	A	2.4	A
<b>Greeley St/DW Hwy. Overall</b>	<b>17.7</b>	<b>B</b>	<b>24.1</b>	<b>C</b>
Greeley St EB Left Turn	32.2	C	22.4	C
Greeley St EB Through	19.2	B	6.8	A
Greeley St EB Right Turn	4.5	A	1.6	A
Greeley St WB All Moves	19.4	B	7.0	A
DW Hwy NB Left Turn	21.4	C	41.9	D
DW Hwy NB Through and Right	10.9	B	31.3	C
DW Hwy SB Left Turn	28.2	C	36.6	D
DW Hwy SB Through	35.8	D	43.6	D
DW Hwy SB Right Turn	0.1	A	0.1	A

**Table 7**

<b>Study Area Un-signalized Intersections:</b>	<b>AM Peak Delay (sec.)</b>	<b>AM Peak LOS</b>	<b>PM Peak Delay (sec.)</b>	<b>PM Peak LOS</b>
<b>Bedford Rd/Joppa Rd</b>				
Bedford Rd WB Left Turn	7.6	A	7.5	A
Joppa Rd NB Left Turn	10.7	B	11.6	B
Joppa Rd NB Right Turn	9.6	A	8.9	A
<b>Baboosic Lk Rd/Joppa Rd</b>				
Baboosic Lk Rd EB All movements	7.5	A	7.7	A
Baboosic Lk Rd WB All movements	7.9	A	7.4	A
Joppa Rd NB All Movements	12.4	B	13.0	B
Joppa Rd SB All Movements	15.1	C	13.2	B
<b>Turkey Hill Rd/Amherst St</b>				
Amherst Rd EB Left Turn	2.5	A	7.7	B
Turkey Hill Rd SB Left and Right Turns	171.4	F	40.4	E
<b>Turkey Hill Rd/Baboosic Lk Rd</b>				
Baboosic Lk Rd WB Left Turn	8.5	A	7.7	B
Turkey Hill Rd NB Left and Right Turns	14.0	B	40.4	E
<b>DW Hwy/Wire Rd</b>				
Daniel Webster Hwy NB Left Turn	9.0	A	9.8	A
Wire Rd EB Left and Right Turns	17.3	C	17.1	C

<b>Study Area Un-signalized</b>	<b>AM Peak</b>	<b>AM Peak LOS</b>	<b>PM Peak</b>	<b>PM Peak LOS</b>
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Intersections:	Delay (sec.)		Delay (sec.)	
<b>Bedford Rd/Wire Rd</b>				
Bedford Rd EB All Movements	9.8	A	9.0	A
Bedford Rd WB All Movements	8.4	A	9.9	A
Wire Rd NB All Movements	8.4	A	9.2	A
Wire Rd SB All Movements	9.9	A	8.8	A

## D. Summary of Existing Traffic Conditions

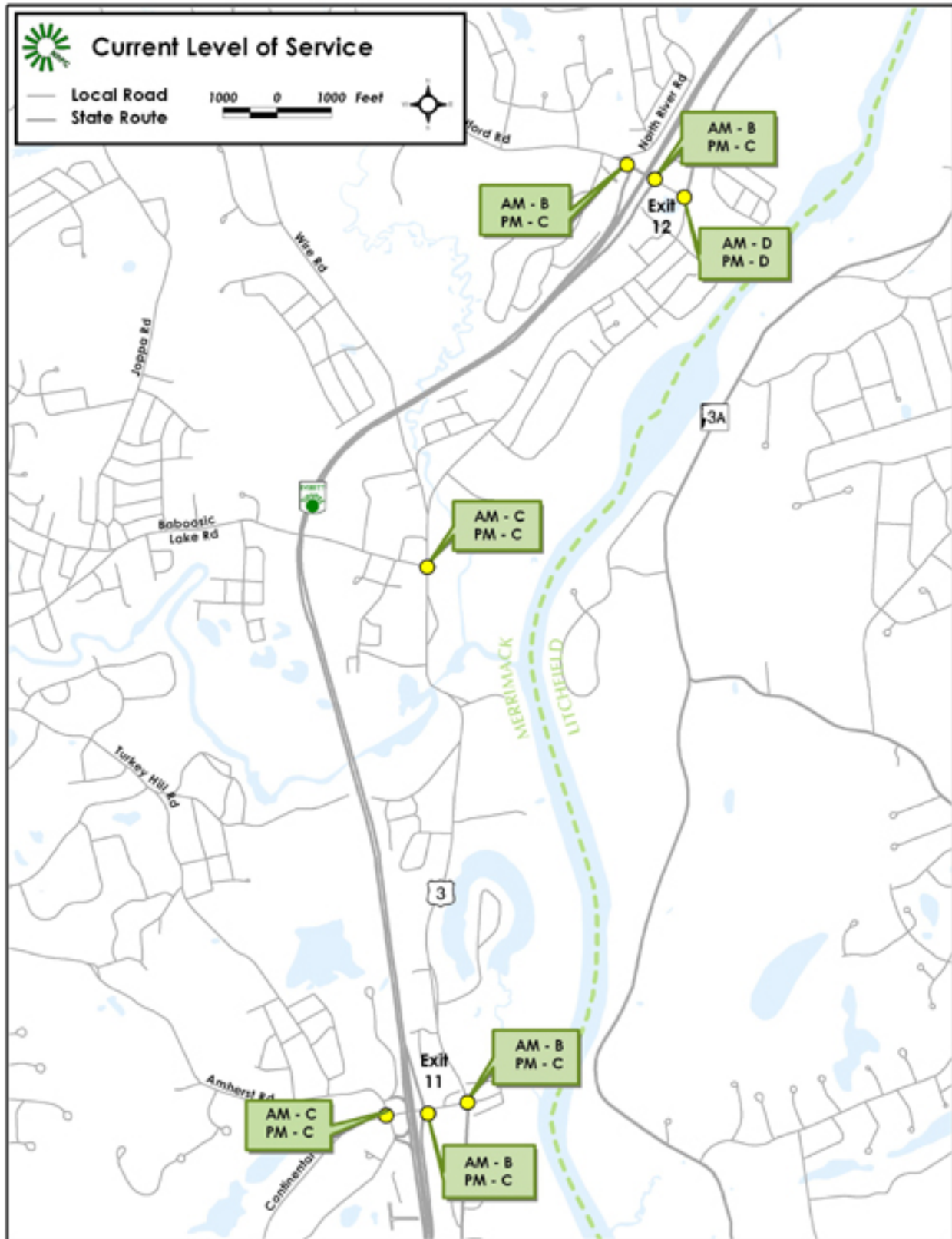
Based on the summary tables, the overall levels-of-service at the study area signalized intersections under existing 2002 morning and afternoon peak hour conditions are at LOS "B" and "C." The summary table shows capacity inadequacies and long delays on specific lane approaches at study area intersections:

- **Bedford Road/Turnpike Exit 12 Off Ramp Intersection** - The Bedford Road westbound through movements currently experience LOS "E" conditions during the afternoon peak.
- **Baboosic Lake Road/Daniel Webster Highway Intersection** - The Baboosic Lake Road eastbound right turns experience LOS "E" during the existing morning peak hour.
- **Continental Blvd./Camp Sargent Road/Amherst Road Intersection** - The Amherst Road southbound left turn movements currently experience LOS "E" conditions during the morning peak hour.

Existing levels-of-service for the critical movements at the study area un-signalized intersections are LOS "C" or better except for two locations.

- **Turkey Hill Road and Amherst Street** - The southbound approach to the intersection operates under LOS "F" and "E" conditions during the existing 2002 AM and PM peak hours respectively. The Town of Merrimack has assigned a police officer for traffic control during the AM peak to mitigate these conditions on weekdays. The LOS analysis in the table summary does not reflect this recent improvement at the intersection.
- **Turkey Hill Road/Baboosic Lake Road Intersection** - The Turkey Hill Road northbound approach operates at LOS "E" during the existing afternoon peak hour.

### FIGURE 4 2002 AM and PM Levels of Service



## FUTURE TRAFFIC CONDITIONS

Future traffic conditions for the purposes of this study were evaluated using two scenarios:

A) A "No Build" scenario in which the configuration of Exit 12 and Bedford Road remained as they are today.

B) A "Build" scenario in which a northbound on-ramp and a southbound off-ramp have been added to the interchange to create a typical diamond interchange. It has been assumed that the two intersections of the FEE Turnpike ramps with Bedford Road would be signalized (as they are today). Addition of the ramps on the north side of Bedford Road would also require realigning the intersection of Back River Road and Bedford Road.

For the purposes of this study, both the "Build" and "No Build" Scenarios assume construction of the Manchester Airport Access Road. Figure 5, below, shows both the No Build and Build configurations of Exit 12.

### A. 2025 Traffic Forecasts

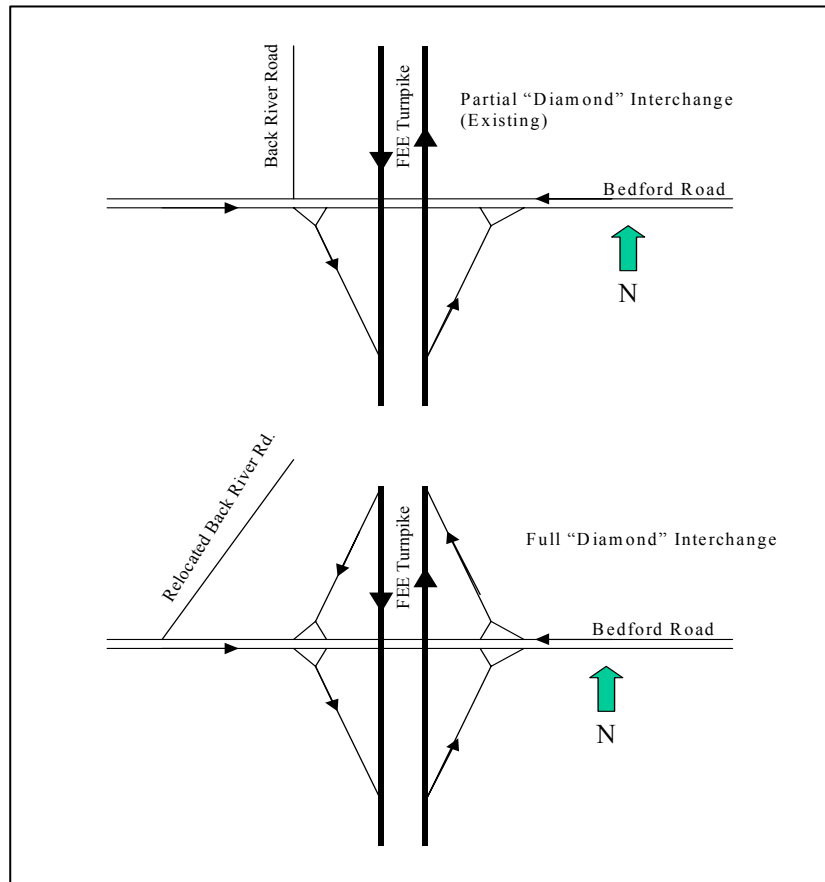
Future traffic volumes were projected to a 20-year horizon, utilizing the NRPC regional traffic model. The traffic model converts land use inputs, specifically the number of housing units, employment and school enrollment, into vehicle trips based on trip generation equations for each specific land use. The trips are then distributed throughout the regional study area and beyond utilizing a "gravity" model. The future development scenario has been developed based on existing land use patterns, local land use policies and zoning, the availability of vacant land and the presence of environmental constraints.

Two traffic model scenarios were run to determine the increase in traffic that can be expected in the 20-year time horizon. The "No-Build" scenario represents future 20-year conditions with a road network that does not include the construction of the proposed ramps. The "Build" scenario represents future 20-year traffic conditions with the construction of the proposed ramps. The percentage increases in traffic from the 24-hour base year volumes to the "No-Build" and the "Build" volumes were applied to the existing 2002 peak hour turning movements to determine the "No-Build" and "Build" peak hour turning movements. Table 7, below compares the most recent traffic counts at key locations with the No Build and Build traffic forecasts for 2025.

Table 6, on the following page shows the forecast traffic volumes at key locations throughout north and central Merrimack. As these traffic forecasts demonstrate the addition of ramps on the northside of Exit 12 would have profound impacts on traffic patterns in the town. The following summarizes the anticipated changes in the traffic patterns:

- **Bedford Road** - The new ramps on the north side of Exit 12 are forecast to attract 33,900 vehicles per day, a very large volume of traffic. Bedford Road will be most impacted by this large volume of new traffic. Traffic will virtually double on Bedford Road west of US 3 Daniel Webster Highway with an increase in the 2025 forecast from 12,400 vehicles per day for the No Build Scenario to 24,200 vehicles per day in the Build scenario. Just west of the FEE Turnpike 2025 forecast traffic will increase from 12,100 vehicles per day in the No Build Scenario to 17,000 vehicles per day in the Build scenario.

**FIGURE 5**  
**Existing and Proposed Exit 12 Interchange**



*Nashua Regional Planning Commission, December 1, 2003*

**Table 8**

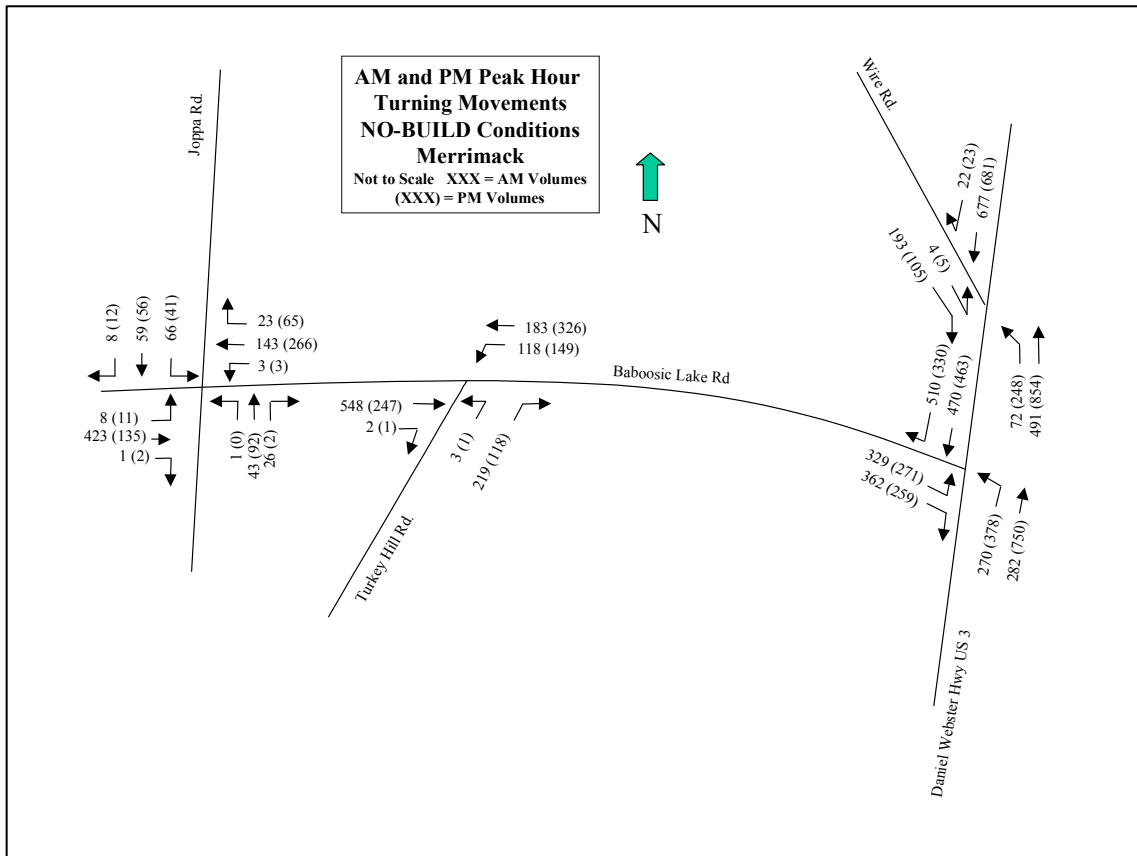
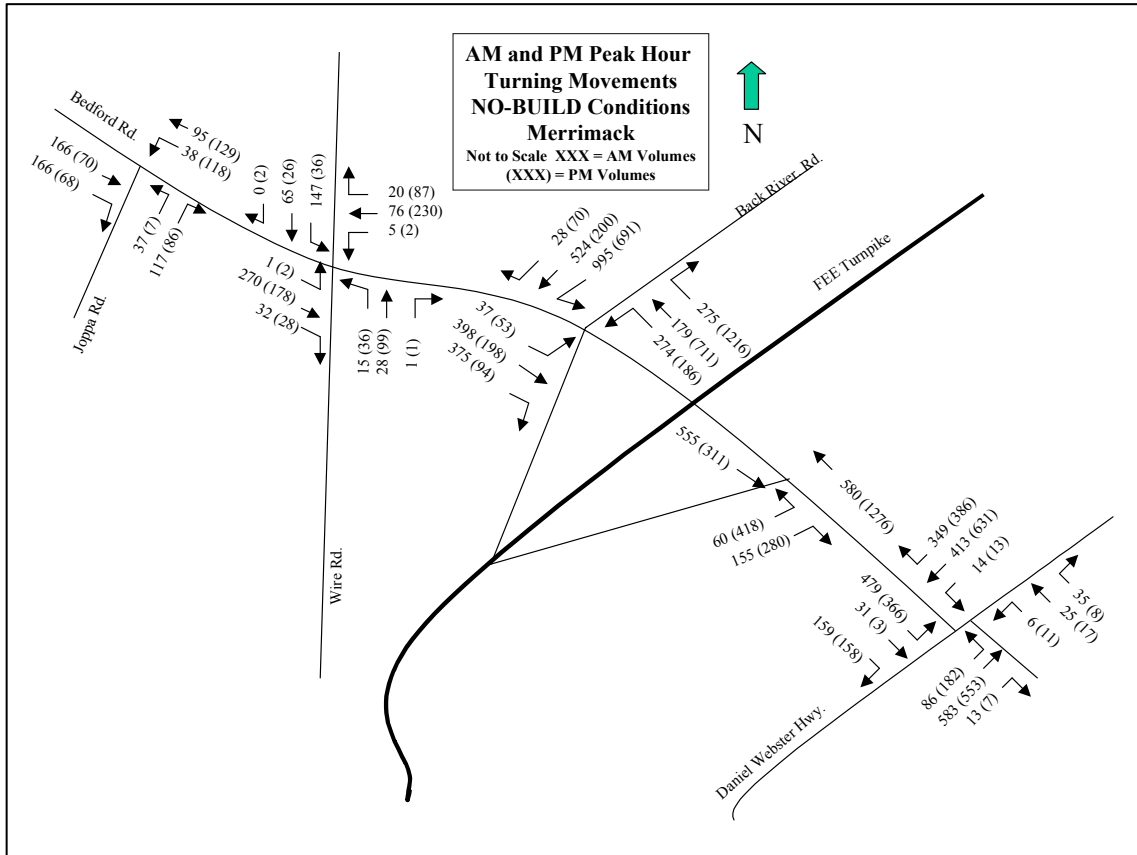
	Recent Traffic Count (year)	2025 Forecast No Build Scenario	2025 Forecast Build Scenario
Bedford Rd. over Baboosic Brook	6,000 (1999)	8,600	6,700
Bedford Road just west of FEE Turnpike	11,400 (2001)	12,100	17,000
Bedford Road just west of US 3 Daniel Webster Hwy	NA	12,400	24,200
Existing Exit 12 Ramps total	9,600 (2003)	10,700	10,600
Proposed Exit 12 north side ramps	NA	NA	33,900
Back River Road at Bedford Town Line	3,000 (2000)	9,400	2,800
US 3 Daniel Webster Hwy north of Bedford Rd.	14,030 (2000)	17,200	13,100
US 3 Daniel Webster Hwy south of Bedford Rd.	16,500 (2000)	18,400	21,100

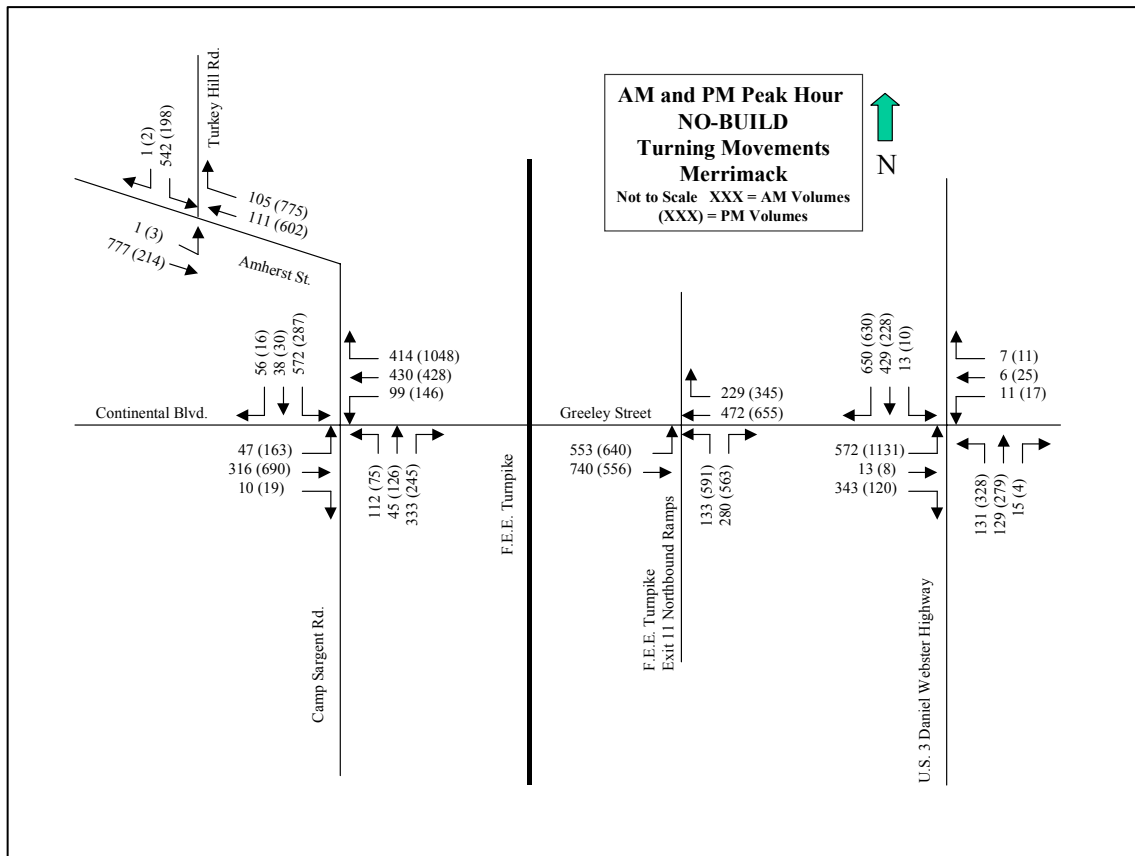
Merrimack FEE Turnpike Exit 12 Ramp Study

	Recent Traffic Count (year)	2025 Forecast No Build Scenario	2025 Forecast Build Scenario
US 3 Daniel Webster Hwy north of Baboosic Lake Rd	14,500 (2000)	15,500	24,000
US 3 Daniel Webster Hwy south of Baboosic Lake Rd	19,400 (1997)	20,600	15,800
US 3 Daniel Webster Hwy north of Greeley St.	20,200 (2000)	25,000	20,400
Baboosic Lake Road east of FEE Turnpike bridge	11,200 (2001)	13,400	13,600
Joppa Road just north of Baboosic Lake Road	2,659 (1997)	2,800	3,300
Greeley Street just west of FEE Turnpike	19,900 (2000)	30,300	28,700
Turkey Hill Road just north of Amherst Road	7,500 (1997)	12,100	10,100

- Roads North of Bedford Road** - Addition of the ramps on the north side of Exit 12 will allow traffic from north Merrimack to access the FEE Turnpike for trips to and from Bedford and other points to the north. As a result, there will be a decrease in traffic on US 3 Daniel Webster Highway and on Back River Road north of Bedford Road. In the 2025 No Build scenario, traffic on Back River Road at the Bedford town line is expected to be 9,400 vehicles per day. In the Build scenario, 2025 traffic is forecast to be lower than current traffic volumes at this same location with only 2,800 vehicles per day. Similarly, traffic on US 3 Daniel Webster Highway is forecast to be 17,200 vehicles per day in the No Build scenario but 13,100 in the 2025 Build scenario.
- Roads between Bedford Road and Baboosic Lake Road** - The addition of ramps on the north side of Exit 12 will also have the effect of attracting traffic from central Merrimack that currently uses Exit 11 to instead use Exit 12. As a result, the addition of the ramps on the north side of Exit 12 results in traffic increases on the collector and main local streets in the area between Bedford Road and Baboosic Lake Road. As shown in Table 6, in 2025 traffic will increase on US 3 Daniel Webster Highway immediately south of Bedford Road from 18,400 in the No Build scenario to 21,100 in the Build scenario. On US 3 Daniel Webster Highway just north of Baboosic Lake Road this increase is expected to be even more pronounced. At that location in the 2025 forecast there is expected to be 15,500 vehicles per day in the No Build scenario but 24,000 in the Build scenario. Similarly, traffic is expected to increase in the 2025 forecast on Joppa Road just north of Baboosic Lake Road from 2,800 in the No Build scenario to 3,300 in the Build scenario.
- Roads between Baboosic Lake Road and Greeley Street** - The addition of ramps on the north side of Exit 12 will also effect traffic on roads between Baboosic Lake Road and Greeley Street. In this area, traffic will be reduced because traffic that formerly traveled south to Exit 11 to access the FEE Turnpike for longer trips north, can now accomplish the same outcome by traveling north to Exit 12. As a result, 2025 forecast traffic on US 3 Daniel Webster Highway immediately north of Greeley Street will decrease from 25,000 vehicles per day in the No Build scenario to 20,400 vehicles per day in the Build scenario. Similarly, 2025 traffic forecast on Turkey Hill Road just north of Amherst Road will decrease from 12,100 in the No Build Scenario to 10,100 in the Build scenario.

## FIGURE 6 2025 No-Build AM and PM Peak Turning Movements

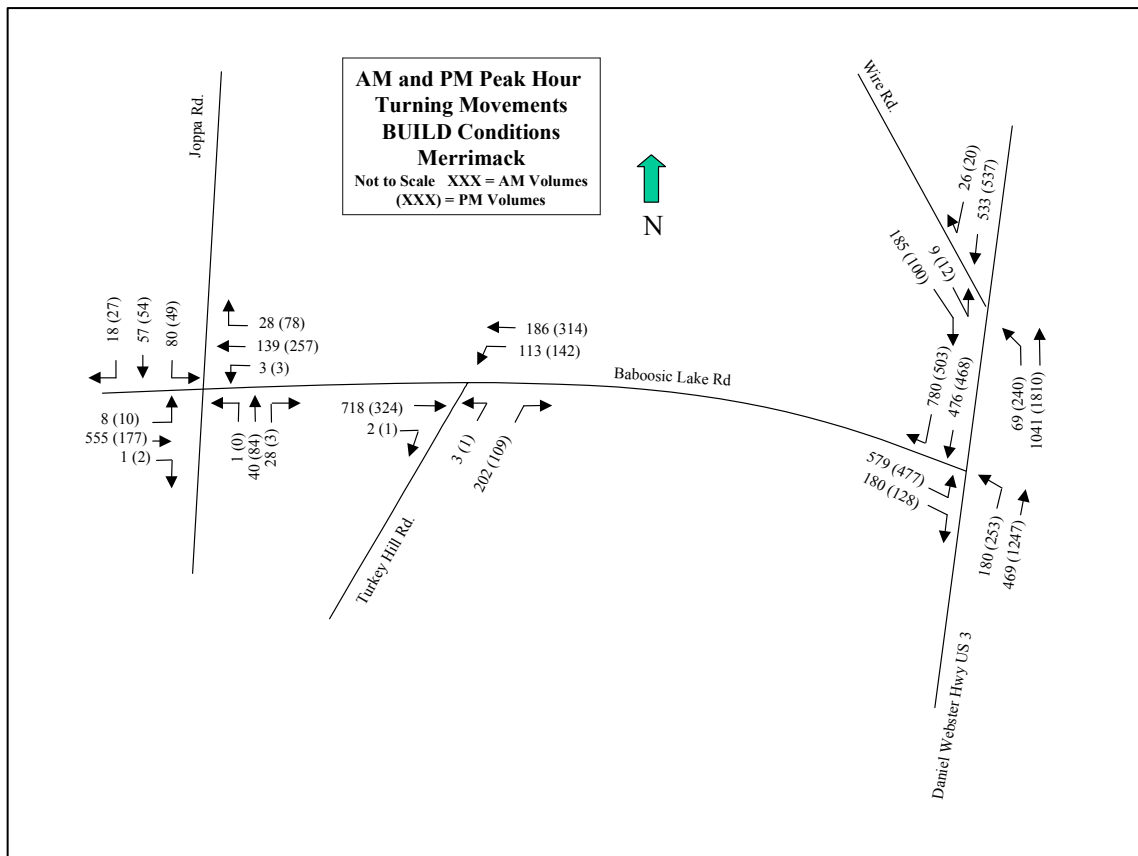
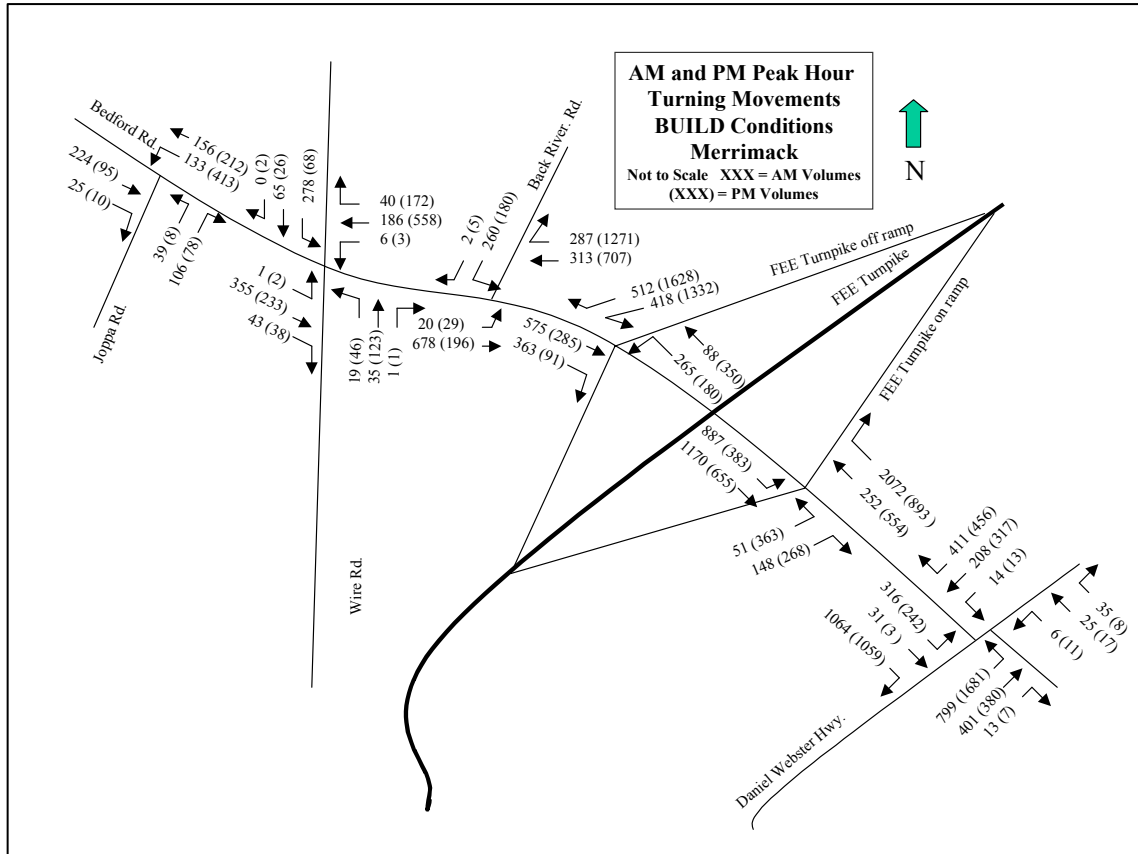


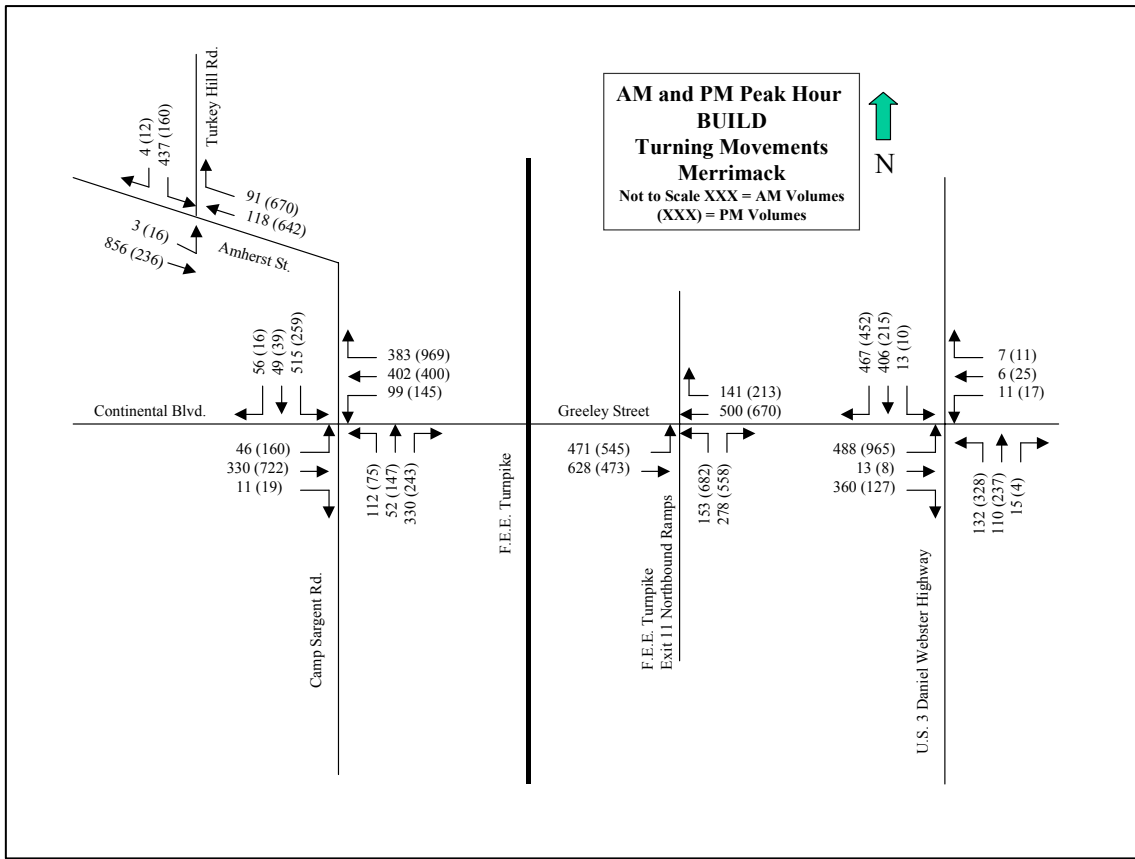


Nashua Regional Planning Commission, December 1, 2003

These changes in the traffic patterns in the north and central sections of Merrimack will also strongly effect the turning movements that are expected to take place a key intersections in the area and as a result effect the Level of Service that is expected in the future. Figure 6 on the preceding page shows the 2025 turning movement forecasts for the No Build scenario. Figure 7 on the following pages shows the 2025 turning movement forecasts for the Build scenario. The 2025 Level of Service and forecast delay for all intersection movements at signalized intersections for both the No Build and Build scenarios is shown in Table 7. The 2025 Level of Service and forecast delay for all intersection movements for unsignalized intersections for both No Build and Build scenarios is shown in Table 8.

## FIGURE 7 2025 Build AM and PM Peak Turning Movements





Nashua Regional Planning Commission, December 1, 2003

Table 9

Study Area Signalized Intersections:	No-Build Scenario				Build Scenario			
	AM Peak LOS	AM Peak Delay (sec.)	PM Peak LOS	PM Peak Delay (sec.)	AM Peak LOS	AM Peak Delay (sec.)	PM Peak LOS	PM Peak Delay (sec.)
<b>Bedford Rd./Back River Rd./FEET SB ON RAMPS EXIT 12</b>								
Overall	F	170.4	F	186.9				
Bedford Rd EB Left Turn	B	17.7	C	27.7				
Bedford Rd EB Through	D	49.2	B	12.2				
Bedford Rd EB Right Turn	A	0.4	A	0.0				
Bedford Rd WB Left Turn	C	28.1	D	38.1				
Bedford Rd WB Through	C	23.4	F	205.8				
Back River Rd SB All Moves	F	314.9	F	241.0				
<b>Bedford Rd./FEET Southbound ON RAMPS EXIT 12</b>								
Overall					B	18.5	E	63.4
Bedford Rd EB Through					C	31.6	C	26.6
Bedford Rd EB Right					A	0.4	A	0.1
Bedford Rd WB Left					D	47.5	D	36.6
Bedford Rd WB Through					B	12.6	B	16.2
SB FEE Off ramp Left					C	20.8	F	92.1
SB FEE Off ramp Right					A	0.6	E	63.0
<b>Bedford Rd./FEET Northbound OFF RAMPS EXIT 12</b>								
Overall	B	13.1	F	166.6	F	127.2	C	30.2
Bedford Rd EB Left Turn	NA	NA	NA	NA	F	153.1	F	97.4
Bedford Rd EB Through	B	12.4	B	15.3	C	21.8	B	13.7
Bedford Rd WB Through	B	13.1	F	281.6	C	28.9	D	41.9
Bedford Rd WB Right Turn	NA	NA	NA	NA	F	195.1	A	1.8
Exit 12 off Ramp Left Turn	B	13.8	C	24.9	D	35.4	D	39.5
Exit 12 off Ramp Right Turn	B	15.2	C	21.4	D	51.5	C	32.4

Merrimack FEE Turnpike Exit 12 Ramp Study

Study Area Signalized Intersections (continued):	No-Build Scenario				Build Scenario			
	AM Peak LOS	AM Peak Delay (sec.)	PM Peak LOS	PM Peak Delay (sec.)	AM Peak LOS	AM Peak Delay (sec.)	PM Peak LOS	PM Peak Delay (sec.)
<b>Bedford Rd/DW Hwy</b>								
<b>Overall</b>	<b>D</b>	<b>46.8</b>	<b>D</b>	<b>51.2</b>	<b>F</b>	<b>123.1</b>	<b>F</b>	<b>327</b>
Bedford Rd EB Left and Through	F	101.7	F	160.0	F	92.0	F	81.0
Bedford Rd EB Right Turn	A	9.6	A	0.0	A	1.7	A	1.7
Parking Lot WB All Moves	B	17.6	C	27.6	C	24.6	C	29.1
DW Hwy NB Left Turn	D	39.3	C	30.6	F	388.2	F	788.6
DW Hwy NB Through and Right	C	21.7	B	10.6	B	10.3	A	7.0
DW Hwy SB Left and Through	D	42.8	E	74.4	C	31.3	D	36.1
DW Hwy SB Right Turn	D	37.3	A	0.1	F	123.9	A	0.1
<b>Baboosic Lk Rd/DW Hwy</b>								
<b>Overall</b>	<b>D</b>	<b>44.3</b>	<b>D</b>	<b>40.5</b>	<b>F</b>	<b>145.9</b>	<b>F</b>	<b>133.2</b>
Baboosic Lk Rd EB Left Turn	D	35.1	C	28.9	F	99.2	E	63.1
Baboosic Lk Rd EB Right Turn	E	77.3	C	30.1	B	15.2	C	22.5
DW Hwy NB Left Turn	B	19.8	E	56.6	B	17.4	C	25.5
DW Hwy NB Through	A	8.2	C	29.9	B	15.5	F	260.5
DW Hwy SB Through	C	26.7	E	57.2	D	41.0	C	30.2
DW Hwy SB Right Turn	E	76.0	D	39.8	F	382.7	E	62.4
<b>Greeley St/FEE Ramps Exit 11</b>								
<b>Overall</b>	<b>C</b>	<b>21.3</b>	<b>C</b>	<b>33.9</b>	<b>B</b>	<b>19.4</b>	<b>C</b>	<b>27.8</b>
Greeley St EB Left Turns	D	37.4	D	49.0	C	28.0	D	37.8
Greeley St EB Through	A	3.5	A	6.9	A	3.4	A	7.9
Greeley St WB Through and Right	C	26.6	D	53.4	C	25.9	D	39.5
FEE Ramps NB Left Turn	D	37.7	D	42.0	D	38.2	D	40.8
FEE Ramps NB Right Turn	B	15.5	A	0.2	B	15.5	A	0.2
<b>Continental Blvd/Amherst Rd/Camp Sargent Rd.</b>								
<b>Overall</b>	<b>D</b>	<b>41.2</b>	<b>D</b>	<b>44.2</b>	<b>D</b>	<b>42.9</b>	<b>D</b>	<b>40</b>
Continental Blvd EB Left Turn	D	42.6	D	37.2	D	37.5	C	33.6
Continental Blvd EB Through	D	53.4	E	75.8	D	44.5	D	47.3
Continental Blvd WB Through	E	57.9	E	61.7	E	69.4	E	61.7
Continental Blvd WB Right Turn	A	5.2	B	14.2	A	5.7	B	17.2
Camp Sargent Rd NB Left Turn	E	66.9	D	47.2	D	53.7	D	47.2
Camp Sargent Rd NB Through	D	48.0	E	65.9	D	42.7	E	65.9
Camp Sargent Rd NB Right Turn	C	25.9	C	20.6	C	24.5	C	20.6
Amherst Rd SB Left Turn	D	53.0	D	46.8	E	59.9	E	66.5
Amherst Rd SB Through	C	24.3	C	35.5	C	23.2	D	37.8
Amherst Rd SB Right Turn	A	1.2	A	1.5	A	1.4	A	1.5
<b>Greeley St/DW Hwy.</b>								
<b>Overall</b>	<b>B</b>	<b>14.6</b>	<b>C</b>	<b>23.4</b>	<b>B</b>	<b>15.1</b>	<b>C</b>	<b>21.8</b>
Greeley St EB Left Turn	B	11.4	C	24.4	B	10.5	B	10.8
Greeley St EB Through	B	12.4	A	9.3	B	12.4	A	7.3
Greeley St EB Right Turn	A	4.0	A	2.2	A	4.1	A	2.2
Greeley St WB All Moves	B	12.5	A	9.6	B	12.5	A	7.5
DW Hwy NB Left Turn	C	30.2	D	45.3	C	30.2	E	66.8
DW Hwy NB Through and Right	B	17.6	C	29.7	B	17.5	C	33.2
DW Hwy SB Left Turn	C	30.1	D	41.7	C	30.0	D	41.6
Dw Hwy SB Through	D	37.3	D	45.1	D	36.2	D	44.7
DW Hwy SB Right Turn	A	0.2	A	0.2	A	0.1	A	0.1

**Table 10**

Study Area Un-Signalized Intersections:	No-Build Scenario				Build Scenario			
	AM Peak LOS	AM Peak Delay (sec.)	PM Peak LOS	PM Peak Delay (sec.)	AM Peak LOS	AM Peak Delay (sec.)	PM Peak LOS	PM Peak Delay (sec.)
<b>Bedford Rd/Joppa Rd</b>								
Bedford Rd WB Left Turn	A	8.0	A	7.7	A	8.0	A	8.3
Joppa Rd NB Left Turn	B	11.7	B	12.1	C	15.3	D	28.2
Joppa Rd NB Right Turn	B	10.3	A	9.1	B	10.1	A	9.1
<b>Baboosic Lk Rd/Joppa Rd</b>								
Baboosic Lk Rd EB All movements	A	7.5	A	7.9	A	7.5	A	7.9
Baboosic Lk Rd WB All movements	A	8.1	A	7.5	A	8.5	A	7.6
Joppa Rd NB All Movements	B	14.0	B	14.4	C	15.9	B	14.8
Joppa Rd SB All Movements	C	19.0	B	13.5	D	25.5	C	15.7
<b>Turkey Hill Rd/Amherst Road</b>								
Amherst Rd EB Left Turn	A	7.6	B	12.2	A	7.6	B	11.9
Turkey Hill Rd SB Left and Right	F	423.4	F	106.6	F	354.0	F	89.1
<b>Turkey Hill Rd/Baboosic Lk Rd</b>								
Baboosic Lk Rd WB Left Turn	A	8.9	A	8	A	8.2	A	8.3
Turkey Hill Rd NB Left and Right	C	16.6	B	10.4	B	12.1	B	11.2
<b>DW Hwy/Wire Rd</b>								
Daniel Webster Hwy NB Left Turn	A	9.3	B	10.5	A	8.8	A	9.6
Wire Rd EB Left and Right Turns	C	20	C	22.0	C	19.4	F	150.9
<b>Bedford Rd/Wire Rd</b>								
Bedford Rd EB All Movements	B	10.6	A	9.6	C	16.9	B	13.5
Bedford Rd WB All Movements	A	8.6	B	10.6	B	12.1	F	73.6
Wire Rd NB All Movements	A	8.6	A	9.6	B	10.3	B	13.0
Wire Rd SB All Movements	B	10.2	A	9.0	C	16.5	B	11.8
<b>Bedford Rd/Back River Rd.</b>								
Bedford Rd. EB Left and Through					A	8.7	C	18.5
Back River Rd. SB Left and Right					F	188.2	F	425.5

## B. Future Traffic Analysis Summary

As described above, the No Build scenario represents the traffic conditions that can be expected in Merrimack in 2025 based on expected growth in population and employment and without any changes to the town's road network. Based on that analysis, there are two signalized intersections in town that will operate at Level of Service F in 2025 in either the morning or afternoon peak hours or both and one unsignalized intersection that will experience Level of Service F for one of the movements.

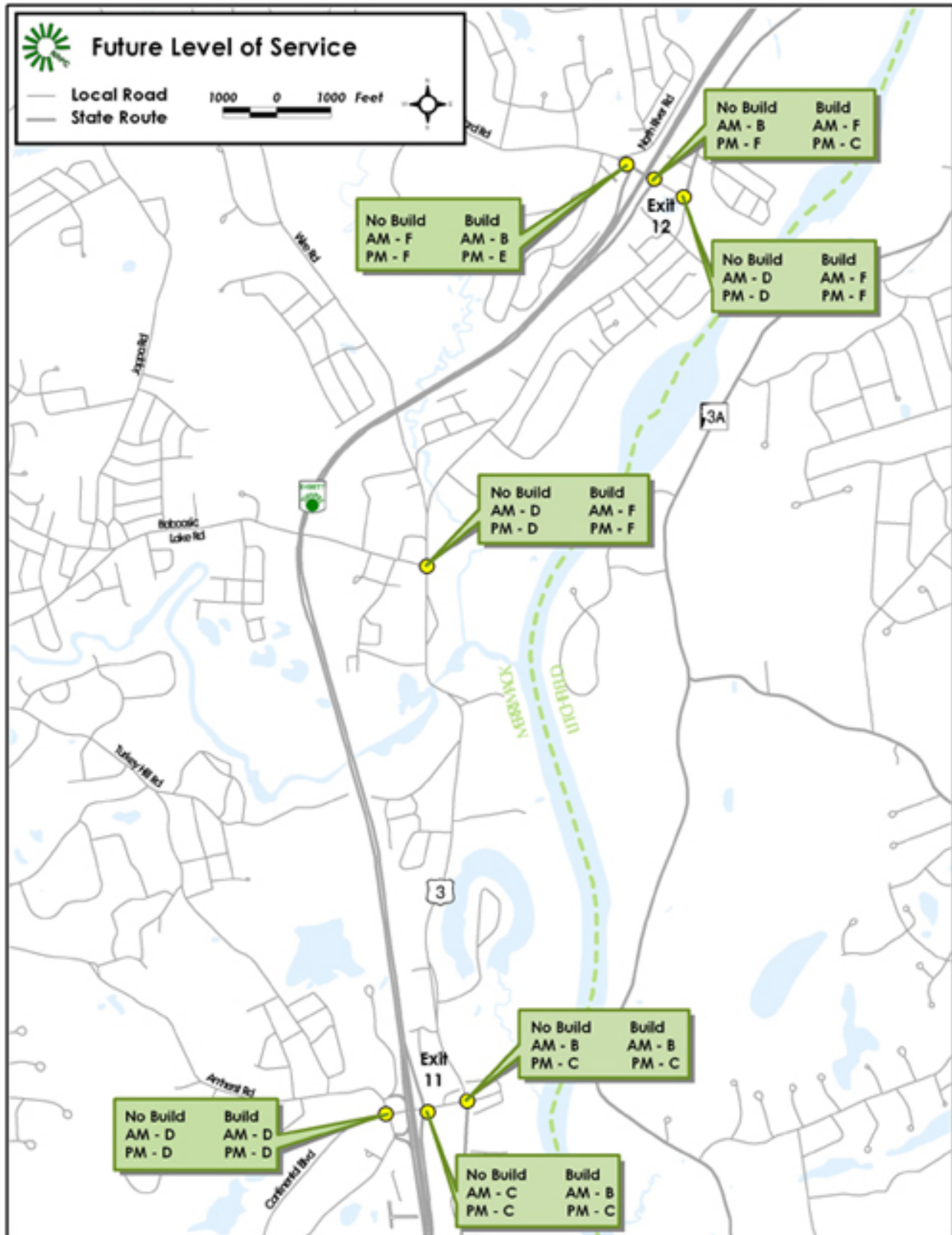
- **Bedford Road/Back River Road/Exit 12 Turnpike Southbound on Ramp** - This intersection will operate under LOS "F" conditions during both the morning and afternoon peak hours under the future No-Build conditions. This very poor level of service is mainly the result of very high amounts of delay on all the movements out of Back River Road. In addition, the westbound through traffic on Bedford Road will operate a Level of Service F in the afternoon peak period.
- **Bedford Road/Exit 12 Turnpike Northbound Off Ramp** - This intersection will operate under LOS "F" conditions during the afternoon peak hour in the No-Build scenario. This is due to the very heavy volume of westbound traffic on Bedford Road at that time.

- **Turkey Hill Road/Amherst Road Intersection** - The southbound left from Turkey Hill Road to Amherst Road eastbound will operate at Level of Service F in both the morning and afternoon peak periods.

If the ramps are added to the north side of Exit 12, the changes in the traffic patterns that are described above will impact the operations of a number of intersections throughout the north and central parts of Merrimack.

- **Bedford Road/FEE Turnpike Southbound On and Off Ramps** - The intersection Level of Service at this intersection will improve due to the fact that the Back River Road leg will have been removed and replaced with the FEE Turnpike southbound off-ramp. During the morning peak, the intersection Level of Service will improve from F to a B and in the afternoon peak the Level of Service will improve from an F to an E.
- **Bedford Road/Back River Road Unsignalized Intersection** - As described earlier, this will be a new intersection created by the realignment of the south end of Back River Road to accommodate the new southbound off-ramp. This intersection will operate at Level of Service F in both the morning and afternoon peak hours.
- **Bedford Road/FEE Turnpike Northbound On and Off Ramps** - This intersection will operate at Level of Service F in the morning peak period due to very heavy traffic on the Bedford Road eastbound left into the new northbound on-ramp, and the Bedford Road westbound right into the same ramp.
- **Bedford Road/US 3 Daniel Webster Highway** - This intersection will operate at Level of Service F in both the morning and afternoon peak periods. This is due to the very heavy traffic volumes on both the Bedford Road eastbound left turn and also on the US 3 Daniel Webster Highway northbound left.
- **Baboosic Lake Road/US 3 Daniel Webster Highway** - This intersection will also operate at Level of Service F in both the morning and afternoon peak hours.

## FIGURE 8 2025 Level Of Service For No-Build And Build Scenarios

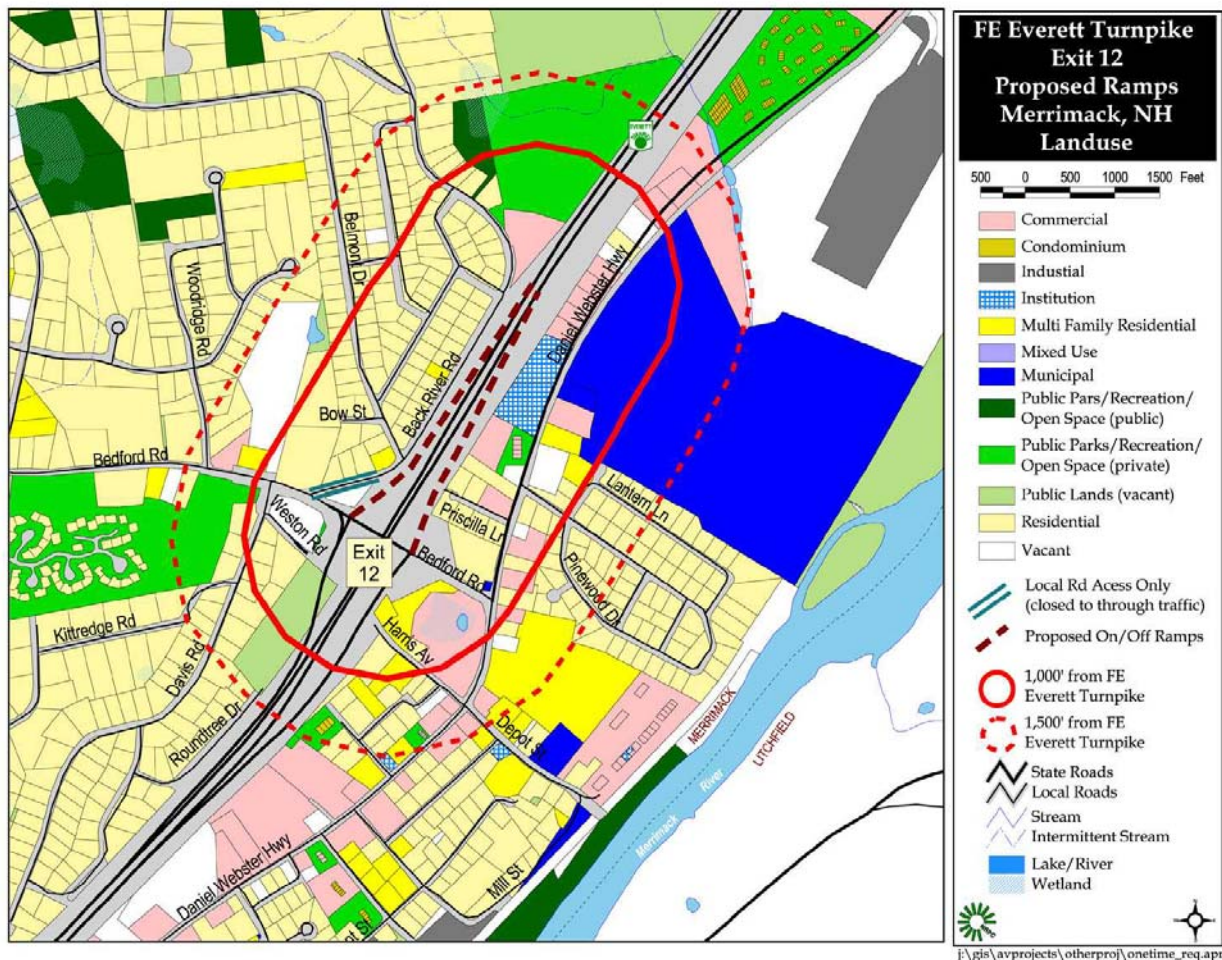


Nashua Regional Planning Commission, December 1, 2003

# EFFECTS ON LAND USE, THE ENVIRONMENTAL AND QUALITY OF LIFE

Figure 9 shows the proposed on and off ramps located north of Bedford Road. The corridors for the proposed ramps were digitally generated based on the length of the existing ramps south of Bedford Road. The new ramps will complete the diamond intersection and join Bedford Road with a 4 way intersection. The Town of Merrimack 1979 Parcel Map indicates the FE Everett Turnpike (FEE) has a right-of-way (ROW) of approximately 110 feet between the FEE and the Back River Road pavement. The NH DOT Bureau of Turnpikes confirmed this estimation. Barring extensive grading for the southbound off ramp to Bedford Road, this width should accommodate a one lane ramp. The segment of Back River Road shown as a dashed turquoise line on Figure 9 would most likely have to be re-connected between Belmont Drive and Bedford Road to keep ramp traffic separated from local traffic. The upgrades to this segment could impact up to four residential properties. The ROW impacts will be finalized during the preliminary engineering design phase. If the ROW between the FEE and Back River Road does not accommodate the off ramp, approximately twelve single and multiple family residential properties along Back River Road may be impacted.

**Figure 9**  
**Existing Land Uses Surrounding Proposed Ramps**

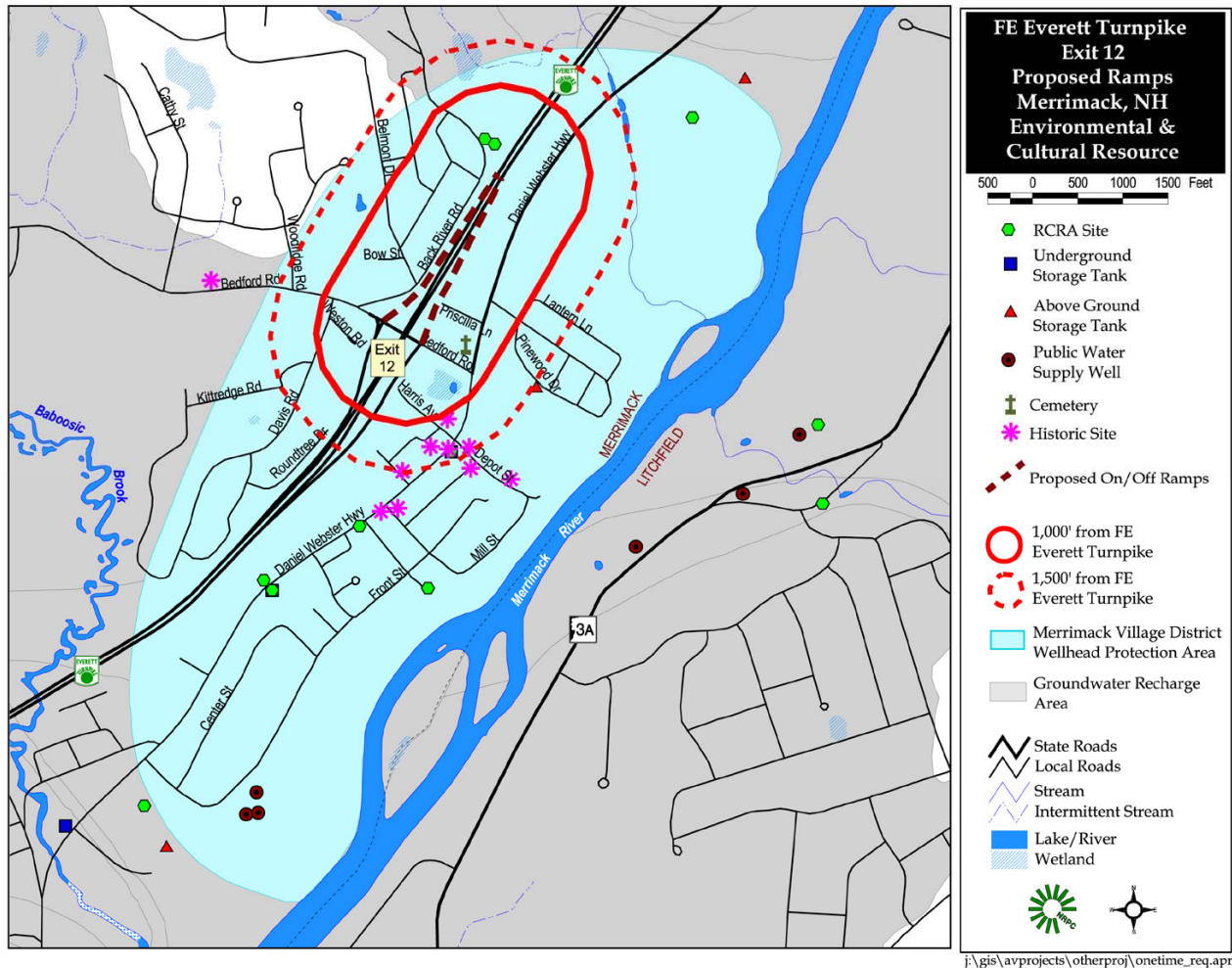


There is a width of approximately 110 feet between the residential properties at the end of Priscilla Lane and the commercial and institutional properties on the eastern side off the FEE Turnpike. These properties will most likely be impacted due to the steep grade from Bedford Road down to the FEE and the possibility of including an additional, separated turn lane onto the northbound on ramp.

Figure 10, below, shows the environmental and cultural resources in the project area. The entire project area is within the Department of Environmental Services Wellhead Protection Area for the Merrimack Village District (MVD) public drinking water wells. According to MVD, a 16-inch water main runs from DW Highway under the FEE Turnpike to Belmont Drive. A water main runs along the west side of Back River Road and down Priscilla Lane, which suggests that private well contamination is not an issue. Inquiries of local officials and information from the New Hampshire GRANIT database indicate that there are no significant natural resources within the study area that would be impacted.

However, the amount of stormwater flowing to the Merrimack River from the FEE Turnpike and streets within the project area has increased dramatically due to development. The Nashua Regional Planning Commission and DES researched the closed drainage system as

**Figure 10**  
**Environmental and Cultural Resources**



part of a water quality and stream bank erosion investigation of the stormwater outfall at the intersection of Depot and Mill Streets. Pre-treatment of stormwater drainage or on-site filtration should be considered during the design phase prior to entering a closed pipe system. The wetland to the south of Bedford Road and west of DW Highway is a fairly healthy system despite the surrounding development and impervious surfaces. Any drainage to this wetland should be avoided.

Within the study area, there is an old cemetery with surrounding stone walls that is listed on the Historical Register. According to the Heritage Commission, there are old and significant structures that do not appear on the map because they are not on the Historical Register data layer. This includes a Victorian house (Lot 6E2-2) that lies directly north of the cemetery. A Georgian Cape with a central chimney is on the corner of Priscilla Lane and DW Highway (Lot 6E2-3). The old Smith Barn is now Silos Restaurant. If a proposed Reeds Ferry Historic District were established, then all four properties would be included in the Historic District Overlay.

This project should not have a significant effect upon environmental or cultural resources as long as plans do not call for a separate turning lane for the proposed northbound on ramp that may necessitate encroachment on the cemetery property (Lot 6E2-1).

The construction of this project would result in significant air quality benefit. An air quality analysis conducted by NRPC shows that the addition of these ramps would reduce hydrocarbon emissions by 13.63 kilograms per day and emissions of nitrous oxides by 20.54 kilograms per day. This represents a total decrease in pollutants of 34.17 kilograms per day. This is a very large relative decrease in pollutants.

The traffic analysis conducted for this study using the NRPC Travel Demand model also gives some indication of changes in the quality of life of Merrimack residents that would result from the construction of the ramps on the north side of Exit 12. The model shows that driving by Merrimack residents would decrease by 62,447 miles per day if the ramps were added to the north side of Exit 12. In terms of travel time, this represents a decrease in driving time of 4.26 minutes per person per day for Merrimack residents or 25.9 hours per year per person.

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