

# Roadway Infrastructure Master Planning Study Merrimack, New Hampshire



Prepared For:  
**Town of Merrimack, New Hampshire**  
**Community Development Department**



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### Roadway Infrastructure Master Planning Study Merrimack, New Hampshire



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## Executive Summary

### Roadway Infrastructure Master Planning Study Merrimack, New Hampshire



## EXECUTIVE SUMMARY

### Study Purpose

The Town of Merrimack, New Hampshire, ranked by CNN Money as one of the top 50 livable small communities in the country, is in the midst of a significant economic growth spurt. Its two key north-south access corridors, the FE Everett Turnpike and the Daniel Webster Highway (Route 3) are the focus of intense economic activity. This Merrimack, New Hampshire Roadway Infrastructure Master Plan provides a guide to the Town in anticipating and accommodating future traffic growth in a way that maintains an acceptable quality of life for Merrimack residents and visitors alike.

The Infrastructure Master Plan that follows culminates more than 2 years of effort by the Town, NRPC and FST to identify Merrimack's existing and future roadway infrastructure problem areas and potential solutions that may occur through a combination of public and private infrastructure investments. The Plan is not 'cast in stone'. Its findings are intended be used as a tool to help the Town plan for its impending growth. The Plan is flexible and readily updatable as new information emerges regarding development plans on specific parcels and will assist the Town in evaluating parcel development plans as they come on line.

Two roadway infrastructure phasing forecasts were performed by NRPC in cooperation with the Town and evaluated by FST -- Short Range, through the year 2017, and Long Range, from 2017 through 2027. Forecasts are updatable and will be updated as new changes occur.

### Major Findings

Table ES-1 starting on the page that follows summarizes in alphabetical order potential short- and long-range improvement strategies in Merrimack, NH by intersection. Refer to Chapter IV for details on where and when traffic growth is expected, and just as importantly, where it *isn't* expected and on local streets. NRPC projects that by the year 2017, if development and background trends continue, traffic volumes will overall be approximately 49% higher, *on average*, than found in 2007. By the year 2027, Merrimack's traffic volumes will, *on average*, be approximately 63-65% higher than they were in 2007. The source of the traffic growth will be new development to go along with population and regional travel through Merrimack, primarily on the arterial systems of FE Everett Turnpike and the Daniel Webster Highway (DWH - US Route 3).

Because much of DWH through Merrimack is under the jurisdiction of New Hampshire Department of Transportation (NHDOT), it is assumed that fundamentally, the *DWH needs to maintain its efficiency at accommodating through traffic to the maximum extent possible, while concurrently accommodating access to abutting properties, including those where redevelopment or development is contemplated.* Good access management suggests that traffic signalization should be a last, not first, resort for DWH traffic control.

Therefore, we recommend the Town work with development property owners adjacent to DWH to consolidate their driveway access demands with new parallel service/distribution roads providing access to existing traffic signals on both sides of DWH *where it makes sense to do so.*

**Table ES-1  
Summary of Potential Short-Range and Long-Range Improvement Strategies in Merrimack, NH**

Location	Implementation Period	Improvements	Results
Amherst at Turkey Hill Rd	Prior to 2017	Consider traffic signal control at this intersection with or without possible geometric improvements	Intersection operations improve from LOS F in the AM and PM to a LOS C in the AM and LOS D in the PM for both 2017 and 2027 mitigated cases.
Camp Sergeant Rd, Burger King, Shaw's, and Greeley Street	Prior to 2017	Either coordinate and retime signals, or explore the potential for eliminating left turns from Greeley Street/Continental Boulevard by relocating them, if possible.	See improvement graphic for overall changes in intersection operations at these four locations with signal coordination/timing changes; modest improvements occur during the AM and PM peak hours. With left lane diversions, the LOS goes to D overall during the AM and PM peak hours by 2027.
Continental Blvd at Industrial Drive	Prior to 2017	Adjust signal timing to improve intersection operations.	Levels of service improve one grade from LOS C to B during the AM and LOS D to C during the PM in 2017 and 2027
Daniel Webster Highway (US Route 3) at Baboosic Lake Rd	Prior to 2017	Adjust signal timing to improve intersection operations.	Projected 2017AM and PM peak hour levels of service C-D do not change with the timing modifications, but average motorist delays are reduced by 10-20 seconds in 2017 and 2027. Similarly, PM peak hour LOS would remain C during 2017, but with a reduction of approximately 10 seconds from LOS E to LOS D by 2027.
Daniel Webster Highway (US Route 3) at East Chamberlain Rd	Prior to 2017	Evaluate geometric modification to reduce size of East Chamberlain Road opening and improve access for lefts in and consider peak hour left turn restrictions if safety problems are found with higher future Daniel Webster Highway volumes	Levels of service with or without the geometric changes are similar; traffic operations improve to D during the PM peak hour, but AM peak hour will operate with delays unless gaps are created by upstream and downstream traffic signals.
Daniel Webster Highway (US Route 3) at Greeley St	Prior to 2017	Optimize signal timing during PM peak period. Consider modifying westbound Greeley Street approach to create an exclusive left turn lane and a shared right/through lane	PM peak hour levels of service improve from LOS E and LOS F in 2017 and 2027, respectively, to LOS D.
Daniel Webster Highway (US Route 3) at Harris Pond Drive North and Parcel B - Edgebrook Heights	Prior to 2017	Provide new access to development Parcel B - Edgebrook Heights opposite Harris Pond Drive north. Provide an exclusive left turn lane from the future commercial driveway and a shared through /left lane. Adjust phasing and timing to optimize signal operations.	LOS F during both peak hours improves to B/C by 2017 and D by 2027.

**Table ES-1  
Summary of Potential Short-Range and Long-Range Improvement Strategies in Merrimack, NH (Continued)**

Location	Implementation Period	Improvements	Results
Daniel Webster Highway (US Route 3) at Manchester Street	Prior to 2017	Consider one of two options. Either signalize the intersection and provide a two lane approach on Manchester Street. This location is a higher priority for signalization than Henry Clay Drive/Mast Road. Or relocate Manchester Street traffic via a new connection to the existing BAE Systems traffic signal if right-of-way issues can be worked out along the Parcel D - BAE Systems.	LOS F during both peak hours improves to LOS A in 2017 and LOS B-C by 2027.
Daniel Webster Highway (US Route 3) at Parcel G - Kollsman	Prior to 2017	Evaluate the potential for three access points with a possible fourth egress. The primary access may be via the existing Kollsman/Budweiser signal. A secondary entrance would include a possible signalized intersection approximately 1,000 feet north of Industrial Drive or an unsignalized left-in, right-in/right out unsignalized access whether stop or yield control from Parcel G - Kollsman to Industrial Drive in the direction of Exit 10 might also be considered.	LOS F operations during both peak hours improve to LOS A-C during both peak hours.
Daniel Webster Highway (US Route 3) at Parcel H - Flatley	Prior to 2017	Create at least two access points. Check to see if the primary access location meets signal warrants. If development of Parcel H <u>follows</u> the Exit 12 improvements, it may not be necessary to signalize it and full traffic movements may be allowable at both access point. The secondary driveway access is assumed to be right-in and right-out with left turns in only without Exit 12 improvements.	By 2017, without mitigation, Parcel H - Flatley at Daniel Webster Highway will operate at LOS F and LOS A with mitigation. By 2027, due to a projected decline in Daniel Webster Highway traffic in front of the site, the projected AM level of service will be C without signalization, but the PM would be LOS F without signalization. The LOS with signalization would be A during both peak hours.
Daniel Webster Highway (US Route 3) at Pond View and Island Drives	Prior to 2017	Evaluate either signal control or potential geometric modifications such as a modern one-lane roundabout.	Peak hour operations on Daniel Webster Highway would slow and speeds both northbound and southbound would decline. Alternative traffic signal control if warrants met; otherwise the LOS goes from E existing to LOS F in both 2017 and 2027. A single lane roundabout would slow through traffic flow at all times of the day and would operate with congestion during peak hours if growth occurs as projected by NRPC.

**Table ES-1  
Summary of Potential Short-Range and Long-Range Improvement Strategies in Merrimack, NH (Continued)**

Location	Implementation Period	Improvements	Results
Daniel Webster Highway (US Route 3) at Railroad Ave S & Auto Body Drive.	Prior to 2017	If gaps are not metered by upstream and downstream traffic signals, consider restricting all left-turning vehicles on the Railroad Avenue approach to Daniel Webster Highway and allowing right turns in and out only during the AM and PM peak periods. vehicles desiring left turns can make a U-turn at the Connell's Plaza (CVS) signal to the north and at the Rite Aid Plaza signal south of the intersection via Daniel Webster Highway. Alternatively, consider making north and south Railroad Avenue a one-way pair. consider optional geometric safety modifications. signal warrants are unlikely to be met and signal control visibility after the southbound horizontal curve on Daniel Webster Highway would be problematic. Greenspace would increase with geometric modifications.	LOS F is expected during both peak hours by 2017. Restricting exiting traffic to rights in and out improves the LOS to C during 2017, but congestion would occur during the PM peak hour by 2027.
Daniel Webster Highway (US Route 3) at Star Drive	Prior to 2017	Consider signalizing Star Drive at Daniel Webster Highway if future warrants are met. Consider alternative access for abandoned westerly parcel to line up better with Star Drive when a new use occupies the former McDonald's site. Alternate access should enhance safety by eliminating closely spaced and offset left turn movements.	LOS F is expected during both peak hours by 2017. Signalization will improve the expected LOS to A from 2017 to 2027 and create an opportunity to access parcels to the east of the B&M railroad with a new at grade crossing. Geometric modifications should enhance safety.
Daniel Webster Highway (US Route 3) at Wire Road	Prior to 2017	Check to see if location meets signal warrants. If so, signalize the intersection and evaluate potential improvements to existing geometry.	Meets 2017 AM peak hour warrant. Signalize the intersection of Wire Road at DW Hwy in 2017. AM and PM 2017 and 2027 unmitigated LOS is F for DW Hwy at Wire Rd. It improves to a LOS B in the 2017 and 2027 AM mitigated cases and LOS A in both PM mitigated cases.
Manchester Street at Parcel D - BAE Systems	Prior to 2017	Consider a frontage road access strategy to Parcel D - BAE Systems. As envisioned the Manchester Street corridor would be realigned to parallel Daniel Webster Highway to the existing BAE Systems Driveway, such that the driveway serves both BAE Systems traffic and regionally generated traffic. If such is the case, it may be possible to signalize the Henry Clay Drive at Daniel Webster Highway intersection. Alternatively, a secondary Manchester Street access could be created with only site-generated traffic oriented to the existing BAE Systems Driveway via a frontage road serving internally-generated traffic only.	Create "right in/ right out" only driveway at Parcel D. Divert left-turning vehicles to intersection of DW Hwy at Manchester Street Signalize the intersection of Manchester Rd at Daniel Webster Highway in 2017.

**Table ES-1**  
**Summary of Potential Short-Range and Long-Range Improvement Strategies in Merrimack, NH (Continued)**

Location	Implementation Period	Improvements	Results
Bedford Road at FE Everett Turnpike	Between 2017 and 2027	Signalize both intersections and provide a five lane bridge to accommodate increased two-way traffic volumes and turning movements.	LOS E during 2027 AM and PM peak hours improves to LOS C with signal timing modifications.
Daniel Webster Highway (US Route 3) at Harris Pond Drive South and Parcel A	Between 2017 and 2027	Consider creating at least two new access points to Parcel A - Southwood. Conceptually, the primary access would allow rights and left turns in, but rights out only via a new driveway on Daniel Webster Highway located approximately 500' south of Harris Pond Drive South. A secondary driveway should be considered on Harris Pond Drive South just west of the existing median primarily as an egress to allow left-turning vehicles needing to access Daniel Webster Highway NB to use the existing signal at the intersection of Harris Pond Drive North with Daniel Webster Highway either via the existing Harris Pond Drive loop road or the existing frontage road.	LOS at Harris Pond Drive South is acceptable if lefts out are restricted. Ultimately the level of congestion will be reduced by the amount of future left turning traffic that diverts to the existing Harris Pond Drive North signal.
Daniel Webster Highway (US Route 3) at Henry Clay and Mast Roads	Between 2017 and 2027	If Manchester Street intersection is not signalized by 2017, consider signalizing this intersection, as it will meet warrants. If it is signalized, provide two lane approaches in both directions of Mast Road and Henry Clay Drive. If a signal is installed at Manchester Street, a potential signal at Henry Clay Drive must be coordinated with it.	LOS E/F during the 2017 and 2027 peak hours becomes an LOS A with signalization.
Daniel Webster Highway (US Route 3) at Industrial Drive	Between 2017 and 2027	Adjust signal timing and lane assignments with the new Parcel F - Anheuser Busch access driveway. Check lane allocation for future westbound approach from Parcel F - Anheuser Busch. Convert the double left-turn lane on the eastbound approach to an exclusive left lane and a shared through/left lane. Create a southbound exclusive left turn lane on Daniel Webster Highway serving the future access driveway.	LOS E/F during the 2027 peak hours become LOS D with proposed lane configurations.
Daniel Webster Highway (US Route 3) at Robert Milligan Parkway	Between 2017 and 2027	Check to see if location meets signal warrants. If so, signalize the intersection and evaluate potential improvements to existing geometry if not enough traffic gaps are provided in Daniel Webster Highway traffic from upstream signal at Industrial Drive.	LOS A/D during AM and PM peak hours today is expected to decline to LOS F by 2017 and remain so through 2027. Signalization, if warrants are met, is expected to enhance operations to LOS A in 2027.

**Table ES-1  
Summary of Potential Short-Range and Long-Range Improvement Strategies in Merrimack, NH (Continued)**

<b>Location</b>	<b>Implementation Period</b>	<b>Improvements</b>	<b>Results</b>
Daniel Webster Highway (US Route 3) at Robert Milligan Parkway	Between 2017 and 2027	If location did not meet signal warrants in 2017, reevaluate them for 2027. If the intersection meets signal warrants, signalize the intersection and evaluate potential improvements to existing geometry.	Meets peak hour signal warrant for the 2027 PM peak hour. Signalize intersection when it meets warrants in 2027. AM and PM 2027 unmitigated LOS is F and improves to LOS A in the mitigated case.
Daniel Webster Highway (US Route 3) at Twin Bridge Rd	Between 2017 and 2027	Check to see if location meets signal warrants. If so, signalize the intersection.	Signalize the intersection of Twin Brook Road at DW Hwy by 2027 if and when it meets signal warrants and add a southbound left-turn lane on DW Hwy. 2027 AM LOS is E and PM LOS is F in the unmitigated case. This improves to AM LOS A and PM LOS C in the mitigated case.
Daniel Webster Highway and Bedford Road	Between 2017 and 2027	Modify signal timing to optimize operations with new Bedford Road and Daniel Webster Highway traffic volumes following Exit 12 diamond interchange modifications.	Adjust signal timing to improve overall intersection operations to a LOS C in the AM and PM 2017 and 2027 cases.
Daniel Webster Highway at BAE Systems Driveway	Between 2017 and 2027	Adjust signal timing and phasing to improve signal operations at this intersection and if Manchester Street/Parcel D - BAE Systems development traffic is added.	Adjust signal timing to improve 2027 PM overall operation to LOS B from LOS D.
Daniel Webster Highway at Greeley St	Between 2017 and 2027	Optimize signal timing and reevaluate lane approaches for PM case.	Move westbound approach to align with the intersection. Adjust the signal timing. Reassign eastbound lanes to a double left turn lane and a shared/right lane.
Daniel Webster Highway at Parcel E (former Nashua Corporation)	Between 2017 and 2027	NHDOT recently removed a traffic signal at this intersection. By 2027, may need to re-install a signal if warrants are met with re-developed site.	LOS F during both peak hours improves to LOS A and B by 2027 with signalization.

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## Chapter I Introduction

### Roadway Infrastructure Master Planning Study Merrimack, New Hampshire



# Chapter I - INTRODUCTION

## I. THE SETTING

Located between the City of Nashua and the Town of Bedford, Merrimack, New Hampshire is in the midst of a significant economic growth spurt. Its two key north-south corridors, the FE Everett Turnpike and the Daniel Webster Highway (Route 3) are the focus of intense economic activity. To accommodate projected growth in an acceptable manner, the Town retained FST in a partnership with the Nashua Regional Planning Commission (NRPC) to provide the necessary regional context for traffic changes. The plan identifies existing and future roadway infrastructure problem areas with potential solutions to them that may occur through a combination of public and private investments in infrastructure.

## II. STUDY SCOPE

This Roadway Infrastructure Master Plan provides the Town of Merrimack with a guide for adjusting its roadway system to accommodate projected traffic growth from future development.

Two road infrastructure phasing forecasts were performed by NRPC and evaluated by FST. Short Range traffic conditions were projected through the year 2017, while Long Range traffic conditions were projected for the period between 2017 and 2027.

Working closely with the Town, both NRPC and FST made ‘best guess’ estimates of both land use changes and, in turn, traffic changes.

Estimates made for this study will need to change in the future as development types and quantities become firmed up with actual site plan information. In the meantime, assumptions made are documented so it will be possible to adjust for changes as they come on line and keep the context for roadway infrastructure changes up to date.

The impetus for this study was the Town’s original concern about potential development or redevelopment of many large parcels primarily within southeast Merrimack. The Town opted to expand the study area to include the remainder of Route 3/Daniel Webster Highway corridor in Town.

The Town of Merrimack wants to ensure that new development or redevelopment throughout the Town does not overburden its available transportation infrastructure or increase traffic volumes in nearby residential neighborhoods. The idea is to allow the Town to anticipate and prepare for long-term investments in the transportation infrastructure to keep the system functional as development occurs and allow the Town to be pro-active toward addressing future congestion needs rather than re-active after congestion occurs. Many of the intersections studied are under the jurisdiction of NHDOT. The Town expects to provide NHDOT with the study findings and work with NHDOT to help implement study findings to the maximum extent possible.

While the NRPC Town of Merrimack traffic forecasts are regionally-based (refer to Chapters III and IV), this study focuses on three geographic growth areas within the Town as follows:

- **Southeast Merrimack Area** – is bounded by Amherst Road/Greeley Street to the north, the Merrimack River to the east, the City of Nashua to the south, and the Continental Boulevard, Tinker, and Naticook Roads to the west.
- **Northeast Merrimack Area** – is bounded by the Town of Bedford to the north, the Merrimack River to the east, Exit 12/Bedford Road to the south, and Back River Road to the west.
- **Downtown Merrimack Area** – is bounded by Exit 12/Bedford Road to the north, the Merrimack River to the east, the FE Everett Turnpike to the west, and Amherst Road/Greeley Street to the south.

Working closely with the Town and FST, NRPC modified its regional 2017 short and 2027 long term traffic projection models to identify 24-hour trends on study area roadways as well as AM and PM peak hour traffic conditions at selected locations within the Town. NRPC efforts are documented in Chapters III and IV of this study.

To provide a sound basis for its traffic forecasts, NRPC routinely conducts manual turning movement and automatic traffic recorder counts within Merrimack and nearby communities. Additionally, the Town of Merrimack provided a significant amount of traffic-related information from consultant reports on specific recent development projects. After reviewing the available information, NRPC conducted supplemental counts at key intersections where data was deemed to be ‘missing’. FST, in turn, balanced the

available data to create a SYNCHRO® model to analyze and simulate existing (2007) AM and PM commuter peaks.

NRPC coordinated with the Town to identify assumptions regarding land use development quantities within the Town’s potential development areas. The Town also reviewed NRPC assumptions regarding programmed roadway infrastructure improvements. Based on the ‘best available’ updated information, the Town of Merrimack staff assisted NRPC in making aggregate land use assumptions. NRPC, as detailed in Chapters III and IV, used the land use data obtained to adjust its regional model and forecast 2017 and 2027 daily volumes as well as AM and PM turning movements at selected intersections. FST, in turn, obtained the NRPC forecasts and interpolated data as necessary to include additional intersections in 2017 and 2027 AM and PM peak hour turning movement forecasts within the Town’s three study areas. FST evaluated eight traffic projection cases using the SYNCHRO® model. Four future 2017 and 2027 AM and PM ‘Base Case’ conditions were evaluated with infrastructure modifications already-programmed for implementation. Building upon the ‘Base Case’ forecasts, FST developed four models with additional roadway modifications to address 2017 and 2027 AM and PM ‘Base Case’ analysis condition deficiencies.

A key goal of the study is to identify the breadth of potential mitigation measures and provide a qualitative assessment of environmental constraints to proposed measures within the study area (i.e., potential for affecting buildings, wetlands, etc.). Additionally, access management issues needed to accommodate short and long-range conditions on the Town’s roadway infrastructure were

addressed. The study recognized the need of NHDOT to maintain adequate capacity and traffic operations on its roadway system. To address future access management, the best locations for future access driveway locations were evaluated. Ideally, rail service with feeder bus service will become a reality in the long term.

Three key issues are of importance pertaining to infrastructure planning assumptions:

**A. Identifying the range of projected development quantities in the development zones by the Town**

As noted above, the development quantities assumed for the 2017 and 2027 traffic forecasts are not ‘cast in stone’ and *are subject to change* in the future as specific plans for development come on line. Projected development quantities are conservative, or high side, to ensure that infrastructure needs will be met. NRPC compiled and graphically displayed tentative land use assumptions within the development zones (refer to Chapter III). After several review sessions for adjustments, the Town concurred with assumptions prior to completing the model runs. Model runs estimated 2017 and 2027 daily traffic volumes. The daily model traffic volumes were adjusted by NRPC to estimate AM and PM peak hour turning movements at critical intersections. While limited Saturday counts are available for the Industrial Drive and Continental Boulevard corridors, Saturday conditions were not being modeled by

NRPC but land use assumptions are such that future Saturday traffic forecasts may be possible.<sup>1</sup>

**B. Identifying the streets and intersections to be included in the traffic analysis areas**

Following is a summary of streets and intersections included in each of the following three project areas. Please be advised that the intersection of Daniel Webster Highway with Columbia Circle and Wright Avenue was not reviewed, as it was under design at the time the study was undertaken.

**i. Southeast Merrimack Area**

- Daniel Webster Highway and potentially its intersections with:
  - Harris Pond Drive
  - Bowers Landing Drive
  - Webb Drive
  - Mast Road/Henry Clay Drive
  - Robert Milligan Parkway
  - Industrial Drive
  - Star Drive
  - Greeley Street
  - Manchester Street
  - Other major site access driveways
- Industrial Drive and its intersections at:
  - Exit 10 NB on/off-ramps

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<sup>1</sup> FST reviewed Saturday daily and mid-day peak hour counts and projections *by others* to determine whether specific roadway changes may be needed to accommodate Saturday peak hour traffic conditions projected.

- Exit 10 SB on/off-ramps
  - Spartan Way
  - Commerce Drive
  - Continental Boulevard
- Greeley Street at:
  - Amherst Road/Camp Sargent Road/Continental Boulevard
  - FE Everett NB on/off ramps
- Amherst Road at:
  - Executive Park Drive
  - Naticook Road
  - Turkey Hill Road
- Continental Boulevard at:
  - Camp Sargent Road (S)
  - Greens Pond Road
  - Cambridge Drive
  - Camp Sargent Road/Contra Way
  - Tinker Road
  - Naticook Road
  - Route 101A (Milford Street)
- Tinker Road at:
  - Manchester Street
- Manchester Street at:
  - Al Paul Lane
- ii. **Northeast Merrimack Area**
  - Daniel Webster Highway and its intersections with:
    - Bedford Road
- Priscilla Road
  - Hilton Road
  - Shelburne Road
  - Other major development access driveways (e.g., the Flatley site)
- Bedford Road and its intersections with:
  - Exit 12 NB off-ramp (and future NB on-ramp)
  - Exit 12 SB on-ramp
  - Existing Back River Road (and future Relocated Back River Road)
  - Future access to potential commuter rail station site
- iii. **Downtown Merrimack Area**
  - Daniel Webster Highway and its intersections with:
    - East Chamberlain Road
    - Railroad Avenue
    - Woodbury Street
    - Loop Road Area including signalized intersection
    - Baboosic Lake Road
    - Wire Road
    - Twin Bridge Road
    - Front Street/McGaw Bridge Road
    - Pine Street
    - Elm Street
    - Maple Street
    - Depot Street
    - Other major development access driveways

- Baboosic Lake Road and its intersections with:
  - Church Street
  - McElwain Street
  - Hillside Terrace
  - O’Gara Drive
  
- Wire Road and its intersection with:
  - Hillside Terrace/McGaw Bridge Road
  
- Woodbury Street and its intersection with:
  - McElwain Street

While NRPC provided many new ground counts, traffic conditions evaluated at several intersections were interpolated from ground counts and estimated where count data was not available from nearby daily counts.

Aerials contained in this report were provided by the Town of Merrimack, New Hampshire Geographic Information System (based on year 2005 aerial photography) *and all are oriented in a north up* vertical position to ease reader understanding and for consistency purposes.

### C. Assumptions regarding programmed roadway improvement projects prior to 2017 and 2027

Several Town of Merrimack projects are documented in the *Nashua Metropolitan Areas Long Range Transportation Plan for 2007-2027*. The list of potential long-range projects has changed somewhat since 2006. For this study, it is assumed:

- The *Airport Access Road in Bedford is to be constructed prior to 2017*. During 2009, this project was selected to receive American
- The Route 3 (FE Everett Turnpike) widening with Exit 12 modifications will be constructed prior to 2027.
- A new commuter rail station with ancillary parking or joint private/public transit development is to be completed by 2027.
- NH Route 101A corridor improvements will occur by 2027; and
- The Circumferential Highway has been dropped from consideration.

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## Chapter II Existing Conditions

### Roadway Infrastructure Master Planning Study Merrimack, New Hampshire



## CHAPTER II – EXISTING CONDITIONS

### I. 2007 TRAFFIC OPERATIONS ANALYSIS CRITERIA

The Town of Merrimack and New Hampshire Department of Transportation (NHDOT) provided a listing of existing intersections within the Town that are controlled by traffic signals.

NHDOT provided the signal control data necessary to evaluate AM and PM peak hour traffic signal operations at the 21 existing Merrimack traffic signals under its control. In total, at this time, the Town of Merrimack has a total of 29 traffic signals, 8 of which are under the jurisdiction of the Town of Merrimack. All of Merrimack’s existing signals are fully actuated, but none are coordinated with one another. Figure II-1 identifies the locations of the traffic signals within the Town. Most of the Town’s traffic signals are located along Daniel Webster Highway, Continental Boulevard, and Bedford Road. A traffic signal at the intersection of the former Nashua Corporation exit driveway with Daniel Webster Highway was removed by NHDOT during 2008 after the signal no longer met warrants.

Operations at traffic signals and unsignalized intersections are generally worst during the weekday morning and evening peak hours. Operations can be given score-card like level of service (LOS) rankings from A-F, with A being the best and F being the worst. Table I-1 the right is a summary of the nationally-accepted delay criteria for evaluating and ranking signalized and unsignalized intersection operations.

Table I-1 Highway Capacity Manual Delay Criteria Unsignalized Intersections	
Level of Service	Average Total Delay Range (seconds/vehicle)*
A	≤10
B	>10 and ≤15
C	>15 and ≤25
D	>25 and ≤35
E	>35 and ≤50
F	>50

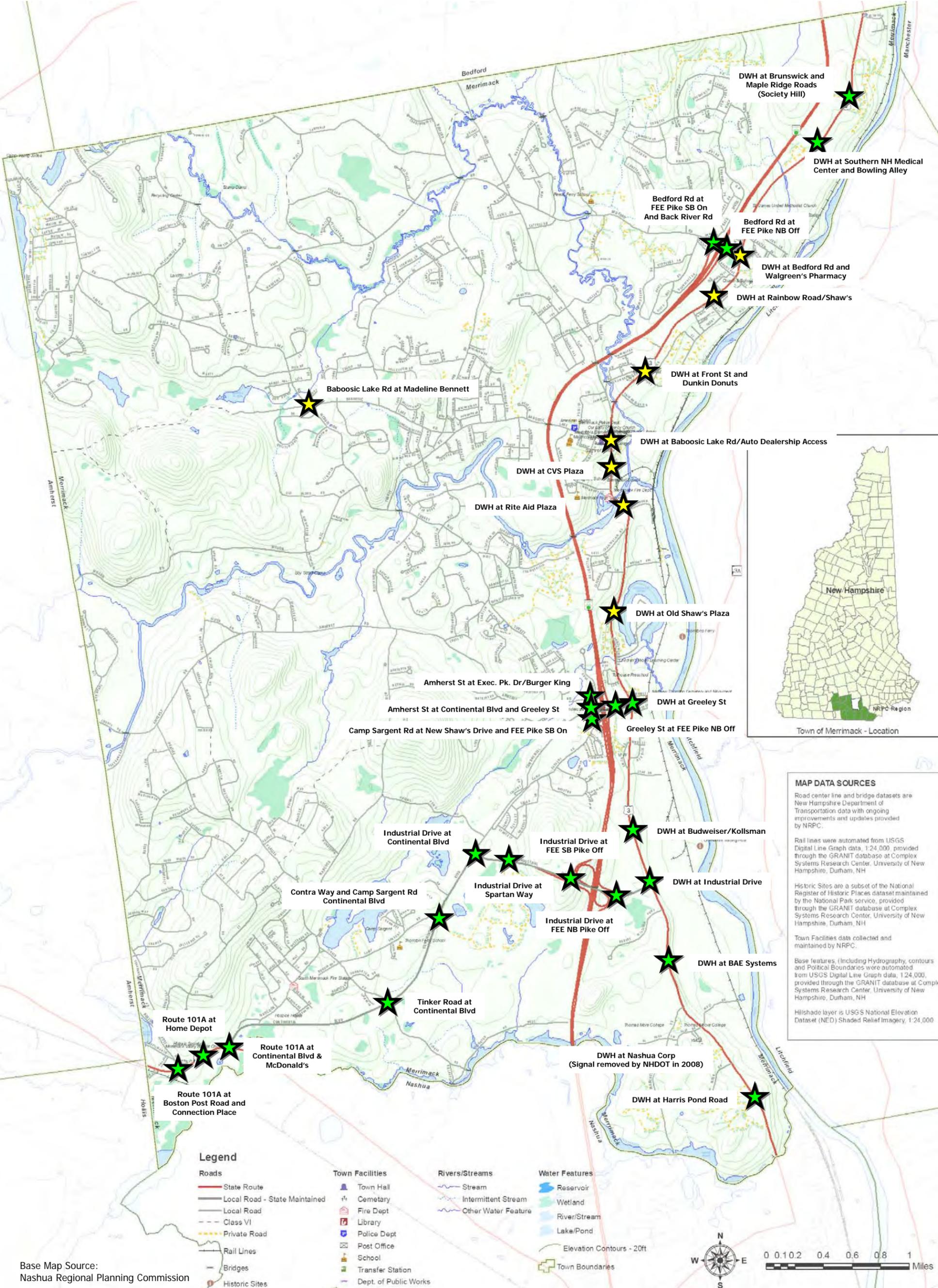
Signalized Intersections	
Level of Service	Average Total Delay Range (seconds/vehicle)*
A	≤10
B	>10 and ≤20
C	>20 and ≤35
D	>35 and ≤55
E	>55 and ≤80
F	>80

\* Source: Highway Capacity Manual 2000. Average Total Delay is the difference between free-flow travel time and stopped plus acceleration and deceleration delays during the peak 15-minute period.

# Traffic Signal Locations

# Merrimack, New Hampshire Infrastructure Planning Study

-  NHDOT Signal Location
-  Town of Merrimack Signal Location



Base Map Source:  
Nashua Regional Planning Commission

Signal Data Source: Town of Merrimack, NH

FAY, SPOFFORD & THORNDIKE

## II. 2007 TRAFFIC OPERATIONS FINDINGS

Tables II-2A and II-2B summarize AM and PM traffic operations at the signalized in non-signalized intersections respectively ranked in order of severity of the operations. Please note that the ‘Intersection Tracking Number’ refers to the model number of the intersection. This randomly-generated designation *does not refer to the importance of the intersection.*

From Table II-2A, the most congested *signalized* intersections in Town during the *morning* peak hour time are:

- Continental Boulevard at Amherst Road (LOS D)
- Baboosic Lake Road at Daniel Webster Highway (LOS D)
- Burger King at Amherst Road and Executive Park Drive (LOS D)

Similarly, from Table II-2B, the most congested (LOS D-F) *signalized* intersections in Town during the *afternoon* peak hour are:

- Burger King at Amherst Road and Executive Park Drive (LOS F)
- Camp Sargent Road at Amherst Road and Continental Boulevard (LOS E)
- Continental Boulevard at Amherst Road (LOS D)

From Table II-2A, the most congested *non-signalized* intersections in Town (LOS D-F) during the *morning* peak hour time occur at:

- Amherst Road at Turkey Hill Road (LOS F)
- Manchester Street at Daniel Webster Highway (LOS F)
- Wire Road at Daniel Webster Highway (LOS E)
- Pond View Road at Daniel Webster Highway (LOS E)
- Henry Clay Drive at Daniel Webster Highway (LOS D)

Similarly, from Table II-2B the most congested (LOS F-D) *non-signalized* intersections in Town during the *afternoon* peak hour are located at:

- Amherst Road at Turkey Hill Road (LOS F)
- Manchester Street at Daniel Webster Highway (LOS F)
- Henry Clay Drive at Daniel Webster Highway (LOS F)
- Pond View Drive at Daniel Webster Highway (LOS E)
- Harrisville Avenue at Daniel Webster Highway (LOS E)
- Robert Milligan Parkway at Daniel Webster Highway (LOS D)
- Nashua Corp/Dave & Laurie’s Driveway at Daniel Webster Highway (LOS D)
- Continental Boulevard at Cambridge Drive (LOS D)
- Harris Pond Road South at Daniel Webster Highway (LOS D)
- Webb Drive at Daniel Webster Highway (LOS D)
- Continental Boulevard at Naticook Road (LOS D)
- Shaw’s/Maple Street at Daniel Webster Highway (LOS D)

The section that follows contains many 2005 aerial photos courtesy of the *Town of Merrimack, New Hampshire Geographic Information System*. One aerial was obtained from the *City of Nashua GIS Department*.



**Table II-2A**  
 Merrimack, New Hampshire  
 2007 AM Peak Hour Operations  
 Ranked by Levels of Service

Signalized Intersections			
Intersection Street Names	Delay	2007 AM LOS	V/C
Continental Boulevard at Amherst Road	44	D	0.77
Burger King at Amherst Road and Executive Park Dr.	36	D	0.67
Baboosic Lake Road at Daniel Webster Highway	36	D	0.8
Camp Sargent Road at Continental Boulevard	28	C	0.58
NH 101 A & Continental Boulevard	24	C	0.59
Dunkin Donuts/Front Street at Daniel Webster Highway	23	C	0.57
Bedford Road at Daniel Webster Highway/Walgreens	21	C	0.56
SNHRMC/Gobains/Ten Pin at Daniel Webster Highway	20	C	0.50
Greeley Street at Daniel Webster Highway	20	B	0.69
Bedford Road at Back River Road/FE Everett Tpke Exit 12 SB On-ramp	19	B	0.63
Industrial Drive at Commerce and Spartan Way	17	B	0.57
Industrial Drive at Continental Boulevard	15	B	0.61
Industrial Drive at FE Everett Tpke Exit 10 SB Off-ramp	13	B	0.61
Greeley Street at FE Everett Tpke Exit 11 NB On-/Off-ramp	13	B	0.53
New Shaw's at Camp Sargent Road and FE Everett Tpke Exit 11	13	B	0.43
BAE Driveway at Daniel Webster Highway	12	B	0.49
Industrial Drive at Daniel Webster Highway	11	B	0.38
Industrial Drive at FE Everett Tpke Exit 10 NB Off-ramp	10	A	0.39
Kollman/Budweiser at Daniel Webster Highway	10	A	0.25
Brunswick Street at Daniel Webster Highway	8	A	0.45
Bedford Road at FE Everett Tpke Exit 12 NB Off-ramp	8	A	0.35
Tinker Road at Continental Boulevard	7	A	0.57
Connell's (CVS) Plaza Driveway at Daniel Webster Highway	7	A	0.59
Rite Aid Plaza at Daniel Webster Highway	5	A	0.58
Old Shaw's Plaza/MEG at Daniel Webster Highway	4	A	0.58
Harris Pond Drive N at Daniel Webster Highway	0	A	0.56
Daniel Webster Highway at Shaw's Market	0	A	0.43
Unsignalized Intersections			
Intersection Street Names	Delay	2007 AM LOS	V/C
Amherst Road at Turkey Hill Road	100+	F	0.62
Manchester Street at Daniel Webster Highway	59	F	0.42
Wire Road at Daniel Webster Highway	48	E	0.56
Pond View Drive at Daniel Webster Highway	40	E	0.64
Henry Clay Drive at Daniel Webster Highway	26	D	0.31
Webb Drive at Daniel Webster Highway	24	C	0.54
Harris Ave at Daniel Webster Highway	22	C	0.40
Woodbury Street at Daniel Webster Highway	20	C	0.61
Continental Boulevard at Naticook Road	20	C	0.54
Priscilla Lane at Daniel Webster Highway	18	C	0.48
Continental Boulevard at Cambridge Drive	18	C	0.46
Harris Pond Drive S at Daniel Webster Highway	18	C	0.40
Shaw's Right in Only/Maple Street at Daniel Webster Highway	17	B	0.61
Dave/Laurie's Auto/former Nashua Corp at Daniel Webster Highway	17	C	0.35
Camp Sargent Road at Continental Boulevard	17	C	0.31
Baboosic Lake Road at Hillside Terrace	17	C	0.25
Baboosic Lake Road at Church and McElwain Streets	16	C	0.23
Greens Pond Road at Continental Boulevard	13	B	0.25
Baboosic Lake Road at O'Gara Drive	3	A	0.27
Robert Milligan Parkway at Daniel Webster Highway	1	A	0.37
EB Industrial Drive at FE Everett Tpke Exit 10 SB On-ramp	0	A	0.30
WB Industrial Drive at FE Everett Tpke Exit 10 SB On-ramp	0	A	0.53
EB Industrial Drive at FE Everett Tpke Exit 10 NB On-Ramp	0	A	0.32
WB Industrial Drive at FE Everett Tpke Exit 10 NB On-Ramp	0	A	0.21

Delay - Seconds during peak 15 minute period of the peak hour.

LOS - Level of Service from A to F, A is best, F is worst

V/C - Proportion of volume to capacity, 1+ means indicates an over-capacity condition.

\* Projected volume exceeds capacity more than 50%.



**Table II-2B**  
 Merrimack, New Hampshire  
 2007 PM Peak Hour Operations  
 Ranked by Levels of Service

Signalized Intersections			
Intersection Street Names	Delay	2007 PM LOS	V/C
Burger King at Amherst Road and Executive Park Dr.	100+	F	0.94
Camp Sargent Road at Continental Boulevard	72	E	0.86
Continental Boulevard at Amherst Road	41	D	0.88
Greeley Street at Daniel Webster Highway	34	C	0.87
NH 101 A & Continental Boulevard	32	C	0.86
Greeley Street at FE Everett Tpke Exit 11 NB On-/Off-ramp	30	C	0.88
Bedford Road at Daniel Webster Highway/Walgreens	29	C	0.76
SNHRMC/Gobains/Ten Pin at Daniel Webster Highway	29	C	0.62
Industrial Drive at Commerce and Spartan Way	22	C	0.76
Tinker Road at Continental Boulevard	22	C	0.85
Baboosic Lake Road at Daniel Webster Highway	20	C	0.69
Dunkin Donuts/Front Street at Daniel Webster Highway	18	B	0.53
Industrial Drive at Continental Boulevard	17	B	0.81
New Shaw's at Camp Sargent Road and Exit 11	16	B	0.45
Bedford Road at Back River Road/FE Everett Exit 12 SB On-ramp	14	B	0.52
BAE Driveway at Daniel Webster Highway	13	B	0.53
Industrial Drive at Daniel Webster Highway	12	B	0.48
Harris Pond Drive N at Daniel Webster Highway	12	B	0.51
Bedford Road at FE Everett Tpke Exit 12 NB Off-ramp	11	B	0.60
Kollsman/Budweiser at Daniel Webster Highway	10	A	0.33
Connell's (CVS) Plaza Driveway at Daniel Webster Highway	9	A	0.65
Rite Aid Plaza Drive at Daniel Webster Highway	9	A	0.8
Industrial Drive at FE Everett Tpke SB Exit 10 Off-ramp	8	A	0.55
Industrial Drive at FE Everett Tpke NB Exit 10 Off-ramp	8	A	0.31
Old Shaw's Plaza/MEG at Daniel Webster Highway	8	A	0.74
Brunswick Street at Daniel Webster Highway	7	A	0.47
Daniel Webster Highway at Shaw's Market	7	A	0.50
Unsignalized Intersections			
Intersection Street Names	Delay	2007 PM LOS	V/C
Amherst Road at Turkey Hill Road	100+	F	0.87
Manchester Street at Daniel Webster Highway	100+	F	0.43
Baboosic Lake Road at O'Gara Drive	92	F	1.04
Henry Clay Drive at Daniel Webster Highway	82	F	0.51
Pond View Drive at Daniel Webster Highway	50	E	0.69
Harris Ave at Daniel Webster Highway	49	E	0.69
Robert Milligan Parkway at Daniel Webster Highway	30	D	0.40
Dave/Laurie's Auto/former Nashua Corp at Daniel Webster Highway	29	D	0.37
Continental Boulevard at Cambridge Drive	27	D	0.74
Harris Pond Drive S at Daniel Webster Highway	26	D	0.43
Webb Drive at Daniel Webster Highway	26	D	0.51
Continental Boulevard at Naticook Road	26	D	0.76
Shaw's Right in Only/Maple Street at Daniel Webster Highway	26	D	0.54
Camp Sargent Road at Continental Boulevard	25	C	0.28
Priscilla Lane at Daniel Webster Highway	21	C	0.55
Woodbury Street at Daniel Webster Highway	20	C	0.65
Baboosic Lake Road at Church and McElwain Streets	19	C	0.26
Baboosic Lake Road at Hillside Terrace	17	C	0.13
Wire Road at Daniel Webster Highway	16	C	0.58
Greens Pond Road at Continental Boulevard	13	B	0.32
WB Industrial Drive at FE Everett Tpke Exit 10 SB On-ramp	0	A	0.42
EB Industrial Drive at FE Everett Tpke Exit 10 SB On-ramp	0	A	0.60
WB Industrial Drive at FE Everett Tpke Exit 10 NB On-Ramp	0	A	0.17
EB Industrial Drive at FE Everett Tpke Exit 10 NB On-Ramp	0	A	0.41

Delay - Seconds during peak 15 minute period of the peak hour.

LOS - Level of Service from A to F, A is best, F is worst

V/C - Proportion of volume to capacity, 1+ means indicates an over-capacity condition.

\* Projected volume exceeds capacity more than 50%.

### III. CHARACTERISTICS OF EXISTING KEY INTERSECTIONS AND FACILITIES

Daniel Webster Highway (US Route 3) meanders its way through the Town of Merrimack with several different cross-sections and alignments. Within the *Phase I, Southeast Merrimack* study area, this study evaluated existing year 2007 conditions at the following intersections:

**Harris Pond Drive** is the furthest south roadway intersecting **Daniel Webster Highway (DWH)** within the Town of Merrimack. It is a relatively short loop road on the west side of the DWH that intersects it twice which serves commercial and residential uses. Its southerly intersection with the DWH is controlled by a stop sign, while its northerly intersection is traffic signal controlled (refer back to Figure 1). In the vicinity of both intersections, the posted speed limit of Daniel Webster Highway (DWH) is 40 miles per hour. A sidewalk is provided on the east side of DWH and on the west side of Harris Pond Drive (north). Until its recent removal, the nearest traffic signal controlled intersection was located at the Nashua Corporation exit approximately 1,800 feet north of Harris Pond Drive.

DWH has one through travel lane in each direction with a wide shoulder on both sides of the road. Both northbound DWH approaches to Harris Pond Drive have exclusive left turn lanes to remove left turning traffic from through traffic lanes of travel on DWH. Both Harris Pond Drive legs are median-divided with one through lane wide enough for traffic to bypass vehicles waiting to turn left or right.



*Harris Pond Drive N at Daniel Webster Highway (US Route 3)*



*Harris Pond Drive S at Daniel Webster Highway (US Route 3)*

**Bowers Landing Drive** is stop sign controlled at its intersection with **DWH** approximately 530 feet north of its intersection Harris Pond Drive. Bowers Landing Drive has a cross connector to allow its users to approach the DWH via the Harris Pond Drive North traffic signal to perform left and right turns onto DWH, particularly during peak traffic hours. At its intersection with Bowers Landing Drive, DWH has a four-lane paved cross-section with shoulders on both sides. Two through lanes, one in each direction, are provided on DWH. The center lane of DWH is a two-way left turn lane, while a northbound exclusive right turn lane provides inbound only access to the Nashua Corporation site.



*Bowers Landing Drive at Daniel Webster Highway*

**Webb Drive**, located approximately 950 feet north of Bowers Landing Drive, is stop controlled at its intersection with **DWH**. DWH, however has five travel lanes including the center two way left turn lane and two general purpose lanes in each direction, as it flares out from the four lane cross section provided at Bowers Landing Drive. Angle parking adjacent to Webb Drive requires use of Webb Drive for backing maneuvers.



*Webb Drive and Nashua Corporation Exit at Daniel Webster Highway*

Located 300 feet north of Webb Drive, the former **Nashua Corporation** exit opposite **Dave and Laurie's Auto Shop** was traffic signal controlled at its intersection with **DWH** when original field investigations were undertaken in spring 2008. Since that time, the intersection has been converted to two-way stop sign-control. DWH has a five-lane cross-section, with the center lane being used as a northbound left lane. Because the Nashua Corporation egress driveway is one way toward DWH, southbound left turns are not permitted. A sidewalk is provided on the east side of DWH.

**Mast Road/Henry Clay Drive** intersects **DWH** in a four-way intersection approximately 1,450 feet north of the Nashua Corporation intersection. Both Mast Road and Henry Clay Drive are stop-sign controlled on their approaches to DWH. Unlike the 2005 photo to the right, DWH retains its five-lane cross-section with a two-way center left turn lane plus narrow shoulders. Striped for a single lane, the pavement of Henry Clay Drive is wide enough to be striped for two lanes. A sidewalk is provided on the east side of DWH. Henry Clay Drive at Mast Road and DWH was the third most congested unsignalized intersection in the Town of Merrimack in 2007.



*Henry Clay Drive and Mast Road at Daniel Webster Highway*

Located approximately 1,000 feet north of Henry Clay Drive and Mast Road, **Manchester Street** intersects **DWH** in a four-way intersection opposite a driveway to a private development. Both the Manchester Street and private development driveway are stop-sign controlled at the intersection with DWH. Manchester Street is an arterial that connects DWH to the City of Nashua via a bridge and ultimately down to Route 101. A continuous sidewalk is provided on the east side of DWH, and on the west side of DWH north of Manchester Street. DWH, unlike the 2005 photo to the right, retains its five-lane paved cross-section through the intersection with a two-way center left turn lane. Manchester Street has a single approach lane, as does the private development. However, Manchester Street is not wide enough to accommodate a right bypass for more than a couple of vehicles waiting to turn left. Manchester Street was the second most congested unsignalized intersection in Merrimack in 2007.



*Manchester Street at Daniel Webster Highway*

Located approximately 1,250 feet north of Manchester Street, **BAE Industries** southerly site driveway at **DWH** is controlled by a traffic signal. This three-way ‘T’ intersection operates well during the AM and PM peak hours. A curb cut only is located on the east side of the DWH indicating the location of a future developable parcel. DWH retains its five-lane paved cross-section through this intersection. The BAE driveway approaches DWH in two lanes, an exclusive left turn and exclusive right turn lane. A sidewalk separated by green space is provided on the west side of DWH to the north of the BAE signalized driveway, while a continuous sidewalk is provided on the east side of DWH directly adjacent to it. A BAE Driveway approximately 1,000 feet north of the signal-controlled driveway has a similarly designed ‘T’ intersection, but is stop-sign controlled at its intersection with DWH.

**Robert Milligan Parkway**, a dead end street approximately a quarter mile north of the unsignalized BAE driveway intersects **DWH** in a high-type ‘T’ intersection design. Robert Milligan Parkway left turn approach to DWH is stop-controlled, while its right turn approach is yield controlled. Channelization (see left) is provided to accommodate southbound right turns from DWH into Robert Milligan Parkway and southbound right turns onto DWH. Through the intersection, DWH is median-divided, as is Robert Milligan Parkway. Northbound DWH has three lanes plus an exclusive left turn lane, while southbound it has two through lanes plus an exclusive right turn lane. Robert Milligan Parkway is designed to accommodate future traffic signal control, should it be necessary.



*BAE Industries at Daniel Webster Highway*



*Robert Milligan Parkway at Daniel Webster Highway*

**Industrial Drive**, located approximately 1,000 feet north of Robert Milligan Parkway is an east-west arterial that connects the FE Everett Turnpike to DWH via Exit 10. Industrial Drive is traffic signal controlled at its intersection with **DWH**. All eastbound movements are signal controlled, including double left turn and double right turn lanes. The southbound traffic movement onto Industrial Drive is a free right turn. Southbound on DWH, there are three approach lanes including an exclusive right turn lane and two through lanes. Northbound, there are four lanes including two through lanes and a double left turn lane.

An accessible pedestrian crossing is provided on the west side of DWH at the crossing of Industrial Drive, and is connected to the sidewalk running along the west side of DWH. The intersection operates well during peak hours.

The traffic signal controlled **Budweiser/ Kollsman** driveways intersections with **DWH** are located approximately 2,000 feet north of Industrial Drive. DWH is median-divided, as are both driveways. All four right turn lanes are channelized. Left turn lanes are offset such that left turns cannot be run concurrently. However, neither driveway experiences congestion during the AM or PM peak periods. Accessible sidewalks are provided on the west side of DWH at the Kollsman Drive crossing.



*Industrial Drive at Daniel Webster Highway*



*Budweiser/Kollsman Drives at Daniel Webster Highway*

**Star Drive** intersects **DWH** from the east opposite a former McDonald’s restaurant with offset inbound and outbound driveways. The former McDonald’s restaurant exiting driveway and Star Drive are stop controlled at their intersections with DWH. DWH has five lanes including a two-way left turn lane, while Star Drive and the former McDonald’s Restaurant have single approach lanes to the intersection. Sidewalks are not provided near this intersection.

**Greeley Street** intersects **DWH** to form a four-way intersection that is traffic signal controlled. The design of this intersection is very similar that found at the Industrial Drive intersection with DWH. DWH is divided by a raised median on its approaches to Greeley Street. Northbound DWH has four traffic lanes, two of which are through lanes and a double left turn lane.

Southbound, DWH has an exclusive left turn lane, two through lanes, and an exclusive free right turn lane onto Greeley Street. The west leg of Greeley Street is also divided by a raised median. On its eastbound approach to the intersection, Greeley Street has three lanes including an exclusive left turn lane, a shared left/through lane, and an exclusive right turn lane. Eastbound Greeley Street approaches the intersection in a single lane. North of Greeley Street, the speed limit on DWH drops to 30 miles per hour, while south of Greeley Street it remains 40 miles per hour, as it is at the other intersections to the south in the area. Sidewalks are provided on both sides of Greeley Street, but only on the west side of DWH, primarily to the south of the intersection. The intersection operates with little delay during the AM and PM peak hours.



*Star Drive and former McDonald’s at Daniel Webster Highway*



*Greeley Street at Daniel Webster Highway*

**Industrial Drive** is a relatively short east-west arterial roadway connecting DWH to the FE Everett Turnpike via the **FE Everett Turnpike Exit 10 northbound on/off ramps**. **Industrial Drive** has a five-lane paved cross-section – three through lanes westbound and two eastbound – and is divided by a raised median.

The northbound Exit 10 off-ramp terminates in a signalized intersection that operates well during the AM and PM peak hours. The northbound off-ramp is comprised of an exclusive right turn lane and two exclusive left turn lanes, while the free-flow westbound on-ramp operates in a single lane.

At the **Everett Turnpike Exit 10 southbound on/off ramps**, **Industrial Drive** retains its five-lane cross-section. The traffic signal controlled southbound off-ramp, like the northbound off-ramp has three lanes, but the lane configuration is slightly different, as the center lane accommodates both left and right turning traffic. Like the northbound off-ramp signal, the southbound off-ramp signal operates well during peak hours.



*Exit 10 Northbound On/Off Ramps at Industrial Drive*



*Exit 10 Southbound On/Off Ramps at Industrial Drive*

**Spartan Way** and **Commerce Drive** (a future driveway to the Premium Outlet Mall site) form a four-way signalized intersection with **Industrial Drive**. Until the Premium Outlets Mall construction begins, the intersection operates as if it were a ‘T’ intersection of Spartan Way with Industrial Drive. It is located approximately 2,500 feet to the west of the FE Everett Turnpike southbound off-ramp/Industrial Drive intersection cited on the previous page. Providing access to Fidelity Corporation, Spartan Way is very busy during peak traffic hours, but, under existing conditions, the intersection operates well during the AM and PM peak hours. Spartan Way has four approach lanes – two exclusive channalized right-turn lanes and two exclusive left turn lanes. Industrial Drive has four approach lanes westbound, including two left-turn lanes and two through lanes, while it has two through lanes and an exclusive channelized right turn lane into Spartan Way in the eastbound direction.



*Spartan Way and Future Premium Outlets Mall Driveway with Industrial Drive*

**Continental Boulevard** intersects **Industrial Drive** at its westerly terminus approximately 1,100 feet west of Spartan Way. Traffic signal controlled, the westbound Industrial Drive approach has three approach lanes including an exclusive channelized right turn lane and a double left turn lane. The southbound Continental Boulevard approach has two through lanes, a very short right turn lane to a private driveway, and a long left turn lane providing access to Industrial Drive eastbound. The northbound Continental Boulevard has two through lanes, an exclusive left turn lane into the private driveway, and a channelized exclusive right turn lane to Industrial Drive eastbound. No sidewalks are provided.



*Continental Boulevard at Industrial Drive*

**Greeley Street** is approximately 1,400 feet in length between its westerly terminus at Continental Boulevard and its easterly terminus at DWH. It intersects the FE Everett Turnpike Exit 11 northbound on/off ramps approximately 800 feet west of its intersection with the **DWH**. West of its intersection with **Amherst Road**, and **Camp Sargent Road**, it continues southwesterly as **Continental Boulevard**. The 2007 analysis indicates that the intersection of Amherst Road at Continental Boulevard is the most congested in the Town of Merrimack, particularly during the PM peak hour. The AM peak hour level of service is calculated as LOS D. Sidewalks are available on both sides of Greeley Street.

The predominant issue related to intersection congestion is the close proximity of four traffic signal controlled intersections at:

- Executive Park Drive/Amherst Road;
- Greeley Street at Amherst Road, Continental Boulevard, and Camp Sargent Road;
- Camp Sargent Road at FE Everett Turnpike Exit 11 Southbound and Shaw’s Plaza; and
- Greeley Street at the northbound Exit 11 on-/off-ramps.

Each signal is fully actuated, but, at present, operating independent of one another. The absence of coordination results in queue overlaps and delays on various approaches to the closely spaced intersections. In the worst case, approximately 200 feet queuing space is available on Amherst Road between the northerly intersection of Executive Park Drive and Greeley Street. Similarly, between the Shaw’s Plaza/Exit 11 Southbound interchange and Greeley Street, the available queuing space is limited to approximately 325 feet. In the westbound direction the queuing space between the northbound Exit 11 and the Continental Boulevard intersection is approximately 600 feet.



*Greeley Street at Daniel Webster Highway*



*Greeley Street at FE Everett Turnpike Exit 11 at Camp Sargent Road, Amherst Road, and Continental Boulevard*

**Amherst Road’s** intersections with **Turkey Hill Road** and **Naticook Road** are both unsignalized. Turkey Hill Road is stop-controlled at its intersection with Amherst Road and is the most congested unsignalized intersection in the Town. This intersection is located approximately 900 feet northwest of Executive Park Drive. Turkey Hill Road mainly serves traffic to and from the east on Amherst Road.

**Naticook Road** is located several miles northwest of Turkey Hill Road. From the aerial, confirmed by the recent counts, most of the traffic turns right from **Amherst Road** onto Naticook Road, and left from Naticook Road onto Amherst Road.

**Continental Boulevard** is a southwest-northeast arterial in Merrimack connecting to Route 101A (Milford Street) to Exit 11 of the FE Everett Turnpike and Greeley Street. Except in the vicinity of Greeley Street and Route 101A, there is sparse development along most of Continental Boulevard’s length. North of Industrial Drive, it typically has four travel lanes, two in each direction with auxiliary turn lanes at the higher volume streets that it intersects. South of Industrial Drive, it typically has one through lane in each direction augmented by turn lanes at major intersections. The following Continental Boulevard intersections were reviewed:

The southern part of **Camp Sargent Road** forms an unsignalized ‘T’ intersection with **Continental Boulevard**. Camp Sargent Road is stop-sign controlled at its intersection with Continental Boulevard and operates at an acceptable level of service ‘C’ during the AM and PM peak hours. Camp Sargent Road has a single lane in each direction while Continental Boulevard has two travel lanes in each direction, but no turning lanes at Camp Sargent Road.



*Turkey Hill Road at Amherst Road*



*Naticook Road at Amherst Road*



*Continental Blvd. at Camp Sargent/Green’s Pond Rds.*

As shown on the previous page, approximately 300 feet southwest of Camp Sargent Road, **Greens Pond Road** also forms an unsignalized ‘T’ intersection with **Continental Boulevard** and operates acceptably during peak hours. Greens Pond Road carries very low traffic volumes, as it is unpaved for much of its length and has one travel lane in each direction. Continental Boulevard has two travel lanes in each direction and has a painted median between Camp Sargent Road and Green’s Pond Road.

The unsignalized intersection of **Cambridge Drive** at Continental Boulevard is located at a transitional segment of Continental Boulevard with one through lane in each direction. A striped flush median narrows to the northeast through its intersection with Cambridge Drive.

The signalized intersection of **Contra Way** and **Camp Sargent Road** with **Continental Boulevard** is located approximately 1,000 feet southwest of Cambridge Drive. Continental Boulevard flares out in both directions to provide three approach lanes including a through lane and exclusive left and right turn lanes. The Camp Sargent Road is striped for a single lane but wide enough to provide a bypass lane around left turning motorists. Contra Way provides an access to the Fidelity site and provides an exclusive right turn lane and a shared left/through lane. Sidewalks are not provided. The 2007 analysis indicates this intersection operates acceptably (LOS C) during the AM peak hour, but with congestion (LOS E) during the PM peak hour.



*Cambridge Drive at Continental Boulevard*



*Continental Boulevard at Camp Sargent and Contra Way*

**Tinker Road** is also signalized at its intersection with **Continental Boulevard**. Tinker Road is a collector street providing east-west access between residential areas to the west to its terminus at Manchester Street in Nashua. All approaches to Tinker Road are striped for one travel lane, but shoulders are wide enough to permit bypasses of left turning vehicles. While future provisions for sidewalks exist, they are not provided at this time. The level of service analysis indicates this intersection operates acceptably during the 2007 AM and PM peak hours (LOS A and C, respectively).



*Continental Boulevard at Tinker Road*

**Naticook Road** forms an unsignalized ‘T’ intersection with **Continental Boulevard**. While Continental Boulevard retains one through lane in each direction, the eastbound Continental Boulevard approach has two lanes, one of which is an exclusive left turn lane to Naticook Road.



*Continental Boulevard at Route 101A and Private Driveway*

The southbound Naticook Road approach lane is wide enough to allow motorists to bypass rare vehicles waiting to turn left. The intersection’s pavement wearing pattern indicates that the most of the Naticook Road traffic is oriented to and from the south on Continental Boulevard. No sidewalks are provided. The intersection is located approximately a quarter mile northeast of Route 101A. Peak hour operations at this intersection are at LOS C-D during the 2007 AM and PM peak hours, respectively.



*Continental Boulevard at Naticook Road*

The southernmost four-way intersection of **Continental Boulevard** at **Route 101A** is also its busiest from a traffic volume perspective. Its layout, however, provides enough capacity such that its AM and PM peak hour volumes are accommodated at an acceptable LOS C. Continental Boulevard and Route 101A are divided by raised medians on all approaches to the intersection. The southbound Continental Boulevard

approach includes an exclusive channelized right turn lane, an exclusive through lane to the private driveway opposite the intersection and a double left turn lane to Route 101A eastbound. The northbound approach from the private driveway includes an exclusive left turn lane, a through lane and an exclusive channelized right turn lane. The eastbound approach from Route 101A includes an shared right/through lane, an exclusive through lane and a double left turn lane, while the westbound approach includes a shared through/right lane, two through lanes, and an exclusive left turn lane. Sidewalks are provided on both sides of Route 101A, but not on Continental Boulevard.

**Tinker Road** intersects **Manchester Street** at a stop controlled ‘T’ intersection and is located in the City of Nashua, New Hampshire. All approaches have a single lane. As can be seen from the 2006 aerial photo to the right, courtesy of the City of Nashua GIS Department, a bituminous concrete sidewalk is provided on the south side of Tinker Road at the intersection and the west side of Manchester Street. A crosswalk is provided on the Tinker Road approach.



*Tinker Road at Manchester Street (Nashua, NH)*



*Al Paul Lane at Manchester Street*

**Manchester Street** and **Al Paul Lane** form an unsignalized four-way intersection. All approaches to the intersection have one lane. Both Al Paul Lane approaches are stop sign controlled. Sidewalks are not provided at this intersection that has an acceptable level of service during peak hours.

**Manchester Street** at **Heron Pond Road** and **Bowers Landing Road** forms a four-way intersection. Both the Heron Pond Road and Bowers Landing Road are stop sign controlled at Manchester Street. The intersection operates acceptably during peak hours.



*Manchester Street at Heron Pond Road and Bowers Landing Road*

Within the *Phase II, Northeast Merrimack* study area, this study evaluated conditions at the following intersections:

**DWH** is signal-controlled at its four-way intersection with **Bedford Road** and a private driveway to **Walgreen's Drug Store**. The signal operates at an acceptable LOS C during 2007 peak hours. The southbound DWH approach to the intersection has three travel lanes including a through/right lane and an exclusive through lane and an exclusive left turn lane.

The northbound DWH approach has two lanes including an exclusive left turn lane and a shared through/right lane. The Bedford Road approach has two lanes including an exclusive left turn lane and a shared through/right lane. Crosswalks are provided across all approaches and sidewalks are provided on all legs to the intersection.

**DWH at Brunswick and Maple Ridge Road** is traffic signal controlled. On its southbound approach to the intersection, DWH has a short exclusive left turn lane and a shared through/ right lane. On its northbound approach, DWH has three approach lanes including an exclusive left turn lane, a through lane, and an exclusive right turn lane. Both Brunswick and Maple Ridge Roads are median divided and have two approach lanes. Brunswick Road has an exclusive left turn lane and a shared right/through lane, while Maple Ridge Road is wide enough for two approach lanes but is marked as a single lane. The intersection operates at an LOS A during both 2007 peak hours. A sidewalk is provided on the west side of DWH to the north of the intersection.



*Looking West on Bedford Road at Daniel Webster Highway*



*Brunswick and Maple Ridge Roads at Daniel Webster Highway*

**DWH** is unsignalized at its intersection with **Priscilla Lane**, which forms a three-way intersection approximately 500 feet north of Bedford Road. Priscilla Lane approaches DWH from the west in a single lane and is stop-sign controlled. It operates at an acceptable LOS C during the morning and afternoon peak hours. Sidewalks are not provided at this intersection.

**Hilton Road** is also unsignalized at its intersection with **DWH**. Hilton Road is located approximately 230 feet north of Priscilla Lane, but carries higher traffic volumes, as it serves a much larger neighborhood area.

Hilton Road is unmarked at its intersection with DWH, but is stop sign controlled. It operates at acceptable LOS C during the AM and PM peak hours. As can be seen from the aerial, all approaches to the intersection are single lane. All approaches, however, have shoulders sufficiently wide to allow traffic to bypass vehicles waiting to make left turns on the right. Sidewalks are not provided.



*Priscilla Lane at Daniel Webster Highway*



*Daniel Webster Highway at Hilton Road*

**Shelburne Road** is stop-sign controlled at its intersection with DWH. Located approximately 800 feet southwest of the Ten Pin/Southern New Hampshire Regional Medical Center/Saint Gobain traffic signal on DWH, Shelburne Road is median-divided at its intersection with DWH.

The Shelburne Road approach provides an exclusive left turn and exclusive right turn lanes. Although not shown in the aerial, the northbound approach of DWH includes an exclusive left turn lane and a through lane, while the southbound approach provides a single general purpose through lane. Sidewalks are not provided in the site vicinity.

The signalized intersection of **the DWH at the Ten Pin/Southern New Hampshire Regional Medical Center (SNHMC) at Saint Gobain Access Driveways** has channelized right turn lanes on all approaches as well as exclusive left turn lanes and a single through lane on all approaches. The intersection operates very well during the AM and PM peak hours. Approval of SNHMC in the former Newick’s Restaurant site required construction of a sidewalk along its frontage tying into an existing New Hampshire Department of Transportation sidewalk to the northwest.



*Shelburne Road at Daniel Webster Highway*



**Bedford Road at Exit 12** has two traffic signals spaced within just over 400 feet of one another. Bedford Road provides one through lane in each direction. At the intersection of Back River Road and Bedford Road, an exclusive westbound right turn lane is provided to Back River Road. Only a northbound off-ramp and southbound on-ramp are provided. The northbound off ramp provides an exclusive left turn lane and exclusive right turn lane approaching the signal, while an exclusive channelized right turn lane is provided to the southbound on-ramp. Exit 12 functions as a half interchange, northbound on and southbound off service is not provided. Sidewalks are provided on both sides of Bedford Road in the vicinity of the intersection.



*Exit 12 at Bedford and Back River Roads*

Within the *Phase III, Downtown Merrimack* study area, from south to north, this study evaluated conditions at the following intersections:

**Pond View and Island Drives at DWH** form two closely spaced ‘T’ intersections approximately 2,100 feet north of Greeley Street. Pond View Drive intersects Daniel Webster Highway from the east. Both Island Drive and Pond View Drive intersects Daniel Webster Drive (the former DWH mainline) an approximately 700-foot long one-way northbound frontage road to DWH. Pond View Drive’s intersection with the Daniel Webster Drive is located just 35 feet east of its intersection with the DWH proper. Pond View Drive is stop controlled at its intersection with both DWH and Daniel Webster Drive. All approaches have one lane. Traffic operations for 2007 were acceptable during peak hours. Island Drive also has access to the DWH via Daniel Webster Drive. All traffic accessing Island Drive must enter and exit via Daniel Webster Drive.



*Daniel Webster Highway at Pond View and Island Drives*

The site drive to **Old Shaw's Plaza** is also traffic signal controlled and is located approximately 3,100 feet north of Greeley Street. DWH has a single through travel lane in each direction plus a northbound exclusive left turn lane and a southbound exclusive right turn lane. Separate exclusive left and exclusive right turn lanes are provided on the site drive's approach to DWH. Sidewalks are not provided at this intersection that also serves as the main site drive to the adjacent East Ridge multi-family development, as shown in the photo to the right.



*Old Shaw's Plaza/East Ridge at Daniel Webster Highway*

**East Chamberlain Road** intersects **DWH** at a skew intersection as can be seen from the aerial. East Chamberlain Road is stop sign controlled at its intersection with DWH. DWH has a single lane on both approaches to the intersection, but a painted median allows left turning motorists refuge from oncoming traffic. This intersection is located approximately 250 feet south of the Rite Aid Plaza signalized intersection.



*East Chamberlain Road at Daniel Webster Highway*

The **Rite Aid Plaza Site Drive intersection** at **DWH** is controlled by a traffic signal. Located just north of East Chamberlain Road, DWH has a single through lane in both directions plus a southbound right turn lane and a northbound left turn lane. The Rite Aid Plaza drive has two approach lanes to DWH and is median divided. A sidewalk is provided on the northwest side of the DWH connecting the Rite Aid Plaza to a driveway opposite Railroad Avenue. This intersection operates well during peak hours.



*Rite Aid Plaza at Daniel Webster Highway*

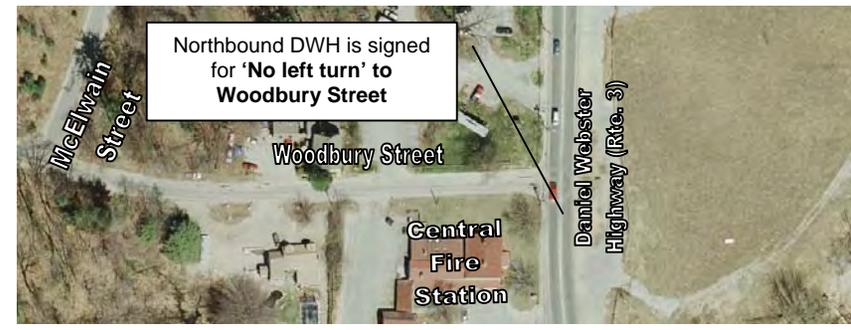
**Railroad Avenue at DWH** is comprised of two unsignalized intersections and is located approximately 325 feet north of the Rite Aid Plaza traffic signal. The southerly Railroad Avenue intersection is stop sign controlled while the northerly intersection is yield sign controlled. From the aerial to the right, the northerly Railroad Avenue leg intersects the DWH at a skew on the outside of a horizontal curve on, while the southerly Railroad Avenue leg intersects the DWH at 90° opposite a gas station driveway to form a four-way intersection with the Prime Gas Station driveway. Sidewalks are provided on the east side of the DWH north of the Railroad Avenue north intersection and on the west side south of the southerly intersection. The relatively low volume of traffic exiting from the Railroad Avenue intersection operates with some congestion during the AM peak hour and with considerable congestion during the PM peak hour.

Woodbury Street presents a traffic hazard to the motoring public.



*Railroad Avenue at Daniel Webster Highway*

**Woodbury Street** forms a ‘T’ intersection at **DWH** just north of the Central Fire Station. All approaches have a single lane. Approximately 850 feet to the west, **McElwain Street** is stop-sign controlled at its intersection with **Woodbury Street**. Located approximately 800 feet north of Railroad Avenue following an ‘S’ curve on DWH in the vicinity of the Chamberlain Bridge, Woodbury Street is stop sign controlled on its approach to the DWH. Sidewalks are provided on the east side of DWH. A sign at Woodbury Street, often ignored, prohibits northbound left turns into Woodbury Street. While the left turn movements are supposed to occur 600 feet upstream at the newly modified Connell’s (CVS) Plaza traffic signal which has a separate left turn lane, count data indicates some are still being made at the DWH/Woodbury Street intersection. Both intersections operate acceptably during peak hours during 2007, but continuing illegal left turns into



*Woodbury Street at Daniel Webster Highway*

The south end of the **Loop Road** at the **DWH** is located approximately 200 feet south of a traffic signal serving the newly renovated **Connell's (CVS) Plaza**. Loop Road and DWH have single lanes at their unsignalized intersection. The Loop Road approach is stop-controlled and its skewed 25° intersection with the DWH is problematic, as vehicles parked in the parking lot in the northeast corner can block visibility of the intersection. Ideally, intersections should be designed to intersect at no less than a 60° angle – and preferably at a 90° angle, if possible.

The traffic signal controlling the **Connell's (CVS) Plaza Driveway** at **DWH** and its intersection layout was modified during 2008 to eliminate the southbound exclusive right turn lane shown on the aerial to the right. New sidewalk enhancements (see photo to the lower right) and the southbound left turn lane was relocated to serve the entrance to the Classic Gas service station. A sidewalk is provided on the both sides of the DWH with a signal-controlled crosswalk at the traffic signal.

At its northerly intersection with the **Loop Road**, **DWH** has one through lane in each direction, as does the stop sign controlled Loop Road. Like the southerly intersection, the Loop Road northerly intersection approaches DWH at a tight skew. A sidewalk is provided on the west side of DWH.



*Loop Road North at Daniel Webster Highway*



*Connell's (CVS) Plaza and Loop Road South at Daniel Webster Highway*



*Looking South along Daniel Webster Highway to newly renovated Connell (CVS) Plaza*

**Baboosic Lake Road** is signalized at its intersection with **DWH**. An exclusive left turn lane is provided for each DWH approach to this intersection. DWH has a through lane in each direction. In the southbound direction, the DWH has three approach lanes, one each for the through, right and left traffic movements. The eastbound Baboosic Lake Road approach has two lanes, one for right turn traffic movements and the other for through/left turn traffic movements (see aerial right). The former Emerald Isle Auto Sales and Connell’s Auto Repair driveway is approximately 50 feet offset to the north from Baboosic Lake Road. This offset, which ideally should be eliminated, creates an awkward and hazardous condition for motorists turning left out of Baboosic Lake Road. The intersection that requires a separate traffic signal phase. Sidewalks are provided on all sides of the intersection. The intersection operates at an LOS D when school bus activity is significant during the AM peak hour. While the commuter PM peak hour operates an acceptable LOS C, school bus traffic clogs the intersection during the 2-3 PM hour when schools are released.

Located approximately 1,050 feet north of Baboosic Lake Road, the unsignalized intersection of **Wire Road** at the **DWH** operates at LOS E during the AM peak hour and LOS C during the PM peak hour. Like the Loop Road intersection, Wire Road intersects DWH at a roughly 35° skew angle (see right) with a wide pavement opening that makes vehicle turning movements more hazardous than with a 90° intersection. Northbound on DWH, a left turn lane is provided. Both Wire Road and DWH have single approach lanes. However, the southbound approach DWH to Wire Road channelizes northbound through traffic away from the exclusive left turn lane via median striping. A sidewalk is provided on the west side of DWH up to Wire Road.



*Baboosic Lake Road at Daniel Webster Highway and Auto Sales /Repair Shop*



*Looking North on Daniel Webster Highway at Baboosic Lake Road*



*Wire Road at Daniel Webster Highway*

Approximately 750 feet north of Wire Road, **Twin Bridge Road** intersects **DWH** to form an unsignalized intersection. It operates acceptably during both peak hours. Twin Bridge Road is stop controlled and has no sidewalks on its approach to the DWH, which it intersects on the inside of a long horizontal curve. A sidewalk, separated by a greenspace, is provided only on the east side of the DWH north of the intersection.



*Twin Bridge Road at Daniel Webster Highway*

Located approximately 1,150 feet northwest of the Twin Bridge Road, **Front Street** and **Dunkin Donuts** intersect **DWH** in a four-way intersection controlled by a traffic signal. It operates acceptably during both peak hours. Northbound DWH has three approach lanes including a left, through and right lane, while DWH southbound has two lanes, a shared through/right and an exclusive left turn lane. Both the Dunkin Donuts site drive and Front Street approaches have two lanes including a shared through/left lane and an exclusive right turn lane. A sidewalk is provided on the north side of Front Street and on the west side of the DWH directly in front of the Dunkin Donuts site and to the McGaw Bridge Road.



*Front Street at Daniel Webster Highway*

**McGaw Bridge Road**, located approximately 150 feet north of Front Street, is unsignalized at its intersection with **DWH**. It forms a ‘T’ intersection and has a single approach lane and is stop sign controlled at its intersection with the DWH. The DWH has a single lane in each direction. It operates acceptably during both peak hours.

**Pine Street** at the **DWH** is another unsignalized ‘T’ intersection located approximately 1,250 feet northeast of the McGaw Bridge Road, but only 375 feet southwest of the traffic signal at the Reeds Ferry Shaw’s Plaza. Pine Street approaches the DWH from the east in a single lane and is stop sign controlled at its intersection. A sidewalk is provided on the west side of the DWH.

**Rainbow Avenue** at the **Reeds Ferry Shaws** and **DWH** is controlled by a traffic signal (see below to the right). DWH has a through lane in each direction plus an exclusive northbound left turn lane and an exclusive southbound right turn lane. The southwestbound painted median is provided on the DWH is wide enough to accommodate traffic waiting to turn left into Rainbow Avenue. The exit from the Reeds Ferry Shaws Plaza has two approach lanes including an exclusive right lane and a shared through left lane. The Rainbow Avenue approach has a single through lane. The intersection operates acceptably during peak hours. A sidewalk is provided on the west side of the DWH, along the Shaws Plaza frontage.

**Elm Street** intersects the **DWH** from the east in a ‘T’ intersection approximately 750 feet northeast of Rainbow Avenue. Elm Street has a one-lane approach to the DWH and a sidewalk is provided on the west side of the DWH. DWH’s southbound exclusive right lane to the Shaw’s Plaza is opposite the Elm Street intersection and a painted median is provided. The intersection’s existing peak hour traffic operations are acceptable.



*Pine Street at Daniel Webster Highway*



*Rainbow Avenue at Shaw’s and Daniel Webster Highway and Elm Street*

**Maple Street** forms another unsignalized ‘T’ intersection on the **DWH** approximately 300 feet east of Elm Street. Stop controlled at its intersection with DWH, Maple Street is located opposite an exclusive right turn entrance to the Reeds Ferry Shaws Plaza, approximately 550 feet northeast of the traffic signal. A sidewalk is provided on the west side of the DWH ending at the Plaza right turn entrance. The DWH has one general-purpose lane in each direction. Left turns are not permitted in the northbound direction of DWH into the Shaw’s drive at this location. The intersection operates acceptably during peak hours.

**Depot Street/Harris Avenue** forms a four-way intersection with **DWH** approximately 1,000 feet northeast of the Maple Street intersection (see lower photo to the right). Both the Depot Street and Harris Avenue approaches to DWH are stop sign controlled. The DWH provides one through lane in each direction. Depot Street provides an exclusive left turn lane and shared through /right lane in the westbound direction. The eastbound Harris Avenue approach is marked for a single lane. Angle parking is provided on the south side of Harris Avenue as it approaches the DWH.



*Maple Street at Daniel Webster Highway and Shaw’s Plaza Exclusive Right in Entrance*



*Depot Street at Daniel Webster Highway*

Following is a summary of the existing characteristics of intersections off the Daniel Webster Highway in the Town Center area.

**Church and McElwain Streets** intersect **Baboosic Lake Road** offset by approximately 50 feet and located approximately 550 feet west of the DWH. The two closely-spaced intersections form ‘T’s with Baboosic Lake Road. McElwain Street is generally busier than Church Street, as it provides access to Town Hall. Both McElwain and Church Streets are stop sign controlled on their approaches to Baboosic Lake Road. All streets have a single travel lane in each direction. Both intersections operate acceptably during peak hours. A sidewalk is provided on the south side of Baboosic Lake Road.



*Baboosic Lake Road at McElwain and Church Streets*

**Hillside Terrace** intersects **Baboosic Lake Road** from the north to form a ‘T’ intersection. The intersection is located approximately 650 feet west of McElwain Street. All approaches have a single lane. Analysis indicates it operates acceptably during both peak hours. A sidewalk is provided on the south side of Baboosic Lake Road.



*Baboosic Lake Road at Hillside Terrace*

**O’Gara Drive** intersects **Baboosic Lake Road** from the south to form a ‘T’ intersection. Stop sign controlled at its intersection with Baboosic Lake Road, O’Gara Drive’s operations are acceptable during the AM peak hour, but congested (LOS F) during the afternoon peak hour. All approach legs have a single lane. O’Gara Drive serves the Merrimack High School. A sidewalk is provided on the south side of Baboosic Lake Road.



*Baboosic Lake Road at O’Gara Drive*

**McGaw Bridge Road** intersects **Wire Road** at a hazardous 35° skewed angle forming an awkward ‘T’ interesection opposite **Hillside Terrace**. Each approach has a single lane and no sidewalks are available for pedestrian movements. The analysis indicates the intersection operates acceptably during the AM and PM peak hours.



*Wire Road at McGaw Bridge Road and Hillside Terrace*

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## **Chapter III**

### **Traffic Model Technical Report**

#### **Roadway Infrastructure Master Planning Study**

##### **Merrimack, New Hampshire**



# CHAPTER III TRAFFIC MODEL TECHNICAL REPORT

## I. BACKGROUND

As the Metropolitan Planning Organization (MPO) for the Nashua region, NRPC employs a series of local and regional travel demand models for use in forecasting future traffic conditions and air quality indicators. NRPC uses TransCad (currently at Version 5.0), a widely-recognized software package in the industry, to produce and run all its models. The software uses various land use, population, and employment data as inputs and forecasts daily traffic volumes for any base year or future scenario. This process is detailed in later chapters.

For the Merrimack project, NRPC created a new town-wide model with a more intense zone and network structure in order to handle the more specific roadway and intersection issues that the Town wanted to address. Similar small models have recently been used for NRPC corridor studies in the towns of Brookline and Mont Vernon with great success.

The goals of using a traffic model for this project were to arrive at future turning volumes at key intersections and to analyze traff

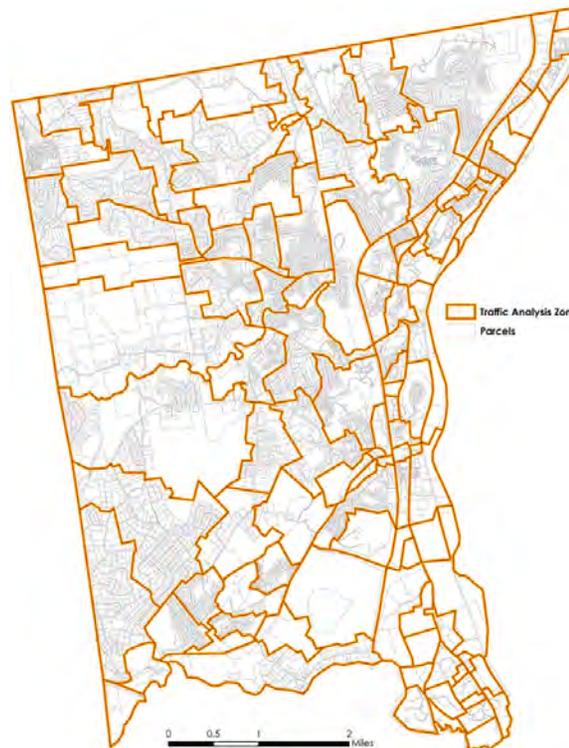
intersections due to the potential influx of large commercial and residential developments in the Town. The specifics of both these larger projects and the overall growth of currently vacant developable land in Town were agreed upon by NRPC and Merrimack staff.

## II. MODEL STRUCTURE

### A. ZONES

The Merrimack model is made up of 116 total traffic analysis zones (TAZs). A TAZ is used to aggregate the socioeconomic data of a group of parcels (or census blocks or similar geographical divisions) and load all trips coming out of those parcels onto the network at the proper locations. Of the total, 107 zones are located within Merrimack and 9 are considered “external”, representing trips coming from and going to Nashua, Manchester, Bedford, Massachusetts, and all other points north, south, and west of Merrimack. Map III-1 shows the TAZ structure in relation to Merrimack parcels. Parcel lines are maintained by NRPC and are representative of the conditions at the time of the creation of the model.

Parcels designated as locations  
e development were given their



Map III-1 Merrimack Traffic Analysis Zones

own TAZ, making it easier to isolate and identify the traffic each one produces. The majority of these parcels are located along Daniel Webster Highway, with the exception of the Chelsea outlets project.

## B. ROADS

The Merrimack model road network consists of most major thru-streets in Town, as well as external connections and centroid connector links. Map III-2 shows the street links in Merrimack, which include 90 of the 161 miles of Class V or higher roads in the Town.

For each road segment, the following attributes are included in order for the model to run properly:

- o Length
- o Direction
- o Speed<sup>1</sup>
- o Capacity including:
  - Number of lanes
  - Presence of median
  - Side friction<sup>2</sup>
  
- o Toll

In future scenarios, certain road segments were added or changed based on planned transportation projects in and

around Merrimack. These include the widening of the Everett Turnpike to a consistent 6-lane cross-section from Exit 8 to the Bedford Tolls, the addition of ramps on the north side of Bedford Rd at Exit 12, and the Airport Access Road connecting the Turnpike to Manchester-Boston Regional Airport.

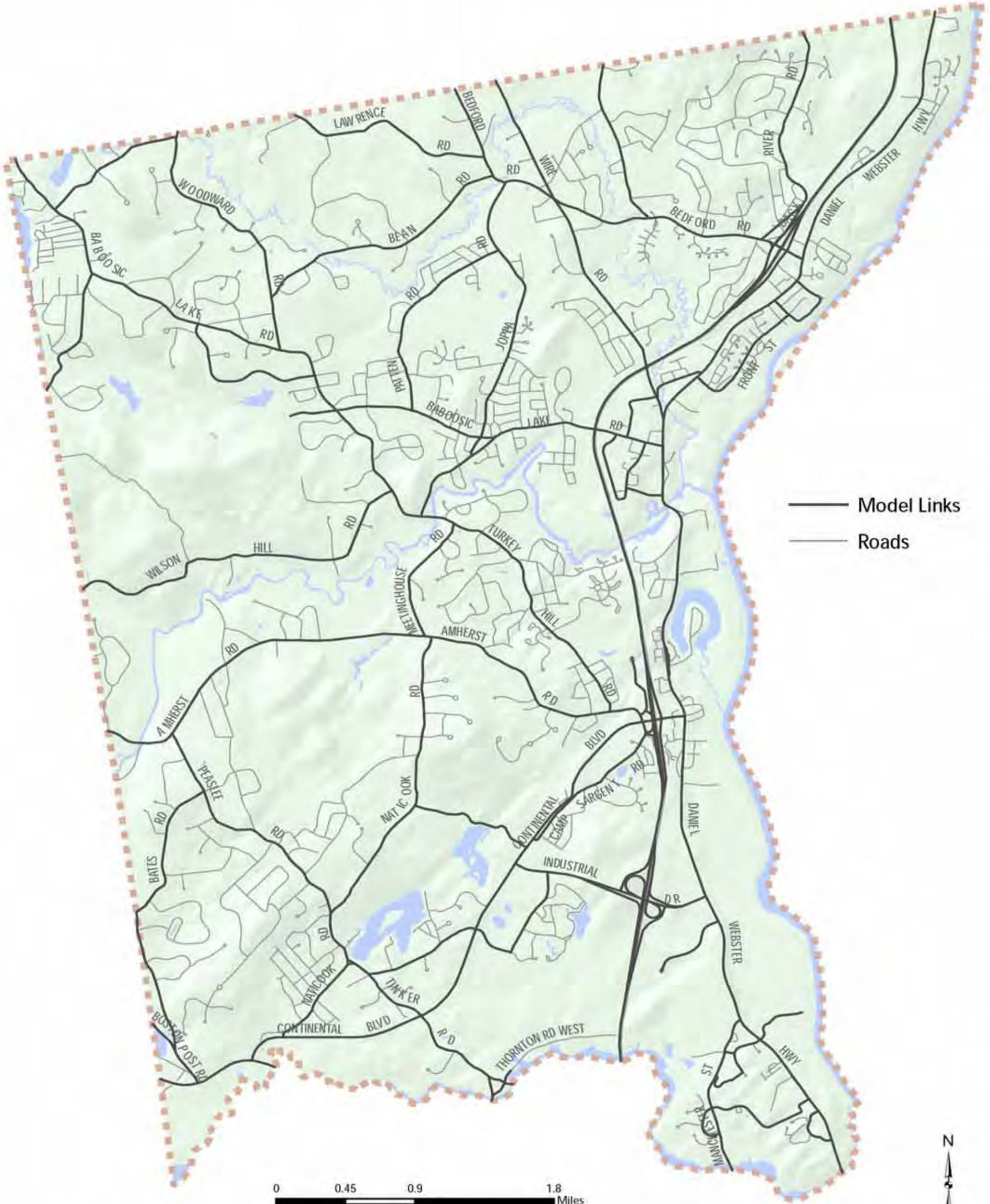
Finally, the network also includes centroid connectors, as mentioned above. These connectors, one per zone, are used to load the data from each TAZ onto the main roads of the model network. Connectors were placed in a specific location to accurately represent intersection conditions along a corridor where necessary, such as certain driveways to large businesses along the Daniel Webster Highway (refer ahead to Page III-5 for a sample illustration of Accurate Centroid Connectors). In many cases, however, centroid connectors are only general representations of the smaller roads that are not otherwise included in the network.

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<sup>1</sup>Speed is originally encoded according to posted limit, but later adjusted up or down during calibration to more accurately reflect true driving speeds across a 24-hour time period.

<sup>2</sup>Side friction is an indication of the density of development occurring around the road. Similarly-constructed streets in urban vs. rural areas will handle different capacities due to the presence of multiple curb cuts and other limiting factors.

# Map III-2 Merrimack Model Road Network



**C. MODEL INPUTS**

**i. Population Data**

Population data is entered into the model by household. The most recent data set for Merrimack is still the 2000 Census, so NRPC used 2007 population estimates from the NH Office of Energy Planning (NHOEP) to bump up the 2000 Census figures in order to use 2007 as the base year scenario. In 2000, the population of Merrimack was 25,119 while the 2007 NHOEP estimate was 26,297 – a 4.6% increase. Thus, the total number of households in town was also estimated to be 4.6% higher and then redistributed proportionally across each TAZ. The same method was used to arrive at the occupation of each worker in Merrimack (and the external zones) and vehicle availability for each household.

For population data in future year model runs, NRPC used a buildout scenario method. Future households were created on lots where they were allowable, based on town regulations such as minimum lot size and zoning, as well as limiting environmental factors such as wetlands and slope. Next, the households were assigned a build year (either 2017 or 2027) according to a suitability index used in the Community Viz software package. Based on proximity to major routes and public utilities, certain parcels are deemed more “desirable” for earlier development. In cases where residential development was expected on this project’s larger “focus parcels”, Town staff assigned the buildout year. Finally, these additions were summarized to the TAZ level for use in the model. In all, 828 households were added in the 2017 scenario and an additional

843 were added for 2027. Map III-3 below shows an example of how centroid connectors were placed for major parcels.



*Map III-3 -Example of Accurate Centroid Connectors*

**ii. Employment Data**

Employee counts were derived from ES 202 data, which is collected quarterly by the State of New Hampshire’s Department of Employment Security. NRPC most recently acquired this dataset for the year 2002. The data contains total monthly employment numbers for every business in the Town along with its address. These numbers are then geo-coded (matched to an address range in a GIS layer) and then summed to the TAZ they are located in.

Since this dataset was over 5 years old, NRPC then artificially added employees where new business of large sizes have opened since and subtracted employees where businesses had moved or closed. In cases where new employees were added, NRPC used a combination of ITE trip rates and an estimated floor area of the workplace to arrive at an approximate number. Examples include the Shaw’s Plaza at Exit 11, the Fidelity expansion on Manchester St., and the Campers Inn on Robert Milligan Pkwy.

Future year employment was calculated using the same buildout methods as those used for population (explained above). Further steps were taken to assign a specific industry class to each new business. This involved first breaking all the new commercial numbers into “retail”, “office/service”, or “industrial”, based on zoning and typical nearby uses. Next, those general categories were given more specific designations such as “professional”, “education/health”, and “manufacturing” by using the same percentages within in general class as exist in the current year model. For example, if 27% of all industrial jobs were in related to manufacturing in 2007, then that same percentage is applied to the total industrial jobs in the future years.

Certain larger developments, including all of the ones projected in the focus parcels, were given more specific parameters based on as much information as Merrimack could provide at the time. This information, primarily given in terms of square footage of a certain expected use, was then converted into employees using ITE trip generation rates and floor area ratios.

The data added to these focus parcel TAZs is discussed in the section of this report entitled “Intersection Analysis – Traffic Share”

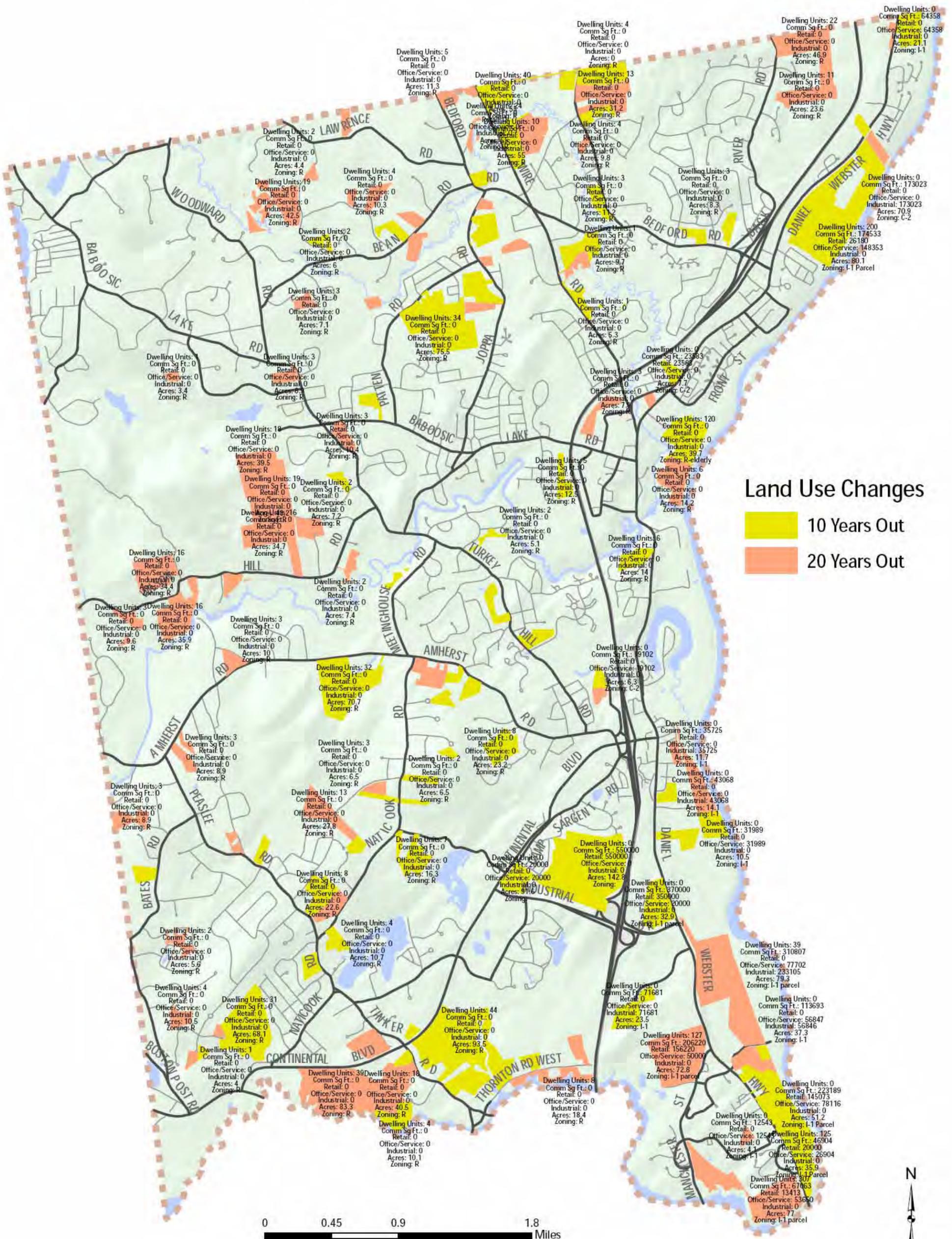
In all, nearly 1,700 households and 7,000 jobs were added to Merrimack TAZs. Table III-1 shows the exact numbers. Map III-4 shows all data added to the model in future years, by parcel, and in which years these parcels were assumed to be fully developed.

**TABLE III-1 – FUTURE DATA ADDITIONS TO MERRIMACK ZONES**

	by 2017	by 2027
Households	828	1671
Employees	4735	6859
Retail	2996	3692
Office	1290	1996
Industrial	449	1171

Data Source: NRPC

# Map III-4 Land Use Changes





### iii. Externals

For households and workers (employees who work in, but live outside of, Merrimack), NRPC used population projections from various sources. For New Hampshire communities, projections from the NH Office of Energy and Planning (OEP) were used. For Massachusetts, NRPC used the Boston Metropolitan Area Planning Council (MAPC) projections for the eastern part of the State.

In both cases, data for 2017 and 2027 – the horizon years used in this project – were not available and so data was interpolated using 2015, 2020, and 2030 data.

Similar methods were used to derive future employment data by industry. In New Hampshire, the Department of Employment Security’s Economic and Labor Market Information Bureau (ELMI) has developed a 2016 projection for the major industry types. NRPC used this data in its 2017 model, and extended the projections out to 2027 for that year’s data. This data is statewide only, and is the best dataset available. For Massachusetts, the Office of Labor and Workforce Development (EOLWD) also has 2016 projections available at the statewide level.

## III. MODEL CALIBRATION

### A. METHODOLOGY

In order to use the travel demand model as a tool to most accurately predict future traffic changes, it first needs to be calibrated to current data – in this case, the most recent traffic counts available in and around the Town. For this project, NRPC used average weekday traffic volumes (24-hour) conducted since 2002 to calibrate the model to current conditions. Anything older was not considered recent enough to be a reliable number. In locations where NRPC felt that additional counts were needed to fill in gaps, or obtain an even more recent count – such as around important intersections – new data was collected. These counts were performed mostly in the late Fall of 2008. Map III-5 and Table III-2 show the most recent 24-hour count for all available locations in Merrimack.

To calibrate average daily traffic estimates, NRPC performs a series of model runs, each time adjusting the speeds on the road network to either draw traffic to a road (if model volumes are lower than the expected volumes) or divert it elsewhere (if the volumes are coming out too high). For the Merrimack model, NRPC ran the model over 70 times in order to meet certain calibration criteria.

**TABLE III-2 – AVERAGE WEEKDAY TRAFFIC VOLUMES**

Street	Location	Count	Year
Amherst Rd	@ Amherst T/L	1,942	2008
Amherst Rd	W. of Meetinghouse Rd	3,931	2006
Amherst Rd	W. of Turkey Hill Rd	4,955	2007
Baboosic Lake Rd	@ Amherst T/L	1,783	2008
Baboosic Lake Rd	E. of McQuestion Rd	3,719	2006
Baboosic Lake Rd	over Everett Turnpike	12,094	2007
Baboosic Lake Rd	W. of US3	11,405	2006
Back River Rd	@ Bedford T/L	2,804	2008
Bean Rd	over Baboosic Brook	825	2008
Bedford Rd	@ Bedford T/L	1,038	2008
Bedford Rd	over Baboosic Brook	6,754	2008
Bedford Rd	W. of Everett Tpk	10,716	2007
Bedford Rd	W. of US3	12,137	2008
Boston Post Rd	S. of Seaverns Bridge Rd	7,141	2007
Camp Sargent Rd	W. of Continental Blvd	3,863	2008
Continental Blvd	E. of Naticook Rd	14,463	2007
Continental Blvd	N. of Contra Way	14,427	2008
Continental Blvd	N. of Industrial Dr	10,874	2006
Continental Blvd	N. of NH101A	18,370	2007
Continental Blvd	S. of Contra Way	14,735	2008
Continental Blvd	W. of Amherst Rd	10,229	2007
Contra Way	E. of Continental	2,492	2008
Daniel Webster Hwy	@ Nashua C/L	15,581	2007
Daniel Webster Hwy	N. of Bedford Rd	14,423	2006
Daniel Webster Hwy	N. of Front St	13,922	2008
Daniel Webster Hwy	N. of Greeley St	21,297	2008
Daniel Webster Hwy	N. of Industrial Dr	15,841	2007
Daniel Webster Hwy	N. of Manchester St	19,049	2007
Daniel Webster Hwy	N. of Shelburne Rd	13,609	2008
Daniel Webster Hwy	N. of Wire Rd	15,951	2008
Daniel Webster Hwy	over Souhegan River	17,803	2007
Daniel Webster Hwy	S. of Baboosic Lake Rd	19,298	2008

Street	Location	Count	Year
Daniel Webster Hwy	S. of Bedford Rd	15,715	2008
Daniel Webster Hwy	S. of Columbia Cir	20,964	2008
Daniel Webster Hwy	S. of Greeley St	16,318	2008
Daniel Webster Hwy	S. of Industrial Dr	20,292	2008
Daniel Webster Hwy	S. of Manchester St	16,357	2008
Daniel Webster Hwy	S. of Wire Rd	19,302	2008
Dunbarton Dr	E. of Tinker Rd	152	2006
Everett Turnpike	@ Merrimack T/L	13,087	2006
Everett Turnpike	@ Nashua C/L	54,000	2003
Everett Turnpike	N. of Exit 10	56,000	2003
Everett Turnpike	N. of Exit 11	55,000	2003
Exit 10	NB off	3,467	2008
Exit 10	NB on	5,017	2008
Exit 10	NB on-ramp from EB	2,903	2008
Exit 10	NB on-ramp from WB	1,484	2008
Exit 10	SB off	4,550	2008
Exit 10	SB on-ramp EB	2,656	2008
Exit 10	SB on-ramp from WB	749	2008
Exit 11	NB off	5,345	2008
Exit 11	NB on	4,193	2008
Exit 11	SB off-ramp	4,555	2008
Exit 11	SB on-ramp from Amherst Rd	3,526	2008
Exit 11	SB on-ramp from Camp Sgt	1,898	2008
Exit 12	NB off	4,886	2008
Exit 12	SB on	5,053	2008
Front St	E. of US3	5,046	2008
Greeley St	W. of US3	23,370	2008
Hilton Dr	E. of US3	755	2006
Industrial Dr	W. of Spartan Way	10,130	2007
Industrial Dr	W. of US3	9,768	2008
Manchester St	@ Nashua C/L	3,989	2008
Manchester St	S. of Henry Clay Dr	4,411	2006
Manchester St	W. of US3	3,556	2008

**Fay, Spofford & Thorndike**

Street	Location	Count	Year
McGaw Bridge Rd	over Baboosic Brook	1,427	2008
Milford Rd	@ Hollis T/L	37,343	2007
Milford Rd	@ Nashua C/L	42,858	2007
Naticook Rd	S. of Amherst Rd	2,558	2007
Peaslee Rd	N. of Bates Rd	1,627	2008
Peaslee Rd	N. of Naticook Rd	3,592	2008
Pondview Dr	E. of Daniel Webster Dr	296	2006
Scott Dr	S. of Bryce Dr	124	2006
Shaw's Plaza	W. of Daniel Webster Hwy	3,914	2006
Spartan Way	S of Industrial Dr	7,622	2008
Tinker Rd	S. of Camp Sargent Rd	442	2008
Tinker Rd	S. of Continental Blvd	3,252	2007
Tinker Rd	W. of Thornton Rd	2,834	2003
Turkey Hill Rd	over Souhegan River	10,740	2008
Wire Rd	@ Bedford T/L	3,440	2008
Wire Rd	W. of Everett Tpke	4,884	2008
Wire Rd	W. of US3	3,971	2008

# Map II-5

## Average Weekday Traffic Volumes (2006-2008)





**B. CALIBRATION TARGETS**

The Federal Highway Administration (FHWA) and the Michigan Department of Transportation (MDOT) have both established widely-used modeling guidelines that include a set of targets that an urban model should meet when calibration is complete. These targets are expressed in terms of percent deviation from expected daily traffic, depending on the magnitude of the volumes each road segment handles.

MDOT’s model calibration standards are tighter than those of FHWA on high-volume roads, whereas the opposite is true for smaller facilities. NRPC chose to adopt the stricter of the two targets for each volume tier in order to achieve maximum accuracy and predicting capability. Table III-3 displays these targets.

In the Merrimack model, there were 78 links with an existing traffic count to calibrate to. Of these, 67 were calibrated to within NRPC’s target deviation range. This percent within range is considered more than acceptable for a calibrated model of this scale. Map III-6 displays which road segments were within the range, and which were not.

In addition to percent deviation, another tool to measure how well a model is calibrated is by looking at the square of the correlation coefficient ( $R^2$ ). This estimates the correlation between the actual ground counts and the modeled traffic volumes. An  $R^2$  value of 1.0 represents perfect agreement between the two sets of data. Generally, anything above 0.85 is considered acceptable for a regional model. NRPC’s calibrated Merrimack model registered an  $R^2$  value of 0.994 – an indication of an extremely accurate calibration.

**TABLE III-3 – PERCENT DIFFERENCE TARGETS FOR DAILY VOLUMES ON MODEL LINKS**

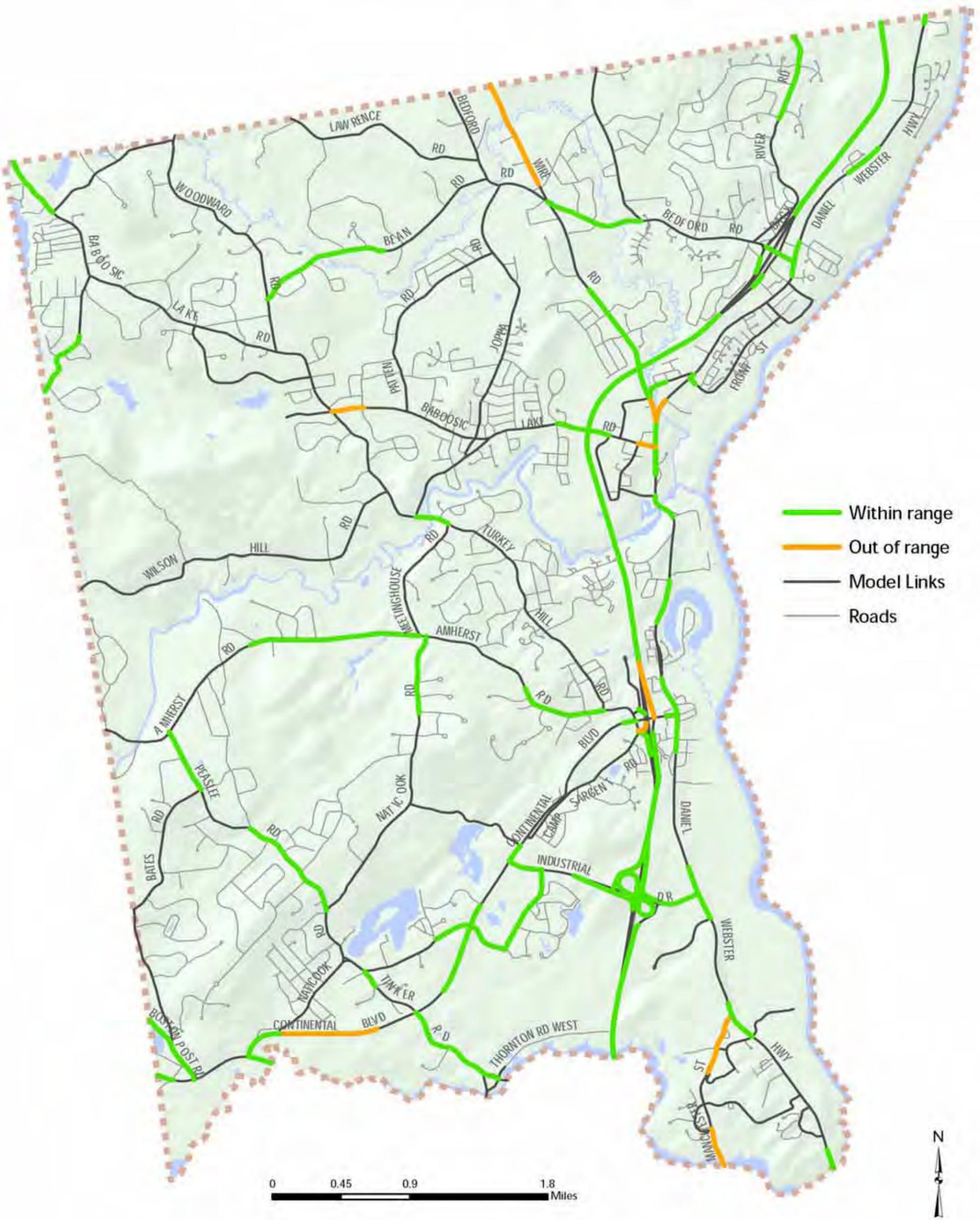
Average Daily Traffic	Maximum Calibration Deviation from Volume Counts	
	MDOT	FHWA
< 1,000	200%	<b>60%</b>
1,000 to 2,500	100%	<b>47%</b>
2,500 to 5,000	50%	<b>36%</b>
5,000 to 10,000	<b>25%</b>	29%
10,000 to 25,000	<b>20%</b>	25%
25,000 to 50,000	<b>15%</b>	22%
> 50,000	<b>10%</b>	21%

**Bold** indicates standards used by NRPC

Source:

<http://tmip.fhwa.dot.gov/resources/clearinghouse/docs/mvrcm/ch7.htm>

# Map III-6 Calibration Range Results



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## Chapter IV TRAFFIC FORECASTS

### Roadway Infrastructure Master Planning Study Merrimack, New Hampshire



## CHAPTER IV TRAFFIC FORECASTS

### I. BACKGROUND

As the Metropolitan Planning Organization (MPO) for the Nashua region, NRPC employs a series of local and regional travel demand models for use in forecasting future traffic conditions and air quality indicators. NRPC uses TransCad (currently at Version 5.0), a widely-recognized software package in the industry, to produce and run all its models. The software uses various land use, population, and employment data as inputs and forecasts daily traffic volumes for any base year or future scenario. This process is detailed in Chapter III -Traffic Model Technical Report.

For the Merrimack project, NRPC created a new town-wide model with a more intense zone and network structure in order to handle the more specific roadway and intersection issues that the Town wanted to address. Similar small models have recently been used for NRPC corridor studies in the towns of Brookline and Mont Vernon with great success.

The goals of using a traffic model for this project were to arrive at future turning volumes at key intersections and to analyze traffic share at key intersections due to the potential influx of large commercial and residential developments in the Town. This report details the results of those model runs and associated analyses.

Model runs were performed for two analysis years – 2017 and 2027. The first section of this Chapter focuses on

townwide traffic volumes for each of those two years, based on future network and land use changes. Generally, these changes are also discussed in depth in Chapter III, as cited above.

Next, this Chapter focuses on five key intersections in the Town, and the potential share of traffic at each one that is going to experience from one of the large potential future development parcels. The aim of this part of the project is to be able to approach the developers of these projects with an early estimate of the traffic share they will be responsible for and thus the share of improvement costs they should contribute. The first part of this chapter includes the details of specific household and employment data added to these focus parcels.

Model assumptions for programmed roadway modifications are documented in the *Nashua Metropolitan Areas Long Range Transportation Plan for 2007-2027*. The list of potential long-range projects has changed somewhat since 2006. For this study, it is assumed:

- The Airport Access Road in Bedford is to be constructed by 2017. During 2009, this project was selected to receive funding under the American Recovery and Reinvestment Act.
- The Route 3 (FE Everett Turnpike) widening with Exit 12 modifications will be constructed prior to 2027.
- A new commuter rail station with ancillary parking or joint private/public transit development is to be completed by 2027.
- NH Route 101A corridor improvements will occur by 2027; and
- The Circumferential Highway has been dropped from consideration.

One important piece of information not found in this Chapter is intersection level of service and recommendations for improvement. For this, refer to Chapter V - Short and Long Range Infrastructure Analysis.

**II. FOCUS PARCELS**

**A. LOCATIONS**

Parcels where large developments could potentially occur in the future year scenarios were provided to NRPC by the Town of Merrimack and are referred to in this document as “focus parcels”. Six of these seven parcels are located in the southeast part of the community, with the exception of the Flatley property in the northeast. Table IV-1 shows the location and reference name of these areas. These parcels are either currently vacant or have sizable amounts of vacant land next to an existing development that could be used in the future. In some cases, these parcels could see complete redevelopment in the next 10 to 20 years.

**B. PHASING**

Per Town of Merrimack staff, NRPC phased in development of each of these parcels for the proper horizon year. Four of the focus parcels – Edgebrook Heights, Nashua Corp., Kollsman, and Flatley – were entered into the 2017 model, meaning their development would take place at some point between the current year and 2017. The other three focus parcels – Southwood, BAE, and Anheuser-Busch – were then programmed for 2027. Normal growth throughout the rest of the Town was determined parcel-by-parcel for a buildout process, with phasing determined by a development suitability index. This is discussed further in Chapter III of this study.

**TABLE IV- 1 – FOCUS DEVELOPMENT PARCEL**

**REFERENCE TABLE**

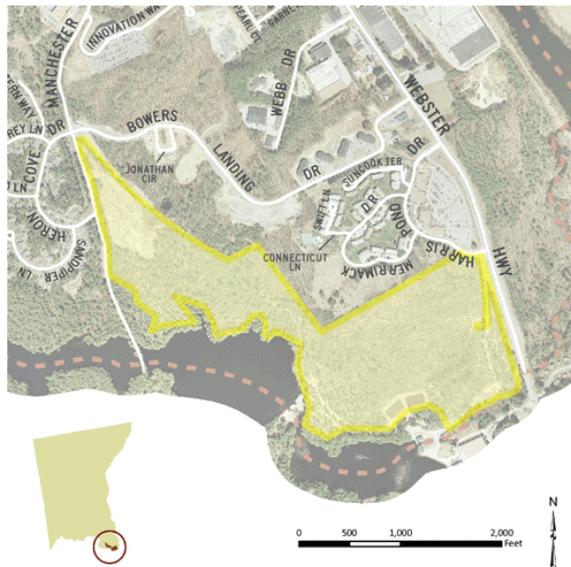
Parcel Identifier	Description	Approx. Acreage
A	Southwood Site (between Manchester Street and Everett Turnpike)	94.7
B	Edgebrook Heights (East of Daniel Webster Highway on Nashua City Line)	52.6
D	BAE Site (West of Daniel Webster Highway between Al Paul Lane and Technology Park Drive)	157.0
E	Nashua Corp. Site (East of Daniel Webster Highway opposite Webb Drive)	52.5
F	Anheuser-Busch Site (East of Daniel Webster Highway opposite Industrial Drive)	195.7
G	Kollsman Site (Northwest corner of Daniel Webster Highway at Industrial Drive)	65.9
H	Flatley Site (East of Daniel Webster Highway on the Saint Gobain site)	150.0

**C. MODEL DATA**

NRPC’s model uses households, residents by job industry, and employees by industry as its main inputs. Thus for every focus parcel, NRPC required this information for the residential and commercial developments being predicted. If the estimates were not available directly in this format, ITE Trip Generation rates were used, based on expected square footage at each location. Note that, in general, retail uses produce far more trips than office and industrial uses with a similar number of employees. The following pages provide a combined location illustration and tabular summary of the model input data added to each of the seven focus parcels.

**PARCEL A – SOUTHWOOD**

**Map IV-1: Location of Parcel A**

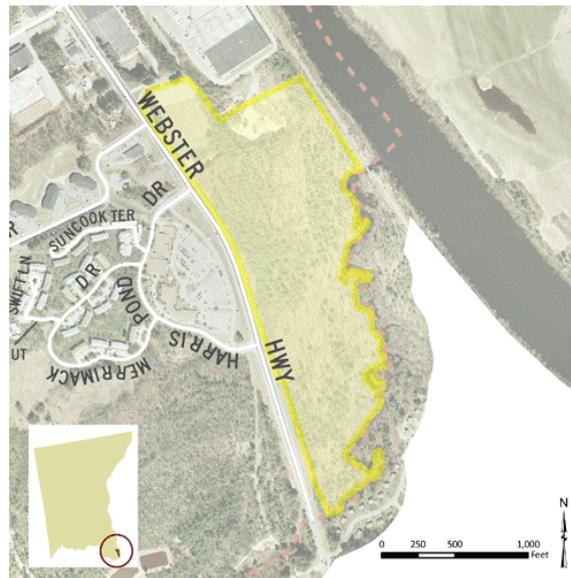


**TABLE IV-2: PARCEL A DATA**

Site Info	
Build Date	2027
Residential Units	307
Retail Sq Ft	13,143
Office/Service Sq Ft	53,650
Industrial Sq Ft	0
Total Employees	173
Total Daily Trips at Build-out (in and out)	11,600

**PARCEL B – EDGEBROOK HEIGHTS**

**MAP IV-2: LOCATION OF PARCEL B**

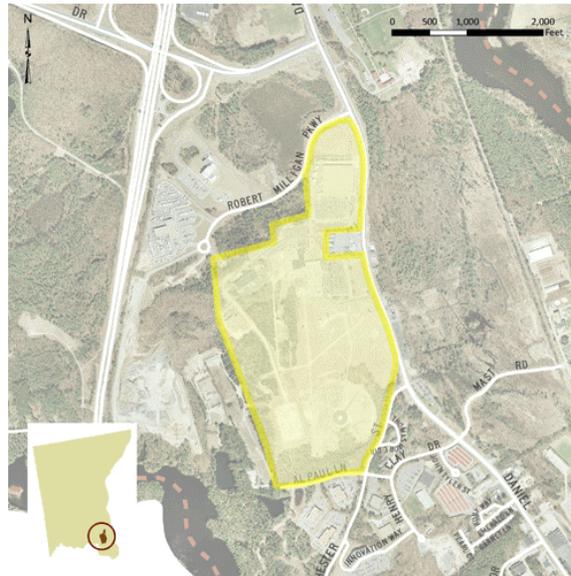


**TABLE IV-3: PARCEL B DATA**

Site Info	
Build Date	2017
Residential Units	125
Retail Sq Ft	20,000
Office/Service Sq Ft	26,904
Industrial Sq Ft	0
Total Employees	192
Total Daily Trips at Build-out (in and out)	3,400

**PARCEL D – BAE SYSTEMS**

**MAP IV-3: LOCATION OF PARCEL D**

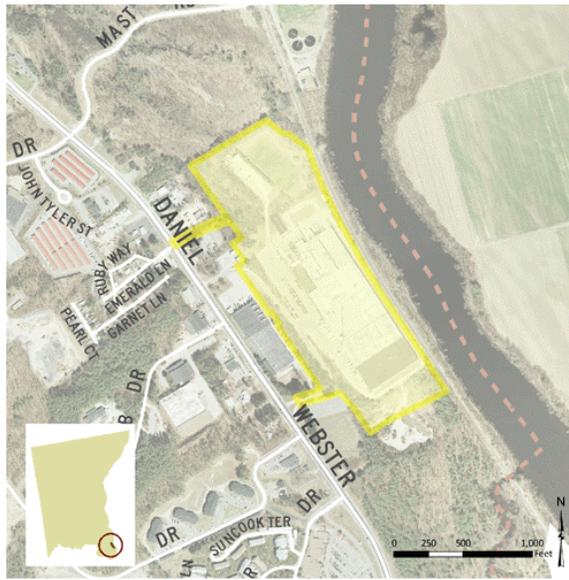


**TABLE IV-4: PARCEL D DATA**

Site Info	
Build Date	2027
Residential Units	127
Retail Sq Ft	156,220
Office/Service Sq Ft	50,000
Industrial Sq Ft	0
Total Employees	548
Total Daily Trips at Build-out (in and out)	7,800

**PARCEL E – NASHUA CORP.**

**MAP IV-4: LOCATION OF PARCEL E**

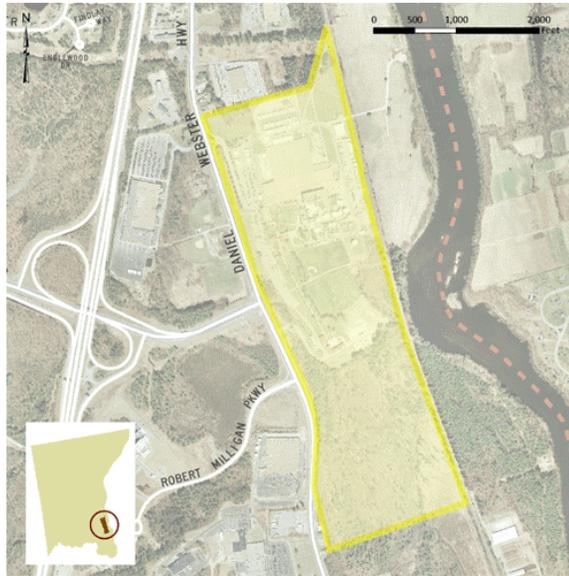


**TABLE IV-5: PARCEL E DATA**

Site Info	
Build Date	2017
Residential Units	0
Retail Sq Ft	145,073
Office/Service Sq Ft	78,116
Industrial Sq Ft	0
Total Employees	589
Total Daily Trips at Buildout (in and out)	9,700

**PARCEL F – ANHEUSER-BUSCH**

**MAP IV-5: LOCATION OF PARCEL F**

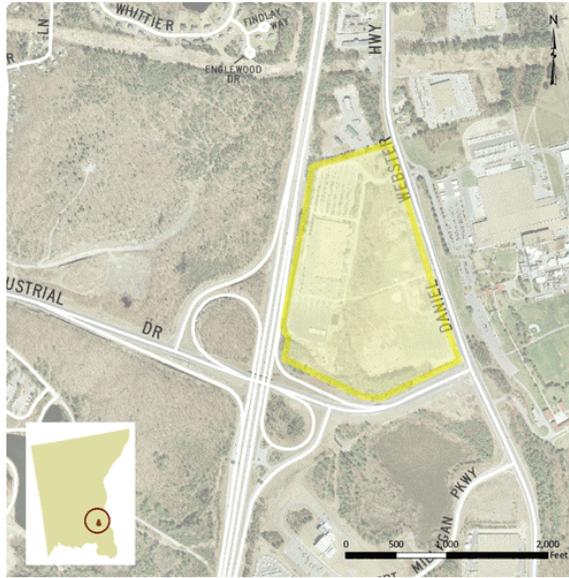


**TABLE IV-6: PARCEL F DATA**

Site Info	
Build Date	2027
Residential Units	39
Retail Sq Ft	0
Office/Service Sq Ft	134,549
Industrial Sq Ft	289,951
Total Employees	800
Total Trips at Buildout (in and out)	5,200

**PARCEL G – KOLLSMAN**

**MAP IV-6: LOCATION OF PARCEL G**



**TABLE IV-7: PARCEL G DATA**

Site Info	
Build Date	2017
Residential Units	0
Retail Sq Ft	350,000
Office/Service Sq Ft	20,000
Industrial Sq Ft	0
Total Employees	941
Total Trips at Buildout (in and out)	17,000

**PARCEL H – FLATLEY**

**MAP IV-8: LOCATION OF PARCEL H**



**TABLE IV-8: PARCEL H DATA**

Site Info	
Build Date	2017
Residential Units	200
Retail Sq Ft	26,180
Office/Service Sq Ft	148,353
Industrial Sq Ft	173,023
Total Employees	720
Total Trips at Buildout (in and out)	6,700

**D. MERRIMACK PREMIUM OUTLETS**

Not listed among the focus parcels, but included in all future model runs, is the Merrimack Premium Outlets development, west of the Exit 10 interchange on Industrial Drive. With a concrete idea of the amount and type of development to take place in association with this project, NRPC and the Town felt it was not appropriate to analyze its traffic impacts in a similar manner to the more uncertain future development parcels.

However, with the amount of traffic this project is expected to create, it was important to include the Outlets in any 2017 and 2027 model analysis. NRPC used the trip generation estimates from the Traffic Impact Study done by VHB in 2007. These trips, from their general origin (again, according to the Traffic Study), were loaded into the future model runs. The total in and out trips to this development equaled 12,454.

**III. TOWNWIDE TRAFFIC VOLUMES**

**A. 2017 SCENARIO**

*NOTE – Refer to MapIV-8 for all data discussed in this section*

As noted in the technical report, except for the assumed construction of the Airport Access Road in the Town of Bedford, no physical changes to the road network were put in place for 2017, as the major road projects slated for Merrimack in the most recent planning cycle do not occur until after this horizon year. Therefore, the only additions to the model for 2017 were the driveways and trip data associated with the

major developments as well as the smaller background buildout growth occurring throughout the Town.

Table 12 shows the modeled traffic volumes for the 2017 scenario, adjusted to the most recent traffic count in the NRPC database. For example, if volume on a road segment increased 42% from base year to 2017 in the traffic model, NRPC applied that 42% growth to the most recent count to arrive at the adjusted final number.

**TABLE IV-9 – AVERAGE WEEKDAY TRAFFIC IN 2017 – ADJUSTED TO COUNTS**

Street	Location	Current	2017	% Change
Amherst Road	@ Amherst T/L	1,942	2,095	7.9%
Amherst Road	W. of Meetinghouse Road	3,931	4,326	10.0%
Amherst Road	W. of Turkey Hill Road	4,955	5,557	12.1%
Baboosic Lake Road	@ Amherst T/L	1,783	1,946	9.1%
Baboosic Lake Road	E. of McQuestion Road	3,719	3,734	0.4%
Baboosic Lake Road	over Everett Turnpike	12,094	12,508	3.4%
Baboosic Lake Road	W. of US3	11,405	12,243	7.3%
Back River Road	@ Bedford T/L	2,804	4,393	56.7%
Bean Road	over Baboosic Brook	825	909	10.2%
Bedford Road	@ Bedford T/L	1,038	319	-69.3%
Bedford Road	over Baboosic Brook	6,754	8,025	18.8%
Bedford Road	W. of Everett Tpke	10,716	11,242	4.9%
Bedford Road	W. of US3	12,137	13,542	11.6%
Boston Post Road	S. of Seaverns Bridge Road	7,141	7,710	8.0%
Camp Sargent Road	W. of Continental Boulevard	3,863	3,998	3.5%
Continental	E. of Naticook Road	14,463	17,383	20.2%

Street	Location	Current	2017	% Change
Boulevard				
Continental Boulevard	N. of Contra Way	14,427	18,078	25.3%
Continental Boulevard	N. of Industrial Drive	10,874	10,946	0.7%
Continental Boulevard	N. of NH101A	18,370	20,960	14.1%
Continental Boulevard	S. of Contra Way	14,735	18,118	23.0%
Continental Boulevard	W. of Amherst Road	10,229	9,606	-6.1%
Contra Way	E. of Continental Boulevard	2,492	2,716	9.0%
Daniel Webster Highway	@ Nashua C/L	15,581	21,795	39.9%
Daniel Webster Highway	N. of Bedford Road	14,423	20,207	40.1%
Daniel Webster Highway	N. of Front Street	13,922	15,757	13.2%
Daniel Webster Highway	N. of Greeley Street	21,297	25,855	21.4%
Daniel Webster Highway	N. of Industrial Drive	15,841	29,298	85.0%
Daniel Webster Highway	N. of Manchester Street	19,049	25,667	34.7%
Daniel Webster Highway	N. of Shelburne Road	13,609	18,409	35.3%
Daniel Webster Highway	N. of Wire Road	15,951	18,374	15.2%
Daniel Webster	over Souhegan River	17,803	20,135	13.1%

Street	Location	Current	2017	% Change
Daniel Webster Highway	S. of Baboosic Lake Road	19,298	21,409	10.9%
Daniel Webster Highway	S. of Bedford Road	15,715	18,701	19.0%
Daniel Webster Highway	S. of Columbia Cir	20,964	25,182	20.1%
Daniel Webster Highway	S. of Greeley Street	16,318	23,914	46.5%
Daniel Webster Highway	S. of Industrial Drive	20,292	27,524	35.6%
Daniel Webster Highway	S. of Manchester Street	16,357	16,673	1.9%
Daniel Webster Highway	S. of Wire Road	19,302	22,164	14.8%
Everett Turnpike	@ Bedford T/L	58,210	63,769	9.5%
Everett Turnpike	@ Nashua C/L	54,000	75,580	40.0%
Everett Turnpike	N. of Exit 10	56,000	65,938	17.7%
Everett Turnpike	N. of Exit 11	55,000	64,404	17.1%
Exit 10	NB off	3,467	12,746	267.6%
Exit 10	NB on	5,017	7,396	47.4%
Exit 10	NB on-ramp from EB	2,903	4,068	40.1%
Exit 10	NB on-ramp from WB	1,484	3,265	120.0%
Exit 10	SB off	4,550	5,956	30.9%
Exit 10	SB on-ramp EB	2,656	10,422	292.4%
Exit 10	SB on-ramp from WB	749	4,970	563.6%
Exit 11	NB off	5,345	6,510	21.8%

Street	Location	Current	2017	% Change
Exit 11	NB on	4,193	4,585	9.3%
Exit 11	SB off-ramp	4,555	6,579	44.4%
Exit 11	SB on-ramp from Amherst Road	3,526	4,147	17.6%
Exit 11	SB on-ramp from Camp Sgt	1,898	2,183	15.0%
Exit 12	NB off	4,886	5,156	5.5%
Exit 12	SB on	5,053	4,965	-1.7%
Front Street	E. of US3	5,046	5,383	6.7%
Greeley Street	W. of US3	23,370	24,904	6.6%
Industrial Drive	W. of Spartan Way	10,130	14,744	45.5%
Industrial Drive	W. of US3	9,768	21,895	124.2%
Manchester Street	@ Nashua C/L	3,989	9,433	136.5%
Manchester Street	S. of Henry Clay Drive	4,411	11,655	164.2%
Manchester Street	W. of US3	3,556	9,693	172.6%
McGaw Bridge Road	over Baboosic Brook	1,427	1,642	15.1%
Milford Road	@ Hollis T/L	37,343	40,133	7.5%
Milford Road	@ Nashua C/L	42,858	42,879	0.0%
Naticook Road	S. of Amherst Road	2,558	2,608	2.0%
Peaslee Road	N. of Naticook Road	3,592	3,998	11.3%
Spartan Way	S of Industrial Drive	7,622	7,425	-2.6%
Tinker Road	S. of Continental Boulevard	3,252	3,985	22.5%
Tinker Road	W. of Thornton Road	2,834	3,473	22.5%
Turkey Hill Road	over Souhegan River	10,740	10,779	0.4%
Wire Road	@ Bedford T/L	3,440	4,225	22.8%
Wire Road	W. of Everett Tpke	4,884	5,913	21.1%
Wire Road	W. of US3	3,971	4,565	15.0%

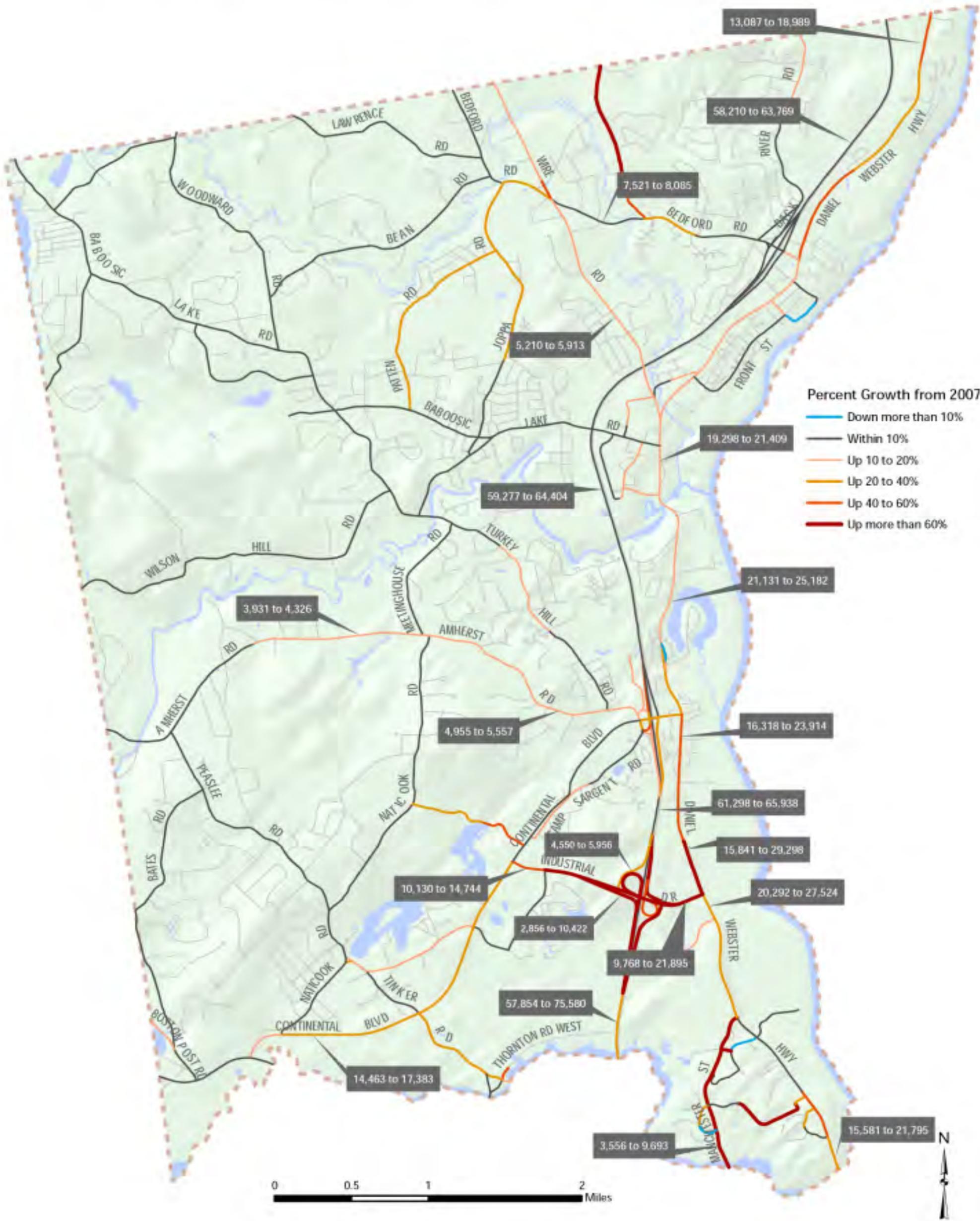
As expected, because of the intense development patterns predicted for the southeastern part of Merrimack by 2017, traffic volumes increase heavily along Industrial Drive, the Exit 10 ramps, Manchester Street, and Daniel Webster Highway (US3) between Industrial and Greeley Street. All these streets experience increases of at least 60% the current volumes by 2017, with some segments more than doubling in volume. Manchester Street’s large increases are due mostly to the dwindling room for traffic on Daniel Webster Highway running parallel to it.

Other routes seeing some of the more substantial volume increases in Town include:

- Daniel Webster Highway north of Exit 12, which is seeing around 5,000 more vehicles per day (vpd) in 2017 prior to programmed Exit 12 enhancements which decrease volumes more than 10% in this same segment by 2027.
- Continental Boulevard south of Industrial Drive, up anywhere from 2,000 to 4,000 vpd (due mostly to traffic associated with the Premium Outlet development, but also being used as a route to the large development on the Kollsman parcel)
- Wire and Bedford Roads in the northern part of Merrimack - This is where some of the prominent background growth is taking place, due to the room for residential growth at buildout. These roads currently have relatively low volumes, so increases in traffic are magnified moreso on a percentage basis there than on the major routes in Town.

# Map IV-8

## Change in Daily Traffic Volumes from 2007 to 2017



**B. 2027 SCENARIO**

*NOTE – Refer to Maps IV-9 and IV-10 for all data discussed in this section*

Two major network changes come into play for the 2027 model scenario - the widening of the Everett Turnpike to a 6-lane configuration from Exit 11 northward to the Bedford Tolls, and the associated addition of on- and off-ramps at Exit 12 on the northern side of Bedford Road.

The widening of the turnpike increases capacity, thus making the road more “attractive”, from a modeling perspective. The Exit 12 ramp completion would allow northbound traffic from the northern parts of Town a quicker route to the turnpike, rather than backtracking to Exit 11 or using back roads up to Bedford and Manchester. As the results show, this has other consequences on local traffic.

Finally, more focus parcel and background development was added to the 2027 model, as outlined in the Technical Report section of this full report.

Table 13 shows the modeled traffic volumes for the 2027 scenario, adjusted to the most recent traffic count in the NRPC database.

**TABLE IV-10 –AVERAGE WEEKDAY TRAFFIC IN 2027 – ADJUSTED TO COUNTS**

Street	Location	Current	2027	% Change
Amherst Road	@ Amherst T/L	1,942	2,227	14.7%
Amherst Road	W. of Meetinghouse Road	3,931	4,309	9.6%
Amherst Road	W. of Turkey Hill Road	4,955	5,665	14.3%
Baboosic Lake Road	@ Amherst T/L	1,783	1,960	9.9%
Baboosic Lake Road	E. of McQuestion Road	3,719	3,853	3.6%
Baboosic Lake Road	over Everett Turnpike	12,094	13,075	8.1%
Baboosic Lake Road	W. of US3	11,405	13,147	15.3%
Back River Road	@ Bedford T/L	2,804	3,981	42.0%
Bean Road	over Baboosic Brook	825	1,026	24.4%
Bedford Road	@ Bedford T/L	1,038	346	-66.7%
Bedford Road	W. of Everett Tpke	10,716	11,983	11.8%
Bedford Road	W. of US3	12,137	30,714	153.1%
Boston Post Road	S. of Seaverns Bridge Road	7,141	8,467	18.6%
Camp Sargent Road	W. of Continental Boulevard	3,863	4,861	25.8%
Continental Boulevard	E. of Naticook Road	14,463	16,492	14.0%
Continental Boulevard	N. of Contra Way	14,427	17,560	21.7%
Continental Boulevard	N. of Industrial Drive	10,874	10,815	-0.5%
Continental Boulevard	N. of NH101A	18,370	20,086	9.3%
Continental Boulevard	S. of Contra Way	14,735	17,560	19.2%
Continental Boulevard	W.of Amherst Road	10,229	9,557	-6.6%

Street	Location	Current	2027	% Change
Boulevard				
Contra Way	E. of Continental Boulevard	2,492	2,691	8.0%
Daniel Webster Highway	@ Nashua C/L	15,581	30,045	92.8%
Daniel Webster Highway	N. of Bedford Road	14,423	11,204	-22.3%
Daniel Webster Highway	N. of Front Street	13,922	19,703	41.5%
Daniel Webster Highway	N. of Greeley Street	21,297	26,841	26.0%
Daniel Webster Highway	N. of Industrial Drive	15,841	35,161	122.0%
Daniel Webster Highway	N. of Manchester Street	19,049	33,875	77.8%
Daniel Webster Highway	N. of Shelburne Road	13,609	7,365	-45.9%
Daniel Webster Highway	N. of Wire Road	15,951	22,003	37.9%
Daniel Webster Highway	over Souhegan River	17,803	24,278	36.4%
Daniel Webster Highway	S. of Baboosic Lake Road	19,298	25,167	30.4%
Daniel Webster Highway	S. of Bedford Road	15,715	21,946	39.7%
Daniel Webster Highway	S. of Columbia Cir	20,964	26,209	25.0%
Daniel Webster Highway	S. of Greeley Street	16,318	26,559	62.8%

Street	Location	Current	2027	% Change
Daniel Webster Highway	S. of Industrial Drive	20,292	35,868	76.8%
Daniel Webster Highway	S. of Manchester Street	16,357	22,780	39.3%
Daniel Webster Highway	S. of Wire Road	19,302	26,004	34.7%
Everett Turnpike	@ Bedford T/L	58,210	77,850	33.7%
Everett Turnpike	@ Nashua C/L	54,000	79,792	47.8%
Everett Turnpike	N. of Exit 10	56,000	68,053	21.5%
Everett Turnpike	N. of Exit 11	55,000	64,310	16.9%
Exit 10	NB off	3,467	14,559	319.9%
Exit 10	NB on	5,017	8,002	59.5%
Exit 10	NB on-ramp from EB	2,903	3,917	34.9%
Exit 10	NB on-ramp from WB	1,484	3,980	168.2%
Exit 10	SB off	4,550	6,983	53.5%
Exit 10	SB on-ramp EB	2,656	10,601	299.1%
Exit 10	SB on-ramp from WB	749	7,154	855.1%
Exit 11	NB off	5,345	7,377	38.0%
Exit 11	NB on	4,193	4,067	-3.0%
Exit 11	SB off-ramp	4,555	6,008	31.9%
Exit 11	SB on-ramp from Amherst Road	3,526	4,948	40.3%
Exit 11	SB on-ramp from Camp Sgt	1,898	2,756	45.2%
Exit 12	NB off	4,886	5,274	7.9%
Exit 12	SB on	5,053	5,739	13.6%
Front Street	E. of US3	5,046	5,847	15.9%
Greeley Street	W. of US3	23,370	25,924	10.9%
Industrial Drive	W. of Spartan Way	10,130	14,544	43.6%

Street	Location	Current	2027	% Change
Industrial Drive	W. of US3	9,768	28,912	196.0%
Manchester Street	@ Nashua C/L	3,989	11,594	190.6%
Manchester Street	S. of Henry Clay Drive	4,411	14,689	233.0%
Manchester Street	W. of US3	3,556	12,087	239.9%
McGaw Bridge Road	over Baboosic Brook	1,427	1,610	12.8%
Milford Road	@ Hollis T/L	37,343	37,888	1.5%
Milford Road	@ Nashua C/L	42,858	46,835	9.3%
Naticook Road	S. of Amherst Road	2,558	2,735	6.9%
Peaslee Road	N. of Naticook Road	3,592	4,027	12.1%
Spartan Way	S of Industrial Drive	7,622	7,672	0.7%
Tinker Road	S. of Continental Boulevard	3,252	5,152	58.4%
Tinker Road	W. of Thornton Road	2,834	4,490	58.4%
Turkey Hill Road	over Souhegan River	10,740	11,486	6.9%
Wire Road	@ Bedford T/L	3,440	3,032	-11.9%
Wire Road	W. of Everett Tpke	4,884	6,528	33.7%
Wire Road	W. of US3	3,971	3,970	0.0%

Traffic along Daniel Webster Highway continues to increase as more commercial development is added to the corridor, with a maximum of over 35,000 vpd being forecasted near the Industrial Drive interchange. These volumes are generally higher than what the southern end of Daniel Webster Highway in Nashua sees currently, and comparable to some of the busier stretches of NH Route 101A near the Merrimack-Nashua line.

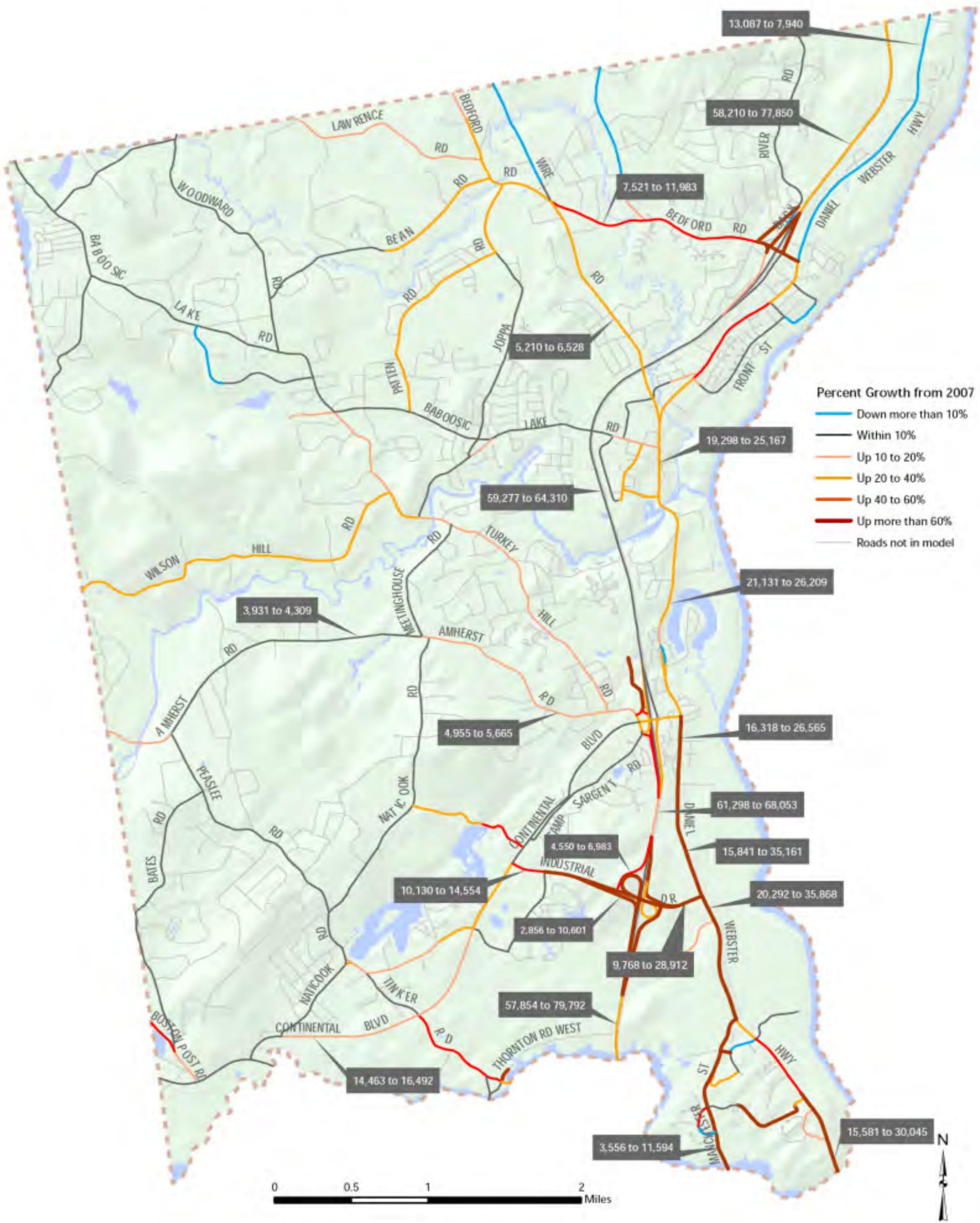
On the Bedford end of Daniel Webster Highway, volumes are substantially down, due to the programmed Exit

12 ramp completion. This more than offsets the increase in traffic that would be seen there due to the Flatley development being built out. Also as a result of the ramps, Bedford Road between the interchange and Daniel Webster Highway becomes one of the most travelled segments in Town, with just over 30,000 vpd forecasted.

Map IV-8 shows the percent change in daily traffic volume between the two future scenarios, from 2017 to 2027. Most percentage-based growth here is occurring on road segments near the focus parcels that are not being built out until the 2027 scenario, and on smaller residential roads where development is forecasted. This map also shows the decreasing traffic along the northern end of Daniel Webster Highway due to the addition of the Exit 12 ramps.

# Map IV-9

## Change in Daily Traffic Volumes from 2007 to 2027



# Map IV-10

## Change in Daily Traffic Volumes from 2017 to 2027



#### IV. INTERSECTION TRAFFIC SHARES

Aside from forecasting volumes for any road segment, NRPC's traffic model also has the capability to show the breakdown of where that traffic is headed, or where it's coming from. This is known as the "select link" analysis. For this analysis, the user can choose any segment in the model and have the software return how many vehicles that use that link are also using any other chosen link in the model.

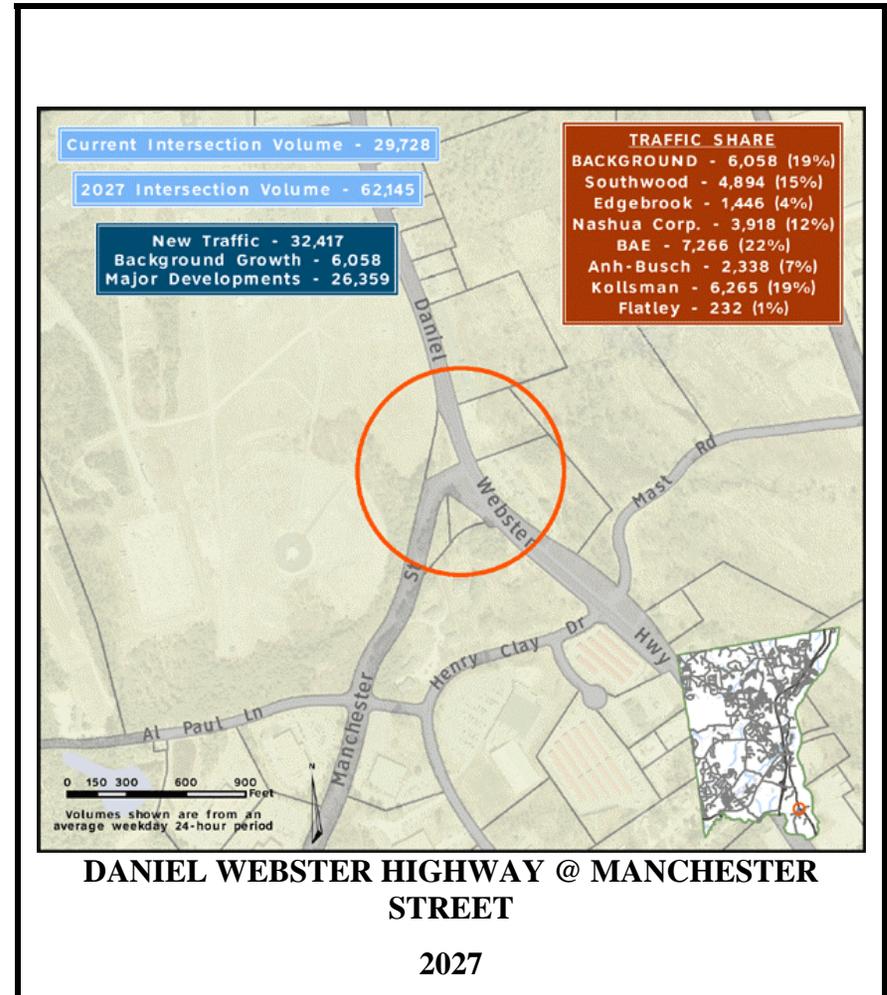
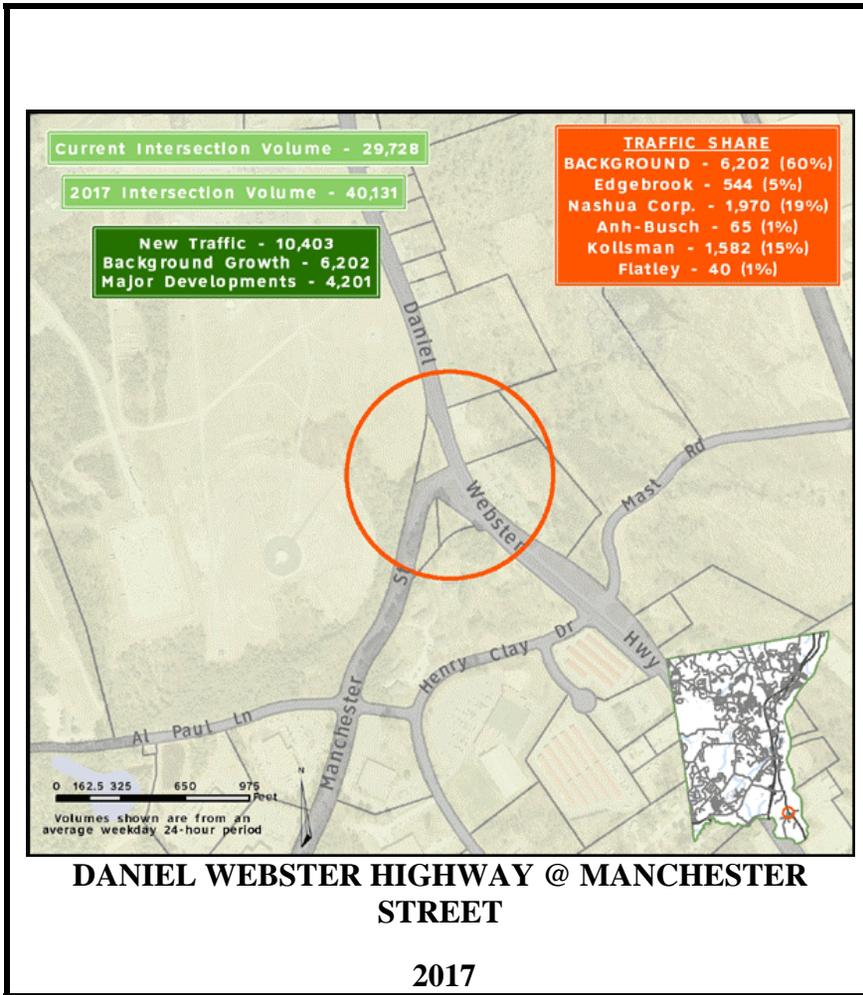
NRPC put this methodology to use to accomplish one of Merrimack's goals for this project. The Town wants to be able to have an idea as to what percent of traffic at a given intersection can be attributed to one or more particular developments, so that they can request the developer to contribute a similar share of the money it would take to make any necessary improvements to that intersection. For this project, Merrimack decided it wanted to include only the focus parcels in the percent breakdown of traffic at each location, with any background traffic growth and traffic from the Merrimack Premium Outlets project combined in a separate category.

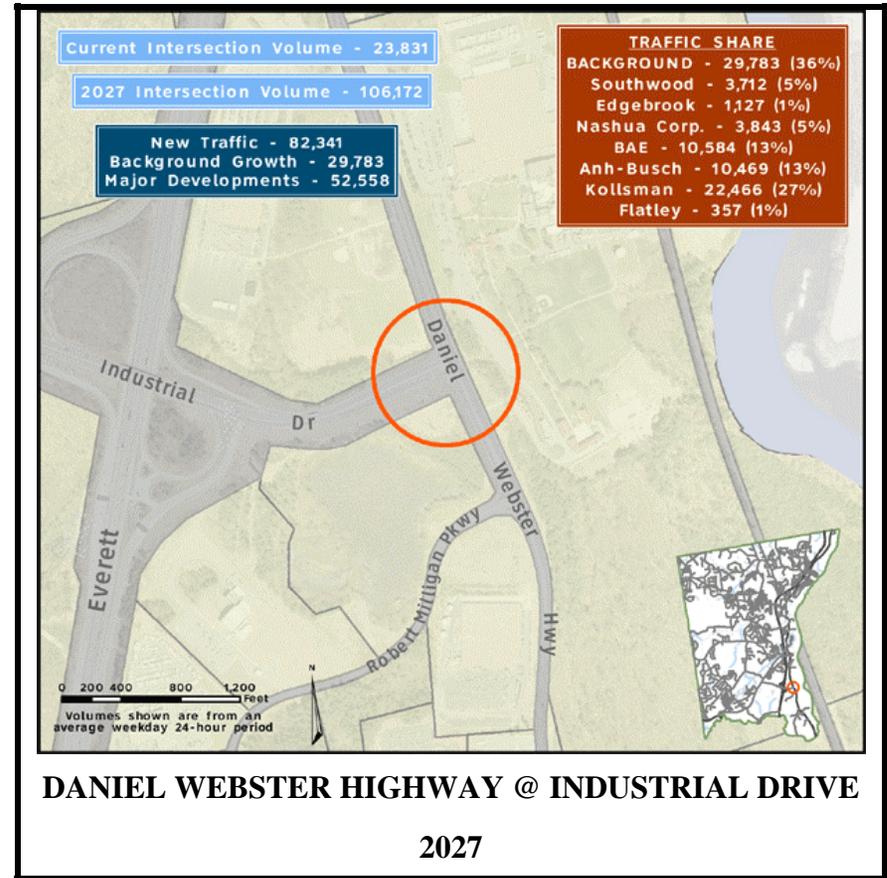
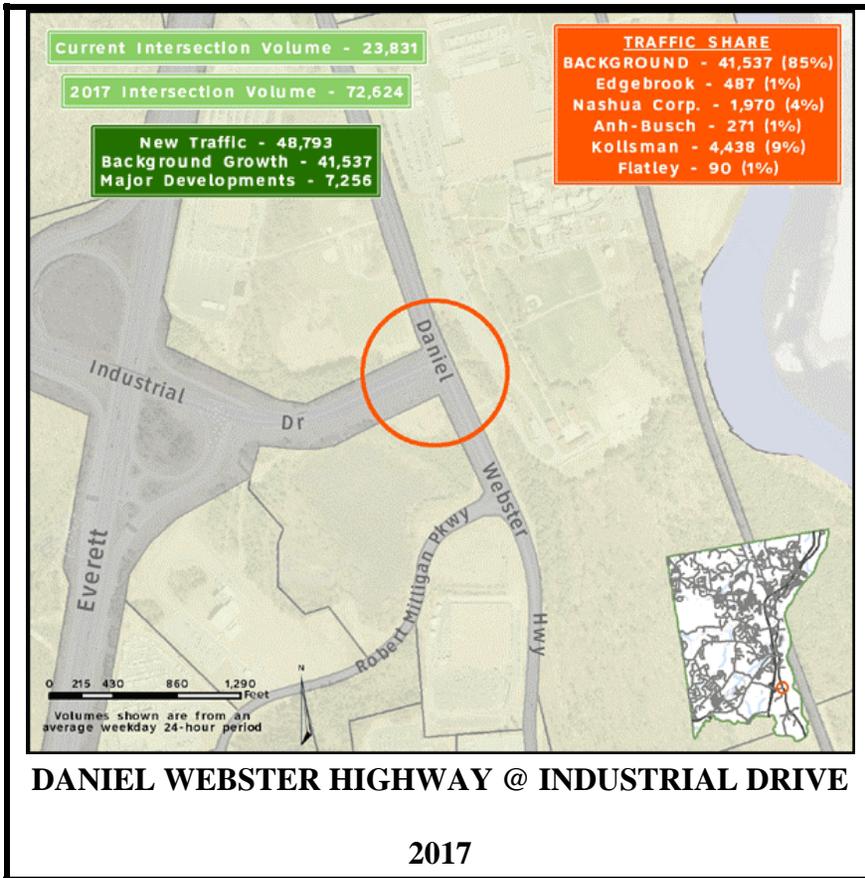
It is important to note that NRPC plans to maintain the model parameters used for this analysis and update them per Town needs. For example, if a traffic study is completed in support of the development of any of the focus parcels, with concrete trip generation numbers, NRPC will be able to substitute those numbers for the estimates and assumptions used in this original iteration for an updated model run. This will allow Merrimack to be more confident in the accuracy of any cost sharing estimates they provide to developers.

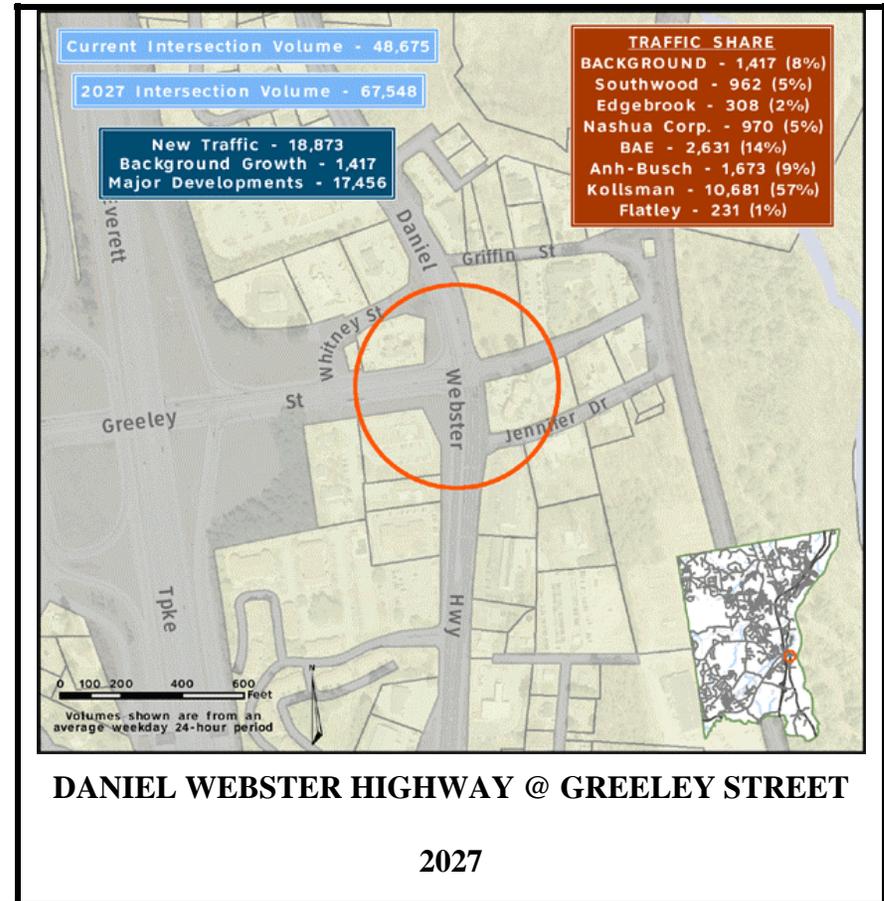
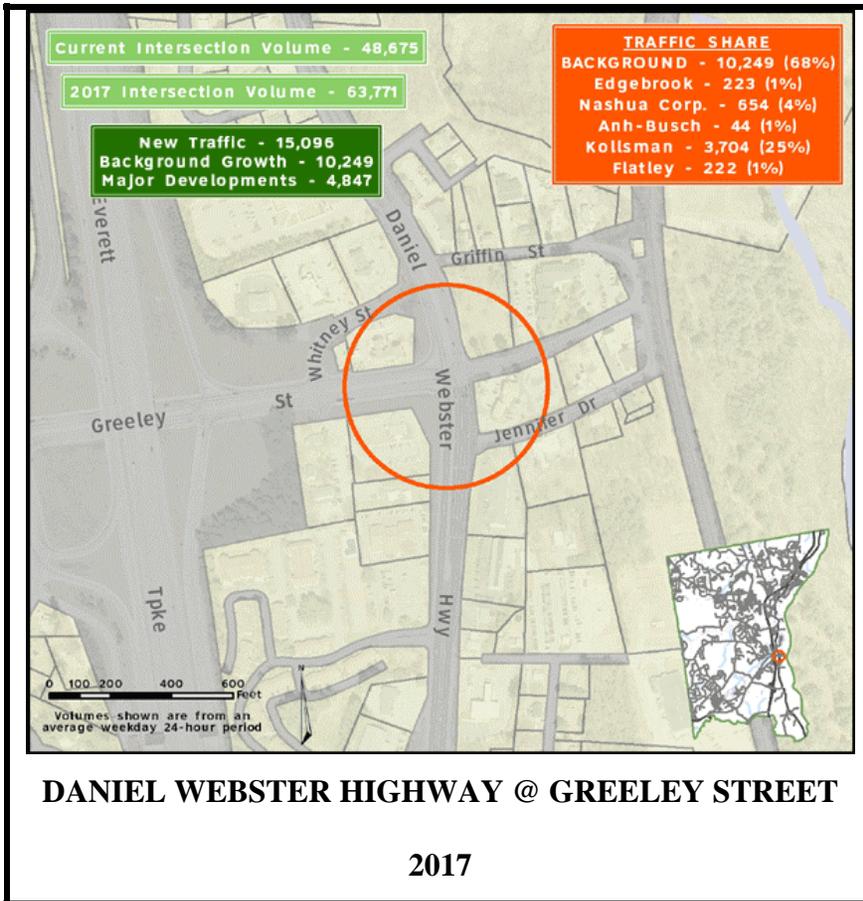
What follows are diagrams showing the forecasted traffic share for each focus parcel in 2017 and 2027 from the model as it stands today. Only those developments projected to be fully built out by 2017 are included in the share analysis for that year. Town staff selected key intersections to be analyzed. ***Estimated traffic share percentages indicate the relative proportion that a particular component contributes to the total traffic through an intersection during the 2017 or 2027 analysis years. Estimated percentages are subject to change when the identification of the actual land uses for the development parcel sites occurs and as future regional model enhancements are performed.*** The five intersections selected included:

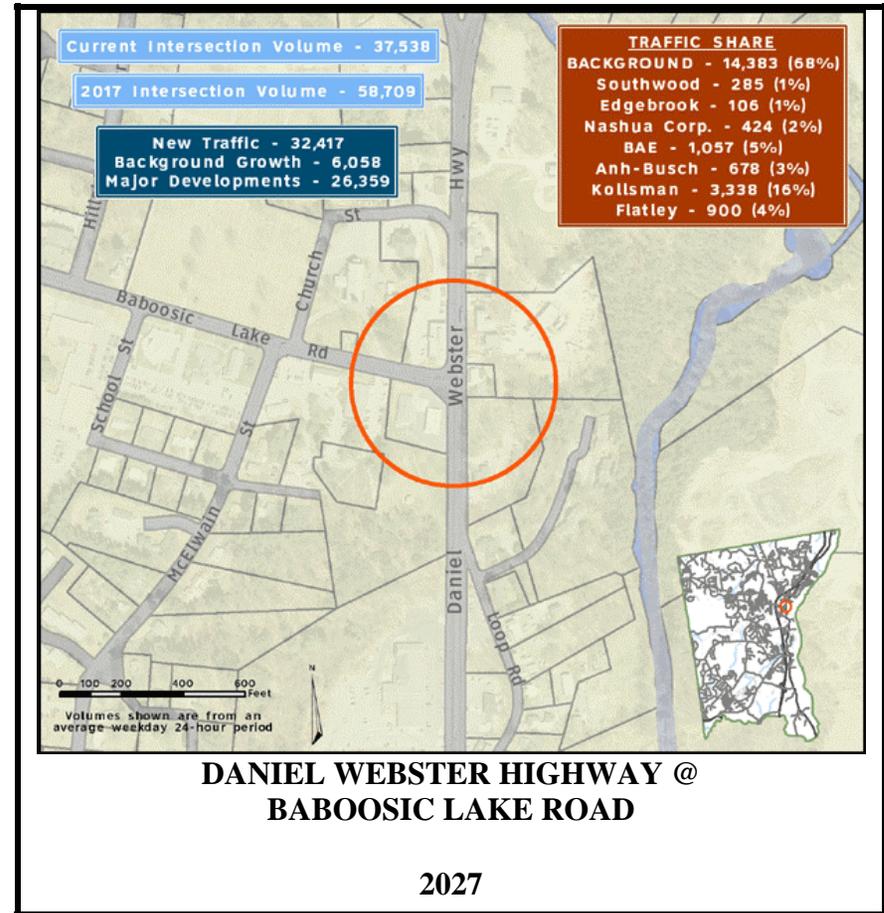
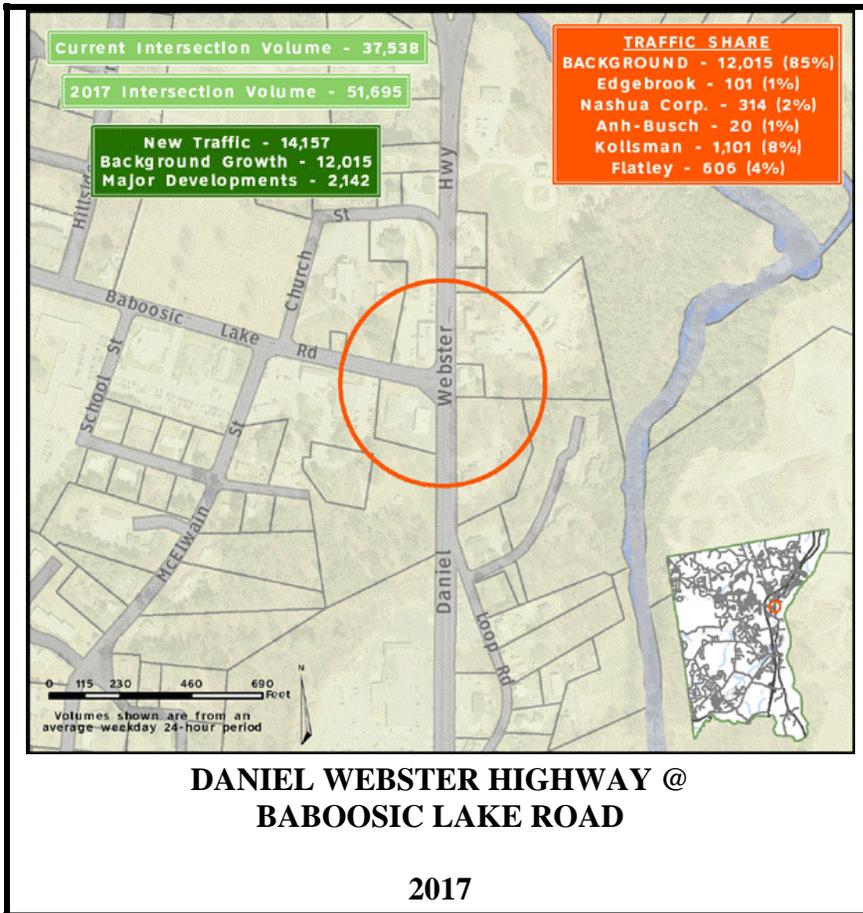
- Daniel Webster Highway at Manchester Street
- Daniel Webster Highway at Industrial Drive
- Daniel Webster Highway at Greeley Street
- Daniel Webster Highway at Baboosic Lake Road
- Continental Boulevard at Amherst Street and Camp Sargent Road and Greeley Street

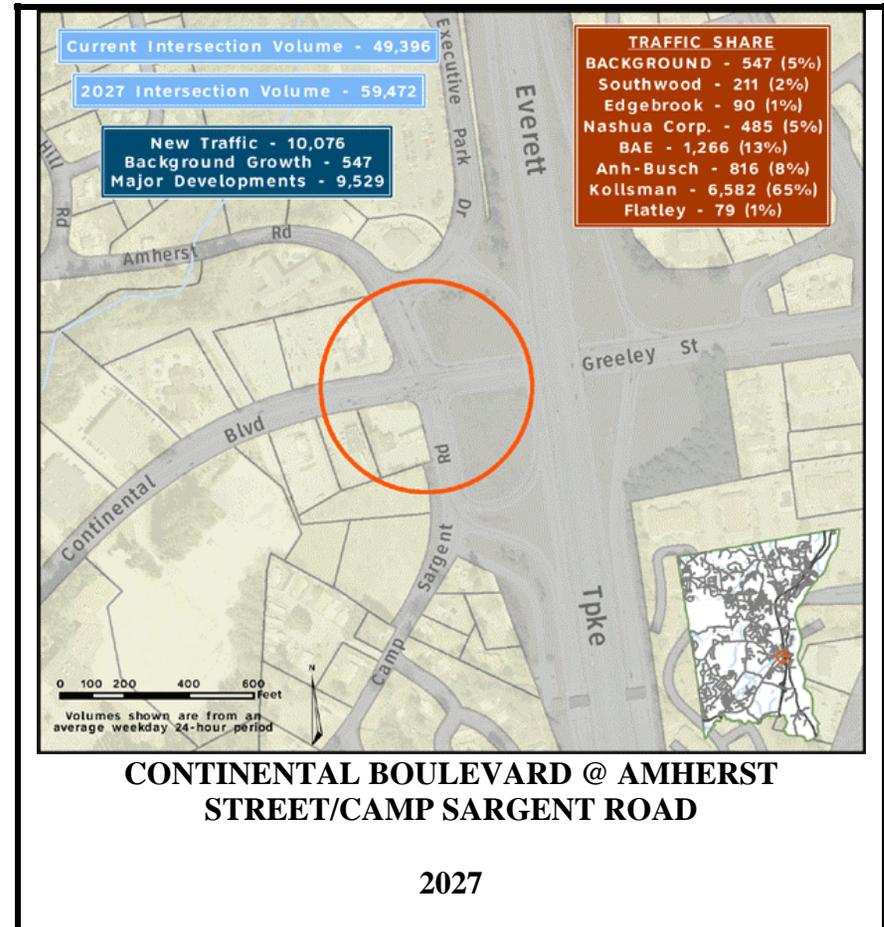
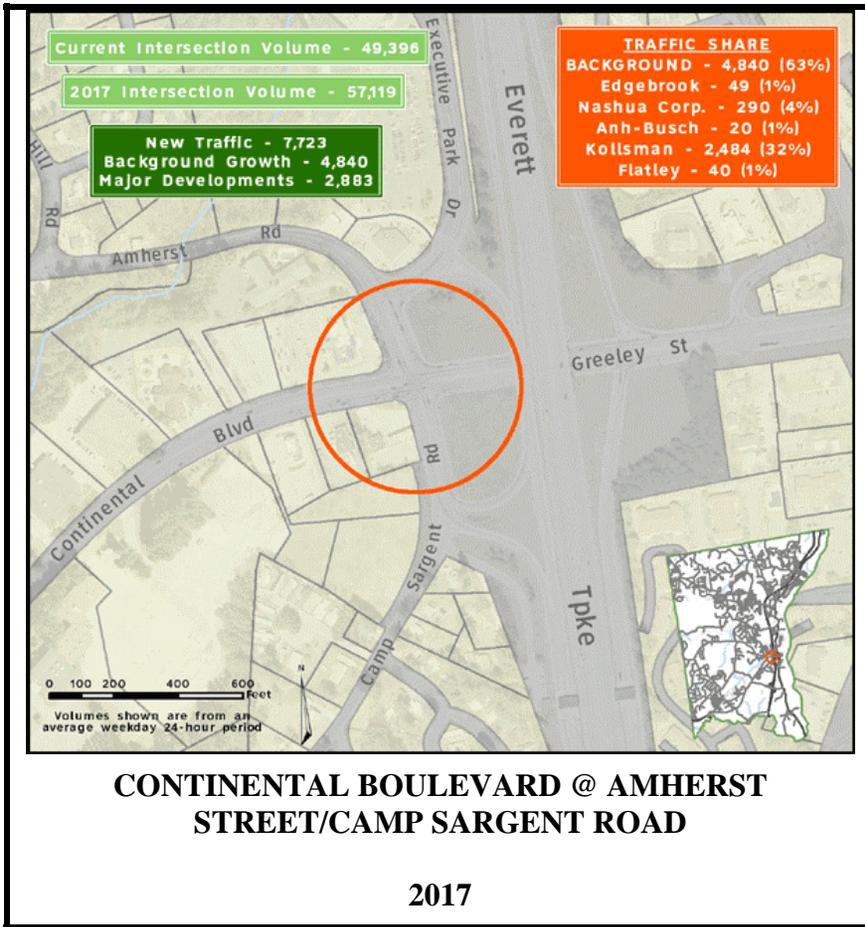
It is important to understand that generated trips are conservative (high side) as all trips generated are assumed external to each site and are assumed as 'new' to the area (e.g., pass-by and diverted linked trips for retail parcels, which can be substantial depending on the volume of traffic, *have not been assumed* in the trip demand estimates).











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## Short and Long Range Infrastructure Analysis

### Roadway Infrastructure Master Planning Study Merrimack, New Hampshire





# Chapter V – Short and Long Range Infrastructure Analysis

## I. INFRASTRUCTURE ANALYSIS APPROACH 2017 AND 2027

This portion of the Master Plan focuses on the analysis of Short- and Long-term roadway infrastructure enhancements needed to accommodate traffic volumes projected for the years 2017 and 2027. Projections of physical improvements within the Town of Merrimack evolved from an eight-step process:

- 1) Existing (2007) AM and PM peak hour volumes were evaluated throughout the Town by using a combination of NRPC count data, on-site observations, Town of Merrimack data, and NHDOT signal data. Results of current conditions analyses are documented in an Existing Conditions Chapter II of this report
- 2) NRPC projected daily and peak hour traffic growth over ten and twenty-year horizons based on the Town of Merrimack’s preliminary estimate of changes in land uses between 2007 and 2017, as well as between 2017 and 2027.
- 3) NRPC provided summary estimates of turning movement counts for the years 2007, 2017, and 2027 at selected intersections.
- 4) Based on the NRPC summary estimates of selected turning movement counts, FST reviewed and documented minor adjustments to the turning

movement projections and interpolated the projections to include intersections beyond the list of those specifically addressed by NRPC.

- 5) FST employed the Synchro®/Simtraffic® model to analyze adjusted 2017 and 2027 AM and PM peak hour volumes to represent ‘base’ projected conditions without enhancements beyond those already programmed
- 6) FST reviewed the base condition model findings and recommended strategies to address noted 2017 and 2027 deficiencies. Deficiencies and projections were evaluated for each intersection.
- 7) Proposed infrastructure enhancement strategies were discussed with the Town to identify issues and opportunities to adjust strategies for further evaluation. Proposed strategies are subject to change as developments come on line, but provide guidance to consider impacts within a townwide context.
- 8) As development parcels are developed, it is anticipated that the model can, and should be, refined to accommodate altered land use patterns from those assumed during this study.

NRPC’s regional approach to modeling the Merrimack conditions is discussed fully in Chapters III and IV of this report.

AM and PM peak hour volumes used to analyze 2017 and 2027 projected conditions are based on NRPC projections for selected Town of Merrimack intersections and summarized in the Technical Appendix to this report.



In total, *eight* Tables summarizing future peak hour traffic operating conditions were evaluated and are provided in the Technical Appendix. Traffic operations involved in the rankings were from worst to best and were divided by signalized and unsignalized intersections. The Tables included:

**Base Case** (with Programmed Improvements only):

- Table A-1: 2017 AM Peak Hour Traffic Operations Summary
- Table A-2: 2017 PM Peak Hour Traffic Operations Summary
- Table A-3: 2027 AM Peak Hour Traffic Operations Summary
- Table A-4: 2027 PM Peak Hour Traffic Operations Summary

**With Improvements** (to correct identified deficiencies):

- Table A-5: 2017 AM Peak Hour Traffic Operations Summary
- Table A-6: 2017 PM Peak Hour Traffic Operations Summary
- Table A-7: 2027 AM Peak Hour Traffic Operations Summary
- Table A-8: 2027 PM Peak Hour Traffic Operations Summary

**II. PROJECTED MERRIMACK 2017 AND 2027 CONDITIONS**

**A. Synchro Traffic Model Analysis Findings By Location**

Because the original impetus for this study was impending traffic growth in the southeast part of Merrimack, the analysis of impacts is being addressed from south to north, beginning along the Daniel Webster Highway (US Route 3 or ‘DWH’). Following the DWH analyses, locations identified within the Town Center off DWH are also addressed.

**B. Programmed Infrastructure Assumptions**

Programmed roadway infrastructure improvements that we assume will be implemented by the horizon year of 2017 include:

- Project # 14413 - Sidewalk enhancements along DWH in the Town Center Area as part of an enhancements project to fill in missing gaps (\$306,000, 2009);
- Project # 12105 – FE Everett Turnpike safety improvements (\$11,900,000, 2009);
- Project # 13923 - McGaw Bridge Replacement (\$460,000, 2012).
- Undesignated Project # - Improvements to the signalized intersection of Industrial Drive at Spartan Way and Commerce Drive in



connection with the Premium Outlets Mall development.

- Routine maintenance of local roads and streets.
- Construction of the Airport Access Road in Bedford, NH prior to 2017 (priority moved up during 2009).

Programmed roadway infrastructure improvements that we assume will be implemented by the horizon year of 2027 include:

- Project # 13761 - Widening the FE Everett Turnpike to a typical 6-lane cross-section (3 each way) between Exit 11 and the Town of Bedford Toll Plaza.
- Project # 10625 – Conversion of the Exit 12 partial diamond interchange into a full-diamond interchange at Bedford Road.

Because much of DWH through Merrimack is under the jurisdiction of New Hampshire Department of Transportation (NHDOT), it is assumed that fundamentally, the *DWH needs to maintain its efficiency at accommodating through traffic to the maximum extent possible, while at the same time adequately accommodating access to abutting properties, including those where redevelopment or development is contemplated.* Good access management suggests that traffic signalization should be a last resort for DWH traffic control, not a first resort.

We recommend the Town work with development property owners adjacent to DWH to consolidate their driveway access demands with new parallel service/distribution

roads providing access to existing traffic signals on both sides of DWH *where it makes sense to do so.* This strategy will minimize the need to construct and maintain new traffic signals along DWH, thereby benefiting the quality of the service provided on DWH as an important north-south arterial.

### III. LOCATION-SPECIFIC TRAFFIC IMPROVEMENT STRATEGIES

Following is a summary of location-specific strategies for addressing cited short- and long-term traffic needs building upon the findings of the existing conditions analysis.

For ease of review, narratives and displays are provided on separate sheets facing one another and organized generally starting in southeast Merrimack just north of the City of Nashua and proceeding in a northerly direction.

A. Harris Pond Drive (South) at Daniel Webster Highway

Approximate Parcel A – Southwood Development Quantities			Approximate % ADT Traffic Change from 2007		
Type	2017	2027	Roadway	2017	2027
Residential Units	N/A	310 units	DWH - South of Harris Pond Drive (South)	10–20	75-100
Industrial	N/A	N/A	DWH - North of Harris Pond Drive (South)	20–40	75-100
Retail	N/A	13,400 ft <sup>2</sup>	Harris Pond Drive (South) West of DWH	>10	10-20
Office/R&D	N/A	54,000 ft <sup>2</sup>			

Figure V-1 is a summary display of potential improvements at the Harris Pond Drive South intersection with DWH that may be needed after the year 2017 but prior to 2027. Figure V-1 also provides a summary of levels of service for existing and projected conditions as well as a preliminary order of magnitude cost estimate for the potential improvements.

The existing layout of DWH adjacent to Harris Pond South with an exclusive left turn lane with a single through lane in each direction should sufficiently accommodate DWH *mainline* peak hour demands projected for the 2027 long-term horizon year. Harris Pond Drive South at DWH is stop controlled.

Because Parcel A – Southwood is not expected to be developed until after 2017, future traffic operations are expected to be acceptable until it is developed. Given the projected distribution pattern of traffic generated by Parcel A-Southwood, it is anticipated that there will be significant left turn demands added to the Harris Pond South approach to DWH without diverting its traffic to the existing signal at Harris Pond North or installing a new traffic signal at Harris Pond South/DWH.

A horizontal curve in DWH approximately 600 feet north of the intersection restricts southbound visibility of this intersection. It is therefore recommended that the Town work with future Parcel A – Southwood developers to encourage the use of either Harris Pond Drive to access the existing traffic signal at Harris Pond Drive North. Or, if adjacent owners will permit it, allow alignment of a future Southwood driveway such that cross-parcel roadway access to the Harris Pond Drive North intersection,. Otherwise, significant left turn demands of nearly 150 vehicles per hour would occur from Harris Pond Drive South onto the DWH during the PM peak hour.

Because residences are expected as part of the Southwood development, it is recommended the Town consider requiring minimum 6-foot wide sidewalks on the south side of Harris Pond Drive South and the west side of DWH in coordination with the Town and NHDOT. The Southwood developer in coordination with the Town and NHDOT should create its primary access as a right-in/left-in/right out access to at least 500 feet south of Harris Pond Drive South within the site’s frontage. DWH shoulders are already wide enough to accommodate future bike travel on DWH.

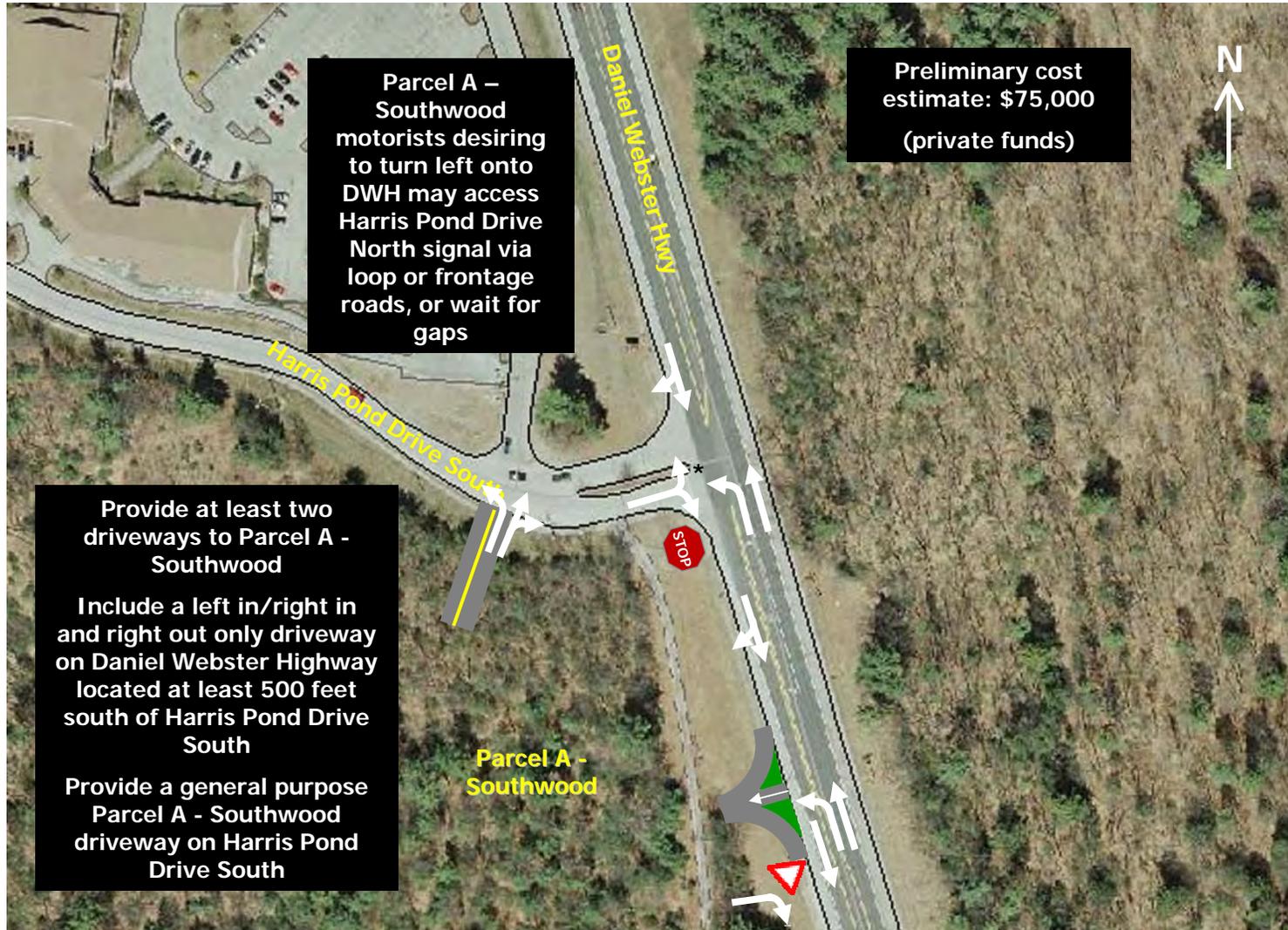
## Level of Service (LOS) Summary Table

	2007 Existing	2017 without Mitigation	2027 without Mitigation	2027 with Mitigation
AM Peak Hour	C	F	F	F*
PM Peak Hour	D	F	F	F*

\* If Harris Pond South approach to DWH is restricted to rights out only, mitigated LOS would be **B** during the AM and PM peak hours.



*Existing Conditions*



*Figure V-1*  
**Harris Pond Drive S and Parcel A - Southwood at Daniel Webster Highway**  
Merrimack, NH

Proposed Improvements Assumed Constructed Between 2017 and 2027

Base Map Source: Town of Merrimack, New Hampshire Geographic Information System [www.merrimackgis.org](http://www.merrimackgis.org)



**B. Harris Pond Drive (north) at Daniel Webster Highway**

Approximate Parcel B – Edgebrook Heights Development Quantities			Approximate % ADT Traffic Change from 2007		
Type	2017	2027	Roadway	2017	2027
Residential Units	125 units	N/A	DWH - South of Harris Pond Drive (North)	40-75	75-100
Industrial	N/A	N/A	DWH - North of Harris Pond Drive (North)	40-75	75-100
Retail	20,000 ft <sup>2</sup>	N/A	Harris Pond Drive (South) West of DWH	20-40	10-20
Office/R&D	27,000 ft <sup>2</sup>	N/A	Edgebrook Heights (Parcel B) Driveway	>150	<10

Refer to Figure V-2 for a summary of potential improvements at the Harris Pond Drive North intersection with DWH that may be needed prior to the year 2017. Also shown are projected levels of service for existing and projected conditions with and without the recommended improvements as well as a preliminary order of magnitude cost estimate for the potential improvements. Figure V-2 shows the location of the frontage road that could conceivably be used to accommodate some of the left turn demands for traffic traveling north on DWH generated by Parcel A - Southwood toward Harris Pond Drive North.

Designated by NRPC as Parcel B - Edgebrook Heights, is located on the east side of the DWH at its signalized intersection with Harris Pond Drive North. The site is expected to be developed for retail, office, and residential uses sometime between 2007 and 2017, or during the short-range forecast period. As in the vicinity of Harris Pond Drive North, overall traffic volumes on DWH are expected to nearly double by 2027. Like its Harris Pond Drive South counterpart to the south, DWH adjacent to Harris Pond North has an existing exclusive left turn lane with a single through lane in each direction that should sufficiently accommodate DWH *mainline* peak hour demands projected for the 2017 and 2027 short and long-term horizon years. Because it is already signalized, it is

anticipated that a new commercial driveway could be considered opposite the Harris Pond Drive intersection.

Because there will be new left turn demands added to the DWH southbound approach to Harris Pond Drive North, specific provisions should be considered for left turns in all four directions. Opposing left turns should be designed such that they can occur simultaneously to allow the intersection to operate efficiently during the AM and PM peak periods. By the year 2017, it is recommended the Town work with NHDOT to reconfigure the intersection such that exclusive left turn lanes and shared through/right lanes are provided on all approaches to the intersection and crosswalks on all approaches. The intersection will require a new mast arm installation on two corners. Due to the nature of the expected Edgebrook Heights development, including some residential development, it is recommended the Town also consider requiring the Edgebrook Heights developer to provide sidewalks on both sides of the new commercial driveway, tying into the sidewalk system on the east side of DWH. The new site driveway should be designed in coordination with the Town and NHDOT. Left turn lanes should be designed such that the signal can control opposing left turn movements simultaneously. Shoulders capable of accommodating bike travel (at least 6-foot wide) should also be considered.

### Level of Service (LOS) Summary Table

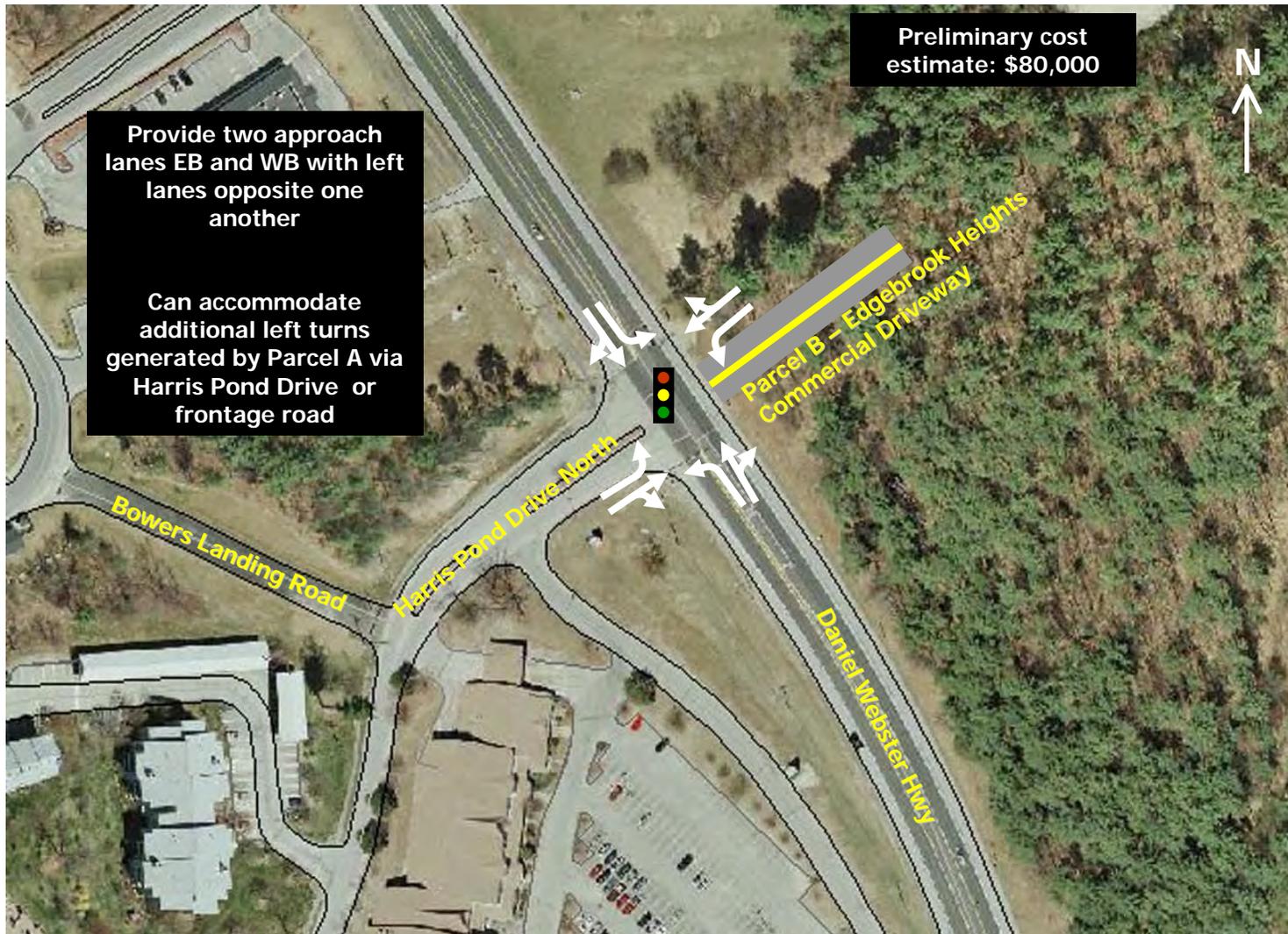
	2007 Existing	2017 without Mitigation	2017 with Mitigation	2027 without Mitigation	2027 with Mitigation
AM Peak Hour	<b>A</b>	<b>F</b>	<b>B</b>	<b>F</b>	<b>D</b>
PM Peak Hour	<b>B</b>	<b>F</b>	<b>C</b>	<b>F</b>	<b>D</b>



Existing Conditions

Photo Direction

*Figure V-2*  
**Harris Pond Drive N and Parcel B – Edgebrook Heights at Daniel Webster Highway**  
 Merrimack, NH  
 Proposed Improvements Assumed Constructed by 2017



Base Map Source: Town of Merrimack, New Hampshire Geographic Information System [www.merrimackgis.org](http://www.merrimackgis.org)



C. Parcel E – Nashua Corp at Daniel Webster Highway

Approximate Parcel E – Nashua Corp Development Quantities			Approximate % ADT Traffic Change from 2007		
Type	2017	2027	Roadway	2017	2027
Residential Units	N/A	N/A	<b>DWH</b> - South of Webb Drive	40-75	75-100
Industrial	N/A	N/A	<b>DWH</b> - North of Webb Drive	<10	40-75
Retail	145,000 ft <sup>2</sup>	N/A	<b>Webb Drive</b> – West of DWH	>10	<10
Office/R&D	78,000 ft <sup>2</sup>	N/A			

Refer to Figure V-3 for a summary of potential improvements at the NRPC’s designated Parcel E – (former) Nashua Corp frontage with DWH. Improvements illustrated on Figure V-3 may be needed by the year 2017. A preliminary order of magnitude cost estimate is provided along with projected levels of service with and without the improvements.

Figure V-3 shows the location of the potential replacement primary access driveway that could conceivably be used to accommodate the redeveloped Parcel E - Nashua Corp traffic demands opposite Webb Drive. This would have the added benefit of making Webb Drive access safer and would improve the spacing of signals on DWH.

Parcel E - Nashua Corp site, the east side of the DWH is expected to be developed for retail and office service uses sometime between 2007 and 2017, or during the short-range forecast period. DWH volumes in front of the Nashua Corporation site are expected to nearly double between 2007 and 2027. The former Nashua Corporation exit, until approximately a year ago, was traffic signal controlled at its westbound exit onto DWH. DWH adjacent to the site has a typical five-lane cross section with a narrow shoulder and a center lane that is used as a two-way turning lane.

Redevelopment of this site could take one of two directions. In one case, the existing roadway circulation and building infrastructure could be reused and the intersection at the former location opposite Dave and Laurie’s Auto Body shop re-signalized. Alternatively, because Webb Drive has an opportunity for some long term development, a signal could be located opposite Webb Drive to create a new four-way intersection, replacing the existing ‘T’ intersection of the westbound Webb Drive approach with DWH.

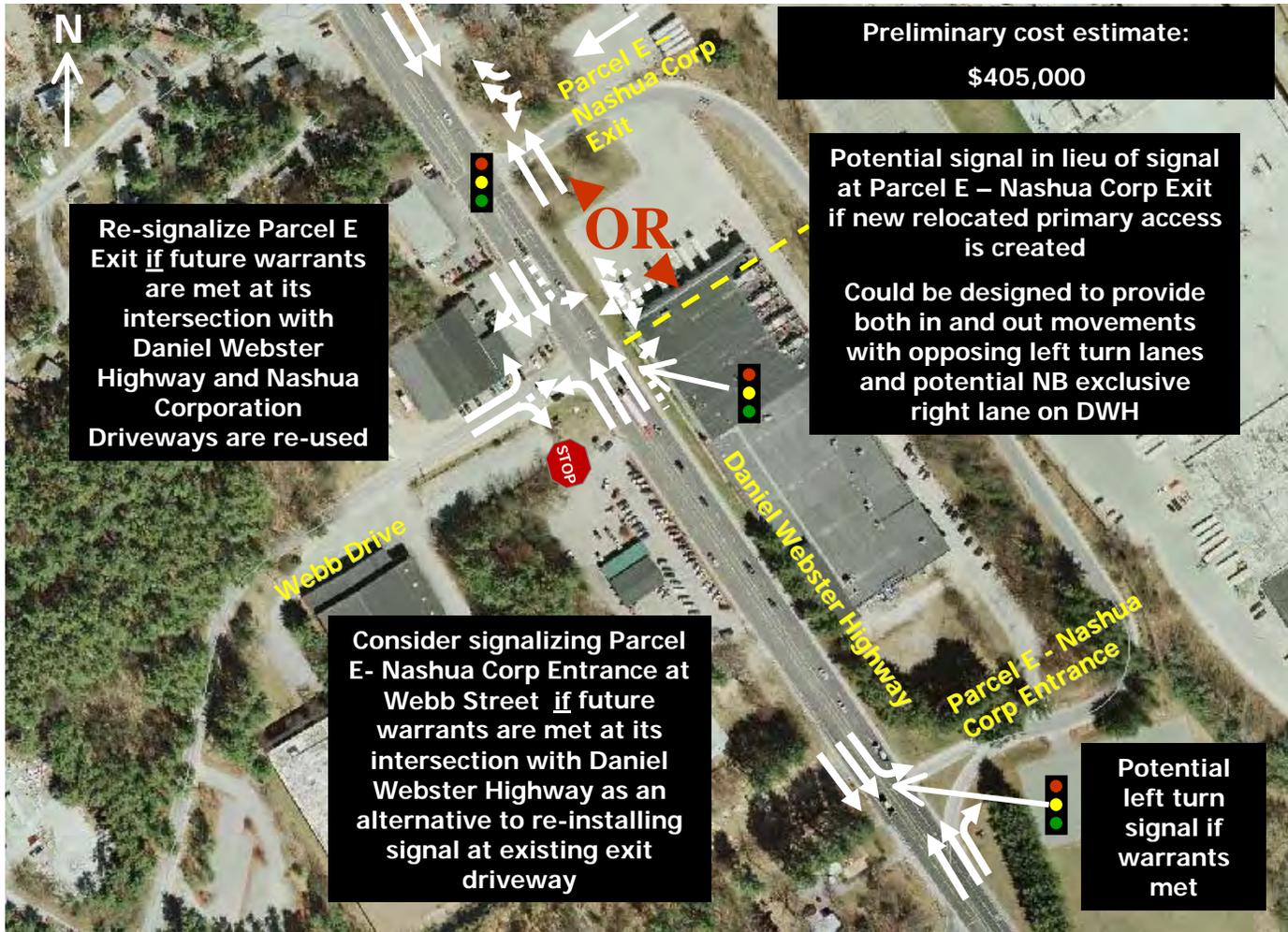
By the year 2017, it is recommended the Town work with the re-developer of the Parcel E – Nashua Corp site and NHDOT to create a new signal controlled access to Nashua Corporation site preferably at Webb Drive. Or, consider re-installing a new signal at the DWH/Nashua Corp Exit intersection where one was recently removed. From a system perspective, installation of a single signal is recommended. It is recommended the Town also consider requiring the Nashua Corporation developer to provide sidewalks on both sides of any new commercial driveway system that may be developed. If Webb Drive is signalized opposite a new Parcel E - Nashua Corp consolidated driveway, exclusive left turn lanes should be designed such that the signal can control opposing left turn movements simultaneously. Shoulders capable of accommodating bike travel (at least 6-foot wide) should also be considered on DWH.

## Level of Service (LOS) Summary Table

	2007 Existing	2017 without Mitigation	2017 with Mitigation	2027 without Mitigation	2027 with Mitigation
AM Peak Hour	C	E	A	F	A
PM Peak Hour	D	E	B	F	B



*Existing Conditions*



*Figure V-3*  
**Parcel E – Nashua Corp at Daniel Webster Highway**  
Merrimack, NH

Proposed Improvements  
Assumed Constructed  
By 2017



D. Henry Clay Drive and Mast Road at Daniel Webster Highway

Approximate Mast Road Development Quantities			Approximate % ADT Traffic Change from 2007		
Type	2017	2027	Roadway	2017	2027
Residential Units	N/A	N/A	DWH - South of Henry Clay Drive	<10	40-75
Industrial	N/A	58,000 ft <sup>2</sup>	DWH - North of Henry Clay Drive	<10	20-40
Retail	N/A	N/A	Henry Clay Drive – West of DWH	<-20	< -20
Office/R&D	33,000 ft <sup>2</sup>	N/A	Mast Road – East of DWH	<10	<10

Figure V-4 provides a summary of potential improvements at the intersection of Henry Clay Drive with DWH that may be needed by the year 2027. A preliminary order of magnitude cost estimate is provided along with projected levels of service with and without the improvements.

The east side of the DWH via Mast Road is to be developed with new retail, office, and industrial uses over the next twenty years during the short- and long range forecast periods. At this time, it is anticipated that most of the development will occur during the period between 2017 and 2027.

Mast Road and Henry Clay Drive are stop-controlled at their intersection with DWH. DWH adjacent to the intersection has a typical five-lane cross section with narrow shoulders and exclusive left turn lanes in both directions. The biggest issue at this intersection is the difficulty of accommodating left turn demands exiting from Mast Road and Henry Clay Drive onto DWH with AM and PM peak congestion worsening in the future. Because the intersection is located approximately 1,000 feet south of Manchester Street, which has much higher turning volumes during peak hours, the Town is concerned whether Manchester Street or Henry Clay Drive should be signalized, or whether both will require traffic signalization.

By the year 2017, it is recommended the Town work with NHDOT to signalize the intersection of Manchester Street with DWH as a first step, if the Manchester Street intersection demands with DWH are unable to be diverted to the existing BAE signalized intersection requiring construction of a new frontage road on the west side of DWH between Manchester Street and the BAE Driveway. Without signalization of either Henry Clay Drive with Mast Road, both intersections will operate with congestion during the peak hours.

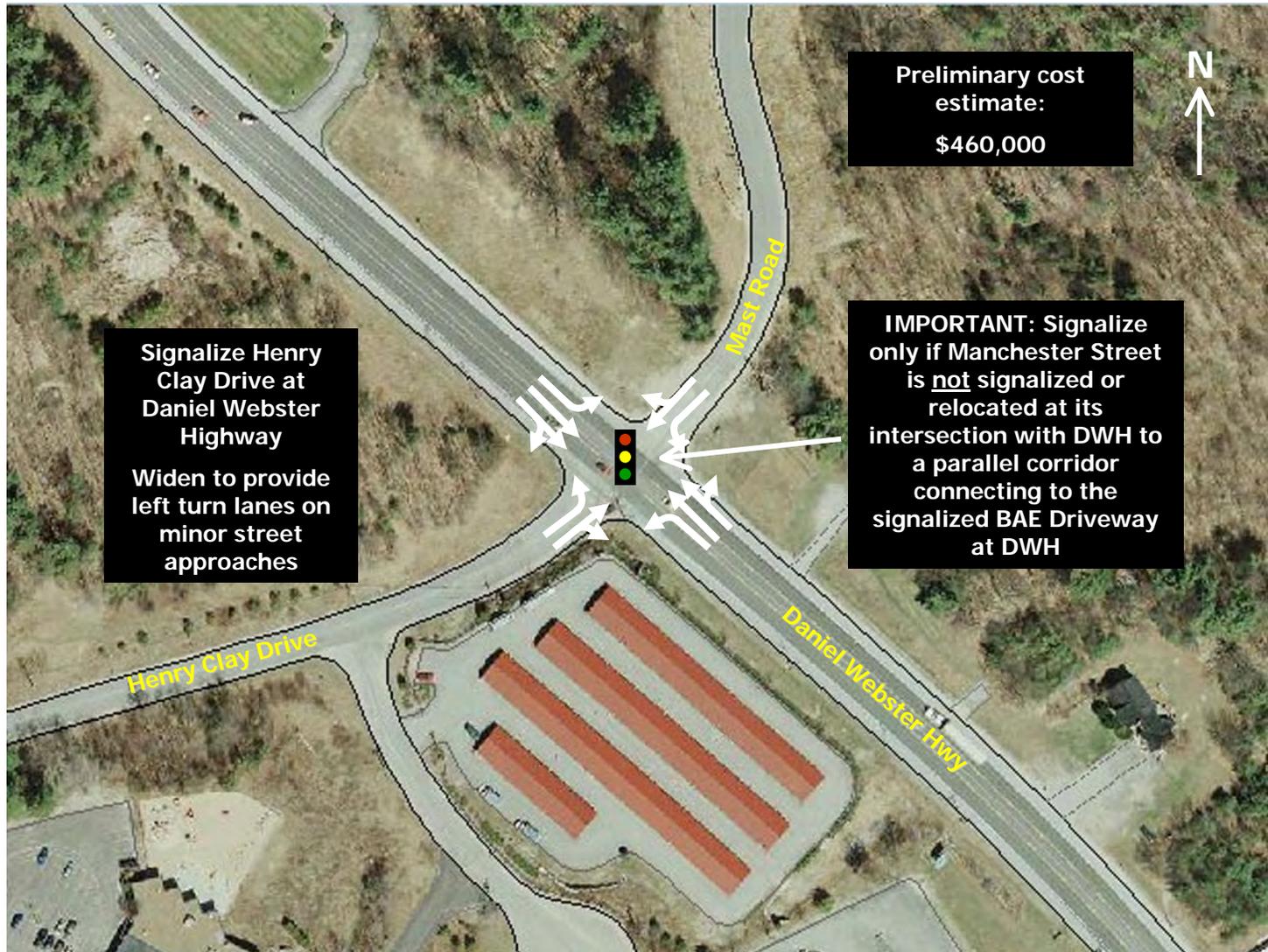
Provision of an exclusive left turn lane approximately 100-150 feet in length on both the Henry Clay Drive and Mast Road approaches will benefit the capacity of the intersection. Some of the heavy left turn demands expected at Henry Clay Drive could conceivably be diverted to and from Manchester Street or further north to the BAE intersection. While installation of a signal at this intersection should benefit the development potential along the east end of Mast Road, if the Manchester Street corridor is able to be diverted via a new frontage road to BAE, the Henry Clay Drive intersection need not be signalized, as new DWH gaps will be created by the BAE signal to improve peak hour operations at the Henry Clay Drive intersection.

### Level of Service (LOS) Summary Table

	2007 Existing	2017 without Mitigation	2017 with Mitigation	2027 without Mitigation	2027 with Mitigation
AM Peak Hour	D	F	A	F	A
PM Peak Hour	F	F	A	F	A



Existing Conditions



*Figure V-4*  
**Henry Clay Drive at Daniel Webster Highway**  
 Merrimack, NH  
 Proposed Improvements Assumed Constructed Between 2017 and 2027

Base Map Source: Town of Merrimack, New Hampshire Geographic Information System [www.merrimackgis.org](http://www.merrimackgis.org)



E. Manchester Street at Daniel Webster Highway and Parcel D – BAE Systems

Approximate Parcel D- BAE Systems Development Quantities			Approximate % ADT Traffic Change from 2007		
Type	2017	2027	Roadway	2017	2027
Residential Units	N/A	130	DWH – South of Manchester St	<10	20-40
Industrial	N/A	N/A	DWH – North of Manchester St	>35	>65
Retail	N/A	156,000 ft <sup>2</sup>	<b>Manchester St</b> – West of DWH	>35	>65
Office/R&D	N/A	50,000 ft <sup>2</sup>			

Refer to Figure V-5 for a summary of potential improvements at the intersection of Manchester Street near DWH that may be needed by the year 2017. A preliminary order of magnitude cost estimate is provided along with projected levels of service with and without the improvements.

DWH has a five-lane cross-section at its intersection with Manchester Street. It has two-lanes in each direction and a two-way left turn lane at Manchester Street opposite a private driveway. Between 2017 and 2027, NRPC anticipates Parcel D - BAE Systems on the west side of the DWH at Manchester Street will be developed with significant new retail and office use, as well as residential uses. Overall, if it is not relocated, Manchester Street’s traffic at DWH could grow by nearly 65% by 2027, while DWH traffic is expected to nearly double.

Because the Parcel D - BAE Systems development is under the same ownership, traffic from the new development can possibly be added to the existing BAE Systems traffic signal, located approximately ¼ of a mile north of Manchester Street. Construction of a two-lane distributor roadway connecting Manchester Street to the BAE Driveway is recommended to assist in relieving future traffic demands at the intersection of Manchester Street with DWH. If opened to

through traffic, this new distributor road, a portion of which already exists, would reduce the demands at the Manchester Street intersection by consolidating them at the existing BAE signalized intersection with DWH. This would also reduce traffic on DWH between the BAE Driveway and Manchester Street. In order to achieve the relocation of Manchester Street traffic, it would be necessary to modify its intersection and alignment with DWH, as conceptualized on Figure V-5 (and Figure V-6 further on).

By the year 2017, if right-of-way issues do not allow Manchester Street intersection demands with DWH to be diverted to the existing BAE signalized intersection via a new frontage road, Manchester Street *should be* signalized-- in lieu of Henry Clay Drive at Mast Road -- at its intersection with DWH.

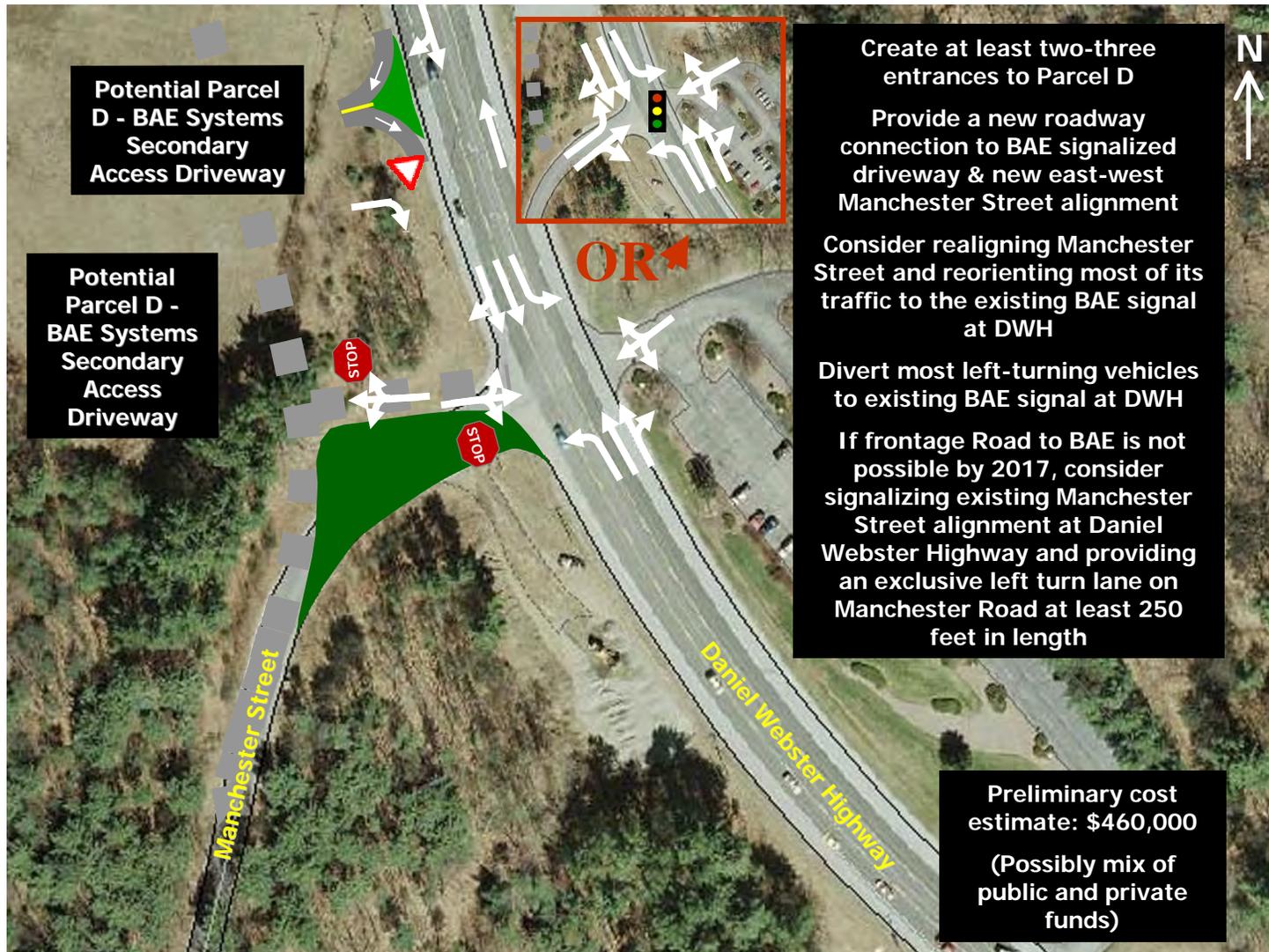
In the event Manchester Street is signalized at DWH, a two-lane approach would be needed to accommodate expected high left turn volumes from Manchester Street onto DWH northbound originating to the south. Signalization of Manchester Street at DWH does not preclude the need for the frontage road to consolidate future new BAE Systems traffic demands to its existing signal at DWH should the BAE development occur in the long term, as anticipated.

### Level of Service (LOS) Summary Table

	2007 Existing	2017 without Mitigation	2017 with Mitigation	2027 without Mitigation	2027 with Mitigation
AM Peak Hour	F	F	A	F	B
PM Peak Hour	F	F	A	F	D



Existing Conditions



*Figure V-5*  
**Manchester Street at Daniel Webster Highway and Parcel D – BAE Systems Merrimack, NH**

Proposed Improvements Assumed Constructed by 2017

Base Map Source: Town of Merrimack, New Hampshire Geographic Information System [www.merrimackgis.org](http://www.merrimackgis.org)





F. BAE Driveway – Parcel D at Daniel Webster Highway

Approximate Parcel D – BAE Systems Development Quantities			Approximate % ADT Traffic Change from 2007		
Type	2017	2027	Roadway	2017	2027
Residential Units	N/A	130	DWH - South of BAE Signal	<10	20-40
Industrial	N/A	N/A	DWH - North of BAE Signal	20-40	75-100
Retail	N/A	156,000 ft <sup>2</sup>	<b>BAE Driveway</b> – West of DWH	<10	>150
Office/R&D	N/A	50,000 ft <sup>2</sup>			

Refer to Figure V-6 for a summary of potential improvements at the intersection of BAE Driveway at DWH that may need to be constructed between 2017 and 2027. A preliminary order of magnitude cost estimate is provided along with projected levels of service with and without the improvements.

Because the BAE Driveway is already traffic signal controlled at its intersection with DWH, and Parcel D is related to the BAE site, an existing frontage road could be widened and extended between Manchester Street and the BAE Driveway. This connection will be appropriate to construct sometime between 2017 and 2027 concurrent with the Parcel D - BAE Systems site development. Traffic on DWH is expected to grow 20%-100% between 2007 and 2027, while BAE driveway traffic could more than double if additional traffic demands from Parcel D - BAE Systems and Manchester Street are relocated to it.

Construction of a two-lane distributor roadway connecting Manchester Street to the BAE Driveway is recommended for consideration to assist in relieving future traffic demands from BAE Systems (Parcel D) that would otherwise occur at the intersection of Manchester Street with DWH. Even if not directly connected to Manchester Street, a

site distributor roadway parallel to DWH would reduce future traffic demands at the Manchester Street intersection by

consolidating them to the BAE Driveway intersection with DWH. This would also reduce traffic on DWH between the BAE Driveway and Manchester Street. The Distributor Road should be a two-lane roadway, preferably with sidewalks on both sides. Sidewalks should also be added to the south side of BAE Driveway. If the desire is to provide an LOS C, rather than an LOS D during peak hours, the BAE Driveway approaching DWH should be widened to provide a double left turn lane and an exclusive right turn lane. Otherwise, the current two-lane approach to DWH should be re-stripped to allow left turns from both lanes, the right lane being a shared left/right lane. Existing DWH shoulders are wide enough to accommodate bicycle use in the vicinity of the BAE Driveway.

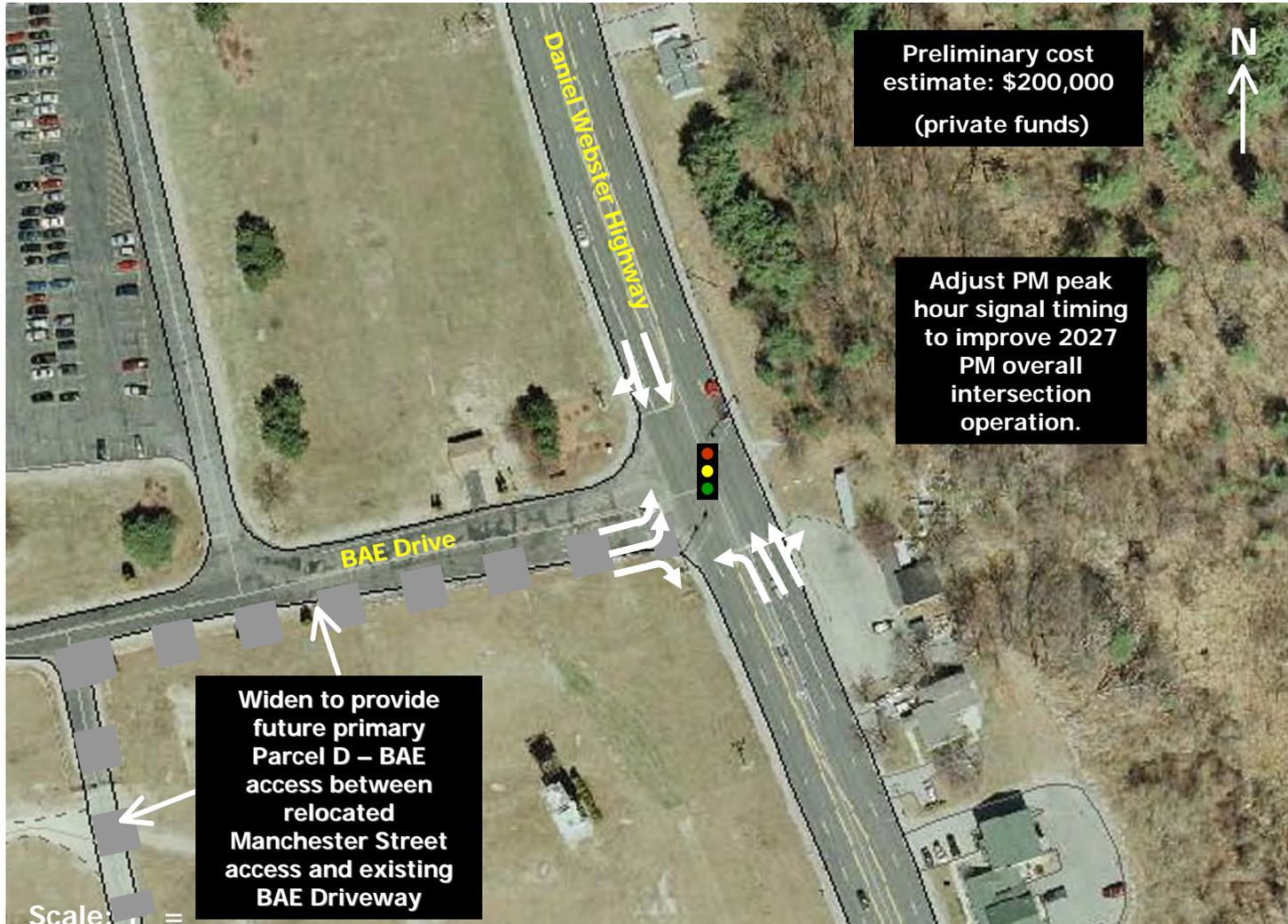
### Level of Service (LOS) Summary Table

	2007 Existing	2017 without Mitigation	2027 without Mitigation	2027 with Mitigation
AM Peak Hour	<b>B</b>	<b>B</b>	<b>B</b>	<b>B</b>
PM Peak Hour	<b>B</b>	<b>B</b>	<b>D</b>	<b>C</b>



*Existing Conditions*

**➔ Photo Direction**



*Figure V-6*  
**BAE Driveway at Daniel Webster Highway**  
 Merrimack, NH

Proposed Improvements Assumed Constructed Between 2017 and 2027

Base Map Source: Town of Merrimack, New Hampshire Geographic Information System [www.merrimackgis.org](http://www.merrimackgis.org)



G. Robert Milligan Parkway at Daniel Webster Highway

Approximate Robert Milligan Parkway Development Quantities			Approximate % ADT Traffic Change from 2007		
Type	2017	2027	Roadway	2017	2027
Residential Units	N/A	N/A	DWH - South of Tech Pk Drive	<10	20-40
Industrial	72,000 ft <sup>2</sup>	N/A	DWH - North of Tech Pk Drive	20-40	75-100
Retail	N/A	N/A	Technology Park Drive – West of DWH	10-20	10-20
Office/R&D	N/A	N/A			

Figure V-7 summarizes potential improvements at the intersection of Robert Milligan Parkway at DWH that may be needed between 2017 and 2027. A preliminary order of magnitude cost estimate is provided along with projected levels of service with and without the improvements.

Robert Milligan Parkway has a high-type design and is stop-controlled at DWH. The existing DWH layout includes two southbound through lanes and three northbound through lanes with an exclusive southbound right turn lane and an exclusive northbound left turn lane. DWH is divided by a median on both approaches to Robert Milligan Parkway, which is also median divided.

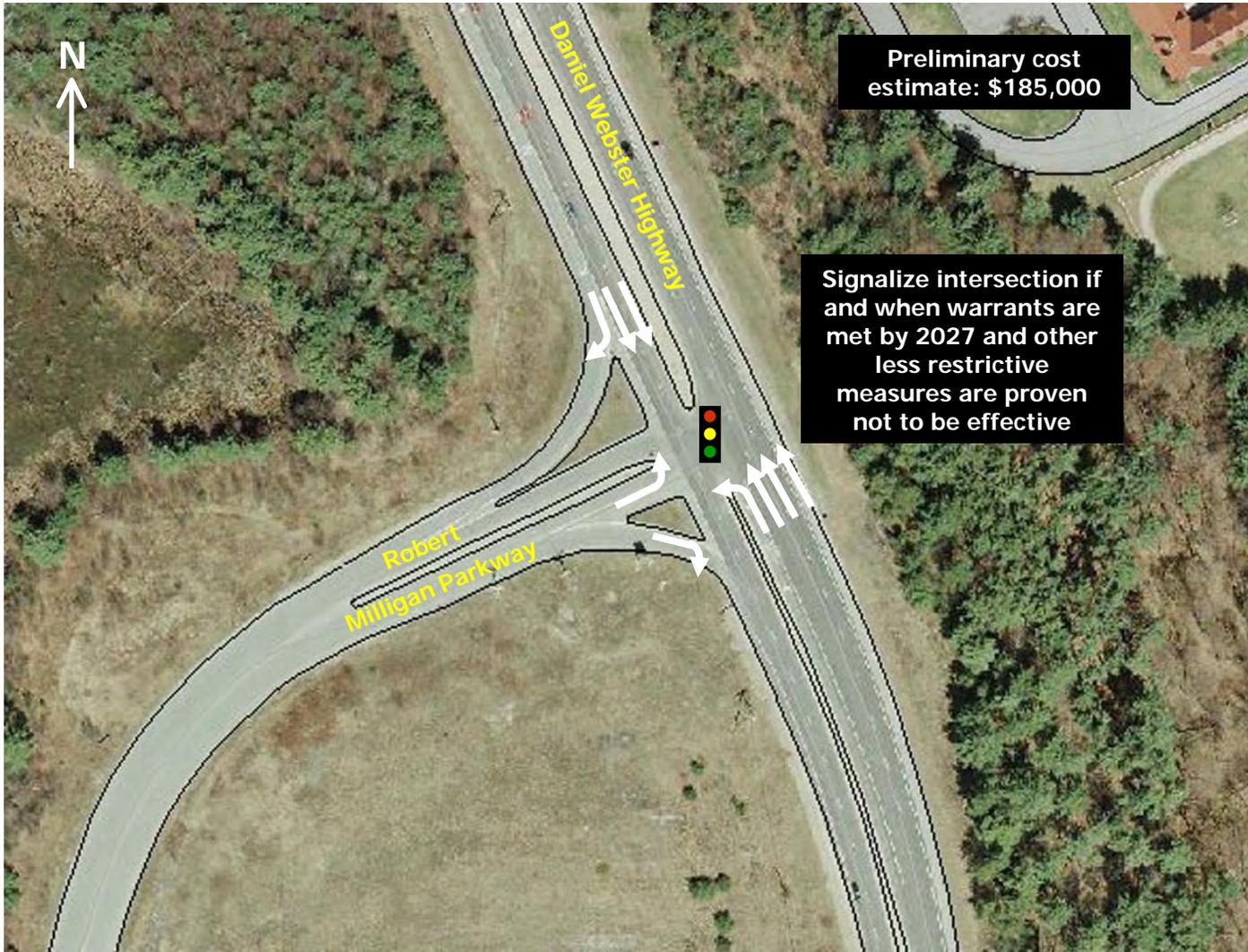
Robert Milligan Parkway is expected to operate with congestion by the year 2017, but the gaps in traffic are expected to be sufficient to allow projected peak hour left-turning traffic to exit onto DWH. Prior to 2017, additional industrial development is anticipated on Robert Milligan Parkway. Even though Robert Milligan Parkway traffic is expected to increase by under 20% between 2007 and 2027, DWH traffic is projected to nearly double by 2027, which will reduce traffic gaps accordingly.

The existing intersection design is readily convertible to future traffic signalization control. Located approximately 1,000 feet south of Industrial Drive at DWH, prior to 2017, the Industrial Park Drive/DWH upstream traffic signal is expected to create enough gaps to permit left turning traffic to exit from Robert Milligan Parkway onto DWH northbound, but as traffic grows, particularly during the PM peak period, fewer acceptable gaps will occur on DWH to allow left turning movements to occur safely out of Robert Milligan Parkway.

Between 2017 and 2027 (or sooner if signal warrants are met), Robert Milligan Parkway abutters should work with the Town and NHDOT to install a new traffic signal at the DWH intersection.

## Level of Service (LOS) Summary Table

	2007 Existing	2017 without Mitigation	2027 without Mitigation	2027 with Mitigation
AM Peak Hour	A	E	F	A
PM Peak Hour	D	F	F	A



*Existing Conditions*



*Figure V-7*  
**Robert Milligan Parkway at Daniel Webster Highway**  
 Merrimack, NH

Proposed Improvements  
 Assumed Constructed  
 Between 2017 and 2027

Base Map Source: Town of Merrimack, New Hampshire Geographic Information System [www.merrimackgis.org](http://www.merrimackgis.org)

H. Industrial Drive and Parcel F - Anheuser-Busch at Daniel Webster Highway

Approximate Parcel F- Anheuser Busch Development Quantities			Approximate % ADT Traffic Change from 2007		
Type	2017	2027	Roadway	2017	2027
Residential Units	N/A	40	DWH - South of Industrial Drive	20-40	75-100
Industrial	N/A	233,000 ft <sup>2</sup>	DWH - North of Industrial Drive	75-100	100-150
Retail	N/A	N/A	Industrial Drive	100-150	100-150
Office/R&D	N/A	78,000 ft <sup>2</sup>	Parcel F driveway – East of Industrial Drive	N/A	N/A

Figure V-8 is a summary display of potential improvements at the Industrial Drive intersection with DWH that may be needed between the year 2017 and 2027. A preliminary order of magnitude cost estimate is provided along with projected levels of service with and without the improvements. Figure V-8 notes that the potential left lane from the future Parcel F – Anheuser Busch access driveway should be designed such that left turns out of the driveway can occur simultaneous with left turns from Industrial Drive to DWH northbound. The potential southbound left turn lane should be at least 12 feet wide, as it will be serving industrial uses on the Parcel F – Anheuser Busch site.

Industrial Drive is a six-lane divided roadway served by Exit 10 on the FE Everett Turnpike. It is located perpendicular to the DWH between Continental Boulevard and DWH. Industrial Drive and also has the potential to provide access to Parcels F and G. Parcel F – Anheuser Busch is located on the easterly terminus of Industrial Drive and it is anticipated that Parcel F – Anheuser Busch will be developed with a substantial amount of office and industrial uses sometime between 2017 and 2027, during the long-range forecast period. Traffic demands on Industrial Drive at DWH are expected to nearly triple by 2027 compared to 2007,

while traffic demands on DWH are expected to more than double compared to those found in 2007.

The existing layout of DWH at Industrial Drive has a double left turn lane on its northbound approach as well as two through lanes with an exclusive right turn lane on its southbound approach. The median-divided eastbound Industrial Drive approach has two exclusive right turn lanes and two exclusive left turn lanes to DWH northbound. The development of Parcel F – Anheuser Busch should include the provision of a new access road opposite Industrial Drive. Construction of a new access road will be very costly and challenging with steep retaining walls. Use of the existing driveway could provide supplemental right-in only access to Parcel F – Anheuser Busch. The new access road should provide an exclusive left turn lane with a single shared through/right lane. A 6-foot wide sidewalk connecting to the Parcel F – Anheuser Busch buildings should also be required on the west side of the access road. It will also be necessary to add a minimum 200-foot exclusive left turn lane on the southbound DWH approach and to retime the existing signal for efficient operations.

By the year 2027, without mitigation, congested AM and PM peak hour traffic operations at the Industrial Drive/DWH intersection are expected. Traffic in the area is projected to be two to three times as high as it is today.

### Level of Service (LOS) Summary Table

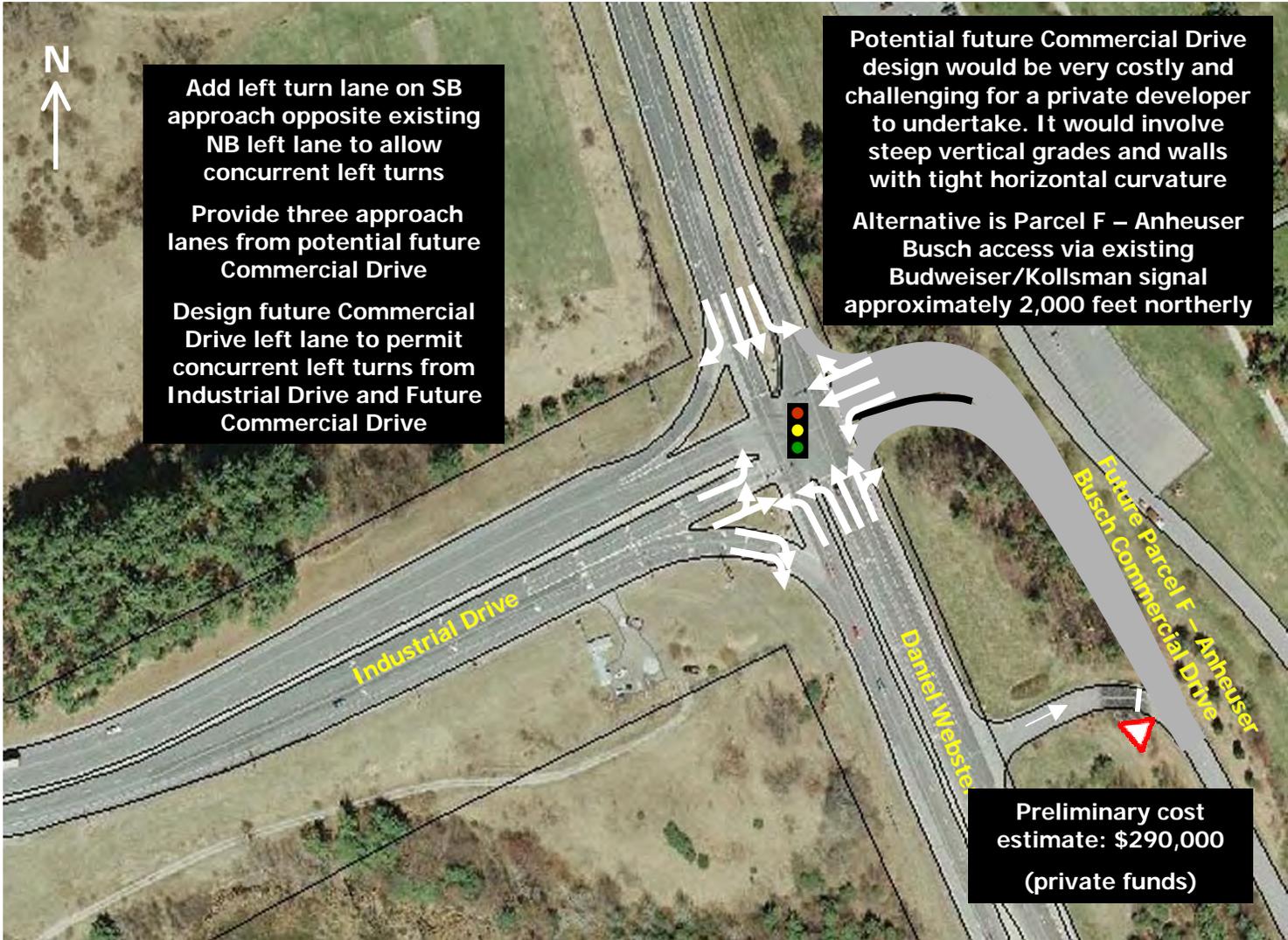
	2007 Existing	2017 without Mitigation	2027 without Mitigation	2027 with Mitigation
AM Peak Hour	<b>B</b>	<b>C</b>	<b>E</b>	<b>D</b>
PM Peak Hour	<b>B</b>	<b>C</b>	<b>F</b>	<b>D</b>



Existing Conditions

Photo Direction

*Figure V-8*  
**Industrial Drive and Parcel F – Anheuser Busch at Daniel Webster Highway Merrimack, NH**  
 Proposed Improvements Assumed Constructed Between 2017 and 2027



Base Map Source: Town of Merrimack, New Hampshire Geographic Information System [www.merrimackgis.org](http://www.merrimackgis.org)





I. Parcel G - Kollsman at Daniel Webster Highway and Industrial Drive

Approximate Parcel G - Kollsman Development Quantities			Approximate % ADT Traffic Change from 2007		
Type	2017	2027	Roadway	2017	2027
Residential Units	N/A	N/A	DWH - South of Parcel G Driveway	75-100	100-150
Industrial	N/A	N/A	DWH - North of Parcel G Driveway	40-75	75-100
Retail	350,000 ft <sup>2</sup>	N/A	New Parcel G Driveway at DWH	N/A	N/A
Office/R&D	20,000 ft <sup>2</sup>	N/A			

Figures V-9A and V-9B provide summary displays of potential improvements at DWH by the year 2017. A preliminary order of magnitude cost estimate is provided along with projected levels of service with and without the improvements. All future access modifications require NHDOT concurrence.

Parcel G - Kollsman is located in the northwest corner of the Industrial Drive intersection with DWH. Parcel G - Kollsman has the most significant potential for new trip generation of all the parcels being evaluated. It is located on the west side of DWH between the existing signal serving Kollsman /Budweiser Driveways and Industrial Drive, which are separated by approximately 2,000 feet. Traffic demands on DWH by 2027 are projected to more than double over those found in 2007. It is anticipated that Parcel G - Kollsman will be developed with major retail use and office use long before Parcel F – Anheuser Busch is developed, and prior to 2017.

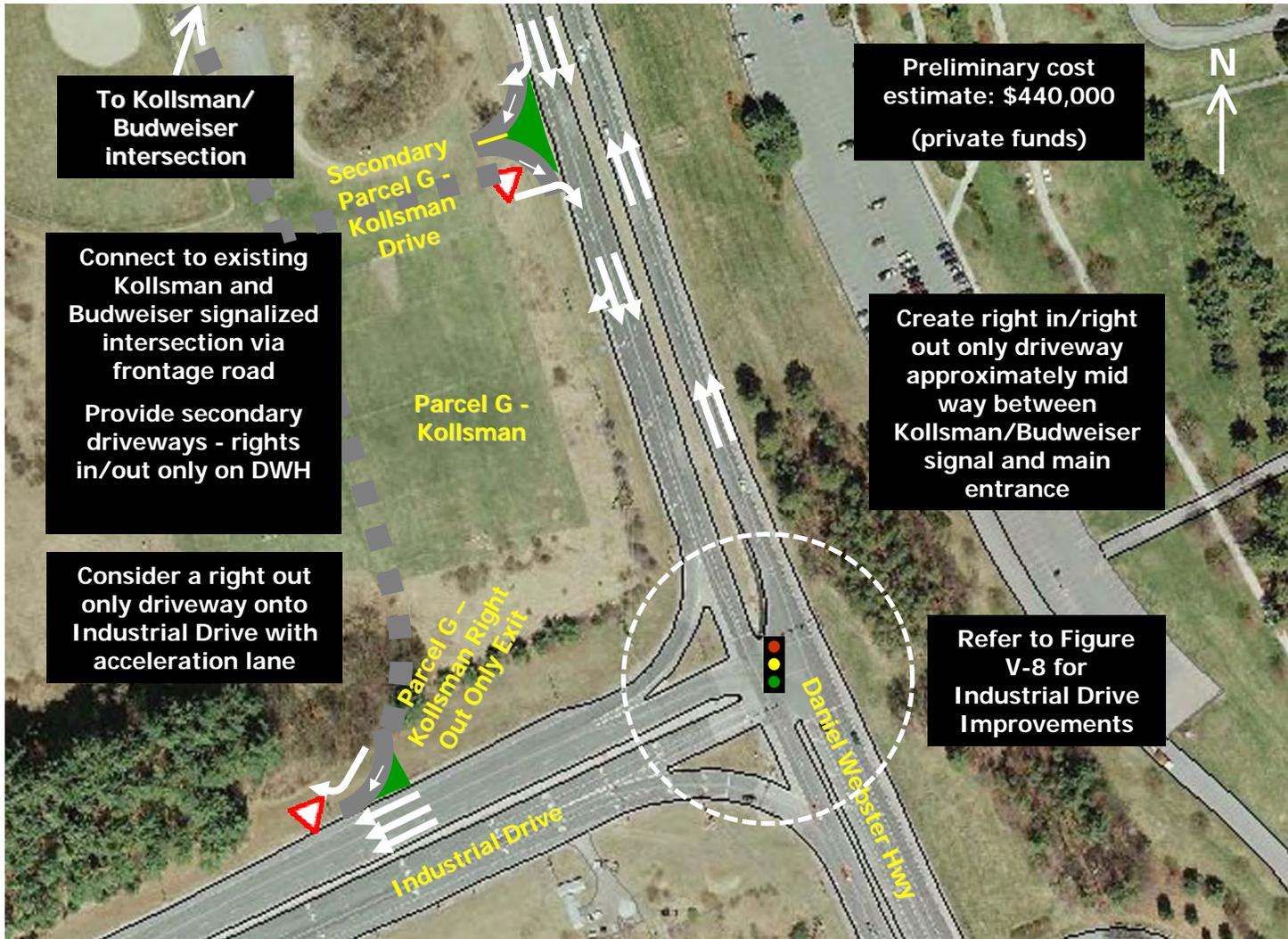
As envisioned, Parcel G - Kollsman could be served by up to three accesses and possibly four egresses. At least two accesses will be needed to serve Parcel G - Kollsman, in any event. Because this site is being developed by Kollsman, there may be an opportunity to avoid the creation of a new traffic signal on DWH by allowing Parcel G – Kollsman traffic to

access DWH via the existing signalized Kollsman/Budweiser Driveway. Or, there may be an opportunity to allow access to the site via *two* traffic signals – a new one plus the existing one. As a largely retail parcel, the developer might be concerned about visibility if motorists travelling north on DWH must enter via the Parcel G - Kollsman/Budweiser entrance, well past the buildings on Parcel G. In front of Parcel G - Kollsman, DWH is median-divided and has two through lanes in each direction and wide shoulders. A possible primary access could be created midway between the Kollsman/ Budweiser signal and Industrial Drive, or approximately 1,000 feet north of the Industrial Drive intersection. The access could conceivably include a signalized intersection with full access or be designed to permit right turns in and out only plus left turns in only, or even a double left turn lane into the site. The potential mid-way access provides the best opportunity for full access closest to FE Everett Turnpike Exit 10. Additionally, the site could be accessed via the Kollsman Parcel G - Kollsman signal by enhancing an access road paralleling DWH that already exists. The Parcel G - Kollsman/Budweiser signal could be used to provide access to and from the north on DWH.

Lastly, an optional right only egress approximately 500 feet west of DWH or midway between DWH and the Exit 10 northbound on ramp should be considered. Such an egress would allow Parcel G - Kollsman more direct access to Industrial Drive/Exit 10 and reduce its traffic impacts on DWH. This access should work at an acceptable level of service under stop or yield control in the foreseeable future.

## Level of Service (LOS) Summary Table

	2007 Existing	2017 without Mitigation	2017 with Mitigation	2027 without Mitigation	2027 with Mitigation
AM Peak Hour	N/A	F	A	F	A
PM Peak Hour	N/A	F	C	F	C



Base Map Source: Town of Merrimack, New Hampshire Geographic Information System [www.merrimackgis.org](http://www.merrimackgis.org)



*Existing Conditions*



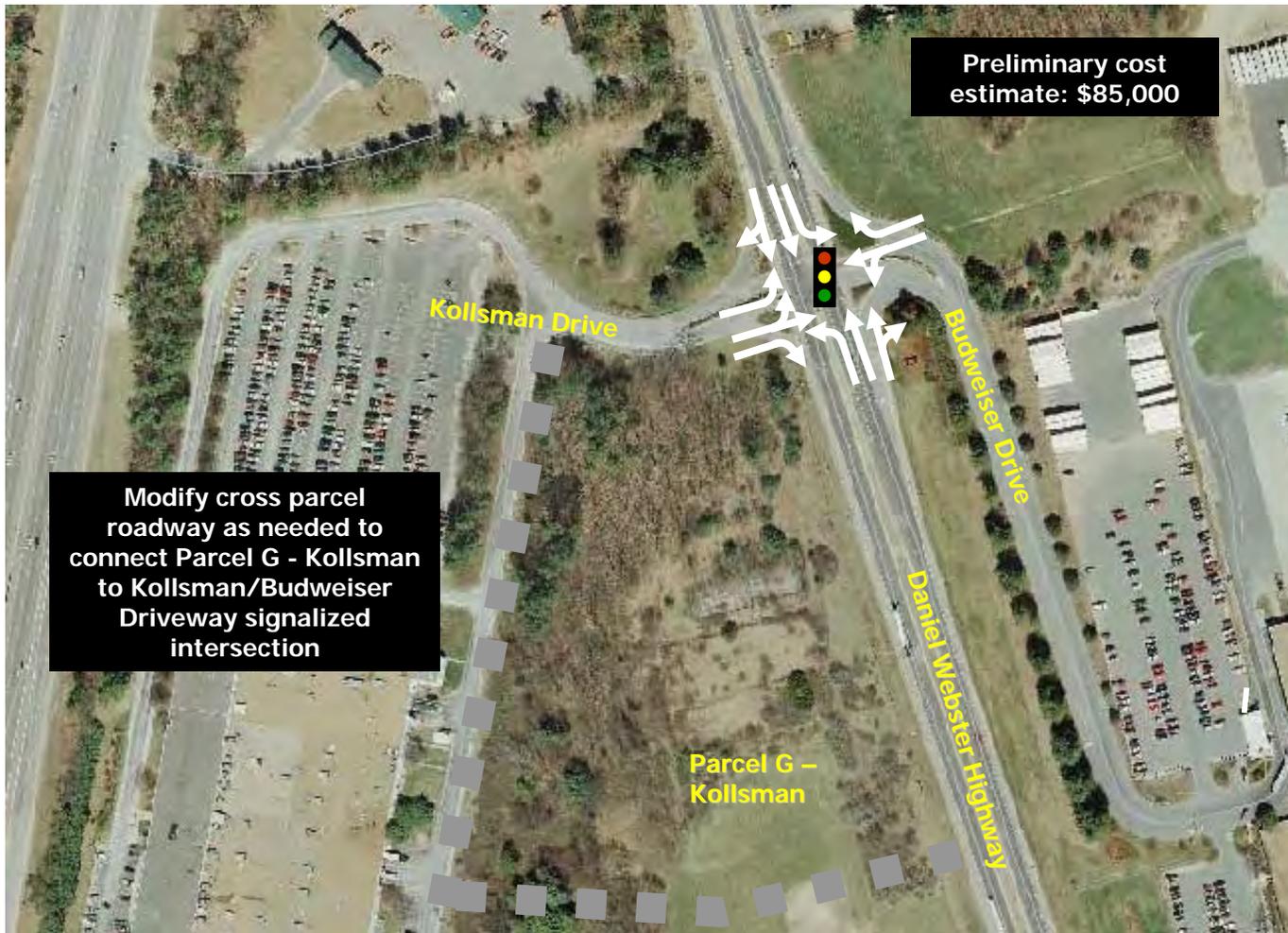
*Figure V-9A*  
**Parcel G - Kollsman at Daniel Webster Highway**  
 Merrimack, NH

Proposed Improvements  
 Assumed Constructed  
 by 2017



### Level of Service (LOS) Summary Table

	2007 Existing	2017 without Mitigation	2017 with Mitigation	2027 without Mitigation	2027 with Mitigation
AM Peak Hour	N/A	F	A	F	A
PM Peak Hour	N/A	F	C	F	C



Existing Conditions

Photo Direction

*Figure V-9B*  
**Kollsmann/Budweiser Driveways at Daniel Webster Highway north of Parcel G – Kollsmann Merrimack, NH**  
 Proposed Improvements Assumed Constructed By 2017



I. Parcel G - Kollsman at Daniel Webster Highway and Industrial Drive (Continued)

Minimum 6-foot wide sidewalks should be provided on the west side of DWH along the Parcel G - Kollsman frontage and along any access roads created to the site. The DWH median is wide enough at 20 feet to provide at least a single left turn lane into the site at a new access. Based on the projections, it would be necessary to create a minimum 400-foot exclusive left turn lane in the median on the northbound DWH approach to a new signal, and to retime the existing signal at Parcel G - Kollsman/Budweiser intersection for efficient operations. By the year 2017, without traffic signal mitigation, Parcel G - Kollsman congestion would occur during both peak hours. It is projected that traffic in the area will be two to three times as high as it is today.

J. Star Drive at Daniel Webster Highway

Approximate Star Drive Area Development Quantities			Approximate % ADT Traffic Change from 2007		
Type	2017	2027	Roadway	2017	2027
Residential Units	N/A	N/A	DWH - South of Star Drive	40-75	40-75
Industrial	31,000 ft <sup>2</sup>	43,000 ft <sup>2</sup>	DWH - North of Star Drive	40-75	40-75
Retail	N/A	N/A	Star Drive – West of DWH	±200	±350
Office/R&D	79,000 ft <sup>2</sup>	N/A			

Figure V-10 provides summary display of potential improvements at the Star Drive intersection with DWH assumed constructed by the year 2017. A preliminary order of magnitude cost estimate is provided along with projected levels of service with and without the improvements.

The former McDonald’s site opposite Star Drive at Daniel Webster Highway closed during the past year. This presents a redevelopment opportunity for the site and an opportunity to re-align the entering site access driveway, and preferably both site driveways, opposite Star Drive, which serves several commercial parcels. There is also a possibility that Star Drive could be extended easterly to accommodate several smaller development parcels east of the B&M railroad with construction of a new at-grade railroad crossing and another distributor road located east of the railroad and west of the Merrimack River. DWH traffic is expected to grow by approximately 75% by the year 2027, If Star Drive’s traffic absorbs traffic from parcels east of the B&M railroad, its year 2017 and 2027 volumes could double and triple, respectively compared to those found in 2007. It is anticipated that Star Drive will meet signal warrants prior to 2017.

Based on forecasted traffic demands, we recommend creation of exclusive left turn lanes in both directions of DWH within its

existing five-lane cross-section. The intersection would also benefit from the creation of a two-lane approach on Star Drive to provide an exclusive right turn lane and a shared through/left turn lane. The exclusive lane would preferably be at least 150 feet in length. A median to accommodate the southbound left turn demands is recommended if the driveway entrance for the former McDonald’s parcel is *not relocated* opposite Star Drive.

If at all possible, all future development sites west of DWH in the vicinity of Star Drive should be connected by a system of internal cross-parcel driveways to access the Star Drive intersection in the interests of good access planning.

### Level of Service (LOS) Summary Table

	2007 Existing	2017 without Mitigation	2017 with Mitigation	2027 without Mitigation	2027 with Mitigation
AM Peak Hour	C	F	A	F	A
PM Peak Hour	E	F	A	F	A



Existing Conditions

➔ Photo Direction

**Figure V-10**  
**Star Drive at Daniel Webster Highway**  
 Merrimack, NH

Proposed Improvements Assumed Constructed by 2017

Base Map Source: Town of Merrimack, New Hampshire Geographic Information System [www.merrimackgis.org](http://www.merrimackgis.org)





K. Greeley Street at Daniel Webster Highway

Approximate Greeley St Development Quantities			Approximate % ADT Traffic Change from 2007		
Type	2017	2027	Roadway	2017	2027
Residential Units	N/A	N/A	DWH - South of Greeley Street	40-75	40-75
Industrial	N/A	36,000 ft <sup>2</sup>	DWH - North of Greeley Street	20-40	20-40
Retail	N/A	19,000 ft <sup>2</sup>	Greeley Street – West of DWH	20-40	20-40
			Greeley Street – East of DWH	20-40	60-80
Office/R&D	N/A	N/A			

Figure V-11 provides a summary display of potential improvements at DWH and Greeley Street by the year 2017. A preliminary order of magnitude cost estimate is provided along with projected levels of service with and without the improvements.

Greeley Street is located approximately 2,500 feet north of Star Drive and already has a high-type design and is signal controlled at its intersection with DWH, as it provides access to Exit 11. All approaches to the intersection are median-divided and have two-five approach lanes including double left turning lanes on the northbound DWH and eastbound Greeley Street. Overall intersection volumes are expected to grow by 48% over 2007 volumes by the year 2017, and 56% over 2007 volumes by 2027. Retail and industrial development is anticipated to the east of DWH to the southwest of Greeley Street off Jennifer Drive.

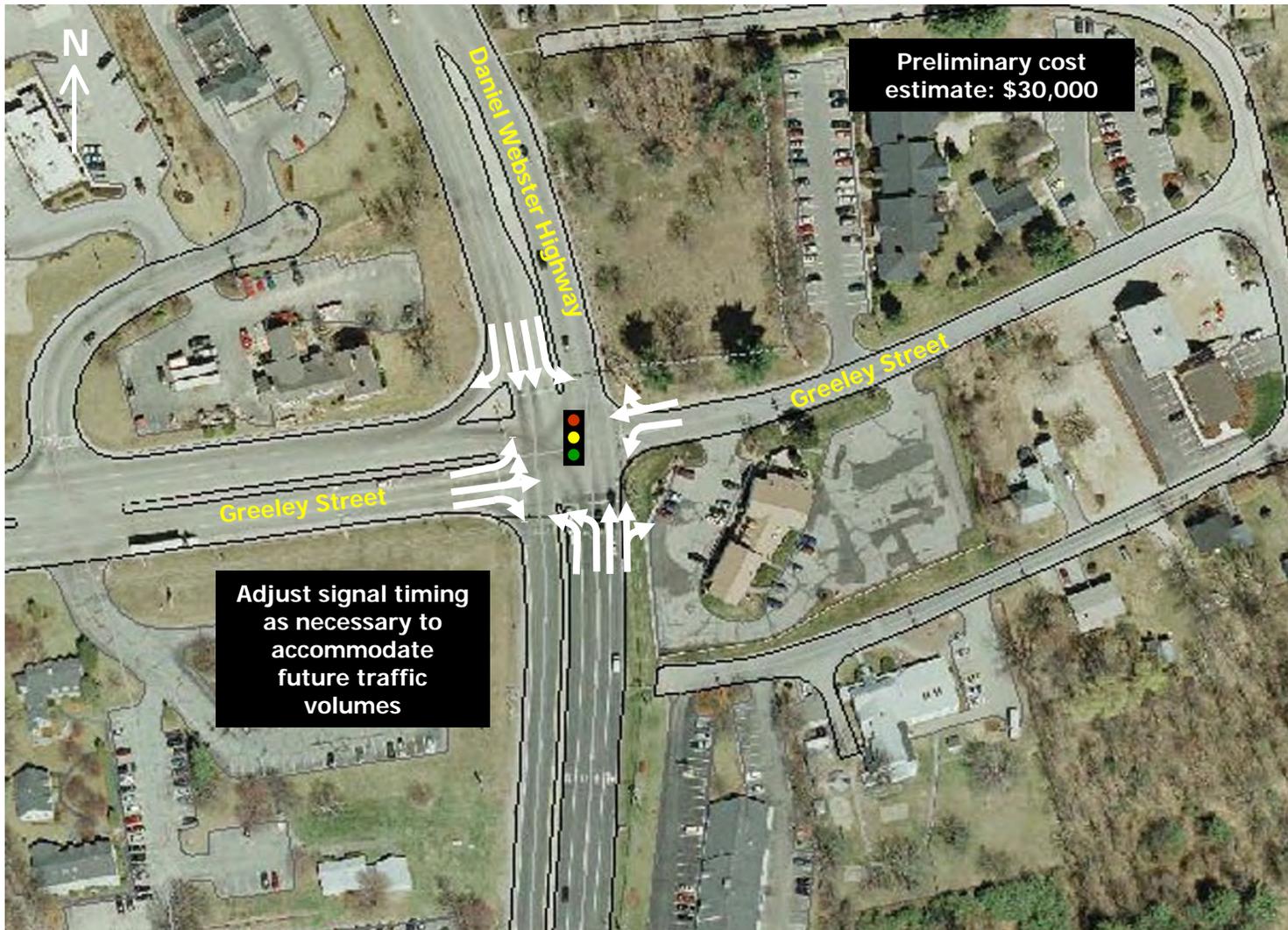
Greeley Street is expected to operate effectively through 2027 with the geometric features it currently has in place. However, there will be a need to adjust its signal timing over time as volumes grow passing through the intersection.

### Level of Service (LOS) Summary Table

	2007 Existing	2017 without Mitigation	2017 with Mitigation	2027 without Mitigation	2027 with Mitigation
AM Peak Hour	<b>B</b>	<b>C</b>	<b>C</b>	<b>C</b>	<b>C</b>
PM Peak Hour	<b>C</b>	<b>E</b>	<b>D</b>	<b>F</b>	<b>D</b>



Existing Conditions



**Figure V-11**  
**Greeley Street at**  
**Daniel Webster**  
**Highway**  
 Merrimack, NH

Proposed Improvements  
 Assumed Implemented  
 by 2017

Base Map Source: Town of Merrimack, New Hampshire Geographic Information System [www.merrimackgis.org](http://www.merrimackgis.org)

L. Island Drive/Pond View Drive at Daniel Webster Highway

Approximate % ADT Traffic Change from 2007		
Roadway	2017	2027
DWH - South of Island/Pond View Drive	20-40	20-40
DWH - North of Island/ Pond View Drive	20-40	20-40
Island/ Pond Drives – East of DWH	<10	<10

Refer to Figure V-12 for an illustration of the signal or roundabout concepts for this intersection. In this case, NHDOT approval will be required if a signal is proposed. A preliminary order of magnitude cost estimate is provided along with projected levels of service with and without the alternate improvements.

Island and Pond View Drives are located east of DWH approximately 2,100 feet north of Greeley Street. Island Drive is served by Daniel Webster Drive, a DWH frontage road that creates an awkward approach intersection with both Pond View Drive, and less than 50 feet westerly, with DWH. Traffic volumes on DWH are expected to grow by approximately 25% between 2007 and 2027. Pond View Drive at DWH, which includes outbound Island Drive traffic volumes, is expected to meet traffic signal warrants by 2017 due to the increase in DWH passing traffic volumes.

The awkward alignments of Pond View and Island Drives plus the availability of Daniel Webster Drive, a frontage road on the former DWH mainline alignment, present an opportunity to consider installation of a modern roundabout. The roundabout would be in lieu of a traffic signal at the Pond View Drive intersection with DWH. Illustrated on Figure V-12,

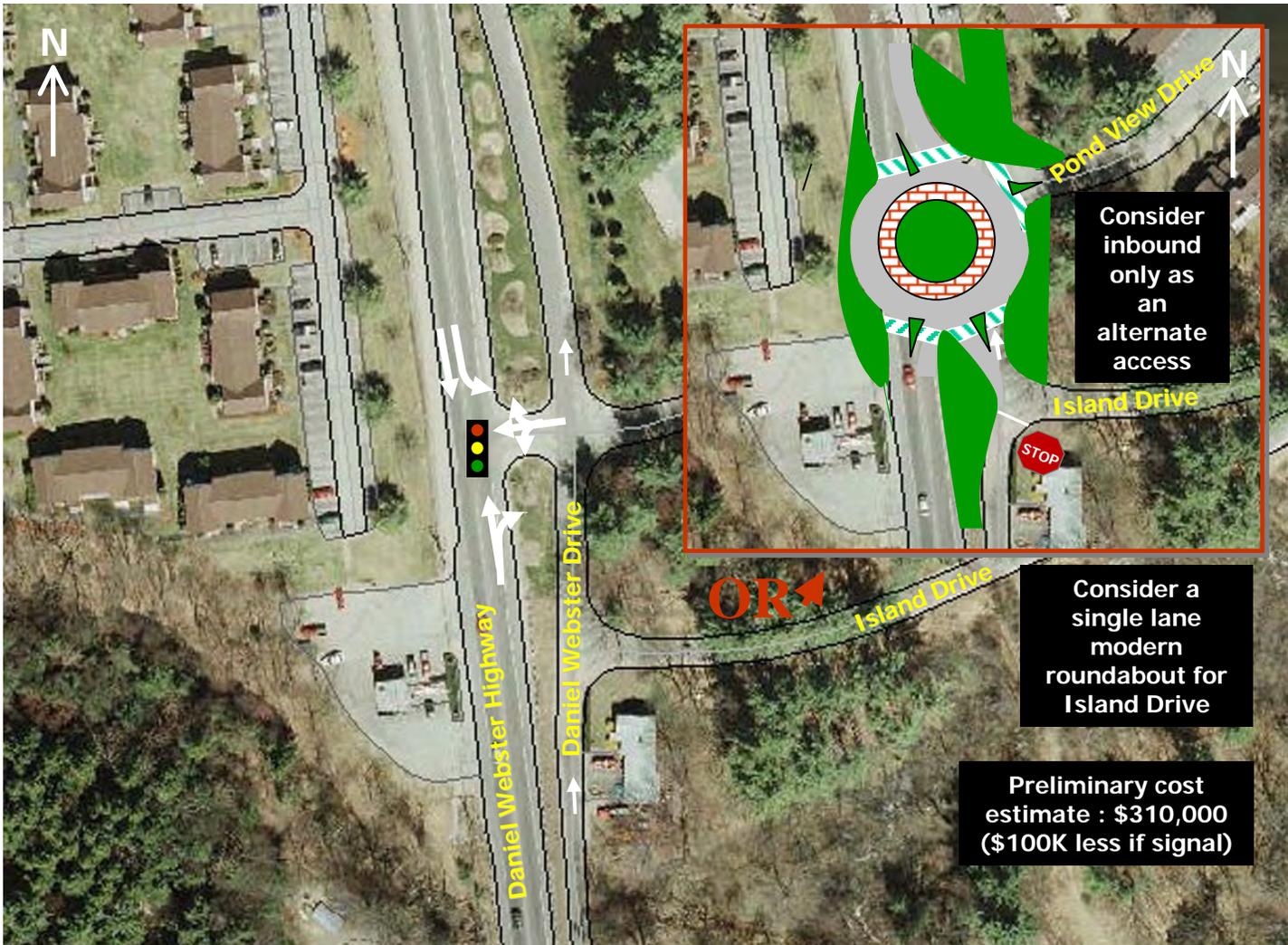
the potential single lane modern roundabout would allow the discontinuance of Daniel Webster Drive north of Pond View Drive and creation of additional green space along DWH. It would also serve a ‘traffic calming’ effect on DWH to reduce speeds through this area, which is posted for a 30 miles per hour speed limit. The roundabout should be designed to accommodate a maximum 20 mph design speed and should include an appropriate truck apron. Pursuit of a modern roundabout would represent a significant design challenge, as DWH peak hour volumes projected for 2017 are expected to exceed the capacity of a single lane modern roundabout (i.e., greater than 1,250 vehicles per hour for circulating traffic weaves). Additionally, the combined Island Drive/Pond View volumes should preferably represent 20% of the DWH volume. The northbound DWH approach would have to be designed to allow right turn access only to Island Drive via Daniel Webster Drive from the south, while allowing traffic in the roundabout to access Island Drive.

Minimum 6-foot wide sidewalks offset from the roundabout traffic should be considered on all sides of the modern roundabout. Four roadway entry points should be provided – both directions of DWH, Pond View, and Island Drives. The northbound DWH frontage road should terminate in a stop-controlled intersection with Island Drive and right turns onto Island Drive should be provided via the northbound frontage road, rather than the modern roundabout, unless accomplished via a full U-turn through the roundabout. A layout of approximately 125 feet in width is available to construct the potential modern roundabout. The roundabout would create an opportunity to enhance access to the existing ice cream stand located just south of the potential modern roundabout.

## Level of Service (LOS) Summary Table

	2007 Existing	2017 without Mitigation	2017 with Mitigation	2027 without Mitigation	2027 with Mitigation
AM Peak Hour	E	F	A*	F	A*
PM Peak Hour	E	F	A*	F	A*

\* With signal. Star Drive approach is LOS F if left unsignalized – roundabout would be disruptive to through traffic flow.



*Existing Conditions*

➔ *Photo Direction*

**Figure V-12**  
**Pond View Drive at Daniel Webster Highway**  
 Merrimack, NH

Proposed Improvements Assumed Constructed by 2017

Base Map Source: Town of Merrimack, New Hampshire Geographic Information System [www.merrimackgis.org](http://www.merrimackgis.org)



M. East Chamberlain Road at Daniel Webster Highway

Approximate East Chamberlain Rd Development Quantities			Approximate % ADT Traffic Change from 2007		
Type	2017	2027	Roadway	2017	2027
Residential Units	6	N/A	DWH - South of E Chamberlain	10-20	20-40
Industrial	N/A	N/A	DWH - North of E Chamberlain	10-20	20-40
Retail	N/A	N/A	<b>East Chamberlain Road</b>	<10	<10
Office/R&D	N/A	N/A			

Refer to Figure V-13 for an illustration of the concept of East Chamberlain Road at DWH primarily to enhance its future safety characteristics. A preliminary order of magnitude cost estimate is provided along with projected levels of service with and without the improvements.

East Chamberlain Road intersects DWH approximately 4,700 feet north of the Pond View/Island Drives intersection, and approximately 300 feet south of the Rite-Aid Shopping Village Plaza signalized intersection. It approaches DWH on a steep downward slope and is skewed at its intersection with it. Traffic on DWH is expected to grow by more than 25% by the year 2027, while East Chamberlain Road traffic volumes are expected to grow less than 10%.

By 2017, without mitigation, East Chamberlain Road peak hour operating conditions at DWH are expected to worsen. However, restricting traffic exiting from East Chamberlain Road to right turns out during peak hours should only be considered if traffic delays become inordinantly long. Without excessive delays, such a restriction is impractical, as it would be largely unenforceable, and would require motorists desiring to travel northbound on DWH to U-turn a half mile away at the Old Shaw’s Plaza. The upstream traffic signal at Rite Aid Village Plaza and downstream traffic signal on DWH

create enough gaps that the traffic volume exiting East Chamberlain Road – expected to be approximately 50 vehicles per hour during the AM peak hour should be able to exit.

To assist with northbound DWH traffic visibility, it is recommended consideration be given to reducing the opening length of East Chamberlain Road at DWH. Creating some green space on the northwest corner of the intersection can reduce the skew of the intersection and intersection crossing distance for pedestrians crossing East Chamberlain Road and better define the roadway entrance for left turning traffic, particularly during late nights and in inclement weather conditions.

### Level of Service (LOS) Summary Table

	2007 Existing	2017 without Mitigation	2017 with Mitigation	2027 without Mitigation	2027 with Mitigation
AM Peak Hour	E	F	F	F	F
PM Peak Hour	E	F	D	F	D



Existing Conditions

➔ Photo Direction



Figure V-13  
**East Chamberlain Road at Daniel Webster Highway**  
 Merrimack, NH

Proposed Improvements Assumed Constructed by 2017

Base Map Source: Town of Merrimack, New Hampshire Geographic Information System [www.merrimackgis.org](http://www.merrimackgis.org)

**N. Railroad Avenue at Daniel Webster Highway**

Approximate % ADT Traffic Change from 2007		
Roadway	2017	2027
DWH - South of Railroad Ave	10-20	20-40
DWH - North of Railroad Ave	10-20	20-40
Railroad Ave	<10	<10

Refer to Figure V-14 for an illustration of the alternate concepts for Railroad Avenue at DWH. A preliminary order of magnitude cost estimate is provided along with projected levels of service with and without the improvements. Like the improvements proposed for East Chamberlain Road at DWH, the Railroad Avenue at DWH improvements are primarily to enhance its future safety characteristics.

Railroad Avenue intersects just south of a reverse curve on DWH. It approaches DWH at two two-way intersections; the southerly one is perpendicular to DWH while the northerly one intersects at an acute angle. Traffic on DWH is expected to grow by more than 25% by the year 2027 in the vicinity of Railroad Avenue.

By 2017, both the north and south Railroad Avenue approaches to DWH are expected to be operating with congestion. While Railroad Avenue itself is expected to experience little growth in traffic volumes, due to the increase in traffic on DWH, gaps in traffic during the peak hours will become more difficult to find. Platooning of vehicles due to traffic signals is beneficial to Railroad Avenue traffic, as vehicles delayed at traffic signals tend to result in more gaps than free flowing traffic.

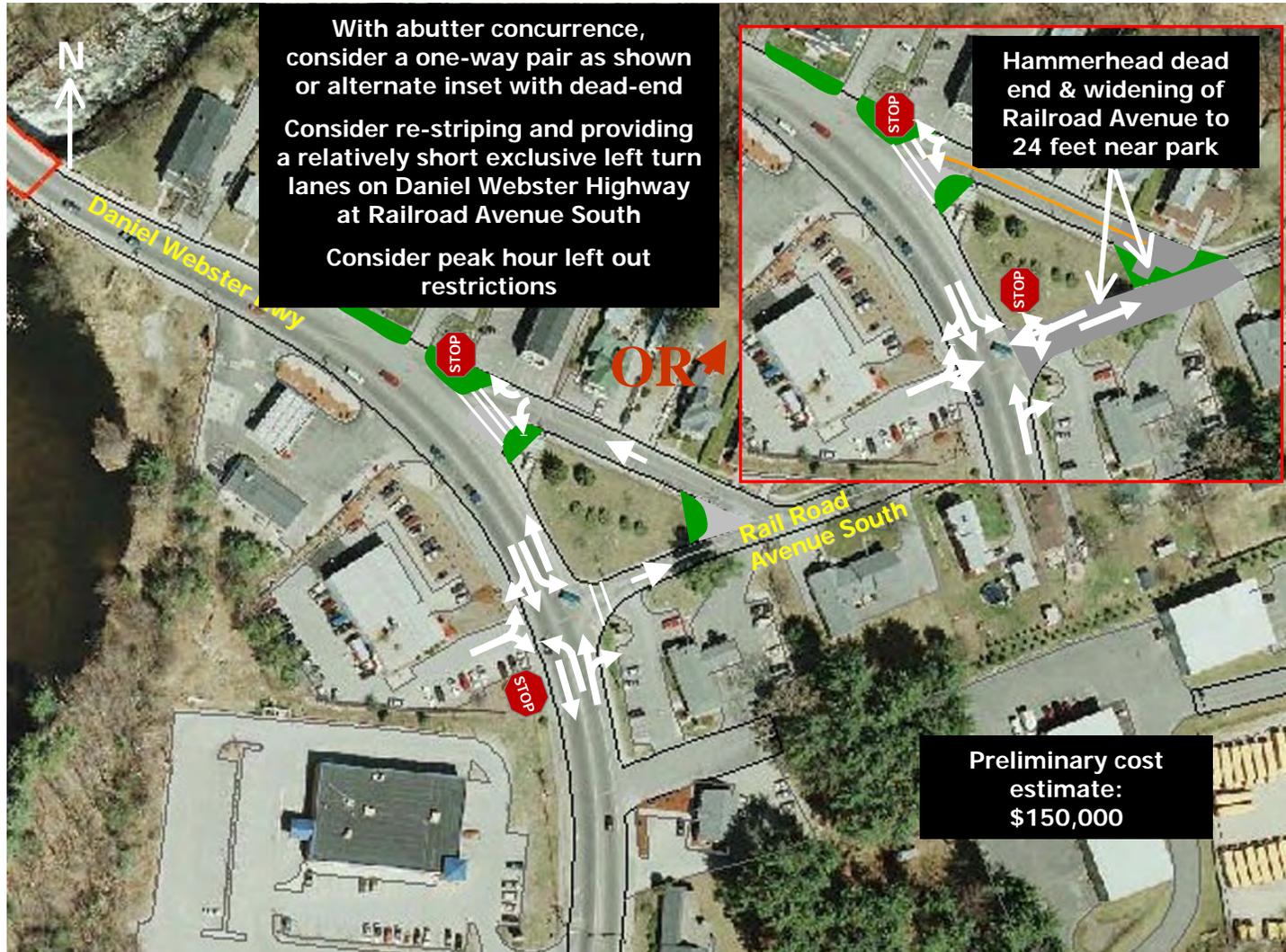
Based on observations, the primary problems at this intersection are geometric, due to the acute angle and the narrowness of Railroad Avenue South approaching DWH. Besides leaving it as it is, a couple of options for this intersection were considered. One option would be to make Railroad Avenue North one-way westbound and Railroad Avenue south one-way eastbound to its intersection with DWH and realign Railroad Avenue North to provide more of a right angle intersection.

Another option would be dead end Railroad Avenue North in a hammerhead design at Railroad Avenue to allow U-turns. With the latter option, it would be necessary to widen Railroad Avenue at its intersection with DWH to provide a pavement width of at least 24 feet. Both options involve creating a southbound left turn lane on DWH to access Railroad Avenue South.

## Level of Service (LOS) Summary Table

	2007 Existing	2017 without Mitigation	2017 with Mitigation	2027 without Mitigation	2027 with Mitigation
AM Peak Hour	<b>E</b>	<b>F</b>	<b>C*</b>	<b>F</b>	<b>D*</b>
PM Peak Hour	<b>F</b>	<b>F</b>	<b>C*</b>	<b>F</b>	<b>F</b>

\* Without peak hour left turn restrictions, the Railroad Avenue approaches will operate at LOS F during the AM and PM peak hours



*Existing Conditions*



*Figure V-14*  
**Railroad Avenue and Auto Body Driveway at Daniel Webster Highway**  
 Merrimack, NH  
 Proposed Improvements Assumed Constructed by 2017

Base Map Source: Town of Merrimack, New Hampshire Geographic Information System [www.merrimackgis.org](http://www.merrimackgis.org)



O. Baboosic Lake Road at Daniel Webster Highway

Approximate % ADT Traffic Change from 2007		
Roadway	2017	2027
DWH - South of Baboosic Lake Rd	10-20	20-40
DWH - North of Baboosic Lake Rd	10-20	20-40
<b>Baboosic Lake Rd</b> west of DWH	<10	10-20

Refer to Figure V-15 for an illustration of proposed improvements to Baboosic Lake Road at Daniel Webster Highway. A preliminary order of magnitude cost estimate is provided along with projected levels of service with and without the improvements. Traffic volumes on DWH are expected to increase between 10 – 20% from 2007 to 2017 and 20 - 40% between 2007 and 2027.

Baboosic Lake Road intersects DWH on an 80° skew to form a ‘T’ intersection. However, the westbound driveway from Emerald Auto Sales is off-set approximately 50 feet to the north of the intersection, thereby creating a four legged-intersection. The northbound DWH movement has an exclusive left-turn lane and a shared through and right-turn lane. Southbound there is an exclusive left, through, and right-turn lane. From Baboosic Lake Road eastbound there is an exclusive left-turn lane and a shared through and right-turn lane. Finally the westbound driveway movement shares one lane for all three directions.

Currently, the intersection operates under signal control and is a LOS D in the AM peak hour and a LOS C in the PM peak hour. The intersection will continue to operate at these levels of service without mitigation until 2027 at which time the LOS will be failing in the AM peak hour and LOS E in the PM peak hour.

Proposed mitigation at this location includes signal-timing adjustments along with the possible future relocation of the westbound driveway directly opposite Baboosic Lake Road. While relocating the westbound driveway would result in safer and improved intersection operations for all modes of travel, this should only occur if there is an opportunity to realign the intersection *without a public property taking*.

### Level of Service (LOS) Summary Table

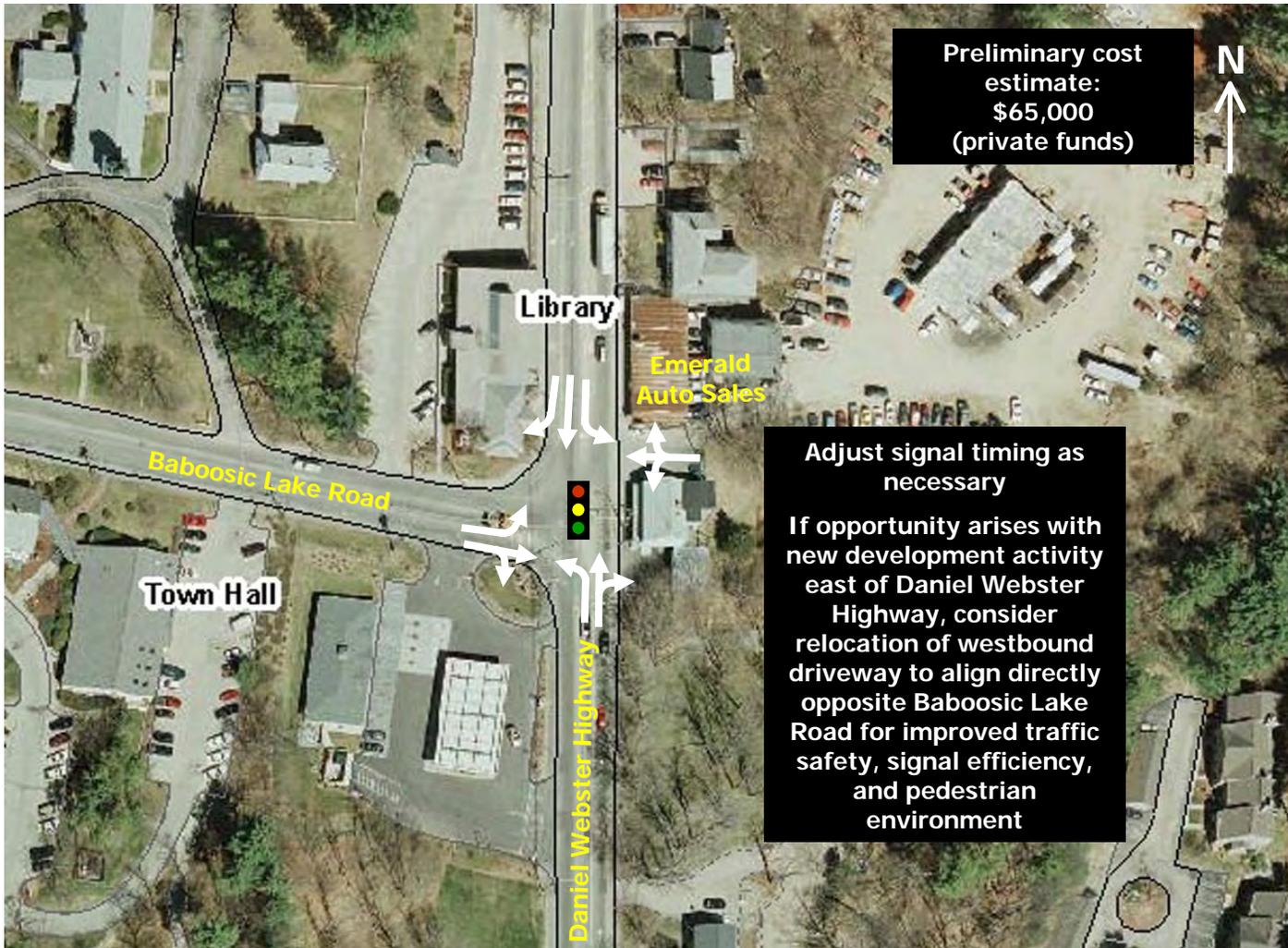
	2007 Existing	2017 without Mitigation	2017 with Mitigation	2027 without Mitigation	2027 with Mitigation
AM Peak Hour	D	D	D	F	E
PM Peak Hour	C	C	C	E	D



Existing Conditions



Figure V-15  
**Baboosic Lake Road at Daniel Webster Highway**  
 Merrimack, NH  
 Proposed Improvements Assumed Implemented by 2017



Base Map Source: Town of Merrimack, New Hampshire Geographic Information System [www.merrimackgis.org](http://www.merrimackgis.org)

P. Wire Road at Daniel Webster Highway

Approximate % ADT Traffic Change from 2007		
Roadway	2017	2027
DWH - South of Baboosic Lake Rd	10-20	20-40
DWH - North of Baboosic Lake Rd	10-20	20-40
Wire Rd west of DWH	10-20	20-40

Refer to Figure V-16 for an illustration of potential improvements at this intersection. A preliminary order of magnitude cost estimate is provided along with projected levels of service with and without the improvements.

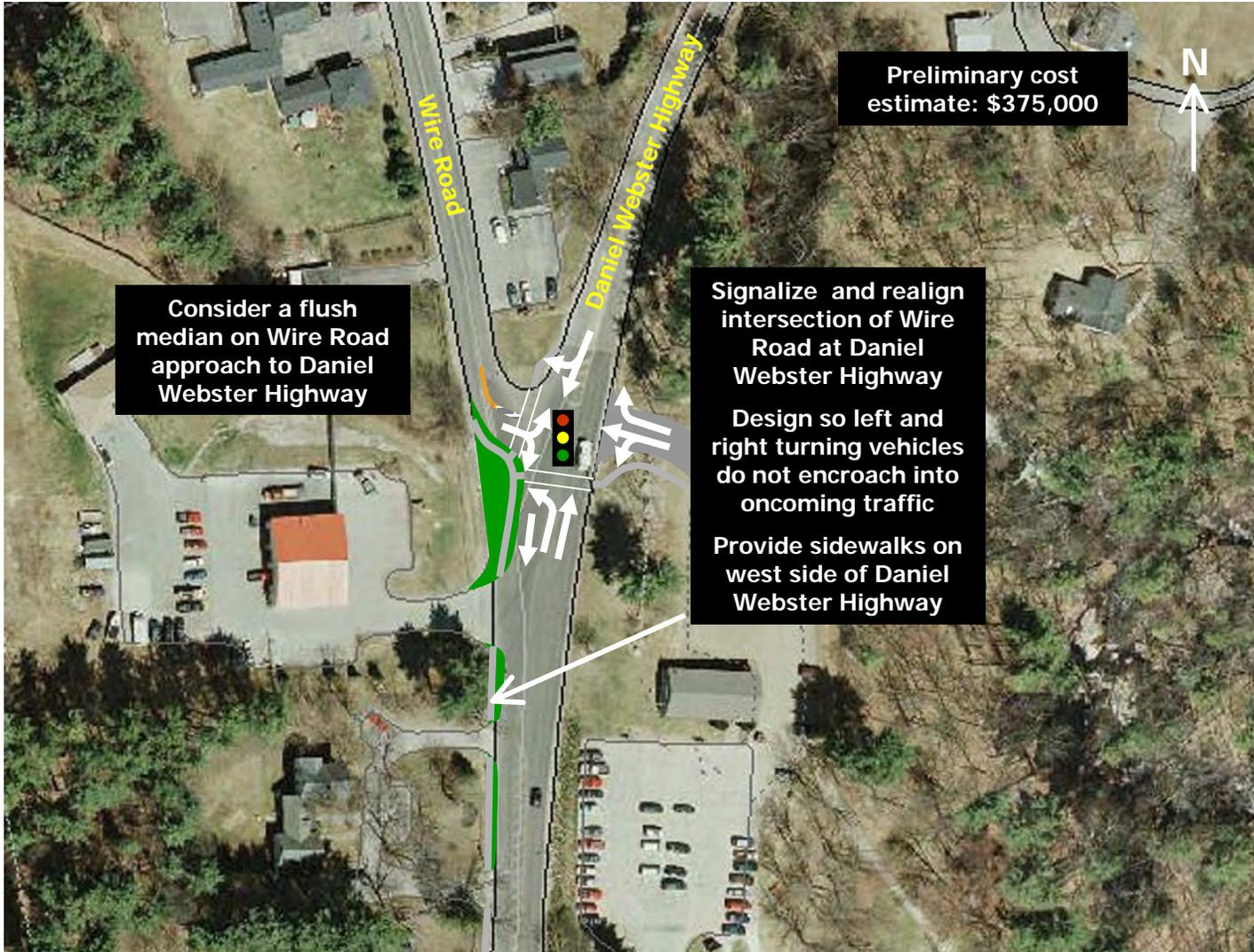
The existing geometry of DWH at Wire Road is a skewed three-legged intersection with major movements running northeast and south on DWH and the minor movement running northwest on Wire Road. Currently the intersection operates under stop-control and is a LOS E in the AM peak hour and a LOS C in the PM peak hour. Traffic volumes are predicted to increase 10 – 20% between 2007 and 2017 and between 20 – 40% between 2007 and 2027. There is development around the area of the intersection proposed in 2017 and 2027. Without mitigation for this location the operations of this intersection will fail (LOS F) in 2017 and 2027 in both AM and PM peak hour.

Proposed mitigation for this location in 2017 will include a new traffic signal along with a realignment of the intersection. The design of the realignment would be such that left-turning vehicles from the driveway do not conflict with the right-turning vehicles from Wire Rd and would include a flush median. Further mitigation suggested also includes providing a sidewalk on the west side of DWH.

In accordance with existing Town plans, the geometry of the new intersection should include an exclusive northbound left-turn lane and through lane on DWH, a shared southbound through and right-turn lane, a shared eastbound left and right-turn lane from Wire Road, and a shared left and through lane along with an exclusive right-turn lane from the westbound driveway approach.

### Level of Service (LOS) Summary Table

	2007 Existing	2017 without Mitigation	2017 with Mitigation	2027 without Mitigation	2027 with Mitigation
AM Peak Hour	<b>E</b>	<b>F</b>	<b>B</b>	<b>F</b>	<b>B</b>
PM Peak Hour	<b>C</b>	<b>F</b>	<b>A</b>	<b>F</b>	<b>A</b>



*Existing Conditions*



*Figure V-16*  
**Wire Road at Daniel Webster Highway**  
 Merrimack, NH  
 Proposed Improvements Assumed Constructed by 2017

Base Map Source: Town of Merrimack, New Hampshire Geographic Information System [www.merrimackgis.org](http://www.merrimackgis.org)





Q. Twin Bridge Road at Daniel Webster Highway

Approximate New Twin Bridge Road Development Quantities			Approximate % ADT Traffic Change from 2007		
Type	2017	2027	Roadway	2017	2027
Residential Units	120	6	DWH - South of Twin Bridge Rd	10-20	20-40
Industrial	N/A	N/A	DWH - North of Twin Bridge Rd	10-20	20-40
Retail	N/A	44,500 ft <sup>2</sup>	<b>Twin Bridge Road</b>	>150	<400
Office/R&D	N/A	N/A			

Refer to Figure V-17 for a summary of proposed improvements at the intersection of Twin Bridge Road assumed to be constructed between 2017 and 2027. A preliminary order of magnitude cost estimate is provided along with projected levels of service with and without the improvements.

Twin Bridge Road will provide access to a proposed development containing 120 age-restricted housing units, anticipated for 2017. Additional development potentially constructed between 2017 and 2027 will include 6 housing units and over 44,500 square feet of retail commercial use. Finally, approximately 10,000 square feet of commercial retail development may occur *opposite* Twin Bridge Road between 2017 and 2027.

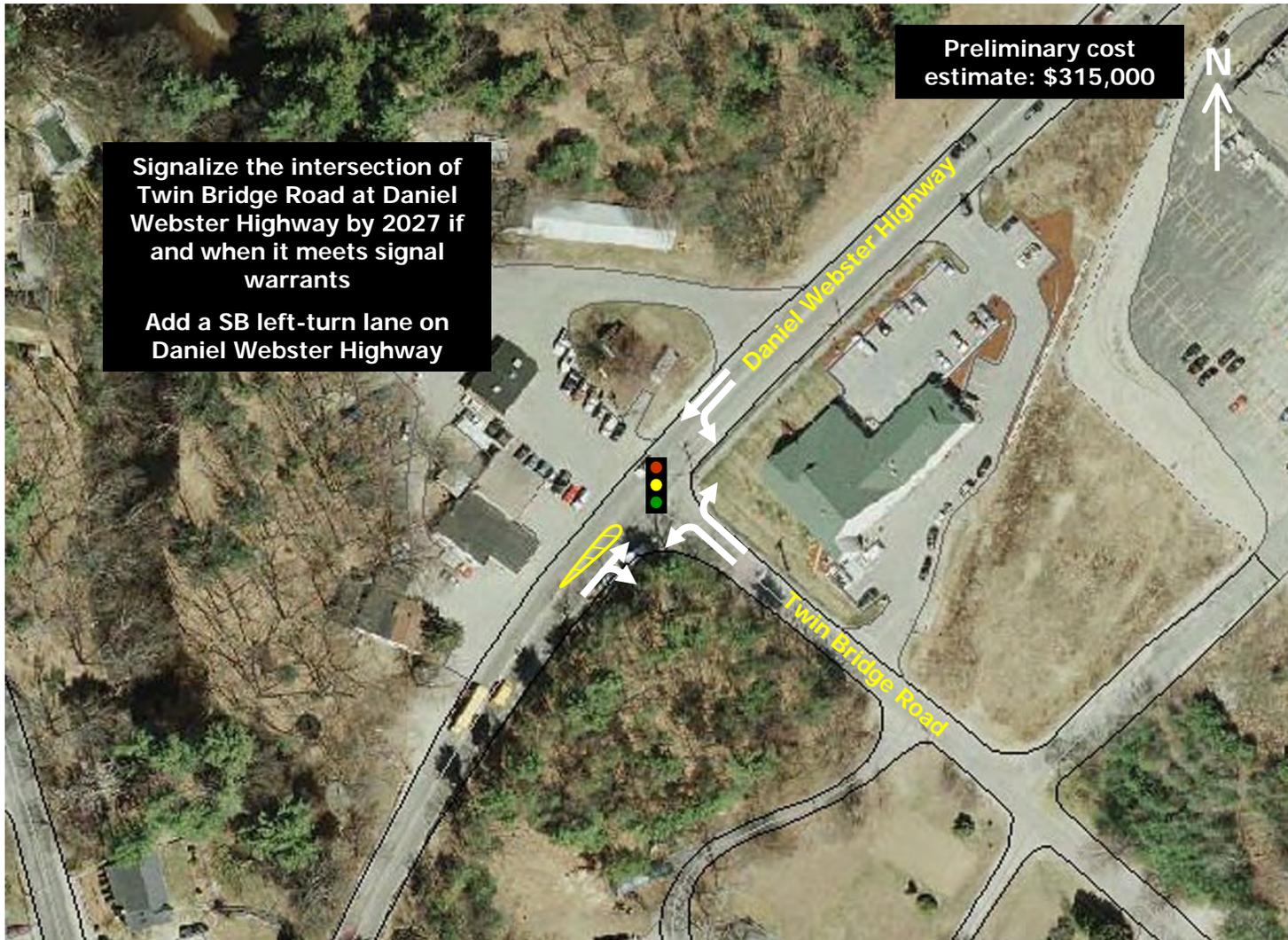
It is anticipated that traffic volumes will increase between 10 – 20% on Daniel Webster Highway north and south of Twin Bridge Road between 2007 and 2017. Traffic volumes are anticipated to increase over 150% on Twin Bridge Road as a result of the housing development to be in place in 2017 and perhaps as much as 400% by 2027 with new retail commercial development that is assumed.

Currently, the geometry of the intersection includes shared lanes to accommodate all of the movements through the intersection. While this geometry provides the adequate capacity in the existing and 2017 case, the operations of the intersection will be congested during the PM peak hour without mitigation in the 2027 case. Proposed mitigation for this intersection includes a signal installation, if signal warrants are met, as well as the addition of an exclusive left and exclusive right-turn lane from Twin Bridge Road and an exclusive left-turn lane southbound on Daniel Webster Highway. The exclusive lanes should be added *prior to 2017* with the development of the 120 housing units.

A sidewalk should be considered on at least one side, perhaps the south side of Twin Bridge Road with the development of the age-restricted housing. Ultimately, a sidewalk on the east side of DWH should be considered between Twin Bridge Road and Wire Road, with the new signal at Wire Road (refer back to Figure V-16).

### Level of Service (LOS) Summary Table

	2007 Existing	2017 without Mitigation	2027 without Mitigation	2027 with Mitigation
AM Peak Hour	C	C	E	A
PM Peak Hour	C	E	F	C



Existing Conditions



**Figure V-17**  
**Twin Bridge Road at Daniel Webster Highway**  
 Merrimack, NH

Proposed Improvements Assumed Constructed Between 2017 and 2027

Base Map Source: Town of Merrimack, New Hampshire Geographic Information System [www.merrimackgis.org](http://www.merrimackgis.org)



R. Bedford Road at Daniel Webster Highway

Approximate % ADT Traffic Change from 2007		
Roadway	2017	2027
DWH - South of Bedford Rd	10-20	20-40
DWH - North of Bedford Rd	40-75	< -20
<b>Bedford Road</b> - west of DWH	20-40	>150

Refer to Figure V-18 for an illustration of recommended improvements at the Bedford Road intersection with DWH. A preliminary order of magnitude cost estimate is provided along with projected levels of service with and without the improvements.

Traffic volumes between 2007 and 2017 are anticipated to increase between 20 – 40% on the eastbound and northbound approaches while the southbound volumes are anticipated to experience a 40 – 75% increase, while traffic on Bedford Road holds steady. Parcel H (Flatley) to the north of this intersection is expected to be developed by 2017.

The existing geometry of the signalized intersection of Bedford Road at DWH is a four-legged intersection. North and southbound approaches are on Daniel Webster Highway, eastbound approach is Bedford Road, and the westbound approach is the Walgreen’s Driveway. Lane assignments on the westbound Walgreen’s approach include a dedicated right-turn lane and a shared left and through lane. The eastbound Bedford road and northbound Daniel Webster Highway lane assignments consist of a dedicated left-turn lane and a shared through and right turn lane. Finally the southbound lane assignments on DWH are dedicated left-turn, through, and right-turn lanes.

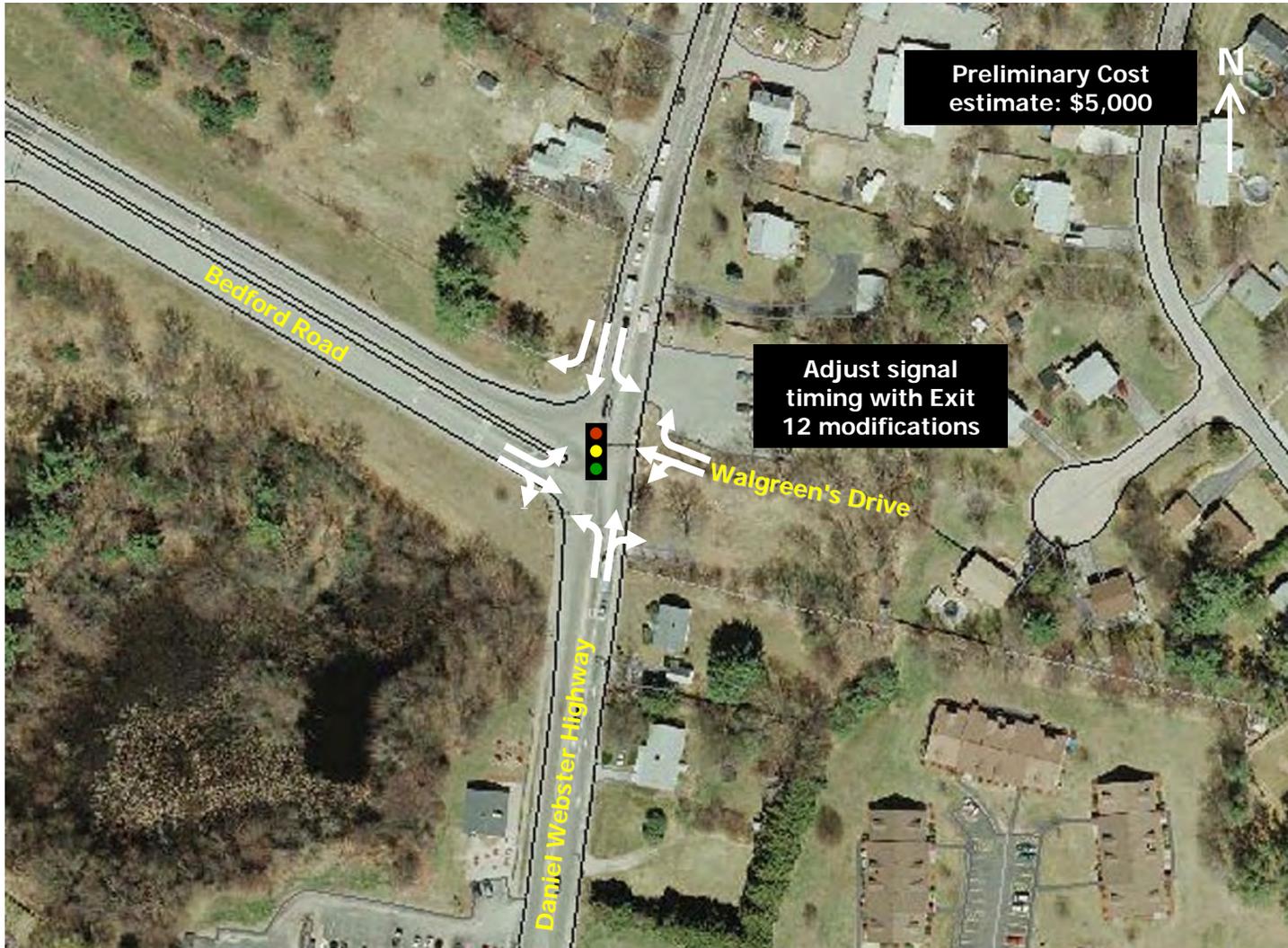
Improvements to the Exit 12 Interchange of the FE Everett Turnpike will significantly increase future traffic volumes experienced at Bedford Road between 2017 and 2027. Bedford Road volumes are expected to ultimately increase more than 2.5 times once the interchange is open. At the same time, volumes on DWH north of Bedford Road will decline by nearly 25% and increase nearly 40% south of Bedford Road. Timing adjustments to recent signal improvements are recommended to keep peak hour levels of service at an acceptable LOS C.

## Level of Service (LOS) Summary Table

	2007 Existing	2017 without Mitigation	2017 with Mitigation	2027 without Mitigation	2027 with Mitigation
AM Peak Hour	<b>C</b>	<b>D</b>	<b>C</b>	<b>E</b>	<b>C</b>
PM Peak Hour	<b>C</b>	<b>E</b>	<b>C</b>	<b>E</b>	<b>C</b>



*Existing Conditions*



*Figure V- 18*  
**Bedford Road at Daniel Webster Highway**  
 Merrimack, NH

Proposed Improvements  
 Assumed Implemented  
 by 2017

Base Map Source: Town of Merrimack, New Hampshire Geographic Information System [www.merrimackgis.org](http://www.merrimackgis.org)





S. Parcel H - Flatley at Daniel Webster Highway

Approximate Parcel H Development Quantities			Approximate % ADT Traffic Change from 2007		
Type	2017	2027	Roadway	2017	2027
Residential Units	200	4	DWH - South of Parcel H	40-75	40-75
Industrial	173,000 ft <sup>2</sup>	N/A	DWH - North of Parcel H	40-75	< -20
Retail	26,000 ft <sup>2</sup>	N/A	Flatley (Parcel H) Driveway	N/A	N/A
Office/R&D	165,000 ft <sup>2</sup>	N/A			

See Figure V-19 for proposed roadway infrastructure improvements assumed with the development of Parcel H – Flatley. A preliminary order of magnitude cost estimate is provided along with projected levels of service with and without the improvements. We assume this site will be developed prior to 2017 with a large mixed-use development. Such a development will require new access onto Daniel Webster Highway. It is assumed the development will include housing, retail, office, and industrial uses. Timing of improvements will be a particular concern with the development of Parcel H - Flatley. NRPC projects that traffic volumes on Daniel Webster Highway near Parcel H - Flatley will *increase* between 20 – 40% north of Parcel H - Flatley and 40 – 75% south of Parcel H - Flatley by 2017. Traffic operations on Daniel Webster Highway at Parcel H – Flatley access driveway with no mitigation will be congested in 2017, but will improve once Exit 12 Interchange improvements are constructed.

*If Exit 12 interchange improvements are constructed and available prior to the development of Parcel H – Flatley, signalization of its primary driveway with DWH will not be necessary, as traffic volumes on the segment of DWH in front of Parcel H – Flatley are expected to decline more than 20% below existing traffic volumes after the full diamond Exit 12 Interchange is completed.*

Traffic mitigation proposed at this location includes an assumption it will have at least two access driveways. The two assumed Parcel H – Flatley driveways should be located such that they are several hundred feet apart from one another. For analysis purposes, the northern driveway is assumed to be the primary entrance/exit, but either could work. The northerly driveway may warrant signal control by 2017 *if Exit 12 improvements do not occur*. With the Exit 12 full diamond, it may be possible to provide two full accesses without signalization. Either of the two driveways could be the primary one, depending on how the site is developed. For the primary driveway, we assume dedicated westbound left and right-turn lanes will be provided from Flatley (Parcel H) to Daniel Webster Highway. On the northbound Daniel Webster Highway approach, dedicated right-turn and through lanes are assumed. On the southbound Daniel Webster Highway approach, dedicated left-turn and through lanes are assumed.

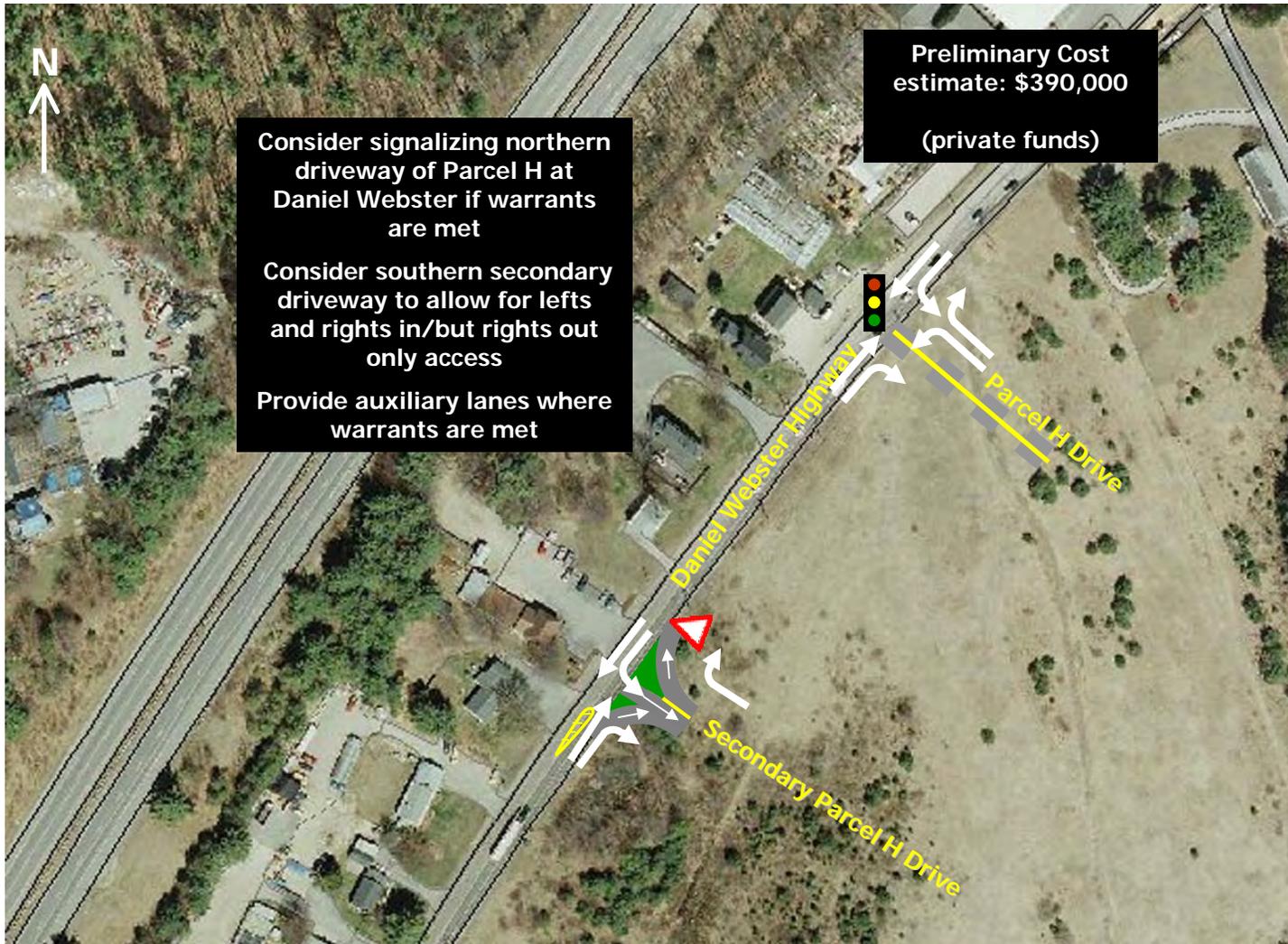
As envisioned, the potential secondary driveway access at the southern end of Parcel H – Flatley would allow for lefts and rights in from Daniel Webster Highway, but only right turning vehicles out. The Daniel Webster Highway approach lane configurations would be the same as at those assumed above for the primary driveway, but the secondary egress assumes a channelized yield control right-turn lane from the development northbound to the Daniel Webster Highway.

### Level of Service (LOS) Summary Table

	2007 Existing	2017 without Mitigation	2017 with Mitigation	2027 without Mitigation	2027 with Mitigation
AM Peak Hour	N/A	F	A	C	A
PM Peak Hour	N/A	F	A	F	A



Existing Conditions



**Figure V-19**  
**Parcel H – Flatley at**  
**Daniel Webster**  
**Highway**  
 Merrimack, NH

Proposed Improvements  
 Assumed Constructed  
 by 2017

Base Map Source: Town of Merrimack, New Hampshire Geographic Information System [www.merrimackgis.org](http://www.merrimackgis.org)

T. Baboosic Lake Road at O’Gara Drive

Approximate % ADT Traffic Change from 2007		
Roadway	2017	2027
Baboosic Rd – East of O’Gara Dr	<10	<10
Baboosic Rd - West of O’Gara Dr	<10	<10
O’Gara Drive	<10	<10

By implementing either of these proposed mitigation measures, PM peak hour operations should improve from LOS F to LOS B.

Refer to Figure V-20 for an illustration of signalization improvements assumed constructed prior to 2017. A preliminary order of magnitude cost estimate is provided along with projected levels of service with and without the improvements. NRPC projects traffic volumes on the four approaches of this intersection to increase by not more than 10% between 2007 and 2017. No development is expected to occur near the intersection by 2017.

The existing intersection of Baboosic Lake Road at O’Gara Drive operates under a two-way stop control with the stops on the O’Gara Drive northbound approach and the opposite side driveway southbound approach. The westbound approach on Baboosic Lake Road has a shared through and left-turn lane, while the eastbound approach has a dedicated through and dedicated right-turn lane. Minor approaches from the driveway and O’Gara Drive have a single shared left, through, and right turn lane.

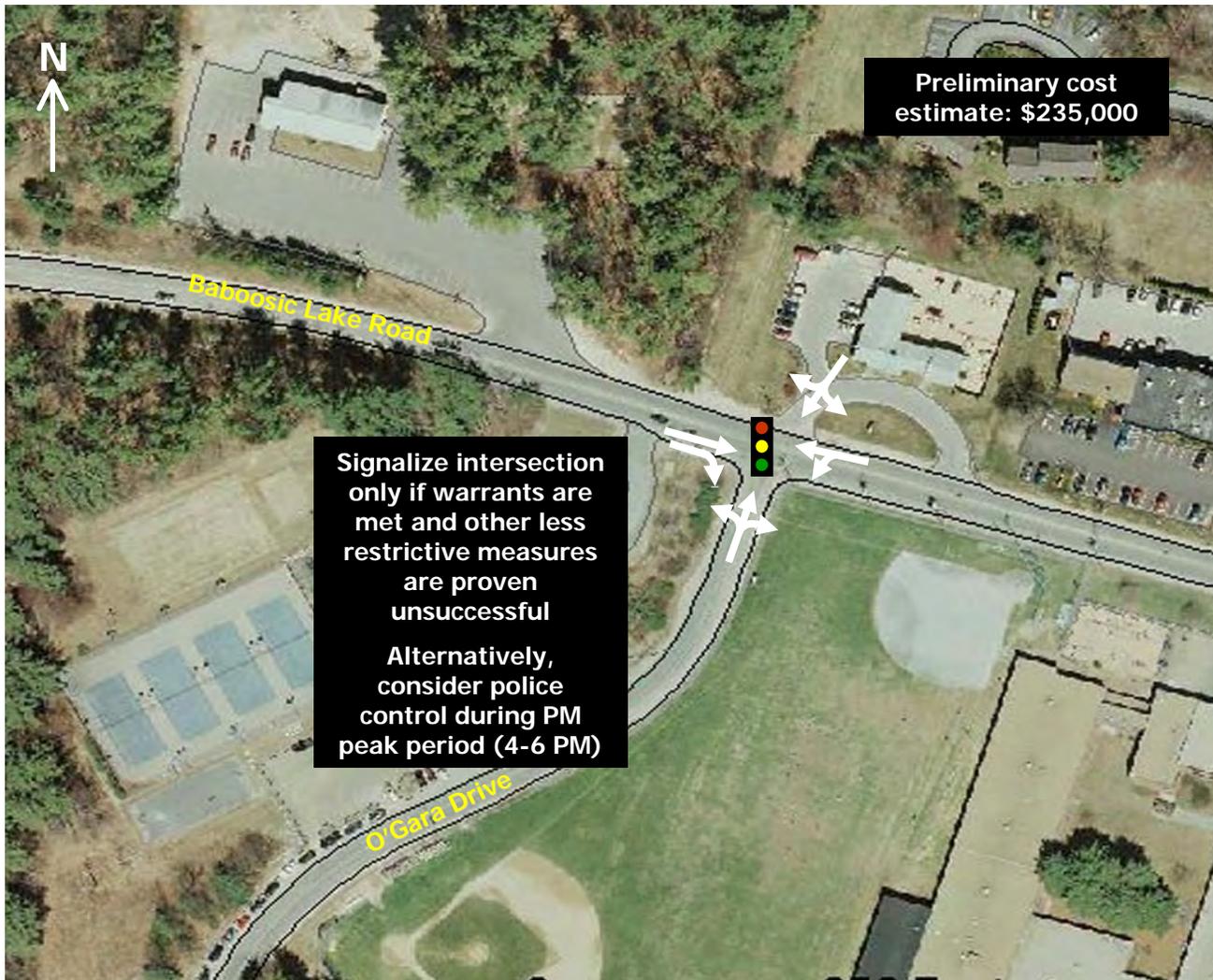
Intersection operations during the existing AM and 2017 to 2027 AM peak hours are expected to be acceptable at a LOS C without mitigation. However the existing PM peak hour operations are LOS F, with congestion worsening over time. The proposed mitigation for this location involves either installation of a traffic signal when signal warrants are met or police officer control during the PM peak period from 4:00 – 6:00 PM.

### Level of Service (LOS) Summary Table

	2007 Existing	2017 without Mitigation	2017 with Mitigation	2027 without Mitigation	2027 with Mitigation
AM Peak Hour	C	C	A	E	A
PM Peak Hour	F	F	B	F	B



*Existing Conditions*



*Figure V-20*  
**Baboosic Lake Road at O'Gara Drive**  
 Merrimack, NH

Proposed Improvements Assumed Constructed by 2017

Base Map Source: Town of Merrimack, New Hampshire Geographic Information System [www.merrimackgis.org](http://www.merrimackgis.org)



U. Amherst Road at Turkey Hill Road

Approximate % ADT Traffic Change from 2007		
Roadway	2017	2027
Amherst Rd - East of Turkey Hill Rd	10-20	10-20
Amherst Rd - West of Turkey Hill Rd	10-20	10-20
Turkey Hill Road	<10	10-20

Refer to Figure V-21 for an illustration of alternative signalization improvements assumed constructed prior to 2017.

Currently, the intersection of Amherst at Turkey Hill Road operates under a stop-control operation on the minor street, Turkey Hill Road. The existing lane configurations of the three approaches are one single lane for the two-shared movements. Intersection approaches from Turkey Hill Road and Amherst Road are steep with 6-8% grades.

Existing operations of the intersection are congested at LOS F during the AM and PM peak hour. Traffic volumes are expected to increase by 10 – 20% between 2007 and 2017 on Amherst Road. This increase in volume will increase delays even more for vehicles that turn onto Amherst Road from Turkey Hill Road. By 2017, 19,000 square foot office development is projected with primary access via Executive Park Drive.

A couple of options for proposed mitigation are proposed at this intersection. One option is to modify the geometry of the intersection to make the westbound traffic on Amherst Road be under stop-control, while the through traffic would be from Amherst Road to Turkey Hill Road (see Figure V-21). The other options for mitigation would be to signalize the intersection with the existing geometry or signalize the intersection with the proposed geometry discussed in option one. Either of the

mitigation options will improve the intersection operations from LOS F in both peak hours to LOS C in the AM peak hour and LOS D in the PM peak hour.

If signalization is contemplated, the signal would have to be coordinated with the Exit 11 signal cluster to avoid backups for the Exit 11/Executive Park Drive intersection. As with other intersections, signalization should be a *last* resort, not a first resort.

### Level of Service (LOS) Summary Table

	2007 Existing	2017 without Mitigation	2017 with Mitigation	2027 without Mitigation	2027 with Mitigation
AM Peak Hour	F	F	C	F	C
PM Peak Hour	F	F	D	F	D



Existing Conditions



Figure V-21  
**Amherst Road at Turkey Hill Road**  
 Merrimack, NH

Proposed Improvements Assumed Constructed by 2017

Base Map Source: Town of Merrimack, New Hampshire Geographic Information System [www.merrimackgis.org](http://www.merrimackgis.org)



V. Continental Boulevard at Industrial Drive

Approximate % ADT Traffic Change from 2007		
Roadway	2017	2027
Continental Boulevard - North of Industrial Dr	<10	<10
Continental Boulevard - South of Industrial Dr	20-40	20-40
Industrial Drive	40-75	40-75

Refer to Figure V-22 for the intersection improvements at Continental Boulevard and Industrial Drive.

By 2017 the expected development at the corner of Industrial Drive and Continental Boulevard is 20,000 square feet of office or service type development. Furthermore, on Industrial Drive east from the intersection, toward F.E. Everett highway, a proposed 550,000 square feet of retail development including the Premium Outlets Mall is assumed by 2017. Traffic volumes on the westbound Industrial Drive leg of this intersection will increase between 40 – 75% from 2007 to 2017. Traffic volumes on the northbound Continental Boulevard approach to the intersection will increase between 20 – 40 % in the ten-year period from 2007 to 2017, while its southbound volumes will increase less than 10% during the same period.

The current geometry of the intersection has adequate capacity to serve demands with future development traffic added. The westbound Industrial Drive approach has a dedicated channelized right-turn lane, a dedicated left-turn lane, and a shared left-turn and through lane while the low-volume eastbound approach has a shared left, through, and right lane. The northbound Continental Boulevard approach has a dedicated, channelized right-turn lane, two dedicated through lanes, and one dedicated left-turn lane. Southbound on Continental Boulevard,

the lane configuration is a dedicated left-turn lane, a through lane, and a shared through and right lane.

It is recommended that the signal timing be adjusted to improve overall intersection operations projected by 2017 from a LOS C to LOS B during the morning peak hour and from a LOS D to a LOS C during the evening peak hour. Timing modifications should be adequate to address projected traffic demands through 2027.

### Level of Service (LOS) Summary Table

	2007 Existing	2017 without Mitigation	2017 with Mitigation	2027 without Mitigation	2027 with Mitigation
AM Peak Hour	<b>B</b>	<b>C</b>	<b>B</b>	<b>C</b>	<b>B</b>
PM Peak Hour	<b>B</b>	<b>D</b>	<b>C</b>	<b>D</b>	<b>C</b>



Existing Conditions

 Photo Direction

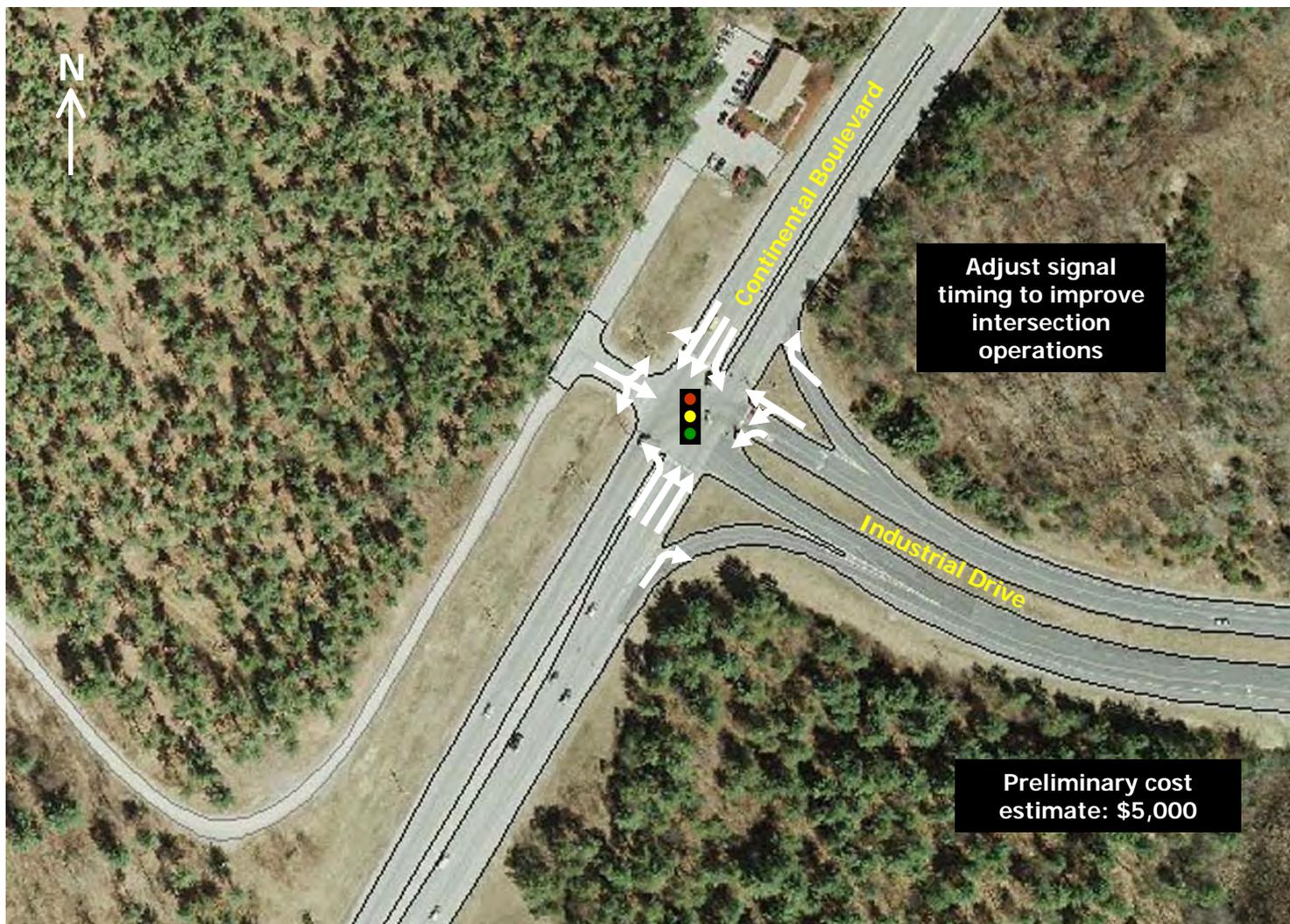


Figure V-22  
Continental Blvd. at  
Industrial Drive  
Merrimack, NH

Proposed Improvements  
Assumed Implemented  
by 2017

Source: Town of Merrimack, New Hampshire Geographic Information System [www.merrimackgis.org](http://www.merrimackgis.org)

W. Exit 11: Amherst St. at Continental Boulevard, Greeley Street and Camp Sargent Road

Approximate % ADT Traffic Change from 2007		
Roadway	2017	2027
Continental Boulevard - West of Amherst St	<10	<10
Continental Boulevard - East of Amherst St	20-40	20-40
Amherst Street - North of Continental Boulevard	10-20	20-40
Amherst Street - South of Continental Boulevard	20-40	20-40

Refer to Figure V-23 for the proposed intersection improvements and resulting LOS operations at the intersections of Amherst at Continental Boulevard, Greeley Street, and Camp Sargent Road.

Traffic volumes on Amherst St in the vicinity of Exit 11 will increase between 20 – 40% from 2007 to 2017.

Due to the close spacing of these intersections, signal coordination is an essential element of any possible solution to its peak period congestion.

In 2017 without any mitigation the AM traffic operations at Amherst Road and Continental Boulevard will deteriorate from a LOS D in the 2007 to a LOS F and will remain a LOS F during the PM peak hour. Furthermore the PM traffic operations at the intersection of Amherst Road at Camp Sargent Road will deteriorate from a LOS C in 2007 to a LOS F in 2017.

Initial mitigation proposed at these four intersections is signal timing and phasing adjustments along with signal coordination. These locations, shown in Figure V-23, include the intersection of Amherst Road at Continental Boulevard, Amherst Road at Greeley Street, and Amherst Road at Camp Sargent Road. If these mitigation measures are implemented the

operations of these four intersections would be LOS D or better during the AM peak hour and LOS E or better in the PM peak hour during 2017, but would, once again, be gridlocked by 2027. The alternative (shown in orange below) of eliminating left turns could produce a situation that will not gridlock the intersection if the private Shaw’s frontage road can be used for diverting left turning traffic.

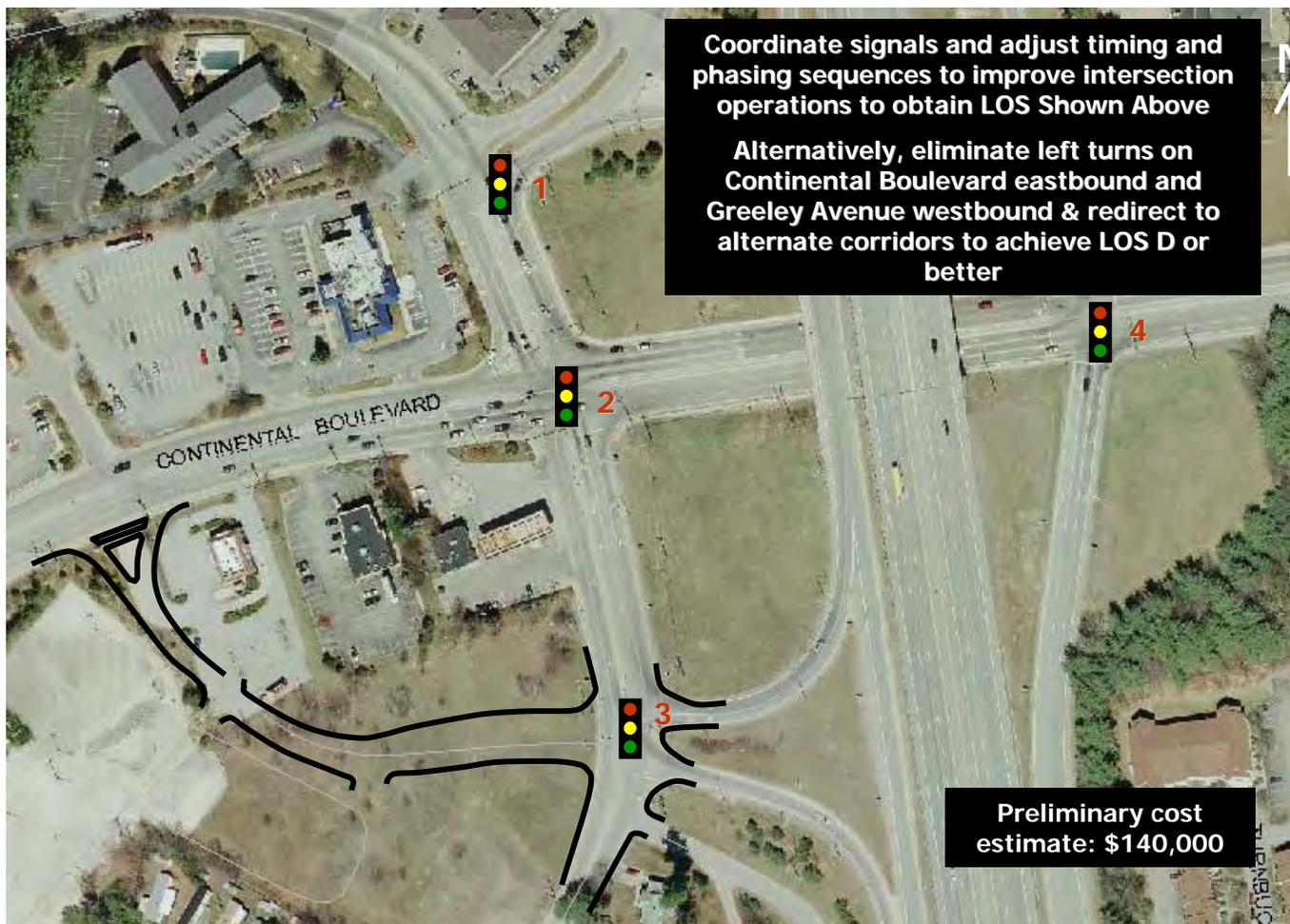
A second option involves eliminating left turn movements on Greeley Street and Continental Boulevard on both approaches to Camp Sargent Road and Amherst Street. Left turns now made from Continental Boulevard would be diverted via right turns to the new Shaw’s Plaza frontage road followed by left turns onto Camp Sargent Road. Left turns now made from Greeley Street would be diverted to right turns to Executive Park Drive and right turns onto the Exit 11 southbound frontage road overpass to the Shaw’s Plaza/Camp Sargent Road intersection (see shown in yellow below). Projected traffic operations improve somewhat compared to the signal coordination option.



Potential Re-directed left turning movements

### Level of Service (LOS) Summary Table

Intersection #	2007 Existing	2017 Without Mitigation	2017 With Mitigation	2027 Without Mitigation	2027 With Mitigation
Intersection #	<b>1 2 3 4</b>	<b>1 2 3 4</b>	<b>1 2 3 4</b>	<b>1 2 3 4</b>	<b>1 2 3 4</b>
AM Peak Hour	<b>D D B B</b>	<b>D F B B</b>	<b>B D C B</b>	<b>D F B B</b>	<b>B E C B</b>
PM Peak Hour	<b>F D B C</b>	<b>F D B F</b>	<b>B E B D</b>	<b>F E B F</b>	<b>B F B F</b>



Existing Conditions

**➔ Photo Direction**

**Figure V-23**  
**Exit 11**  
**Amherst Road at**  
**Continental Boulevard,**  
**Greeley Street and**  
**Camp Sargent Road**  
 Merrimack, NH

Proposed Improvements  
 Assumed Constructed  
 by 2017

Base Map Source: Town of Merrimack, New Hampshire Geographic Information System [www.merrimackgis.org](http://www.merrimackgis.org)



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**Chapter VI**  
**Summary and Projected Implementation Schedule and Costs**

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## Chapter VI –PROJECTED IMPLEMENTATION SCHEDULE AND COSTS

### I. OVERVIEW

Ideally, roadway infrastructure modifications should be installed prior to the opening of major traffic generators. We assume implementation of modifications discussed in Chapter V will occur over time as needs arise. Refer back to Chapter V for the preliminary order-of-magnitude cost of individual projects.

Many variables affect the actual implementation schedule and we note that necessary assumptions made are subject to change over time as more is learned about the specific nature of each individual development activity. The intent of the analysis is to serve as a contextual guide for new development as it occurs. The analysis conducted can, and should, be modified over time to reflect actual development proposals as they come on line and the *actual* status of ‘background’ and public sector infrastructure implementation. The schedule for private sector investments is significant variable that will shift over time. Additionally, public sector funding for enhancing the public roadway infrastructure is dependent on political budgeting cycles.

As in any infrastructure enhancements program, it makes sense to construct underground and overhead utility upgrades *simultaneous with* roadway infrastructure investments, if at all possible. Provisions for sidewalks and bicycle lanes are assumed as needed to accommodate demands. Future construction should be such that the provision of future bus stops or bus access is not precluded, as Merrimack may have rail and feeder bus services in the future.

Table VI-1 summarizes projected implementation costs by location. Infrastructure enhancement costs are affected by three distinct components, existing traffic, growth in background traffic unrelated to new development; and new development traffic.

Generally, individual private sector developers should be responsible for accommodating their specific traffic impacts, but not the impacts due to existing traffic or background traffic growth unrelated to their developments. NRPC has developed a select link analysis procedure for estimating the proportion of traffic anticipated from new development to assist in identifying the amount of traffic generated by new development through each critical intersection. The NRPC formula for assessing impact fees was identified in Chapter IV of this document.

Based on the assumptions made to date, short range roadway infrastructure implementation costs are estimated at just under approximately **\$4 million**, while long range costs are estimated at approximately **\$1.5 million** for a total program of approximately **\$5.5 million**. Costs are in 2009 constant dollars.

Preliminary order of magnitude implementation cost estimates include public and private sector costs for *enhancements only within public rights-of-way*. Design costs were assumed to represent 12% of construction costs, drainage at 16% of construction costs, and 15% of construction costs for general mobilization, traffic management, and erosion, and a 20% contingency was assumed. Modifications to other public and private utilities were not included in these estimated costs. Preliminary costing assumptions need to be revised as actual developments come on line.

Table VI-1

Merrimack, New Hampshire Infrastructure Master Plan Preliminary Implementation Costs <sup>1</sup>	
Prior to 2017	Estimated Cost
Harris Pond Rd N and Parcel B - Edgebrook Heights at Daniel Webster Highway	\$80,000
Manchester Street at Daniel Webster Highway	\$460,000 <sup>2</sup>
Kollsman/Budweiser Driveways at Daniel Webster Highway North of Parcel G	\$85,000
Star Drive at Daniel Webster Highway	\$505,000
Greeley Street at Daniel Webster Highway	\$30,000
Exit 11 at four traffic signals	\$140,000 <sup>3</sup>
Pond View and Island Drives at Daniel Webster Highway	\$310,000
East Chamberlain Road at Daniel Webster Highway	\$20,000
Railroad Avenue at Daniel Webster Highway	\$150,000
Baboosic Lake Road at O'Gara Drive	\$235,000
Wire Road at Daniel Webster Highway	\$375,000
Bedford Road at Daniel Webster Highway	\$5,000
Continental Boulevard at Industrial Drive	\$5,000
Amherst Road at Turkey Hill Road	\$295,000
<b>POTENTIAL TOTAL PUBLIC SHORT RANGE</b>	<b>\$2,695,000</b>
<b>2017 Private Sector in PUBLIC ROW</b>	
Parcel G - Kollsman at DW Hwy (by others)	\$440,000
Parcel H - Flatley at DW Hwy (by others)	\$390,000
Parcel E - Nashua Corp or Webb Drive at Daniel Webster Highway	\$405,000
Baboosic Lake Rd at DW Hwy (by others)	\$65,000
<b>POTENTIAL TOTAL SHORT RANGE BY PRIVATE SECTOR</b>	<b>\$1,300,000</b>
<b>TOTAL SHORT RANGE</b>	<b>\$3,995,000</b>
2017 to 2027	Estimated Cost
Robert Milligan Parkway at DW Hwy	\$185,000
Henry Clay at DW Hwy	\$460,000 <sup>4</sup>
Twin Bridge at DW Hwy	\$315,000
<b>POTENTIAL TOTAL PUBLIC LONG RANGE</b>	<b>\$960,000</b>
<b>2017 to 2027 Private Sector in PUBLIC ROW</b>	
BAE Drive at Daniel Webster Highway	\$200,000
Harris Pond Drive S and Parcel A - Southwood at Daniel Webster Highway (others)	\$75,000
Industrial Drive and Parcel F - Anheuser Busch at Daniel Webster Highway (by others)	\$290,000
<b>POTENTIAL TOTAL LONG RANGE BY PRIVATE SECTOR</b>	<b>\$565,000</b>
<b>TOTAL LONG RANGE</b>	<b>\$1,525,000</b>
<b>Grand Total (includes improvements by others within public ROW)</b>	<b>\$5,520,000</b>

1 Excludes NHDOT improvements already programmed for implementation.

2 Assumes signal with existing Manchester Street alignment widened to accommodate traffic signal movements, not relocation of Manchester Street.

3 Assumes left lane modifications.

4 Optional if Manchester Street signal is constructed.

## TECHNICAL APPENDIX

### 2017 AND 2027 'BASE CASE' AND 'WITH IMPROVEMENTS' TRAFFIC ANALYSIS SUMMARY TABLES

**Table A-1** -Merrimack, New Hampshire 2017 AM Peak Hour Operations – **Base Case** Ranked by Levels of Service

**Table A-2** Merrimack, New Hampshire 2017 PM Peak Hour Operations – **Base Case** Ranked by Levels of Service

**Table A-3** Merrimack, New Hampshire 2027 AM Peak Hour Operations – **Base Case** Ranked by Levels of Service

**Table A-4** Merrimack, New Hampshire 2027 PM Peak Hour Operations – **Base Case** Ranked by Levels of Service

**Table A-5** Merrimack, New Hampshire 2017 AM Peak Hour Operations – **With Improvements** Ranked by Levels of Service

**Table A-6** Merrimack, New Hampshire 2017 PM Peak Hour Operations – **With Improvements** Ranked by Levels of Service

**Table A-7** Merrimack, New Hampshire 2027 AM Peak Hour Operations – **With Improvements** Ranked by Levels of Service

**Table A-8** Merrimack, New Hampshire 2027 PM Peak Hour Operations – **With Improvements** Ranked by Levels of Service



**Table A-1**  
 Merrimack, New Hampshire  
 2017 AM Peak Hour Operations – **Base Case**  
 Ranked by Levels of Service

Signalized Intersections			
Intersection Street Names	Delay	2017 AM LOS	V/C
Harris Pond Drive N at Daniel Webster Highway	100+	F	1.23
Continental Boulevard at Amherst Road	84	F	1.41
Dunkin Donuts/Front Street at Daniel Webster Highway	54	D	1.16
Bedford Road at Daniel Webster Highway/Walgreens	54	D	1.11
Baboosic Lake Road at Daniel Webster Highway	53	D	1.30
Industrial Drive at Commerce and Spartan Way	52	D	1.11
SNHRMC/Gobains/Ten Pin at Daniel Webster Highway	52	D	0.93
Burger King at Amherst Road and Executive Park Dr.	41	D	1.21
Camp Sargent Road at Continental Boulevard	33	C	0.80
Greeley Street at Daniel Webster Highway	27	C	0.78
NH 101 A & Continental Boulevard	24	C	0.68
Industrial Drive at FE Everett Tpke Exit 10 NB Off-ramp	23	C	0.97
Industrial Drive at Daniel Webster Highway	23	C	0.69
Industrial Drive at Continental Boulevard	23	C	0.92
Bedford Road at Back River Road/FE Everett Tpke Exit 12 SB On-ramp	22	C	0.82
Industrial Drive at FE Everett Tpke Exit 10 SB Off-ramp	17	B	0.91
Greeley Street at FE Everett Tpke Exit 11 NB On-/Off-ramp	13	B	0.59
New Shaw's at Camp Sargent Road and FE Everett Tpke Exit 11 SB Ramps	13	B	0.57
BAE Driveway at Daniel Webster Highway	12	B	0.65
Brunswick Street at Daniel Webster Highway	11	B	0.71
Kollman/Budweiser at Daniel Webster Highway	10	A	0.46
Connell's (CVS) Plaza Driveway at Daniel Webster Highway	10	A	0.86
Bedford Road at FE Everett Tpke Exit 12 NB Off-ramp	8	A	0.53
Daniel Webster Highway at Shaw's Market	7	A	0.64
Tinker Road at Continental Boulevard	7	A	0.59
Rite Aid Plaza at Daniel Webster Highway	6	A	0.70
Old Shaw's Plaza/MEG at Daniel Webster Highway	5	A	0.71
Unsignalized Intersections			
Intersection Street Names	Delay	2017 AM LOS	V/C
Daniel Webster Highway at East Chamberlain Road	100+	F	*
Manchester Street at Daniel Webster Highway	100+	F	*
Harris Pond Drive S at Daniel Webster Highway	100+	F	*
Amherst Road at Turkey Hill Road	100+	F	*
Wire Road at Daniel Webster Highway	100+	F	1.42
Daniel Webster Highway at Hilton Road	100+	F	1.21
Daniel Webster Highway at Bower's Landing	100+	F	0.94
Daniel Webster Highway at Shelborne Road	100+	F	0.70
Pond View Drive at Daniel Webster Highway	100+	F	0.63
Parcel G Main Entrance at Daniel Webster Highway	100+	F	0.63
Harris Ave at Daniel Webster Highway	100+	F	0.43
Daniel Webster Highway at Auto Body Driveway	79	F	0.33
Priscilla Lane at Daniel Webster Highway	79	F	0.30
Robert Milligan Parkway at Daniel Webster Highway	66	F	0.30
Dave/Laurie's Auto/former Nashua Corp at Daniel Webster Highway	52	F	0.45
Henry Clay Drive at Daniel Webster Highway	45	E	0.14
Webb Drive at Daniel Webster Highway	29	D	0.09
Woodbury Street at Daniel Webster Highway	34	D	0.49
Continental Boulevard at Cambridge Drive	33	D	0.26
Baboosic Lake Rd at Church Street	31	D	0.59
Baboosic Lake Rd at O'Gara Drive	25	C	0.37
Shaw's Right in Only/Maple Street at Daniel Webster Highway	25	D	0.05
Daniel Webster Highway at Twin Bridge Road	24	C	0.25
Daniel Webster Highway at Pine Street	23	C	0.09
Continental Boulevard at Naticook Road	22	C	0.54
Camp Sargent Road at Continental Boulevard	17	C	0.18
Baboosic Lake Rd at Hillside Terrace	15	B	0.14
Daniel Webster Highway at Railroad Ave N	14	B	0.05
Manchester Street at Al Paul Lane	13	B	0.07
Daniel Webster Highway at McDonald's Exit	13	B	0.04
Greens Pond Road at Continental Boulevard	13	B	0.04
Amherst Road at Naticook Road	12	B	0.16
Manchester St at Heron Pond Rd	11	B	0.03
Daniel Webster Highway at Parcel E In (former Nashua Corp)	10	A	0.00
Woodbury Street at McElwain Street	9	A	0.02
Woodbury Street at Connell's (CVS) Plaza Driveway	2	A	0.01

Delay - Seconds during peak 15 minute period of the peak hour.

LOS - Level of Service from A to F, A is best, F is worst

V/C - Proportion of volume to capacity, 1+ means indicates an over-capacity condition.

\* Projected volume exceeds capacity more than 50%.



**Table A-2**  
 Merrimack, New Hampshire  
 2017 PM Peak Hour Operations – **Base Case**  
 Ranked by Levels of Service

<b>Signalized Intersections</b>			
<b>Intersection Street Names</b>	<b>Delay</b>	<b>2017 PM LOS</b>	<b>V/C</b>
Harris Pond Drive N at Daniel Webster Highway	210	F	*
Burger King at Amherst Road and Executive Park Dr.	188	F	*
Camp Sargent Road at Continental Boulevard	131	F	1.45
Greeley Street at FE Everett Tpke Exit 11 NB On-/Off-ramp	121	F	*
Ten Pin at Daniel Webster Highway	88	F	1.15
Greeley Street at Daniel Webster Highway	76	E	1.13
Bedford Road at Daniel Webster Highway/Walgreens	66	E	1.14
Continental Boulevard at Amherst Road	54	D	1.05
Industrial Drive at Continental Boulevard	51	D	1.14
Dunkin Donuts/Front Street at Daniel Webster Highway	37	D	1.08
Industrial Drive at Daniel Webster Highway	34	C	0.98
NH 101 A & Continental Boulevard	32	C	0.93
Industrial Drive at Commerce and Spartan Way	31	C	0.93
Baboosic Lake Road at Daniel Webster Highway	23	C	0.87
Tinker Road at Continental Boulevard	22	C	0.98
Industrial Drive at FE Everett Tpke Exit 10 SB Off-ramp	21	C	1.01
New Shaw's at Camp Sargent Road and FE Everett Tpke Exit 11SB Ramps	18	B	0.66
Old Shaw's Plaza/MEG at Daniel Webster Highway	18	B	0.97
Connell's (CVS) Plaza Driveway at Daniel Webster Highway	17	B	0.95
BAE Driveway at Daniel Webster Highway	16	B	0.86
Bedford Road at Back River Road/FE Everett Tpke Exit 12 SB On-ramp	14	B	0.54
Industrial Drive at FE Everett Tpke Exit 10 NB Off-ramp	14	B	0.77
Kollman/Budweiser at Daniel Webster Highway	12	B	0.53
Bedford Road at FE Everett Tpke NB Exit 12 Off-ramp	11	B	0.63
Brunswick Street at Daniel Webster Highway	9	A	0.60
Daniel Webster Highway at Shaw's Market	7	A	0.59
Rite Aid Plaza at Daniel Webster Highway	6	A	0.77
Daniel Webster Highway at Pond View Drive	6	A	0.82
<b>Unsignalized Intersections</b>			
<b>Intersection Street Names</b>	<b>Delay</b>	<b>2017 PM LOS</b>	<b>V/C</b>
Daniel Webster Highway at Auto Body Driveway	100+	F	*
Daniel Webster Highway at Parcel G driveway	100+	F	*
Daniel Webster Highway at Railroad Ave N	100+	F	*
Manchester Street at Daniel Webster Highway	100+	F	*
Dave/Laurie's Auto/former Nashua Corp at Daniel Webster Highway	100+	F	*
Daniel Webster Highway at Star Drive	100+	F	*
Robert Milligan Parkway at Daniel Webster Highway	100+	F	*
Daniel Webster Highway at Bower's Landing	100+	F	*
Harris Pond Drive S at Daniel Webster Highway	100+	F	*
Amherst Road at Turkey Hill Road	100+	F	1.46
Daniel Webster Highway at McDonald's Exit	100+	F	1.46
Daniel Webster Highway at East Chamberlain Road	100+	F	1.31
Baboosic Lake Rd at O'Gara Drive	100+	F	1.25
Wire Road at Daniel Webster Highway	53	F	0.70
Daniel Webster Highway at Hilton Road	72	F	0.44
Daniel Webster Highway at Shelborne Road	100+	F	0.26
Harris Ave at Daniel Webster Highway	61	F	0.24
Continental Boulevard at Naticook Road	42	E	0.67
Daniel Webster Highway at Twin Bridge Road	50	E	0.48
Webb Drive at Daniel Webster Highway	48	E	0.27
Priscilla Lane at Daniel Webster Highway	45	E	0.10
Henry Clay Drive at Daniel Webster Highway	100+	F	1.75
Continental Boulevard at Cambridge Drive	27	D	0.11
Shaw's Right in Only/Maple Street at Daniel Webster Highway	26	D	0.10
Amherst Road at Naticook Road	16	C	0.37
Camp Sargent Road at Continental Boulevard	25	C	0.31
Woodbury Street at Daniel Webster Highway	17	C	0.21
Baboosic Lake Rd at Hillside Terrace	19	C	0.16
Baboosic Lake Rd at Church Street	25	C	0.16
Daniel Webster Highway at Elm Street	22	C	0.09
Daniel Webster Highway at Pine Street	23	C	0.09
Daniel Webster Highway at McGraw Bridge Road	20	C	0.08
Daniel Webster Highway at Parcel E In (former Nashua Corp)	13	B	0.29
Manchester Street at Al Paul Lane	14	B	0.22
Greens Pond Road at Continental Boulevard	13	B	0.02
Manchester St at Heron Pond Rd	11	B	0.01
Woodbury Street at CVS Driveway	10	A	0.13
Woodbury Street at McElwain Street	9	A	0.02
Delay - Seconds during peak 15 minute period of the peak hour.			
LOS - Level of Service from A to F, A is best, F is worst			
V/C - Proportion of volume to capacity, 1+ means indicates an over-capacity condition.			
* Projected volume exceeds capacity more than 50%.			



**Table A-3**  
 Merrimack, New Hampshire  
 2027 AM Peak Hour Operations – **Base Case**  
 Ranked by Levels of Service

<b>Signalized Intersections</b>				
<b>Intersection Street Names</b>	<b>Delay</b>	<b>2027 AM LOS</b>	<b>V/C</b>	
Harris Pond Drive N at Daniel Webster Highway	163	F	*	
Industrial Drive at FE Everett Tpke Exit 10 Off-ramp	111	F	*	
Bedford Road at Back River Road/FE Everett Tpke Exit 12 SB On-ramp	108	F	*	
Continental Boulevard at Amherst Road	106	F	*	
Baboosic Lake Road at Daniel Webster Highway	78	E	1.40	
Bedford Road at Daniel Webster Highway/Walgreens	70	E	1.27	
Industrial Drive at Daniel Webster Highway	57	E	1.44	
Dunkin Donuts/Front Street at Daniel Webster Highway	53	D	1.16	
Burger King at Amherst Road and Executive Park Dr.	40	D	1.21	
Camp Sargent Road at Continental Boulevard	36	D	0.83	
Bedford Road at FE Everett Tpke Exit 12 NB Off-ramp	32	C	1.00	
Industrial Drive at Commerce and Spartan Way	31	C	0.85	
Greeley Street at Daniel Webster Highway	30	C	0.85	
NH 101 A & Continental Boulevard	25	C	0.72	
Industrial Drive at Continental Boulevard	23	C	0.93	
Connell's (CVS) Plaza Driveway at Daniel Webster Highway	20	C	1.00	
Ten Pin at Daniel Webster Highway	17	B	0.29	
Industrial Drive at Southbound FE Everett Tpke Exit 10 Off-ramp	16	B	0.88	
Greeley Street at FE Everett Tpke Exit 11 NB On-/Off-ramp	15	B	0.58	
BAE Driveway at Daniel Webster Highway	15	B	0.84	
Rite Aid Plaza at Daniel Webster Highway	14	B	0.93	
New Shaw's at Camp Sargent Road and Exit 11	13	B	0.54	
Brunswick Street at Daniel Webster Highway	11	B	0.33	
Kollsmann/Budweiser at Daniel Webster Highway	11	B	0.51	
Tinker Road at Continental Boulevard	8	A	0.71	
Old Shaw's Plaza/MEG at Daniel Webster Highway	8	A	0.80	
Daniel Webster Highway at Shaw's Market	6	A	0.55	
<b>Unsignalized Intersections</b>				
<b>Intersection Street Names</b>	<b>Delay</b>	<b>2027 AM LOS</b>	<b>V/C</b>	
Daniel Webster Highway at East Chamberlain Road	100+	F	*	
Manchester Street at Daniel Webster Highway	100+	F	*	
Harris Pond Drive S at Daniel Webster Highway	100+	F	*	
Amherst Road at Turkey Hill Road	100+	F	*	
Wire Road at Daniel Webster Highway	100+	F	*	
Daniel Webster Highway at Bower's Landing	100+	F	*	
Daniel Webster Highway at Auto Body Driveway	100+	F	1.48	
Henry Clay Drive at Daniel Webster Highway	100+	F	0.96	
Robert Milligan Parkway at Daniel Webster Highway	100+	F	0.76	
Dave/Laurie's Auto/former Nashua Corp at Daniel Webster Highway	100+	F	0.73	
Pond View Drive at Daniel Webster Highway	100+	F	0.70	
Woodbury Street at Daniel Webster Highway	70	F	0.76	
Webb Drive at Daniel Webster Highway	69	F	0.21	
Daniel Webster Highway at Railroad Ave N	49	E	0.24	
Baboosic Lake Rd at Church Street	48	E	0.73	
Daniel Webster Highway at Twin Bridge Road	45	E	0.56	
Baboosic Lake Rd at O'Gara Drive	36	E	0.48	
Continental Boulevard at Cambridge Drive	35	E	0.28	
Daniel Webster Highway at Pine Street	24	C	0.09	
Harris Ave at Daniel Webster Highway	21	C	0.10	
Continental Boulevard at Naticook Road	20	C	0.50	
Baboosic Lake Rd at Hillside Terrace	19	C	0.20	
Daniel Webster Highway at Hilton Road	18	C	0.23	
Shaw's Right in Only/Maple Street at Daniel Webster Highway	18	C	0.03	
Camp Sargent Road at Continental Boulevard	17	C	0.18	
Priscilla Lane at Daniel Webster Highway	17	C	0.06	
Manchester Street at Al Paul Lane	15	C	0.10	
Amherst Road at Naticook Road	13	B	0.17	
Greens Pond Road at Continental Boulevard	13	B	0.04	
Daniel Webster Highway at Shelborne Road	12	B	0.05	
Daniel Webster Highway at Parcel E In (former Nashua Corp)	11	B	0.15	
Manchester Rd at Heron Pond Rd	11	B	0.03	
Woodbury Street at CVS Driveway	9	A	0.04	
Woodbury Street at McElwain Street	9	A	0.02	

Delay - Seconds during peak 15 minute period of the peak hour.

LOS - Level of Service from A to F, A is best, F is worst

V/C - Proportion of volume to capacity, 1+ means indicates an over-capacity condition.

\* Projected volume exceeds capacity more than 50%.



**Table A-4**  
 Merrimack, New Hampshire  
 2027 PM Peak Hour Operations – **Base Case**  
 Ranked by Levels of Service

<b>Signalized Intersections</b>				
<b>Intersection Street Names</b>	<b>Delay</b>	<b>2027 PM LOS</b>	<b>V/C</b>	
Harris Pond Drive N at Daniel Webster Highway	345	F	*	
Bedford Road at Back River Road/FE Everett Tpke Exit 12 SB On-ramp	276	F	*	
Burger King at Amherst Road and Executive Park Dr.	173	F	*	
Dunkin Donuts/Front Street at Daniel Webster Highway	127	F	1.48	
Greeley Street at FE Everett Tpke 11 NB On-/Off-ramp	122	F	1.84	
Camp Sargent Road at Continental Boulevard	119	F	1.46	
Bedford Road at Relocated Back River Road	86	F	1.21	
Greeley Street at Daniel Webster Highway	81	F	1.16	
Continental Boulevard at Amherst Road	77	E	1.21	
Bedford Road at Daniel Webster Highway/Walgreens	69	E	1.32	
Industrial Drive at Daniel Webster Highway	69	F	4.17	
Baboosic Lake Road at Daniel Webster Highway	64	E	1.11	
Connell's (CVS) Plaza Driveway at Daniel Webster Highway	54	D	1.18	
Bedford Road at FE Everett Tpke NB Exit 12 Off-ramp	47	D	1.16	
Industrial Drive at FE Everett Tpke NB Off-ramp	44	D	1.13	
Ten Pin at Daniel Webster Highway	42	D	0.83	
BAE Driveway at Daniel Webster Highway	41	D	1.10	
Industrial Drive at Continental Boulevard	37	D	1.04	
Industrial Drive at Commerce and Spartan Way	35	D	0.99	
NH 101 A & Continental Boulevard	35	C	1.02	
Industrial Drive at FE Everett Exit 10 SB Off-ramp	24	C	1.03	
Old Shaw's Plaza/MEG at Daniel Webster Highway	23	C	0.97	
Tinker Road at Continental Boulevard	22	C	0.98	
New Shaw's at Camp Sargent Road and Exit 11	20	B	0.75	
Kollsman/Budweiser at Daniel Webster Highway	12	B	0.63	
Brunswick Street at Daniel Webster Highway	9	A	0.34	
Daniel Webster Highway at Pond View Drive	9	A	0.84	
Daniel Webster Highway at Shaw's Market	8	A	0.74	
Rite Aid Plaza at Daniel Webster Highway	8	A	0.82	
<b>Unsignalized Intersections</b>				
<b>Intersection Street Names</b>	<b>Delay</b>	<b>2027 PM LOS</b>	<b>V/C</b>	
Daniel Webster Highway at Parcel G driveway	100+	F	*	
Henry Clay Drive at Daniel Webster Highway	100+	F	*	
Daniel Webster Highway at Auto Body Driveway	100+	F	*	
Daniel Webster Highway at Railroad Ave N	100+	F	*	
Manchester Street at Daniel Webster Highway	100+	F	*	
Harris Pond Drive S at Daniel Webster Highway	100+	F	*	
Robert Milligan Parkway at Daniel Webster Highway	100+	F	*	
Daniel Webster Highway at Star Drive	100+	F	*	
Dave/Laurie's Auto/former Nashua Corp at Daniel Webster Highway	100+	F	*	
Daniel Webster Highway at Twin Bridge Road	100+	F	*	
Daniel Webster Highway at East Chamberlain Road	100+	F	*	
Daniel Webster Highway at Bower's Landing	100+	F	*	
Daniel Webster Highway at McDonald's Exit	100+	F	*	
Amherst Road at Turkey Hill Road	100+	F	*	
Baboosic Lake Rd at O'Gara Drive	100+	F	1.37	
Wire Road at Daniel Webster Highway	100+	F	1.17	
Webb Drive at Daniel Webster Highway	74	F	0.48	
Daniel Webster Highway at Pine Street	60	F	0.19	
Continental Boulevard at Cambridge Drive	47	E	0.19	
Shaw's Right in Only/Maple Street at Daniel Webster Highway	38	E	0.12	
Continental Boulevard at Naticook Road	32	D	0.59	
Daniel Webster Highway at McGraw Bridge Road	32	D	0.13	
Daniel Webster Highway at Elm Street	32	D	0.10	
Baboosic Lake Rd at Church Street	27	D	0.18	
Daniel Webster Highway at Hilton Road	26	D	0.19	
Harris Ave at Daniel Webster Highway	26	D	0.15	
Camp Sargent Road at Continental Boulevard	25	C	0.31	
Woodbury Street at Daniel Webster Highway	21	C	0.30	
Priscilla Lane at Daniel Webster Highway	21	C	0.04	
Baboosic Lake Rd at Hillside Terrace	20	C	0.18	
Amherst Road at Naticook Road	17	C	0.40	
Manchester Street at Al Paul Lane	17	C	0.31	
Daniel Webster Highway at Shelborne Road	17	C	0.02	
Greens Pond Road at Continental Boulevard	13	B	0.02	
Daniel Webster Highway at Parcel E In (former Nashua Corp)	12	B	0.24	
Manchester Rd at Heron Pond Rd	11	B	0.01	
Woodbury Street at CVS Driveway	10	A	0.13	
Woodbury Street at McElwain Street	9	A	0.02	
Delay - Seconds during peak 15 minute period of the peak hour.				
LOS - Level of Service from A to F, A is best, F is worst				
V/C - Proportion of volume to capacity, 1+ means indicates an over-capacity condition.				
* Projected volume exceeds capacity more than 50%.				



**Table A-5**  
Merrimack, New Hampshire  
2017 AM Peak Hour Operations – **With Improvements**  
Ranked by Levels of Service

Existing or Potentially Signalized Intersections With Improvements			
Intersection Street Names	Delay	2017 AM LOS	V/C
Baboosic Lake Road at Daniel Webster Highway	41	D	0.97
Camp Sargent Road at Continental Boulevard	32	C	0.74
Amherst Road at Turkey Hill Road	31	C	0.87
Bedford Road at Daniel Webster Highway/Walgreens	30	C	0.81
Greeley Street at Daniel Webster Highway	27	C	0.78
Continental Boulevard at Amherst Road	26	C	0.94
NH 101 A & Continental Boulevard	24	C	0.68
Industrial Drive at FE Everett Tpke Exit 10 NB Off-ramp	23	C	0.97
Industrial Drive at Continental Boulevard	23	C	0.92
Industrial Drive at Commerce and Spartan Way	23	C	0.81
Industrial Drive at Daniel Webster Highway	23	C	0.69
Burger King at Amherst Road and Executive Park Dr.	23	C	0.60
Bedford Road at Back River Road/FE Everett Tpke Exit 12 SB On-ramp	22	C	0.82
Harris Pond Drive N at Daniel Webster Highway	20	B	0.79
Wire Road at Daniel Webster Highway	18	B	0.81
Industrial Drive at FE Everett Tpke Exit 10 SB Off-ramp	17	B	0.91
SNHRMC/Gobains/Ten Pin at Daniel Webster Highway	16	B	0.71
New Shaw's at Camp Sargent Road and FE Everett Tpke Exit 11SB Ramps	16	B	0.61
BAE Driveway at Daniel Webster Highway	12	B	0.65
Greeley Street at FE Everett Tpke Exit 11 NB On-/Off-ramp	11	B	0.45
Brunswick Street at Daniel Webster Highway	11	B	0.71
Dunkin Donuts/Front Street at Daniel Webster Highway	11	B	0.51
Connell's (CVS) Plaza Driveway at Daniel Webster Highway	10	A	0.86
Kollman/Budweiser at Daniel Webster Highway	10	A	0.46
Bedford Road at FE Everett Tpke Exit 12 NB Off-ramp	8	A	0.53
Manchester Street at Daniel Webster Highway	8	A	0.53
Daniel Webster Highway at Shaw's Market	7	A	0.64
Tinker Road at Continental Boulevard	7	A	0.59
Henry Clay Drive at Daniel Webster Highway	7	A	0.39
Baboosic Lake Rd at O'Gara Drive	7	A	0.43
Rite Aid Plaza at Daniel Webster Highway	6	A	0.70
Old Shaw's Plaza/MEG at Daniel Webster Highway	5	A	0.71
Parcel E (former Nashua Corp) Exit at Daniel Webster Highway	4	A	0.35
Daniel Webster Highway at McDonald's Exit	8	A	0.55
Parcel G Main Entrance at Daniel Webster Highway	6	A	0.44
Assumed Unsignalized Intersections *			
Intersection Street Names	Delay	2017 AM LOS	V/C
Daniel Webster Highway at Hilton Road	100+	F	1.21
Daniel Webster Highway at Bower's Landing	100+	F	1.15
Daniel Webster Highway at East Chamberlain Road	100+	F	0.86
Daniel Webster Highway at Shelburne Road	100+	F	0.70
Pond View Drive at Daniel Webster Highway	100+	F	0.63
Daniel Webster Highway at Auto Body Driveway and Railroad Avenue	100+	F	0.52
Harris Ave at Daniel Webster Highway	100+	F	0.43
Priscilla Lane at Daniel Webster Highway	79	F	0.40
Robert Milligan Parkway at Daniel Webster Highway	66	F	0.30
Woodbury Street at Daniel Webster Highway	34	D	0.49
Continental Boulevard at Cambridge Drive	33	D	0.26
Baboosic Lake Rd at Church Street	31	D	0.59
Webb Drive at Daniel Webster Highway	29	D	0.09
Shaw's Right in Only/Maple Street at Daniel Webster Highway	25	D	0.05
Daniel Webster Highway at Twin Bridge Road	24	C	0.25
Daniel Webster Highway at Pine Street	23	C	0.09
Continental Boulevard at Naticook Road	22	C	0.54
Harris Pond Drive S at Daniel Webster Highway	19	C	0.13
Camp Sargent Road at Continental Boulevard	17	C	0.18
Baboosic Lake Rd at Hillside Terrace	15	B	0.14
Daniel Webster Highway at Railroad Ave N	14	B	0.05
Manchester Street at Al Paul Lane	13	B	0.07
Greens Pond Road at Continental Boulevard	13	B	0.04
Amherst Road at Naticook Road	12	B	0.16
Manchester Rd at Heron Pond Rd	11	B	0.03
Daniel Webster Highway at Parcel E In (former Nashua Corp)	10	A	0.00
Woodbury Street at McElwain Street	9	A	0.02
Woodbury Street at Connell's (CVS) Plaza Driveway	2	A	0.01

Delay - Seconds during peak 15 minute period of the peak hour.

LOS - Level of Service from A to F, A is best, F is worst

V/C - Proportion of volume to capacity, 1+ means indicates an over-capacity condition.

\* Projected volume exceeds capacity more than 50%.



**Table A-6**  
 Merrimack, New Hampshire  
 2017 PM Peak Hour Operations – **With Improvements**  
 Ranked by Levels of Service

Existing or Potentially Signalized Intersections With Improvements			
Intersection Street Names	Delay	2017 PM LOS	V/C
Greeley Street at Daniel Webster Highway	49	D	1.07
Camp Sargent Road at Continental Boulevard	42	D	0.88
Amherst Road at Turkey Hill Road	41	D	1.04
Dunkin Donuts/Front Street at Daniel Webster Highway	37	D	0.65
Bedford Road at Daniel Webster Highway/Walgreens	35	C	0.84
Industrial Drive at Daniel Webster Highway	34	C	0.98
Industrial Drive at Continental Boulevard	33	C	0.90
NH 101 A & Continental Boulevard	32	C	0.86
Industrial Drive at Commerce and Spartan Way	31	C	0.88
Daniel Webster Highway at Parcel G driveway	26	C	0.93
Baboosic Lake Road at Daniel Webster Highway	26	C	0.81
Continental Boulevard at Amherst Road	24	C	0.96
Harris Pond Drive N at Daniel Webster Highway	23	C	0.90
Tinker Road at Continental Boulevard	22	C	0.98
Ten Pin at Daniel Webster Highway	22	C	0.71
Industrial Drive at FE Everett Tpke Exit 10 SB Off-ramp	21	C	1.01
Greeley Street at FE Everett Tpke Exit 11 NB On-/Off-ramp	21	C	0.79
Old Shaw's Plaza at Daniel Webster Highway	18	B	0.97
New Shaw's at Camp Sargent Road and FE Everett Tpke Exit 11SB Ramps	18	B	0.66
Connell's (CVS) Plaza Driveway at Daniel Webster Highway	17	B	0.95
BAE Driveway at Daniel Webster Highway	16	B	0.86
Burger King at Amherst Road and Executive Park Dr.	15	B	0.81
Parcel E Exit (formerNashua Corp) at Daniel Webster Highway	15	B	0.63
Industrial Drive at FE Everett Tpke Exit 10 NB Off-ramp	14	B	0.77
Bedford Road at Back River Road/FE Everett Tpke Exit 12 SB On-ramp	14	B	0.54
Baboosic Lake Rd at O'Gara Drive	12	B	0.68
Kollsman/Budweiser at Daniel Webster Highway	12	B	0.53
Bedford Road at FE Everett Tpke NB Exit 12 Off-ramp	11	B	0.63
Manchester Street at Daniel Webster Highway	9	A	0.65
Brunswick Street at Daniel Webster Highway	9	A	0.60
Daniel Webster Highway at former McDonald's Exit	8	A	0.55
Daniel Webster Highway at Shaw's Market	7	A	0.59
Henry Clay Drive at Daniel Webster Highway	7	A	0.47
Rite Aid Plaza at Daniel Webster Highway	6	A	0.77
Daniel Webster Highway at Star Drive	6	A	0.68
Wire Road at Daniel Webster Highway	6	A	0.64
Assumed Unsignalized Intersections *			
Intersection Street Names	Delay	2017 PM LOS	V/C
Daniel Webster Highway at Railroad Ave North	100+	F	*
Robert Milligan Parkway at Daniel Webster Highway	100+	F	*
Daniel Webster Highway at Bower's Landing	100+	F	*
Harris Pond Drive S at Daniel Webster Highway	100+	F	*
Daniel Webster Highway at Railroad Ave N	100+	F	1.33
Daniel Webster Highway at Shelborne Road	100+	F	0.26
Daniel Webster Highway at Hilton Road	72	F	0.44
Harris Ave at Daniel Webster Highway	61	F	0.24
Daniel Webster Highway at Twin Bridge Road	50	E	0.48
Webb Drive at Daniel Webster Highway	48	E	0.27
Priscilla Lane at Daniel Webster Highway	45	E	0.10
Continental Boulevard at Naticook Road	42	E	0.67
Daniel Webster Highway at East Chamberlain Road	28	D	0.22
Continental Boulevard at Cambridge Drive	27	D	0.11
Shaw's Right in Only/Maple Street at Daniel Webster Highway	26	D	0.10
Camp Sargent Road at Continental Boulevard	25	C	0.31
Baboosic Lake Rd at Church Street	25	C	0.16
Daniel Webster Highway at Pine Street	23	C	0.09
Daniel Webster Highway at Elm Street	22	C	0.09
Daniel Webster Highway at McGraw Bridge Road	20	C	0.08
Baboosic Lake Rd at Hillside Terrace	19	C	0.16
Woodbury Street at Daniel Webster Highway	17	C	0.21
Amherst Road at Naticook Road	16	C	0.37
Manchester Street at Al Paul Lane	14	B	0.22
Daniel Webster Highway at Parcel E In (former Nashua Corp)	13	B	0.29
Greens Pond Road at Continental Boulevard	13	B	0.02
Manchester Rd at Heron Pond Rd	11	B	0.01
Woodbury Street at CVS Driveway	10	A	0.13
Woodbury Street at McElwain Street	9	A	0.02
Daniel Webster Highway at Pond View Drive	6	A	0.82
Delay - Seconds during peak 15 minute period of the peak hour.			
LOS - Level of Service from A to F, A is best, F is worst			
V/C - Proportion of volume to capacity, 1+ means indicates an over-capacity condition.			
* Projected volume exceeds capacity more than 50%.			
** Signals could conceivably be installed at congested unsignalized intersections if other less restrictive measures are not effective, warrants are met, and any necessary auxiliary left or right turn lanes can be provided.			



**Table A-7**  
 Merrimack, New Hampshire  
 2027 AM Peak Hour Operations – **With Improvements**  
 Ranked by Levels of Service

Existing or Potentially Signalized Intersections With Improvements			
Intersection Street Names	Delay	2027 AM LOS	V/C
Industrial Drive at Daniel Webster Highway	69	E	0.92
Baboosic Lake Road at Daniel Webster Highway	58	E	1.01
Harris Pond Drive N at Daniel Webster Highway	49	D	0.95
Bedford Road at Back River Road/FE Everett Tpke Exit 12 SB On-ramp	41	D	0.96
Greeley Street at Daniel Webster Highway	38	D	1.24
Bedford Road at Daniel Webster Highway/Walgreens	35	C	1.07
Amherst Road at Turkey Hill Road**	33	C	0.91
Camp Sargent Road at Continental Boulevard	27	C	0.82
Continental Boulevard at Amherst Road	24	C	0.97
Burger King at Amherst Road and Executive Park Dr.	24	C	0.63
Industrial Drive at FE Everett Tpke Exit 10 NB Off-ramp	22	C	0.86
NH 101 A & Continental Boulevard	22	C	0.60
Industrial Drive at Commerce and Spartan Way	19	B	0.76
Industrial Drive at Continental Boulevard	18	B	0.89
Wire Road at Daniel Webster Highway**	18	B	0.88
New Shaw's at Camp Sargent Road and Exit 11	15	B	0.57
Ten Pin at Daniel Webster Highway	15	B	0.28
Industrial Drive at FE Everett Tpke Exit 10 SB Off-ramp	14	B	0.68
BAE Driveway at Daniel Webster Highway	14	B	0.63
Dunkin Donuts/Front Street at Daniel Webster Highway	13	B	0.50
Daniel Webster Highway at Shaw's Market	13	B	0.35
Manchester Street at Daniel Webster Highway**	12	B	0.8
Greeley Street at FE Everett Tpke Exit 11 NB On-/Off-ramp	12	B	0.48
Brunswick Street at Daniel Webster Highway	12	B	0.24
Rite Aid Plaza at Daniel Webster Highway	9	A	0.85
Bedford Road at FE Everett Tpke Exit 12 NB Off-ramp	9	A	0.74
Tinker Road at Continental Boulevard	9	A	0.61
Kollsman/Budweiser at Daniel Webster Highway	9	A	0.47
Connell's (CVS) Plaza Driveway at Daniel Webster Highway	8	A	0.74
Daniel Webster Highway at Twin Bridge Road	7	A	0.59
Baboosic Lake Rd at O'Gara Drive	7	A	0.54
Pond View Drive at Daniel Webster Highway	6	A	0.77
Parcel G Main Entrance at Daniel Webster Highway	6	A	0.53
Henry Clay Drive at Daniel Webster Highway*	6	A	0.44
Old Shaw's Plaza/MEG at Daniel Webster Highway	4	A	0.79
Robert Milligan Parkway at Daniel Webster Highway	4	A	0.48
Parcel E (former Nashua Corp) Exit at Daniel Webster Highway**	4	A	0.38
Harris Pond Drive S at Daniel Webster Highway	3	A	0.61
Assumed Unsignalized Intersections *			
Intersection Street Names	Delay	2027 AM LOS	V/C
Daniel Webster Highway at East Chamberlain Road	100+	F	7.57
Daniel Webster Highway at Bower's Landing	100+	F	1.96
Woodbury Street at Daniel Webster Highway	70	F	0.76
Daniel Webster Highway at Railroad Ave N	56	E	0.22
Baboosic Lake Rd at Church Street	48	E	0.73
Continental Boulevard at Cambridge Drive	35	D	0.27
Webb Drive at Daniel Webster Highway	35	D	0.11
Daniel Webster Highway at Auto Body Dr and Railroad Ave	30	D	0.06
Harris Ave at Daniel Webster Highway	29	D	0.14
Baboosic Lake Rd at Hillside Terrace	22	C	0.23
Daniel Webster Highway at Pine Street	22	C	0.07
Continental Boulevard at Naticook Road	20	C	0.50
Shaw's Right in Only/Maple Street at Daniel Webster Highway	20	C	0.04
Daniel Webster Highway at Hilton Road	19	C	0.24
Camp Sargent Road at Continental Boulevard	17	C	0.18
Priscilla Lane at Daniel Webster Highway	17	C	0.06
Manchester Street at Al Paul Lane	15	C	0.10
Amherst Road at Naticook Road	13	B	0.17
Greens Pond Road at Continental Boulevard	13	B	0.04
Daniel Webster Highway at Shelborne Road	12	B	0.05
Manchester St at Heron Pond Rd	11	B	0.03
Woodbury Street at Connell's (CVS) Plaza Driveway	9	A	0.04
Woodbury Street at McElwain Street	6	A	0.05

Delay - Seconds during peak 15 minute period of the peak hour.

LOS - Level of Service from A to F, A is best, F is worst

V/C - Proportion of volume to capacity, 1+ means indicates an over-capacity condition.

\* Projected volume exceeds capacity more than 50%.

\*\* Signals could conceivably be installed at congested unsignalized intersections if other less restrictive measures are not effective, warrants are met, and any necessary auxiliary left or right turn lanes can be provided.

