

# Roadway Infrastructure Master Planning Study Merrimack, New Hampshire



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



Prepared By:  
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April 2010

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## Acknowledgements

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



## Acknowledgements

The completion of this study would not have been possible without the direct active involvement of many individuals.

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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 follows 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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## Short and Long Range Infrastructure Analysis

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





# 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.



## 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 I-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

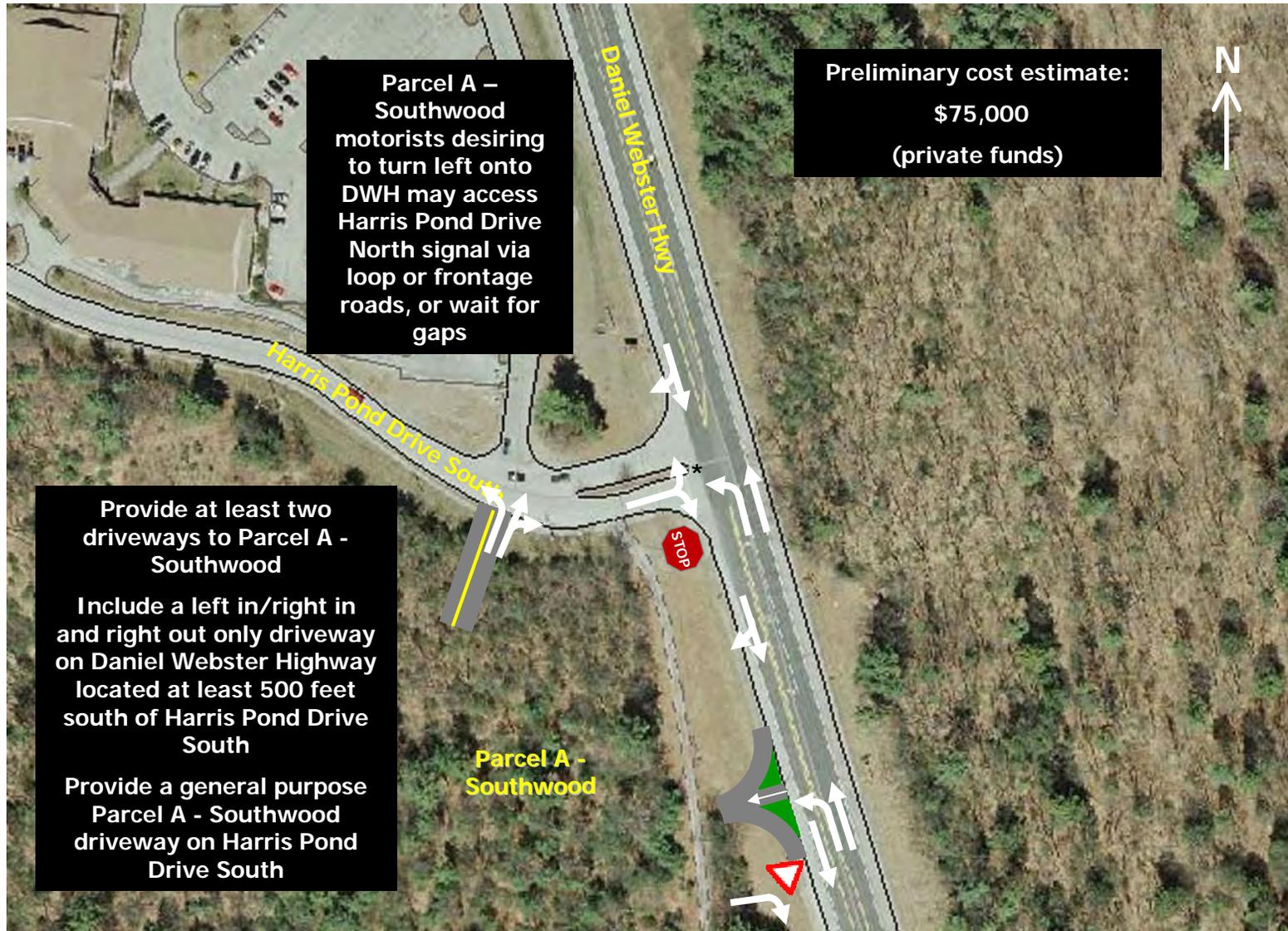
	2007 Existing	2017 without Mitigation	2027 without Mitigation	2027 with Mitigation
AM Peak Hour	<b>C</b>	<b>F</b>	<b>F</b>	<b>F*</b>
PM Peak Hour	<b>D</b>	<b>F</b>	<b>F</b>	<b>F*</b>

\* 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*

**Photo Direction**



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

Potential 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 I-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.

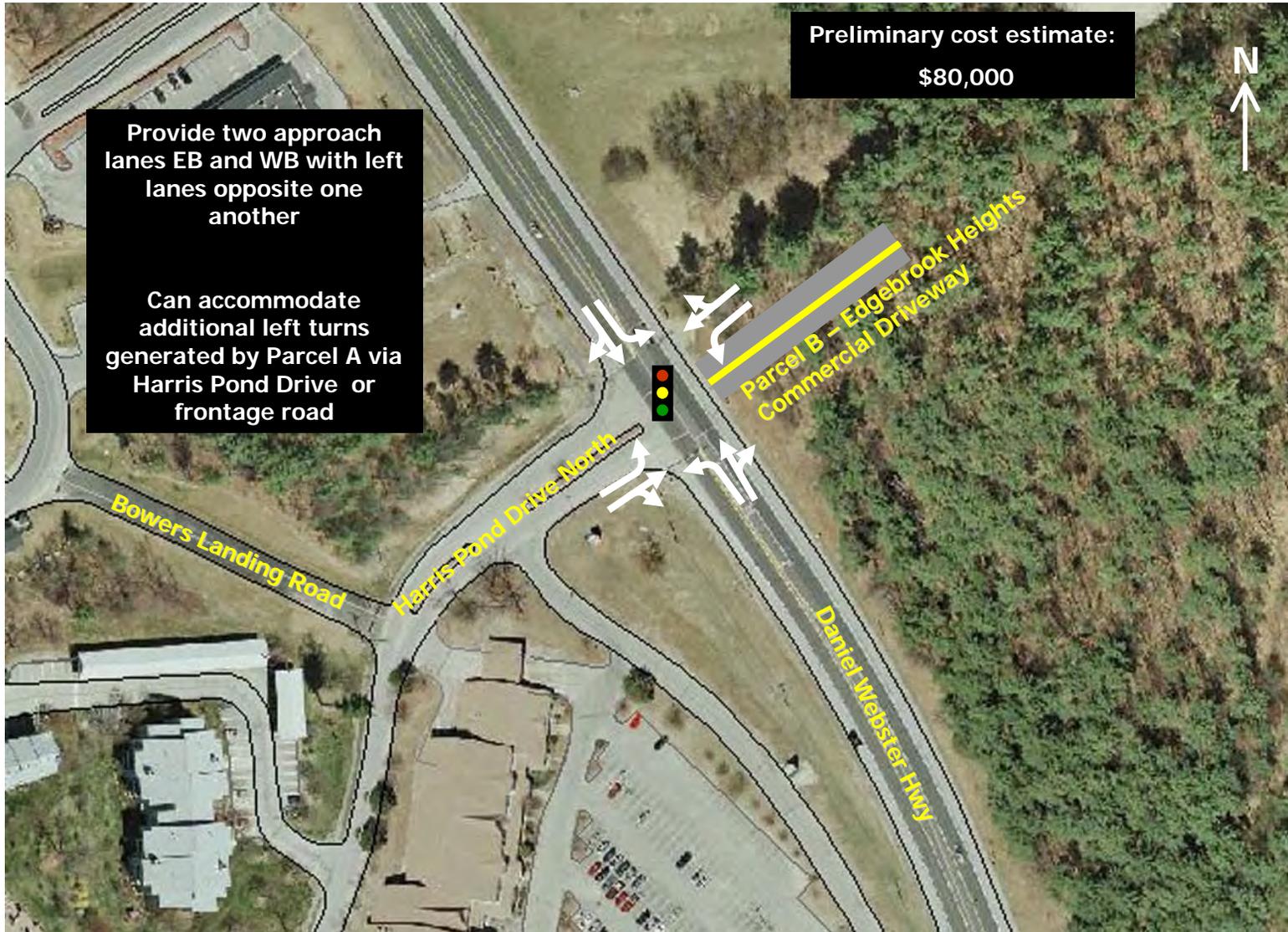
## Level of Service (LOS) Summary Table

	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 I-2*  
**Harris Pond Drive N and Parcel B – Edgebrook Heights at Daniel Webster Highway**  
Merrimack, NH

Potential 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	DWH - South of Webb Drive	40-75	75-100
Industrial	N/A	N/A	DWH - North of Webb Drive	<10	40-75
Retail	145,000 ft <sup>2</sup>	N/A	Webb Drive – West of DWH	>10	<10
Office/R&D	78,000 ft <sup>2</sup>	N/A			

Refer to Figure I-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.

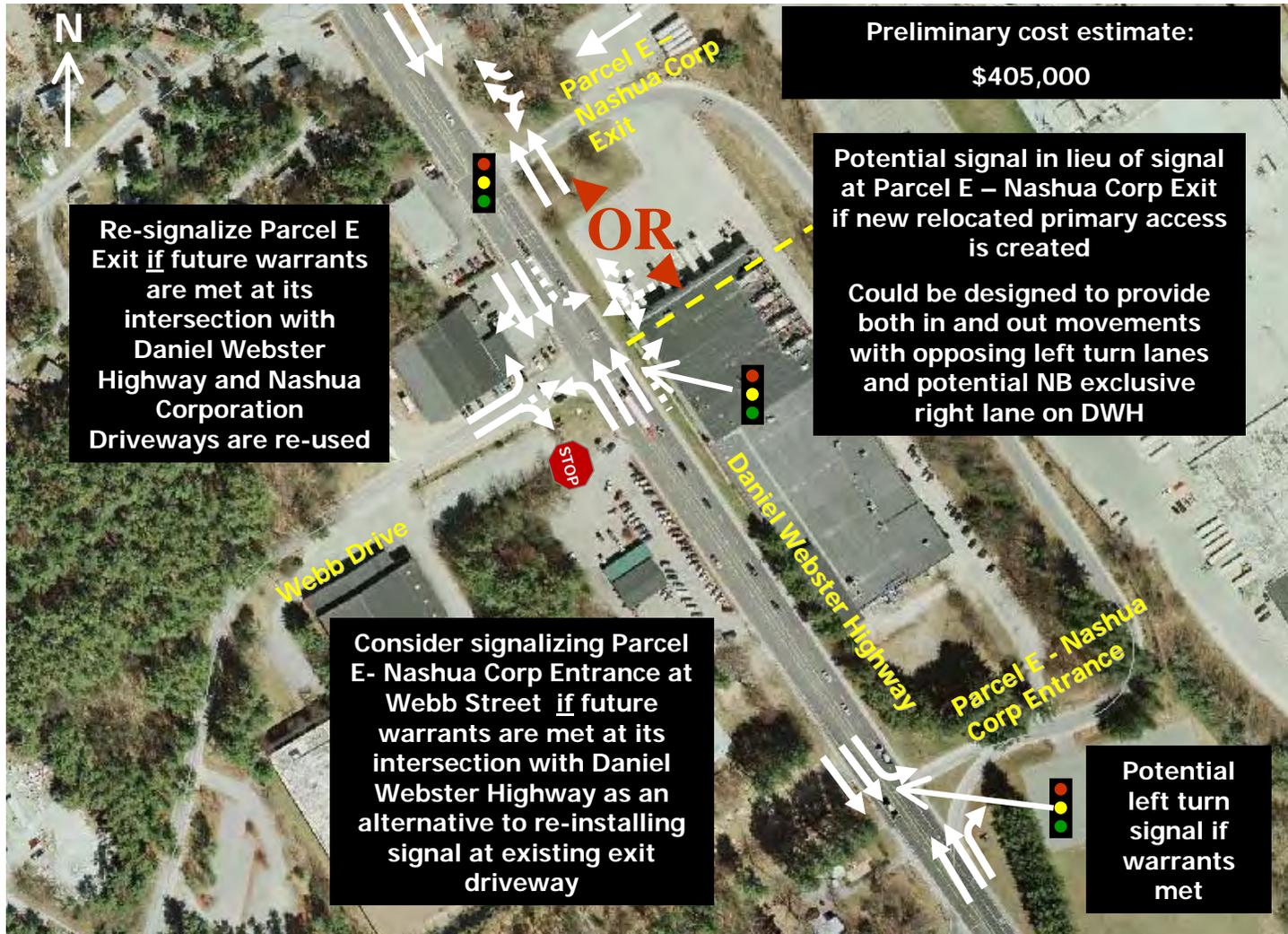
## Level of Service (LOS) Summary Table

	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

➔ Photo Direction



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

Potential 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 I-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 expected 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.

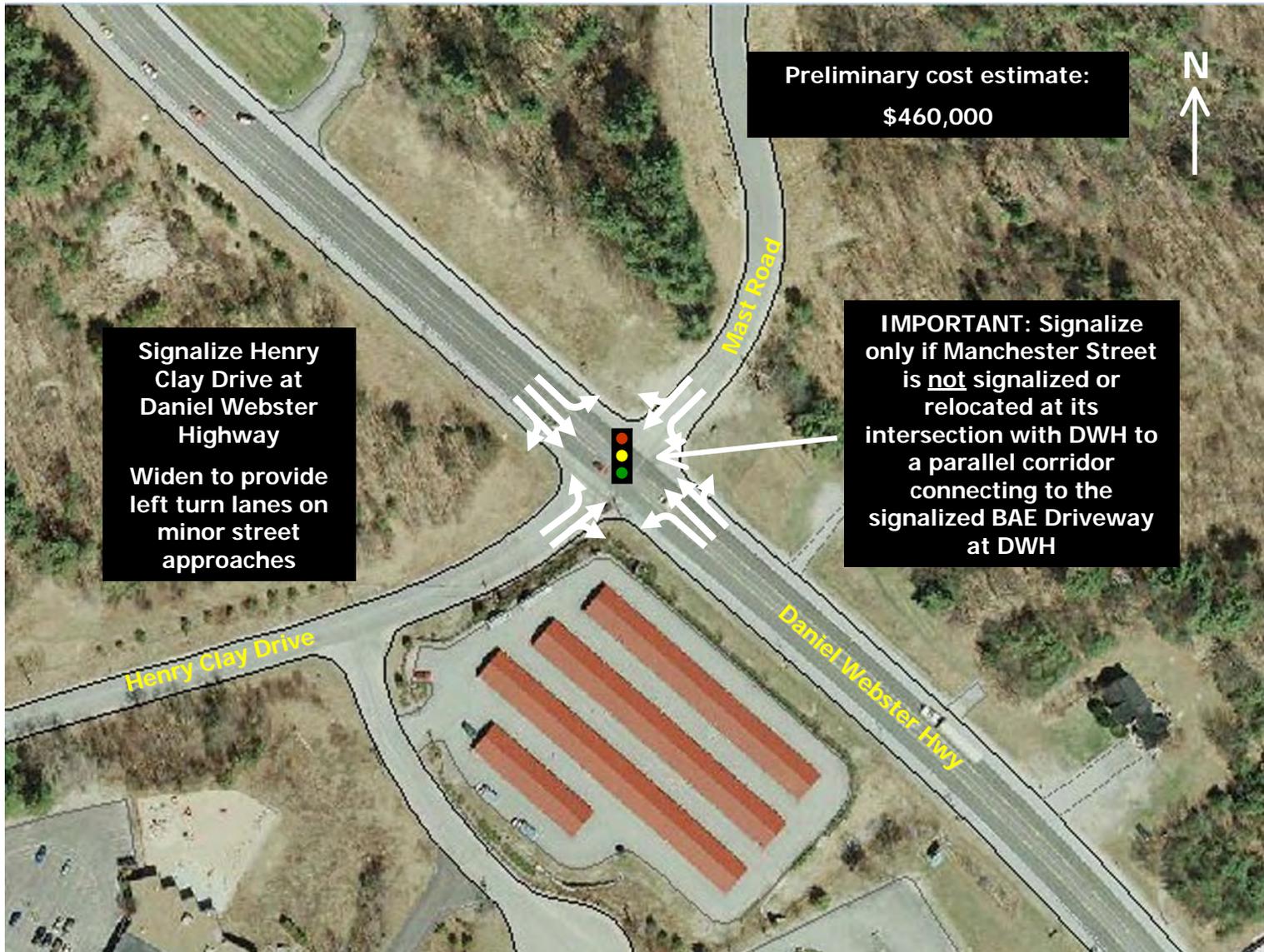
Provision of an exclusive left turn lane approximately 100-150 feet in length on both the Henry Clay Drive and Mast Road approaches will benefit the capacity of the intersection. Some of the heavy left turn demands expected at Henry Clay Drive could conceivably be diverted to and from Manchester Street 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 I-4*  
**Henry Clay Drive at Daniel Webster Highway**  
Merrimack, NH

Potential 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 I-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

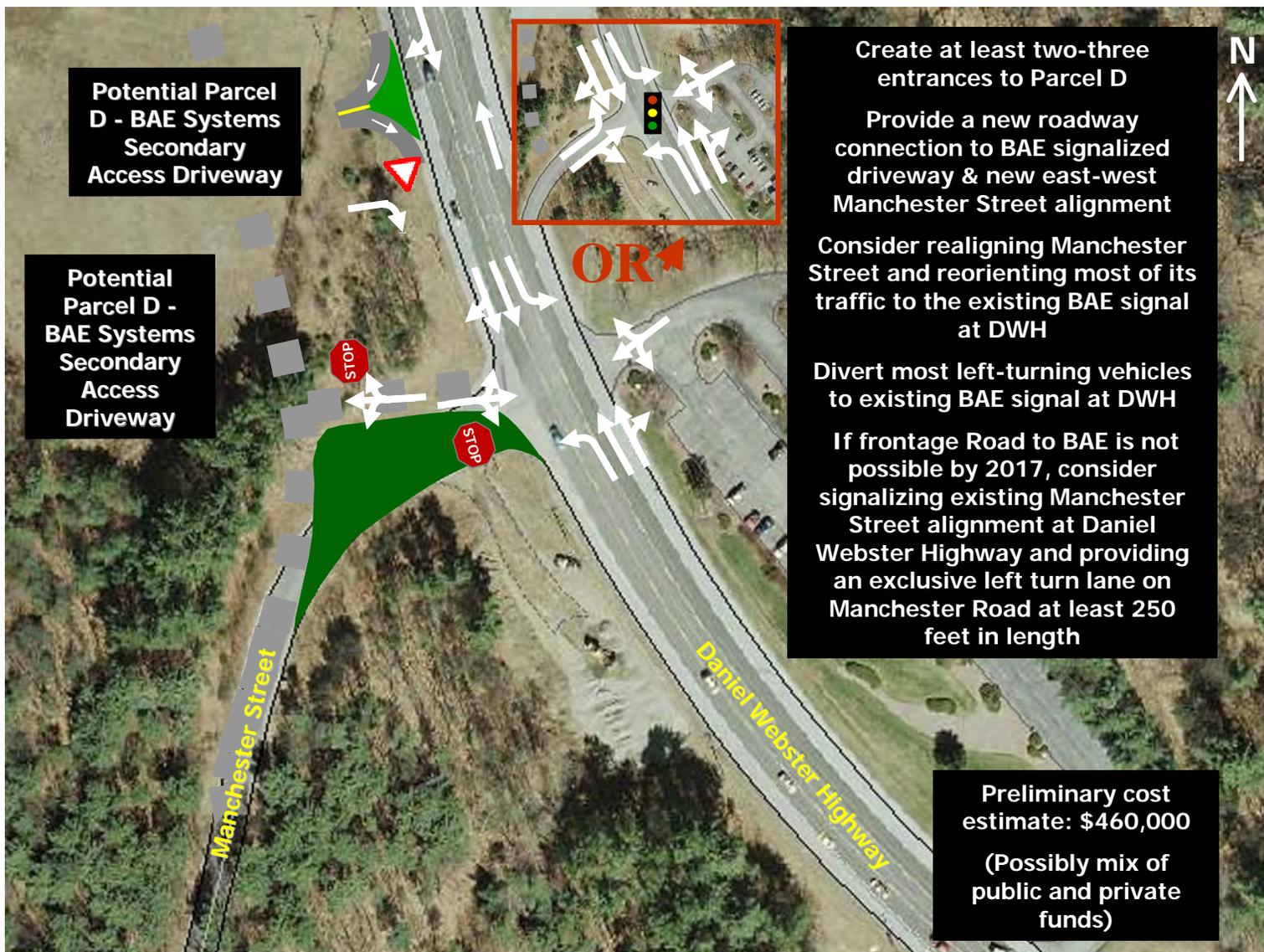
through traffic, this new distributor road, a portion of which already exists, would reduce the demands at the Manchester Street intersection by consolidating them at the existing BAE signalized intersection with DWH. This would also reduce traffic on DWH between the BAE Driveway and Manchester Street. 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*

**➔ Photo Direction**

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

Potential Improvements Assumed Constructed by 2017



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>	BAE Driveway – West of DWH	<10	>150
Office/R&D	N/A	50,000 ft <sup>2</sup>			

Refer to Figure I-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>

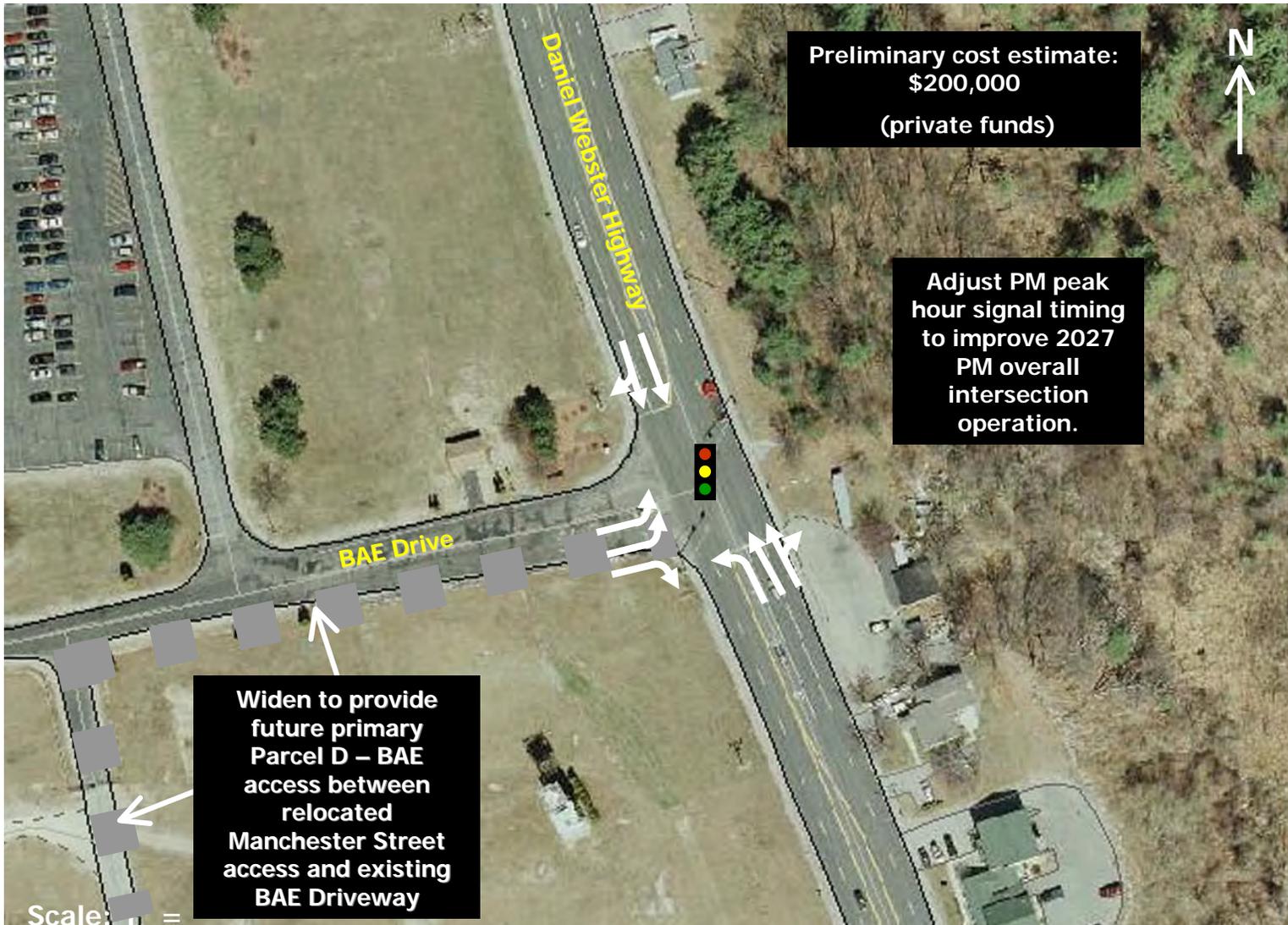


*Existing Conditions*



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

Potential 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 I-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.

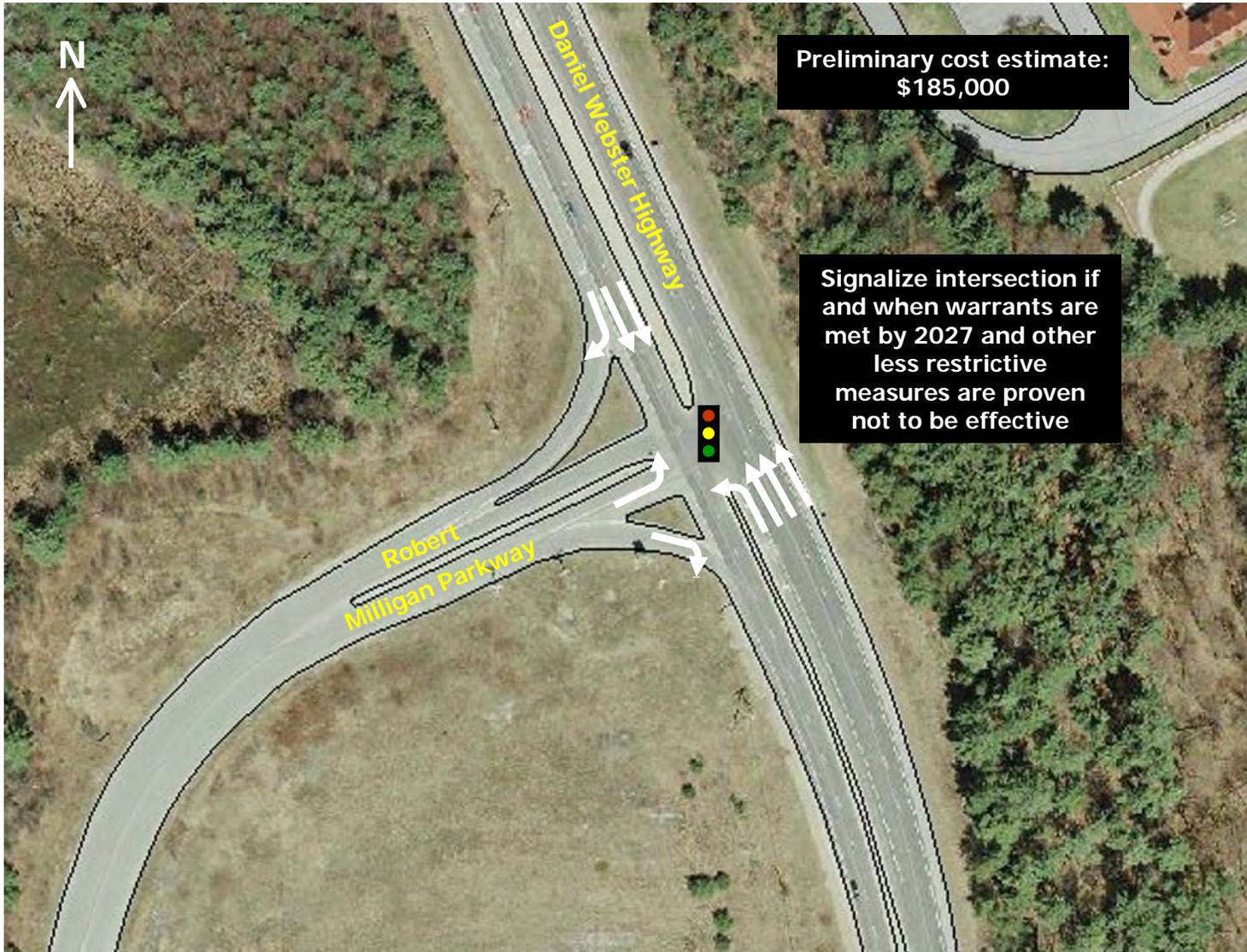
Robert Milligan Parkway is expected to operate with congestion by the year 2017, but the gaps in traffic are expected to be sufficient to allow projected peak hour left-turning traffic to exit onto DWH. Prior to 2017, additional industrial development is anticipated on Robert Milligan Parkway. Even though 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*

**➔ Photo Direction**

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

Potential 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 I-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,

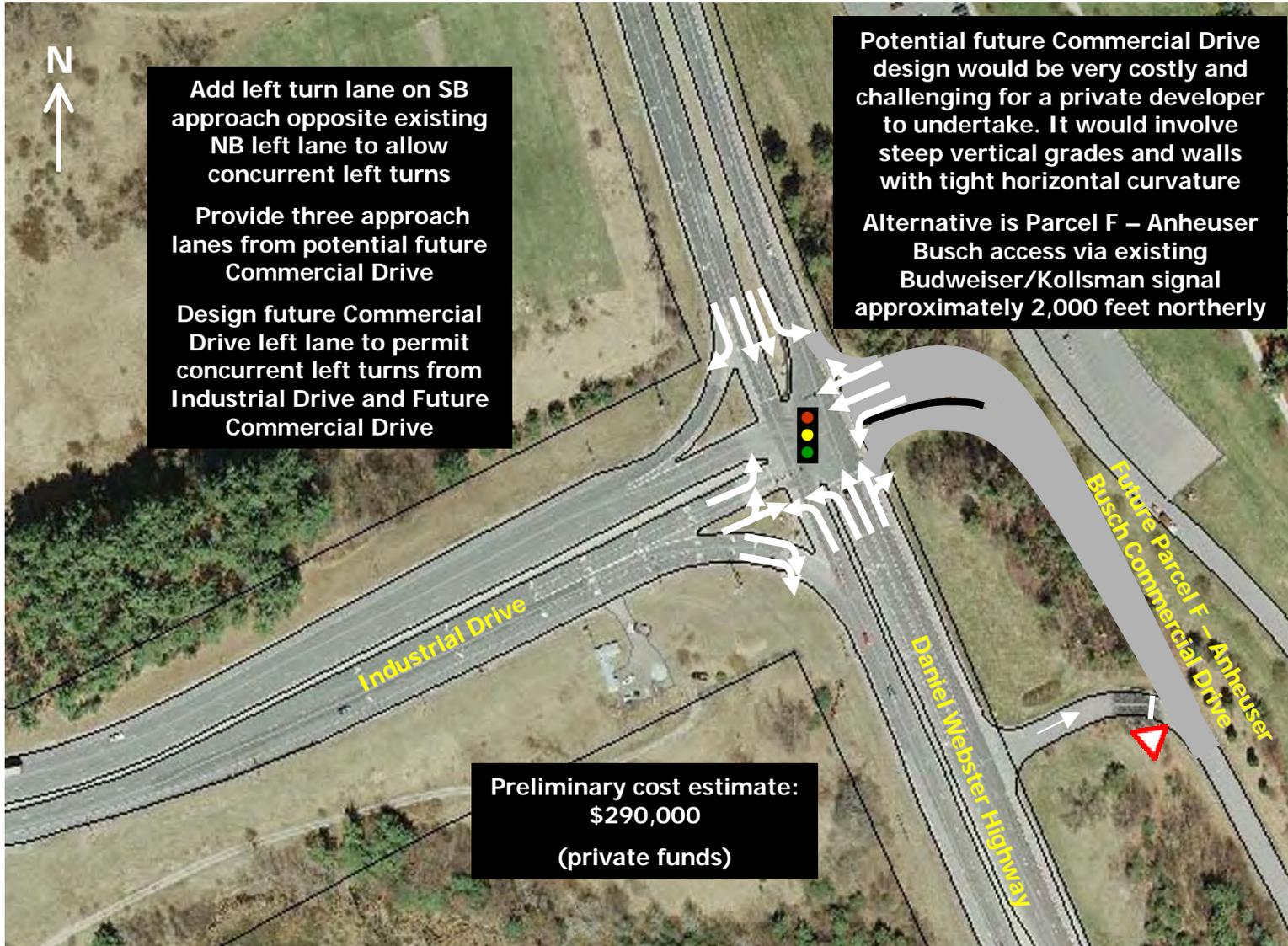
while traffic demands on DWH are expected to more than double compared to those found in 2007.

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

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	<b>New Parcel G Driveway</b> at DWH	N/A	N/A
Office/R&D	20,000 ft <sup>2</sup>	N/A			

Figures I-9A and I-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.

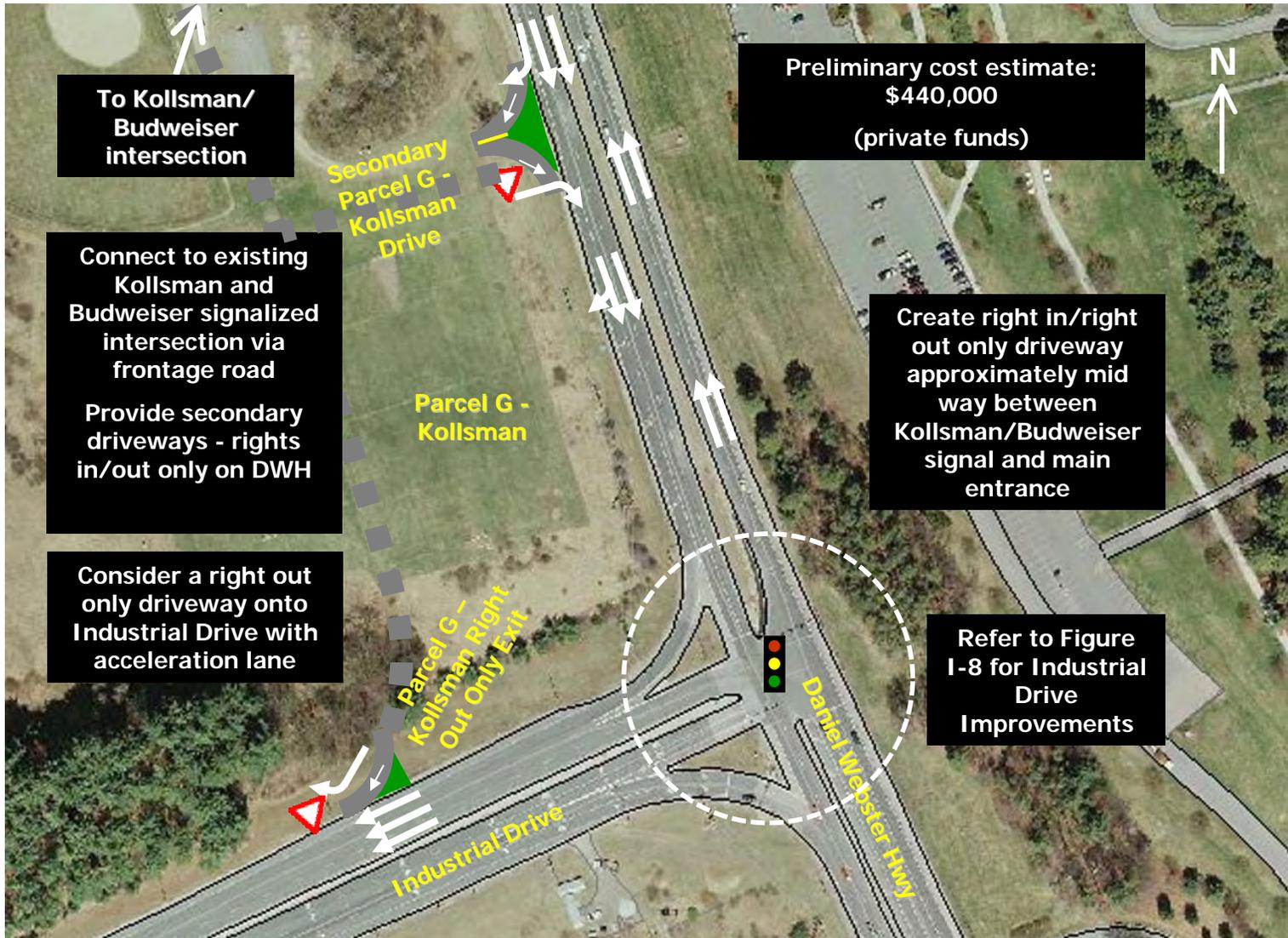
As envisioned, Parcel G - Kollsman could be served by up to three accesses and possibly four egresses. At least two accesses will be needed to serve Parcel G - Kollsman, in any event. Because this site is being developed by Kollsman, there may be an opportunity to avoid the creation of a new traffic 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 Parcel G- Kollsman site could be accessed via the existing Kollsman/Budweiser signal by enhancing an existing access road paralleling DWH. The Parcel G - Kollsman/Budweiser signal could be used to provide access to and from the north on DWH.

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

**➔ Photo Direction**

*Figure I-9A*  
**Parcel G - Kollsman at Daniel Webster Highway**  
 Merrimack, NH  
 Potential 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	<b>N/A</b>	<b>F</b>	<b>A</b>	<b>F</b>	<b>A</b>
PM Peak Hour	<b>N/A</b>	<b>F</b>	<b>C</b>	<b>F</b>	<b>C</b>



*Existing Conditions*

➔ *Photo Direction*

*Figure I-9B*  
**Kollman/Budweiser Driveways at Daniel Webster Highway north of Parcel G – Kollman Merrimack, NH**

Potential 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 shown on Figure I-9B 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 I-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 I-10*  
**Star Drive at Daniel Webster Highway**  
Merrimack, NH

Potential Improvements  
Assumed Constructed  
by 2017



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 I-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.

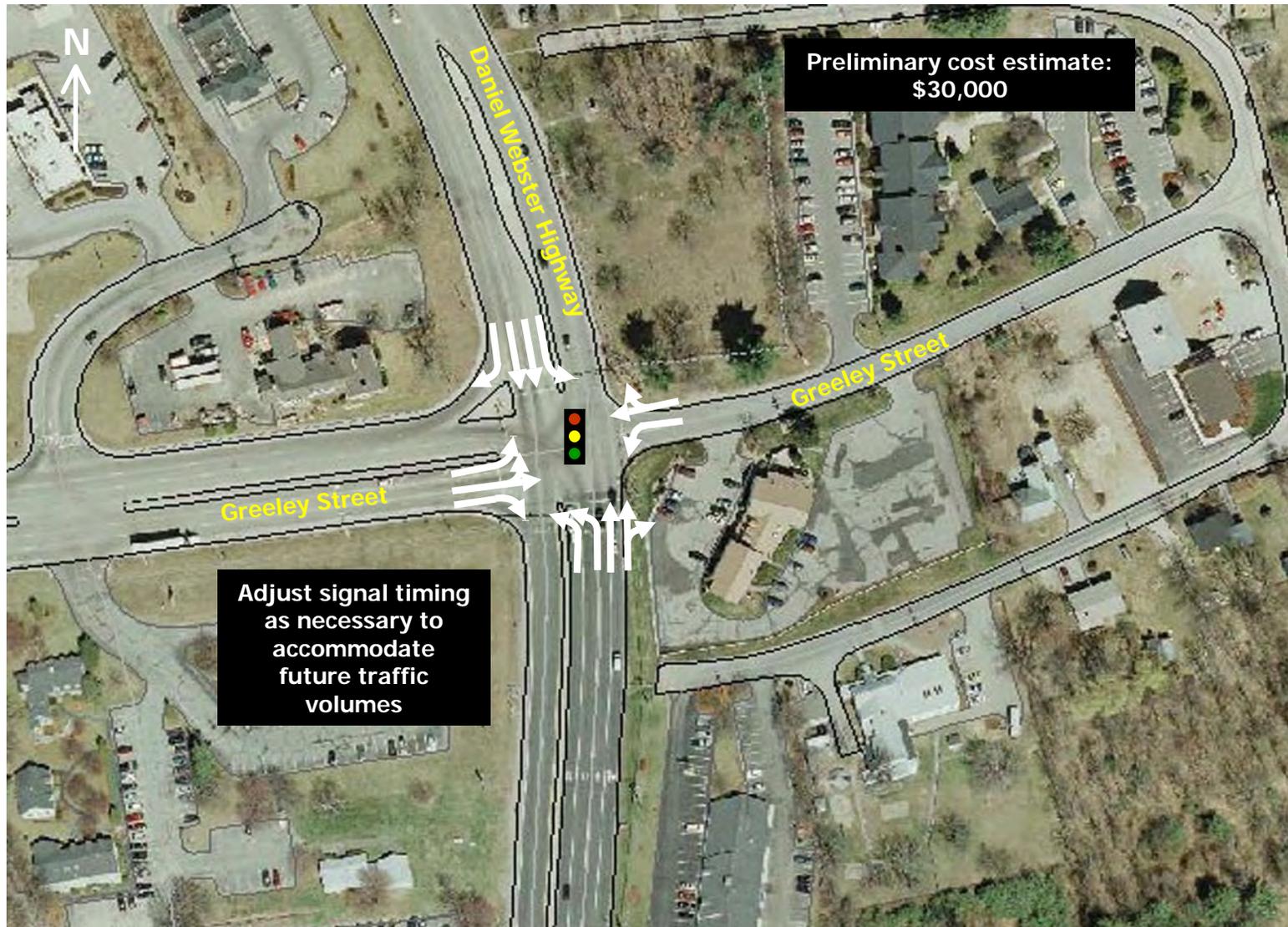
## Level of Service (LOS) Summary Table

	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*

**➔ Photo Direction**



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

Potential Improvements  
 Assumed Implemented  
 by 2017

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 I-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.

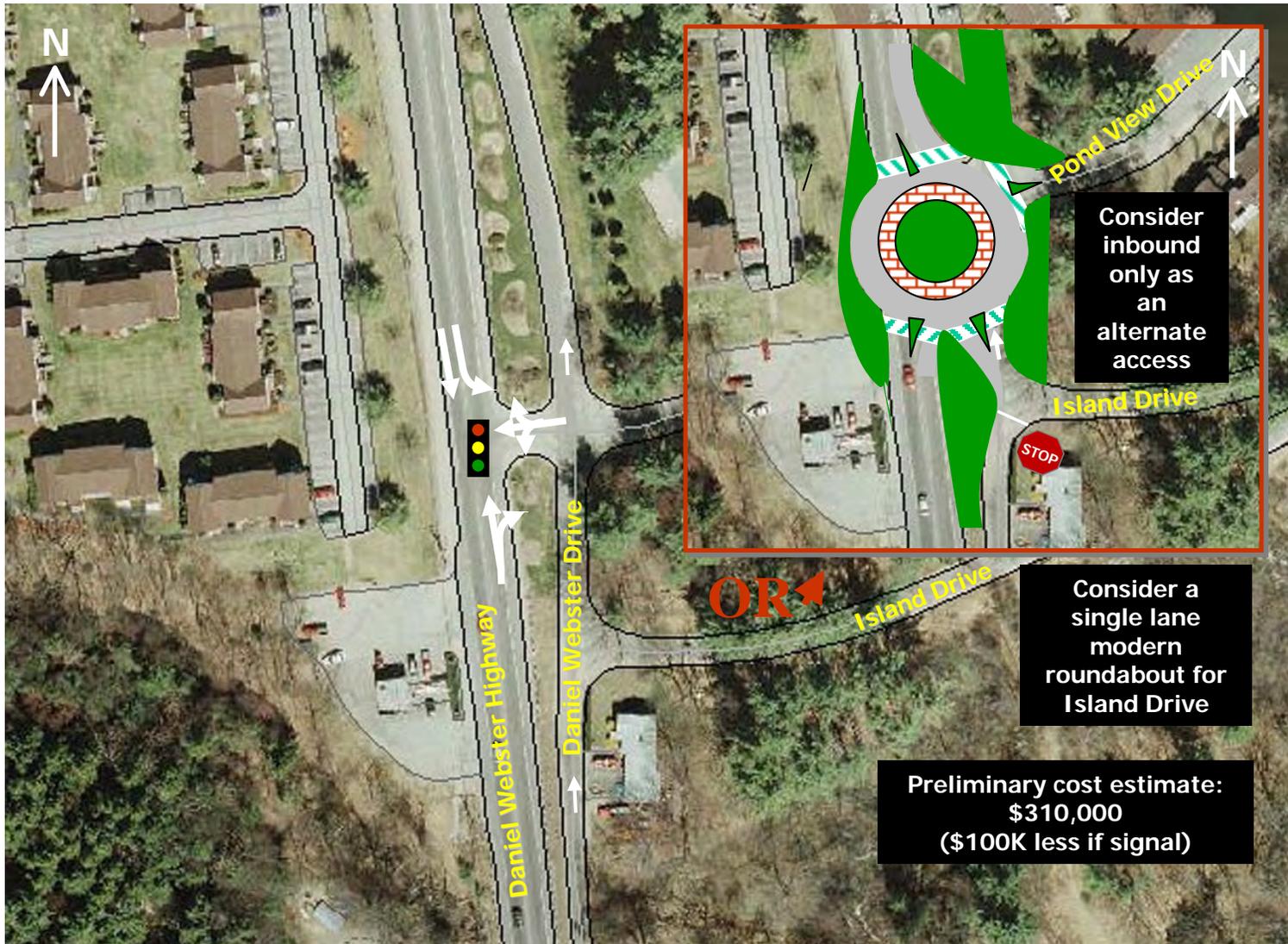
## Level of Service (LOS) Summary Table

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

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



*Existing Conditions*



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

Potential Improvements  
Assumed Constructed  
by 2017



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 I-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 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 inordinately 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 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	<b>E</b>	<b>F</b>	<b>F</b>	<b>F</b>	<b>F</b>
PM Peak Hour	<b>E</b>	<b>F</b>	<b>D</b>	<b>F</b>	<b>D</b>



*Existing Conditions*

**➔ Photo Direction**

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

Potential 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 I-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.

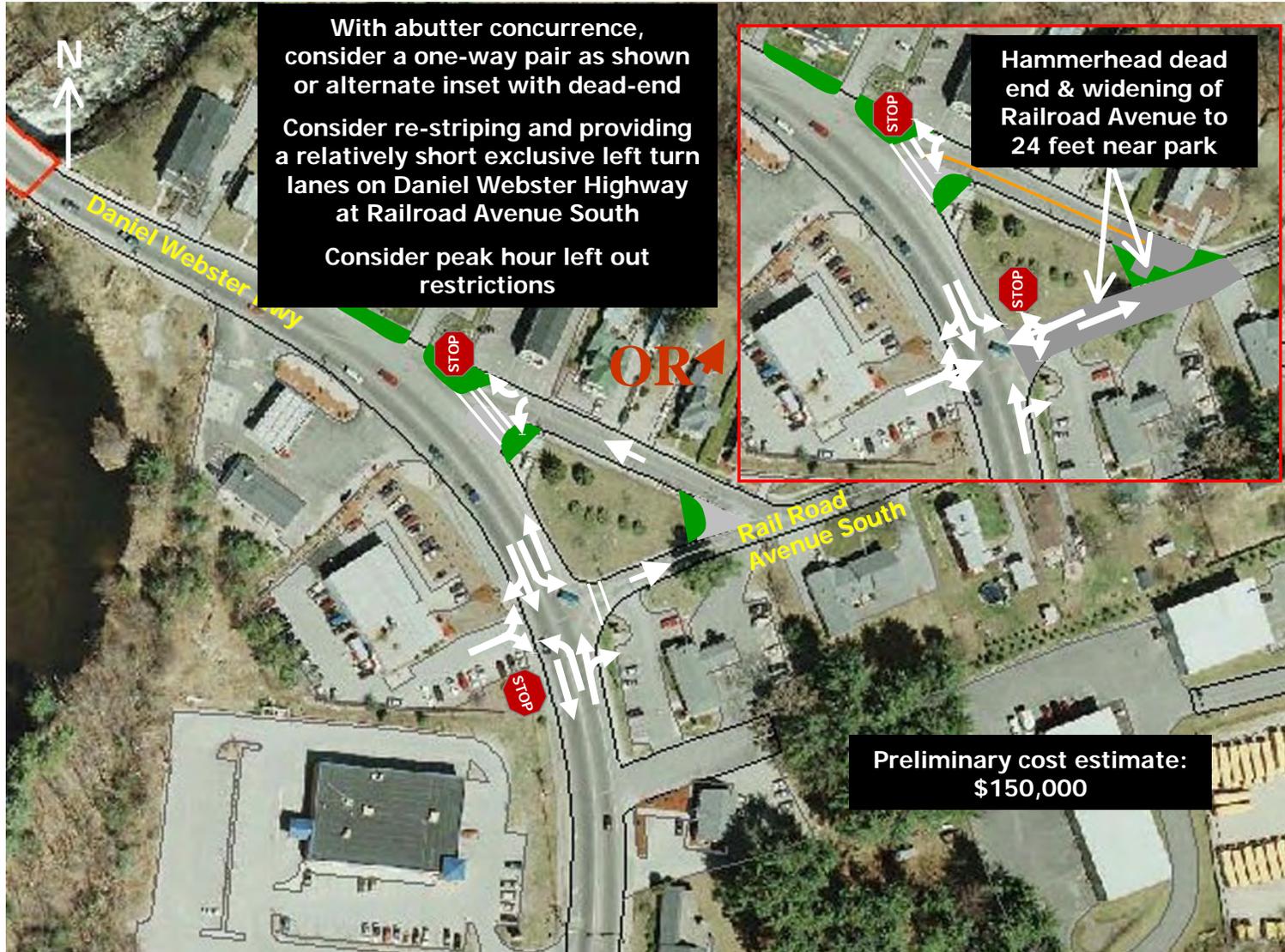
Based on observations, the primary problems at this intersection are geometric, due to the acute angle and the narrowness of Railroad Avenue South approaching DWH. Besides leaving it as it is, a couple of options for this intersection were considered. One option would be to make Railroad Avenue North 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	E	F	C*	F	D*
PM Peak Hour	F	F	C*	F	F

\* 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 I-14*  
**Railroad Avenue and Auto Body Driveway at Daniel Webster Highway**  
 Merrimack, NH  
 Potential Improvements Assumed Constructed by 2017

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 I-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

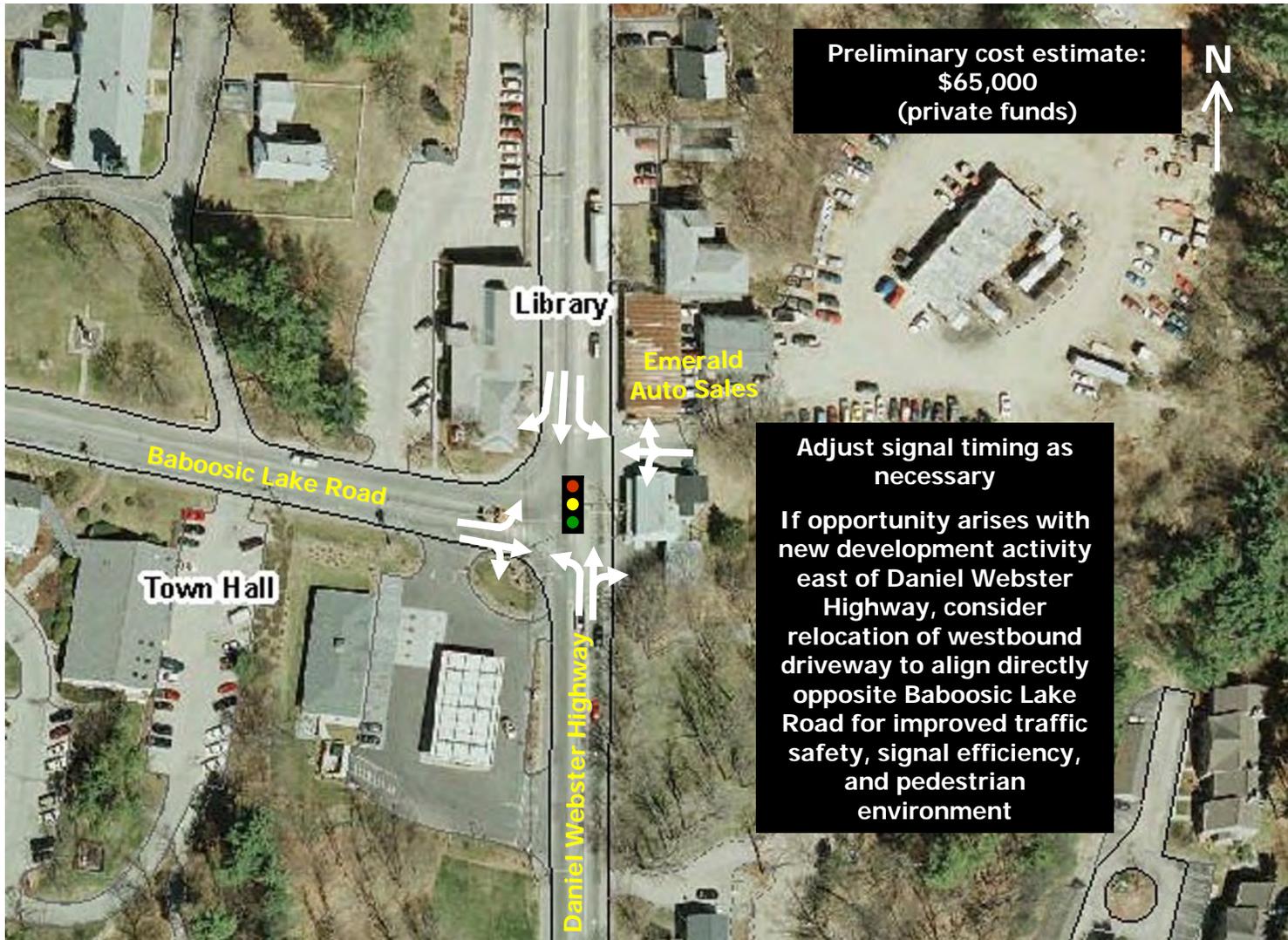


Existing Conditions



*Figure I-15*  
**Baboosic Lake Road at Daniel Webster Highway**  
 Merrimack, NH

Potential 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 I-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 relocated Twin Bridges Park driveway do not conflict with the right-turning vehicles from Wire Rd and would include a possible flush median on Wire

Road. Further suggested mitigation also includes providing a sidewalk on the west side of DWH.

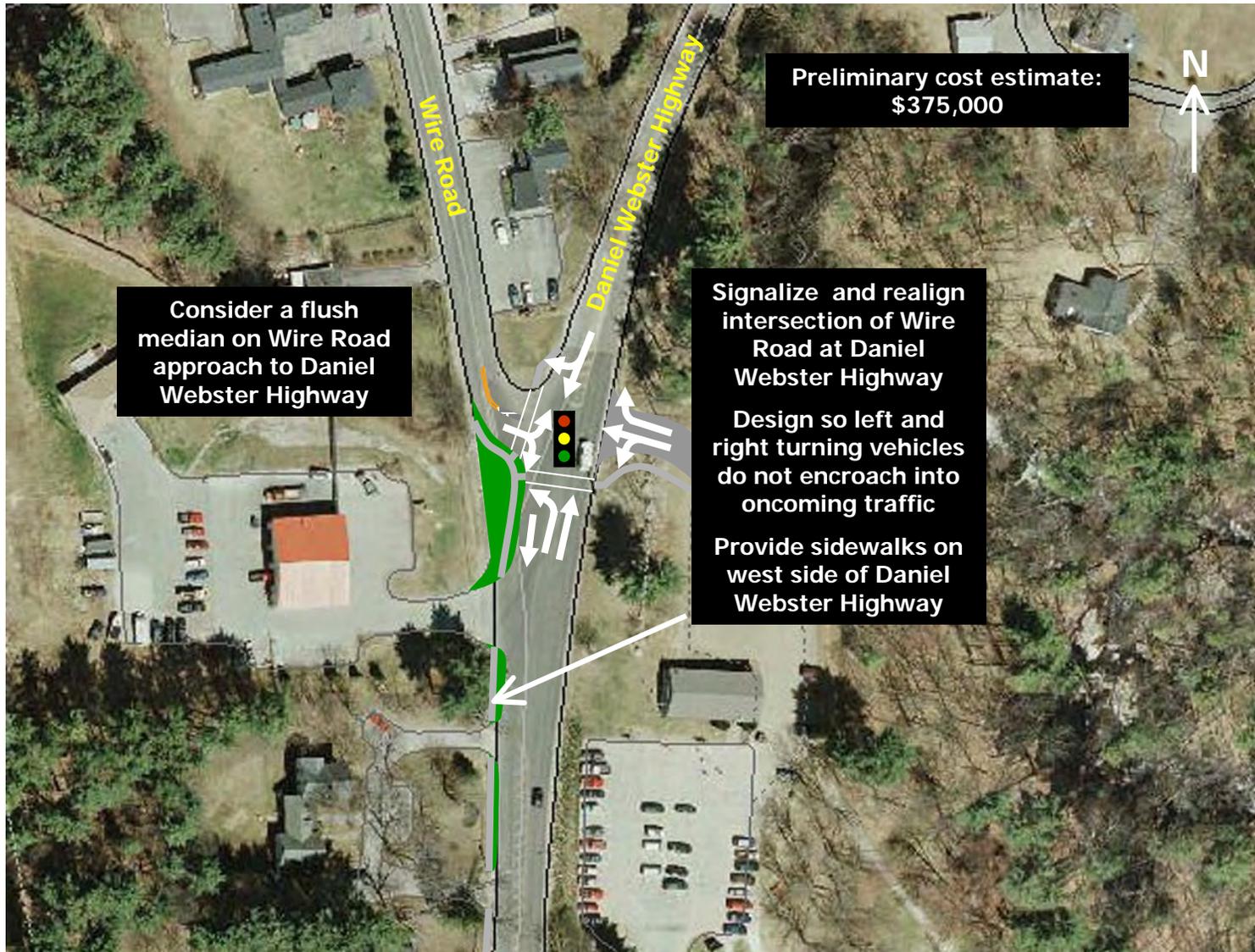
In accordance with existing Town plans, the geometry of the new intersection should include an exclusive northbound left-turn lane and through lane on DWH, a shared southbound through and right-turn lane, a shared eastbound left and right-turn lane from Wire Road, and a shared left and through lane along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

## 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	B	F	B
PM Peak Hour	C	F	A	F	A



*Existing Conditions*



*Figure I-16*  
**Wire Road at Daniel Webster Highway**  
Merrimack, NH

Potential 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 I-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.

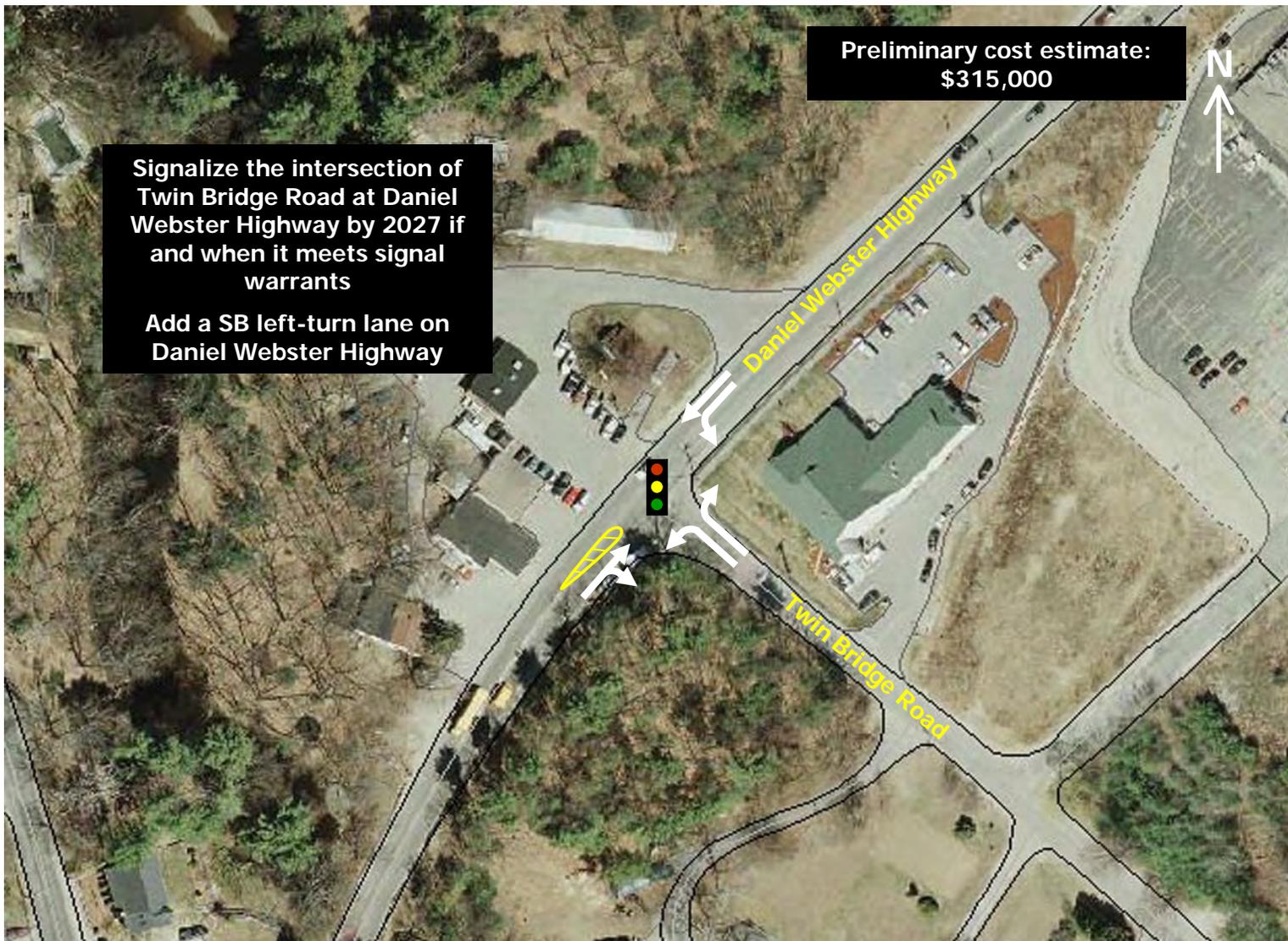
It is anticipated that traffic volumes will increase between 10 – 20% on Daniel Webster Highway north and south of Twin Bridge Road between 2007 and 2017. Traffic volumes are anticipated to increase over 150% on Twin Bridge Road as a result of the housing development to be in place in 2017 and perhaps 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 cases, 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

➔ Photo Direction

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

Potential Improvements Assumed Constructed Between 2017 and 2027

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 I-18 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.

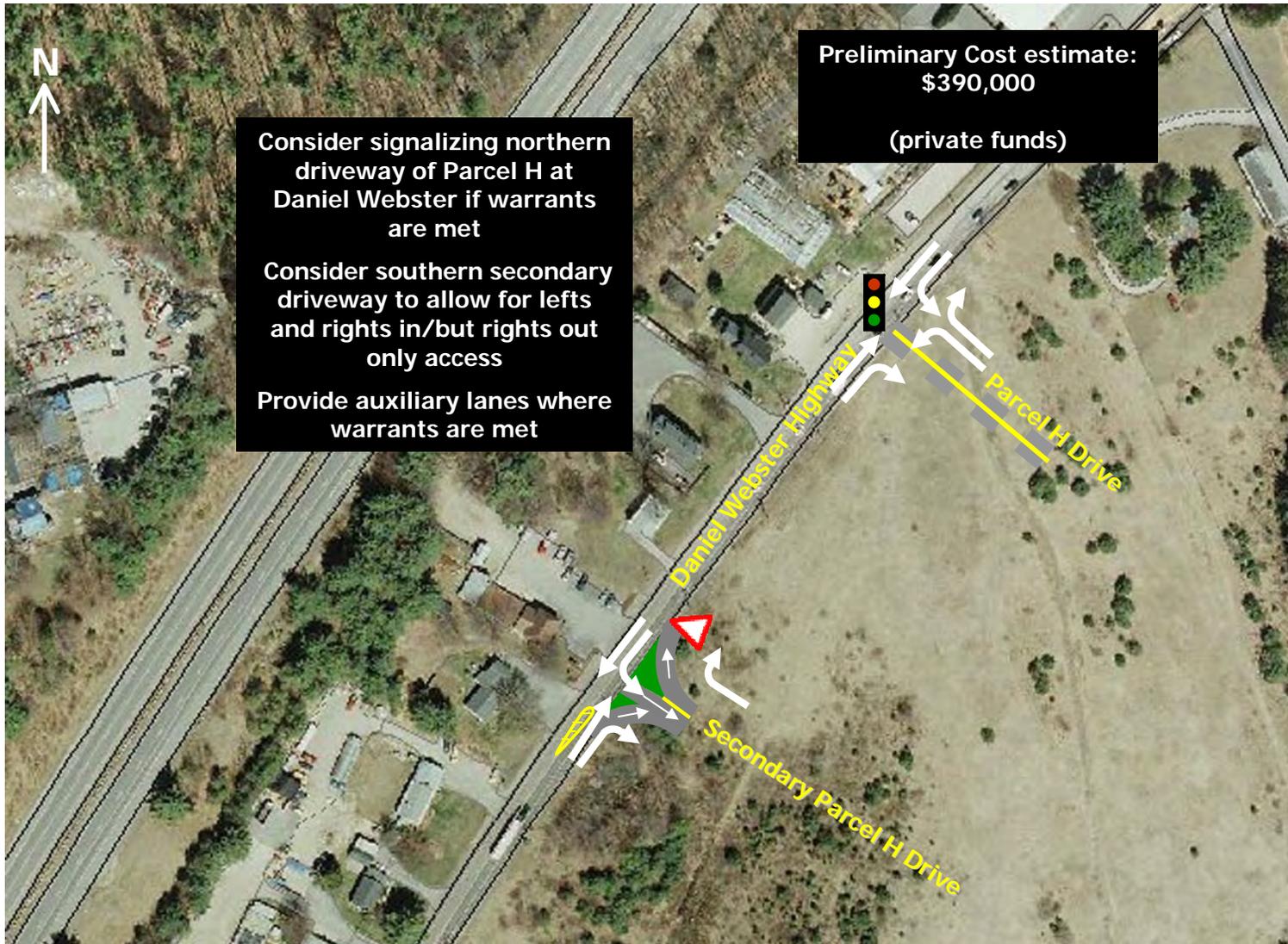
As envisioned, the potential secondary driveway access at the southern end of Parcel H – Flatley would allow for lefts and rights in from Daniel Webster Highway, but only right turning vehicles out. The Daniel Webster Highway approach lane configurations would be the same as at those assumed above for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

## 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 I-18*  
**Parcel H – Flatley at Daniel Webster Highway**  
 Merrimack, NH

Potential Improvements Assumed Constructed by 2017

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 I-19 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. By 2017, development of Parcel H (Flatley) to the north of this intersection is expected.

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	C	D	C	E	C
PM Peak Hour	C	E	C	E	C



*Existing Conditions*

**➔ Photo Direction**



**Figure I-19**  
**Bedford Road at**  
**Daniel Webster**  
**Highway**  
 Merrimack, NH

Potential Improvements  
 Assumed Implemented  
 by 2017

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

Refer to Figure I-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.

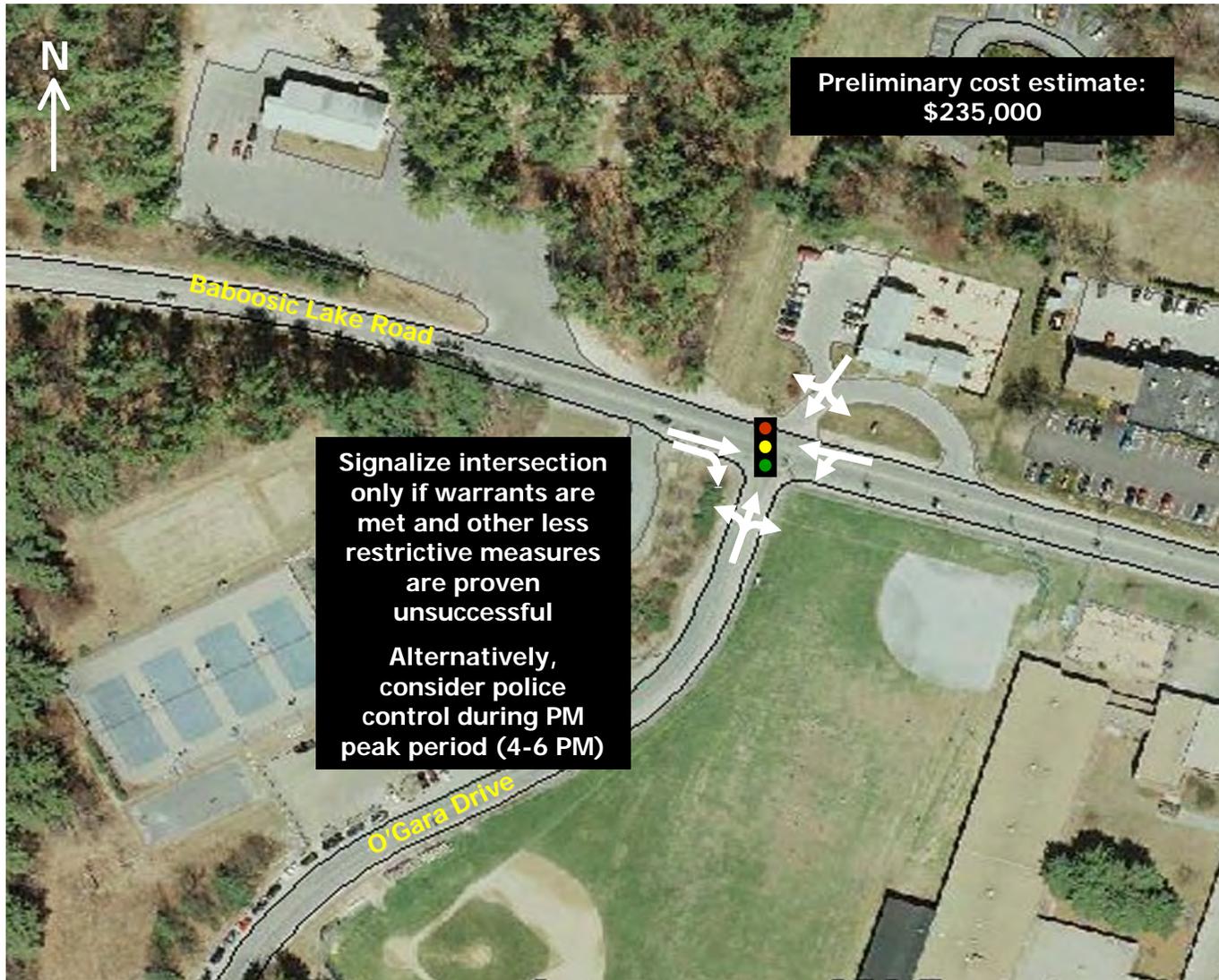
By implementing either of these proposed mitigation measures, PM peak hour operations should improve from LOS F to LOS B.

## 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 I-20*  
**Baboosic Lake Road  
at O'Gara Drive**  
Merrimack, NH

Potential 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 I-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.

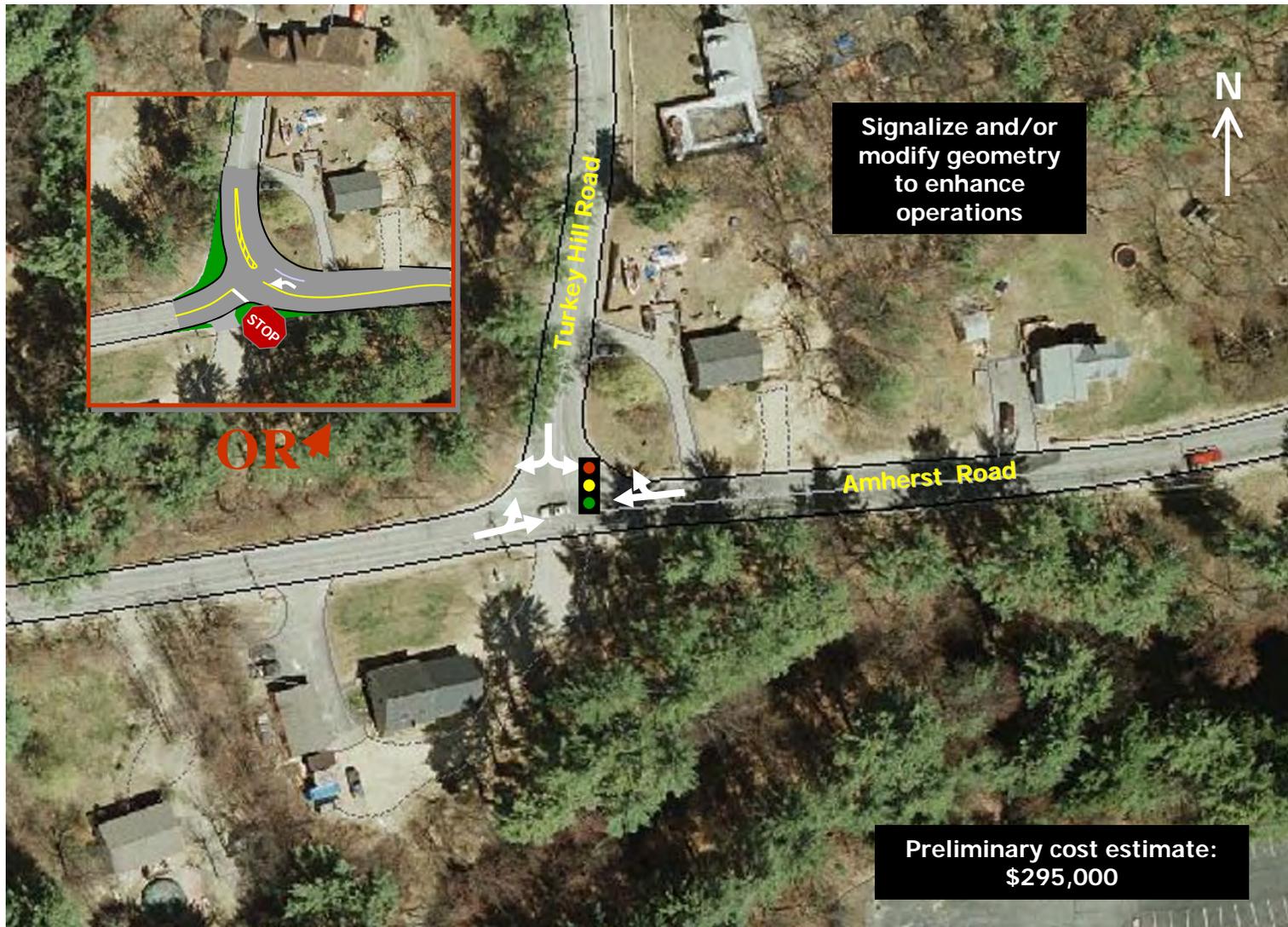
If signalization is contemplated, the signal would have to be coordinated with the Exit 11 signal cluster to avoid backups for the Exit 11/Executive Park Drive intersection. As with other intersections, signalization should be a *last* resort, not a first resort.

### 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 I-21*  
**Amherst Road at Turkey Hill Road**  
 Merrimack, NH  
 Potential 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 I-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>

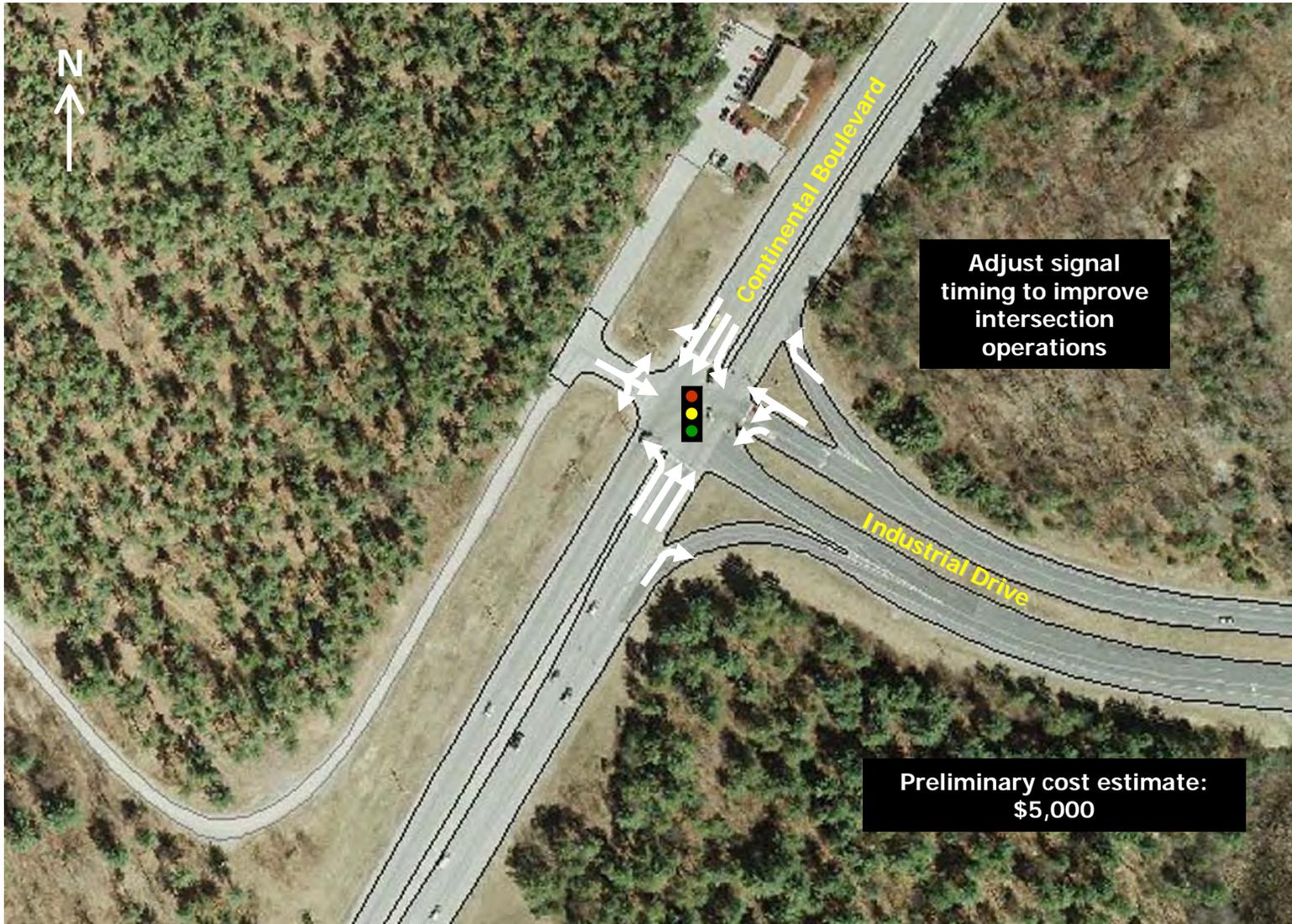


*Existing Conditions*

**Photo Direction**

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

Potential 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 I-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.

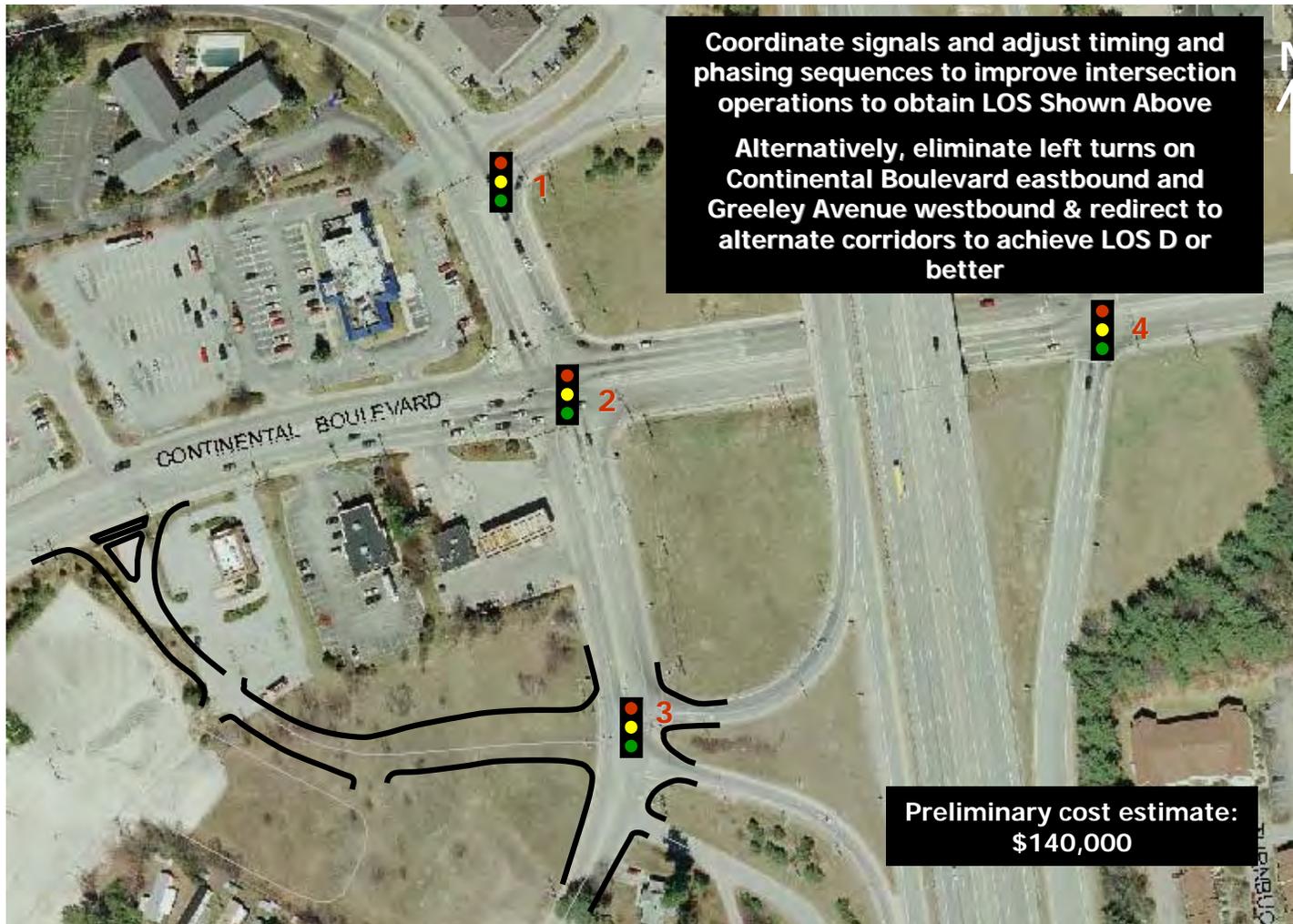
A second option involves eliminating left turn movements on Greeley Street and Continental Boulevard on both approaches to Camp Sargent Road and Amherst Street. Left turns now made from Continental Boulevard would be diverted via right turns to the new Shaw’s Plaza frontage road followed by left turns 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
AM Peak Hour	<b>1 2 3 4</b> <b>D D B B</b>	<b>1 2 3 4</b> <b>D F B B</b>	<b>1 2 3 4</b> <b>B D C B</b>	<b>1 2 3 4</b> <b>D F B B</b>	<b>1 2 3 4</b> <b>B E C B</b>
PM Peak Hour	<b>1 2 3 4</b> <b>F D B C</b>	<b>1 2 3 4</b> <b>F D B F</b>	<b>1 2 3 4</b> <b>B E B D</b>	<b>1 2 3 4</b> <b>F E B F</b>	<b>1 2 3 4</b> <b>B F B F</b>



*Existing Conditions*

**➔ Photo Direction**

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

Potential Improvements  
Assumed Constructed  
by 2017

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

## Projected Implementation Schedule and Costs

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



## 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 costs and components 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.

Table 1 summarizes projected implementation costs by location. 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. 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 methodology for assessing a possible ‘fair share contribution’ should be refined over time. Refer to Chapter IV of this document for a discussion of the methodology.

Preliminary order of magnitude implementation cost estimates include public and private sector costs for *enhancements only within public rights-of-way*. Initial order of magnitude construction cost estimates were increased to include other essential elements of implementation. For example, design costs were assumed to represent 12% of construction costs, drainage costs at 16% of construction costs, and general mobilization, traffic management, and erosion costs were estimated at 15% of construction costs. Additionally, a contingency cost assumed at 20% of construction costs was added onto the total. 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. Based on the assumptions made to date, short-range roadway infrastructure implementation costs prior to 2017 are estimated at just under approximately **\$4 million**, while long-range costs prior to 2027 are estimated at approximately **\$1.5 million** for a total program of approximately **\$5.5 million**. Costs are in 2009 constant dollars.

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.