

Merrimack, NH

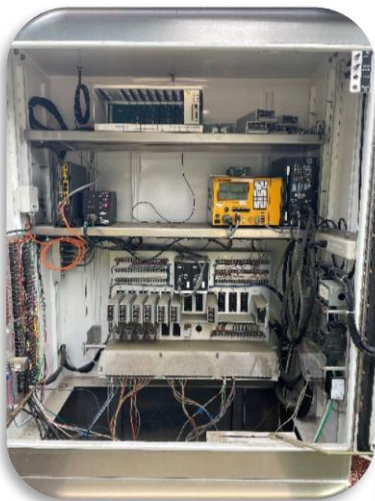
Wire Road at US Route 3 Intersection & Roadway Safety Improvements

NHDOT Project No. 41588

November 2022

DRAFT

ENGINEERING STUDY



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Prepared by: **BETA GROUP, INC.**

Prepared for: Town of Merrimack, New Hampshire

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- A. Church Street Turnaround Concept
- B. Turning Movement Volumes
- C. Crash History Assessment
- D. Capacity Analyses
- E. Local Concerns Meeting Minutes and Presentation**
- F. Traffic Signal Warrant Analyses
- G. Conceptual Plans
- H. Alternatives Presentation/Public Meeting and Meeting Minutes**
- I. Environmental Documentation**
- J. Cost Estimates

*** Items to be provided by QCC and will be included in Appendix when secured.*

1.0 INTRODUCTION AND BACKGROUND

The objective of the Wire Road at US Route 3 (Daniel Webster Highway) Intersection and Roadway Safety Improvements Project is to improve safety and traffic operations for all users, including pedestrians and vehicles. This project will be incorporated as part of an ongoing bridge replacement project, located at US Route 3 over the Baboosic Brook, which is currently under design by Quantum Construction Consultants (QCC). BETA Group, Inc. (BETA) is a sub consultant to QCC.

The project limits as depicted in **Figure 1** extend from the intersection of Baboosic Lake Road and Route 3, through the Wire Road and Route 3 intersection, to the southerly limit of the Baboosic bridge reconstruction project, about 100 feet south of the proposed bridge, approximately 1,300 feet in total. The overall project scope includes intersection design at Wire Road and Route 3, the potential relocation of the Merrimack Youth Association (MYA) driveway (access management), Americans with Disabilities (ADA) compliant pedestrian ramps, curb, and sidewalks from the intersection of Baboosic Lake Road and US Route 3 to the northerly project limit. Improvements include drainage relocation/enhancements, potential new signal installation at Wire Road and Route 3, box widening, and pavement milling and overlay, including guardrail installation. Pedestrian accommodation and improvements have been identified in the *Town of Merrimack Master Plan* as an important component of the corridor, in addition to the intersection improvements. The project also consists of signal coordination between the potential new signal at Wire Road and three existing signals along the Route 3 corridor. The three intersections are CVS at Route 3, Baboosic Lake Road at Route 3, and Front St at Route 3.

2.0 PURPOSE AND NEED

One of the key tasks of the design process as outlined by Local Public Agency (LPA) procedures is to define the project's Purpose and Need Statement. This will be the basis by which the concept alternatives are evaluated. The statement below was developed by BETA with input from the Town.

2.1 PURPOSE

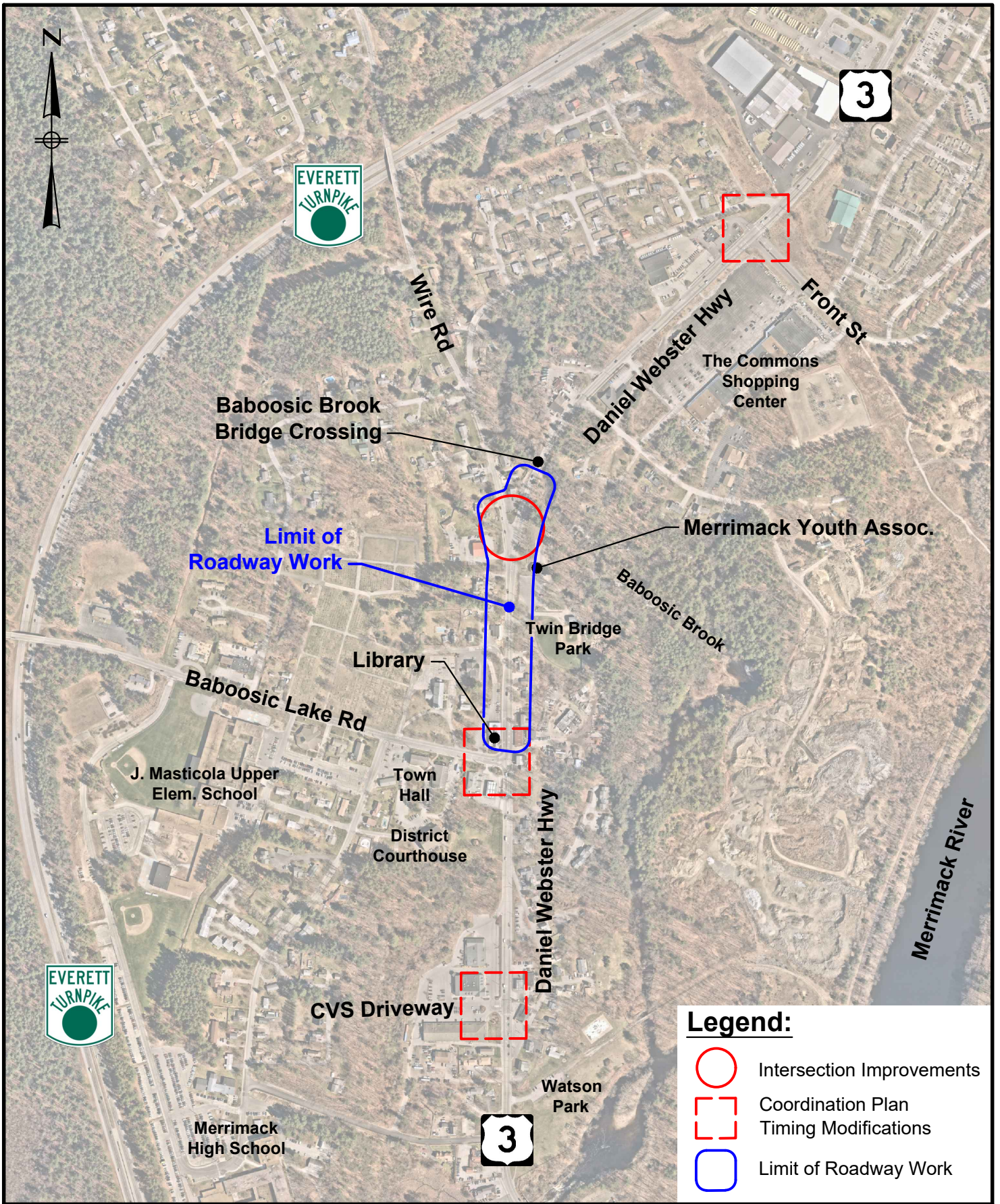
The *purpose* of the project is to improve safety and traffic operations for pedestrians and vehicles within the project corridor limits. The intersection of Wire Road and Route 3 was evaluated for stop controlled, a roundabout, or signalization. If a traffic signal is warranted, coordination of the new signal and the signals at the intersections of CVS at Route 3, Baboosic Lake Road at Route 3, and potentially Front Street at Route 3 would be evaluated.

2.2 NEED

The *need* for this project is to address safety and traffic concerns identified by the community; by implementing safety improvements along the corridor and providing a more efficient intersection to improve the flow of traffic along US Route 3 within the project limits. In addition, pedestrian connectivity, safety, and access management are ongoing needs for the community.

3.0 EXISTING CONDITIONS

The following sections provide descriptions of the existing geometric conditions of the corridor and its major intersections.



Legend:




-  Intersection Improvements
-  Coordination Plan Timing Modifications
-  Limit of Roadway Work



Figure 1
Location Map
Approx. Scale - 1" = 700'

3.1 PROJECT CORRIDOR

The US Route 3 corridor is a two-lane urban minor arterial that generally travels north-south through the Town of Merrimack and is a major commuter road. Within the project area, the Route 3 corridor is primarily commercial with some residential properties. The intersections of US Route 3 at the CVS plaza driveway and Route 3 at Baboosic Lake Road are coordinated wirelessly via time-based coordination. The posted speed limit along US Route 3 in the project area is 30 miles per hour.

The majority of the work will be between Baboosic Lake Road and just south of the Baboosic Brook bridge. This existing corridor consists of two 12–13-foot travel lanes and 2–6-foot shoulders, with 10-11 foot turn lanes and painted medians throughout. Currently there is no sidewalk on the east side of US Route 3 and the west side has sidewalk from Baboosic Lake Road to Church Street. Right of way is approximately 66 feet wide along the corridor and widens at the Wire Road intersection. Wire Road intersects with US Route 3 at a severe skew, limiting sight lines for motorists and resulting in difficult turning movements to and from Wire Road. The lack of visibility is a potential safety issue. Additionally, there is excessive open pavement in this area which invites higher speeds. Currently there are no pedestrian accommodations at this intersection. Merrimack Youth Association and Twin Bridge Park can be accessed via a shared full access driveway approximately 200 feet south of the Wire Road intersection. The Merrimack Public Library, John O’Leary Adult Community Center and First Church of Merrimack have access to Route 3 via Church Street (in addition to Baboosic Lake Road). The Town has indicated in a 2013 Public Information Meeting and a Highway Safety Committee meeting that there is support for closing access to US Route 3 via Church Street due to poor sight lines and the desire to add sidewalks. Currently Church Street has more than a 15% grade, which would make a pedestrian crossing of Church Street not ADA compliant. The Town has proposed a turnaround at the library and adult center driveway (see **Appendix**).

Underground utilities consist of water, sewer, gas and several closed drainage systems. Electric and cable/telephone is provided via overhead wire/utility poles with some underground electric and cable services.

Stormwater runoff from the project corridor is collected and discharged, untreated, through several distinct closed drainage systems located on Wire Road and Route 3, or via overland flow. Although the outfalls from the closed drainage systems are located outside of the project limits, it is anticipated that all flows from the project corridor are either directly or indirectly discharged to Baboosic Brook. The project corridor is located entirely within a designated MS4 area and will be required to meet municipal stormwater requirements, including the guidance set forth in the New Hampshire Stormwater Manual.

3.2 PROJECT INTERSECTIONS

An overview of the project area and additional intersections is listed below. A brief overview of the existing traffic signal equipment is provided in **Table 1**.

3.2.1 Route 3 at Front Street/Dunkin Driveway

- a. Front Street is a local roadway that intersects Route 3 from the east. Front Street provides a shared left turn/through lane and an exclusive right turn lane at the intersection. Front Street is separated by a raised vegetated median island. There is a four-foot-wide asphalt sidewalk provided on the northbound side of Front Street.
- b. The Dunkin Driveway is a privately owned driveway that intersects Route 3 from the west. The Dunkin Driveway has a 50± right turn lane. There is a cement concrete raised median which divides the entering and exiting traffic.

- c. Route 3 provides one travel lane in each direction with a 100± foot southbound left turn lane, a 95± foot northbound left turn lane and a 95± northbound right turn lane. There is a four-foot-wide asphalt sidewalk provided on the west side of Route 3 at the intersection.
- d. The intersection provides a combination of overhead mast arm mounted equipment and post mounted equipment. Post mounted signals are provided for the Dunkin Donuts driveway approach. Crosswalks are provided across the western and northern legs of the intersection. Each crosswalk has its own pair of pedestrian pushbuttons and signal heads, mounted on traffic signal posts or mast arms.
- e. A Gridsmart video detection system is provided.

3.2.2 Route 3 at Wire Road

- a. Wire Road is a major collector that intersects Route 3 at a skewed angle from the northwest. Wire Road has one lane in each direction. Wire Road is stop controlled at Route 3. Sidewalks are not provided on Wire Road.
- b. Route 3 generally provides one travel lane in each direction with a 125± foot northbound left turn lane. There is a four-foot wide asphalt sidewalk provided on the west side of Route 3. The traffic on Route 3 is free flowing.

3.2.3 Route 3 at Merrimack Youth Association (MYA) Driveway

- a. The Merrimack Youth Association driveway intersects Route 3 from the east and serves two-way traffic to/from parking areas for the MYA building and the Twin Bridge Park. The park includes walking trails, a baseball field, and a playground. The driveway is effectively stop controlled, though no signage is provided.
- b. Route 3 generally provides one travel lane in each direction, widening to provide a northbound left turn lane north of the driveway. The widening includes a painted gore area within the northern vicinity of the driveway. The traffic on Route 3 is free flowing.
- c. No sidewalk is provided at the intersection, though a crosswalk is marked on the northern leg connecting the driveway with the western side of Route 3.

3.2.4 Route 3 at Baboosic Lake Road

- a. Baboosic Lake Road is a major collector that intersects Route 3 from the west. Baboosic Lake Road generally provides one lane in each direction but provides one 150' left-turn lane and one 150' right-turn lane approaching the intersection. Four-and-a-half-foot wide asphalt sidewalks are provided on both sides of Baboosic Lake Road.
- b. Route 3 provides one travel lane in each direction with a 270± foot northbound left turn lane, a southbound 90± exclusive left turn lane and a 175± foot exclusive right turn lane at the intersection. There is a four-foot wide asphalt sidewalk provided on a portion of the southbound side of Route 3.
- c. A signal controlled commercial driveway for Lakeview Materials intersects Route 3 from the east approximately 50 feet north of Baboosic Lake Road. Signals are post mounted for the driveway.
- d. The intersection provides a combination of overhead mast arm and post mounted traffic signal equipment. Crosswalks are provided across the western and southern legs of the

intersection. Each crosswalk has its own pair of pedestrian pushbuttons and signal heads, mounted on traffic signal posts or mast arms.

- e. A GPS clock unit and antenna in addition to a Gridsmart video detection system are provided.

3.2.5 Route 3 at CVS Plaza Driveway

- a. The CVS plaza driveway is a privately owned driveway that intersects Route 3 from the west. There is a cement concrete raised median that divides entering and exiting vehicles at the driveway.
- b. Route 3 is a minor arterial and generally provides one travel lane in each direction with a 70± foot southbound left turn lane (into the D&W Auto Center Gas station) and a 70± foot northbound left turn lane (CVS plaza driveway). Four-and-a-half-foot wide asphalt sidewalks are provided on each side of Route 3.
- c. The intersection provides overhead mast arm mounted equipment painted black. Crosswalks are provided across the western and southern legs of the intersection. Each crosswalk has its own pair of pedestrian pushbuttons and signal heads, mounted on traffic signal posts or mast arms.
- d. A GPS clock unit and antenna in addition to a Gridsmart video detection system are provided.

Table 1: Existing Traffic Signal Inventory

Intersection Locations	Controller Brand	Pedestrian Pushbuttons & Signal Heads	Communication (Interconnect)
1. Route 3 at Front Street	McCain ATCeX	Pushbuttons, No Countdowns	Not coordinated
2. Route 3 at Baboosic Lake Road	McCain ATCeX (Master)	Pushbuttons, Countdown Heads	Wireless Coordination (on-line)
3. Route 3 at CVS plaza	Eagle EPAC 300	Pushbuttons, Countdown Heads	Wireless Coordination (on-line)

3.3 TRAFFIC COUNTS

To assess existing traffic conditions along the Route 3 corridor, manual turning movement counts (TMCs) were collected at the major intersections as shown in **Table 2**. Passenger cars, heavy vehicles, pedestrians, and bicycles were counted at all locations. The weekday morning peak hour was found to occur from 7:15 to 8:15 AM, while the weekday evening peak hour was found to occur from 5:00 to 6:00 PM. The Saturday midday peak hour occurs from 11:15 AM to 12:15 PM. Complete traffic volume data can be found in the Appendix.

NHDOT Count Station 02297001 located on Route 3 north of Hilton Drive was assessed to determine the need for seasonally adjusting the September and May 2022 traffic data. The count station data suggests volumes in May and September are higher than the average month, but slightly lower than the peak month for the roadway. To reflect peak season traffic on Route 3, the May turning count volumes were adjusted upwards by a factor of 1.01 and the September turning counts were adjusted upwards by a factor of 1.04.

Table 2: Traffic Data Collection Schedule

<u>Intersection</u> Route 3 at:	<u>Count Date</u>	<u>Count Interval</u>
Front Street	Thursday, September 8 th , 2022	7:00 AM to 9:00 AM 4:00 PM to 6:00 PM
	Saturday, September 10 th , 2022	11:00 AM to 2:00 PM
Wire Road	Tuesday, May 10 th , 2022	7:00 AM to 6:00 PM
	Saturday, May 14 th , 2022	11:00 AM to 2:00 PM
Merrimack Youth Association Driveway	Tuesday, September 6 th , 2022	9:30 AM to 7:15 AM
	Saturday, September 17 th , 2022	11:00 AM to 2:00 PM
Baboosic Lake Road	Thursday, September 8 th , 2022	7:00 AM to 9:00 AM 4:00 PM to 6:00 PM
	Saturday, September 10 th , 2022	11:00 AM to 2:00 PM
CVS plaza	Thursday, September 8 th , 2022	7:00 AM to 9:00 AM 4:00 PM to 6:00 PM
	Saturday, September 10 th , 2022	11:00 AM to 2:00 PM

A graphical summary of weekday peak hour turning volume is provided in **Figure 2**, with Saturday midday peak hour volumes in **Figure 3**.

3.4 SAFETY ANALYSIS

Crash data for the intersection of Route 3 and Wire Road was obtained from the Town of Merrimack Police Department for the years January 2017 through July 2022. A total of 10 crashes were reported at the intersection during the time period. The most prevalent crash types were rear-end type crashes which accounted for seven of the 10 crashes. All seven crashes involved minor damage and no injury. Two crashes involved single vehicles with no injuries. One crash was related to snow and an inexperienced driver who went off the roadway and struck a guardrail and the other involved a driver who was under the influence and also struck the same guardrail. The final crash involved a motorist and a child on a bicycle who suddenly pulled in front of the motorist. No injuries were reported for this crash.

3.5 EXISTING LEVEL OF SERVICE ANALYSIS

To evaluate existing traffic conditions, a capacity (level of service) analysis was performed. This analysis was performed using methods of the Highway Capacity Manual (HCM) published by the Transportation Research Board. For intersections, six levels of service, "A"- "F", have been established with "A" representing very good operation and "F" representing very poor operation. For signalized and unsignalized intersections, level of service is defined in terms of total delay and is computed for individual intersection turning movements. Delay is a measure of driver discomfort, frustration, fuel consumption, and lost travel time. The relationship between LOS and delay is summarized in **Table 3**.

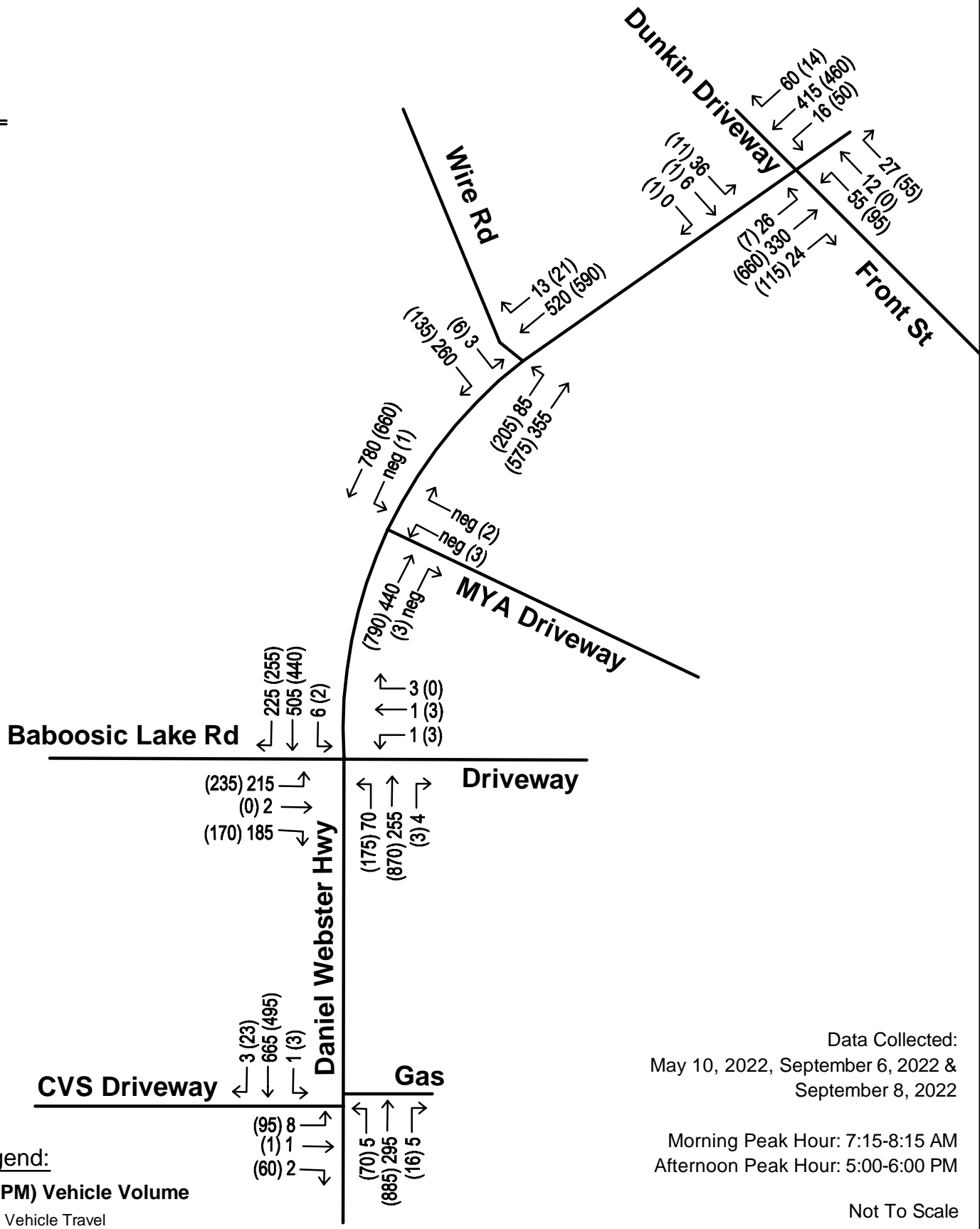


Figure 2
 Existing 2022
 AM & PM Peak Hour Volume

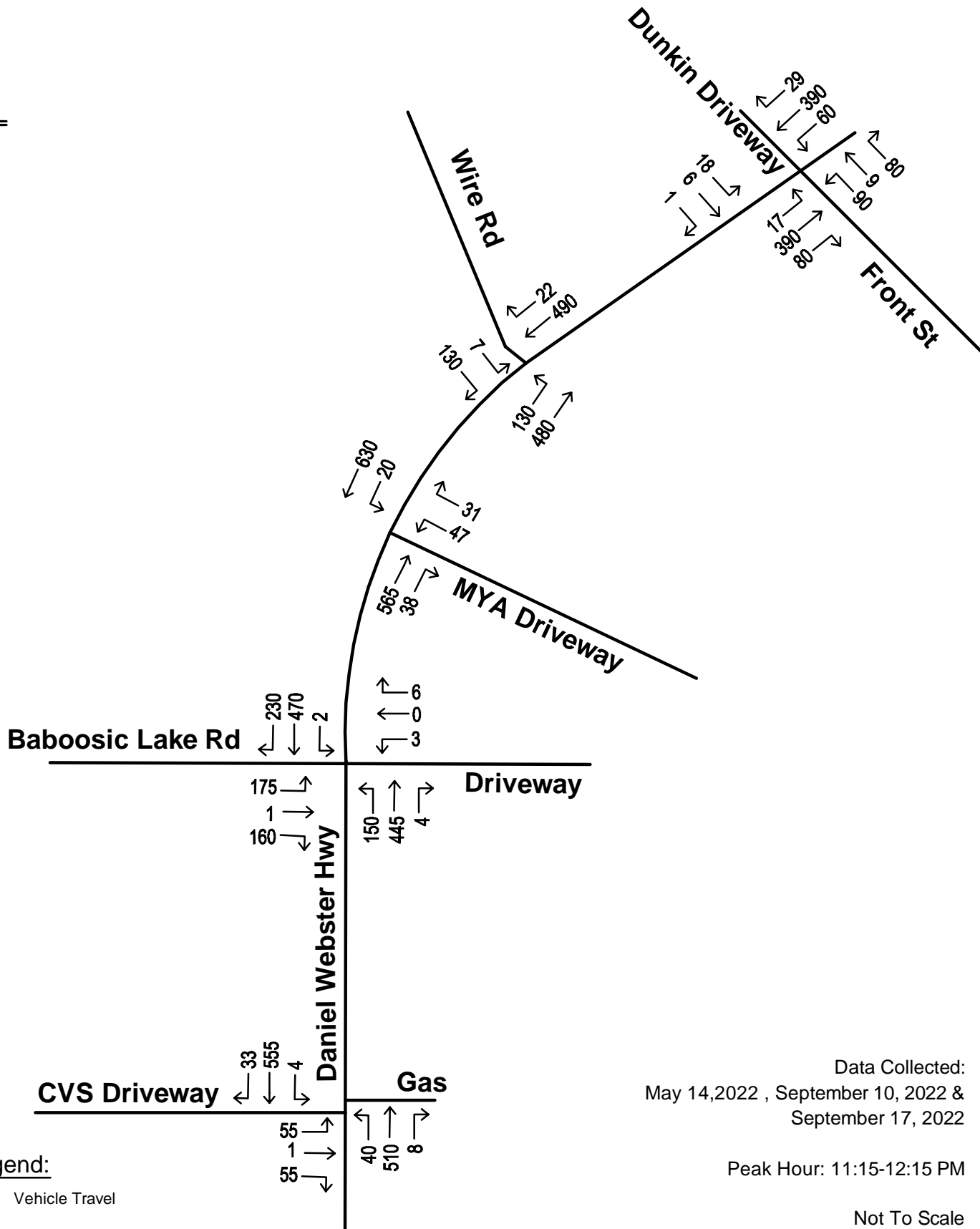


Figure 3
 Existing 2022
 Saturday Peak Hour Volume

Table 3: Level of Service Criteria

LOS	Unsignalized Intersection Criteria Average Total Delay (Seconds per Vehicle)	Signalized Intersection Criteria Average Total Delay (Seconds per Vehicle)	General Description
A	< 10.0	< 10.0	Free Flow
B	10.1 to 15.0	10.1 to 20.0	Stable flow (slight delays)
C	15.1 to 25.0	20.1 to 35.0	Stable flow (acceptable delays)
D	25.1 to 35.0	35.1 to 55.0	Approaching unstable flow (tolerable delay)
E	35.1 to 50.0	55.1 to 80.0	Unstable flow (intolerable delay)
F	> 50.0	> 80.0	Forced flow (jammed)

A level of service analysis was performed for the intersections along the project corridor using Trafficware's Synchro software package (Version 11). A summary of the morning and evening weekday peak periods, and Saturday peak period results of the capacity analysis are shown in **Table 4**. Complete analysis results are provided in the Appendix. Unsignalized intersections were analyzed using HCM 6th Edition methodologies. Signalized intersections were analyzed using HCM 2000 methodologies, given HCM 6th's limitations with exclusive pedestrian phasing at signalized intersections.

As shown in the Table, the signalized intersection of Baboosic Lake Road operates with LOS D overall in the weekday evening peak hour. During all other peak periods, signalized intersections operate with an acceptable LOS C or better overall. Signalized side streets were found to operate with LOS D or better conditions during the three peak periods. Signalized southbound and northbound left turns were found to have the highest delays (LOS E) in some peak periods given the high through volume for Route 3. The unsignalized Wire Road approach was found to operate with LOS C conditions in all three peak periods given the volume departing overwhelmingly favors right turn movements. The unsignalized MYA driveway operates with LOS E conditions on Saturday, which was generally found to have the highest activity for the MYA and the park.

4.0 LOCAL CONCERNS MEETING

An initial public meeting was conducted on September 26, 2022. This Local Concerns meeting was held at the Town Hall and conducted by Kyle Fox, PE (Town) and Jim Bouchard PE (QCC). The meeting included an overview of the proposed intent and scope of the project. A copy of the meeting minutes and presentation will be included in the **Appendix** when secured.

Table 4: Existing Conditions Level of Service Analysis

INTERSECTION	AM Peak Hour		PM Peak Hour		SAT Peak Hour	
	LOS	DEL	LOS	DEL	LOS	DEL
<i>Route 3 at Front Street / Driveway - Signalized</i>						
Driveway - SELT	C	25.3	C	31.3	C	20.0
Driveway - SER	-	-	C	30.0	B	19.3
Front - NWLT	C	23.6	D	39.0	C	22.4
Front - NWR	C	22.1	C	30.2	B	19.6
Route 3 - NEL	C	33.8	D	42.3	D	42.4
Route 3 - NET	A	9.3	B	11.5	B	13.5
Route 3 - NER	A	7.0	A	6.9	B	10.1
Route 3 - SWL	E	65.5	D	39.0	C	29.6
Route 3 - SWTR	B	11.7	A	7.4	B	10.9
Overall	B	13.9	B	13.8	B	15.1
<i>Route 3 at Wire Road - Unsignalized</i>						
Wire - EB	C	22.6	C	22.3	C	17.2
Route 3 - NBL	A	9.3	B	10.3	A	9.4
<i>Route 3 at MYA Driveway - Unsignalized</i>						
Driveway - WB	-	-	D	28.5	E	48.0
Route 3 - SB	-	-	A	9.6	A	8.8
<i>Route 3 at Baboosic Lake Road / Driveway - Signalized</i>						
Baboosic Lake - EBL	D	51.2	D	36.6	D	43.6
Baboosic Lake - EBTR	D	39.7	C	31.4	D	36.2
Driveway - WB	E	61.7	E	67.7	D	49.1
Route 3 - NBL	E	55.8	E	58.6	D	50.8
Route 3 - NBTR	B	18.7	D	47.7	A	9.4
Route 3 - SBL	E	76.8	E	61.6	D	51.5
Route 3 - SBT	C	25.9	D	36.2	C	23.5
Route 3 - SBR	B	17.0	C	24.9	B	16.8
Overall	C	30.5	D	41.2	C	24.8
<i>Route 3 at CVS Driveway / Gas Station - Signalized</i>						
CVS - EBLT	C	34.0	D	49.8	D	46.5
CVS - EBR	C	27.3	D	36.8	D	36.7
Route 3 - NBL	C	31.1	D	52.2	D	46.4
Route 3 - NBTR	A	5.0	B	12.1	A	6.1
Route 3 - SBL	C	26.5	D	36.9	D	42.2
Route 3 - SBTR	B	14.3	B	15.1	B	11.5
Overall	B	12.0	B	18.0	B	13.5

LOS – Level of Service

DEL – Control Delay, reported in seconds per vehicle

Movements with “-” have no demand during the respective peak hour and therefore operate with no delay.

5.0 FUTURE CONDITIONS

5.1 FUTURE TRAFFIC VOLUMES

Intersection improvement projects are normally designed to accommodate traffic projected to a future design year. For this project, it was decided to use a seven-year projection to 2029.

Discussions with the Town of Merrimack recommended a 1.0% per year growth rate. The growth rate was applied and compounded over the seven-year design horizon to establish the projected future 2029 peak hour volumes.

Background development trips within the study area were revised based on a Traffic Impact Assessment (TIA) prepared by Stephen G. Pernaw & Company, Inc. dated May 2022 for a 48-unit workforce housing development. Review of the TIA suggests the trips generated by this proposed development through the study area are not significant and are considered to be reflected in the annual growth rate.

The 2029 design year weekday AM and PM, and Saturday peak hour traffic volumes are shown in **Figure 4** and **Figure 5**, respectively.

5.2 TRAFFIC SIGNAL WARRANT ANALYSIS

In order to justify the installation or continued operation of traffic signals at an intersection, one or more of the signal warrants in the *Manual on Uniform Traffic Control Devices* (MUTCD) must be met. If one or more of the warrants is met and it is felt the installation of a signal will improve the overall safety and operation of the intersection, then installation or continued operation of a signal operation is justified.

The nine warrants outlined in the MUTCD are as follows:

Warrant 1, Eight Hour Vehicular Volume

Warrant 6, Coordinated Signal System

Warrant 2, Four Hour Vehicular Volume

Warrant 7 Crash experience

Warrant 3, Peak Hour

Warrant 8, Roadway Network

Warrant 4, Pedestrian Volume

Warrant 9, Intersection Near a Grade Crossing

Warrant 5, School Crossing

A signal warrant analysis was performed for the intersection of Route 3 and Wire Road in accordance with the procedures and criteria described in the MUTCD. This assessment focused on vehicular volume-based Warrants 1, 2, and 3. A summary of this exercise is provided in **Table 5**. The complete signal warrant analysis is included in the **Appendix**.

Table 5: Traffic Signal Warrant Analysis

INTERSECTION Route 3 at Wire Road	Warrant 1 8-Hour Volume	Warrant 2 4-Hour Volume	Warrant 3 Peak Hour Volume
Unadjusted Traffic Volume	YES	YES	YES
Reduced Right Turn Volume*	NO	NO	YES

Note: Warrants 4 through 9 were not evaluated.

* Right Turns reduced in accordance with NCHRP Report 457 Figure 2-11

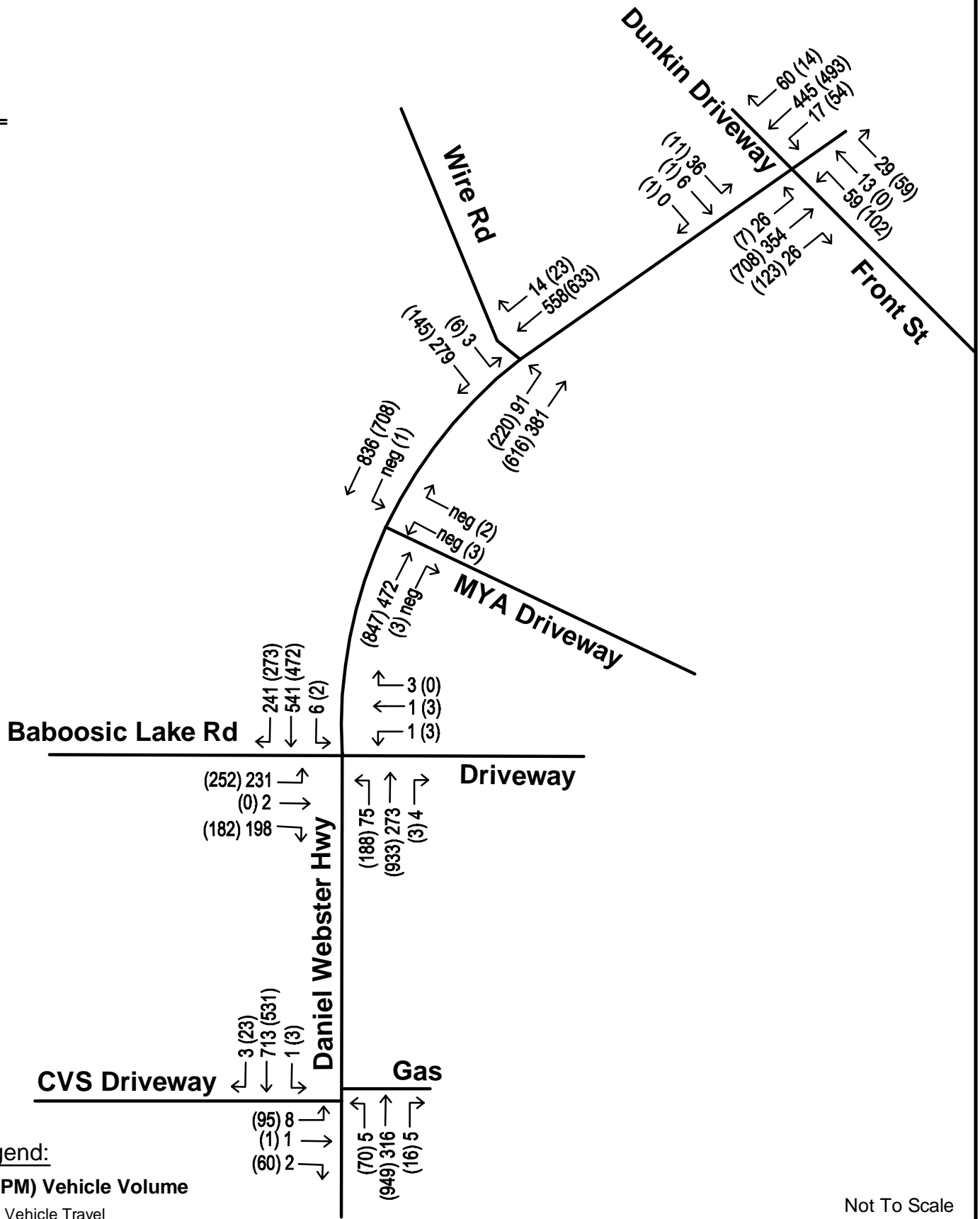


Figure 4
 Future 2029
 AM & PM Peak Hour Volume

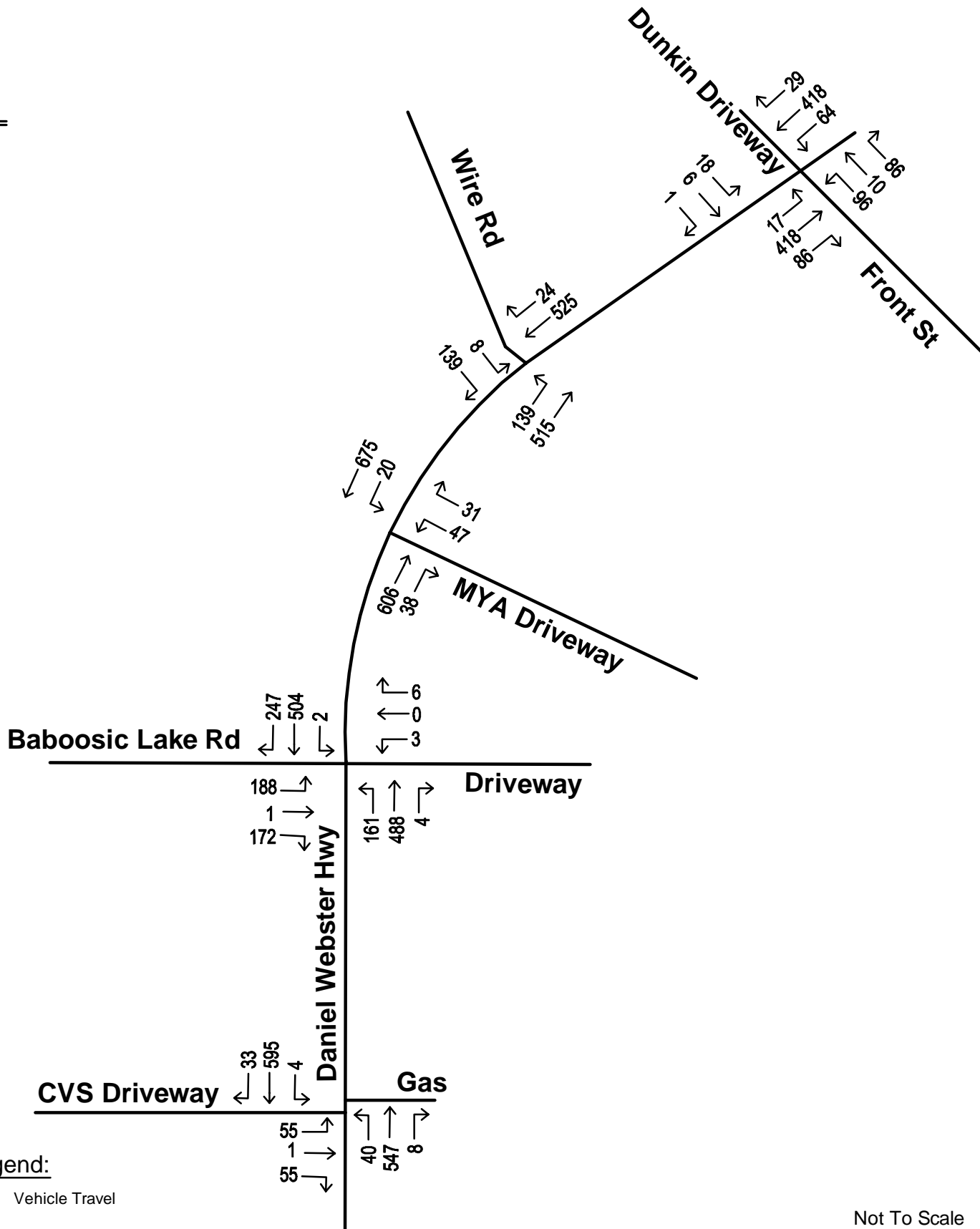


Figure 5
Future 2022
Saturday Peak Hour Volume

The initial review found volume departing Wire Road is high enough throughout the 12-hour period to meet all three warrants. However, the turning volumes suggest approximately 90-100% of all hourly traffic departing Wire Road are right turns to Route 3 South. To address this, BETA applied guidance in NCHRP Report 457 Figure 2-11, which recommends reducing minor street volume to account for the effect of Right Turns on Red. This exercise found significant reductions in right turns throughout the course of the 12-hour period, below thresholds for Warrant 1 and Warrant 2. The reduced volumes do continue to meet Warrant 3 (Peak Hour) in the afternoon/evening commuting peak period.

Since Warrant 3 is met for the signalized intersection, even after applying the reduction for right turns, signalization of the intersection is justified.

5.3 FUTURE “NO-BUILD” LEVEL OF SERVICE ANALYSIS

To examine the “No-Build” scenario, a level of service analysis was performed for the project intersections with projected (2029) volumes under existing geometry. The criteria used for the analysis is the same as in **Section 3.5**. As a result of the estimated increase in traffic volumes, traffic operations can be expected to degrade when compared to existing conditions. A summary of No-Build conditions can be seen in **Table 6**. The complete capacity analysis is provided in the **Appendix**.

The increased traffic volume due to growth increased the overall intersection delay for Baboosic Lake Road in the evening peak period to LOS E conditions. This is due to worsened conditions for northbound traffic at the signal, which degraded from LOS E to LOS F conditions. All other signalized intersections continue to operate with LOS C or better in all three peak periods. The unsignalized intersection of Wire Road continues to operate with acceptable LOS D or better conditions in the peak hour, only slightly degraded from LOS C in the existing condition. The MYA driveway degraded to LOS F during the Saturday mid-day peak hour, down from LOS E in existing conditions.

6.0 ALTERNATIVES ANALYSIS

Concept alternatives were developed for the corridor, and capacity analyses were conducted for the intersection as needed. Once the preferred alternative concept is determined, capacity analyses for the corridor will be included in the Build section of the study. The alternatives outlined below were compared to determine the option that best meets the stated project need to improve safety and traffic operations for pedestrians and vehicles at the intersection and along the corridor.

6.1 WIRE ROAD INTERSECTION

Three intersection reconfiguration options were established for the US Route 3 at Wire Road intersection. The three options are discussed in the following sections. Conceptual plans for the three intersection options are included in the **Appendix**.

6.1.1 OPTION 1 – REALIGNED STOP CONTROLLED INTERSECTION

Option 1 maintains an unsignalized intersection with a realigned Wire Road approach that intersects US Route 3 at closer to a 90-degree angle to improve sight lines and remove excess pavement width. The Wire Road eastbound approach would continue to be stop controlled and would consist of one shared left/right-turn lane. The right turn volumes do not warrant the need for exclusive left and right turn lanes. The northbound US Route 3 approach to Wire Road would provide a longer 11-foot wide, 160-foot-long left-turn lane. A 10-foot wide, 100-foot-long exclusive left-turn lane would be provided on the US Route 3 southbound approach to the MYA driveway which is approximately 200 feet south of the US Route 3 at Wire Road intersection.

Table 6: Future (No-Build) Conditions Level of Service Analysis

INTERSECTION	AM Peak Hour		PM Peak Hour		SAT Peak Hour	
	LOS	DEL	LOS	DEL	LOS	DEL
<i>Route 3 at Front Street / Driveway - Signalized</i>						
Driveway - SELT	C	28.1	C	29.9	C	21.9
Driveway - SER	-	-	C	28.9	C	21.1
Front - NWLT	C	26.2	C	34.3	C	24.9
Front - NWR	C	24.3	C	29.1	C	21.5
Route 3 - NEL	D	36.1	D	43.6	D	53.5
Route 3 - NET	A	8.9	B	14.5	B	14.8
Route 3 - NER	A	6.5	A	7.9	B	10.7
Route 3 - SWL	E	69.1	D	40.3	C	29.0
Route 3 - SWTR	B	11.3	A	8.7	B	10.7
Overall	B	14.0	B	15.3	B	16.0
<i>Route 3 at Wire Road - Unsignalized</i>						
Wire - EB	D	27.9	D	26.5	C	19.4
Route 3 - NBL	A	9.6	B	10.7	A	9.7
<i>Route 3 at MYA Driveway - Unsignalized</i>						
Driveway - WB	-	-	D	32.4	F	62.9
Route 3 - SB	-	-	A	9.9	A	9.0
<i>Route 3 at Baboosic Lake Road / Driveway - Signalized</i>						
Baboosic Lake - EBL	D	47.8	C	34.7	D	41.1
Baboosic Lake - EBTR	D	37.7	C	29.6	C	34.8
Driveway - WB	E	61.7	E	67.7	D	49.1
Route 3 - NBL	E	56.9	E	56.8	D	50.0
Route 3 - NBTR	C	20.7	F	88.6	B	10.7
Route 3 - SBL	E	76.8	E	61.6	D	51.5
Route 3 - SBT	C	30.8	D	45.2	C	28.3
Route 3 - SBR	B	18.8	C	27.3	B	18.8
Overall	C	32.1	E	59.4	C	26.3
<i>Route 3 at CVS Driveway / Gas Station - Signalized</i>						
CVS - EBLT	C	34.0	D	49.8	D	46.5
CVS - EBR	C	27.3	D	36.8	D	36.7
Route 3 - NBL	C	31.1	D	52.2	D	46.4
Route 3 - NBTR	A	5.1	B	13.8	A	6.4
Route 3 - SBL	C	25.7	D	35.8	D	39.6
Route 3 - SBTR	B	16.1	B	16.7	B	13.0
Overall	B	13.2	B	19.1	B	14.0

LOS – Level of Service

DEL – Control Delay, reported in seconds per vehicle

Movements with “-” have no demand during the respective peak hour and therefore operate with no delay.

In addition, the pedestrian crossing on the north leg of the MYA driveway intersection would be highlighted with a Rectangular Rapid Flashing Bacon (RRFB) assembly. Also provided at the intersection will be 5-foot sidewalks, granite curbing, and ADA accessible ramps and crossings. A painted median is provided on Wire Road to allow for truck turns at the intersection without encroachment on the opposing lanes. Relocating the existing MYA/Twin Bridge Park driveway to the Wire Road intersection was considered; however, a through movement to and from the MYA property at the relocated driveway would create a condition where vehicles have to cross two lanes of traffic on US Route 3 without a signal. It is a safer option to retain the existing MYA driveway configuration, and allow vehicles to turn right out of the MYA property and access Wire Road via the dedicated left turn lane. This concept is provided in the **Appendix**.

There is no projected change to intersection operations as a result of this configuration.

6.1.2 OPTION 2 – ROUNDABOUT

A hybrid roundabout concept was developed for the US Route 3 at Wire Road intersection. The hybrid roundabout includes a two-lane US Route 3 northbound approach, with a 175-foot left-turn lane and a through lane, and single lane approaches for Route 3 southbound and Wire Road. This concept is provided in the **Appendix**. Capacity analyses were conducted based on the Georgia Department of Transportation (GDOT) Roundabout Analysis Tool Version 4.2.¹ The Tool utilizes similar methodologies to the Highway Capacity Manual (HCM), summarizing Level of Service based on delay per passenger car unit. The assessment was conducted based on existing traffic volumes, summarized in **Table 7**, and Future year traffic volume, summarized in **Table 8**. Full analysis results are provided in the **Appendix**.

Table 7: Existing Conditions Analysis - Roundabout

INTERSECTION	AM Peak Hour		PM Peak Hour		SAT Peak Hour	
	LOS	DEL	LOS	DEL	LOS	DEL
<i>Route 3 at Wire Road – Hybrid Lane Roundabout</i>						
Route 3 - SWB	A	8.8	B	12.2	A	8.7
Route 3 - NB L	A	3.5	A	3.9	A	3.5
Route 3 - NB R	A	6.1	A	7.0	A	6.3
Wire - SEB	B	10.6	A	8.5	A	7.3
Overall	A	7.9	A	8.9	A	7.1

LOS - Level of Service

DEL - Delay, reported in seconds per passenger car unit (PCU)

¹ Georgia Department of Transportation, *Roundabout Design Guide*, Revision 2, dated 11/9/2022

Table 8: Future Conditions Analysis - Roundabout

INTERSECTION	AM Peak Hour		PM Peak Hour		SAT Peak Hour	
	LOS	DEL	LOS	DEL	LOS	DEL
<i>Route 3 at Wire Road – Hybrid Lane Roundabout</i>						
Route 3 - SWB	A	9.6	B	14.2	A	9.5
Route 3 - NB L	A	3.5	A	4.0	A	3.6
Route 3 - NB R	A	6.4	A	7.4	A	6.7
Wire - SEB	B	12.1	A	9.3	A	7.9
Overall	A	8.6	A	10.0	A	7.7

LOS - Level of Service

DEL - Delay, reported in seconds per passenger car unit (PCU)

The capacity analysis results for both the existing and future years suggest favorable LOS conditions (B or better) given the roadway alignments and the limited number of left turns from Wire Road in the peak periods. This results in a limited number of conflicts within the roundabout, thereby minimizing delays but improving safety and visibility for vehicles and motorists departing Wire Road. However, the construction of the concept requires significant impacts to properties including the MYA/Twin Bridge Park property, 1 Wire Road, 2 Wire Road, and 4 Wire Road to accommodate the required deflection and the size of the circle itself. These large right-of-way acquisitions costs associated with this option are highly undesirable.

6.1.3 OPTION 3 – SIGNALIZED INTERSECTION

The Option 3 concept provides a complete traffic signal at the intersection of Wire Road. The concept maintains the realigned Wire Road approach as discussed for Option 1 with one 12-foot-wide shared left/through/right-turn lane. A new two-way driveway for the MYA/Twin Bridge Park would be provided across from Wire Road to form a four-legged intersection. The left turn volumes are low and do not warrant the need for exclusive left and right/thru turn lanes on Wire Road. An 11-foot wide, 160-foot left-turn lane and a through lane would be provided on the US Route 3 northbound approach and the southbound approach would maintain a shared left/through/right-turn lane. The signal system would include pedestrian signals across all four legs of the intersection. An exclusive left turn lane southbound on Route 3 into the relocated MYA driveway was considered; however, the existing left turn volume to MYA is low and adding an additional lane would impact the adjacent bridge project currently under design. Five-foot wide sidewalks, granite curbing and ADA accessible ramps and crossings will be provided at the intersection. A painted median is provided on Wire Road to allow for truck turns at the intersection without encroachment on the opposing lanes.

The MYA driveway located approximately 200 feet south of the Route 3 at Wire Road intersection would be converted from a full access to right-in/right-out with a concrete island to discourage left turns. Consistent with **Section 7.1**, the pedestrian crossing on the north leg of the MYA driveway intersection would be highlighted with a Rectangular Rapid Flashing Bacon (RRFB) assembly.

Capacity analysis for this scenario were conducted in accordance with **Section 3.5** assuming a fully actuated traffic signal at the Wire Road intersection, and the conversion of the existing MYA driveway to right-in/right-out. This scenario also assumes coordination with abutting intersections, which is

expounded in **Section 7.4**. A summary of intersection operations for Option 3 is provided in **Table 9**. Full analysis results are provided in the **Appendix**.

Table 9: Future Conditions Analysis – Wire Road Option 3

INTERSECTION	AM Peak Hour		PM Peak Hour		SAT Peak Hour	
	LOS	DEL	LOS	DEL	LOS	DEL
<i>Route 3 at Wire Road / MYA Driveway - Signalized</i>						
Wire - EB	D	51.9	D	52.3	D	40.2
MYA - WB	-	-	D	51.5	D	53.1
Route 3 - NBL	A	2.2	A	1.8	A	3.6
Route 3 - NBTR	A	1.7	A	1.7	A	4.4
Route 3 - SB	A	7.6	A	8.4	B	10.6
Overall	B	15.0	A	9.1	B	12.3
<i>Route 3 at MYA Driveway - Unsignalized</i>						
MYA - WBR	-	-	C	16.3	B	13.7

LOS – Level of Service

DEL – Control Delay, reported in seconds per vehicle

Movements with “-” have no demand during the respective peak hour and therefore operate with no delay.

The traffic signal analysis found the proposed traffic signal with coordination is expected to maintain LOS D conditions for Wire Road with negligible impact to operations along US Route 3 in either direction. This is effectively because the volume departing Wire Road are almost entirely right turns and it is expected that Right Turn on Red will be allowed. Realigning the MYA driveway to accommodate left turns with a dedicated signal phase improves operations from LOS F to LOS D in the weekday evening and Saturday mid-day peak hours. The existing driveway converted to only allow right turns is projected to operate with LOS C or better in the same peak hours.

7.0 OTHER PROJECT CONSIDERATIONS

7.1 ROADWAY CROSS SECTION

Independent of the Wire Road intersection concepts, the Project includes the installation of new 5-foot-wide asphalt sidewalks, concrete ADA compliant pedestrian ramps and crossings, and 6-inch granite curb from Baboosic Lake Road to the northerly project limit, see the blue boundary shown in **Figure 1**. Existing driveway openings shall be maintained regardless of the addition of curb and sidewalks. Pavement markings will consist of a 12-foot travel lane in each direction with 3-foot shoulders. A combination of full depth box widening and mill and overlay is proposed from just south of the existing MYA driveway to just south of the Baboosic Brook bridge project. The Project intends to include some form of geometric change to the corridor to reduce the visual perception of “wide open pavement”, with the intent to reduce speeds closer to the posted speed limits and improve sight lines. The roadway geometric changes will also allow WB-50 tractor trailers, school buses and emergency vehicles to make the turning movements at the Wire Road intersection without encroachment on the opposing lanes. A retaining wall will be required in front of 480 DW Highway (Route 3) with the addition of a sidewalk. Guardrail will be installed along a portion of the frontage of MYA/Twin Bridge Park property. The project will maintain the existing pedestrian crossing across Route 3 to the MYA/Twin Bridge Park entrance and

include two solar powered Rectangular Rapid Flashing Beacons (RRFB). Bicycle accommodations are provided through the shared lane use of the travel lanes and shoulders.

7.2 STORMWATER

The project is not anticipated to result in significant alterations to existing drainage patterns or significant increases in impervious area; therefore, stormwater improvements will be limited to providing additional catchment structures and installing Best Management Practices (BMPs) to meet Town, State, and Federal regulations to the extent required. BMPs will generally consist of a combination of deep sump catch basins, leaching basins, and stormwater basins with sediment forebays, which will provide water quality treatment, peak flow mitigation, and groundwater recharge. Upgrades to the existing closed drainage systems are not anticipated to be necessary.

7.3 CHURCH STREET

Independent of Wire Road, the Project includes the closure of access to Church Street from Route 3. The Town has indicated that there are sight line issues with turning movements on Church Street and a desire to extend pedestrian accommodation north of the library. However, the current grade of Church Street, at this location, exceeds 15% slope. To meet ADA compliancy and provide an accessible crossing requires Church Street to be reconstructed to even steeper grades. The Town has proposed a turnaround at the driveways of the adult center, library and 480 DW Highway (Route 3). The turnaround would allow driveway access to be maintained for the three land uses via Baboosic Lake Road. A new driveway for the library directly to Route 3 was considered, however the steep grades near Church Street make a driveway opening unfeasible and locations on flatter slopes would likely require the removal of library parking spaces. Creating a new driveway opening is undesirable, as southbound queues from Baboosic Lake Road intersection extend past the library and Church Street at peak hour. From an access management standpoint, the closure of Church Street at this location will reduce the conflict points on Route 3. A concept sketch of the Church Street location is included in the **Appendix**.

7.4 INTERSECTION COORDINATION AND COMMUNICATIONS

The signalized Option 3 for Wire Road includes the installation (or upgrade) of communication and coordination between the four signalized intersections within the Study Area. This communication and traffic signal coordination is a component to meet the stated purpose of the Project to improve vehicular flow and minimize vehicle delay, while also providing for increased safety for all users.

The existing wireless communication between the intersections of Route 3 and CVS plaza and Route 3 and Baboosic Lake Road will be retained and continued to the newly signalized intersection at Wire Road and to the Route 3 at Front Street intersection. To accommodate this, both the proposed Wire Road traffic signal and the existing signal system at Front Street will need new equipment for wireless coordination.

In conjunction with traffic signal installation and coordination equipment, updated traffic signal timing plans will be developed to include the additional intersections and updated traffic count data. Proposed communication updates along the corridor afford the opportunity to develop full system coordinated timing plans during all peak periods.

As part of this assessment, capacity analysis for updated coordination amongst the four intersections were conducted in accordance with **Section 3.5** and **Section 6.1.3**. A summary of intersection operations for this condition is provided in **Table 10**. Full analysis results are provided in the **Appendix**.

Table 10: Future Conditions Analysis – Coordinated Signals

INTERSECTION	AM Peak Hour		PM Peak Hour		SAT Peak Hour	
	LOS	DEL	LOS	DEL	LOS	DEL
<i>Route 3 at Front Street / Driveway - Signalized</i>						
Driveway - SELT	D	53.8	D	46.0	D	37.9
Driveway - SER	-	-	D	45.3	D	36.9
Front - NWLT	E	63.4	D	54.8	D	46.6
Front - NWR	D	49.9	D	45.7	D	37.3
Route 3 - NEL	D	52.7	E	69.5	D	51.2
Route 3 - NET	A	6.3	B	11.0	B	11.0
Route 3 - NER	A	4.4	A	4.0	B	17.7
Route 3 - SWL	E	63.3	E	56.5	D	46.4
Route 3 - SWTR	A	6.2	A	8.4	A	9.5
Overall	B	16.1	B	15.9	B	18.7
<i>Route 3 at Wire Road / MYA Driveway - Signalized</i>						
Wire - EB	D	51.9	D	52.3	D	40.2
MYA - WB	-	-	D	51.5	D	53.1
Route 3 - NBL	A	2.2	A	1.8	A	3.6
Route 3 - NBTR	A	1.7	A	1.7	A	4.4
Route 3 - SB	A	7.6	A	8.4	B	10.6
Overall	B	15.0	A	9.1	B	12.3
<i>Route 3 at Baboosic Lake Road / Driveway - Signalized</i>						
Baboosic Lake - EBL	D	47.3	D	39.3	D	35.7
Baboosic Lake - EBTR	D	37.8	C	33.0	C	31.4
Driveway - WB	E	64.2	E	66.2	D	49.0
Route 3 - NBL	D	49.8	D	54.6	D	46.6
Route 3 - NBTR	B	12.3	F	82.4	B	13.0
Route 3 - SBL	F	87.8	E	74.8	D	52.7
Route 3 - SBT	C	26.3	D	47.6	D	47.7
Route 3 - SBR	C	25.0	E	71.2	D	48.3
Overall	C	29.7	E	63.1	D	35.2
<i>Route 3 at CVS Driveway / Gas Station - Signalized</i>						
CVS - EBLT	E	73.0	D	50.6	D	46.4
CVS - EBR	E	57.1	D	37.7	D	36.7
Route 3 - NBL	E	71.0	D	54.7	D	46.3
Route 3 - NBTR	A	3.3	B	16.0	A	7.3
Route 3 - SBL	D	43.4	D	45.3	E	60.0
Route 3 - SBTR	A	2.1	A	4.7	B	16.4
Overall	A	3.6	B	16.7	B	15.7

LOS – Level of Service

DEL – Control Delay, reported in seconds per vehicle

Movements with “-” have no demand during the respective peak hour and therefore operate with no delay.

The coordinated traffic signal analysis found the updated coordination and traffic timing schemes result in maintained overall intersection operations of generally LOS C or better in all three peak hours, with the exception of Baboosic Lake Road which operates at LOS E in the weekday evening commuting peak hour. Independent intersection movements were found to increase in delay when compared to the Future (No-Build) shown in **Table 6** given the methodologies recommend by NHDOT to alter the Future Year Peak Hour Factor. This parameter change generally represents or accounts for changes in peak hour travel patterns given changes in the roadway design. In general, the updated timings and coordination results in improved conditions for major street (Route 3) through traffic, thereby increasing throughput along the corridor, at the expense of increased delays for side streets and protected left turning movements.

7.5 RIGHT OF WAY

The proposed project will be mostly undertaken in areas that are currently owned and maintained by the Town. Some proposed work will be located on private property and as such, temporary and permanent easements/takings will be required. Options 1 and 3 have similar easement requirements, mostly temporary easement for grading, slope work and construction access. Permanent easements/takings in these options are mostly on Wire Road for the addition of new sidewalk. Option 2 has much more extensive permanent impacts to private property as a result of the roundabout and will require the most amount of right of way acquisition. See Appendix for concept plans with easement locations and cost estimates for acquisition totals.

7.6 UTILITIES

The proposed project will require some utility relocation as a result of construction activities. Currently there is underground gas, sewer, water, drainage, electrical services via risers and overhead wire within the project limits. All three options will require the reset of several utility poles, risers and underground services that include electric, cable and telephone. With the addition of curb and sidewalk and roadway geometric changes, modifications to existing closed drainage systems will also be required. Drainage modifications are proposed for all options to meet all local, state, and federal requirements. Water service relocations may be required to avoid conflicts with the proposed drainage. Options 1 and 3 are not anticipated to have impacts on the existing water mains, sewer and gas. Option 2 (roundabout) will require relocation of a water main, and gas as depicted on the concept plans. Coordination with the utility companies will be required.

7.7 CONSTRUCTION IMPACTS TO TRAFFIC

All options will require some impact to existing traffic due to construction activities. A traffic management plan is imperative to ensure consistent and safe traffic operations during construction. There will likely be a need for flaggers, uniformed police officers, message signs, construction signage, temporary pavement markings, lane shifts and temporary one-way alternating configuration. Delays and congestion will occur during construction operations, however by implementing Smart Work Zone Technologies such as advance signage and public outreach, traffic impacts can be minimized. These systems are intended to better inform motorists, encourage them to take alternate routes, reduce their frustrations, and enhance safety for motorists and workers.

8.0 DESIGN CRITERIA

Below is a list of the relevant design criteria and manuals:

- 2016 NHDOT Standard Specifications
- NHDOT Highway Design Manual
- Proposed Accessibility Guidelines for Pedestrian Facilities in the Public Right-of- Way
- ADA Standards for Transportation Facilities
- AASHTO 2018 Geometric Design of Highways and Streets
- AASHTO Roadside Design Guide
- NCHRP Report 672 Roundabouts: An Informational Guide
- NCHRP Report 457 Evaluating Intersection Improvements: An Engineering Study Guide
- Manual on Uniform Traffic Control Devices (MUTCD)

9.0 ENVIRONMENTAL REVIEW AND DOCUMENTATION

Environmental, cultural and natural resource support and documentation for the project will be provided by QCC. It is anticipated that as a result of the project, there will be minimal impacts to culture and natural resources areas, most of which will be temporary in nature. Relevant documentation will be provided in the **Appendix** when secured. It is noted that the Town owned parcel that encompasses Merrimack Youth Association and Twin Bridge Park is a section 4F property and construction activities will be within 250 feet of a shoreland (Baboosic Brook).

10.0 PUBLIC MEETING

The Public Meeting to discuss the Alternatives is scheduled to be held on December 15, 2022. Meeting minutes and presentation slides will be provided in the **Appendix** when secured.

11.0 PREFERRED ALTERNATIVE

As described in **Section 6.0**, design alternatives were developed that meet the project's purpose and need, to improve safety and traffic operations for pedestrians and vehicles at the intersection of US Route 3 and Wire Road and improve operations along the US Route 3 corridor in the project area. Option 3 is the preferred alternative as it provides pedestrian and vehicular safety improvements and also considers the geometric constraints that limit impacts to surrounding properties.

The following improvements are recommended at the US Route 3 and Wire Road intersection:

- ✓ A complete traffic signal system with pedestrian signal control on all four legs of the intersection
- ✓ The Wire Road approach realigned with one shared left/through/right-turn lane
- ✓ A new two-way driveway for the MYA across from Wire Road to form a four-legged intersection.
- ✓ A 155-foot left-turn lane and a through lane on the Route 3 northbound approach
- ✓ Video detection via single camera on all approaches
- ✓ Communication equipment, including a GPS clock unit and antenna

The following improvements are recommended at the US Route 3 and existing MYA Driveway intersection:

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- ✓ The MYA driveway converted from full access to right-in/right-out.
- ✓ Maintain the existing pedestrian crossing on the north leg of the MYA driveway intersection highlighted with a Rectangular Rapid Flashing Beacon (RRFB) assembly.

The following improvements are recommended at the remaining intersections along US Route 3 at the CVS driveway, Baboosic Lake Road, and Front Street:

- ✓ Wireless coordination between the four signalized intersections.
- ✓ Updated/new coordination plans for each of the intersections.
- ✓ Wireless communication equipment consisting of a GPS clock unit at the Route 3 and Front Street intersection.

Corridor wide improvements are recommended as outlined in **Section 7.1**. The following proposed improvements will enhance pedestrian and vehicular safety on a corridor level.

- ✓ 12-foot-wide travel lanes, 3-foot shoulders, 5-foot asphalt sidewalk, granite curb, ADA accessible ramps
- ✓ Revised geometry to improve sight lines and remove perception of “wide open pavement” areas
- ✓ Guardrail along frontage of MYA/Twin Bridge Park property
- ✓ Closure of US Route 3 access to Church Street (access management)
- ✓ Drainage improvements
- ✓ Rapid rectangular flashing beacons
- ✓ Full depth box widening and mill and overlay

11.1 COST ESTIMATE

Costs per component are provided in **Section 6.0** based on each component considered. The following table summarizes cost by option. **Table 11** provides a summary of the estimated construction cost per option broken up into a 2022 and 2025 construction cost. A detailed breakdown of the cost per alternative is provided in the **Appendix**.

Table 11: Wire Road Construction Cost Summary

Options	2022 Construction Cost	2025 Construction Cost
Option 1 - Realigned Stop Controlled Intersection	\$890,000	\$970,000
Option 2 - Roundabout	\$1,610,000	\$1,760,000
Option 3 - Signalized Intersection	\$1,400,000	\$1,530,000