US Route 5 Improvements Study

Arboretum Lane to Highland Avenue
Hartford, Vermont

Project Definition Report

Prepared by:

Stantec

Prepared for:

VERMONT
AGENCY OF TRANSPORTATION

April 16, 2020

The preparation of this report has been financed in part through grant[s] from the Federal Highway Administration and Federal Transit Administration, U.S. Department of Transportation, under the State Planning and Research Program, Section 505 [or Metropolitan Planning Program, Section 104(f)] of Title 23, U.S. Code. The contents of this report do not necessarily reflect the official views or policy of the U.S. Department of Transportation.

Prepared by:

Stantec Consulting Services Inc.
55 Green Mountain Drive
So. Burlington, VT 05403
(802) 864-0223

Under the direction of:

Vermont Agency of Transportation

Table of Contents

LIST OF TABLES

LIST OF FIGURES

1.0 EXECUTIVE SUMMARY

This study involves a 2 mile section of the US Route 5 corridor in Hartford, Vermont. It extends from the US 5/Arboretum Lane intersection northerly to the US 5/Highland Avenue intersection as shown in Figure 1 on page 4. This study does not address issues associated with the US 5/US 4 intersection, as this is the subject of another VTrans study and it does not include the US 5/Sykes Mountain Avenue intersection, as its reconstruction into a roundabout is scheduled to start in 2020. This study solicited stakeholder and public input, compiled and analyzed existing conditions, established corridor needs, evaluated solutions to address these needs and determined the preferred improvements along the corridor.

Based on stakeholder and public input, the more significant needs identified along this corridor include:

- Address safety concerns in the project area, primarily at the US 5/VT 14 intersection
- Provide for safe and efficient bicycle and pedestrian travel through the corridor.
- Address congestion issues in the project area, primarily at the US 5/I-91 interchange ramps and the US 5/Veterans Drive intersection.

After seeking input from stakeholders, the public and internal VTrans staff, the following are the preferred short term improvements for the corridor.

- Continue the four Town of Hartford ongoing projects along this corridor that will contribute to the corridor improvements: US5/Sykes Mtn Avenue Roundabout (2020-2021): Hartford STP 0113(15)S; Sykes Mountain Avenue Sidewalk (2020-2021): Hartford STP EH09(15);US 5 Sidewalk – Arboretum Lane to Ballardvale Drive: Hartford STP E10(18); US 5 Sidewalk – Ballardvale Drive to Sykes Mountain Avenue: Hartford BP 14(4).
- In conjunction with the VTrans VT Route 14 Hartford Class 1 Resurfacing/Hartford STP PC21(4) project which is currently programed for the 2021 construction season incorporate the following along VT Route 14:
    - Replace the existing traffic signal equipment at US5/VT 14 and VT14/Bridge/Pine Street intersections
    - Reconfigure the US 5 Northbound right turn lane at VT 14 to a more acute angle to address existing rear-end crash pattern.
    - Replace overhead signs at US 5/VT 14 and the VT 14/Bridge/Pine Street intersection with ground mounted signs.
    - Convert the existing VT 14 Eastbound left turn lane at the VT 14/Bridge/Pine Street intersection to a combined through and left turn lane.

- In conjunction with the VTrans US 5 Hartland - Wilder Resurfacing, which is anticipated to be part of the 2022-2023 VTrans Resurfacing program, incorporate the following along US Route 5:
    - For the US Route 5 corridor convert the existing four lane section to two lanes, one in each direction, and provide buffered bike lanes in the existing right hand lanes from Highland Avenue to I-89.
    - At the Highland Avenue and VT 14 intersections reconfigure the US 5 approach lanes to accommodate the buffered bike lane.
    - At the US 5/North Main Street intersection replace the existing traffic signal; add a North Main Street approach crosswalk with a pedestrian signal; reconfigure the approach lanes to accommodate the buffered bike lanes; and realign the North Main street approach right turn to be more acute.
    - At the I-91 Northbound Off Ramp reconfigure the intersection to a T-type intersection with a 2 lane ramp approach; widen I-91 Northbound Off Ramp to 2 lanes for 400 feet; remove the existing I-91 Northbound Off Ramp to Sykes Mountain Avenue; provide lane markings compatible with proposed roundabout at Sykes Mountain Avenue; and provide a crosswalk at the I-91 Northbound Off Ramp off ramp.
    - At the I-91 Southbound Off Ramp widen the off ramp to 2 lanes for 200 feet; realign the US 5 southbound thru lane through the intersection to minimize the existing lane shift; provide channelization with yield condition for US 5 Southbound right turns; and maintain one US 5 Southbound thru lane from Sykes Mountain Avenue to Southbound ramp.
    - From Ballardvale Drive to Veteran's Drive continue US 5 bike lanes with pavement markings and signs through Veterans Drive.

This study also established preferred long term improvements so as they can be considered for programming by VTrans for future funding. These preferred long term improvements are as follows:

- At the US 5/I-91 Northbound Ramps realign the I-91 Northbound On Ramp to intersect US 5 opposite the I-91 Northbound Off Ramp; reconfigure medians to reflect new alignment, install a traffic signal at this intersection; and coordinate its operation with adjacent signals.
- At the US 5/I-91 Southbound Ramps install a traffic signal at this intersection and coordinate its operation with adjacent signals.

Composite plans of these improvements are in Appendix A . The Town of Hartford Selectboard and management of the VTrans Project Delivery Bureau approved these preferred improvements and these approvals are documented in Appendix D.

2.0 INTRODUCTION

In response to numerous public concerns and safety issues along the US Route 5 corridor in Hartford Vermont, the Vermont Agency of Transportation met with Town staff in March of 2018. It was determined that although the corridor has some developing improvement projects and studies, there would be a benefit to have a study look at the whole corridor and provide a cohesive plan. The product is this Project Definition Report that identifies issues and concerns through data collection and public input, provides a project purpose and need and develops and evaluates alternative improvement strategies leading to the selection of preferred improvements and/or alternatives.

The process includes working closely with a stakeholder group made up of Town staff, Two Rivers Ottaquchee Regional Commission (TRORC) staff, and others, and soliciting public input on alternative solutions. Advisory committee members for this project are listed below.

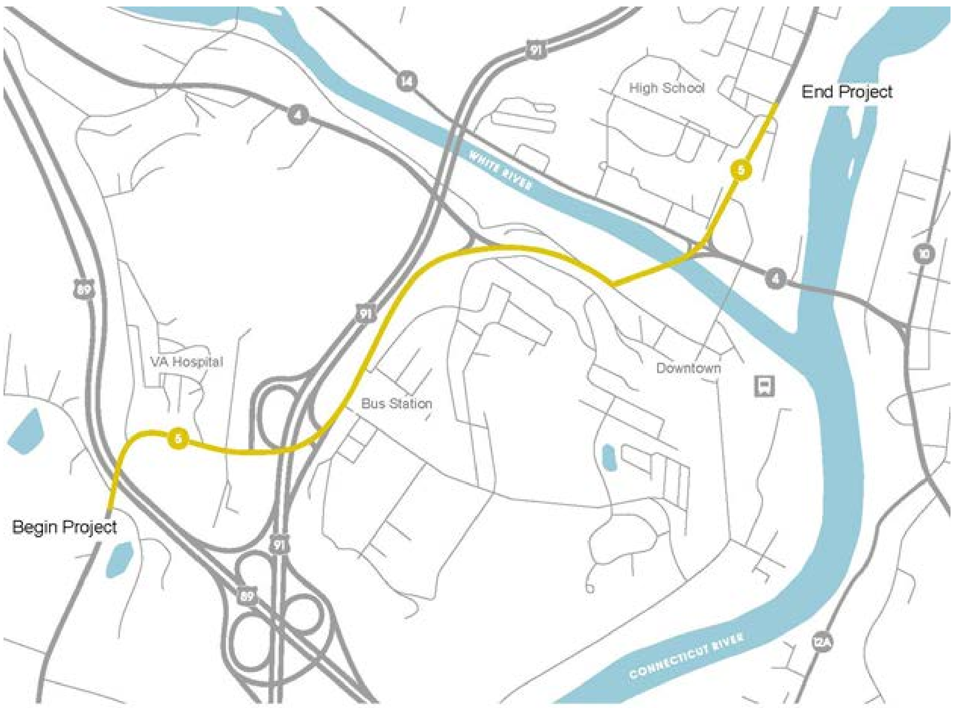
Town of Hartford Staff	Hannah Tyler, Brannon Godfrey, Matt Osborn, Lori Hirshfield
VTrans Staff	Erin Parizo
TRORC Staff	Rita Seto

This group is charged with guiding the scoping process and providing input. VTrans will propose the preferred improvements after coordination with these stakeholders.

3.0 PROJECT BACKGROUND

The US Route 5 corridor in Hartford Vermont is a principal arterial that is a state owned and maintained highway. It was largely reconstructed in the late 1960's in conjunction with the I-89 and I-91 construction. Much of it was constructed as a divided four lane highway. The area from Arboretum Road to Highland Avenue includes 12 intersections and the I-91 interchange. Over the years, safety, condition, and capacity issues have evolved as changes in land use, increases in traffic volumes, increases in pedestrian and bicycle activity, and the introduction of transit routes occurred.

Figure 1 - Project Study Area



3.1 STUDY REVIEW AND CURRENT INITIATIVES

Several studies and plans have been developed for this area that considered traffic and pedestrian concerns. The most recent studies were reviewed in the preparation of this scoping study and are listed below.

- *Hartford Master Plan 2014*
- *Hartford Pedestrian and Bicycle Plan 2009*

Some progress has been made in recent years to address some of corridor issues. The known current initiatives are as follows:

- Sykes Mountain Avenue reconstruction of a roundabout at the US 5 and Sykes Avenue intersection.
- US 5 sidewalk and bike lanes from Arboretum Road to Sykes Avenue.
- US 5 and I-91 Northbound off ramp intersection reconfiguration.
- US 5 and US 4 intersection roadway safety audit and project definition study for intersection improvements.
- US 5 and VT 14 intersection roadway safety audit.

This study considers and coordinates with the current initiatives underway.

3.1.1 Hartford Master Plan 2014

The Town typically updates its master plan on a five year cycle and it is currently going through its 2019 Town Plan Update, so their 2014 plan is the most recent adopted plan. During the fall of 2002, the Town undertook a series of community meetings to solicit input from the public regarding the update of the Town Master Plan. The public participation process also included a focus group discussion on transportation issues that reiterated the above recommendations and added the following:

- Improve specific intersections.
- Improve intersection signal controls and lower speed limits.
- Develop a Bicycle/Pedestrian Master Plan and ensure adequate maintenance of existing pedestrian and bicycle facilities while encouraging/requiring developers to implement pedestrian/bicycle facilities.
- Ensure adequate design standards for new development.
- Re-examine parking requirements

3.1.2 Hartford Pedestrian and Bicycle Plan 2009

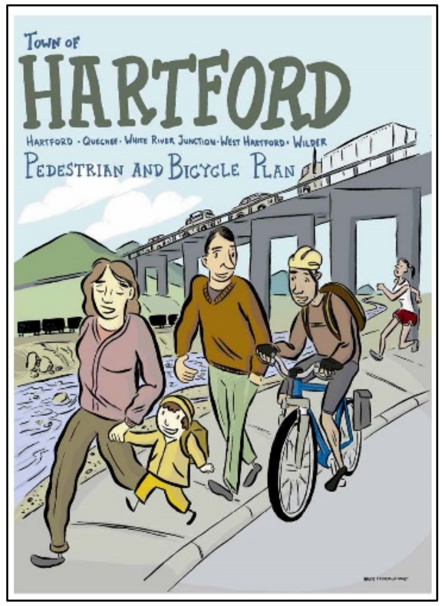
This Plan was developed by a group of citizen planners committed to improving walking and bicycling in the Town of Hartford. The Committee was challenged between proposing small-scale inexpensive improvement projects versus larger-scale more expensive projects. While the inexpensive and easy projects can be repeated many times over, the impacts remain relatively small. The large-scale projects are expensive, difficult to implement, and time-consuming, but they are a significant long-term solution. In the end, the consensus was that both strategies needed to be proposed in this Plan. The following are the plan's pertinent recommendations.

- RECOMMENDATION #5: Construct facilities as outlined in the Pedestrian and Bicycle prioritization map and table. Focus on engineering full segments so that smaller-scale incremental improvements can be constructed as adjacent properties develop and/or construction funds become available.

- RECOMMENDATION #6: Preserve or enhance public rights-of-way to provide sufficient room for pedestrian and bicycle facilities along all arterial and collector streets located within the Town's designated development area.

- RECOMMENDATION #12: Retrofit existing State controlled roadways to accommodate bicyclists. In White River Junction and the other villages, bicyclists should share the travel lane with vehicles. Along road segments with slower speeds (35 mph and lower), there should be a minimum 11 foot travel lane and 3 foot shoulders. Along road segments with 40 mph speed limits and higher, the standard bicycle lane (4-6 foot shoulders) is necessary – even when the wider road profiles could result in higher traffic speeds. The highest priority for retrofitting roads with bicycle lanes is US Route 4 (east-west connector) and US Route 5 (Connecticut River Scenic Byway).

Figure 2 - Pedestrian and Bicycle Plan



The committee reviewed many of the top priority roads in the town and ranked them for bicycle and pedestrian improvements. The top priorities are not the entire list of Town priorities, but a list of projects that can be realistically addressed over the next 20-30 years. The ranking depends on creating planning priority scores in the first step, ensuring every village receives a ranked project in the second step, and then comparing walking and bicycling experiences for the last step. This ranking included the following projects in this project area and their ranking out of the 31 projects identified.

Table 1 - Prioritization of Projects in Project Area

Rank	Road Name	Description	Existing Sidewalk	Existing Bike Facility	Recommendation
2	N Hartland Rd	VA Cutoff to Sykes Mtn. Ave.	No	No	Ped/ Bicycle
8	N Main St	Sykes Mountain Ave to Bridge (US 5)	Yes	No	Bicycle
14	N Main St	Woodstock Road to N Main St (US 5) Bridge	Yes	No	Bicycle

3.1.3 Sykes Mountain Avenue Reconstruction

This project involves the reconstruction of the US 5 and Sykes Mountain Avenue intersection into a roundabout along with other roadway improvements and another roundabout along Sykes Mountain Avenue. Currently, this project is in the right-of-way acquisition phase and scheduled for construction beginning in 2020. For this study it is assumed this project will be completed and any proposed improvements should be compatible with this construction. Specific items to consider for this study include:

- Bicycle accommodations including the addition of bicycle ramps and paths at the roundabout.
- One travel lane exiting the roundabout on US 5 northbound and southbound.
- Two travel lanes entering the roundabout on US 5 northbound and southbound.

3.1.4 US 5 Sidewalk and Bike Lanes

The Town is utilizing a VTrans Bicycle Pedestrian Grant to pursue construction of a 5-foot wide sidewalk along US 5 from Arboretum Lane to Ballardvale Drive. This includes providing 4-foot wide shoulders/bike lanes on both sides of US 5. This provides an important connection with Ballardvale Drive hotels and the Upper Valley Aquatic Center and contributes to a portion of the priority number 2 project mentioned in the Pedestrian and Bicycle Plan. The project is in the Right-of-Way acquisition phase and is scheduled for construction in 2019 or 2020.

The Town has a second VTrans Bicycle Pedestrian Grant to design and construct a 5-foot wide sidewalk along US 5 from Ballardvale Drive to Sykes Mountain Avenue. Conceptual plans have been developed, but further development of the project is pending resolution of the proposed improvements and funding at the I-91 Northbound Off Ramp and US 5 intersection.

3.1.5 US 5 and US 4 Intersection Scoping

VTrans is conducting a separate scoping process that is evaluating potential improvements at the US 5 and US 4 intersection. The scoping is building off a VTrans Roadway Safety Audit (RSA) conducted in October 2016. This RSA highlighted the crash pattern involving left turns off US 4 eastbound to US 5 northbound and proposed potential improvements to be considered in the VTrans scoping. This scoping process will be coordinated with this project to provide a compatible solution.

3.1.6 US 5 and VT 14 Intersection Roadway Safety Audit

In April of 2018, VTrans conducted an RSA process for the US 5 and VT 14 intersection. The RSA provided the following most significant concerns:

- A Crash Pattern Between a US 5 Northbound Left Turning Vehicle and a US 5 Southbound Vehicle
- Significant Crash Pattern Involving Rear-End Crashes Between Two US 5 Northbound Right Turning Vehicles onto Maple Street eastbound
- Significant Crash Pattern at Coop Food Between a Left Turning Vehicle into the Parking Lot and a Westbound Vehicle.
- People unfamiliar with the characteristics of the traffic signal and who are trying to make a left from VT 14 (heading east) to US 5 going north on a green light do not realize that they have to yield to oncoming traffic which often cannot be seen due to vehicles in the left turn lane (from US 4 to US 5 south).

The RSA considered short term and long term solutions to address these concerns and concluded the following:

- Short term improvements are inhibited since the VTrans' signal group (TSMO) indicated that the age of the traffic signal infrastructure along with the conduits' overall condition preclude short term improvements to the signal such as adding a flashing yellow phase and that there are no feasible improvements that can be made without the full replacement of all signal infrastructure at the intersection
- For US 5 Northbound approach long term improvements include:
  - Convert the left turning phase from permitted on green ball to flashing yellow permitted.
  - Evaluate permitted protected or protected only left turn phasing.
  - Evaluate the conversion of the signals from being mounted on pedestals to mast arms on all approaches.
  - Evaluate the construction of a roundabout. A roundabout would reduce congestion by facilitating turning and crossing maneuvers and would reduce crashes.
- For the VT 14 Eastbound approach long term improvements include:
  - Convert the left turning phase from permitted on green ball to flashing yellow permitted
- For the VT 14 Eastbound approach long term improvements include:
  - Evaluate the possibility of signalizing the ramp.
  - Evaluate the reconfiguration of the slip lane by reducing the angle of the slip lane to provide a better line of sight for turning traffic.
  - Evaluate the construction of a roundabout.

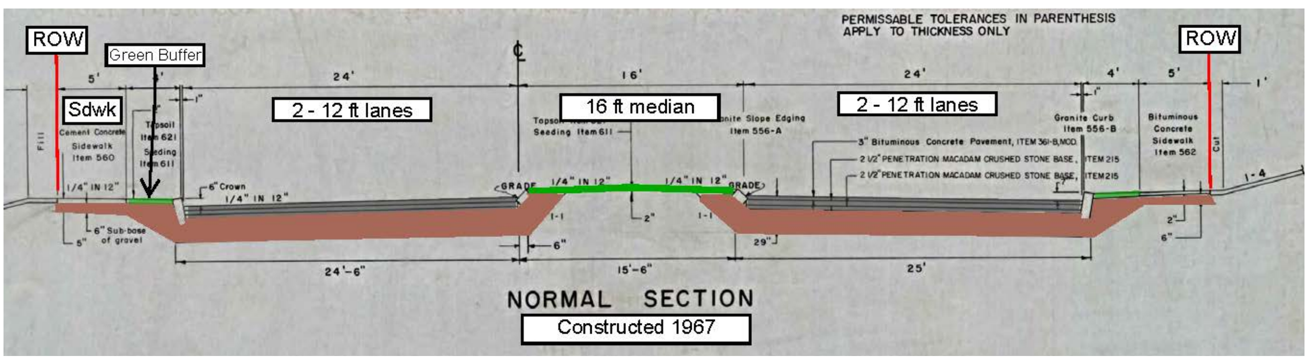
For the purpose of this study it is important to note that Advance Transit, the local transit company, will be eliminating the bus stop that they call Cota & Cota (which is located on the southbound side of US 5 just north of the intersection) as soon as spring 2018. The transit company explained that the buildup of left turning traffic from US 5 south to VT 14 going east is so high in the afternoon that their bus, after making the stop, cannot transition into the left turn lane.

4.0 EXISTING CONDITIONS

4.1 ROADWAY CHARACTERISTICS

Most of US 5 in this project area was reconstructed in 1967 with a full depth of new subbase and pavement, new drainage system, and in some areas water and sewer utilities. It was constructed as a curbed four lane roadway (two 12-foot lanes in each direction) that are separated by a landscaped median (16 feet wide). South of the I-91 interchange the roadway tapers from a four lane to two lane section with no median. There is no existing sidewalk from Arboretum Lane to Sykes Mountain Avenue but one is planned. A 5-foot wide sidewalk exists along the eastern side from Sykes Mountain Avenue to North Main street and across the White River Bridge. From VT 14 intersection northward along US 5 there is a sidewalk on both sides. A typical section is shown in figure below. Bicyclists using this area typically either ride on the 5-foot wide sidewalk or assume a lane on the roadway.

Figure 3 - Existing Typical Section



The roadway is bordered by primarily commercial development. It is most concentrated outside the limited access limits for the I-91 interchange. The median extends the full length of the project area and restricts some left turns. Restricted US 5 left turns are accommodated by a northbound U-turn at Airport Road and a southbound U-turn jug handle just south of the US 4 intersection. A jug handle is a type of ramp, or slip road, which allows drivers to change directions without disruptive stops or direct left turns.

The current posted speed is 35 mph from Arboretum Lane to Airport Road. It changes to 40 mph north of the Airport Road intersection and is reduced to 30 mph on the US 5 approach to North Main Street and remains 30 mph northward for the remaining project area.

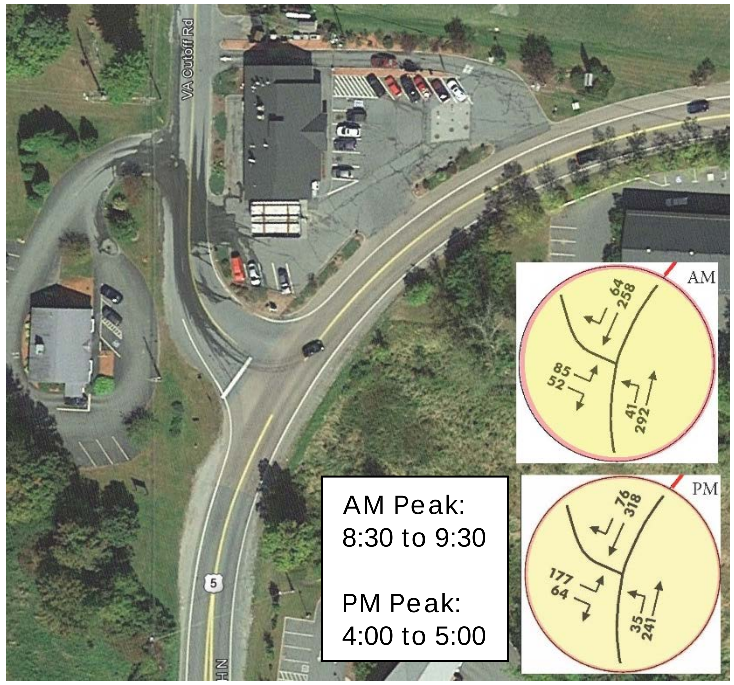
US 5 is a principal arterial, owned and maintained by the State of Vermont. From the I-91 interchange to North Main Street, US 5 is part of the National Highway System.

4.2 INTERSECTION CHARACTERISTICS

4.2.1 US 5 / VA Cutoff Road

The US 5/ VA Cutoff road intersection is a state-controlled, T-type unsignalized intersection. All approaches are single lanes. AM and PM peak hour volumes based on 2018 VTrans 12 hour turning movement counts are shown in Figure 4. Based on field observations and public input the following are considerations when determining and evaluating improvements:

Figure 4 - US5/VA Cutoff Road Intersection (Google, 2015)

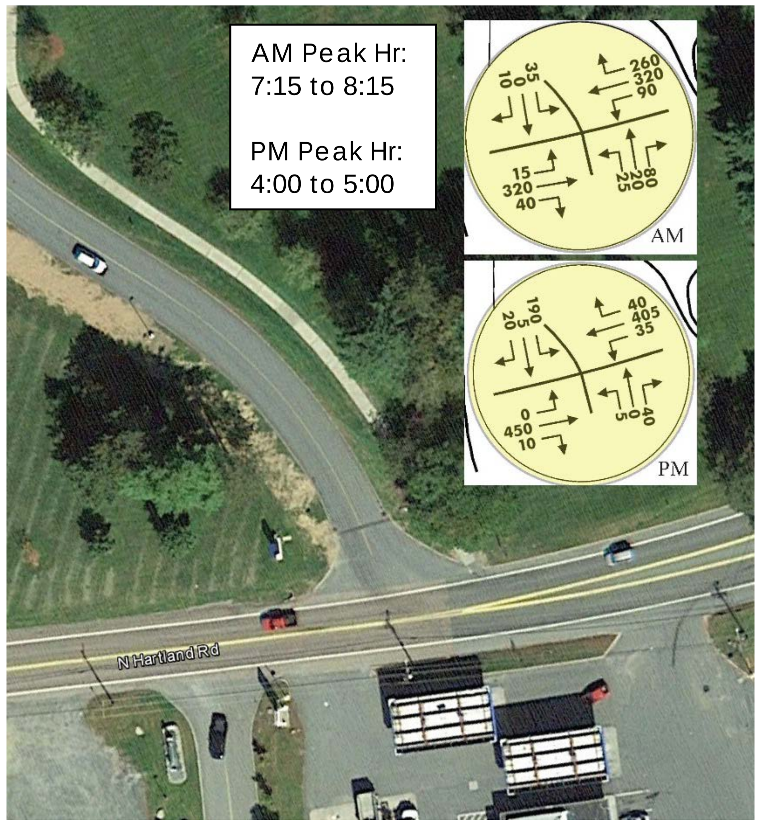


- VA Cutoff Road queues occur mostly in the afternoon peak as VA employees egress in PM using the VA Cutoff Road and it shows in the traffic count volumes
- Corner site distance on the VA Cutoff Road is good to the right but more difficult to see to the left. Some traffic accelerates around the corner. Posted speed is 35 mph.
- Jake’s, on the corner, closed as of November 2018. Pumps do detour thru traffic and is not an ideal location for them. Whatever goes in after Jakes will drive the intersection.
- This is a primary route for the Town’s Emergency response vehicles as their facility is on VA Cutoff Road.
- Pedestrians walk recreationally during day, not always using paths built on campus. No pedestrian path or sidewalks along VA Cutoff or US Route 5, but US Route 5 sidewalk is planned.
- VA Shifts: 24 hour shifts but most common are staggered shifts that start 7, 7:30, and 8 am. Peak departures are from 3:25 pm to 5 pm. In addition to VA staff, VA facility users include medical students, contractors, visitors, and patients.
- Transit service: Advance Transit drops off at the VA in the morning and afternoon. Also, VA has its own shuttles that service Vermont and 4 contiguous counties in New Hampshire, plus Manchester, and Boston.
- Delivery trucks to VA use VA Cutoff Road entrance to the back of the VA

4.2.2 US 5/ Veterans Drive/Dunkin Donuts

The US 5/Veteran's Drive intersection is a state-controlled, four-way unsignalized intersection. The east approach was recently reconstructed with the redevelopment of the parcel into a Dunkin Donuts and is not depicted in the available aerial photo used in Figure 5. The US 5 Northbound (NB) and the Veterans Drive approach are single lanes while the US 5 Southbound (SB) approach includes 2 lanes, and a combined thru and right turn lane and an exclusive left turn lane into Dunkin Donuts. The Dunkin Donuts approach includes two exiting lanes and one entry lane. There are currently no crosswalks at the intersection. A sidewalk on the east side of US 5 and bike lanes are planned in future project as previously mentioned. AM and PM peak hour volumes are based on 2018 VTrans 12 hour turning movement counts, which are post Dunkin Donuts development are shown in Figure 5. Based on field observations and public input, the following are considerations when determining and evaluating improvements:

Figure 5 - US 5/Veterans Drive Intersection(Google, 2015 prior to Dunkin Donuts)



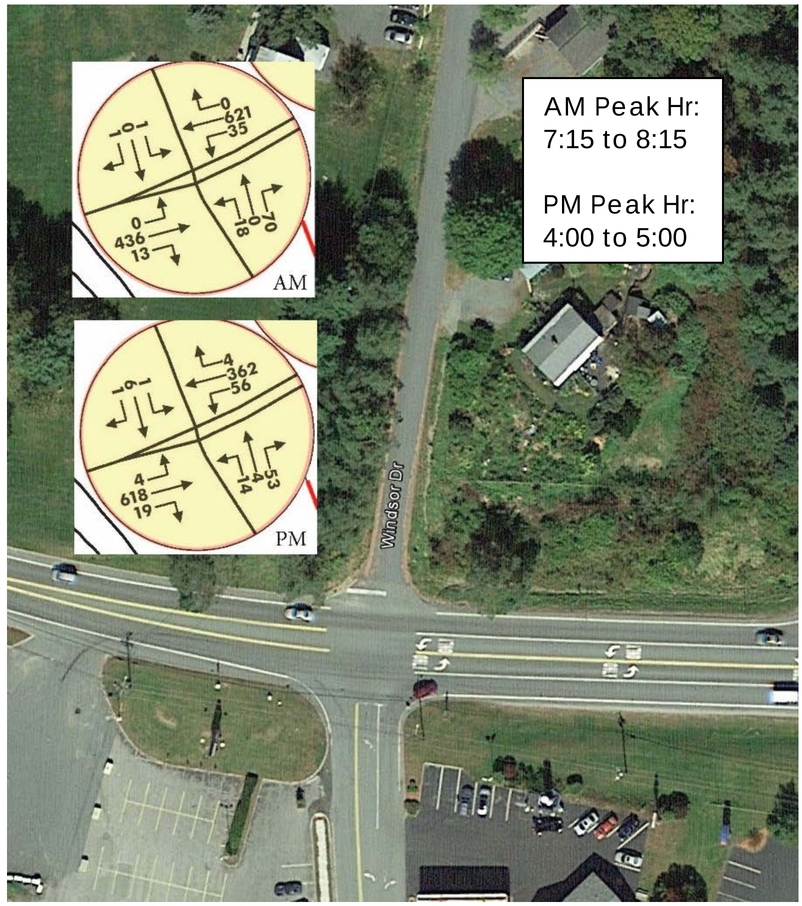
- VA traffic tends to exit using the VA Cutoff Road and not using Veteran's Drive due to limited sight distance and limited traffic gaps.
- Removing the I-91 SB on-ramp slip lane causes US 5 Northbound left turns onto I-91 SB On Ramp traffic to back-up. In the afternoon, this turning traffic backs up on US 5, in front of Bobs, Dunkin Donuts, and past Veterans Drive.
- Dunkin Donuts operations has complicated intersection. Advance Transit stops at Dunkin Donuts.
- There are no pedestrian facilities. Some VA visitors, new staff and clients do come from nearby hotels. Behind Dunkin Donuts, there are five hotels. Difficult to cross US 5. There are many reports of near misses. People like to walk down to DD on break. Sometimes they walk past the intersections either way to get away from turning traffic.

- A new VA security fence also impacts pedestrians. The fence channels walkers to entrances, while they used to be able to walk anywhere across campus.
- People also drop cars off for service, then walk to VA.
- A crosswalk may have impact on traffic. Some VA staff have suggested an elevated, heated crosswalk.
- Queueing/congestion: Northbound US 5 left turning into Veterans Drive, do not pull to the left as there is no dedicated left turn lane and traffic backs behind them. There is now a left turn lane into DD.
- Hartford Police Department (HPD) indicated: Challenging intersection with no ped crashes, but increased motor vehicle crashes. To access DD, there is a shallow driveway and vehicles need to turn wide, into one of exiting lanes. Lanes don't work with space for entrance and an island is in the way. There is no opportunity to use hotel entrance or Ballardvale Drive, as it is privately owned, and has concrete barriers. Area needs access management and maybe a traffic signal. With DD redevelopment, four-way intersection was constructed but needs work.
- VA patients tend to be older Vietnam vets, with different driving habits, cautious.
- Traffic signal at Sykes Mountain Ave (SMA) causes breaks in traffic. Roundabout may make traffic continuous and amplify issues.
- Limited sight distance from Veterans Drive approach looking east.

4.2.3 US 5/Ballardvale Drive/Winsor Drive

The US 5/Ballardvale Drive/Winsor Drive intersection is a four-way unsignalized intersection. The lane geometry and the AM and PM peak hour volumes based on 2018 VTrans 12 hour turning movement counts are shown in Figure 6. There are currently no crosswalks at the intersection. A sidewalk on the east side of US 5 and bike lanes are planned in future project as previously mentioned. Based on field observations and public input, the following are considerations when determining and evaluating improvements:

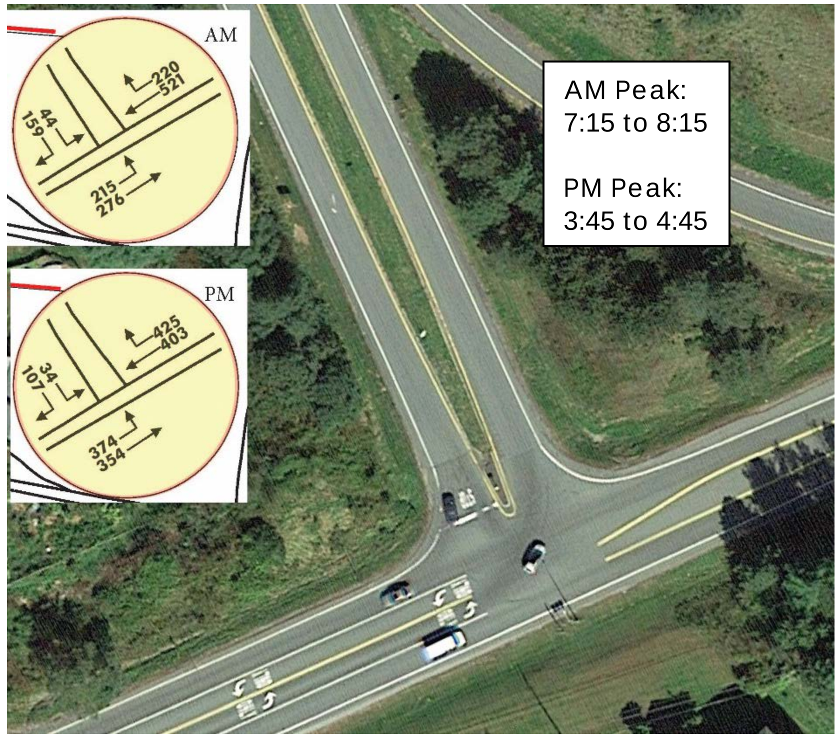
Figure 6 - US 5/Ballardvale Drive/Winsor Drive Intersection (Google 2015)



- VA staff/visitors park on narrow Winsor Drive, blocking traffic, and then cut through bushes to access VA and avoid Veteran's Drive. VA has a program to install fencing around facility and this will address issue.
- Winsor has low traffic volumes with 5 or 6 residents. During wintertime when exiting Winsor Dr, it is hard to stop due to steep grade.
- Ballardvale Drive is an entrance to hotels and a gas station. During nighttime, it is hard to see when turning onto Ballardvale. May need lighting.
- Old Howard Johnson restaurant is a vacant building used for aquatic center swim meet overflow parking plus other downtown overflow parking.

4.2.4 US 5/I-91 Southbound Off Ramp and On Ramp

Figure 7 - US 5/I-91 Southbound Off Ramp and On Ramp Intersection (Google 2015)



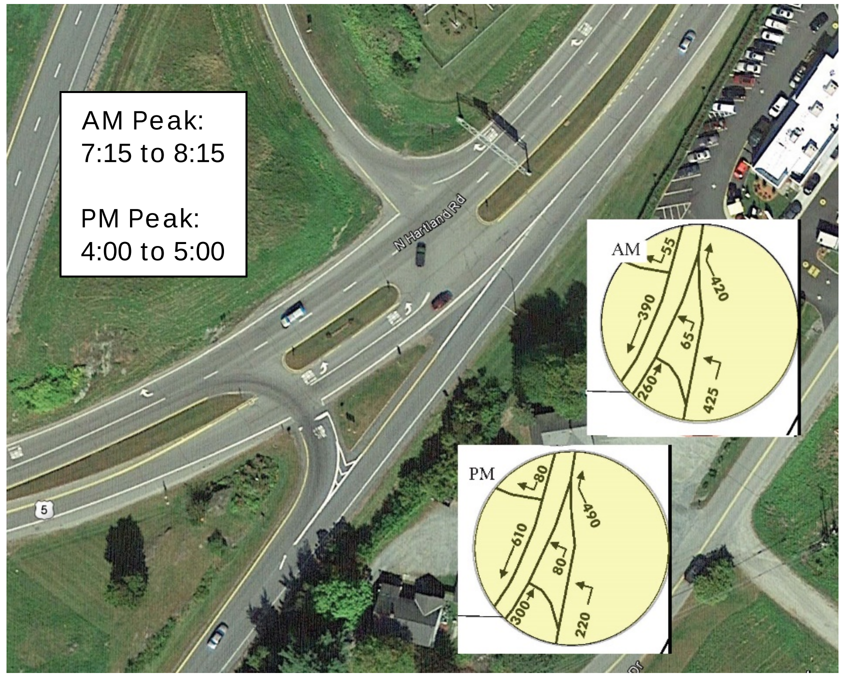
The US 5/I-91 Southbound Off Ramp and On Ramp intersection is a state-controlled, T-type unsignalized intersection. The AM and PM peak hour volumes based on 2018 VTrans 12 hour turning movement counts are shown in Figure 7. The lane geometry was changed in 2017 with the replacement of the I-91 overpass bridges. This change is not reflected in the Figure. The I-91 Southbound On Ramp was closed off and the one US 5 SB lane was changed to two lanes, a thru lane and a right turn lane. This was done without widening and provides an offset for the southbound thru lane through the intersection. There are currently no crosswalks at the intersection. A sidewalk on the east side of US 5 and bike lanes are planned in a future project as previously mentioned. Based on field observations and public input the following are considerations when determining and evaluating improvements:

- US 5 Northbound left turns queue beyond Ballardvale. This is due to the removal of the separate SB On Ramp and now northbound left turns yield to southbound thrus and rights.
- Exiting I-91 SB Off Ramp, left turn onto US 5 North is difficult with limited traffic gaps. Some vehicles turn right and make a U-turn.
- US 5 SB right lane becomes exclusive right turn lane and requires thru traffic to weave.
- During the bridge replacement, the temporary signal worked well. It provided breaks in traffic. Many thought it made sense to make permanent. Taking away ramp and taking away signal, confuses things. For US 5 SB right turn lane a yield sign was placed, then removed because it didn't work.
- Some people avoid intersection during peak periods and may use Wilder exit instead.
- Making a NB left turn to ramp can be hard at night as lane striping and lighting is poor.

4.2.5 US 5/I-91 Northbound Off Ramp and On Ramp

The US 5/I-91 Northbound Off Ramp and On Ramp intersections are separate T-type unsignalized intersection. The lane geometry and the AM and PM peak hour volumes based on 2018 VTrans 12 hour turning movement counts are shown in Figure 8. The I-91 On Ramp has no identified significant operation and safety issues. There are currently no crosswalks at the intersection. A sidewalk on the east side of US 5 and bike lanes are planned in a future project as previously mentioned. Based on field observations and public input the following are considerations when determining and evaluating improvements:

Figure 8 - US 5/I-91 Northbound Off Ramp and On Ramp Intersection (Google 2015)



- Crossing the I-91slip ramp is problematic for pedestrians.

- The I-91 Off ramp forms the right lane and acts as a thru and right turn lane, into Sykes Mountain Avenue. It is difficult for US 5 NB traffic to enter the short right lane.

- Queues back up onto I-91. With slippery weather there are crashes resulting.

- Off ramp geometry encourages high speeds.

- If people aren't familiar with the area, turning left onto US 5 SB and heading towards the VA, they're often in the wrong lane and need to weave from the right turn lane into the through lane.

- I-89 bridges between Hartford/Lebanon will be in construction in future and will likely impact this exit.

The I-91 On Ramp has no identified significant operation or safety issues.

4.2.6 US 5/Sykes Mountain Avenue

This intersection is currently a four-way signalized intersection planned to be improved with a modern roundabout. Therefore, existing issues and potential improvements are not part of this study. Proposed improvements will consider the roundabout design and they should be compatible with its configuration and operation.

4.2.7 US 5/Airport Road

This intersection is a four way unsignalized intersection. The lane geometry is shown in the adjacent figure. It includes a US 5 NB U-turn operation to address the left turn restriction by the existing median. Based on field observations and public input, the following are considerations when determining and evaluating improvements:

Figure 9 – US 5/Airport Road Intersection (Google 2015)

- Exiting Airport Road and turning left turn on US 5, you need to quickly get into far hand lane, to position for getting on the interstate. Certain times of day are challenging.
- Hartford Department of Public Works (HDPW) is located on Airport Road and their trucks use the intersection. There is confusion created by adjacent gas station access.
- There is a US 5 NB U-turn operation provided. Full size school buses have hard time making U-turn movement. If a bus fuels at Evans (most do at Evans or Mobil), going back to interstate isn't easy.
- If exiting plaza across street, and going straight to Airport Rd, or to US 5, there are bullfighting traffic interactions.
- Bikes/pedestrians: North along US 5 there are not many cyclists. There is no shoulder and it is uncomfortable when on-road. Consider increasing shoulder or providing bike facility. Can use Sykes to get downtown. Could look at how to better sign bike routes. It has been a challenge to locate bike signage.

4.2.8 US 5/US 4

Given the past concerns at this intersection, VTrans has completed a Roadway Safety Audit (RSA) for the intersection. Based on the RSA results, VTrans has initiated a separate project definition process to develop and evaluate alternative improvements. The project improvements recommended by both projects will be compatible.

4.2.9 US 5/North Main Street

This intersection is a three-way T-type signalized intersection. The lane geometry and the AM and PM peak hour volumes based on 2018 VTrans 12 hour turning movement counts are shown in the adjacent figure. There are sidewalks on three approaches and there are no crosswalks. Overhead signs provide lane designations and direction. Based on field observations and public input the following are considerations when determining and evaluating improvements:

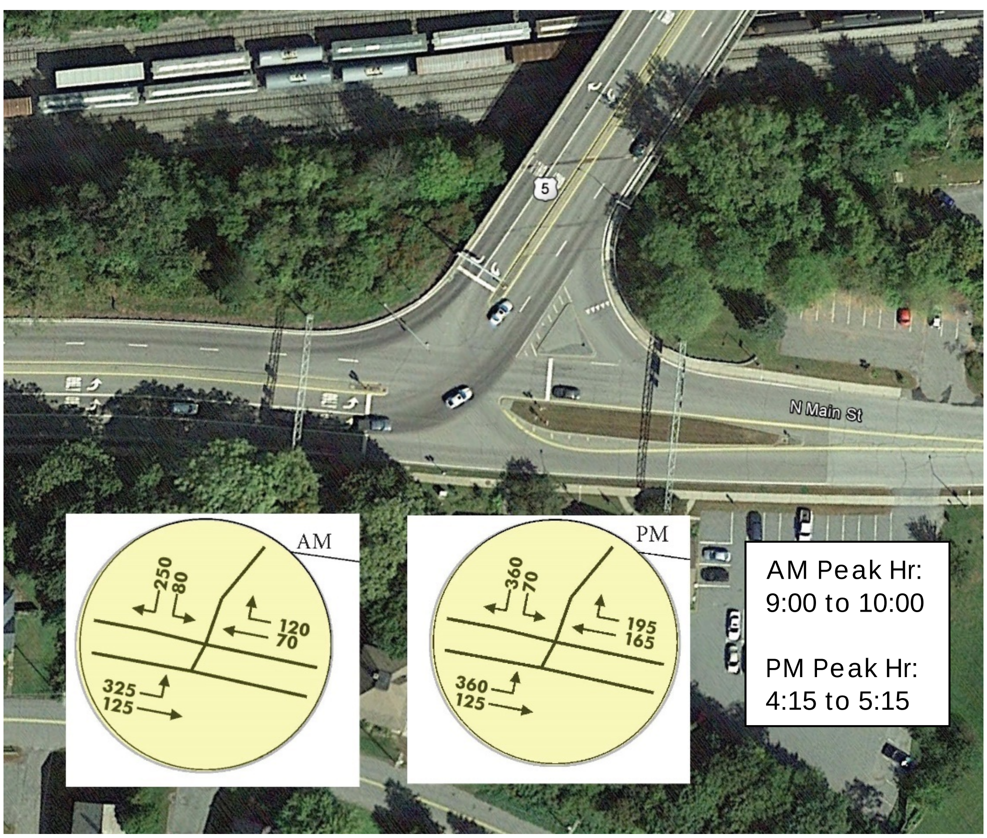
- Currently there are two US 5 NB left turn lanes and their use depends on where traffic is going on the other side of the bridge. If going east on US 4/Co-op, use right lane. If continuing on US 5, use left lane.

- Modernizing Traffic Signal System would be good. Right turn across bridge, should have green arrow.

- With current bridge construction the bridge and US 5 NB left turn lane is down to one NB lane. There does not appear to be a queuing issue during peak periods.

- There is no crosswalk or connection of the west side US 5 sidewalk to bridge sidewalk. Need to consider traffic impacts of adding a crosswalk.

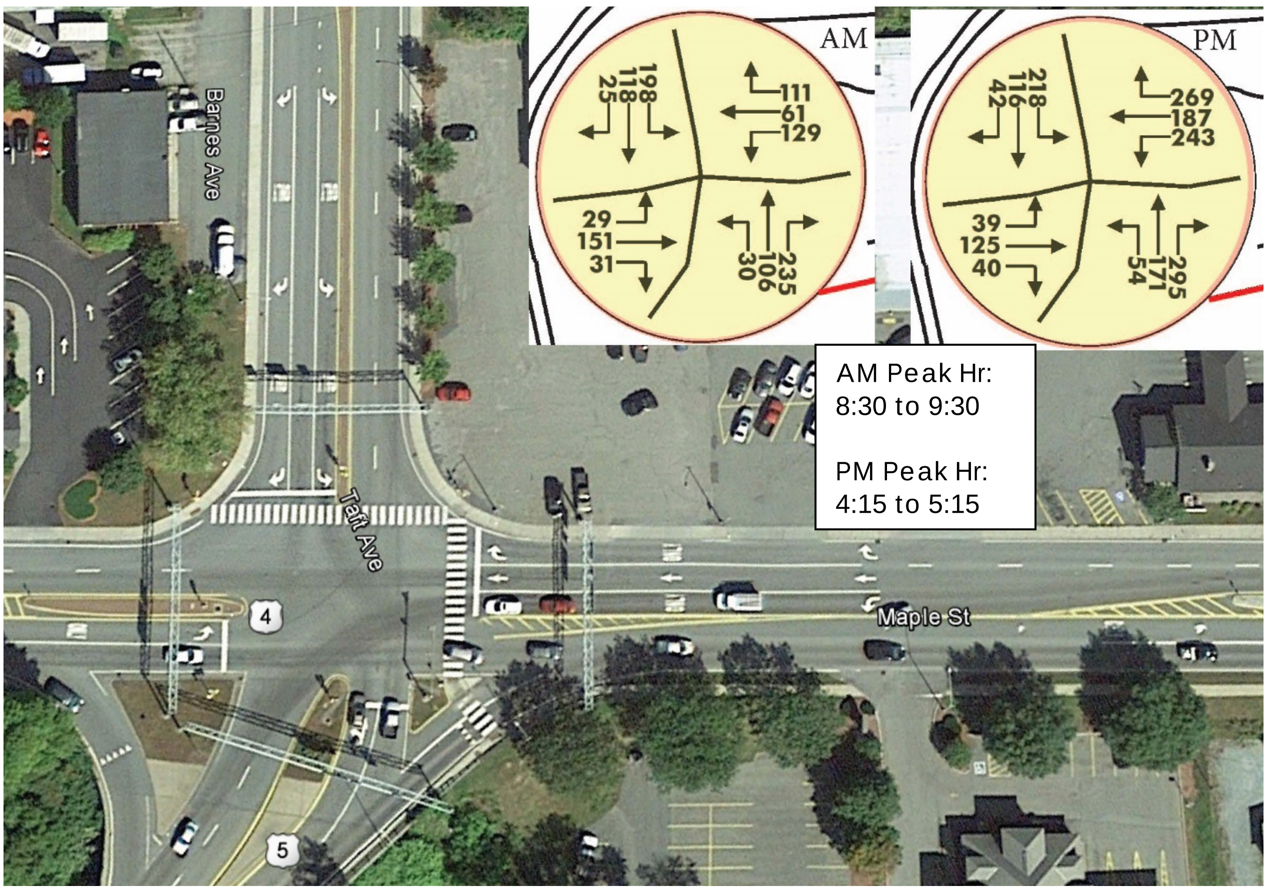
Figure 10 - US 5/North Main Street Road Intersection (Google 2015)



4.2.10 US 5/VT 14

This is a four way signalized intersection. The lane geometry and the AM and PM peak hour volumes based on 2018 VTrans 12 hour turning movement counts are shown in the adjacent figure. There are sidewalks on all approaches, and crosswalks on two approaches and a slip ramp. Most signal heads are lower level post mounted, except for the VT 14 Westbound (WB) approach signal heads, which are mast arm mounted. There are protected left turn phases and signal head arrows for US 5 SB and VT 14 Eastbound (EB). There are protected pedestrian crossing signal phases and actuated pedestrian signals on these approaches as well. Overhead sign structures on all approaches provide lane designations and route markers. There is a planned 2020 VTrans Resurfacing project on VT 14 through this intersection that will be coordinated with proposed improvements from this project definition process. Based on field observations and public input the following are considerations when determining and evaluating improvements:

Figure 11 - US 5/VT 14 Intersection (Google 2015)



- This intersection is a High Crash Location and the results of a VTrans RSA are in section 3.1.6.
- For US 5 southbound left turns, long queues develop in the peak periods.
- Pedestrians jay walk across US 5 north of the intersection where there is a bus stop and avoid using crossing at the intersection.
- For VT 14 Eastbound traffic, it is difficult to see oncoming through traffic when making a left turn onto US 5, because that traffic is obstructed by opposing left turning vehicles waiting on red arrow.
- It is confusing for US 5 Northbound traffic turning left onto VT 14, there is no protected left turn arrow and they need to yield to US 5 Southbound through traffic.

4.2.11 VT 14/Bridge Street/Pine Street

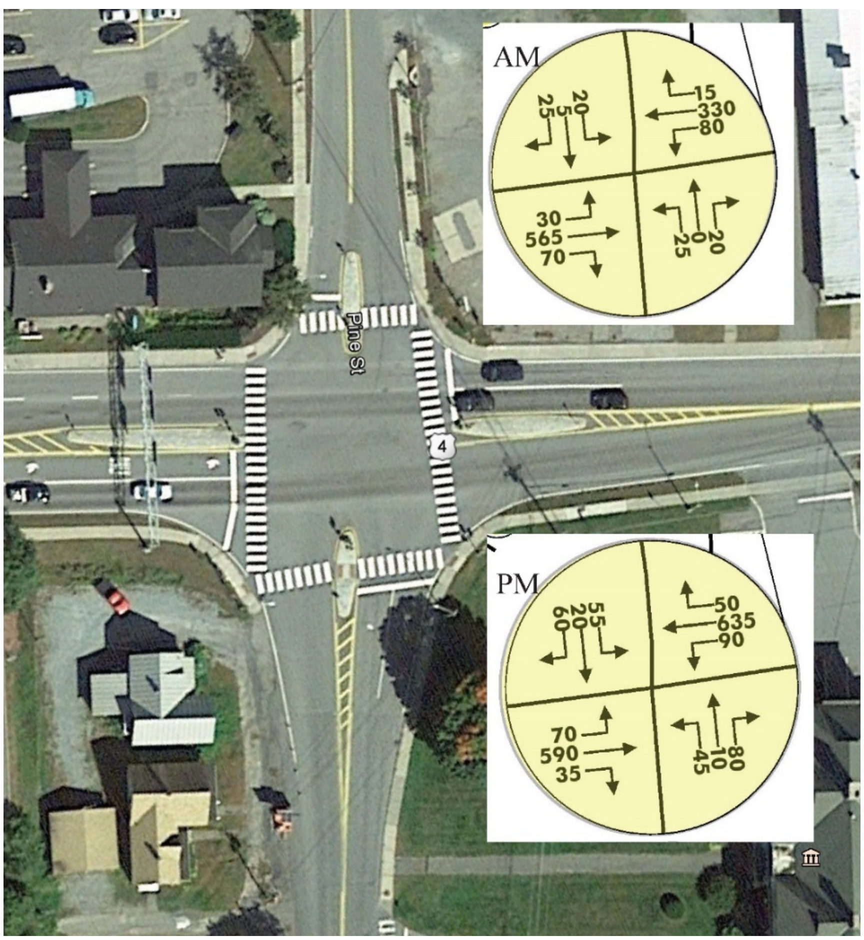
This intersection is a four-way signalized intersection. The lane geometry and the AM and PM peak hour volumes based on 2018 VTrans 12 hour turning movement counts are shown in the following figure. The protected pedestrian crossing signals have been abandoned and the signal dates back to the late 1960's. All signal heads are post mounted and there are no protected turning movements. Based on field observations and public input the following are considerations when determining and evaluating improvements:

- This is an old traffic signal and should be replaced.
- The overhead signs should be removed and replaced with low level signs.
- VT 14 Eastbound traffic turning left onto Pine Street do not have a protected left turn arrow and have difficulty turning with limited gaps in VT 14 Westbound traffic.
- Traffic operations may benefit by coordinating the signal operation with US 5/VT 14 signal.

Figure 12 - VT 14/ Bridge St/Pine St Intersection (Google 2015)

AM Peak Hr:
7:15 to 8:15

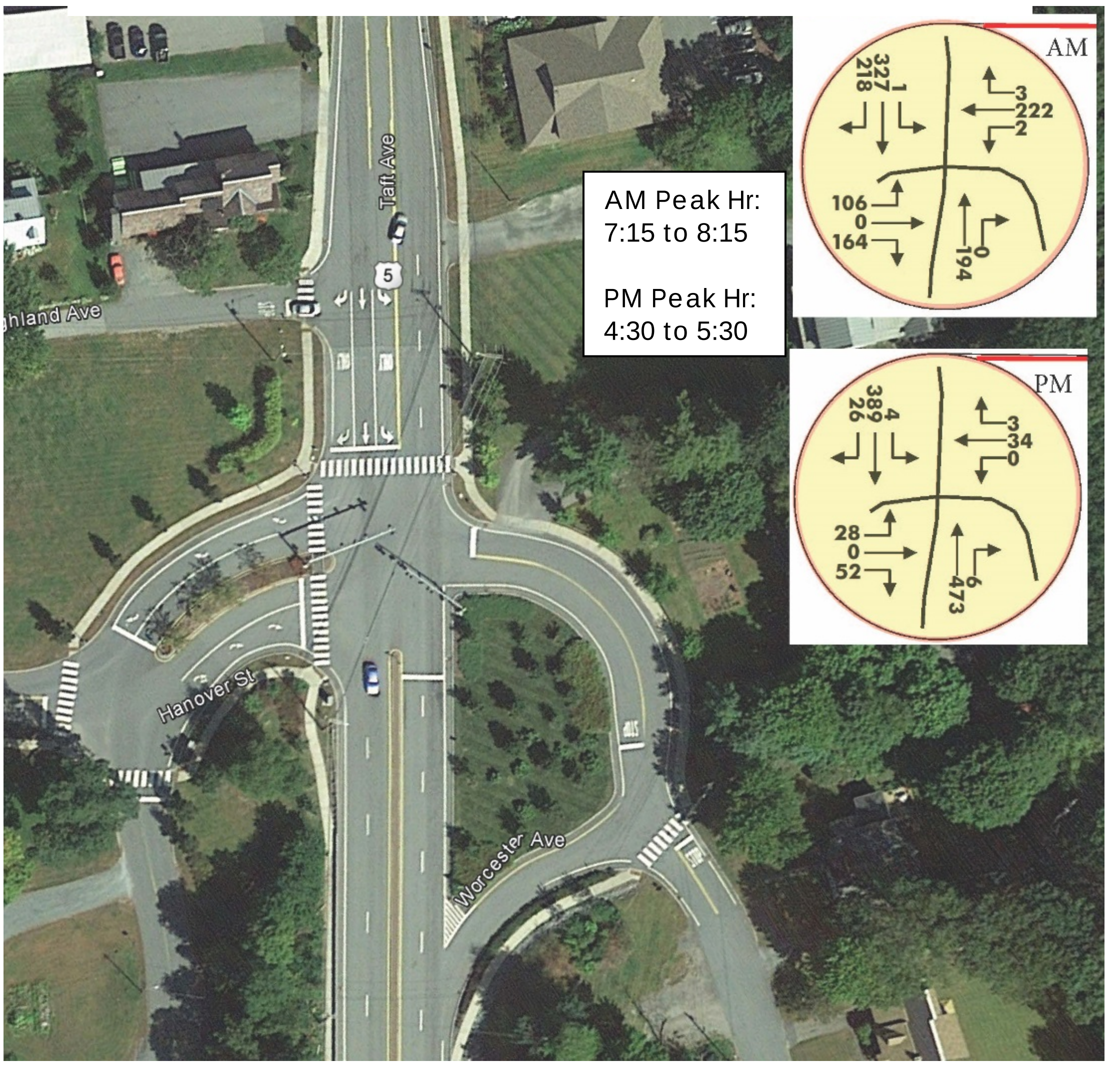
PM Peak Hr:
4:00 to 5:00



4.2.12 US 5/Highland Avenue/Worcester Avenue

This intersection is a four way signalized intersection. The lane geometry and the AM and PM peak hour volumes based on 2018 VTrans 12 hour turning movement counts are shown in the following figure. This signal is coordinated with the signal at the adjacent Highland Avenue and Hanover Street intersection. There are protected pedestrian crossing signal phases and actuated pedestrian signals on two approaches. This area of US 5 and the intersection was reconstructed in 2009.

Figure 13 – US 5/ Highland Ave Intersection (Google 2015)



Based on field observations and public input the following are considerations when determining and evaluating improvements:

- There is no signal coordination with the Highland Avenue/Hanover Street intersection and the US 5 Southbound right turns onto Highland Avenue queue back from the Highland Avenue/Hanover Street signal and blocks US 5 Southbound through traffic.

- The pedestrian phases are exclusive, meaning all traffic approaches remain red during the phase and the duration of the pedestrian phase seems greater than needed.
- Highland Avenue left turns do not have a protected phase and are required to yield to Worcester Avenue through traffic. These left turns queue back into the Highland Avenue/Hanover Street intersection.

4.3 TRANSIT OPERATIONS

Advance Transit operates a free transit service in the project area. They are a not-for-profit charitable organization and have two routes, the Green Route and the Orange Route that service the project area. Their route map can be seen here. The Green Route travels US 5 for VT 14 northward and includes stops on US 5 approximately 300 feet north of the VT 14 intersection.

The Orange Route travels US 5 from the Veterans Drive to the North Main Street intersection. This route includes US Route 5 northbound stops at: VA Outpatient Entrance, Ballardvale Drive, Airport Road, and the Bugbee Center at the US 5/North Main St Intersection.

4.4 TRAFFIC VOLUMES

Traffic volume data including Annual Average Daily Traffic (AADT) values and Peak Hourly Volumes for the study area were collected from VTrans. 2017 AADT values for the study area road segments are displayed in Table 1. The segment of US Route 5 between the I-91 NB exit ramps and Sykes Mountain Avenue has the highest volume, over twice as high as the volume of US Route 5 south of the VA Cutoff Road. The volumes along VT 14, east of US 5, are also high for the project study area, with an impact on the relationship between the two VT 14 study intersections.

Table 2 - 2017 AADT Volumes

Route	Location	AADT
US 5	Arboretum Ln to VA Cutoff Rd	5,200
	VA Cutoff Rd to Veterans Dr	6,300
	Veterans Dr to I-91 SB Ramps	10,000
	I-91 SB Ramps to I-91 NB Ramps	11,500
	I-91 NB Ramps to Sykes Mtn Ave	13,000
	Sykes Mtn Ave to Airport Dr	8,700
	Airport Dr to US 4 / Woodstock Rd	9,100
	US 4 / Woodstock Rd to N Main St	8,600
	N Main St to VT 14	6,800
	VT 14 to Highland Ave	6,900
	Highland Ave to Bugbee St	6,600
VT 14	Union St to US 5	4,500
	US 5 to Pine St / Bridge St	11,400
	Pine St / Bridge St to Prospect St	11,900

Existing weekday commuter peak hour traffic conditions for the study area were determined using the latest available data. Traffic volume data are collected periodically by VTrans at intersections in the region. Collected data used to establish existing conditions include counts by VTrans from 2016, 2017, and 2018.

Figures 14 and 15 displays balanced existing AM and PM turning movement counts for the study area intersections.

Figure 14 - Existing AM Peak Hour Volumes

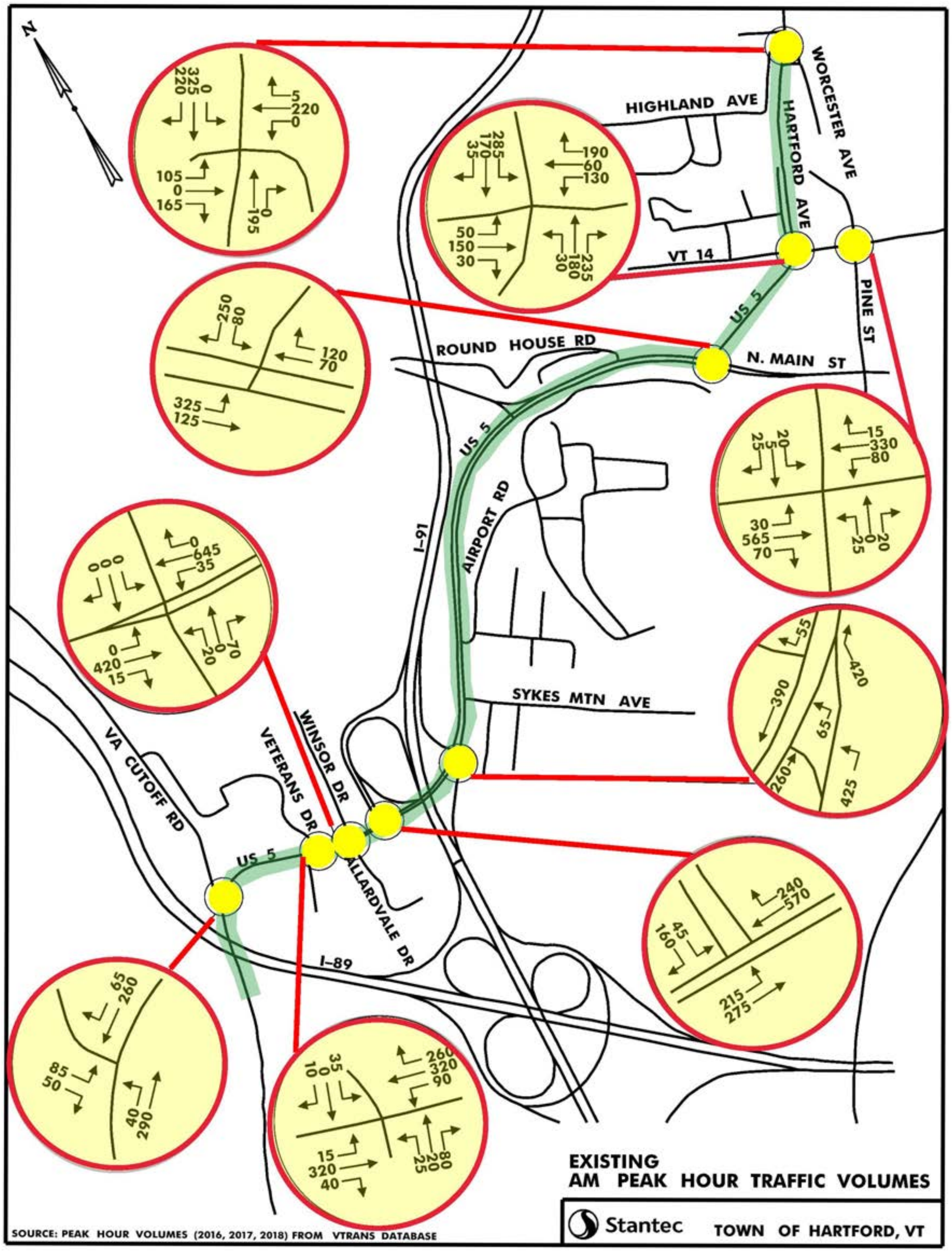
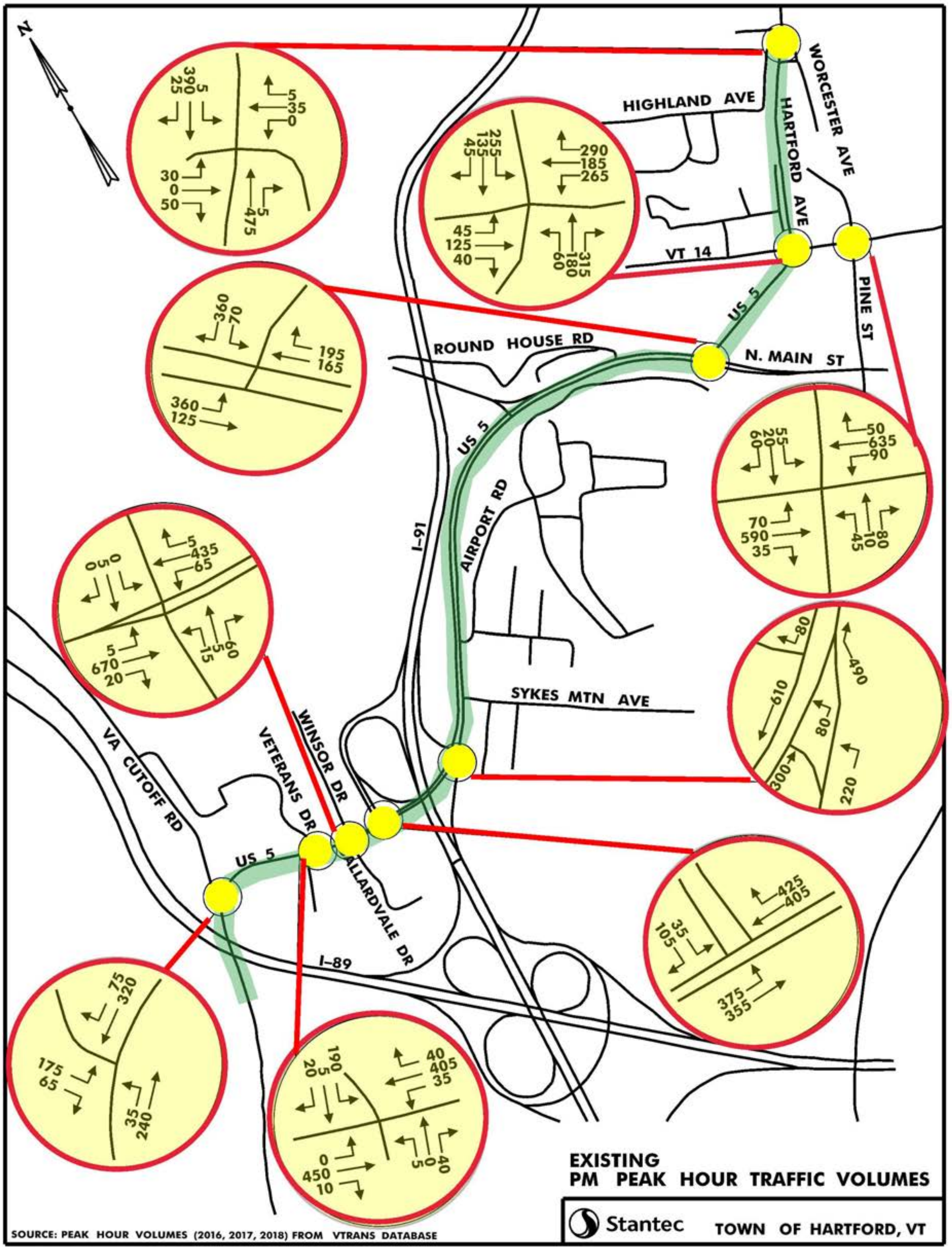


Figure 15 - Existing PM Peak Hour Volumes



5.0 INTERSECTION OPERATIONS

Intersection and roadway operating levels of service (LOS) have been calculated for the study area intersections based on the traffic volume, geometry and traffic control type previously mentioned. The results of these calculations, which are intended to quantify intersection operations, are presented in Table 3.

5.1 LEVELS OF SERVICE

5.1.1 Level of Service Criteria

Level of service (LOS) is a term used to describe the quality of the traffic flow on a roadway facility at a particular point in time. It is an aggregate measure of travel delay, travel speed, congestion, driver discomfort, convenience, and safety based on a comparison of roadway system capacity to roadway system travel demand. Operating levels of service are reported on a scale of A to F, with A representing the best operating conditions with little or no delay to motorists, and F representing the worst operating conditions with long delays and traffic demands sometimes exceeding roadway capacity.

Intersection operating levels of service are calculated in accordance with procedures defined in the *Highway Capacity Manual*, published by the Transportation Research Board. For unsignalized and signalized intersections, the operating level of service is based on travel delays. Delays can be measured in the field but generally are calculated as a function of the following: traffic volume; peaking characteristic of traffic flow; percentage of heavy vehicles in the traffic stream; type of traffic control; number of travel lanes and lane use; intersection approach grades; and pedestrian activity. Through this analysis, volume-to-capacity ratios can be calculated for individual movements or for the intersection as a whole. A volume-to-capacity ratio of 1.0 indicates that a movement or intersection is operating at its theoretical capacity. The specific delay criteria applied per the *2010 Highway Capacity Manual* to determine operating levels of service are summarized in Table 3.

Table 3 - Intersection Level of Service Criteria

	Average Delay per Vehicle (Seconds)	
Level of Service	Signalized Intersections	Unsignalized Intersections
A	≤10.0	≤10.0
B	10.1 to 20.0	10.1 to 15.0
C	20.1 to 35.0	15.1 to 25.0
D	35.1 to 55.0	25.1 to 35.0
E	55.1 to 80.0	35.1 to 50.0
F[1]	>80.0	>50.0

[1]Level of Service F is also assigned if the volume-to-capacity ratio exceeds 1.0 for a specific movement or lane group. For approach-based and intersection assessments, LOS is defined solely by delay. (Source: *HCM 2010 Highway Capacity Manual*, Transportation Research Board, National Academy of Sciences, Washington, DC, 2010.)

5.1.2 Calculated Operating Levels of Service

The intersection peak hour operating levels of service were calculated using *2010 Highway Capacity Manual* methods as applied by the Synchro software package. Analysis results for existing conditions are reported in Table 4, for estimated 2018 balanced network volumes. The Veterans Drive intersection is close to capacity during the PM peak period. Capacity analysis worksheets are presented in Appendix F.

Table 4 - Existing Intersection Capacity Analysis Results

				Existing (2018)		
	Control	Condition	Peak Hour	LOS[1]	Delay[2]	V/C[3]
VA Cutoff Rd / US 5	Stop	EB approach from VA Cutoff Rd	AM	B	15.0	0.27
			PM	C	21.0	0.52
Veterans Dr / Dunkin Donuts	Stop	EB approach from Veterans Dr	AM	D	30.3	0.24
			PM	F	97.5	0.97
Winsor Dr / Ballardvale Dr	Stop	Left turn from Ballardvale Dr	AM	D	28.5	0.12
			PM	D	34.8	0.11
I-91 SB Ramps / US 5	Stop	EB approach from off ramp	AM	D	34.1	0.64
			PM	E	49.6	0.66
I-91 NB Off Ramp LT / US 5	Stop	Left turn from off ramp	AM	E	48.4	0.90
			PM	D	26.5	0.58
I-91 NB On Ramp / US 5	Free	Left turn onto ramp	AM	A	8.5	0.07
			PM	A	9.7	0.09
I-91 NB Off Ramp RT / US 5	Free	Not calculable	AM	-	-	-
			PM	-	-	-
N. Main St / US 5	Signal	Overall	AM	A	9.8	0.37
			PM	B	10.1	0.46
VT Route 14 / US 5	Signal	Overall	AM	C	33.4	0.66
			PM	D	46.5	0.75
Highland Ave / Worcester Ave	Signal	Overall	AM	B	12.7	0.47
			PM	B	10.1	0.39
VT Route 14 / Pine St / Bridge St	Signal	Overall	AM	A	8.0	0.52
			PM	A	9.9	0.56

1 LOS= Level of Service
2 Delay = Average delay expressed in seconds per vehicle
3 V/C = Volume-to-capacity ratio for critical movements

For the US5/Airport Road intersection, there were no VTrans turning movement counts available. A 40 minute count (3:50 pm to 4:30 pm) in November of 2018 was performed to obtain sense of the intersection traffic volumes. The count was prorated to an hourly volume which indicated 72 vehicles per hour (equal between left and right turns) on the Airport Road approach with 390 Southbound and 380 Northbound vehicles on US 5. With these relatively low volumes and no indication of capacity issues, a 12-hour turning movement count and a capacity analysis was not performed.

5.2 SIGNAL WARRANT ANALYSIS

A signal warrant analysis following the 2009 Manual on Uniform Traffic Control Devices (MUTCD) procedure was performed on the unsignalized intersections. The summary of the full signal warrant analysis, contained in the Appendix G, is in the following table.

Table 5 - Signal Warrant Summary

US 5 Location	Signal Warrants Satisfied	Change to satisfy Future Conditions Signal Warrants	Changes to not satisfy Future Conditions Signal Warrants	Notes
VA Cutoff	None	To meet Warrant 1B: On US 5 need 25% volume increase or 85th % speed greater than 40 mph. To meet Warrant 3 on VA Cutoff need 15 add'l vehicles	NA	Addition of right turn lane on VA Cutoff would reduce delay.
Veterans Drive	None	To meet Warrant 1B: On US 5 need 20% volume increase or 85th % speed greater than 40 mph. To meet Warrant 3 on Veterans Dr. need 13 add'l vehicles	NA	Light volume right turns from Veterans Drive.
Ballardvale Drive	None	To meet Warrant 1B: On US 5: 25% volume increase or 85th % speed greater than 40 mph	NA	Right turns from existing separate right turn lane on Ballardvale Drive not included in warrants analysis.
I-91 SB Ramps	1A, 1B, 2,3	NA	Right turn lane on ramp	
I-91 NB Ramps	1A, 1B, 2,3	NA	NA	Right turns from existing separate right turn lane on from Ramp not critical to warrants analysis.
Airport Road	None	To meet Warrant 1B need 25% volume increase on US 5 and Airport Road	Peak Hour left turn prohibition from Airport Road or right turn lane on Airport Road.	12–hour turning movement count not available.

5.3 CRASH HISTORY

The crash history for the study area was investigated using the VTrans crash database. VTrans keeps records of reported crashes by milepost along State and Federal Aid highways in Vermont. General Yearly Summaries can be requested from VTrans for given roadway segments. The summaries note the location (mile marker), date, time of day, weather conditions, contributing circumstances and severity for reported crashes. Crash data for 2013 through 2017 were reviewed for US Route 5 between mile marker 2.51 (VA Cutoff Rd) and mile marker 4.46 (Hebard Ave).

Table 6 provides a summary of the crash data. The project corridor had 146 crashes reported over a five-year period (2013-2017), mostly in the vicinity of intersections. The most prominent crash types were rear-end collisions, representing over one third of crashes. Only one head-on collision occurred. Most crashes were observed during the midday and afternoon commuter peak hours. Almost two-thirds of crashes occurred during clear weather conditions and less than 15 percent occurred during snow and ice conditions. Twenty percent of crashes involved injuries, and none involved a fatality.

VA Cutoff Road to Winsor Drive: The corridor segment from VA Cutoff Road to Winsor Drive had 13 crashes reported from 2013 to 2017. About half of those crashes were rear-end collisions. Crashes were evenly observed among the morning peak, midday, and evening peak periods. Most crashes involved property damage only, with a couple involving personal injury.

I-91 Ramps: The segment containing the I-91 interchange ramps had 14 crashes reported from 2013 to 2017. Half of those crashes were broadside collisions. All crashes in this segment occurred outside of the morning and evening peak periods. Only one of the crashes resulted in injury.

Sykes Mountain Avenue to Airport Drive: The corridor segment containing Sykes Mountain Avenue and Airport Drive had 40 crashes, with only seven of those occurring around Airport Drive. As noted previously, the intersection with Sykes Mountain Ave will be reconstructed into a roundabout, which would be expected to reduce the occurrence of crashes. Almost half of the crashes in this segment were rear-end collisions, with the other crashes distributed among the remaining crash types, although no head-on collisions occurred. Five of the crashes occurred between 4pm and 5pm, while the remainder happened outside of the morning and evening peak periods. Twenty percent of crashes resulted in personal injury.

US 4 / Woodstock Road: The intersection of US 5 / US 4 / Woodstock Road, which is part of another VTrans scoping effort, had 12 crashes reported from 2013 to 2017. A third of those crashes were rear-end collisions, with the remainder being angle, broadside, and sideswipe collisions. Half of those crashes were observed during the midday period and a third of crashes were observed during the evening peak period. A third of crashes involved personal injury.

North Main Street to Highland Avenue: The corridor segment from the intersection of US 5 / North Main Street to Highland Avenue had 67 crashes reported from 2013 to 2017. Crashes were clustered around the three signalized intersections along that segment, with 52 of those associated with the intersection of VT 14 / US 5. Angle collisions and rear-end collisions each made up about a third of crashes. This segment had the only head-on collision reported along the corridor. The other crashes were about evenly distributed among the remaining crash types. Over half of crashes were observed during the midday period, with another fifth of crashes observed during the evening peak period. About 20 percent of crashes involved personal injury.

Almost a quarter of crashes along the corridor were associated with the intersection of Sykes Mountain Ave / US 5. That intersection is being addressed as part of another project. Over one third of all crashes along the corridor occurred in the vicinity of the intersection of VT 14 / US 5. That intersection is ranked 6th on the State list of intersection high crash locations and was addressed in the previously mentioned roadway safety audit (RSA). Recommendations from that RSA to mitigate observed crash patterns are being evaluated as part of this project.

Table 6 - Crash Summary Data 2013-2017

Year	VA Cutoff to Winsor Dr	I-91 Ramps	Sykes Mtn Ave to Airport Dr	US 4 / Woodstock Rd	N Main St to Highland Ave	Total Crashes
2013	3	3	10	3	15	34
2014	2	4	10	3	15	34
2015	4	1	8	1	14	28
2016	1	0	5	1	6	13
2017	3	6	7	4	17	37
Total	**13**	**14**	**40**	**12**	**67**	**146**
Type						
Angle	2	2	4	3	20	29
Broadside	1	7	4	2	6	20
Rear-end	6	3	18	4	22	53
Head-on	0	0	0	0	1	1
Single Vehicle	2	0	4	1	5	12
Sideswipe	0	1	8	2	7	20
Unknown-other	2	1	2	0	6	11
Total	**13**	**14**	**40**	**12**	**67**	**146**
Severity						
Property Damage	11	13	32	8	53	117
Personal Injury	2	1	8	4	14	29
Fatality	0	0	0	0	0	0
Other	0	0	0	0	0	0
Total	**13**	**14**	**40**	**12**	**67**	**146**
Weather						
Clear	8	10	30	8	39	95
Cloudy	2	3	4	1	9	19
Rain	1	0	0	1	4	6
Snow/Ice	1	0	4	2	12	19
Fog	0	0	0	0	0	0
Unknown	1	1	2	0	3	7
Total	**13**	**14**	**40**	**12**	**67**	**146**
Time of Day						
7:00AM to 9:00AM	4	0	0	1	6	12
9:00AM to 4:00PM	5	12	29	6	37	91
4:00PM to 6:00PM	4	0	5	4	15	28
6:00PM to 7:00AM	0	2	6	1	9	15
Unknown	0	0	0	0	0	0
Total	**13**	**14**	**40**	**12**	**67**	**146**

5.3.1 High Crash Locations

High Crash Locations

VTrans maintains a listing of High Crash Locations (HCL) within the state. A 0.3 mile highway segment or intersection must have at least 5 crashes over a 5-year period and the actual crash rate (number of crashes per million vehicles) must exceed a critical crash rate to be classified as an HCL. The critical crash rate is based on the average crash rate for similar highways.

The VTrans High Crash Report: Sections and Intersections 2012-2016 lists two intersections and three roadway sections as HCLs within the project study area. These are summarized in Table 7.

Table 7 - US 5 Corridor High Crash Locations 2012-2016

	Cross Streets	HCL No.	Mile Marker	AADT	Crashes	Fatalities	Injuries	Actual/ Critical Ratio	Severity Index
Intersections	Sykes Mtn Ave	86	3.050 – 3.080	15,206	23	0	4	1.121	$25,217
	VT Rte 14	6	4.060 – 4.160	14,328	63	1	8	2.426	$44,913
Segments	Arboretum Ln / VA Cutoff	154	2.261 – 2.561	5,383	12	0	1	1.899	$17,733
	Jasmin Ln / I91 NB Ramps	257	2.661 – 2.961	9,045	15	0	3	1.604	$26,740
	Woodstock Rd (US4) / Round House Rd	616	3.461 – 3.761	8,346	10	0	5	1.137	$51,030

Note: Woodstock Rd (US4) / Round House Rd segment is part of the separate VTrans Scoping Effort

5.4 NATURAL RESOURCES

VTrans conducted a preliminary review of the natural resources present within the project area. This included desk research on the following: Stormwater permits, identified and characterized wetlands, streams, rare, threatened, or endangered (RTE) species, wildlife habitat, agricultural land, 4(f) and 6(f) public lands, and hazardous waste sites. Following is a summary of the findings.

Archaeological Resources. VTrans conducted preliminary desk review of the site and neighboring resources consulting the VDHP Environmental Predictive Model, the Online Resource Center (ORC), historic maps such as Beers and Wallings, and additional documentation on the history of Hartford and the construction of US-5. Due to an undefined scope, the assumed APE was 50m from the surrounding roadways. Much of the area consists of dense urbanization, with consistent industrialization to surrounding natural environments. This proves consistent throughout the history of Hartford and White River Junction according to details from historic maps that depict similar circumstances in certain locations within the potential area of effect (APE). A visual analysis of the immediate roadway identifies drainage slopes, and soils that appear manipulated and disrupted as a result of persistent construction and development projects both state and privately funded; in fact, this project proposed by VTrans overlaps with multiple alternative VTrans nominated projects established to improve the condition of the roadway and/or neighboring structures. Therefore, it is predicted the soils surrounding the immediate roadway contain heavy disturbances that exempt most of the project area and APE from archaeological consideration at this time.

However, a distinguished area located near the southern end of the project contains evidence supporting archaeological potential. Class 2 wetlands neighbor this area, along with apparent natural, undisturbed areas (a Figure is in Appendix E). Should the scope of the project exceed the predicted APE, a new assessment of archaeological impacts will be required

Historic Preservation Resources. Multiple historic resources (Figure 1) were identified within the surrounding environment of the project Area of Potential Effect (APE) included the following: Hartford High School; Wright Tomb; 66 Barnes Ave Residence; and, Terraces Historic District

A full description and a map depicting their location is in Appendix E.

Wetlands and Watercourses. There is one small wetland complex south of I-89, east of US 5 and adjacent to Arboretum Lane at the southern end of the project area. There is one larger wetland north of I-89 and east of US Route 5 opposite the VA Cutoff Road and extends behind the Motel 6. There are two small unnamed streams and the White River within the project corridor. See the maps in the appendix for blue lines showing streams. Riparian areas along each of these streams should be protected or enhanced if impacts are anticipated.

Agricultural Soils: There are several areas mapped as prime agricultural soil along the project area. These include the large wetland behind Motel 6 and an area along the southern bank of the white river. A map with these areas is in Appendix E.

Wildlife Habitat. The larger wetland complex is likely home to wildlife and impacts should be minimized. Each stream, especially the White River, likely provides habitat for aquatic organisms and terrestrial wildlife along the riparian corridor. Larger structures installed on the smaller streams where they cross US Route 5 streams would improve aquatic organism passage and terrestrial wildlife movement. Maintaining a healthy riparian area along the White River would help ensure terrestrial wildlife movement along the stream.

Rare, Threatened and Endangered Species. The project area is within the historic range of the state endangered Fowler's toad. It is unlikely that this project will impact this species, although further coordination will be required with Vermont Fish & Wildlife Department. The project is also within the known range the of the federally threatened northern long-eared bat. No restrictions from this species are anticipated.

Stormwater and Water Quality. Based the review of existing imagery and mapping (ANR Natural Resource Atlas, VTrans Operational Stormwater Permits & VTrans Corridor Needs) and a field visit on 2/8/18, there are three stormwater permits near the proposed site area and effort to avoid impacting these permits should be made. These permits involve the Town's Sykes Mountain Ave roundabout project, the Ryder Truck Rental at the US 5/Sykes Mountain Avenue intersection and the Fairfield Inn and Suites off Ballardvale Drive.

The western section of the corridor is in the Ottauquechee-Black-CT Direct region and the eastern section of the corridor is in the White Region. The Connecticut River is listed as an impaired water due to altered flow from the Wilder Dam. This should not be a concern for this project and no specific treatment is required for discharges to this receiving water. The White River is listed as a stressed water due to elevated bacteria levels. The pollutant has been identified as E.Coli however, the sources are unknown. Should stormwater treatment be required in areas where the White River is identified as the receiving water treatment options with bacteria removal efficiencies should be evaluated. This project site is not within an MS4 area.

Public Lands. The project area does include public recreation lands (a Section 4(f) resource) or public lands developed with Land and Water Conservation Funds (a Section 6(f) resource).

Hazardous Waste Sites. The ANR mapping program indicates multiple sites adjacent to the project area although no mapping was provided.

Development Soils. The entire region is designated and coordination will be needed regarding VT LRS for this site.

USDA-Forest Service Lands. None identified.

Scenic Highway/Byway. None identified

ACT 250. There are multiple sites with ACT 250 permits adjacent to the project area and will need to be considered.

FEMA Floodplains. There are floodplains associated with the White River and its limtis are depicted on ANR mapping.

Flood Hazard Area/River Corridor: There is Flood Hazard Area and River Corridor associated with the White River and will require FHARC coordination/permit; see ANR map.

US Coast Guard. None identified.

Lakes and Ponds: None identified.

Environmental Justice: None identified.

Source Protection Area: This area is not a water source protection area.

Public Water Sources/ Private Wells: There are several private wells in the area.

Other: Public sewer covers much of the project area.

6.0 PURPOSE AND NEED STATEMENT

The following statement was developed based on the existing conditions assessment, public input, and project advisory committee discussions.

Purpose: The purpose of this project is to develop transportation system improvements that enhances the safety for all users; reduces traffic congestion and facilitates mobility for people and goods; and improve the bicycle and pedestrian network and its connectivity.

Need:

1. Improve safety for all users in the project area.

- *There is a need to address High Crash Locations (HCL) in the project area.* Based on the most recent VTrans HCL report, there are 2 identified HCL intersections and 3 identified HCL segments within the project corridor. The most significant of these is the US5/VT 14 intersection which is ranked number 6 in the report and the 2 segments at the southern end of the corridor, Arboretum Ln to VA Cutoff (ranked #154) and Veteran's to I-91 NB Ramps (ranked #257). The second HCL intersection is the US5/Sykes Mountain Avenue intersection which is currently planned to be converted to a modern roundabout.
- *There is a need to provide for safe and efficient bicycle and pedestrian travel through the corridor.* There are no on-road or off-road bicycle facilities along the corridor. Much of the corridor has 2-foot shoulders and a 5-foot wide sidewalk. The I-91 interchange does have a planned sidewalk on the east side but it is problematic crossing the I-91 NB off ramp. Marked US 5 pedestrian crossings do not exist at US5/Veteran's Drive or the US 5/North Main Street intersections.

2. Reduce traffic congestion and facilitate mobility for people and goods.

- *There is a need for roadway improvements to reduce congestion and improve efficiency of the highway system in the project area.* Currently the queues and delays are experienced at Veteran's Drive, I-91 SB Off Ramp, and I-91 SB Off-Ramp, VT 14 and Highland Avenue intersections. Levels of service are "D" or below in the AM and/or PM peak hour.

***3.* Improve bicycle and pedestrian network and connectivity.**

- *There is a need to develop bicycle facilities that would establish a connection to destinations along the corridor such as the Veteran's Administration hospital, Sykes Mountain Avenue growth area, the historic downtown and the school facilities at Highland Avenue.* For much of the corridor there are 2-foot shoulders and no off-road bicycle facility.
- *There is a need to develop pedestrian facilities that would complete connections in the existing sidewalk network.* Much of the project corridor has or plans to a have a 5-foot sidewalk at least on one side. A marked US 5 pedestrian crossing does not exist in the area of Veteran's Drive or North Main Street.

7.0 FUTURE CONDITIONS

7.1 FUTURE TRAFFIC VOLUMES

Roadway and traffic conditions in the study area were projected to a future design year of 2040. Existing traffic volumes were increased by 10 percent. This growth rate was obtained from the 2017 VTrans *Red Book* which compiles and analyzes traffic volume data collected by VTrans. The VTrans recommended growth factor to increase 2018 volumes to 2040 is 1.10. Intersection operations were then analyzed for the future travel demands. The resulting 2040 AM and PM peak hour traffic flow networks are shown in Figure 16 and Figure 17.

Figure 16 - 2040 AM Peak Hour Traffic Volumes

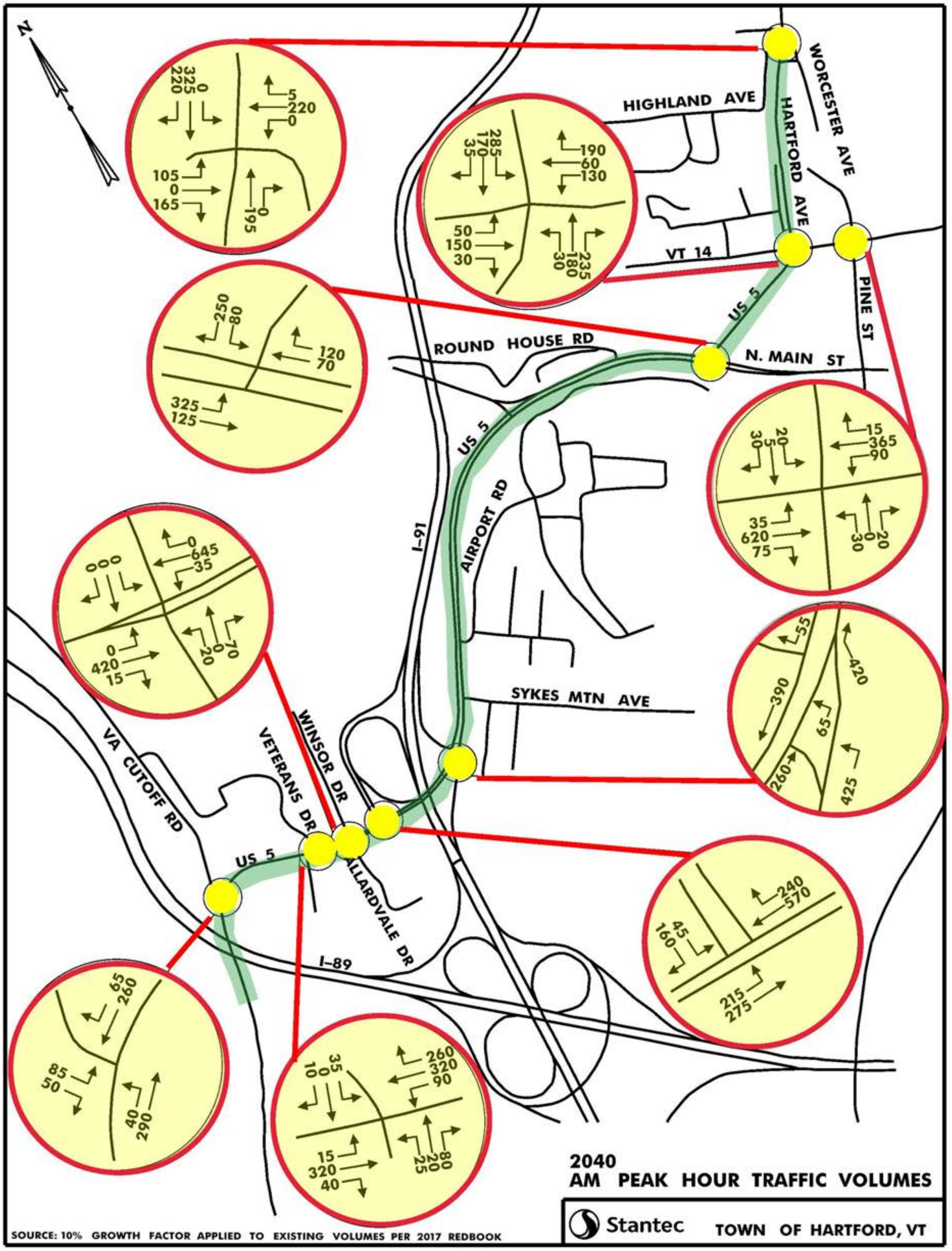
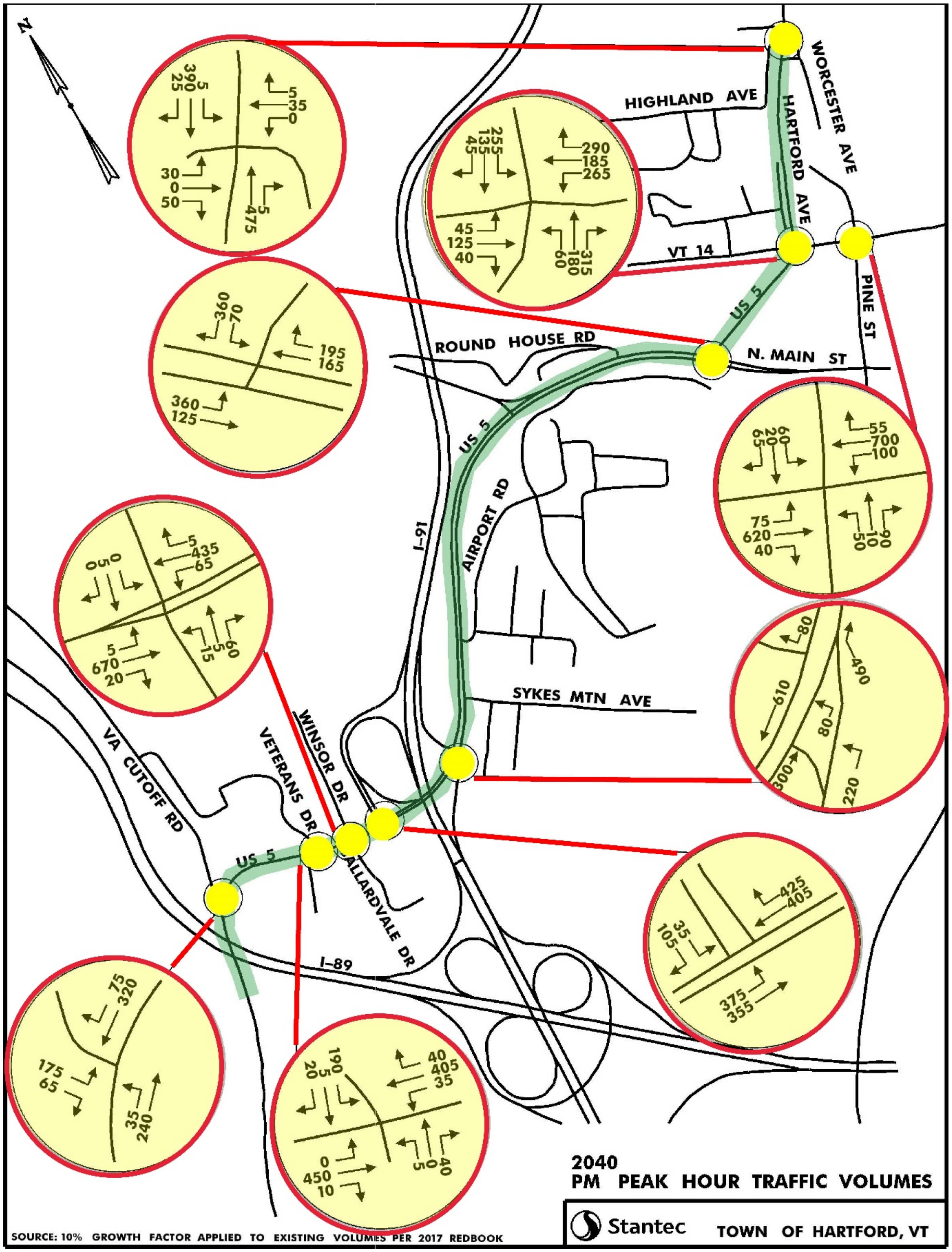


Figure 17 - 2040 PM Peak Hour Traffic Volumes



Stantec

7.2 FUTURE TRAFFIC OPERATIONS

The traffic operations analysis conducted for existing traffic conditions were repeated for the future conditions based on the traffic growth assumptions described above. The analysis examined the 11 intersections. As shown in Table 7 below, new traffic growth will increase utilization (V/C) during both the AM and PM peak hours for each of the intersections. New traffic growth will result in several intersections being over capacity (V/C >1), including: Veterans Drive, I-91 SB Ramps, and I-91 NB Off Ramp.

Table 8 - Future Intersection Capacity Analysis Results

				Existing (2018)			Future (2040) No Action		
	Control	Condition	Peak Hour	LOS[1]	Delay[2]	V/C[3]	LOS[1]	Delay[2]	V/C[3]
US 5 Intersections									
VA Cutoff Rd									
	Stop	EB approach from VA Cutoff Rd	AM	B	15.0	0.27	C	16.8	0.33
			PM	C	21.0	0.52	D	27.1	0.63
Veterans Dr / Dunkin Donuts									
	Stop	EB approach from Veterans Dr	AM	D	30.3	0.24	E	40.5	0.33
			PM	F	97.5	0.97	F	>60	1.24
Winsor Dr / Ballardvale Dr									
	Stop	Left turn from Ballardvale Dr	AM	D	28.5	0.12	D	34.1	0.14
			PM	D	34.8	0.11	E	42.5	0.14
I-91 SB Ramps									
	Stop	EB approach from off ramp	AM	D	34.1	0.64	F	59.9	0.83
			PM	E	49.6	0.66	F	>60	1.62
I-91 NB Off Ramp LT									
	Stop	Left turn from off ramp	AM	E	48.4	0.90	F	90.4	1.06
			PM	D	26.5	0.58	E	36.3	0.70
I-91 NB On Ramp									
	Free	Left turn onto ramp	AM	A	8.5	0.07	A	8.6	0.08
			PM	A	9.7	0.09	A	9.7	0.11
I-91 NB Off Ramp RT									
	Free	Not calculable	AM	-	-	-	-	-	-
			PM	-	-	-	-	-	-
N. Main St									
	Signal	Overall	AM	A	9.8	0.37	A	9.7	0.39
			PM	B	10.1	0.46	B	10.6	0.51
VT Route 14									
	Signal	Overall	AM	C	33.4	0.66	D	40.3	0.72
			PM	D	47.3	0.75	D	47.5	0.86
Highland Ave / Worcester Ave									
	Signal	Overall	AM	C	28.1	0.41	C	29.5	0.46
			PM	B	10.1	0.29	B	10.4	0.32
Additional Intersections									
VT Route 14 / Pine St / Bridge St									
	Signal	Overall	AM	A	8.0	0.52	A	8.8	0.57
			PM	A	9.9	0.56	B	10.7	0.60

[1] LOS= Level of Service
[2] Delay = Average delay expressed in seconds per vehicle
[3] V/C = Volume-to-capacity ratio for critical movements

8.0 ALTERNATIVES

To assist with the evaluation and selection of alternatives, this 2-mile corridor was divided into the following segments:

- US 5 Segment 1: Arboretum Lane to Ballardvale Drive
- US 5 Segment 2: Ballardvale Drive to Sykes Mountain Avenue
- US 5 Segment 3: Airport Road to North Main Street
- US 5 Segment 4: North Main Street to Highland Avenue
- VT 14/Bridge/Pine Street Intersection

Alternatives for each of these areas included No Action, short term improvements that may be accomplished in less than 5 years once funding is in place, and long term alternatives that may take more than 5 years to accomplish once funding is in place. Some of the short term improvements that occur within the width of the existing roadway could be implemented with corridor paving projects as appropriate.

8.1 US 5 SEGMENT 1: ARBORETUM LANE TO BALLARDVALE DRIVE

8.1.1 No Action

For the No Action alternative, the existing transportation facilities in the project area remain as they exist today. With this alternative, the operation of the US 5/Veterans Drive/Dunkin Donuts intersection will continue to be problematic for the Veterans Drive approach as shown on the table below. Currently, the US 5/VA Cutoff Road intersection does not meet signal warrants and will need about 25% growth on the VA Cutoff Road to achieve a traffic volume to meet the peak hour signal warrant. The US 5/Veterans Drive/Dunkin Donuts intersection falls short of the peak hour signal warrant by approximately 10 vehicles on Veterans Drive, but the addition of a signal would likely redirect VA traffic exiting via the VA Cutoff Road to Veterans Drive, thereby meeting a signal warrant.

Table 9 - US 5 Segment 1 Intersection Capacity Analysis Results

				Existing (2018)			Future (2040) No Action		
	Control	Condition	Peak Hour	LOS	Delay (sec)	V/C	LOS	Delay (sec)	V/C
US 5 Intersections									
VA Cutoff Rd									
	Stop	EB approach from VA Cutoff Rd	AM	B	15.0	0.27	C	16.8	0.33
			PM	C	21.0	0.52	D	27.1	0.63
Veterans Dr / Dunkin Donuts									
	Stop	EB approach from Veterans Dr	AM	D	30.3	0.24	E	40.5	0.33
			PM	F	97.5	0.97	F	>60	1.24

8.1.2 Short Term Improvements

The Veterans Drive corner sight distance looking north, and the Winsor Drive corner sight distance looking south, can be improved by removing some existing trees and grading the existing slope. Based on property lines shown in the Hartford STP EH10(18) sidewalk plans, this work can be done within the existing highway right-of-way.

There is a separate project being developed by the Town that will address some of the pedestrian and bicycle concerns in the area. This improvement includes a 5-foot concrete sidewalk along the east side of US 5 from Arboretum Drive to Ballardvale Drive and 4 foot or greater wide shoulders for bicycles. This project has progressed to right-of-way acquisition phase.

This area is also experiencing some redevelopment of the adjacent commercial properties. As this redevelopment occurs, access management should be considered in the permitting process. One candidate may be the Irving Station at the corner of US 5 and the VA Cutoff Road. This facility was recently closed and may be proposed for redevelopment in the future.

One redevelopment that occurred in 2017, was the Dunkin Donuts opposite Veterans Drive. During discussion with stakeholders it was pointed out that turning right out of Dunkin Donuts often requires vehicles to cross into the oncoming US 5 southbound left turn lane. Reconfiguring the Dunkin Donuts drive and parking area to provide an adequate right turn radius is needed. Since this development was granted a State Highway Access and Work Permit by VTrans, this reconfiguration could be pursued under the restrictions and conditions of that permit.

As indicated by the intersection capacity analysis, the traffic operations are problematic, primarily during the PM peak period, as vehicles are exiting Veterans Drive and seeking to turn left onto US 5 northbound. It is suspected that many exiting the Veterans Administration Hospital (VA) are taking the rear exit and using the VA Cutoff Road and based on 2018 traffic counts signal warrants are not met. Travel Demand Management (TDM) may be part of the solution for this peak hour issue. TDM provides travelers with choices to help manage transportation demand, with the potential to reduce overall travel demand for single-occupancy vehicle (SOV) use. When implemented sustainably and successfully, TDM can reduce or delay the total need for capacity expansion. TDM practices include:

- Transit/shuttle service management - Transit service available to a site, personal security, route and scheduling information, and coordination with traveler information service. The VA currently has several shuttle systems serving the facility and VA staff are provided an incentive to use them.

- Alternative work schedules - Four 10-hour days per week, staggered hours, flexible hours. The VA currently uses 3 staggered daytime work shifts. (7am - 3:30 pm, 7:30 am - 4:00 pm and 8 am - 4:30 pm)

- Quality Pedestrian Movement – Availability of pedestrian facilities that are integrated within the overall transportation network and accommodate or even promote non-motorized travel. Within the facility there are pedestrian connections but limited connections beyond the facility. This will improve with the Town's US 5 sidewalk project which will promote walking and the need for a US 5 pedestrian crossing.

- Traveler information - Pre-trip, near pre-trip, and in route information provided to the traveler via roadside, in-vehicle or personal communication devices for the current travel conditions, trip planning services, tourism, special events, and parking information. This is available on the statewide 911 system.

- Parking Management - Parking information, variable pricing, routing to available parking. The VA facility has numerous designated staff parking areas that are free. Expanding one of the parking areas to a parking deck is being discussed.

- Ride-matching Program – Carpools, vanpool programs, preferred parking, transit or parking subsidies. Ride share is promoted but no incentive is provided.

- On-Site Travel Coordinator – Staff and services focused on travel services and demand management strategies. Current VA facility staff serve this function.

- Amenities on site - Bicycle racks, showers, automated teller machines, vanpool or carpool park, local shuttle service, infrastructure for teleworking. There are bicycle racks at the facility but currently not well used.

- Telecommuting Options – Work environment that supports employer-employee relationship from remote sites with consideration of accessibility, accountability, and productivity. There is limited opportunity for this since this is a patient facility that requires on-site service.

- Commercial deliveries management – Most deliveries occur during the non-peak hours and utilize both the VA Cutoff Road and Veterans Drive.

Based on this, there is limited opportunity to significantly reduce peak hour volumes with TDM, but as developments occur at the VA facility, additional programs should be considered.

Temporary signals using wood poles and guys were discussed as a potential short term alternative but were discarded. Utility relocation and right-of-way acquisition needs make the signal installation likely a long term alternative.

8.1.3 Long Term Alternatives

The two long term alternatives evaluated were as follows:

- Alternative LT1 – US 5/VA Cutoff Road Intersection Signal
- Alternative LT2 – US 5/Veterans Drive Intersection Signal

8.1.3.1 LT1 – US 5/VA Cutoff Road Intersection Signal

This alternative adds a signal at the US 5/VA Cutoff Road Intersection and changes the access at Veterans Drive to one-way in, or right-in and right-out only. This would require all Veterans Drive traffic that desires to travel north on US 5, such as to access I-91 and I-89, to use the northern Veterans Administration Hospital (VA) exit at the VA Cutoff Road. This change in operations would shift approximately 200 vehicles exiting the VA in the PM peak from Veterans Drive to the VA Cutoff Road. The results of a capacity analysis for the intersections under this alternative is in the following table. Intersection capacity is greatly improved for both the Veterans Drive and VA Cutoff Road intersections.

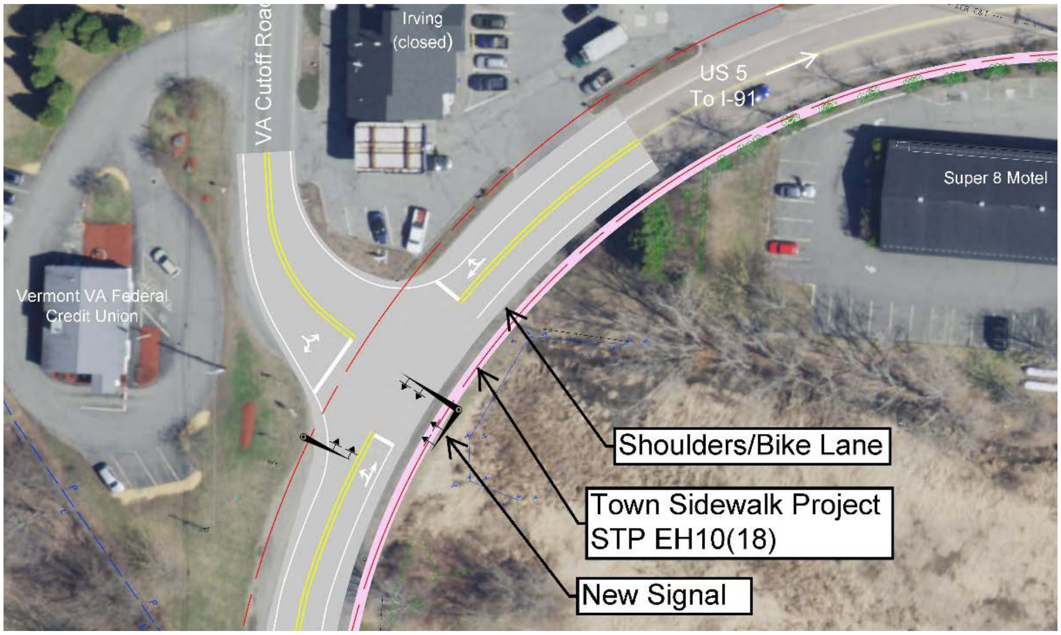
Table 10 - LT1 Future Intersection Capacity Analysis Results

Intersection	Future (2040)				
	Peak Hour	LOS	Delay (sec)	V/C	Queue Length 95th (FT)
VA Cutoff Rd Signal	AM	A	9.0	0.43	122 NBT, 102 SBT
	PM	B	16.4	0.65	209 EBL, 132 NBT, 184 SBT
Veterans Dr / Dunkin Donuts RT in / RT out	AM	B	11.1	0.02	-- / --
	PM	B	11.3	0.03	-- / --

This alternative changes the circulation within the VA facility and requires all exiting traffic to use the rear exit onto the VA Cutoff Road. Based on discussions with VA staff, this recirculation increases traffic on internal roadways that have conflicts and safety concerns. It also requires all delivery trucks to exit via the VA Cutoff Road and that circulation is impractical with the existing internal roadways. Improvements or additional circulation roadways will be required to accommodate this alternative.

As indicated in the figure below, this alternative does not require any geometry changes or addition of lanes. Right-of-way acquisition and communication line relocation may be needed for the signal installation. There is a wetland on the east side of US 5 that should be avoided. Permitting is anticipated to be limited to a Construction General Permit.

Figure 18 - Alternative LT 1 – US 5/ VA Cutoff Road Intersection Signal



8.1.3.2 LT2 – US5/Veterans Drive Signal

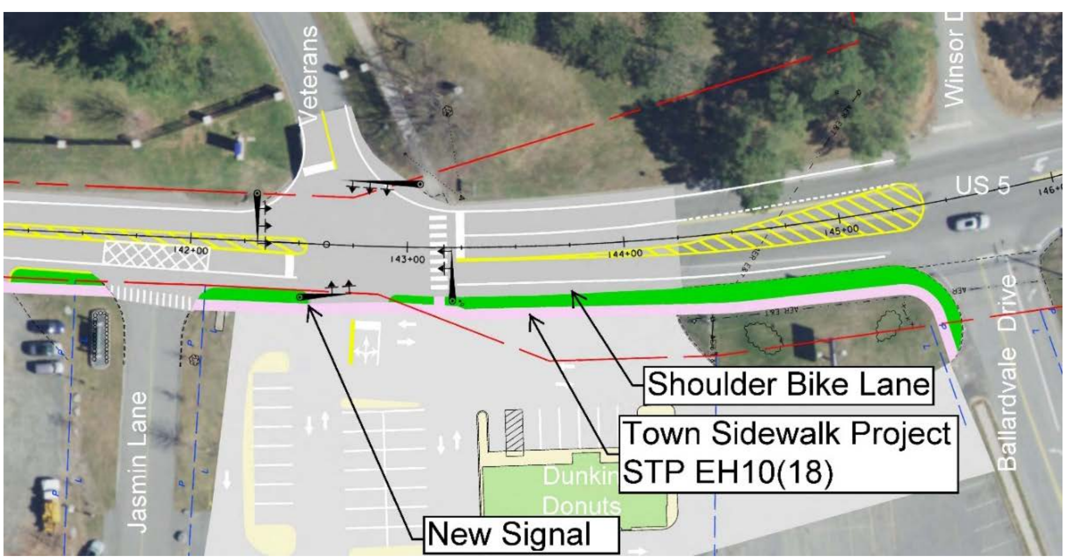
This alternative adds a signal at the US 5/Veterans Drive Intersection, retains the current access operations at Veterans Drive and includes the Dunkin Donuts driveway. Adding a signal does provide the opportunity to include a US 5 pedestrian crosswalk that connects the VA hospital sidewalk system to Dunkin Donuts and the Town's eventual eastside sidewalk. The results of a capacity analysis for the intersections under this alternative are as follows:

Table 11 - LT2 Future Intersection Capacity Analysis Results

Intersection	Future (2040)				
	Peak Hour	LOS	Delay (sec)	V/C	Queue Length 95th (FT)
VA Cutoff Rd Stop Control	AM	A	9.0	0.43	122 NBT, 102 SBT
	PM	B	16.4	0.65	209 EBL, 132 NBT, 184 SBT
Veterans Dr / Dunkin Donuts Signal	AM	A	6.5	0.47	126 SBT
	PM	A	9.9	0.58	183 NBT, 172 SBT

The capacity analysis indicates the greatest queues will occur on US 5 approaches and will block adjacent Jasmin Lane but would not extend into the US 5/Ballardvale/Winsor intersection. As indicated in the figure below, this alternative proposes "Do Not Block Intersection" signs and markings at Jasmin Lane and does not require any geometry changes or addition of lanes. A traffic simulation of this alternative in combination with signals at the I-91 ramps does not indicate any traffic operation issue as the closest intersection is approximately 600 feet away. Right-of-way acquisition and aerial line relocation may be needed for the signal installation. Permitting is anticipated to be limited to a Construction General Permit.

Figure 19 - Alternative LT 2 – US 5/ Veterans Drive Intersection Signal



8.1.4 Alternatives Evaluation

Below is an alternative evaluation matrix that provides a comparison of alternatives. One of the major differences is LT 1- US 5/VA Cutoff Road signal alternative requires improvements to the circulation roadways within the VA facility. The extent, cost and impact of these improvements are not known at this time and their cost is not reflected in the project construction cost in the matrix below. One benefit of a signal at Veterans Drive is that it provides a protected pedestrian crosswalk linking the VA to a proposed sidewalk on the east side of US 5 and to Dunkin Donuts and adjacent hotels and properties. The sidewalk installation does impact the new Dunkin Donuts parking. Its installation requires to Dunkin Donuts driveway stop bar to be relocated more than 10 feet from its present location and removes 4 parking spaces to provide a space for queued vehicles.

Table 12 - LT1 and LT2 Alternatives Evaluation Matrix

CRITERIA	No Action	LT1 – US 5/VA Cutoff Rd. Signal	LT2-US 5/Veterans Dr. Signal
Project Construction Costs	$0	$300,000	$400,000
Complete a missing pedestrian link	No	Some	Yes
Complete a missing bike link	No	Yes	Yes
Traffic Operations	Remains LOS F	LOS A	LOS A
Safety	No Improvement	Improved	Improved
Right-of-way	None	Minor	Minor
Environmental	None	Impact Unlikely	Impact Unlikely
Cultural Resources	No Impact	Impact Unlikely	Impact Unlikely
Utilities/ Drainage	None	Communication line relocation	Aerial line relocation
Stormwater	No Change	Minor Change/ No Permit	Minor Change/ No Permit
Adjacent Properties	No Impact	High Impact	Some Impact

8.2 US 5 SEGMENT 2: BALLARDVALE TO SYKES MOUNTAIN AVENUE

8.2.1 No Action Alternative

For the No Action alternative, the existing transportation facilities in this area remain as they exist today. With this alternative, the operations of the US 5 / I-91 Southbound Off-Ramp/On-Ramp intersection and US 5 / I-91 Northbound Off-Ramp/On-Ramp intersection will continue to be problematic. As shown on the table below, delay and queues will continue on the I-91 ramps. These intersections currently meet signal warrants. The capacity analysis at the US 5 / Ballardvale / Winsor intersection indicates the existing operations are adequate, signal warrants are not currently met, and no improvements are proposed.

Table 13 - US 5 Segment 2 No Action Intersection Capacity Analysis Results

				Existing (2018)			Future (2040) No Action		
	Control	Condition	Peak Hour	LOS	Delay (sec)	V/C	LOS	Delay	V/C
US 5 Intersections – No Action									
Winsor Dr / Ballardvale Dr									
	Stop	Left turn from Ballardvale Dr	AM	D	28.5	0.12	D	34.1	0.14
			PM	D	34.8	0.11	E	42.5	0.14
I-91 SB Ramps									
	Stop	EB approach from off ramp	AM	D	34.1	0.64	F	59.9	0.83
			PM	E	49.6	0.66	F	>60	1.62
I-91 NB Off Ramp LT									
	Stop	Left turn from off ramp	AM	E	48.4	0.90	F	90.4	1.06
			PM	D	26.5	0.58	E	36.3	0.70
I-91 NB On Ramp									
	Free	Left turn onto ramp	AM	A	8.5	0.07	A	8.6	0.08
			PM	A	9.7	0.09	A	9.7	0.11

8.2.2 Short Term Improvements

Although short term improvements are not expected to completely address the capacity or operation issues, the following improvements will assist to address them.

- Widen the I-91 Southbound Off-ramp to two lanes, a left and right turn lane. Interestingly, with a left and right turn lane and using the most recent turning movement counts the intersection technically would no longer meet signal warrants. It is anticipated with improvements, including a future signal, users who are currently avoiding this intersection by using other exits, would use it and volumes would meet signal warrants.

- Merge the US 5 Southbound right lane into a single thru lane after the I-91 Northbound On-Ramp, then mark and sign US 5 Southbound to include a right turn lane onto the I-91 Southbound On-Ramp. This will promote southbound thru vehicles to be in the left lane.

- Realign the US 5 Southbound thru lane at the I-91 Southbound Off-Ramp to soften the current lane shift across the intersection and provide better direction to US 5 southbound thru and right turn traffic.

- Create a T-intersection at the I-91 Northbound off ramp, requiring all northbound off ramp traffic to yield to US 5 vehicles and pedestrians crossing the ramp. This would require widening the ramp to two lanes up to 400 feet from the intersection.

- Provide bike lanes with crossing markings and signs.

- Continue to develop and construct the Town's sidewalk project connecting Ballardvale Drive to Sykes Mountain Avenue.

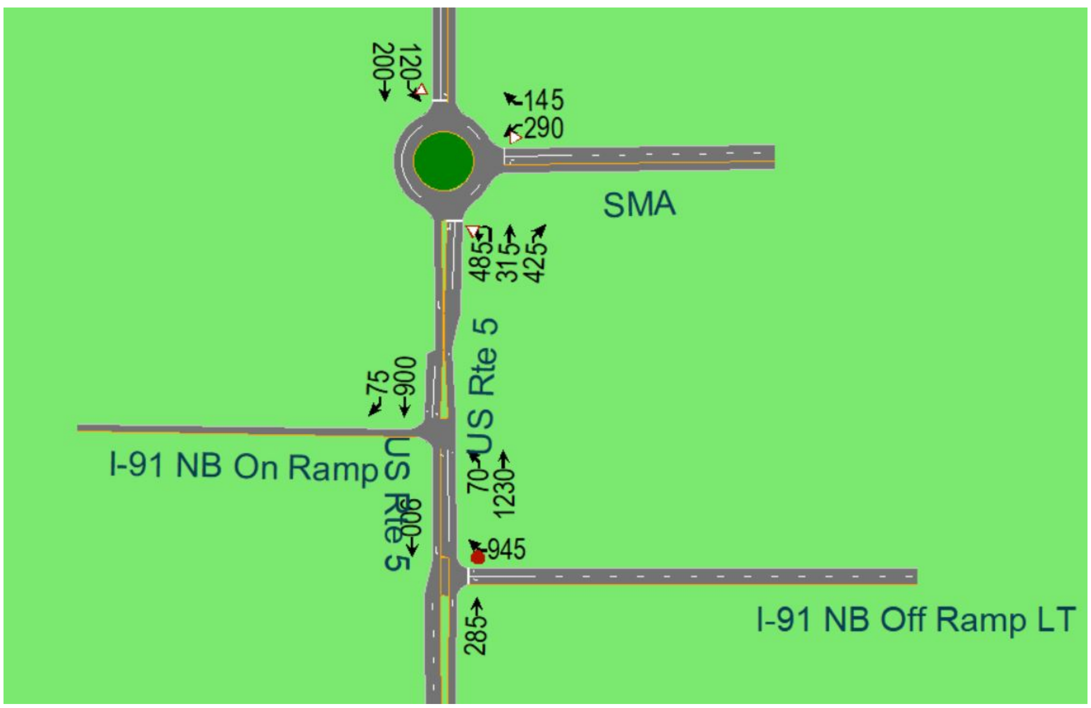
- Continue to develop and construct the roundabout at US 5/Sykes Mountain Avenue intersection.

The lane improvements described above can primarily be accomplished with pavement markings and signs. Some localized widening and edge of pavement relocation is needed for the I-91 Southbound Off ramp, the US 5 Southbound right turn lane and the T-intersection at the I-91 Northbound off ramp. These improvements are shown in the long term alternative figure. There is no right-of-way acquisition or utility relocation anticipated with these improvements. Permitting is anticipated to be limited to a Construction General Permit.

The construction cost of the US 5/I-91 Off-Ramp and On-Ramp intersection and the US 5/I-91 Northbound Off-Ramp intersection improvements is approximately $400,000.

An alternative that restricted I-91 Northbound Off-Ramp vehicles to right turns only and thereby eliminating the need for a signal was considered. This requires the existing ramp traffic that is turning left and destined for US 5 southbound to turn right from the Northbound I-91 Off-Ramp and make a U-Turn at the Sykes Mountain Avenue roundabout. We re-allocated the 2040 DHV turning volumes to reflect this condition and performed a capacity analysis using Synchro. The analysis assumed the conditions and volumes as shown in the following figure. As the figure indicates an additional 485 vehicles use the roundabout to make a U-Turn in the 2040 AM peak hour. With a stop condition for the I-91 Northbound Off-Ramp, the LOS for this approach in the AM peak was LOS D. The Sykes Mountain Avenue approach to planned roundabout was LOS E and the US 5 Southbound approach to the roundabout was LOS D in the PM peak. This analysis suggests the roundabout may need capacity improvements prior to 2040 and the traffic volumes at the I-91 Northbound Off-ramp intersection suggests the US 5 Northbound approach be the stop condition since it's 2040 AM peak traffic volume is 355 vehicles per hour compared to 945 vehicles per hour for the I-91 Northbound Off-Ramp approach. Based on this information it was determined not to pursue this alternative further.

Figure 20 - I-91 Northbound Off-Ramp Right Only 2040 AM Peak Volumes



8.2.3 Long Term Alternatives

8.2.3.1 LT3 - US 5/I-91 NB and SB Ramp Signals

This alternative adds signals at the US 5/I-91 Southbound and Northbound Ramps as signal warrants are currently met. Although by adding a right turn lane at the I-91 Southbound Off Ramp, this intersection will no longer meet signal warrants. It is anticipated that traffic volumes on the I-91 Southbound off-ramp may increase with a signal, as some travelers are using alternate routes to avoid this intersection. Therefore, it is assumed that signal warrants will be met by the time a signal is installed and additional traffic is realized by its installation. Below is the capacity analysis of the signalized intersections. With maximum 95 percentile queues of 290 feet on US 5, the signal operations will not create blocking queues of adjacent intersections such as Sykes Mountain Avenue or Ballardvale Drive.

Table 14 - LT3 Future Intersection Capacity Analysis Results

Intersection	Future (2040)				
	Peak Hour	LOS	Delay (sec)	V/C	Queue Length 95th (FT)
I-91 SB Ramps Signalized	AM	A	8.8	0.50	145 NBL, 206 SBT
	PM	A	7.1	0.58	158 EBL, 211 NBL, 101 NBT, 117 SBT
I-91 NB Ramps Signalize & Combined On & Off Ramps	AM	B	14.8	0.66	217 WBT, 119 NBT, 187 SBT
	PM	B	14.2	0.63	126 WBT, 99 WBR, 116 NBT, 290 SBT

This alternative includes the lane geometry improvements from the short term alternatives and has the following additional features:

- Install coordinated signals at the I-91 Southbound Ramps and I-91 Northbound Ramps.
- Realign the I-91 Northbound On Ramp to create a four-legged intersection with US 5 and the I-91 Northbound Off Ramp.
- Carry the single US 5 Southbound lane exiting the Sykes Mountain Avenue roundabout southerly with right turn lanes for the I-91 Northbound and Southbound On-Ramps.
- Install signal pre-emption detection if excessive queues occur on the I-91 Northbound Off-ramp.

There is no right-of-way acquisition or utility relocation anticipated with this alternative. Permitting is anticipated to be limited to a Construction General Permit.

Figure 21 - Alternative LT 3 – US 5/I-91 SB Ramp Signal

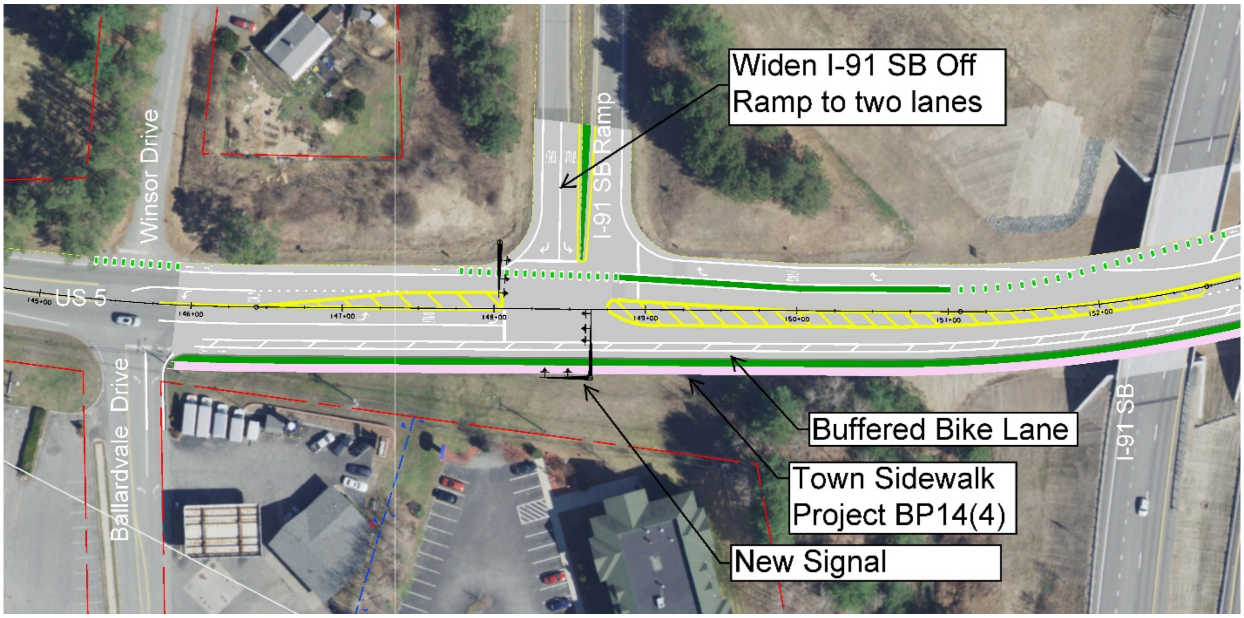
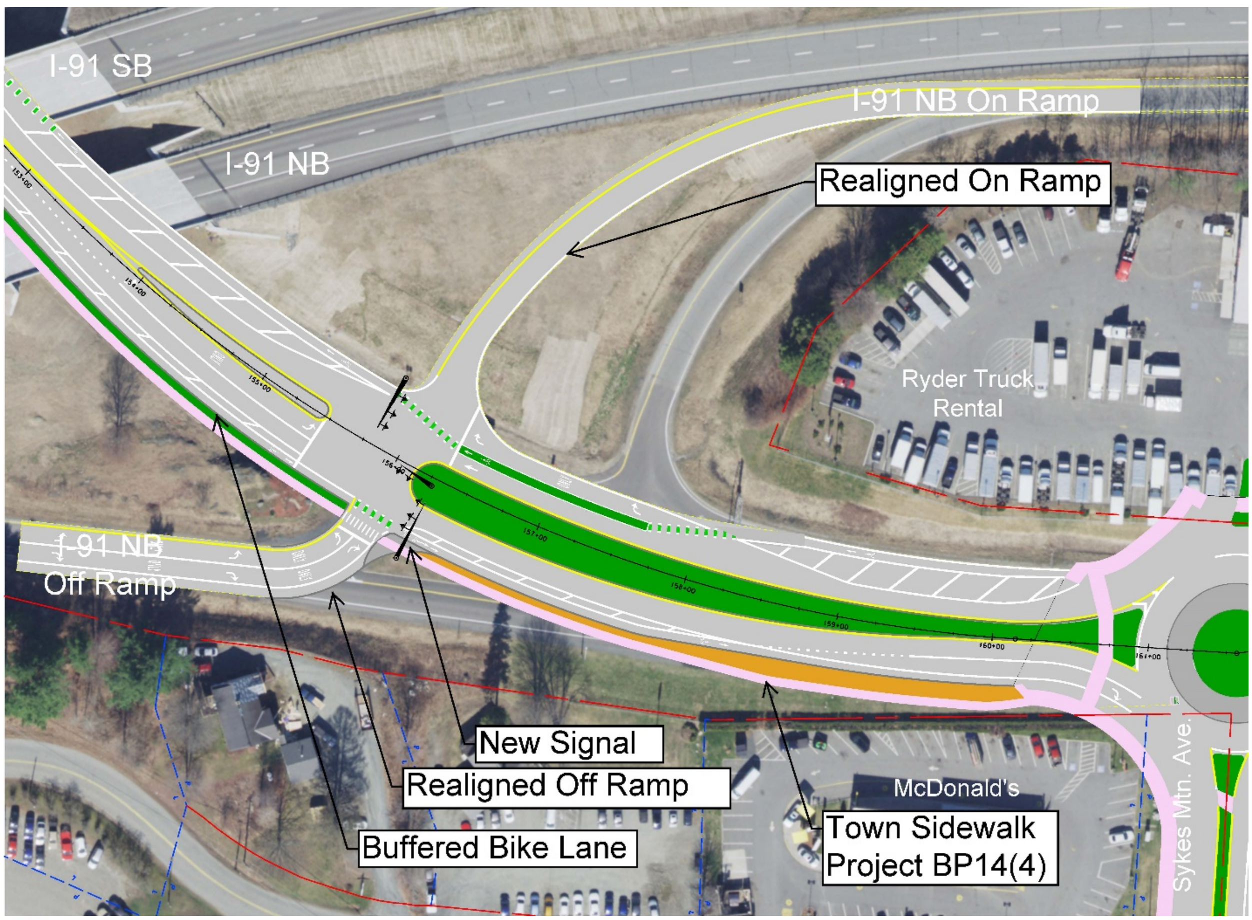


Figure 22 - Alternative LT 3 – US 5/I-91 NB Ramp Signal



8.2.3.2 LT4 - US5/I-91 NB and SB Ramp Intersection Roundabouts

This alternative constructs modern roundabouts at the US 5/ I-91 Northbound and Southbound Ramp intersections. They are single lane roundabouts with a bypass lane for the Off-Ramp approaches. Based on queue lengths and traffic simulations involving these two roundabouts, as well as the upcoming roundabout at Sykes Mountain Avenue, it is expected that these two roundabouts would function sufficiently along the corridor. Below are the capacity analysis results for their operation:

Table 15 - LT4 Future Intersection Capacity Analysis Results

Intersection	Future (2040)				
	Peak Hour	LOS	Delay (sec)	V/C	Queue Length 95th (FT)
I-91 SB Ramps Roundabout – US 5 SB	AM	C	21	0.79	98 NB, 229 SB
	PM	C	16	0.64	231 NB, 124 SB
I-91 NB Ramps Roundabout – US 5 SB	AM	D	27	0.77	197 SB US 5, 175 Off Ramp
	PM	C	19	0.77	201 SB US 5, 118 Bypass: Off Ramp to NB US 5

Features this alternative includes are as follows:

- Construct single lane roundabouts, about 150-foot diameter, with a bypass right turn lane at the Off Ramps.
- Provide a pedestrian crosswalk only at the I-91 Northbound Off Ramp.
- Provide a shared use path alternative and crosswalks for bicycles at the I-91 ramps. Bicyclists can assume a lane through the roundabout or use provided ramps to go onto the shared use path to use crosswalks.
- Realign the I-91 Northbound On-Ramp to create a four-legged intersection with US 5 and the I-91 Northbound Off Ramp.
- Provide buffered bike lanes with crossing markings and signs.

Figure 23 - Alternative LT 4 – US 5/I-91 SB Ramp Roundabout

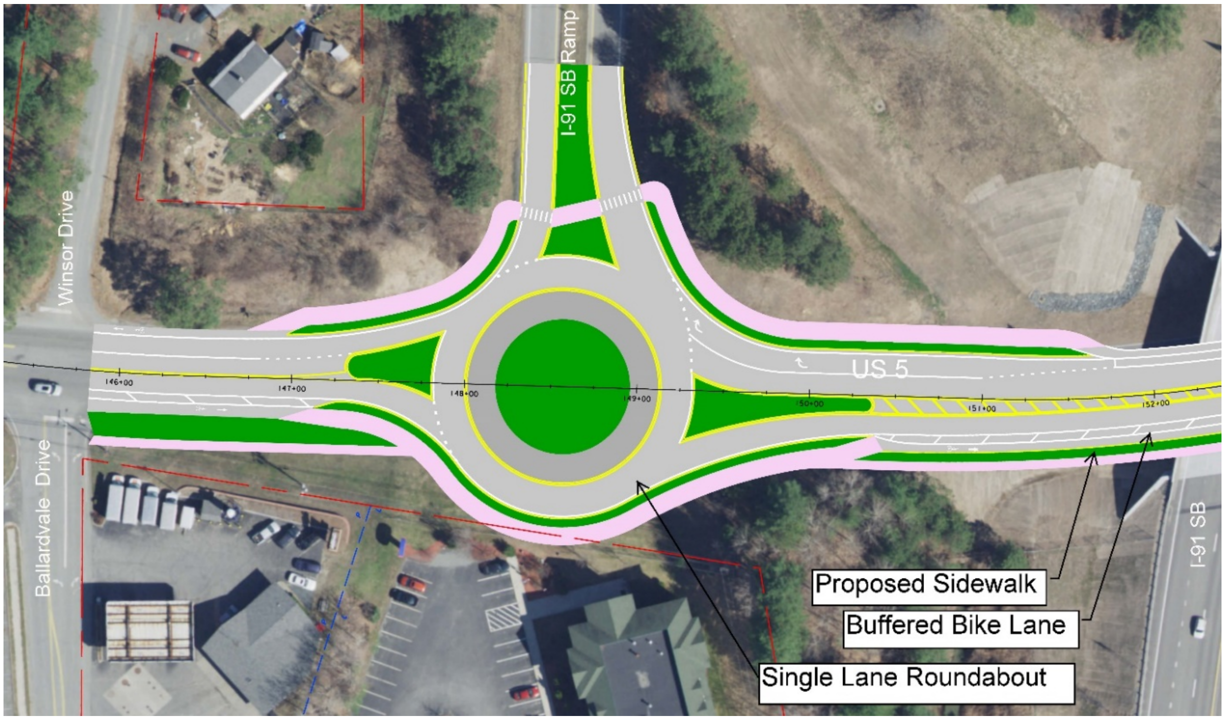
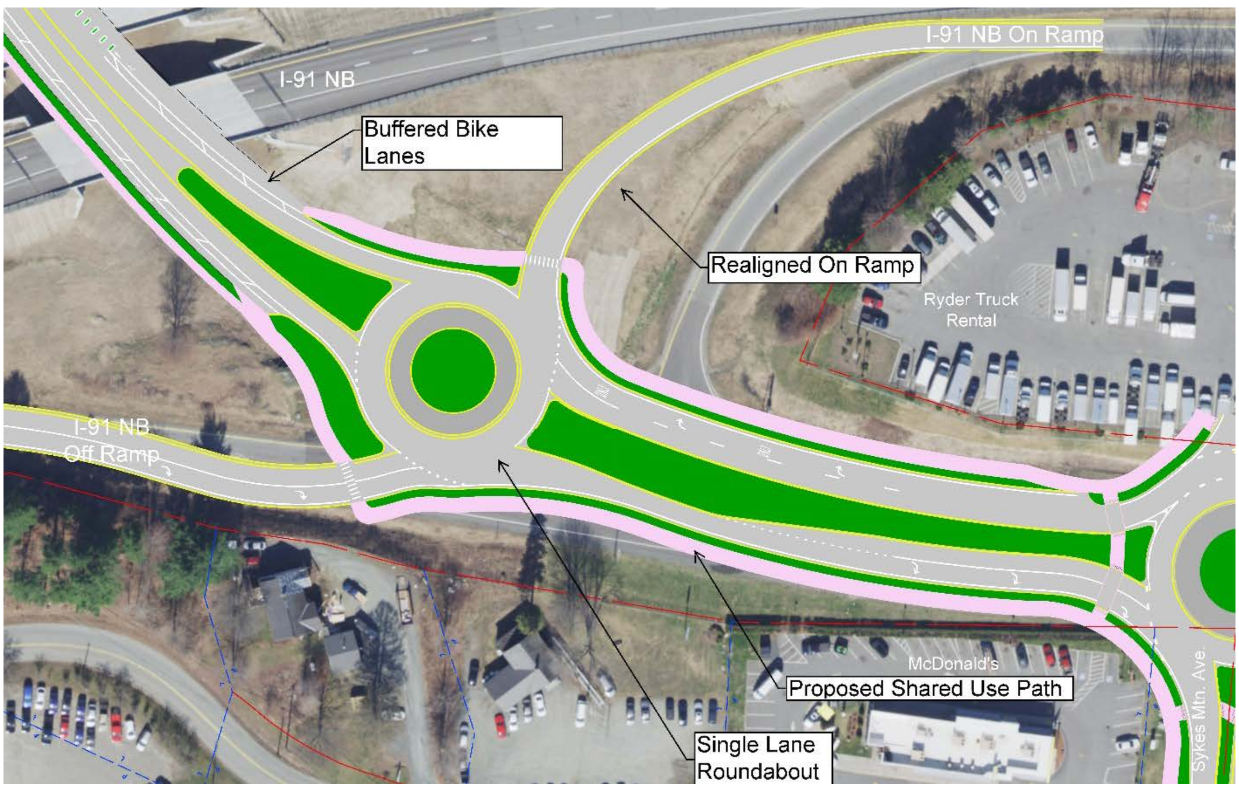


Figure 24 - Alternative LT 4 – US 5/I-91 NB Ramp Roundabout



Roundabouts can provide lasting benefits and value in many ways. They are often safer, more efficient, less costly to maintain, and more aesthetically appealing than conventional intersection designs. Furthermore, roundabouts are an excellent choice to complement other transportation objectives – including Complete Streets, multimodal networks, and corridor access management – without compromising the ability to keep people and freight moving. The FHWA Office of Safety identified roundabouts as a Proven Safety Countermeasure because of their ability to substantially reduce the types of crashes that result in injury or loss of life.

In the 2001-2002 Vermont legislative session, Act 141, Section 37 was passed. This provided support for roundabouts by indicating the following, "The general assembly finds that the installation of roundabouts at dangerous intersections in the state has been cost-efficient and has enhanced the safe operation of vehicles at these locations. The Agency of Transportation is directed to carefully examine and pursue the opportunities for construction of roundabouts at intersections determined to pose safety hazards for motorists."

The potential safety benefits associated with the alternatives proposed for the I-91 Ramps/US 5 intersections were determined and compared to the costs to implement these alternatives. The analysis is based on crash data for the years 2013 through 2017 and procedures described in the *Highway Safety Manual (HSM)* published by the American Association of State Highway and Transportation Officials (AASHTO) in Washington, D.C., 2000. Calculations were conducted using a worksheet developed by VTrans that provides assumed values for the cost of crashes by crash type and other factors to determine the annual cost of a specific expenditure for roadway improvements. The crash values are based on guidance provided in the *HSM*. The benefits of reduced crashes compared to the costs is shown in the table below. The benefit-cost ratios are low as there are limited crashes that occur at these intersections compared to other areas of the project such the US 5/Sykes Mountain Avenue intersection and the US 5/VT 14 intersection.

Table 16 - Benefit-Cost Summary for Improvement Alternatives

	I-91 Ramps/US 5	
Item	**LT3 – Install Traffic Signals**	**LT4 – Construct Modern Roundabouts**
Existing Annual Cost of Crashes	$59,500	$59,600
Anticipated Annual Crash Savings Due to Project	$23,000	$25,400
Project Implementation Cost	$1,500,000	$6,500,000
Annualized Project Cost	$98,500	$426,900
Benefit/Cost Ratio	0.23	0.06

8.2.4 Alternatives Evaluation

Below is an evaluation matrix to summarize the more significant differences between the alternatives. The construction costs and the benefits/cost ratio are the major differences and favor the signal alternative. The roundabout construction does not require right-of way as the ramps are in the I-91 limited access area that has a wide right-of-way.

Table 17 - LT3 and LT 4 Alternatives Evaluation Matrix

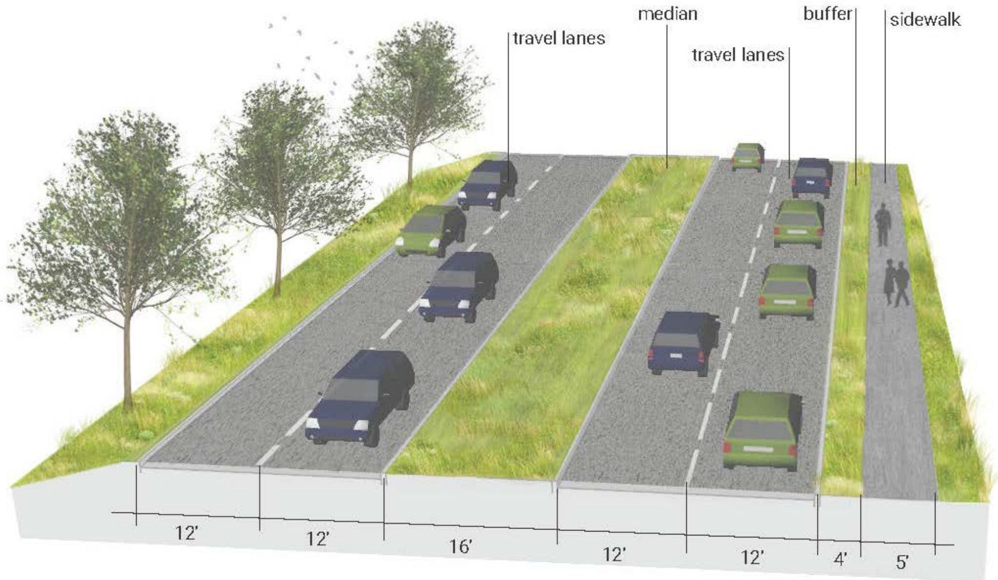
CRITERIA	No Action	LT3 – I-91 Ramp Signals	LT4-I-91 Ramp Roundabouts
Project Construction Costs	$0	$1,500,000	$3,500,000
Benefits/Cost Ratio	-	0.23	0.11
Complete a missing pedestrian link	No	Yes	Yes
Complete a missing bike link	No	Yes	Yes
Traffic Operations	Remains LOS F	LOS A-B	LOS C-D
Safety	No Improvement	Improved	Most Improved
Right-of-way	None	None	Minor
Environmental	None	Impact Unlikely	Impact Unlikely
Cultural Resources	No Impact	Impact Unlikely	Impact Unlikely
Utilities/ Drainage	None	Drainage Impacts	Drainage Impacts
Stormwater	No Change	Minor Change/ No Permit	Permit Required

8.3 US 5 SEGMENT 3: AIRPORT ROAD TO NORTH MAIN STREET

8.3.1 No Action Alternative

This segment remains a four lane highway with a dividing median. There are no shoulders and no dedicated bicycle facilities. Below is a cross section of the existing four lane highway which includes a 5 foot sidewalk.

Figure 25 - Existing US 5 Section



The existing US 5/Airport Road intersection continues to require crossing up to five lanes when exiting Airport Drive, and based on limited information for current traffic volumes, does not appear to meet signal warrants. The US 5/US 4 intersection is not addressed in this report as VTrans is developing the alternative improvements to that intersection separately.

The US 5/North Main Street intersection current and future (2040) capacity analysis, as shown below, indicates the intersection has excess capacity and no capacity improvements are needed, assuming no pedestrian phase is added. This intersection does lack a pedestrian crossing connecting the US 5 eastside sidewalk to the bridge sidewalk and that condition remains with the No Action alternative.

Table 18 - US 5 Segment 3 Intersection Capacity Analysis Results

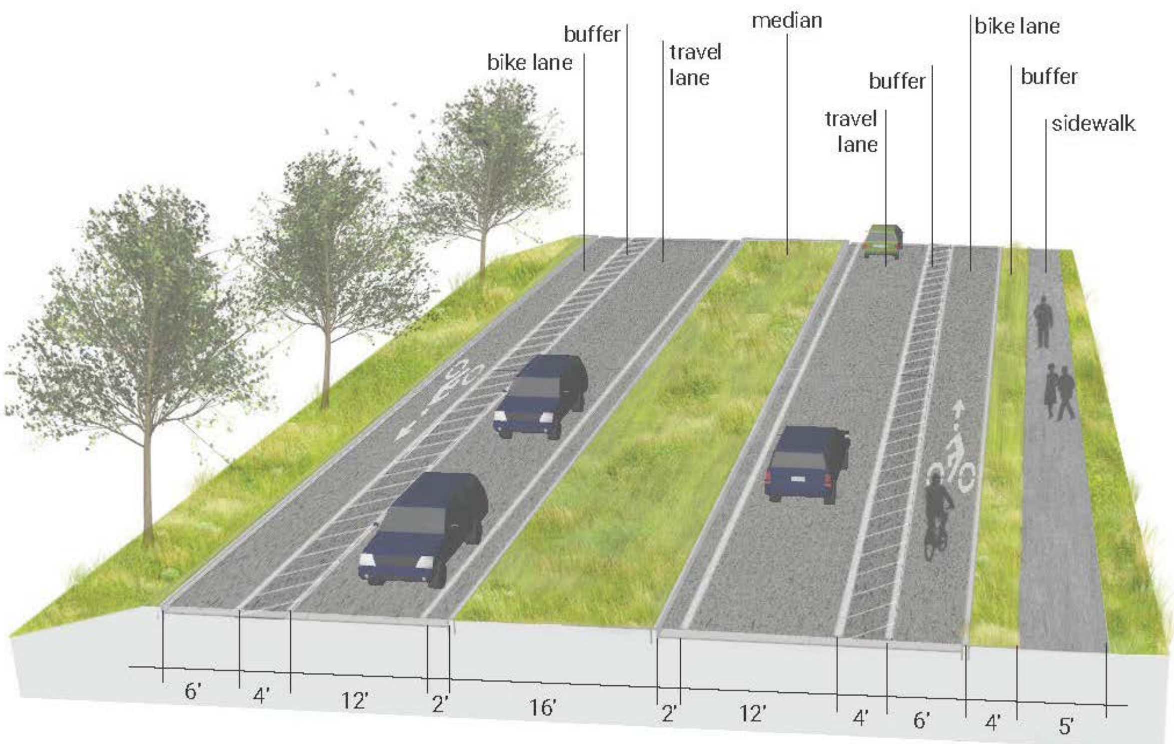
				Existing (2018)			Future (2040) No Action		
	Control	Condition	Peak Hour	LOS	Delay (sec)	V/C	LOS	Delay (sec)	V/C
US 5 Intersections									
North Main Street – existing conditions									
	Signal	Overall	AM	A	9.8	0.37	A	9.7	0.39
			PM	B	10.1	0.46	B	10.6	0.51

8.3.2 Short Term Improvements

The following short term improvements are accomplished primarily with signs and pavement markings and could be considered in the next VTrans resurfacing project. The potential improvements are as follows:

- Replace the existing US 5 right lanes with buffered bike lanes as shown below. The final lane and buffer widths are flexible and could vary, such as the travel lane could be 11 feet with a 6 foot buffer and 5 foot bike lane.

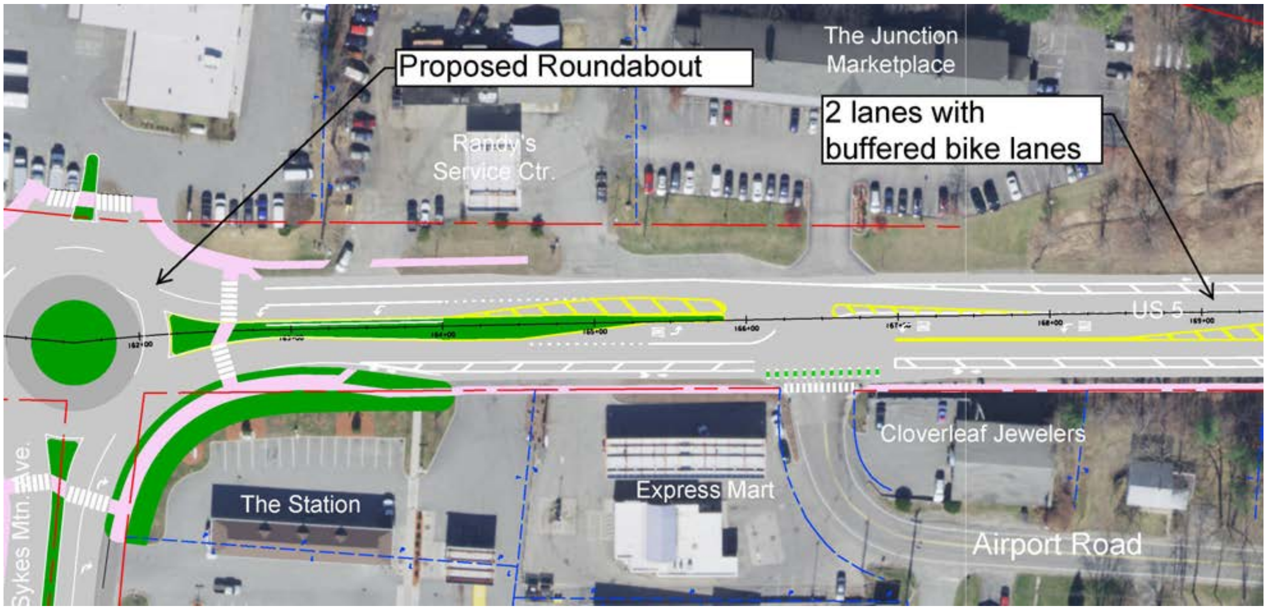
Figure 26 - US 5 Buffered Bike Lane Section



- Revise the US 5 Southbound approach to Sykes Mountain Avenue merge into one lane and then diverge with a left turn lane so as with the roundabout construction, thru traffic does not get trapped in the left turn lane.

On the following page is a graphic depicting the short term improvements at the US5/Airport Road area and the US 5/North Main Street intersection. Much of these improvements are accomplished by revising pavement markings and signs.

Figure 27 - US 5/Airport Road Improvements



The following are short term improvements for the US5/North Main Street Intersection:

- Provide one US 5 Northbound left turn lane and one US 5 Southbound approach lane at North Main Street intersection. This allows two travel lanes and buffered bike lanes on the US 5 Bridge. During recent construction on the bridge, temporary traffic control included reducing lanes to one travel lane in each direction over the bridge. Observations during that period suggest no capacity issues. Below are the capacity analysis results from this proposed intersection lane configuration, which demonstrates adequate capacity with the proposed lane reductions. If it is desired to retain the existing two US 5 Southbound approach lanes on the bridge, the right turn lane can be retained by having a shared travel lane and bike lane for approximately 150 feet.
- Realign the North Main Street channelized right turn to a safer and more acute approach angle and encourage yielding to US 5 vehicles, bicycles and pedestrians.
- Replace overhead signs at US 5/North Main Street intersection with ground mounted signs.
- Add pedestrian crossing connecting the US 5 eastside sidewalk to the bridge sidewalk.
- Upgrade the signal at the US 5/North Main Street Intersection, including pedestrian signal heads and phasing.

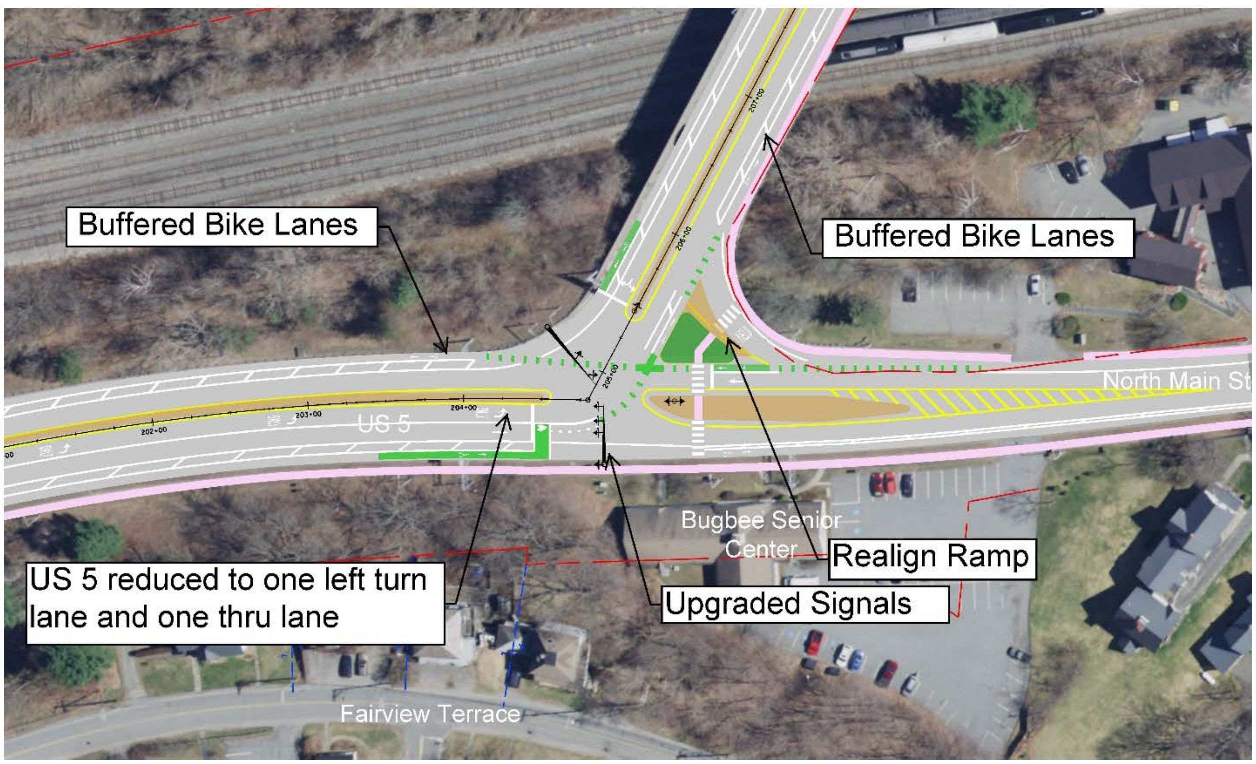
Table 19 provides the capacity analysis results of these intersection changes.

Table 19 - Future Intersection Capacity Analysis Results

Intersection	Future (2040)				
	Peak Hour	LOS	Delay (sec)	V/C	Queue Length 95th (FT)
US5/North Main Street	AM	B	16.5	0.63	188 EBL, 263 NBL
	PM	C	22.3	0.72	247 EBL, 376 NBL, 161 SBT

Below is a graphic depicting the US 5/North Main Street intersection. Many of these improvements are accomplished by revising pavement markings and signs.

Figure 28 - US 5/North Main Street Improvements



These short term improvements do not require right-of-way acquisition and no utility relocation is anticipated. Permitting is anticipated to be limited to a Construction General Permit. Assuming these improvements are done in conjunction with a VTrans Resurfacing project, the additional cost is the signal upgrade which is approximately $250,000.

8.4 US 5 SEGMENT 4: NORTH MAIN STREET TO HIGHLAND AVENUE

8.4.1 No Action

This segment includes US 5 from North Main Street to Highland Ave and the VT14/Bridge/Pine Street intersection. US 5 remains a four-lane highway with a dividing median. There are no shoulders and no dedicated bicycle facilities. The cross section of the existing four lane highway is similar to the Airport Road to North Main Street segment, which includes a 5 foot sidewalk and no shoulders.

The US 5/VT 14 intersection will continue to have the crash concerns with the US 5 Northbound left turns and right turns. Current and future (2040) capacity analyses, as shown below, indicates the intersection is approaching capacity. This analysis uses the existing signal timing and phasing and is not optimized since the signal has limited capabilities to be improved. The critical approaches are the US 5 Southbound left turn lane and the VT 14 Westbound left turn lane.

The US 5/Highland Avenue intersection will continue to experience queues and delays during the AM Peak but based on field observation, that peak is limited to a 20 minute period. The capacity analysis below is for a full peak hour and indicates there is adequate capacity. This is typical of intersection operations that are associated with school peaks. They are of short duration and it is difficult to justify significant capacity investments for this short duration.

For the VT 14/ Bridge Street intersection the capacity analysis of existing conditions indicates sufficient motor vehicle capacity. The needed maintenance of a 40+ year old signal will persist with the No Action alternative.

Table 20 - US 5 Segment 4 No Action Intersection Capacity Analysis Results

				Existing (2018)			Future (2040) No Action		
	Control	Condition	Peak Hour	LOS	Delay (sec)	V/C	LOS	Delay	V/C
US 5/VT 14									
	Signal	Overall	AM	C	33.4	0.66	D	40.3	0.72
			PM	D	47.3	0.75	D	47.5	0.86
Us 5/Highland Avenue									
	Signal	Overall	AM	C	28.1	0.41	C	29.5	0.46
			PM	B	10.1	0.29	B	10.4	0.32
VT 14/Bridge/Pine									
	Signal	Overall	AM	A	8.0	0.52	A	8.8	0.57
			PM	A	9.9	0.56	B	10.7	0.60

8.4.2 Short Term Improvements

There is a VTrans Class I town highway resurfacing project planned for VT 14 during FY 2020 or 2021. Many of the following improvements can be considered by that project.

- Upgrade US 5/VT 14 and VT 14/Bridge/Pine Street signal
- Reassign US 5 approach lanes as shown in figure below
- Realign US 5 Northbound right turn at VT 14 to a more acute angle to address right turn rear end crashes.
- Relocate and shorten pedestrian crossings at the US 5/VT 14 and VT 14/Bridge/Pine street intersection.
- Replace overhead signs at US 5/VT 14 and the VT 14/Bridge/Pine street intersection with ground mounted signs

8.4.2.1 US 5/VT 14 Intersection

Two short term improvements were considered for the US 5/VT 14 intersection. The first includes just upgrading the signal, optimizing signal phasing and timing, and retaining the existing lane configuration. The second adds to that by combining the US 5 northbound left turn lane with the northbound thru lane, providing a longer northbound right turn lane. While the former improvements do result in acceptable LOS, the latter improvements also better accommodate bicycles. The results are displayed in the table below. The queues displayed represent the 95th percentile condition; average queues fit within the storage lanes provided.

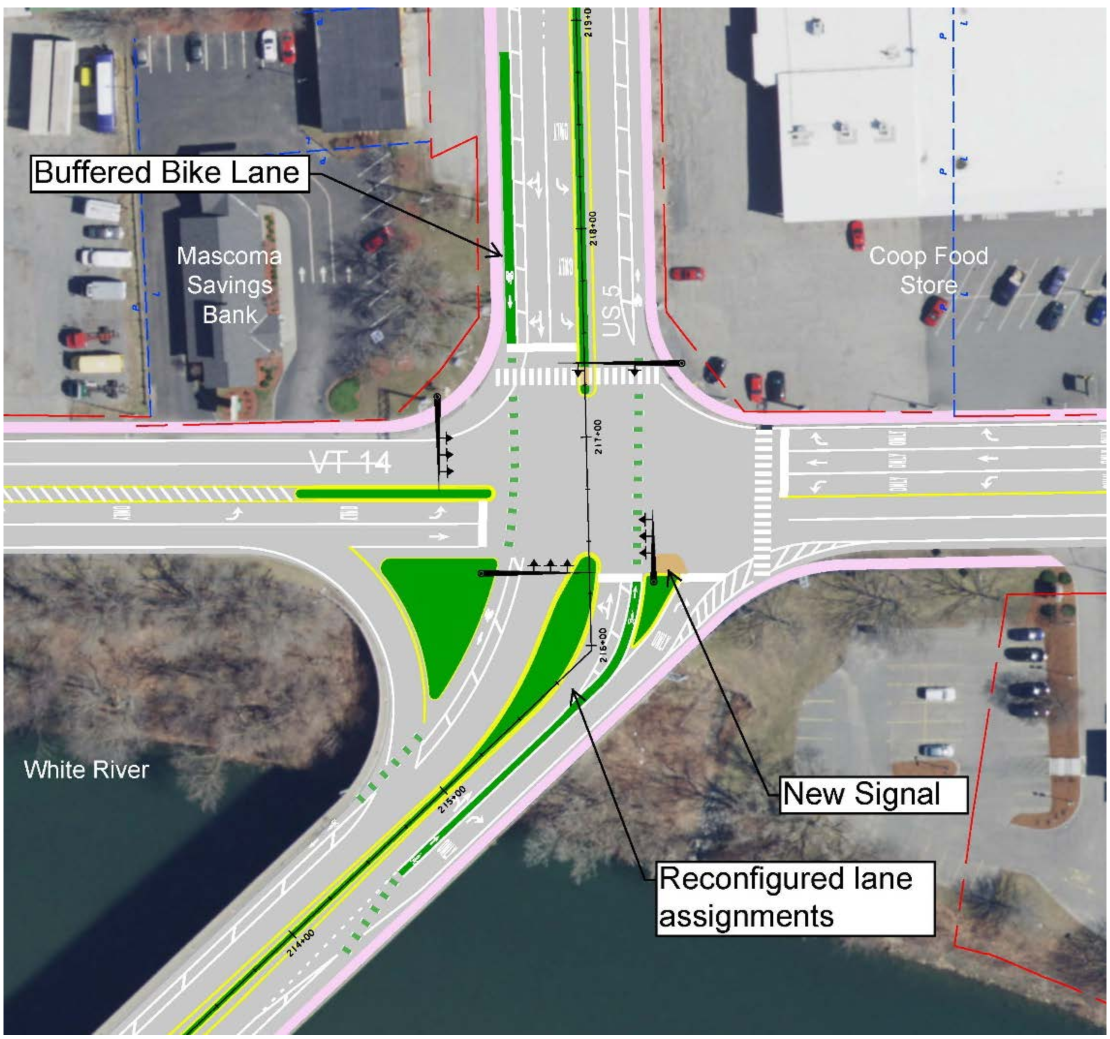
Table 21 - US 5/VT 14 Intersection Short Term Capacity Analysis Results

Intersection	Future (2040)				
	Peak Hour	LOS	Delay (sec)	V/C	Queue Length 95th (FT)
US5/VT14 Signal Upgrade and Optimized	AM	C	26.7	0.61	236 EBT, 154 WBL, 216 NBT, 107 NBR, 283 SBL, 162 SBT
	PM	C	30.0	0.77	148 EBT, 203 WBL, 168 WBT, 172 NBT, 294 NBR, 179 SBL, 96 SBT
US5/VT14 Signal Upgrade Reconfigured lanes, RT lane w/out blockage	AM	C	26.4	0.73	215 EBT, 114 WBL, 374 NBT, 417 SBL, 194 SBT
	PM	C	28.0	0.84	177 EBT, 252 WBL, 156 WBT, 423 NBT, 374 SBL, 169 SBT

The improvements to the US 5/VT 14 intersection are depicted in the following figure. Any improvements that involve adjusting the median on the US 5 bridge are problematic. There is a longitudinal joint the length of the bridge in the center of the median. Therefore, if the median is moved or removed, significant bridge work may be required. This work would include removing the deck between the center bridge beams, adding diaphragms between the center beams and replacing the deck. These short term improvements were developed so as not to impact the bridge and require this work.

These short term improvements are primarily accomplished with revising pavement markings and signs. There is no right-of-way or utility relocation anticipated. This assumes the new signal mast arms do not impact right-of-way or utilities. Permitting is anticipated to be limited to a Construction General Permit. Assuming these improvements are done as part of the upcoming VTrans Resurfacing project, no additional funding is needed.

Figure 29 - US 5/VT 14 Intersection Improvements



Additional short term improvements for this segment, as shown in the figure 29, include the following:

- Revise pavement markings on the US 5 Bridge to provide buffered bike lanes similar to Segment 3. If removing the US 5 Southbound Right turn lane at VT 14 is a concern the right turn lane can be retained by having a shared bike lane for approximately 150 feet.

8.4.2.2 US 5/Highland Avenue Intersection

A number of improvement scenarios were analyzed using Synchro for the US5/ Highland Ave intersection. They included the following:

- Add a protected/permitted phase for the Highland Ave. approach
- Revise the Highland Ave approach to a left turn lane and a combined thru and right turn lane.
- Shorten pedestrian phase at the US 5/Highland Avenue signal.

Adding the permitted and protected phase for the Highland Ave approach left turn and providing an exclusive left turn lane resulted in minimal capacity improvement.

Shortening the pedestrian phase did provide some improvement. The table below displays analysis results for reducing the pedestrian phase to 3.5 feet per second, as well as adding a permitted and protected phase for the eastbound left turn at the US 5 / Highland Ave signal. Results indicate shortening the pedestrian phase to a more standard length improves capacity compared with the No Action alternative, including reduced delay and increased level of service.

Table 22 - US 5/VT 14 Intersection Short Term Capacity Analysis Results

Intersection	Future (2040)				
	Peak Hour	LOS	Delay (sec)	V/C	Queue Length 95th (FT)
US5/Highland Ave Reduce Ped Phase to 3.5 f/s	AM	C	21.2	0.45	131 EBT, 191 WBT, 358 SBT
	PM	A	9.3	0.34	158 NBT, 305 SBT
US5/Highland Ave Permitted/Protected EBL, Reduce Ped Phase to 3.5 f/s	AM	B	18.5	0.47	113 EBT, 191 WBT, 358 SBT
	PM	A	9.6	0.37	168 NBT, 334 SBT

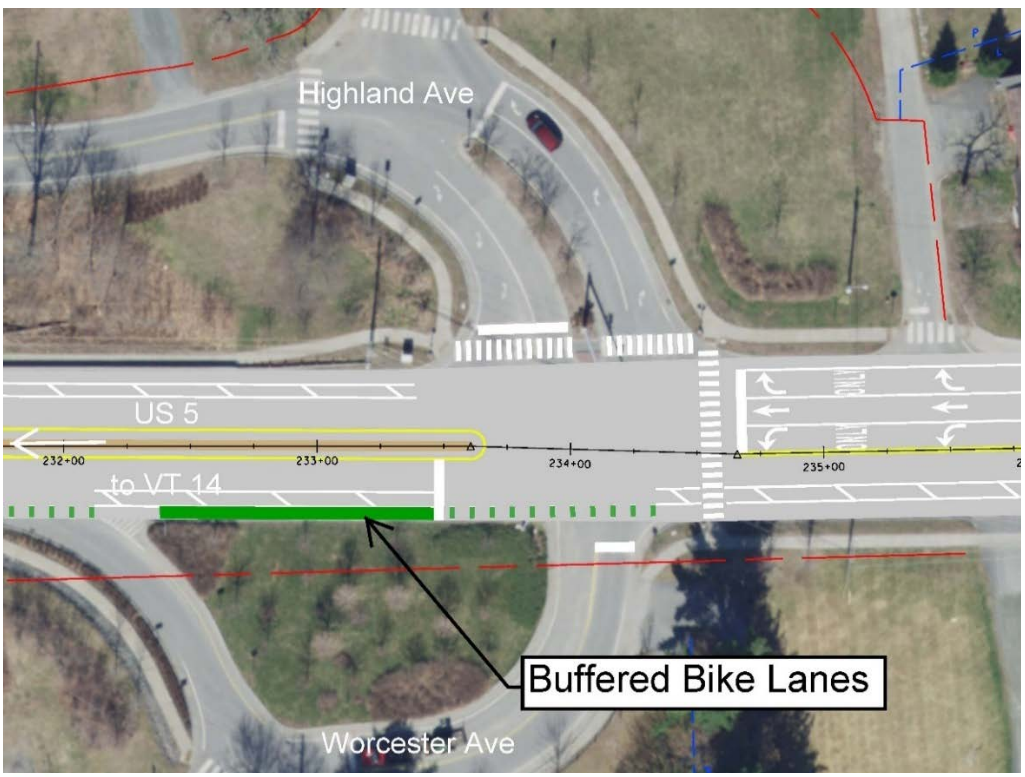
The existing signals at US 5 / Highland Avenue and at Highland Avenue / Hanover Street were constructed when two additional access/egress points were open in the vicinity of the school. This included Cascadnac Ave to the south and Hanover Street / Saunders Ave to the north. The closing of those access/egress points contribute to congestion at the traffic signals during the morning peak period. Based on discussions with the school district and police chief, it is understood that there is a safety concern with reopening these points and they do not support it at this time.

Transportation Demand Management (TDM) is a viable option to pursue with the school. It is likely that a contributing factor to congestion at the traffic signal is the dropping off and picking up of students by parents. If the school encourages more transit, traditional yellow bussing, carpooling, walking, biking, and students driving themselves/each other, the demand will likely decrease, resulting in improved performance of the associated traffic signals at US 5 / Highland Avenue and Highland Avenue/Hanover Street.

To address the queueing of the US 5 Southbound right turns, one change to consider is restricting Hanover Street to one way in during the AM peak period. This will require all traffic entering the high school to egress using Highland Avenue via the Middle School area, similar to the current school buses circulation. This will allow the Highland Avenue signal to operate with just a Highland Avenue Phase and a pedestrian phase. The only phase the Highland Avenue traffic would be stopped is during a pedestrian phase and will allow traffic to follow more freely on Highland Avenue.

To make this intersection more accommodating to bicycles and to continue the US 5 buffered bike lane concept, below is figure showing the buffered bike lanes. The US 5 buffered bike lanes end at Highland Avenue and transition to the existing 4 foot shoulder.

Figure 30 - US 5/VT 14 Intersection Improvements



8.4.2.3 VT 14/Bridge/Pine Street Intersection

As mentioned previously, there is a VTrans Class I town highway resurfacing project planned for VT 14 during FY 2020. The following improvements can be considered by that project.

- Upgrade VT 14/Bridge/Pine Street signal and include pedestrian phase signals with a leading interval phase
- Replace overhead signs with ground mounted signs
- Relocate and shorten the pedestrian crossings

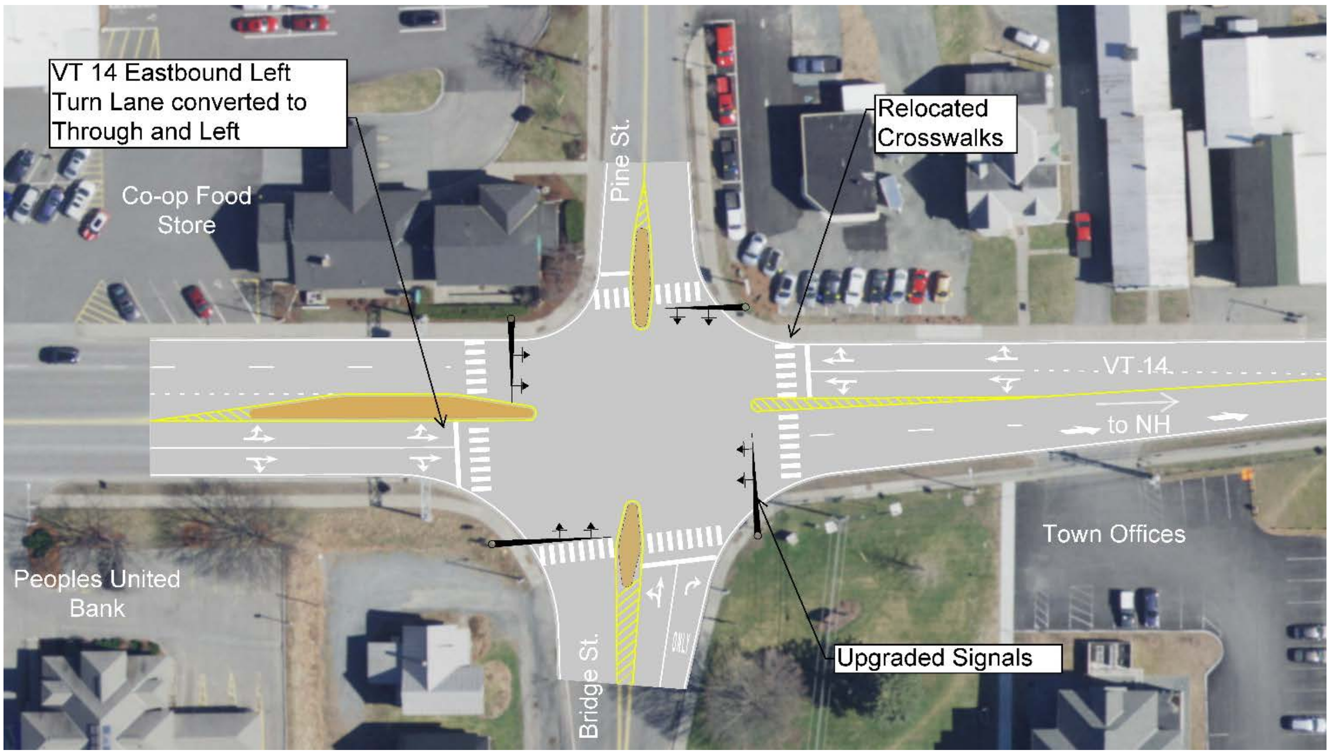
Results of capacity analysis for these improvements are shown below. Signal upgrade and optimization provides a high level of service, low delay, and sufficient capacity. However, the VT 14 eastbound approach 95th percentile queues for this scenario extend almost 400 FT. By converting the existing eastbound left turn lane to a combined through and left turn lane, queues would stay within reasonable limits. The analysis also indicated the intersection's operation is sensitive to the duration of the pedestrian phase and using a leading interval pedestrian phase and minimizing the length the crosswalks is needed.

Table 23 - VT 14/Bridge/Pine Intersection Short Term Improvements Capacity Analysis Results

Intersection	Future (2040)				
	Peak Hour	LOS	Delay (sec)	V/C	Queue Length 95th (FT)
VT14/Bridge/Pine Signal Upgrade /Optimized	AM	A	7.6	0.55	393 EBT, 97 WBT
	PM	B	10.8	0.57	355 EBT, 211 WBT
VT14/Bridge/Pine Signal Upgrade /Optimized Change EB LT to TH/LT	AM	A	5.4	0.35	82 EBT, 54 WBT
	PM	A	8.8	0.53	117 EBT, 147 WBT

One approach is to install the signal and observe its operation prior to final paving and pavement markings. If the observed eastbound queues are a concern, then convert the eastbound left turn lane to a combined left turn and through lane with signs, pavement markings, and signal phase and timing adjustments. Below is a figure depicting the short term improvements including changing the VT 14 Eastbound left turn lane to a combined through and left lane.

Figure 31 - VT 14/Bridge/Pine street Intersection Improvements



8.4.3 Long Term Alternatives

8.4.3.1 LT 5 – US 5/VT 14 Roundabout

Although the short term improvements are expected to assist with reducing crashes at this intersection, if a high crash rate continues, a long term consideration is to construct a roundabout. Based on the capacity analysis, a single lane roundabout would be required and the capacity results are in the following table. These results indicate the roundabout is reaching capacity in 2040, and during further development, adding bypass lanes could be considered.

Table 24 - US 5/VT 14 Intersection Roundabout Capacity Analysis Results

Intersection	Future (2040)				
	Peak Hour	LOS	Delay (sec)	V/C	Queue Length 95th (FT)
US 5/VT 14 Roundabout	AM	C	23	0.74	191 SB, 87 WB, 180 NB
	PM	D	32	0.87	191 SB, 340 WB, 276 NB

The roundabout construction does have some impact on adjacent Coop Food Store and Mascoma Savings Bank properties. It also impacts the median on the bridge and requires the bridge modifications mentioned under short term improvements. These add to the cost of the alternative.

Figure 32 - Alternative LT5 - US 5/VT 14 Intersection Roundabout

8.4.4 US5/VT 14 Intersection Alternatives Evaluation

Below is an evaluation matrix to summarize the more significant differences between the short term improvements and the long term roundabout alternative at the US 5/VT 14 intersection. The construction costs and the benefits/cost ratio are the major differences and favor the signal alternative. A benefit/cost analysis was performed as described with the I-91 ramp alternatives. Since there are a greater number of crashes at this intersection, than the I-91 ramps there is a greater safety benefit to the alternatives and hence a greater benefit to cost ratio.

Table 25 - US 5/VT 14 Intersection Alternatives Evaluation Matrix

CRITERIA	No Action	Short Term Signal Improvements	LT5 - Roundabout
Project Construction Costs	$0	$600,000	$3,500,000
Benefits/Cost Ratio	-	1.41	0.93
Complete a missing bike link	No	Yes	Yes
Traffic Operations	Remains LOS D	LOS C	LOS C-D
Safety	No Improvement	Improved	Most Improved
Right-of-way	None	None	Minor
Environmental	None	Impact Unlikely	Impact Unlikely
Cultural Resources	No Impact	Impact Unlikely	Impact Unlikely
Utilities/ Drainage	None	Minor	Drainage Impacts
Stormwater	No Change	Minor Change/ No Permit	Permit Required

9.0 PUBLIC/STAKEHOLDER INPUT AND RECOMMENDATIONS

On May 10, 2019 the project team met with major project stakeholders with an interest in the corridor. Attendees included staff from the Town of Hartford Public Works, Police, Fire, School District and Planning departments. A representative from the Veteran's Administration (VA) Hospital also attended. The project area, purpose and need were reviewed, and short-term and long-term alternatives for each segment were presented and discussed among stakeholders.

The following are the major comments received:

1. The VA would not advocate for the right in/right out or one-way in at Veterans Drive due to safety issues on the VA campus but supported a signal a Veteran's Drive.

2. When installing a signal at US 5/Veterans Drive, the tight radius for right turning movements out of Dunkin Donuts will need mitigation to avoid encroaching on opposing lane.

3. There was a general concern that any new construction would require reconstruction of the Town's planned sidewalks.

4. A signal at the I-91 ramps were preferred over a roundabout due to greater potential for a lack of gaps on adjacent sections with roundabouts.

5. At the US 5/North Main Street intersection the bike facility should favor bicycles on North Main Street since downtown is a more likely origin or destination for bicyclists.

6. There was a concern with one US 5 northbound lane approaching the Highland Av/Worcester intersection. US 5 northbound right turning vehicles turning on Worcester Avenue will need to yield to through bicyclists. Also, Worcester avenue queues can extend to US 5 and these queues may block US 5 northbound vehicles.

7. Expanded bike facilities is of interest to the community, if that can be reasonably accommodated without increasing congestion.

10.0 PREFERRED ALTERNATIVES

Following the public input process, VTrans conducted some internal meetings to review alternatives and discuss which alternatives were preferred. It was quickly recognized many of the proposed short term alternatives could be readily incorporated into the following upcoming VTrans resurfacing projects:

- VTrans VT Route 14 Hartford Class 1 Resurfacing (2021-2022)
- VTrans US 5 Hartland - Wilder Resurfacing (2022-2023)

Based on this, the following sections describe the preferred short and long term improvements and the improvement figures have been refined from those shown in Section 8.0 Alternatives.

10.1 SHORT TERM IMPROVEMENTS

Short term improvements are improvements that may have minor widening but can typically be completed within the existing highway right-of-way, do not impact utilities, or do not require permits and are expected to be constructed within a 5 year time frame once funding is available.

There are four Town of Hartford ongoing projects along this corridor that will contribute to the short term Improvements. These are as follows:

- US5/Sykes Mtn Avenue Roundabout (2020-2021): Hartford STP 0113(15)S
- Sykes Mountain Avenue Sidewalk (2020-2021): Hartford STP EH09(15)
- US 5 Sidewalk – Arboretum Lane to Ballardvale Drive: Hartford STP E10(18)
- US 5 Sidewalk – Ballardvale Drive to Sykes Mountain Avenue: Hartford BP 14(4)

These will need to be coordinated with the upcoming VTrans resurfacing projects.

Additional short term improvements include:

- Improve corner sight distance for Veterans drive and Winsor Drive by removing vegetation and grading slope on east side of US 5. This work may be accomplished with VTrans district forces or included in the upcoming VTrans resurfacing project.
- Reconfigure Dunkin donuts driveway and parking to address the issue of driveway right turns encroaching on US 5 Southbound left turn lane. The VTrans access permit for this driveway provides a requirement of the owner to address operational issues if needed.
- Apply access management best practices for any future redevelopment along the corridor.
- Encourage continuing and expanding Transportation Demand Management measures by major facilities in the area such as the VA Hospital and the Hartford School District.

10.1.1 VTrans VT Route 14 Hartford Class 1 Resurfacing/Hartford STP PC21(4)

This VTrans project is currently programed for the 2021 construction season and will include the US 5/VT 14 and the VT14/Bridge/Pine Street intersections. For these intersections, the following items are proposed to be incorporated into this VTrans project.

- Replace the existing traffic signal equipment. This allows optimization of the signal operation and improves the intersection capacity.
- Reconfigure the US 5 Northbound right turn lane at VT 14 to a more acute angle to address existing rear-end crash pattern. Depending on timing this could be part of the VTrans US 5 resurfacing project.
- Relocate crosswalks and shorten crossing times.
- Replace overhead signs at US 5/VT 14 and the VT 14/Bridge/Pine Street intersection with ground mounted signs
- Convert the existing VT 14 Eastbound left turn lane to a combined through and left turn lane. One approach is to install the signal and observe its operation prior to final paving and pavement markings. If the observed eastbound queues are a concern, then convert the eastbound left turn lane to a combined left turn and through lane with signs, pavement markings, and signal phase and timing adjustments.

A graphic of the improvements is shown below and a composite of all improvements is in Appendix A. These improvements do vary from the figures shown in the 8.0 Alternatives section as comments obtained during the preferred alternative discussions have been incorporated.

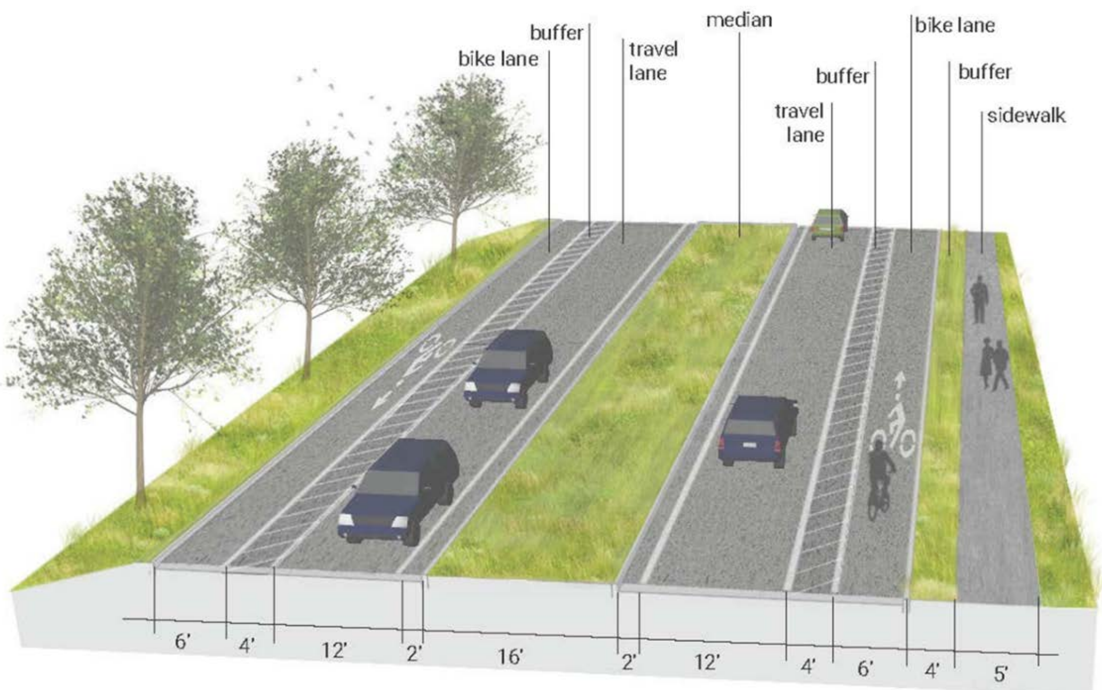
Figure 33 - US 5/VT 14 and the VT14/Bridge/Pine Street intersections

10.1.2 VTrans US 5 Hartland - Wilder Resurfacing

This project is anticipated to be part of the 2022-2023 VTrans Resurfacing program. It will include the full length of the US 5 corridor associated with this study and the following items are proposed to be incorporated into this VTrans project.

- Convert the existing four lane section to two lanes, one in each direction, and provide buffered bike lanes in the existing righthand lanes from Highland Avenue to I-89 as shown in the typical section below. This is accomplished primarily with pavement markings and signs. The dimensions shown may be adjusted such as the travel lane dimension can be reduced to 11 feet and the buffer width increased to 5 feet.

Figure 34 - US 5 Typical Section



- **US 5/Highland Ave and VT 14 intersections:** Reconfigure the US 5 approach lanes at the Highland Avenue and VT 14 intersections to accommodate the buffered bike lane as shown on the following figures. A composite figure is shown in Appendix A.

Figure 35 - US 5/Highland Ave Intersection

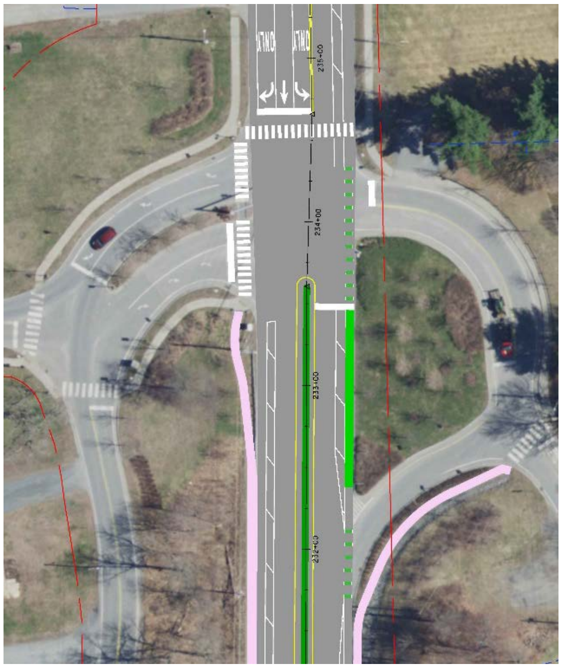
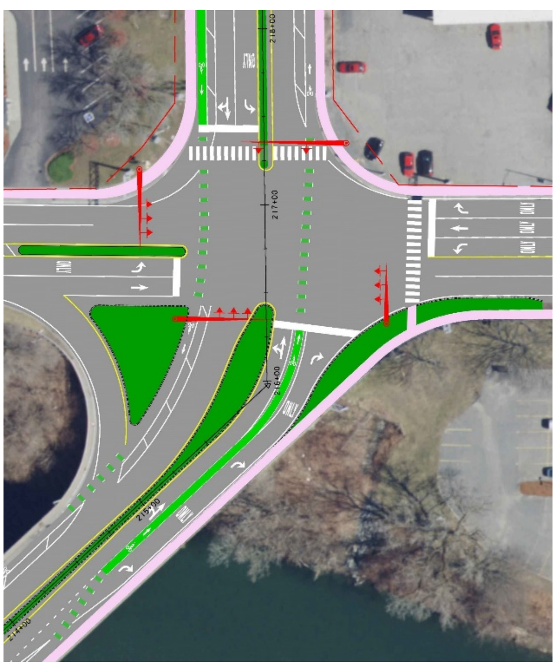
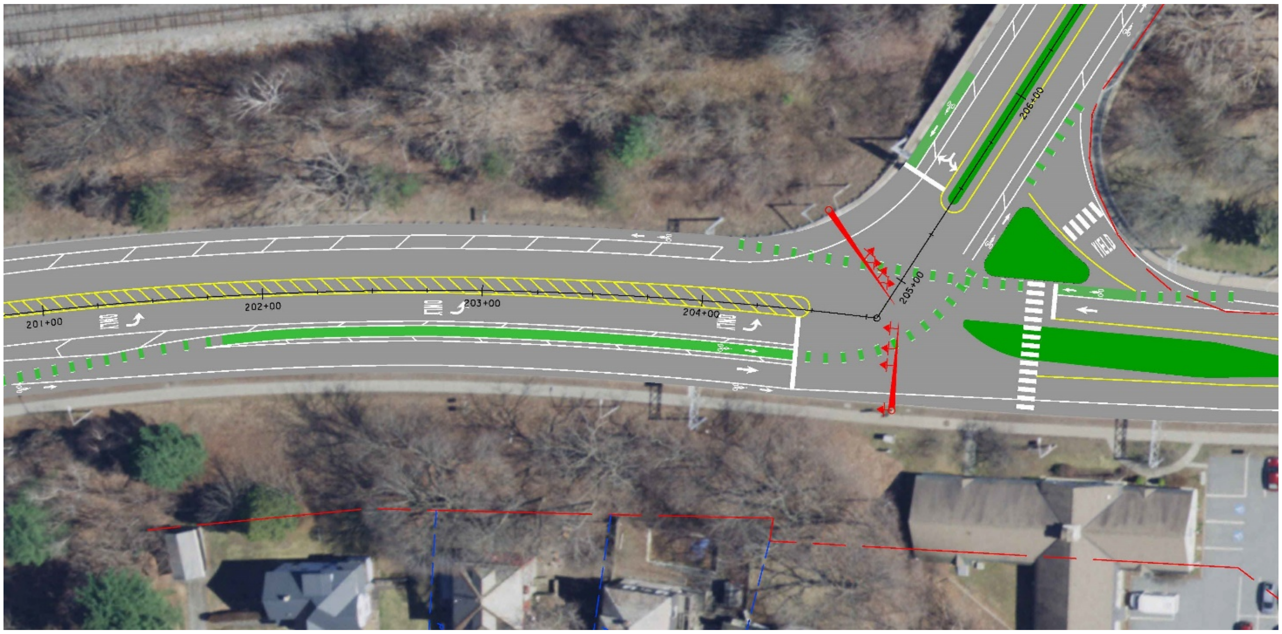


Figure 36 - US 5/VT 14 Intersection



- **US 5/North Main Street Intersection:** Replace the existing traffic signal, add a North Main Street approach crosswalk with a pedestrian signal, reconfigure the approach lanes to accommodate the buffered bike lanes and realign the North Main street approach right turn to be more acute as shown in the figure below.

Figure 37 - US 5/North Main Street Intersection

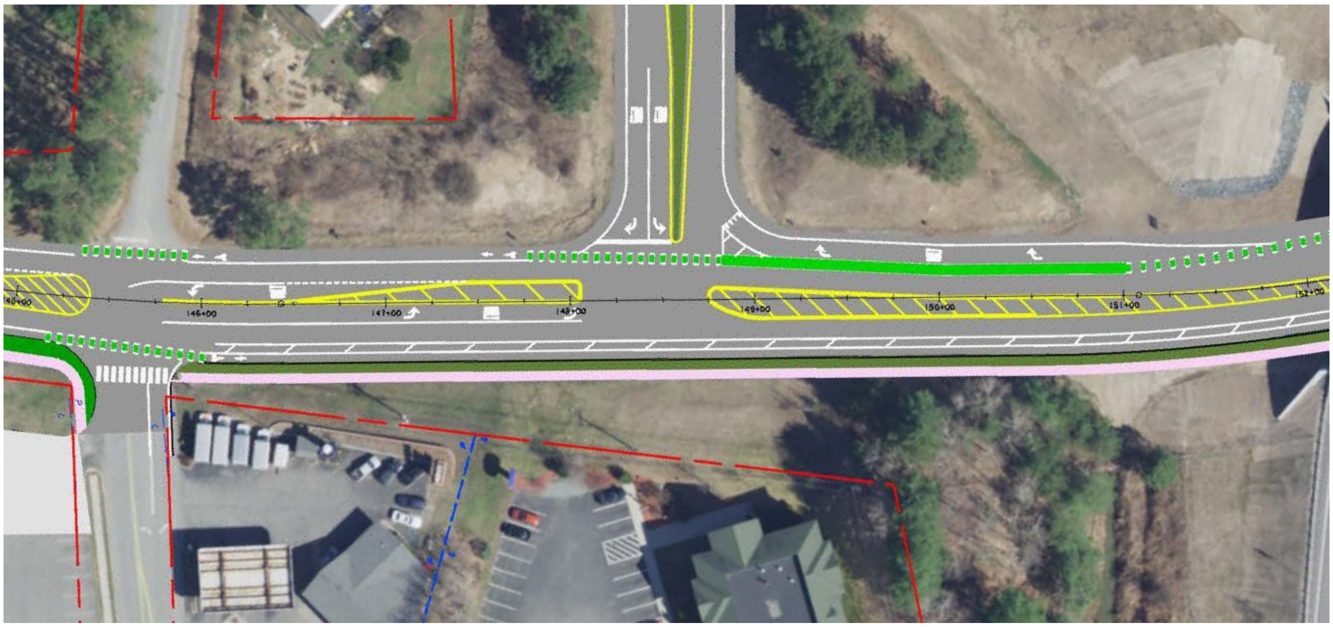


- **US 5/I-91 Northbound Ramps:** Reconfigure the I-91 Northbound Off Ramps to a T-type intersection with a 2 lane ramp approach, widen I-91 Northbound Off Ramp to 2 lanes for 400 feet, remove the existing I-91 Northbound Off Ramp to Sykes Mountain Avenue, provide buffered bike lanes, have lane markings compatible with proposed roundabout at Sykes Mountain Avenue, provide buffered bike lanes and provide a crosswalk at the off ramp. These improvements will require coordination the Town of Hartford's Sykes Mountain Avenue Roundabout project and their Ballardvale Drive to Sykes Mountain Avenue sidewalk project.

Figure 38 - US 5/I-91 Northbound Ramps Intersection

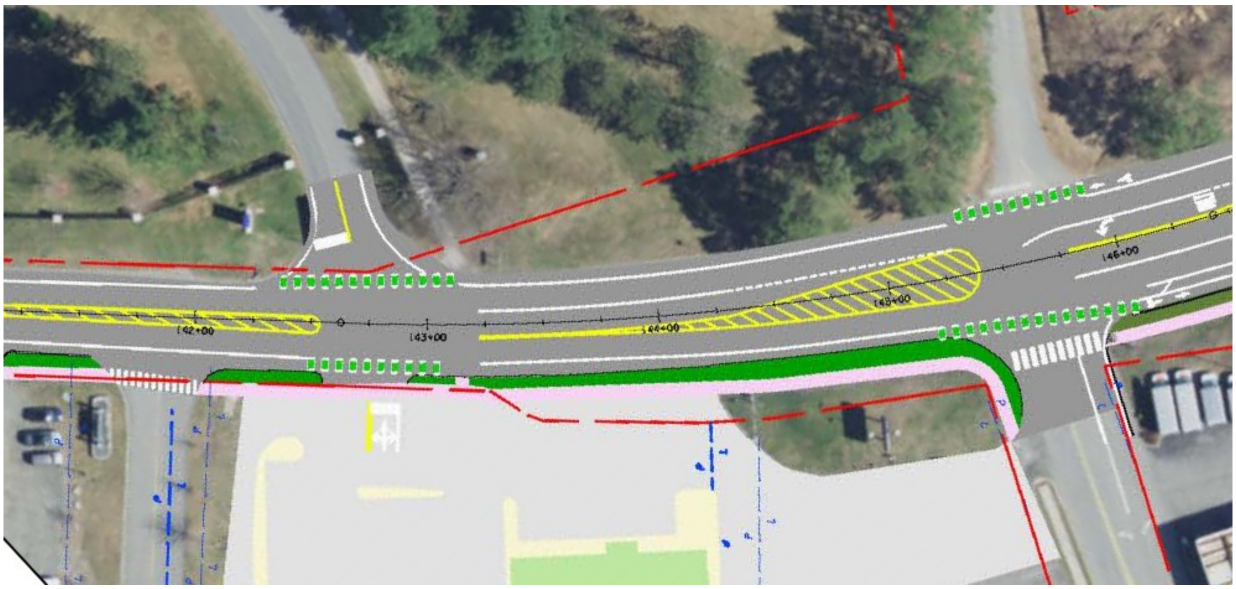
- **US 5/I-91 Southbound Ramps:** Widen the I-91 Southbound Off Ramp to 2 lanes for 200 feet, realign the southbound thru lane through the intersection to minimize the existing lane shift, provide channelization with yield condition for US 5 Southbound right turns, maintain one US 5 Southbound thru lane from Sykes Mountain Avenue to Southbound ramps and provide bike lanes with crossing markings and signs.

Figure 39 - US 5/I-91Southbound Ramps Intersection



- **US 5 – Ballardvale Drive to Veteran's Drive:** Continue US 5 bike lanes with pavement markings and signs through Veterans Drive. If not already completed, improve corner sight distance for Veterans Drive and Winsor Drive by removing vegetation and grading the slope on east side of US 5 and reconfigure Dunkin donuts driveway and parking to address issue of driveway right turns encroaching on US 5 Southbound left turn lane. Coordinate improvements with Town of Hartford's Arboretum Lane to Ballardvale Drive.

Figure 40 - US 5: Ballardvale Drive to Veteran's Drive



For costs and impacts associated with the short term improvements see Section 8.0 Alternatives.

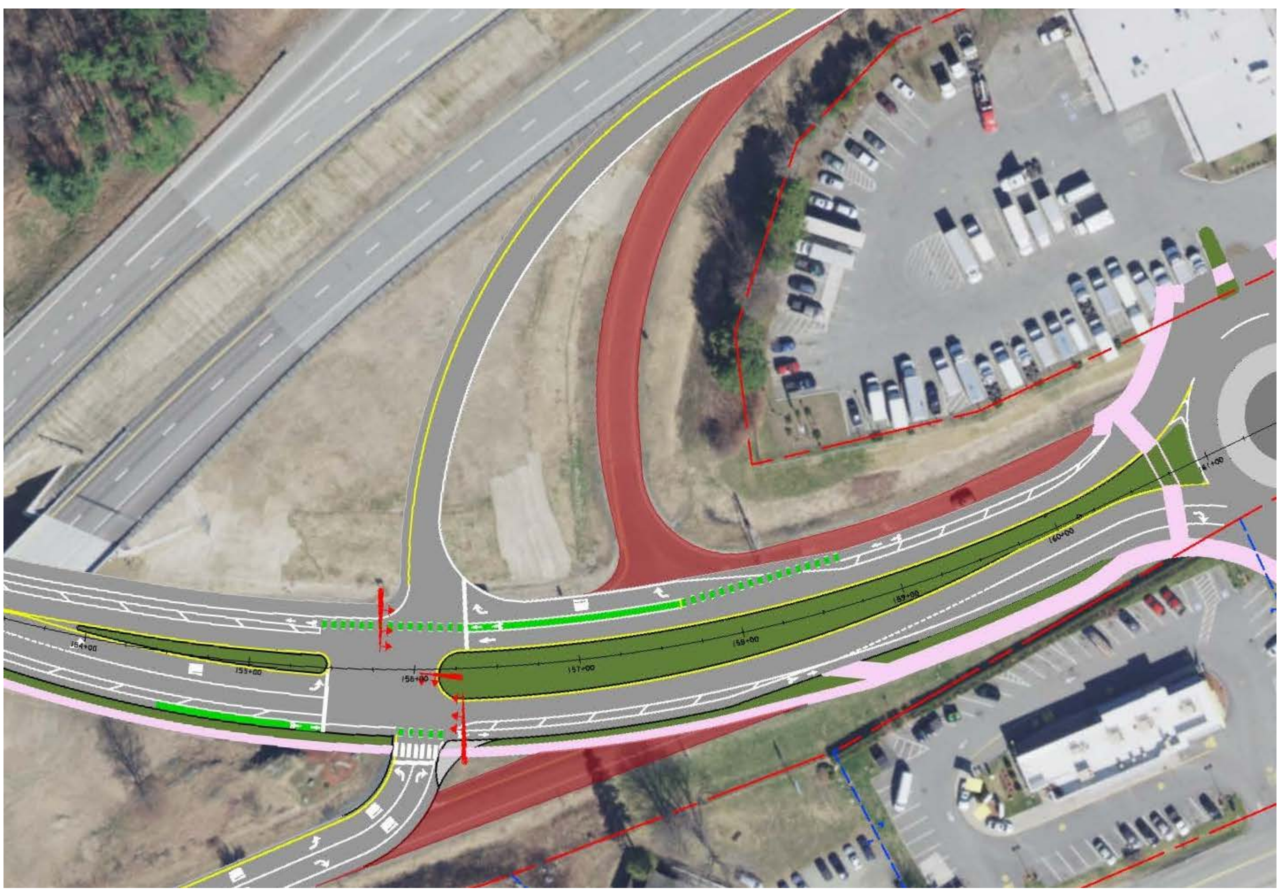
10.2 LONG TERM IMPROVEMENTS

Long term improvements are improvements that typically require right-of-way easements or acquisition, impact utilities, and/or require permits. This typically requires a project delivery time that is greater than five years.

The long term improvements are focused in the I-91 interchange area. It is assumed the previous discussed short term improvements are in place and the long term improvements will add to them, and do not require reconstructing them. These long term improvements are described below. It is recommended they be programmed as one project to contribute to their efficient and cost effective construction.

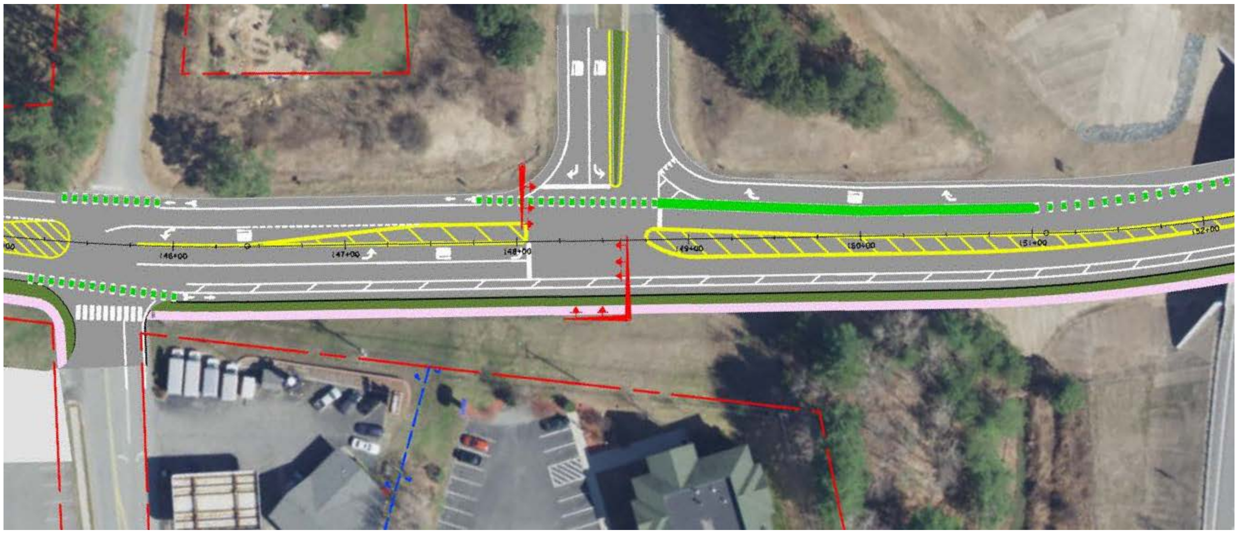
- **US 5/I-91 Northbound Ramps:** Realign the I-91 Northbound On Ramp to intersect US 5 opposite the I-91 Northbound Off Ramp, reconfigure medinas to reflect new alignment, install a traffic signal at this intersection and coordinate its operation with adjacent signals.

Figure 41 - US 5/I-91 Northbound Ramps Intersection



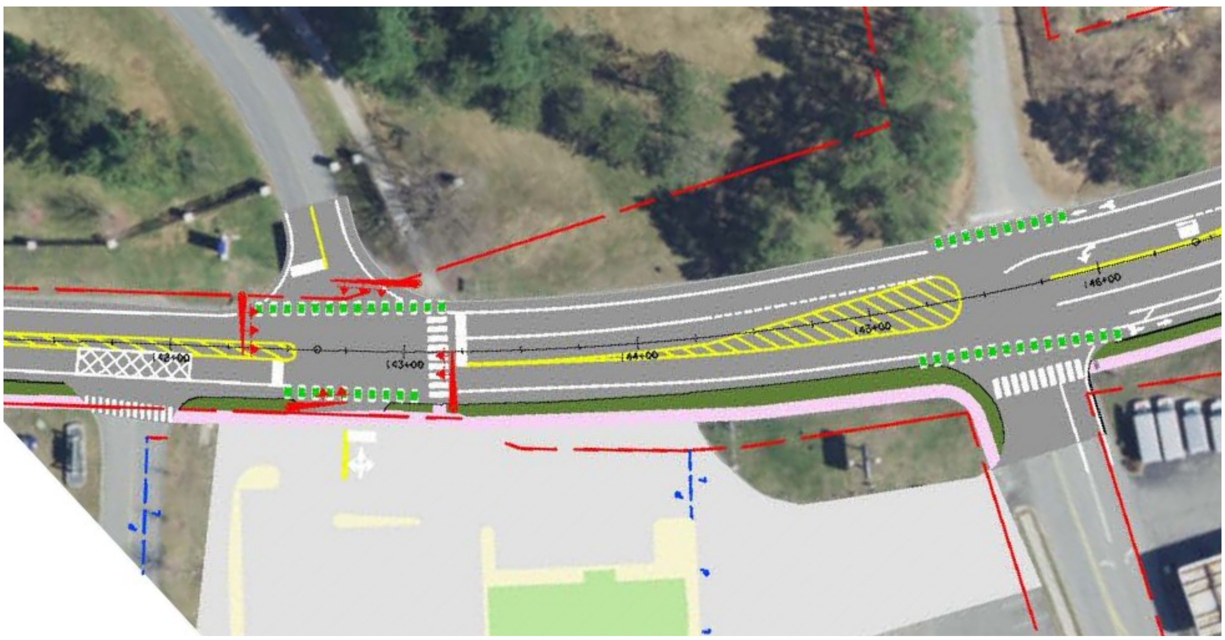
- **US 5/I-91 Southbound Ramps:** Install a traffic signal at this intersection and coordinate its operation with adjacent signals.

Figure 42 - US 5/I-91 Southbound Ramps Intersection



- **US 5 – Ballardvale Drive to Veteran's Drive:** Install a traffic signal at the Veteran's Drive intersection, coordinate its operation with adjacent signals, and include a US 5 signalized crosswalk.

Figure 43 - US 5: Ballardvale Drive to Veteran's Drive



For costs and impacts associated with these improvements see Section 8.0 Alternatives.

11.0 APPROVAL OF PREFERRED ALTERNATIVES

11.1 TOWN APPROVAL

On January 28, 2020, a presentation of the preferred improvements was provided at a noticed public meeting with the Town of Hartford Selectboard. Public comments were received and the selectboard passed a motion approving the US 5 Corridor transportation alternatives as presented. The meeting minutes are in Appendix D.

11.2 STATE APPROVAL

The management of the VTrans Project Delivery Bureau reviewed the alternatives as analyzed in this report and approved the proposed short term and long term preferred alternatives. The short term alternative is to include signal upgrades, additional paving to modify I-91 ramps, and minor changes to signage and pavement markings to add bike lanes and create clarity among all road users. Long-term alternatives include the installation of three new traffic signals which would require separate programming. This approval is included in Appendix D.

APPENDIX A
Preferred Alternative Plans


Hartford US 5
Short Term Improvements


Hartford US 5
Short Term Improvements


Hartford US 5
Long Term Improvements
0
80
160
SCALE IN FEET

APPENDIX B
Cost Estimates

Stantec	Quantity Summary **Hartford** **195311651**			
			Initials	Date
55 Green Mountain Drive **South Burlington, VT 05403** **Tel: (802) 864-0223**	**US Route 5 Improvements Study - LT1**	Calc'd By:	DY	6/19/2019
		Checked By:	GE	6/26/2019
		Revised By:		
		Checked By:		

To **create sheets,** ente

To **create links** to item

Item No.	Item Description	Unit	Unit Price	Alternative A Description Quantity	$
ALTERNATIVE L1					
210.10	COARSE-MILLING, BITUMINOUS PAVEMENT	SY	$4.00	1800	$7,200.00
406.35	SUPERPAVE BITUMINOUS CONCRETE PAVEMENT	TON	$125.00	210	$26,250.00
635.11	MOBILIZATION/DEMOBILIZATION	LS	$15,000.00	1	$15,000.00
641.11	TRAFFIC CONTROL, ALL-INCLUSIVE	LS	$10,000.00	1	$10,000.00
646.404	DURABLE 4 INCH WHITE LINE, POLYUREA	LF	$1.00	700	$700.00
646.414	DURABLE 4 INCH YELLOW LINE, POLYUREA	LF	$1.00	675	$675.00
646.484	DURABLE 24 INCH STOP BAR, POLYUREA	LF	$9.00	60	$540.00
646.492	DURABLE LETTER OR SYMBOL, THERMOPLASTIC	EACH	$160.00	6	$960.00
678.15	TRAFFIC CONTROL SIGNAL SYSTEM, INTERSECTION	EACH	$175,000.00	1	$175,000.00
			Subtotal		$236,325.00
			Contingency	25%	$59,081.25
			Total		$295,406.25
			Round to		$300,000.00

Sub Total	$1,127,137.50
Contengencies (15%)	$169,070.63
Total Opinion of Probable Construction Cost	$1,296,208.13

Stantec	Quantity Summary **Hartford** **195311651**			
			Initials	Date
55 Green Mountain Drive **South Burlington, VT 05403** **Tel: (802) 864-0223**	**US Route 5 Improvements Study - LT2**	Calc'd By:	DY	6/19/2019
		Checked By:	GE	6/26/2019
		Revised By:		
		Checked By:		

To **create sheets,** enter item numl

To **create links** to item sheets pre:

				Alternative A Description	
Item No.	**Item Description**	**Unit**	**Unit Price**	**Quantity**	**$**
ALTERNATIVE L1					
210.10	COARSE-MILLING, BITUMINOUS PAVEMENT	SY	$4.00	1900	$7,600.00
406.35	SUPERPAVE BITUMINOUS CONCRETE PAVEMENT	TON	$125.00	220	$27,500.00
635.11	MOBILIZATION/DEMOBILIZATION	LS	$15,000.00	1	$15,000.00
641.11	TRAFFIC CONTROL, ALL-INCLUSIVE	LS	$10,000.00	1	$10,000.00
646.404	DURABLE 4 INCH WHITE LINE, POLYUREA	LF	$1.00	1750	$1,750.00
646.414	DURABLE 4 INCH YELLOW LINE, POLYUREA	LF	$1.00	1700	$1,700.00
646.484	DURABLE 24 INCH STOP BAR, POLYUREA	LF	$9.00	60	$540.00
646.492	DURABLE LETTER OR SYMBOL, THERMOPLASTIC	EACH	$160.00	3	$480.00
678.15	TRAFFIC CONTROL SIGNAL SYSTEM, INTERSECTION	EACH	$250,000.00	1	$250,000.00
	Misc. Line Striping (8" lines and Crosswalks)	LS	$2,500.00	1	$2,500.00
			Subtotal		$317,070.00
			Contingency	25%	$79,267.50
			Total		$396,337.50
			Round to		$400,000.00

Sub Total	##########
Contengencies (15%)	$226,461.75
Total Opinion of Probable Construction Cost	##########

	Quantity Summary			
Stantec	Hartford			
	195311651			
			Initials	Date
55 Green Mountain Drive South Burlington, VT 05403 Tel: (802) 864-0223	US Route 5 Improvements Study - LT3	Calc'd By:	DY	6/19/2019
		Checked By:	GE	6/26/2019
		Revised By:		
		Checked By:		

To **create sheets,** ente

To **create links** to item

Item No.	Item Description		Unit	Unit Price	Quantity	$
					Alternative A Description	
203.15	COMMON EXCAVATION		CY	$20.00	4600	$92,000.00
203.31	SAND BORROW		CY	$35.00	150	$5,250.00
210.10	COARSE-MILLING, BITUMINOUS PAVEMENT		SY	$4.00	12800	$51,200.00
301.35	SUBBASE OF DENSE GRADED CRUSHED STONE		CY	$45.00	850	$38,250.00
406.35	SUPERPAVE BITUMINOUS CONCRETE PAVEMENT		TON	$125.00	2050	$256,250.00
616.21	VERTICAL GRANITE CURB		LF	$60.00	2900	$174,000.00
618.10	PORTLAND CEMENT CONCRETE SIDEWALK, 5 INCH		SY	$85.00	850	$72,250.00
635.11	MOBILIZATION/DEMOBILIZATION		LS	$80,000.00	1	$80,000.00
641.11	TRAFFIC CONTROL, ALL-INCLUSIVE		LS	$40,000.00	1	$40,000.00
646.404	DURABLE 4 INCH WHITE LINE, POLYUREA		LF	$1.00	7200	$7,200.00
646.414	DURABLE 4 INCH YELLOW LINE, POLYUREA		LF	$1.00	4600	$4,600.00
646.484	DURABLE 24 INCH STOP BAR, POLYUREA		LF	$9.00	110	$990.00
646.492	DURABLE LETTER OR SYMBOL, THERMOPLASTIC		EACH	$160.00	70	$11,200.00
678.15	TRAFFIC CONTROL SIGNAL SYSTEM, INTERSECTION	SB Ramp	EACH	$175,000.00	1	$175,000.00
678.15	TRAFFIC CONTROL SIGNAL SYSTEM, INTERSECTION	NB Ramp	EACH	$175,000.00	1	$175,000.00
900.675	SPECIAL PROVISION	GREEN PAVEMENT MRKS, BIKES)	SY	$5.00	400	$2,000.00
	Misc. Line Striping (8" lines and Crosswalks)		LS	$10,000.00	1	$10,000.00
				Subtotal		$1,195,190.00
				Contingency	25%	$298,797.50
				Total		$1,493,987.50
				Round to		$1,500,000.00

V:\1953\active\195311651\transportation\Estimates Backup\Segment 2_LT 3 backup.xlsm

Sub Total	$5,683,165.00
Contengencies (15%)	$852,474.75
Total Opinion of Probable Construction Cost	$6,535,639.75

Stantec	Quantity Summary **Hartford** **195311651**		
55 Green Mountain Drive **South Burlington, VT 05403** **Tel: (802) 864-0223**	**US Route 5 Improvements Study - LT4**		
		Initials	Date
		Calc'd By: DY	6/26/2019
		Checked By: GE	6/26/2019
		Revised By:	
		Checked By:	

To **create sheets,** ente

To **create links** to item

Item No.	Item Description	Unit	Unit Price	Alternative A Description Quantity	$
203.15	COMMON EXCAVATION	CY	$20.00	10000	$200,000.00
203.31	SAND BORROW	CY	$35.00	200	$7,000.00
210.10	COARSE-MILLING, BITUMINOUS PAVEMENT	SY	$4.00	10500	$42,000.00
301.35	SUBBASE OF DENSE GRADED CRUSHED STONE	CY	$45.00	6500	$292,500.00
406.35	SUPERPAVE BITUMINOUS CONCRETE PAVEMENT	TON	$125.00	7400	$925,000.00
616.21	VERTICAL GRANITE CURB	LF	$60.00	6800	$408,000.00
618.10	PORTLAND CEMENT CONCRETE SIDEWALK, 5 INCH	SY	$85.00	2700	$229,500.00
635.11	MOBILIZATION/DEMOBILIZATION	LS	$350,000.00	1	$350,000.00
641.11	TRAFFIC CONTROL, ALL-INCLUSIVE	LS	$200,000.00	1	$200,000.00
646.404	DURABLE 4 INCH WHITE LINE, POLYUREA	LF	$1.00	7200	$7,200.00
646.414	DURABLE 4 INCH YELLOW LINE, POLYUREA	LF	$1.00	4600	$4,600.00
646.484	DURABLE 24 INCH STOP BAR, POLYUREA	LF	$9.00	110	$990.00
646.492	DURABLE LETTER OR SYMBOL, THERMOPLASTIC	EACH	$160.00	70	$11,200.00
900.675	SPECIAL PROVISION GREEN PAVEMENT MRKS, BIKES)	SY	$5.00	400	$2,000.00
	Misc. Line Striping (8" lines and Crosswalks)	LS	$10,000.00	1	$10,000.00
			Subtotal		$2,689,990.00
			Contingency	30%	$806,997.00
			Total		$3,496,987.00
			Round to		$3,500,000.00

Sub Total	$13,183,964.00
Contengencies (15%)	$1,977,594.60
Total Opinion of Probable Construction Cost	$15,161,558.60

Stantec	**Quantity Summary** **Hartford** **195311651**		
		Initials	Date
55 Green Mountain Drive **South Burlington, VT 05403** **Tel: (802) 864-0223**	**US Route 5 Improvements Study - Segment 4 LT5**	Calc'd By: DY	6/19/2019
		Checked By: GE	6/26/2019
		Revised By:	
		Checked By:	

To **create sheets,** ente

To **create links** to item

Item No.	Item Description	Unit	Unit Price	Alternative A Description Quantity	$
203.15	COMMON EXCAVATION	CY	$20.00	9200	$184,000.00
203.31	SAND BORROW	CY	$35.00	2375	$83,125.00
210.10	COARSE-MILLING, BITUMINOUS PAVEMENT	SY	$4.00	11000	$44,000.00
301.35	SUBBASE OF DENSE GRADED CRUSHED STONE	CY	$45.00	3200	$144,000.00
406.35	SUPERPAVE BITUMINOUS CONCRETE PAVEMENT	TON	$125.00	3400	$425,000.00
616.21	VERTICAL GRANITE CURB	LF	$60.00	3500	$210,000.00
618.10	PORTLAND CEMENT CONCRETE SIDEWALK, 5 INCH	SY	$85.00	1400	$119,000.00
635.11	MOBILIZATION/DEMOBILIZATION	LS	$300,000.00	1	$300,000.00
641.11	TRAFFIC CONTROL, ALL-INCLUSIVE	LS	$150,000.00	1	$150,000.00
646.404	DURABLE 4 INCH WHITE LINE, POLYUREA	LF	$1.00	8600	$8,600.00
646.414	DURABLE 4 INCH YELLOW LINE, POLYUREA	LF	$1.00	4600	$4,600.00
646.484	DURABLE 24 INCH STOP BAR, POLYUREA	LF	$9.00	0	$0.00
646.492	DURABLE LETTER OR SYMBOL, THERMOPLASTIC	EACH	$160.00	60	$9,600.00
678.15	TRAFFIC CONTROL SIGNAL SYSTEM, INTERSECTION	EACH	$300,000.00	1	$300,000.00
900.675	SPECIAL PROVISION GREEN PAVEMENT MRKS, BIKES)	SY	$5.00	225	$1,125.00
	Brick pavers	SY	$225.00	800	$180,000.00
	Misc. Line Striping (8" lines and Crosswalks)	LS	$15,000.00	1	$15,000.00
	Landscaping	LS	$50,000.00	1	$50,000.00
	Bridge work (diaphragms, deck work, etc.)	LS	$400,000.00	1	$400,000.00
			Subtotal		$2,628,050.00
			Contingency	25%	$657,012.50
			Total		$3,285,062.50
			Round to		$3,500,000.00

V:\1953\active\195311651\transportation\Estimates Backup\Segment 4_LT5 backup.xlsm

Sub Total	$12,698,175.00
Contengencies (15%)	$1,904,726.25
Total Opinion of Probable Construction Cost	$14,602,901.25

	Quantity Summary			
Stantec	Hartford			
	195311651			
55 Green Mountain Drive South Burlington, VT 05403 Tel: (802) 864-0223	US Route 5 Improvements Study - Segment 4 Short Term		Initials	Date
		Calc'd By:	DY	6/19/2019
		Checked By:	GE	6/26/2019
		Revised By:		
		Checked By:		

To **create sheets,** ente

To **create links** to item

				Alternative A	
				Description	
Item No.	Item Description	Unit	Unit Price	Quantity	$
203.15	COMMON EXCAVATION	CY	$20.00	60	$1,200.00
203.31	SAND BORROW	CY	$35.00	25	$875.00
210.10	COARSE-MILLING, BITUMINOUS PAVEMENT	SY	$4.00	15500	$0.00
301.35	SUBBASE OF DENSE GRADED CRUSHED STONE	CY	$45.00	200	$9,000.00
406.35	SUPERPAVE BITUMINOUS CONCRETE PAVEMENT	TON	$125.00	1800	$0.00
616.21	VERTICAL GRANITE CURB	LF	$60.00	100	$6,000.00
618.10	PORTLAND CEMENT CONCRETE SIDEWALK, 5 INCH	SY	$85.00	300	$25,500.00
635.11	MOBILIZATION/DEMOBILIZATION	LS	$60,000.00	1	$60,000.00
641.11	TRAFFIC CONTROL, ALL-INCLUSIVE	LS	$10,000.00	1	$10,000.00
646.404	DURABLE 4 INCH WHITE LINE, POLYUREA	LF	$1.00	7200	$7,200.00
646.414	DURABLE 4 INCH YELLOW LINE, POLYUREA	LF	$1.00	4600	$4,600.00
646.484	DURABLE 24 INCH STOP BAR, POLYUREA	LF	$9.00	110	$990.00
646.492	DURABLE LETTER OR SYMBOL, THERMOPLASTIC	EACH	$160.00	70	$11,200.00
678.15	TRAFFIC CONTROL SIGNAL SYSTEM, INTERSECTION	EACH	$300,000.00	1	$300,000.00
900.675	SPECIAL PROVISION GREEN PAVEMENT MRKS, BIKES)	SY	$5.00	225	$1,125.00
	Misc. Line Striping (8" lines and Crosswalks)	LS	$10,000.00	1	$10,000.00
	Landscaping	LS	$15,000.00	1	$15,000.00
			Subtotal		$462,690.00
			Contingency	25%	$115,672.50
			Total		$578,362.50
			Round to		$600,000.00
	Assume cost is part of regular paving project.				

V:\1953\active\195311651\transportation\Estimates Backup\Segment 4_Short Term backup.xlsm

Sub Total	$2,219,415.00
Contengencies (15%)	$332,912.25
Total Opinion of Probable Construction Cost	$2,552,327.25

APPENDIX C
Benefit Costs

1.1.1 Benefit-Cost Analysis

The potential safety benefits associated with the alternative improvement strategies proposed for the I-91 Ramps/US 5 intersections and for the US 5/VT 14 intersection were determined and compared to the costs to implement these strategies. The analysis is based on crash data presented above for the years 2013 through 2017 and procedures described in the *Highway Safety Manual (HSM)* published by the American Association of State Highway and Transportation Officials (AASHTO) in Washington, D.C., 2000. Calculations were conducted using a worksheet developed by VTrans that provides assumed values for the cost of crashes by crash type and other factors to determine the annual cost of a specific expenditure for roadway improvements. The crash values are based on guidance provided in the *HSM*.

Crash Reduction

<u>I-91 Ramps/US 5</u>

The Existing Conditions section of this report indicates that 14 crashes occurred along US 5 at the I-91 interchange over a five-year period. Thirteen of these crashes involved property damage only (PDO) and there was one crash involving personal injuries. The estimated annual cost of crashes at the interchange is approximately $59,500 assuming that injury crashes are valued at $116,00 each and that PDO crashes are valued at $10,400 each

The two alternative improvement strategies under consideration would reduce the number of crashes expected at this location. The first strategy considered is the installation of traffic signal control at both intersections. The *HSM* indicates that this change in traffic control will reduce the injury crash rate by 50 percent and the PDO crash rate by 30 percent. As such, this treatment would reduce the annual cost of crashes at this location by $23,000 or 39 percent. The second strategy considered would replace the existing Stop-sign control with modern roundabouts. The *HSM* indicates that this change in traffic control will reduce the injury crash rate by 71 percent and the PDO crash rate by 21 percent. As such, this treatment would reduce the annual cost of crashes at this location by $25,000 or 43 percent.

<u>US 5/VT 14</u>

The US 5/VT 14 intersection is classified as a High Crash Location by VTrans with 63 crashes reported at this location over a five-year period. Fifty-four of these crashes involved property damage only (PDO). There were 18 crashes involving personal injuries and one involving a fatality. The estimated annual cost of crashes at this intersection is approximately $445,700. This calculation uses the values presented above for PDO and injury crashes and a value of $496,500 for fatal crashes.

The two alternative improvement strategies under consideration would reduce the number of crashes expected at this location. The first strategy considered involves modifications to the existing traffic signals and intersection geometry for the northbound VT 14 approach as suggested in the 2018 Road Safety Audit conducted by VTrans. Suggested measures include:

- Providing protected/permitted signal phasing for the northbound left turn movement;
- Using a flashing yellow signal indication for the permitted interval of the northbound left-turn movement;
- Moving the signal heads from a pedestal adjacent to the intersection to a mast arm over the intersection; and,
- Realigning the right-turn slip lane to improve sight lines for right-turning traffic.

Crash Modification Factors for these improvements based on data from a variety of sources and reprinted in the VTrans benefit-cost workbook were considered. Based on this review it was assumed that the proposed improvements would reduce the crash rate at the intersection by 12.5 percent. As such, these improvements would reduce the annual cost of crashes at this location by $55,700. The second strategy considered would replace the existing signalized intersection with a modern roundabout. The *HSM* indicates that this change in traffic control will reduce the crash rate for all crash types by 48 percent. As such, this treatment would reduce the annual cost of crashes at this location by $213,900.

Project Costs

Stantec has developed preliminary implementation cost estimates for the alternative improvement strategies. At the I-91 interchange, the cost of the suggested conversion from unsignalized control to signal control is $1.5 million. The cost of converting the I-91 Ramp intersections to modern roundabouts is approximately $3.5 million. Applying a 20-year finance period and a 2.75 percent interest rate to these figures indicates annual project costs for signals of $98,500 and $229,600 for roundabouts. The estimated cost for signal upgrades and geometric changes at the VT 14 location is $600,000. Replacing the signalized intersection with a roundabout would cost an estimated $3.5 million.

Benefit-Cost Comparison

The safety benefit and project cost estimates presented above are compared in Table 1. As shown, with the exception of the proposed signal upgrades and geometric changes for the VT 14 location, the estimated annualized project costs exceed the annualized project benefits. The benefit-cost ratios for the I-91 Ramp locations are low relative to the ratios calculated for the VT 14 intersection. At the VT 14 location, the benefit-cost ratios are near or above 1.0 due to the existing high crash rate at this intersection.

Table 1: Benefit-Cost Summary for Improvement Alternatives

	I-91 Ramps/US 5		VT 14/US 5	
Item	Alternative 1 – Install Traffic Signals	Alternative 2 – Construct Modern Roundabouts	Alternative 1 – Upgrade Traffic Signals and Channelization	Alternative 2 – Install Modern Roundabout
Existing Annual Cost of Crashes	$59,500	$59,600	$445,700	$445,700
Anticipated Annual Crash Savings Due to Project	$23,000	$25,400	$55,700	$213,900
Project Implementation Cost	$1,500,000	$3,500,000	$600,000	$3,500,000
Annualized Project Cost	$98,500	$229,600	$39,400	$229,600
Benefit/Cost Ratio	0.23	0.11	1.41	0.93

v:\1953\active\195311651\transportation\report\2019-04-15_benefit-cost text by rb.docx

APPENDIX D
Correspondence

Stantec

Meeting Notes

Project Kick Off Meeting

Hartford US 5 Scoping / 195311651

Date/Time:	September 25, 2018 / 10:00 AM
Place:	Hartford Town Offices
Next Meeting:	TBD
Attendees:	Rep. Kevin Christie, Hannah Tyler, Becky Rhoads, Cheryl Ulz, Tom DeBalsi, Phil Kasten, Brad Vail, Matt Osborn, Lori Hirshfield, Jim Borelli, Joe Nolin, Rita Seto, Chrisopher Andreasson, Scott Cooney, Erin Parizo (VTrans); Greg Edwards (Stantec), Sean Neely (Stantec)
Distribution:	Attendees and Leo Pullar, Town Manager

Item:

Project Roles:

Erin is VTrans project manager and Stantec is consultant working for VTrans. Greg Edwards is Project manager and Sean Neely is project engineer.

Project Area:

US 5, from Arboretum Lane to Highland Ave. VTrans met with Town last March to discuss area concerns (e.g., new development, HCLs, interstate ramp change). That informed the need for a scoping project. This study is to look at the bigger picture, either spot or corridor improvements, and establish a master plan for next steps.

Project Background:

The following projects and activities were discussed:

a. US 5 is state owned and maintained. It is not a class 1 town highway
b. US 5/Sykes Mountain Ave. Roundabouts – designed and currently in ROW, to be in bid phase in 2019
c. US 5 Sidewalk from Arboretum to Ballardvale – designed and currently in ROW
d. US 5/I-91 interchange Bike/Ped Scoping Improvements – in Preliminary design and on hold pending resolution of I-91 Off ramp reconfiguration and funding.
e. US 5/US 4 Intersection Scoping – It is a VTrans in-house scoping project. Erin is managing it.
f. School Parking/Campus Improvements – They are complete and bus traffic circulation has been revised and seems to help. The parking lot demo over summer, found foundation and artifacts from old Hanover St.
g. Existing Bike/Pedestrian plans - There is a bike and pedestrian master plan and Matt will provide a PDF.
h. UVM students are doing a capstone project for downtown bike and pedestrian planning but likely outside the project area.
i. Fairview Terrace retaining wall/operations - Will operate one way downhill as Town develops approach to repair/replace wall.

Item:

j. It was pointed out that Hanover Street is technically the entrance to the high school. Highland Ave may be more clear and will revise information to reflect that.

k. The I-91 Northbound off ramp is part of this project.

l. Maple Street/US4 from US 5 to NH bridge: There is a town group that is conducting a brainstorming/thinking process including Pine Street, shopping center, access, types of development, land use, circulation. Last meeting discussed access points along shopping area which has three points of access. Includes bike/ped considerations too. Group is working with RPC. There have been two meetings, with one more coming up. The Town will keep us in the loop.

m. Hartford Police Chief indicated there is a concern for crash statistics for Maple St and Pine St.

n. Pine Street is access for White River School and Bus company.

k. Planned developments: Sykes Mtn Ave developments include: Subaru dealer opening in a few weeks. Key Auto and thirty unit housing is also underway. All looked at traffic impact, can provide data.

l. VA Hospital Complex; Ten-year plan is to continue to expand, currently 1300 employees. 300-400 additions last few years.

m. Another development potential is the current Listen Building at US Route4/5 intersection. Building is sold and relocating business. Points of access to Route 5 worth looking at in the US 4/US 5 intersection scoping study.

Review of Each Intersection / Segment:

1. US 5/VA Cutoff Road

a. VA employees egress in PM and shows in the traffic count volumes

b. Site distance looked good to right but more difficult to see from left. Some traffic is accelerating around corner. Posted speed is 35 mph, but actual speed seems higher.

c. Jake's, on the corner is closing November 1st. Pumps do detour thru traffic and is not an ideal location for them. Whatever goes in after Jakes will drive intersection.

d. This is one of primary points for exits from the Town's Emergency Facilities that are on VA Cutoff road.

e. VA Cutoff Road queues occur mostly in the afternoon peak.

f. Pedestrians walk recreationally during day. Not always using paths built on campus. No pedestrian path or sidewalks along VA Cutoff or US Route 5, but US Route 5 sidewalk is planned.

g. VA Shifts: 24 hour shifts but most common are staggered shifts that start 7, 7:30, and 8 am. From 3:25pm to 5pm are peak exits. In addition to staff, users include medical students, contractors, visitors, and patients.

h. Transit service: Advance Transit drops off in morning and afternoon. Also, VA has own shuttles that service VT and 4 contiguous counties in NH, plus Manchester, and Boston

j. Delivery trucks use VA Cutoff Road entrance to back of the VA

Item:

k. Bus routes for schools: use the VA Cutoff road. Used to have bus stop at Hotel 8; not anymore. Not many residents there, but sometimes VA visiting families stay at hotel or other hotels in the area.

2. *US 5/Veterans Drive*

a. Most VA traffic exits out the back way, taking VA Cutoff to north. Tend to exit not using front drive due to limited sight distance and limited traffic gaps. Removing the I-89 SB on-ramp slip lane causes US 5 Northbound left turns on to SB On Ramp traffic to back-up. Now in the afternoon, turning traffic backs up on Route 5, in front of Bobs, Dunkin Donuts (DD), past VA. Afternoon peak period is 3:55pm-4:40pm.

b. Dunkin Donuts (DD) operations has complicated intersection. Advanced Transit stops at Dunkin Donuts.

c. There are no pedestrian facilities. Some VA visitors, new staff and clients do come from nearby hotels. Behind DD, there are five hotels. Difficult to cross US 5. There are many reports of near misses. Also see people walking to DD. High concern for pedestrian safety/comfort.

i. New VA security fence also impacts pedestrians. Channels walkers to entrances. Used to be able to walk anywhere across campus.

j. People like to walk down to DD on break. Sometimes walk past intersections either way to get away from turning traffic to avoid getting hit.

k. People also drop cars off for service, then walk to VA

l. A crosswalk may have impact on traffic. Some VA staff have suggested elevated heated crosswalk.

m. Queueing/congestion: Northbound US 5 left turning into Veterans Drive, do not pull to the left as there is no dedicated left turn lane and traffic backs behind them. There is now a left turn lane into DD.

n. Hartford Police Department (HPD) indicated: Challenging intersection with no ped crashes, but increased motor vehicle crashes. To access DD, there is a narrow driveway and vehicles have to turn wide, into one of exiting lanes. Lanes don’t work with space for entrance and an island is in the way. There is no opportunity to use hotel entrance or Ballardvale Road, as it is privately owned, and has concrete barriers. Area needs access management and maybe a traffic signal. With DD redevelopment four-way intersection was constructed but needs work.

o. VA patients tend to be older Vietnam vets, with different driving habits, cautious.

p. South of Sykes Mountain Ave (SMA): Traffic signal at SMA causes breaks in traffic. Roundabout may make traffic continuous and amplify issues.

q. Limited Sight distance from Veterans Drive approach looking east.

r. Some bike lanes and an eastside sidewalk are planned and may slow traffic.

3. *US 5/Ballardvale Road/Windsor Court*

a. VA staff/visitors park on narrow Windsor Court blocking traffic and then cut through bushes to access VA and avoid Veteran’s Drive. VA has a program to install fencing around facility and this will address issue.

b. Queueing/safety: Windsor has low traffic volumes. 5 or 6 residents. Ballardvale Road is entrance to hotels and gas station. During nighttime it is hard to see when turning onto

Item:

Ballardvale. May need lighting. During winter time when exiting Windsor Ct, it is a hard time stopping due to steep grade.

c. Old Howard Johnson restaurant is a vacant building used for aquatic center swim meet overflow parking plus other downtown over flow parking.

4. *US5/I-91 SB On and Off Ramp*
   a. US 5 Northbound left turns queue beyond Ballardvale. This is due to the removal of the separate SB on ramp and now northbound left turns yield to Southbound thru and rights.
   b. Exiting I-91 SB off ramp, left turn onto US 5 North is difficult with limited traffic gaps. Some vehicles turn right and make a U turn.
   c. US 5 Southbound right lane becomes Exclusive right turn lane and requires thru traffic to weave.
   d. During the bridge replacement, the temporary signal worked well. It provided breaks in traffic. Everyone thought it made sense to make permanent. Take away ramp, take away signal, confuses things. For US 5 SB right turn lane a yield sign was placed, then removed. Didn't work.
   e. Some people avoid intersection during peak periods and may use Wilder exit instead.
   f. Making a NB left turn to ramp can be hard at night as lighting is poor. Hard to see who is coming/going, lane striping, etc.
   g. Bikes/Pedestrians: There is sidewalk proposed for east side, through interchange. It is held up pending resolution of crossing I-91 NB off ramp. Also, east side sidewalk and bike lanes on both sides proposed on Route 5, Ballardvale Road to Arboretum Lane
5. *I-91 NB Off Ramp*
   a. Problematic for pedestrians crossing with slip ramp
   b. The off ramp forms the right lane and acts as a thru and right turn lane, into SMA. Difficult for US 5 NB traffic to enter short right lane.
   c. Queues back up onto I-91. With slippery weather there are crashes resulting.
   d. Off ramp geometry encourages high speeds.
   e. If people aren't familiar with the area, turning left onto US 5 SB and heading towards the VA, they're often if the wrong lane and need to weave from the right turn lane into the through lane.
   f. I-89 bridges between Hartford/Lebanon will be in construction in future and will likely impact this exit.
6. *US5/Sykes Mountain Ave*
   a. There is a roundabout designed for this intersection and the proposed lane configuration will need to tie into any proposed improvements.
7. *US5/Airport Road*
   a. No traffic volumes available yet.
   b. Exiting Airport Road and turning left turn on US 5, you need to quickly get into far hand lane, to position for getting on the interstate. Certain times of day are challenging.It may be worth collecting peak turning movement counts there.

Item:

c. DPW is located on Airport Rd and their trucks use it often. There is confusion created by adjacent gas station access.

d. There is a US 5 NB U-turn operation provided. Compromise made with property owner (Gas station) 5-8 years ago, closed left turn to gas. Couldn't get tanker through, gave them this to make turns. Full size school bus has hard time making U-turn movement. If bus fuels at Evans (most do at Evans or Mobil), going back to interstate isn't easy.

e. If exiting plaza across street, and going straight to Airport Rd, or to US 5, there are bullfighting traffic interactions.

f. Bikes/pedestrians: North along US 5 there are not many cyclists. There is no shoulder and uncomfortable on road. Consider increasing shoulder or providing bike facility. Can use Sykes to get downtown. Could we look at how to better sign bike routes. Challenge in past is to best place bike signage.

g. Stretch from SMA northward to the bridge is fast speeds. Posted speed changes from 35 mph to 40 mph near intersection with Sykes Mountain Ave towards downtown. Then down to 30 mph by Roundhouse Road. For additional information on this subject a summary of the VTrans Roadway Safety Audit has been added and included the following: *"An 85th percentile speed estimate is available from a volume count that was done in May 2016. The count location was at mile point 3.2 on US 5. From this count, the 85th percentile speed of the traffic traveling in the northbound direction on US 5 was determined to be 41 mph (meaning that 85% of the traffic travels at a speed of 41 mph or less). The 85th percentile speed of the traffic traveling in the southbound direction on US 5 was estimated to be 43 mph."*

h. HPD Chief: In the interchange area, he is not a fan of bike lanes on roadway. Seeing pedestrians on improved shoulder, concerns Chief since traffic includes logging truck and trucks using the landfill transfer station. Maybe bike lanes once past Airport Road.

8. *US5/US4*

a. This is a separate VTrans scoping and Erin is involved.

b. Is there a thought to reduce lanes on US 5? Traffic volumes suggest it is possible. Projections for growth on Sykes Mountain Ave from 10-15 years ago., have not been met.

c. During winter conditions US 5 SB Tractor trailers back up and stop on the hill.

d. Businesses accesses are on east side. If going into Listen building, vehicles use RT lane, and allows motor vehicles to go past. That makes two lanes helpful.

e. Difficult to distinguish drives to businesses vs. sidewalk.

9. *US 5 /North Main*

a. Currently there are 2 NB left turn lanes and their use depends on where traffic is going on other side of the bridge. If going east on US 4/Coop, use right lane. If continuing on US5, use left lane.

b. Modernizing Traffic Signal System would be good. Right turn across bridge, should have green arrow.

c. With bridge construction the bridge and left turn lane is down to one lane. Haven't noticed a queuing issue. Coach bus traffic is going through downtown then left bridge street to avoid it. Gets dicey in construction temporary traffic control area with large buses.

Item:

d. Bikes/pedestrians: There is no crosswalk or connection of the west side US 5 sidewalk to bridge sidewalk. Need to consider traffic impacts of adding a crosswalk. There is a Torchwalk once a year, and there is no way to cross to bridge. Struggle with wheel chairs over curb there. This is a good spot for bike lane, going into town and would help to slow traffic going downtown. A bike path ends on east side of the river and a bike lane connection one side to the other would be useful.

10. *US 5 / US 4/VT14*

    a. This is a high crash location and VTrans has conducted an RSA. Recommendations included: Signal upgrades, left turn arrows, and adjusting US 4 eastbound slip ramp modifications.

    b. For US 4/Maple St eastward towards NH there are many issues. These are beyond the current scope of this project but should be considered. With state office complex on Prospect street, and the US4/Pine Street light, and access to the Coop, traffic backs up in to the US 5 intersection. US 4 includes a narrow passage under railroad bridge and necks down from 4 to 2 lanes creating queues.

    c. Advanced transit and school busses stop on US 4 and US 5. On US 5 there is a stop just north of the intersection in the four-lane section and buses stop in the righthand lane. At this stop on the eastside there is a gate for the school and it is where kids cross, all lanes with no crosswalk since it is easier than crossing at signal.

11. *US 5/ Highland Ave.*

    a. Eastside jug handle is fine during day, but at peak hours it’s hard to handle volumes.

    b. Coming out of campus on Highland Ave. turning left is hard. Would like to see left turn arrow. Most cars from school make left turn. If two buses try to make left, they will plug up intersection. Have revised bus routes to minimize left turns. Some through vehicles allow left turns to go.

    c. During snowy or inclement weather, trucks and busses get stuck on the hill.

    d. Other high traffic volume time is events: sporting, open houses, voting, etc. Intersection gets jammed.

    e. One of VTrans staff spent time adjusting signal timings last year. We will discuss with them.

    f. US 5 NB onto campus right turn, also gets backed up. Wondering what the issue is. Didn’t notice as much last year. Right turns can block through vehicles.

    g. School starts at 7:30 for high school and 8 for middle school. 7:30am-8:15am and 2:30pm-3:25pm are peak hours

    h. When pedestrian actuation buttons are pushed, it’s an exclusive pedestrian phase with a very long pedestrian cycle.

    i. As a pedestrian, walking to school, sidewalk on both sides, always want to be on right side, but hard to get over there.

    j. These days, way more parents drop off kids which can overwhelm the school parking area. Afternoon pickups start at 2:15pm. Queue almost out to US 5.

    k. Traffic is worse in afternoon as parents wait for kids, then they all leave together.

    l. Buses are staggered, not as much as a problem now.

    m. Sight issue; hard to see cars on jug handle when making LT turn. Maybe worth looking at vegetation trimming.

Item:

n. Northbound on Highland Ave, if a car wants to go left, on to Hanover St. it's awkward. They have to get across quickly. In the morning or afternoon, it's almost impossible to make that move.

12. Other

a. The shoulder/Bike lane on US 5 NB side, going uphill, could be wider. Not riding as fast as others, but going uphill, with vehicles can be scary. If we could narrow lanes, maybe that could help.

Project Communication

Local Concerns Meeting will be held ASAP. Wed/Thurs sometimes good but 2nd and 4th Wednesday's there is a School board meeting. Try not to sched before 6:30 if possible. Erin will talk offline with the town to schedule. Town will put out on social media. Stantec will develop a notice for distribution and posting and will research cost to post in the Valley News.

The meeting adjourned at 11:30 AM

The foregoing is considered to be a true and accurate record of all items discussed. If any discrepancies or inconsistencies are noted, please contact the writer immediately.

Stantec Consulting Services Inc.

Gregory A. Edwards, PE
Senior Principal, Transportation

Phone: (802) 497-6398
Fax: (802) 864-0165
greg.edwards@stantec.com

Stantec

Meeting Notes

Public Meeting

Hartford US 5 Scoping / 195311651

Date/Time:	November 15, 2018 / 6:00PM
Place:	Hartford Town Offices, Hartford Vermont
Next Meeting:	TBD
Attendees:	See attached sign in sheet
Distribution:	Hannah Tyler, Leo Pullar, Lori Hirshfield, Rita Seto, Erin Parizo, File

Item:

Project Presentation

It was indicated Erin is the VTrans project manager and Stantec is the consultant working for VTrans. Greg Edwards is the Stantec project manager and Sean Neely is project engineer. The project area is US 5, from Arboretum Lane to Highland Ave. VTrans met with the Town last March to discuss area concerns (e.g., new development, HCLs, interstate ramp change). That informed the need for a scoping project. This study is to look at the bigger picture, either spot or corridor improvements, and establish a master plan for next steps.

The project definition process and timeline were presented, followed by an overview of collected information, concerns and issues. We then divided the attendees into three groups and each group circulated in 10 to 15 minute intervals to each project section: US 5 – Arboretum Lane to Sykes Mountain Avenue (Greg Edwards); US 5 – Sykes Mountain Avenue to North Main Street (Erin Parizo); US 5 – North Main Street to Highland Avenue (Sean Neely). We discussed previous collected information and solicited and recorded additional information and comments. The following includes collected information for each section of US 5. Attendees were provided three dots and asked to place them next to the most important item. The checkmark next to an item below indicates a dot that was placed on that item.

Review and input for each section:

US 5 - Arboretum Ln to Sykes Mtn Ave

Section Wide

1. Lack of sidewalks and crosswalks ✓✓
2. Lack of bicycle facilities
3. Traffic exceeds speed limit – 35 mph
4. Some intersections are dark
5. Many drives suggest access management is needed at VA Cutoff to Ballardvale
6. VA Hospital has limited parking
7. Walking desire line includes west side of US 5 from VA Cutoff to Veterans Drive and a US 5 crossing at Dunkin Donuts ✓
8. Account for Aquatic Center traffic during events
9. Consider there are trucks from quarry/sandpit and transfer station that use US 5 to access interstate

Item:

US 5/VA Cutoff Road Intersection

1. Limited corner sight distance at VA Cutoff Road looking north
2. Jake's (former) access and interior circulation could improve, since access is close to intersection

US 5/Veterans Drive/Dunkin Donuts Intersection

1. Congestion at Veterans Drive and Dunkin Donuts
2. Limited corner sight distance looking north along US 5 at Veterans Drive
3. Consider VA visitors are often older drivers
4. Dunkin Donuts right turn out of parking lot is tight
5. Dunkin Donuts delivery truck has difficulty maneuvering parking area and entering and exiting Dunkin Donuts

US5/Ballardvale/Winsor Intersection

1. US 5 U-turns occur here to difficulty making a left turn from the I-91 Southbound Off Ramp.

US5/I-91 Southbound Off Ramp/On Ramp Intersection

1. There is queuing on the I-91 SB Off Ramp as it is difficult to turn left
2. US 5 Northbound left turns to I-91 SB On Ramp cannot see US 5 Southbound traffic traffic when obstructed by Southbound trucks, left turn crashes have resulted
3. US 5 Northbound left turns to I-91 SB On Ramp have difficulty turning as US 5 Southbound right turn volume is high, the US 5 Northbound traffic does not yield to US 5 Southbound left turns, and US 5 Southbound thru traffic gets stuck in Southbound right turn lane since the right lane does not include a merge to the left thru lane prior to becoming an exclusive right turn lane.
4. I-91 SB On Ramp right turn is sharp
5. I-91 SB traffic avoids Exit 11 and diverts to Wilder and creates issues at Highland Ave.
6. I-91 SB Off Ramp traffic light installed during I-91 bridge construction worked well.
7. Traffic delays, queues and crashes have increased since elimination of the SB on ramp slip lane. Bring back the slip ramp operation. ✓✓✓✓✓✓✓✓✓✓✓✓✓✓

US5/I-91 Northbound Off Ramp/On Ramp Intersection

1. I-91 Ramp traffic Queues onto I-91 at NB Off Ramp at times during AM peak.
2. Confusing i-91 Northbound right turn weave with US through traffic when approaching Sykes Mountain Avenue. I-91 Northbound Off Ramp traffic does not yield to US 5 right turn traffic at Sykes Mountain Ave ✓
3. Geometry of I-91 NB Off Ramp right turn lane promotes high vehicle speeds
4. Better signage for US 5 NB to I-91 NB On Ramp

Item:

US 5 – Sykes Mtn Ave to North Main St

Section Wide

1. Lack of bicycle facilities ✓
2. Traffic tends to speed going down the hill
3. Visibility of I-91 from US 5 may contribute to speeding (signs, fast vehicles, etc.)
4. Traveling uphill can be challenging in snowy conditions
5. Drainage doesn't seem to be very good at the bottom of the hill – water coming off roadway and slopes from Fairview Terrace can lead to ponding

   Airport Road Intersection
6. Operations can be confusing
7. Open access from Beech Street, Cloverleaf, and Gas Station add to confusion
8. Buses refuel at gas station on Airport Road so there are a lot of larger turning vehicles in and out

   US 4/US 5 Intersection
9. Open driveways on east side of US 4 intersection contribute to confusion for vehicles and pedestrians feeling unsafe
10. Left turns coming off US 4 can be difficult to make ✓✓✓

    North Main Street Intersection
11. Signal upgrade desired
12. Lack of crosswalk from south side of North Main Street to sidewalk on bridge ✓

US 5 – North Main St to Highland Ave

Section Wide

1. *No bike facilities exist on the bridge or throughout this section.*

US 5 / VT 14 / US 4

1. US 5 NB - It might be good to dedicate a left turn lane and arrow for US 5 NB traffic coming off the bridge.
2. US 5 SB - Long queues require 2-3 cycles to clear. It is easy to mistake the right turn lane as a through lane; which forces you to turn right and then drive all the way around the High School. Removing the median and increasing the length of the left turn lane may help.
3. VT 14 WB – Lane splitting here causes confusion and could use better clarity.
4. VT 14 EB – It is difficult to see oncoming through traffic when making a left turn onto US 5, because that traffic is obstructed by opposing left turning vehicles waiting on red arrow. Maybe a left turning arrow for VT 14 EB would help.
5. There is significant pedestrian traffic here. Pedestrian traffic observation needed to see desire lines and modify facilities to better serve pedestrians. There are jay-walking and crossing issues at the Cota & Cota bus stop.

Item:

6. US 5/VT 14 is a High Crash Location ✓

VT 14/Coop Drives

1. The curb cuts for the Coop present access management issues.✓✓ The short curbs can cause confusion when trying to enter the parking lot. Maybe a barrier to force safer entrance would help here.

Hartford Ave to Highland Ave

1. Cars have trouble climbing the hill in winter.
2. Traffic speeds are much higher than necessary on this hill. ✓
3. There are noise complaints on this hill due to Jake brakes, motorcycles, etc. Maybe there are noise mitigation measures that could be implemented.
4. Better signage would be helpful at the jug handle (e.g. to help out-of-towners getting to school events).
5. Sidewalk is needed along US 5 NB at the jug handle to accommodate desire lines.

US 5 / Highland Ave / Worcester Ave

1. Maybe a roundabout can be considered here.
2. Cycling phases could use review; the red light comes quickly.
3. US 5 SB – The right turn lane at the High School impedes thru traffic. Maybe a longer right turn lane would help. ✓✓
4. The pedestrian signal could be improved. ✓ The exclusive pedestrian signal causes unnecessary delay. Maybe concurrent pedestrian signal phasing would help.

VT 14 / US 4 / Pine St / Bridge St

1. This is the oldest traffic light in VT and could be replaced.
2. Pedestrian signals have been dismantled. Adding pedestrian signals would be beneficial.
3. There is visual pollution here due to cluttered signage. Maybe this could be addressed in the upcoming repave. ✓✓✓
4. VT 14 WB – Traffic turning left on Bridge St. can experience confusion with the median configuration.
5. Coordinating this signal with the one at US 5 / VT 14 might improve traffic in this vicinity.
6. VT 14 EB – Traffic turning left onto Pine St. could benefit from a left turn arrow.
7. The upcoming paving project for VT 14 could be a good opportunity for other improvements identified here. ✓
8. A new development is coming to 101 Maple Street, between Pine Street and the railroad, for mixed use (retail, residential, etc.). They are looking at access management improvements that might benefit traffic on VT 14.

The meeting adjourned at 7:30PM

The foregoing is considered to be a true and accurate record of all items discussed. If any discrepancies or inconsistencies are noted, please contact the writer immediately.

Stantec Consulting Services Inc.

Gregory A. Edwards, PE
Senior Principal, Transportation

Phone: (802) 497-6398
Fax: (802) 864-0165
greg.edwards@stantec.com

Date/Time:	December 5, 2018 / 9:00 AM
Place:	55 Green Mountain Drive, South Burlington, VT
Next Meeting:	Next Meeting Date
Attendees:	Erin Parizo (VTrans), Greg Edwards (Stantec), Sean Neely (Stantec)
Distribution:	Attendees

Item:

Meeting purpose: To review status of project and discuss what improvements we should analyze.

Review of Report Draft: Have completed much of the existing conditions section and need to add public comments and traffic analysis.

Environmental Resources: Erin has requested this from VTrans (similar to ROW), may be January or so

Purpose & Need Statement: Stantec has started it based on existing conditions and plan to fill in needs based on corridor needs and specific needs of each intersection.

Pine Street Intersection on VT 14: Add this intersection and VT 14 segment from US 5 to Pine Street to the scope of this project. Stantec will run Synchro analysis of existing conditions and review results. Erin will provide a request to include this and Stantec will add a new task to financial system and track added work. Once the extent of effort is known, an amendment will be provided.

VTrans VT 14 Paving Project: This project will include upgrade of signals at Pine Street and VT 14/US 5. They were thinking of replacing in kind and may consider some curb to curb changes. They are looking at finalizing design next summer and scheduled for FY 2021 construction.

Reviewed signal warrant analysis and/or traffic capacity analysis and for each intersection and discussed potential improvements to analyze:

1. VA Cutoff Road
    a. Doesn't currently meet signal warrant and would need just 15 additional vehicles on VA Cutoff Road to meet peak hour warrant.
    b. Likely would meet signal warrant if implemented one-way entrance at main entrance (Veterans Drive)
    c. Capacity analysis as unsignalized indicates V/C ratio 0.52 (2018 PM) and 0.63 (2040 PM)
    d. There is no redevelopment plan for former Jake's to consider.
    e. Consider adding a right turn lane and see how it fits.
    f. Erin will contact the Veteran's Administration to solicit what they have planned for growth and thoughts on one-way entrance.
    g. One alternative that we may eventually consider is either a signal here or a signal at Veterans drive.
    h. Capacity analysis does not suggest capacity issues for 2040. It does not suggest a US 5 left or right turn lane is needed.

Item:

    i. Stantec to determine existing corner sight distance.

2. Veterans Drive
    a. Doesn't currently meet signal warrants but if Veterans Drive traffic is increased with growth or by the accessibility provided by a signal, it may be warranted.
    b. Capacity analysis as unsignalized indicates V/C ratio 0.95 (2018 PM) and 1.24 (2040 PM)
    c. If there is a signal at VA Cutoff, consider Right In/Right Out at this location
    d. Stantec to perform capacity analysis using 2040 traffic with signal and determine if any auxiliary lanes are needed.
    e. Stantec to discuss what are options without signalization, such as sight distance improvement, auxiliary lanes, and/or crosswalk.
    f. Erin to check with VA on forecasted growth
    g. Stantec to determine existing corner sight distance and what is needed to meet AASHTO.

3. Ballardvale Drive/Winsor Drive
    a. Doesn't currently meet signal warrants
    b. Stantec to review analysis and determine what length of US5 NB left turn lane is needed.
    c. Consider improvements such as signals at adjacent intersections may provide more gaps.

4. I-91 SB Off/On Ramp
    a. Currently meets signal warrants. This does not include reassigning traffic from Wilder Exit.
    b. Capacity analysis as unsignalized indicates V/C ratio 0.66 (2018 PM) and 1.62 (2040 PM)
    c. Stantec to perform capacity analysis using 2040 trafficwith signal to determine resulting delay and queues and if any auxiliary lanes are needed.
    d. If not signalizing, consider making geometry changes instead such as
        i. Providing a single lane coming from Sykes Mountain Ave roundabout, then an explicit Southbound right turn lane lane that yields to NB left turns or merges after turn onto ramp similar to Alternative #3 Option A-2 & C-2 from previous scoping
        ii. Adding RT lane coming off ramp (as stated in Warrants Analysis)
        iii. Not considering former Right Turn Ramp because of bicyclists
    e. Stantec to develop base map and bring in proposed sidewalk, bike lanes and SMA roundabout linework.

5. I-91 NB Off Ramp
    a. Currently meets signal warrants.
    b. Capacity analysis as unsignalized indicates V/C ratio 0.90 (2018 AM) and 1.06 (2040 AM)
    c. Stantec to perform capacity analysis using 2040 traffic with signal, a T-type intersection including a left and right turn lane for the I-91 NB off ramp and one US 5 Southbound lane to determine resulting delay and queues
    d. May eventually consider roundabout as was shown in previous scoping

6. I-91 NB on ramp
    a. No apparent need to analyze.
    b. Consider US 5 Southbound left turns may have less gaps with SMA roundabout.

7. Sykes Mountain Ave Roundabout
    a. Provides one lane exiting US 5 SB and US 5 NB
    b. Provides two lanes entering US 5 SB and US 5 NB

8. Airport Drive
    a. Does not meet signal warrants.
    b. Determine existing corner sight distance

Item:

c. Maintain U-turn operation
d. Consider access management recommendations
e. With US 5 AADT<10,000, consider one lane thru lane on US 5 NB and SB to reduce conflict points.
   i. Maintain 24 feet curb to curb but provide 2 foot shoulder,12 foot lane, 5 ft buffer and 5 ft lane
   ii. For truck climbing, consider keeping two lanes US 5 SB coming up hill (Share The Road)
f. Or move out US 5 NB curb four feet, provide one 20 foot curb to curb roadway and 10 foot shared use path from SMA Roundabout to North Main Street Bridge

9. US 5/North Main Street
   a. Capacity analysis as signalized indicates V/C ratio 0.80 (2018 AM) and 0.70 (2040 AM)
   b. Stantec to perform capacity analysis using 2040 traffic with reduced lanes – one US 5 NB left turn lane, one North Main to US 5 SB lane, and 3 lane bridge and adding pedestrian crosswalk phase on east approach, concurrent with US 5 NB left turns. See sketch.

10. US 5/VT14
    a. Capacity analysis as signalized indicates V/C ratio 0.62 (2018 PM) and 0.65 (2040 PM)
    b. Stantec to perform capacity analysis using 2040 traffic with reconfigured lanes – one US 5 NB left turn lane, one US 5 NB thru and right turn lane, optimized phasing and timing, such as permitted left turns with yellow arrow and exclusive pedestrian crossings. See sketch.
    c. Revise US 5 NB right turns yield to stop.
    d. Moves back stop bars and crosswalks.
    e. For design, will need to consider keeping signals within 120 FT of stop bars.
    f. Consider removing sign bridges – maybe part of paving project? Erin to check with Matt.
    g. Cannot completely remove Island for RT onto bridge from EB 14 since need to provide a signal mast arm.

11. US 5/Highland Ave.
    a. Capacity analysis as signalized indicates V/C ratio 0.41 (2018 AM) and 0.46 (2040 AM)
    b. Stantec to perform capacity analysis converting Highland Ave approach to left turn lane and a thru/right turn lane, provide protected /permitted left turn phase and reduce pedestrian crossing phase.
    c. Traffic volumes for 2016 (before circulation changes at school) vs. 2018?
    d. Determine benefit of concurrent pedestrian phases?
    e. Better coordination - appears to float? Due to pedestrian actuation?
    f. Consider providing pedestrian crossing at Worcester with direct sidewalk.
    g. Bike lane on NB Approach – would need single thru lane on approach.
       i. Look at signal impacts of reducing to single thru approach.
    h. Meet with Derek Lyman to discuss possible signal issues and changes such as better coordination with Hanover/Highland signal since it appears to float and the influence of pedestrian actuation on coordination.

12. Pine Street/ Bridge Street
    a. Stantec to perform capacity analysis for existing (2018) / future No Build (2040)

13. Meet again as project team with others from VTrans. Erin will try for January 10 or later.

Item:

14. Erin to obtain some available utility information from VTrans. and ask for available water/sewer GIS shape files or system plans from Town.

The meeting adjourned at 11:00 AM

The foregoing is considered to be a true and accurate record of all items discussed. If any discrepancies or inconsistencies are noted, please contact the writer immediately.

Stantec Consulting Services Inc.

Greg Edwards

Phone: 802-864-0223

Attachment: None

c. Attendees

Project Alternatives Review with VTrans

Hartford US 5 Corridor Project Definition / 195311651

Date/Time:	February 21, 2019 / 10:30 AM
Place:	AOT - Davis Conf Rm N313
Next Meeting:	TBD
Attendees:	Erin Parizo (VTrans), Derek Lyman (VTrans Traffic Signal Operations), Scott Robertson (VTrans Municipal Assistance Bureau), Trevor Starr (VTrans DTA/GM District 4), Chris Bump (VTrans PM District 4), Matt Bogaczyk (VTrans Pavement Design), Jon Lemieux (VTrans Municipal Assistance Bureau), Patti Colburn (VTrans), Jesse Devlin (VTrans), Greg Edwards (Stantec), Sean Neely (Stantec)
Absentees:	Bruce Nyquist (VTrans Research), Mario Dupigny-Giroux (VTrans Research)
Distribution:	Attendees/Absentees

Item:

Project Roles:

Erin is the VTrans project manager and Stantec is the consultant working for VTrans. Greg Edwards is project manager and Sean Neely is project engineer.

Project Area:

US 5, from Arboretum Lane to Highland Ave. VTrans met with Town last March to discuss area concerns (e.g., new development, HCLs, interstate ramp change). That informed the need for a scoping project. This study is to look at the bigger picture, either spot or corridor improvements, and establish a plan for next steps.

Other Project Area Projects:

- US 5/Sykes Mountain Avenue (SMA) Roundabout
- US 5 Sidewalk from Arboretum to Ballardvale
- US 5/I-91 Interchange Bike/Ped Improvements
- US 4/US 4 Scoping

Area Information, Concerns, and Potential Alternatives:

- US 5 – Arboretum Lane to SMA
    - US5/Veteran's Drive / Dunkin Donuts
        - Currently the intersection is just below the signal warrant threshold for the peak hour warrant, by about 10 vehicles. Adding a signal will likely draw vehicles currently using the VA Cutoff road and therefore meet the peak hour warrant. Alternatives include signalizing intersection or signalizing the US5/VA Cutoff intersection and making Veterans Drive Right-in/Right-out (RIRO),or a one-way entrance, with an exit from VA Cutoff Road.

Item:

- Signalizing Dunkin Donuts could include a crosswalk.
- Jasmin Drive is a private drive and its location is problematic for intersection operation.
- After project team gets buy-in from VTrans management, the recirculation associated with one way or RIRO operation can be discussed with VA (Make sure no opposition from VTrans first). Erin will follow up internally and with the VA.
- There is limited existing sight distance looking northbound from Veterans Drive. **Stantec will evaluate for improvement.**
- VA owns all property on VA side of US 5

- Winsor Drive / Ballardvale Drive
  - Winsor Drive has limited sight distance looking southbound. Could be mitigated by simply cutting trees and cutting the bank back but may require environmental documentation review and easement from property owner. **Stantec will evaluate for improvement.**
- I-91 Southbound Ramps
  - Short term improvement options could include I-91 SB offramp right turn lane, and/or US 5 SB slip ramp (analysis shows slip ramp doesn't make significant impact).
  - Long term improvements could include roundabout or signalization.
  - Currently meets signal warrants.
  - There had been a channelized yield treatment for SB RT turns, but nobody was yielding.
  - Currently two SB lanes, one should be designated RT to I-91 SB. Motorists in the RT lane here change their mind sometimes and get locked into the lane, resulting in conflict.
  - Exiting the ramp, it is difficult to tell if other vehicles are turning. Removing the previous slip lane overall was helpful.
  - Temporary signals were discussed but did receive support.
  - I-91 SB ramps had some Wrong Way incidents. A recent one cause a big pile up on the bridge on I-91.
- I-91 Northbound Ramps
  - I-91 NB off ramp LT: "T" up intersection per previous scoping study.
    - That possibility had been put on hold due to insufficient funding. The local match required was $150,000.
    - **Stantec will perform capacity analysis** (Synchro) for stop-controlled T-intersection.

Item:

        - Without making "T" intersection, no pedestrian solution. May need to look at drastic changes to get pedestrian solution. Current straight ramp for RT not compatible with pedestrian facility.

      - One potential is to restrict NB off ramp movements to right turns, requiring left turns to make U-turn at SMA roundabout for SB US 5. This would require analyzing roundabout and furthering this alternative will be on hold pending results of other alternatives.

      - Signalize intersection

        - Would require realignment with on ramp.

        - Stantec will consider queuing onto ramp, towards interstate, and towards roundabout.

   - End goal for this section of US 5: a preferred alternative that works for corridor

      - If addition to signal alternatives, Stantec will evaluate roundabouts for I-91 SB/NB ramps.

- US 5 – SMA to North Main Street/US 5 Bridge

   - Airport Road

      - No capacity issues. Conflict points, access, surplus pavement. Low volume. No queuing issues.

      - Alternative for this area is to convert existing 4 lanes to 2 lanes with buffered bike lanes. Mostly accomplished with pavement markings.

      - It was pointed out, that winter conditions were problematic for trucks climbing the hill US 5 southbound and was nice to have two lanes, but not an issue anymore. Trucks might currently be using alternate route. If bike lanes are added, they won't likely be used as much during winter, so trucks could use that space during winter.

   - North Main Street / Bridge

      - No capacity issues. Even while bridge deck was under construction over the summer, and lane closures on both sides, with the US 5 NB LT lane towards bridge reduced to one lane, capacity was sufficient.

      - One issue that has been heard was lack of sidewalk connectivity for pedestrian crossing.

      - During paving, Town had requested to reduce striping to provide shoulder for bikes. Crew was unable to do that at that time, due to a culvert failure and night paving requirements. Will need to be restriped in Spring 2019 and will need help with tapering. VTrans had looked at this from a high level; it seemed there is not much room for bike lanes.

      - No complaints during TTC for reduced lane that went south to intersection. The whole lane was closed back towards US 4. Entire third lane was eliminated. It was problematic for bikes

Item:

making LT onto bridge. One issue was on the north side of the bridge, for trucks turning RT onto bridge from VT 14, barrels had to be moved five or six feet sometimes.

- Keep in mind, anything proposed for median island, bridge is essentially two bridges, with a joint right down center of island. Channel width is an inch or two. Need to be aware if changing center line.

- US 5 – VT 14 to Highland Avenue
  - VT 14 / US 5
    - Upcoming VTrans paving project on this section of VT 14 (Class I Town Highway), to include two signal systems (at US 5 and Pine St.) being upgraded to current standard. At VT 14 / US 5 they will upgrade the signal and replace sign structures with lower level signs. With this program, could potentially look at minor curb movement. Won't adjust medians going up the hill, but splitter islands may be eligible, requiring some analysis. Ideally the equipment will be in the right place to be able to move later if needed. They will try to plan ahead to accommodate the preferred alternative from this scoping project.
    - Given this is a high crash location, Stantec will evaluate a roundabout for this location. A 150 FT diameter circle has been roughed out on the alternatives drawing so far to get a sense. That diameter is generous and could likely accommodate whatever is needed. VTrans hasn't had much success with two lane roundabouts but have had some with a single lane and two slip lanes. Because of the high ranking as a high crash location (HCL), it warrants analysis for roundabout, before looking at cost/benefit.
  - VT 14 / Pine Street
    - As part of the upcoming VT 14 paving project mentioned above, medians will be pulled at the Pine Street intersection, allowing for some adjustments to lanes and space for bike lanes.
    - Alternatives to further evaluate include upgrading the signal and adding a westbound left turn lane.
  - US 5 / Highland Avenue
    - Morning peak period capacity issues for a short period (~15-20 minutes) during school drop-off. Analysis supports this. Stantec analyzed reducing pedestrian phase time, protected/permitted left turn for Highland Ave approach. This did not have significant impact on analysis results.
    - Signal was designed with two additional ingress/egress (Cascadnac Ave from south; Hanover St from north). Now both of those access points are closed. Both the school and the sheriff have indicated there is no opportunity for re-opening those access points.
    - Consider 'Do-Nothing' alternative.

Item:

- Can't coordinate signals with current equipment. Coordination would require new technology signal equipment. Expense of upgrade and use of logic statements seems elaborate for a short duration problem.
- School should consider reopening closed ingress/egress points. Closing those access points has created the traffic issues they are now experiencing. Coming from VT 14, Cascadnac Ave does have grade issues, but opening it could help with the protected phase at US 5 / VT 14. The school has not provided much input so far, except for adding a LT arrow. The school, in coordination with local law enforcement has indicated that reopening old ingress/egress is not an option in their mind.
- Consider discussing soft solutions with the school, like encouraging bussing or carpooling to reduce the number of motor vehicle trips during the peak period.

Next Steps:

- Develop matrix for evaluation of alternatives.
- Evaluate roundabouts at I-91 ramps and VT 14.
- Consider feasibility of alternatives
    - Keep in mind bridge functions as two bridges with longitudinal center joint.
    - Alternatives need to be assessed on a corridor basis. Needs to be modeled based on the corridor, and presented as such, while still understanding the individual components.
    - Break corridor up into segments, similar to break-out sessions from local concerns meeting.
    - Present a range from a full treatment, compared with lower cost, short-term improvements.
    - Plan to have a recommended alternative by late spring/early summer. Keep this meeting's attendees in the loop.
- Erin will review project with Bruce and Mario, in terms of HCLs.
- Will discuss any additional signal improvements with Derek.
- Benefit-Cost Analysis (BCA) will be conducted for individual intersections, after other analysis completed.
- Look at alternatives with this VTrans group again and refine before bringing to VTrans management and then presenting to stakeholders and the public.

The meeting adjourned at 12:00 PM

The foregoing is considered to be a true and accurate record of all items discussed. If any discrepancies or inconsistencies are noted, please contact the writer immediately.

Stantec Consulting Services Inc.

Gregory A. Edwards, PE
Senior Principal, Transportation

Phone: (802) 497-6395
Fax: (802) 864-0165
Greg.Edwards@stantec.com

Hartford US 5 Improvements Meeting with VA Staff

/ 195311651

Date/Time:	April 3, 2019 / 2:00 PM
Place:	VA Hospital Building 28 – room 125
Next Meeting:	TBD
Attendees:	Becky Rhoades, Jim Borelli, Joe Nolin, Erin Parizo, Greg Edwards
Absentees:	Shaun Fontenelle
Distribution:	Attendees

Discussion Items:

1. **Existing operations –** Approximately 1200 total VA staff including all shifts. There are 3 daytime shifts with staggered start and end times. (7am - 3:30 pm, 7:30 am - 4:00 pm and 8 am - 4:30 pm)
2. **Existing site circulation, operations and issues –** Jim provided the attached site plan with existing conflicts and safety concern areas along their existing internal roadways. Most notable was the multilegged intersection in the area of the emergency services entrance, and the curved narrow roadways in the rear of the site. There are numerous pedestrian and vehicle conflicts as all parking areas are connected to the facilities via surface sidewalks or/walkways that require crossing or using internal roadways. Internal roadways serve as a component of an emergency evacuation plan.
3. **Commercial Deliveries** – Most deliveries are during the off-peak hours using Patriots Drive but many utilize unloading dock facilities at building 67, the warehouse, and currently exit using Veterans Drive. It is impractical to exit via the existing rear entrances.
4. **Facility Construction** – Some construction may require closing of internal roadways and alter circulation, so a one-way entrance may restrict this flexibility. Potential future projects, some subject to funding, are: employee parking deck, utility upgrades, wellness center, Emergency Services, and Fisher House.
5. **Transportation demand management measures** – Two transit services include VA on their route and VA provides staff incentives for using transit, ride share is promoted, bike racks are provided, shuttle service is provided for eligible patients, and commercial deliveries are typically scheduled off peak.
6. **Alternatives** – Veterans Drive one way or right in and right out requires exiting traffic to circulate through site and use Veterans Cutoff Road. With current internal roadways this creates greater conflict with existing vehicles. We discussed the possibilities on internal improvements such as improving intersection at Emergency services with a roundabout or a new connection to the VA Cutoff Road. VA staff will review possibility of internal improvements. It was pointed out that many of their patients are elderly and exiting at a different location than was entered can be confusing. Consider emergency services and pre-emption at a new signal installation considering proximity to fire department.

Discussion Items:

7. **Next Steps:**

    a. Stantec will provide VA staff with traffic data used in the intersection capacity and signal warrant analysis.

    b. VA to follow up with thoughts related to internal improvements required to make circulation functional under a one-way or right in/right out alternative.

    c. Alternatives to be further defined, preferred alternatives to be selected among Agency staff, Town staff, and other stakeholders, and draft/final scoping report to be developed over the next few months.

The meeting adjourned at 3:30 PM

The foregoing is considered to be a true and accurate record of all items discussed. If any discrepancies or inconsistencies are noted, please contact the writer immediately.

Stantec Consulting Services Inc.

Gregory Edwards, PE

Phone: 603-289-0025
Fax: 802-864-0165

Attachment: Campus Map

c. Attendees

Date/Time:	May 10, 2019 / 1:00 PM
Place:	Hartford Town Offices
Next Meeting:	TBD
Attendees:	Erin Parizo (VTrans), Hannah Tyler (Hartford DPW), Scott Cooney (Hartford Fire), Brad Vail (Hartford Police), Jim Borelli (VHA-WRJ), Tom DeBalsi (Hartford School District), Rita Seto (TRORC), Lori Hirshfield (Hartford Planning), Matt Osborn (Hartford Planning), Greg Edwards (Stantec), Sean Neely (Stantec)
Absentees:	None
Distribution:	Attendees

Item:

Meeting Summary

Project Area, Purpose & Need were reviewed, and short-term and long-term alternatives for each segment were presented and discussed among stakeholders.

Segment 1 – Arboretum to Ballardvale

Questions came up concerning coordination between Town and State 1111 Permit process for access management. It seems that past planning efforts and assumptions haven't always turned out as expected. Plans may need to be monitored/revisited at times to update accordingly.

Simulations conducted for roundabouts and signals along corridor indicate sufficient operations.

Signalization at Veterans Drive is considered due primarily to peak hour volumes.

Sidewalks and bike facilities could not be routed behind properties while staying within current ROW.

<u>LT1 – US 5/VA Cutoff Road Intersection Signal</u>:

The VA would not advocate for the right in/right out or one-way in at Veterans Drive due to safety issues on the VA campus. Medical gas and fuel trucks don't have a good alternative route through campus. With current internal roadways this creates greater conflict with exiting vehicles and pedestrians. Concern for increasing risks to aging veterans getting care at the facility. Many of their patients are elderly and exiting at a different location than was entered can be confusing. Meeting was held with VA leadership to discuss concerns on 4/3/19.

Moving traffic to VA Cutoff Rd would just move problems to that facility, and would require improvements to handle added traffic, trucks, and pedestrians.

<u>LT2 – US 5/Veterans Drive Intersection Signal</u>:

Item:

Roundabout at Veterans Drive is not shown as an alternative because the tight geometry makes it less feasible.

Would need to work through mitigating impacts with Dunkin Donuts. Although LT2 looks favorable, the tight radius for right turning movements out of Dunkin Donuts would need mitigation to avoid encroaching on opposing lane. This is a current issue that remains regardless of whether this alternative is selected.

Segment 2 – Ballardvale to Sykes Mountain Ave

LT3 – US 5/I-91 NB and SB Ramp Signals

The capacity analysis indicates a signal provide good performance here and queues wouldn't be an issue, but additional detection could be put in for the NB off ramp approach if they become a concern..

The Sykes Mountain Ave roundabout construction will not change the slip ramp for the NB on ramp.

LT4 – US 5/I-91 NB and SB Ramp Roundabouts

Concern was raised that roundabouts would require reconstruction of the sidewalks and bike lanes that the Town is planning. Perceptions of additional public monies being spent on changes to projects with recent public expenditures could be a concern..

Concern was raised that roundabout at Sykes Mountain Ave could reduce gaps in traffic for people to turn out of other side roads (e.g., Veterans Drive, Winsor Drive).

Concern was raised about having three roundabouts, and the resulting queues or lack of gaps in the traffic. A signal for the NB ramps might be preferred for that reason. Concern raised for managing bikes and pedestrians, as well as peak demand, with a third roundabout.

A suggestion was offered for adding other criteria to the comparison matrix to consider cohesion with related ongoing Town projects (e.g., sidewalk from Arboretum to Ballardvale going out to bid soon).

Segment 3 – Sykes Mountain Ave to North Main St

Short Term – Replace Existing US 5 Right Lanes with Buffered Bike Lanes

Providing a buffered bike lane for bikes continuing north on North Main Street towards downtown may provide for more users than prioritizing bikes making left onto bridge. Not much demand for left turn onto bridge for school children on bikes is anticipated, as it is not coming from residential areas. For bikes who do use the bridge, maybe they could use the crosswalk to cross to the bridge.

Alternative shows one lane in each direction over the bridge, but the southbound lane could be separated into two lanes closer to the signal if that makes more sense.

US Route 5/US Route 4 is a separate project but will be conducted to be able to work together with this project.

Segment 4 – North Main St to Highland Ave

Short Term – Upgrade Signals, Reconfigure Lanes

Item:

Comments provided that protected left turn phases are needed at US 5/VT 14. Northbound Left and Thru lane could work at US 5/VT 14, so long as a dedicated left turn signal provided. Even with infrequent NB left turns here, concern raised that thru vehicles would get stuck behind left turning vehicles.

Challenges expressed for people traveling through this area to get from A to B.

Concern raised for dropping a lane going up hill towards Highland Ave; could pose hazard for right turning vehicles using jughandle when queues extend to US 5 during peak period. Right now, having two lanes allows movements around those going to jughandle. During winter weather, it can be hard to stop then start again on the hill.

Concern raised for sight distance for bikers, and conflicts between bikes and motor vehicles at Worcester Ave; vehicles need to yield to bikes. This can be an issue when considering brand new drivers around the High School.

Discussion about making Hanover Street one way in, forcing exiting traffic to go through middle school and circle back like buses do. Having buses do this has been helpful. Signal adjustment in recent years by VTrans was helpful here. Due to short peak, it is hard to justify more capacity improvements. Adding a protected left turn out of the school could add to delay.

<u>LT5 – US 5/VT 14 Roundabout</u>

Question raised about additional construction work on bridge this year. Erin checked after the meeting and it is not planned by the district for this season.

VT 14/Bridge St/Pine St

Although comments during the public workshop indicated the pedestrian signals were not working here, it was confirmed that they are in fact operating as an exclusive actuated pedestrian phase.

Inquiry about putting in diagonal crosswalks to meet desire lines across intersection and make it more feasible for pedestrians to make that movement during one phase. There is an example of this done in Brattleboro.

Concurrent pedestrian phasing could be a good option, with a leading interval. Concern raised for difficulty making right turns here during busy times, and the impact of a concurrent ped phase.

Positive input provided for eliminating median islands and adding left turn lanes.

Access management issues raised for VT 14. Redevelopment in this area to occur in the future. Separate properties need to be considered. Suggestion for considering shifting more traffic to Pine Street for accessing properties along this section of VT 14. If that were to be done, would need to address capacity of Pine Street. The school feels Pine Street already has limited capacity and is too narrow.

For encouraging more of a downtown village feel, reducing lane widths could help.

Overall Comments

Item:

Expanding bike facilities is of interest to the community, if that can be reasonably accommodated without increasing congestion. Each location needs to be considered individually, as well as looking at the corridor holistically. It can be difficult for people to conceptualize, because now it seems uncomfortable and dangerous. If it appeared safer and more welcoming, maybe more people would want to ride bikes. Many bike accommodations could be implemented relatively easily.

Draft report was sent out to stakeholders for review and feedback. Comments to be provided by June 5th. Then review with VTrans, prioritization and preferred alternatives selection. A preferred alternatives meeting will need to be scheduled for the public. It might make sense to schedule this separately from a Select Board meeting. Summer months can be challenging to schedule events with people on vacation. Either as a supplement or alternative to a public meeting, enabling online review and comments could be useful.

Ultimate goal is to have one recommendation for the whole project corridor.

The meeting adjourned at 3:00 PM

The foregoing is considered to be a true and accurate record of all items discussed. If any discrepancies or inconsistencies are noted, please contact the writer immediately.

Stantec Consulting Services Inc.

Sean Neely
Civil Engineering Designer

Phone: 802 864 0223
Sean.Neely@stantec.com

Attachment: Attachment

c. Cc List

TOWN OF HARTFORD
SELECTBOARD MINUTES
Tuesday, January 28, 2020, 6:00pm
Hartford Town Hall
171 Bridge Street
White River Junction, VT 05001

Present: Simon Dennis, Selectboard Chair; Richard Grassi, Selectboard Vice Chair; Dennis Brown, Selectboard Clerk; Dan Fraser, Selectboard Member; Alan Johnson, Selectboard Member; Kim Souza, Selectboard Member; Brannon Godfrey, Town Manager; Lana Livingston, Administrative Assistant; Lori Hirshfield; Hannah Tyler; Scott Cooney; Erin Parizo; Greg Edwards; Sean Neely; Bethany Fleishman; Donald Hemenway; Richard Schramm; Alexander Schramm; Jim Borelli; Agnes Anna Zephyr; Clare Forseth; Dave Sherman; Tim McGary; Nancy Howe; Cathy Melocik; March Bartlett; Dennis Smith; Christopher Andreasson; Richard Brittain; Zachary Bryan; Kristine McDevitt; Samantha Dunn; Phil Kasten; Scott Cooney; Thom & Janice Valley; Lannie Collins.

Absent: Jameson Davis, Selectboard Member

CATV Link: http://catv.cablecast.tv/CablecastPublicSite/show/11115?channel=1

I. **Call to Order the Selectboard Meeting**
Selectboard Chair, Simon Dennis called the meeting to order at 6:01 P.M.

II. **Pledge of Allegiance:** Selectboard Vice-Chair, Dick Grassi led the Pledge of Allegiance.

III. **Local Liquor Control Board: N/A**

IV. **Order of Agenda:** No changes

V. **Selectboard**

1. **Public, Selectboard Comments and Announcements:**

Citizen comments: Cathy Melocik from Wilder asked if the sidewalks and crosswalks on Hartford Avenue, Rte. 5, could be looked at. They are not being cleared. Also, there is poor lighting near Chandler Road where there is an AT Stop but no sidewalk and no crosswalk.

Selectboard comments: Kim Souza has been visiting and listening to area Selectboards and Councils to see how they are handling Welcoming Ordinances. She also noted that Lebanon is recently making Zoning Adjustments to allow for affordable housing.

Alan Johnson wanted residents to know that the speed signs for Wilder's Rt 5 are in this next year's budget. If the budget passes on March 3rd, the signs are likely to be put up after July 2020.

Simon Dennis reported that 2 events held at the Quechee Library and Bugbee Senior Center this past week were well attended.

2. **Appointments: N/A**

3. **Special Presentation**

   a. VTrans Rte. 5 Corridor Transportation Alternatives (motion required)

Selectboard Vice Chair, Dick Grassi made the motion to approve the Route 5 Corridor Transportation Alternatives as presented. Selectboard Member, Alan Johnson seconded the motion. 5 were in favor, 1 (Brown) was not in favor. The motion passed.

Kim Souza and Dennis Brown asked if an explanation could be given to the Board about why the ramp entrance was never put back.

Selectboard Chair, Simon Dennis recessed the Selectboard meeting and opened the Public hearing at 7:25 P.M.

4. **Public Hearing:** Vermont Community Development Program Application for Wentworth Phase 2 and Wilder Housing Project

Lori Hirshfield, Town of Hartford Director of Planning and Development, gave an overview of the proposed $400,000 Vermont Community Development Program (VCDP) grant that would be subgranted to Twin Pines Housing Trust to develop 21 new units of mixed income housing on two sites. Andrew Winter, Executive Director of Twin Pines Housing, gave a more detailed summary of the proposed development and site plans.

Marcy Bartlett from Wilder Village asked if there were any other changes to the original site plan for the Wilder site other than the pitch of the roof. Andrew Winter stated there were four: roof pitch; eliminating light in the rear of the building to reduce the impact on the adjoining neighborhood; reduced the height of one light to focus it on the parking area; and additional stormwater filtration in a section of the site.

Ms. Bartlett noted her appreciation, and the neighborhood working together with Twin Pines in the future.

There were no additional public comments.

Selectboard Chair, Simon Dennis closed the public hearing and reopened the Selectboard Meeting at 8:45 P.M.

5. **Board Reports, Motions & Ordinances:**

   a. Vermont Community Development Program Application for Wentworth Phase 2 and Wilder Housing Project (motion required)

Selectboard Member, Alan Johnson made the motion to approve the submittal of the grant application for the Wentworth Community Development Housing Phase 2 (includes the Wilder Housing Project) and authorize the Town Manager to take all necessary actions to apply for and implement the grant And to approve and sign the Resolution for VCDP Grant Application Authority. Selectboard Member, Dan Fraser seconded the motion. All were in favor and the motion passed.

b. Sale of 175 Newton Lane and 1346 Jericho Street (motion required)

Selectboard Member, Dan Fraser made the Motion to Authorize the sale of #4-29 (175 Newton Lane) for $18,264.82 and #4-24 (1346 Jericho Street) for $23,780.25 to Thomas and Janice Valley, with closing to occur on or after 30 days from publication of the notice of sale of Town property. Selectboard Clerk, Dennis Brown seconded the motion. All were in favor and the motion passed.

c. FY21 - FY26 Capital Improvement Plan (motion required)

Selectboard Clerk, Dennis Brown made the motion to approve the FY21 – FY26 Capital Improvement Plan as presented by the Town Manager. Selectboard Member, Kim Souza seconded the motion. All were in favor and the motion passed.

d. Selectboard Self Evaluation (information only)

At the next meeting on February 11th the Board will look at ways to self-evaluate. Kim Souza will look for a rubric. They may also just do a workshop and use the white board method.

e. Town Manager Evaluation Rubric (information only)

The Board decided to use the new form presented by the Town Manager. Board members are to bring their complete forms to the next meeting.

6. **Town Manager's Report:** This Significant Activity Report ending January 27, 2020.

Link: https://www.hartford-vt.org/ArchiveCenter/ViewFile/Item/177

Good news is that VTRANS will pay for the Hartford Bridge Repair.

7. **Commission Meeting Reports:**

Kim Souza reported from HCOREI. They are working their way towards interviewing 3 applicants for the opening they have on the committee.

Dan Fraser thanked Paula Nulty for all the hard work she did to get the Town Report ready for publication.

8. **Consent Agenda (Motion Required): Selectboard Member, Kim Souza made**

the motion to approve the Consent Agenda as corrected. Selectboard Vice Chair, Dick Grassi seconded the motion. All were in favor and the motion passed.

Approve Payroll Ending: 1/25/2020
Approve Meeting Minutes of: 1/14/2020, 1/21/2020 & 1/24/2020
Approve A/P Manifest of: 1/24/2020 and 1/28/2020
Selectboard Meeting Dates of:
- Already Approved: 2/11/2020 and 2/25/2020

9. **Executive Session:**

Discussion of a Labor Relations Agreement for which premature general public knowledge would clearly place the public body at a substantial disadvantage [I VSA §313(a)(1)(B)]

Selectboard Vice Chair, Dick Grassi made the motion that pursuant to 1 VSA 313(a}{1}{B) that the premature general public knowledge of the Comprehensive Tentative Agreement with the Fire Union dated December 13, 2019 will clearly place the Selectboard at a substantial disadvantage." At 10:00 P.M. Selectboard Member, Alan Johnson seconded the motion. All were in favor and the motion passed.

Selectboard Vice-Chair, Dick Grassi made the motion to go into executive session to discuss the Comprehensive Tentative Agreement dated December 13, 2019. Selectboard Member, Alan Johnson seconded the motion. All were in favor and the motion passed.

Selectboard Member, Alan Johnson made the motion to close the Executive Session at 10:45 PM. Selectboard Member, Dan Fraser seconded the motion. All were in favor and the motion passed.

10. **Consideration of Collective Bargaining Agreement with Hartford Career Firefighters' Association Local 2905 of the International Association of Firefighters.**

Selectboard Member, Alan Johnson made the motion to approve the changes to the Fire Union contract that expired on June 30, 2017 as described in the comprehensive Tentative Agreement dated December 13, 2019." Selectboard Member, Dan Fraser seconded the motion. All were in favor and the motion passed.

11. **Adjourn the Selectboard Meeting (Motion Required):**

Selectboard Vice-Chair, Dick Grassi made the motion to close the Selectboard Meeting at 10:50P.M. Selectboard Member, Kim Souza seconded the motion. All were in favor and the motion passed.

All Meetings of the Hartford Selectboard are open to the public. Persons who are

seeking action by the Selectboard are asked to submit their request and/or materials to the Selectboard Chair or Town Manager's office no later than noon on the Wednesday preceding the scheduled meeting date. Requests received after that date will be addressed at the discretion of the Chair. Citizens wishing to address the board should do so during the Citizen Comments period.

Management Approval Of Scope

March 18, 2020

Project: Hartford HES 0113(77) - US Route 5 Corridor from Arboretum Lane to Highland Avenue

Project Manager: Erin Parizo, Traffic Design E.P.

Project Briefing: This project definition effort included analysis of a 2-mile corridor of US Route 5 in Hartford, VT. The Final Report outlines the alternatives that were evaluated, along with the preferred alternatives that were endorsed by the Town Selectboard on January 28th, 2020. The short-term alternatives include signal upgrades, additional paving to modify I-91 ramps, and minor changes to signage and pavement markings to add bike lanes and create clarity among all road users. Short-term improvements are proposed to be included in existing projects in the paving program. Long-term alternatives include the installation of three new traffic signals which would require separate programming.

Maintenance of Traffic: Proposed alternatives can be incorporated into existing or future paving projects or they will be programmed separately as new signal installations. Traffic will be maintained consistent with current practices for resurfacing projects and signal installations using lane closures as needed, flaggers, and uniformed traffic officers. No roadway closures are anticipated.

☒ Project Delivery Bureau Management approves the project scope.

☐ Project Delivery Bureau Management will require more information before making a decision.

☐ Project Delivery Bureau Management recommends getting higher level approval for the proposed scope.

☐ Project Delivery Bureau Management does not recommend the project scope.

☐ Project Delivery Bureau Management approves the project scope with modifications.

E-SIGNED by Jesse Devlin
on 2020-03-27 18:01:16 GMT

March 27, 2020

Highway Safety and Design Program Manager — Date

E-SIGNED by Robert M. White
on 2020-03-30 11:37:29 GMT

March 30, 2020

Project Delivery Bureau Director — Date

PERMIT ID# 41597

FOR AGENCY USE ONLY
Town: HARTFORD
Route: US 5
Mile Marker: 2.64 – 2.77
Log Station: 139+50 – 146+00 LT3 RT

VERMONT AGENCY OF TRANSPORTATION

State Highway Access and Work Permit

Owner's/Applicant's Name, Address, E-mail & Phone No. Hartmont, LLC, 3 Pluff Avenue, North Reading, MA 01864, cscrivanos@scrivanos.com, 978-898-1200.

Co-Applicant's Name, Address, E-mail & Phone No. (if different from above) United Construction Corp. PO Box 48, Newport NH 03773, Cary@unitedconstruction.biz, 603 863 1240

The location of work (town, highway route, distance to nearest mile marker or intersection & which side) 352 N. Hartland Road, Hartford, VT, 1900' west of Sykes Mtn. Ave and Rte 5

Description of work to be performed in the highway right-of-way (attach plan) modify access serving an existing lot from two accesses to a single access at L.S. 142+80 RT (directly across from Veterans Drive) to serve a new Dunkin Donuts restaurant. Work includes a new left-turn lane and associated signage and markings.

Property Deed Reference Book: 495 Page: 719 (only required for Permit Application for access)

Fee $ N/A (fees do not apply for residential or agricultural purposes)

Is a Zoning Permit required? Yes ☐ No ☑ - If Yes, #

Is a 30 VSA § 248 permit required? Yes ☐ No ☑ - If Yes, #

Is an Act 250 permit required? Yes ☐ No ☑ - If Yes, #

Other permit(s) required? Yes ☑ No ☐ - If Yes, name and # of each local Planning Commission

Date applicant expects work to begin March 20 17

Owner/Applicant: Constantine G. Scrivanos Position Title: Owner
(Print name above)

Sign in Shaded area: Date: 1/27/17

Co-Applicant: Cary Whipple Position Title: Vice President
(Print name above)

Sign in Shaded area: Date: 2/2/17

NSTRUCTIONS: -Contact the Development Review and Permitting Services Section (802.828.2653) or your local area Transportation Maintenance District Office to determine your issuing authority. The issuing authority will determine what plans, fee and other documents are required to be submitted with your Vermont Statutes Annotated, Title 19, Section 1111, permit application request.

- Original signatures are required on an original Form. The Owner/Applicant and Co-Applicant (if applicable) declares under the pains and penalty of perjury that all information provided on this form and submitted attachments are to the best of their knowledge true and complete.

FEE: -See **Fee Schedule** for applicable administrative processing and application review fee.

PERMIT APPROVAL

his covers only the work described below: Permission is granted to work within the state highway right-of-way to odify the access serving an existing lot from two accesses to a single access at L.S. 142+80 RT (directly across om Veterans Drive) to serve a new Dunkin Donuts restaurant has been processed by this office and is enclosed. Vork includes the construction of a left-hand turn lane and all associated signage and pavement markings. eplacement of a drainage pipe attached to a VTrans catch basin and service connections to the municipal utilities. ll work shall be in accordance with the attached plans, standards and special conditions.

The work is subject to the restrictions and conditions on the reverse page, plus the Special Conditions stated on the attached page(s).

Date work is to be completed December 1, 2017

Date work accepted: ______________

By ______________ Issued Date May 23, 2017
Authorized Representative for
Secretary of Transportation

By: ______________
DTA or Designee

NOTICE: **This permit covers only the Vermont Agency of Transportation's jurisdiction over this highway under Vermont Statutes Annotated, Title 19, Section 1111.** It does not release the petitioner from the requirements of any other statutes, ordinances, rules or regulations. This permit addresses only access to, work within, and drainage affecting the state highway. It does not address other possible transportation issues, such as access to town highways, use of private roads, and use of railroad crossings. If relevant to the proposed development, such issues must be addressed separately.

No work shall be done under this permit until the owner/applicant has contacted the District Transportation Office at:

District #4, (802) 295-8888

July 1, 2016 (All previously dated editions are not valid)

RESTRICTIONS AND CONDITIONS

DEFINITIONS:

"Agency" means the Vermont Agency of Transportation (a/k/a VTrans).
"Engineer" means the authorized agent of the Secretary of Transportation.
"Owner/Applicant" means the party(s) to whom the permit is to be issued.
"Co-Applicant" means the party who performs the work, if other than Owner/Applicant or a secondary Owner/Applicant under a joint permit application.
"Permit Holder" means the party who currently owns the lands abutting the highway that are the subject of the permit.

GENERAL:

By accepting this permit, or doing any work hereunder, the Owner/Applicant agrees to comply with all of the restrictions and conditions and any imposed special conditions. If the Owner/Applicant is aggrieved by the restrictions and conditions or special conditions of the permit, they shall submit a written request for consideration to the Engineer within 30-days of permit issuance and prior to starting any work. No work will be authorized by the Agency, or performed under the permit, until the dispute is fully resolved.

Vermont Statutes Annotated, Title 30, Chapter 86 ("Dig Safe") requires notice to Dig Safe before starting excavation activities. The Permit Holder or his/her contractor must telephone Dig Safe at 811 at least 48 hours (excluding Saturdays, Sundays and legal holidays) before, but not more than 30 days before, starting excavation activities at any location. In addition, please note that the Agency and many municipalities <u>are not</u> members of Dig Safe and will need to have their utility facilities investigated with due diligence prior to starting excavation activities in or on the State Highway right-of-way.

The Permit Holder is to have a supervisory representative present any time work is being done in or on the State Highway right-of-way. A copy of this permit and Special Conditions must be in the possession of the individual performing this work for the Permit Holder.

Except with the specific, written permission of the District Transportation Administrator, all work in the State Highway right-of-way shall be performed during normal daylight hours and shall cease on Sunday, on all holidays (which shall include the day before and the day following), during or after severe storms, and between December 1 and April 15. These limitations will not apply for the purposes of maintenance, emergency repairs, or proper protections of the work which includes, but not limited to, the curing of concrete and the repairing and servicing of equipment.

The Owner/Applicant shall be responsible for all damages to persons or property resulting from any work done under this permit, even if the Applicant's Contractor performs the work. All references to the Owner/Applicant also pertain to the Co-Applicant.

The Owner/Applicant must comply with all federal and state statutes or regulations and all local ordinances controlling occupancy of public highways. In the event of a conflict, the more restrictive provision shall apply.

The Owner/Applicant must, in every case where there is a possibility of injury to persons or property from blasting, use a pre-approved Blasting Plan. All existing utility facilities shall be protected from damage or injury.

The Owner/Applicant shall erect and maintain barriers needed to protect the traveling public. The barriers shall be properly lighted at night and must be MUTCD (Manual on Uniform Traffic Control Devices) compliant.

All temporary and permanent traffic control measures and devices shall be MUTCD compliant.

The Owner/Applicant shall not do any work or place any structures or obstacles within the State Highway right-of-way, except as authorized by this permit.

The Owner/Applicant may pay the entire cost of the salary, subsistence and traveling expenses of any inspector appointed by the Engineer to supervise such work.

The Engineer may modify or revoke the permit at any time for safety-related reasons, without rendering the Agency or the State of Vermont liable in any way.

In addition to any other enforcement powers that may be provided for by the law, the Engineer may suspend this permit until compliance is obtained. If there is continued use or activity after suspension, the Engineer may physically close the work area and take corrective action to protect the safety of the highway users.

The Permit Holder shall be responsible to rebuild, repair, restore and make good all injuries or damage to any portion of the highway right-of-way that has been brought about by the execution of the permitted work, for a minimum period of eighteen (18) months after final inspection by the District.

Any approved variance from the permitted plans is to be recorded on "as-builts" with copies provided to both the Chief of Permitting Services and the District Transportation Administrator.

ACCESS:

This permit (if for access) does not become effective until the owner/applicant records in the office of the appropriate municipal clerk, the attached "Notice of Permit Action"

As development occurs on land abutting the highways, the Agency may revoke a permit for access and require the construction of other access improvements such as the combination of access points by adjoining owners.

Under Vermont Statutes Annotated, Title 19, Section 1111, no deed purporting to subdivide land abutting a state highway can be recorded unless all the abutting lots so created are in accordance with the standards of Section 1111.

The Permit Holder acknowledges and agrees that neither this permit nor any prior pattern of use creates an ownership interest or other form of right in a particular configuration or number of accesses to or through the highway right-of-way, and that the right of access consists merely of a right to reasonable access the general system of streets, and is not a right to the most convenient access or any specific configuration of access.

DRAINAGE:

The Owner/Applicant shall install catch basins and outlets as may be necessary, in the opinion of the Engineer, to preclude interference with the drainage of the state highway. Direct connections shall <u>not</u> be allowed without written approval.

UTILITY WORK; CUTTING AND TRIMMING TREES:

The Owner/Applicant shall obtain the written consent of the adjoining owners or occupants or, in the alternative, an order from the State Transportation Board in accordance with, Vermont Statutes Annotated, Title 30, Section 2506, regarding cutting of or injury to trees.

In general, all utilities shall be located adjacent to the State Highway right-of-way boundary line and shall be installed without damaging the highway or the highway right-of-way. No pole, push-brace, guy wire or other aboveground facilities shall be placed closer than 10 feet to the edge of traveled-way. If the proposed utility facilities are in conflict with the above, each location is subject to the approval of the Engineer.

Poles and appurtenances shall be located out of conflict with intersection sight distance, guardrail, ditches, signs, culverts, etc.

Where the cutting or trimming of trees is authorized by permit, all debris resulting from such cutting and trimming shall be removed from the State Highway right-of-way.

Open cut excavation for highway crossings is NOT the option of the Applicant, and may be utilized only where attempted jacking, drilling, or tunneling methods fail or are impractical. The Owner/Applicant shall obtain an appropriate modification of the highway permit from the Engineer before making an open cut.

JOINT PERMITS:

A joint permit application is required when more than one party will be involved with the construction, maintenance, and/or operation of the facility being constructed under this permit. Examples include, but are not limited to, joint ownership or occupancy of a utility pole line and construction of a municipal utility line by a contractor. Both utility companies, and in the second case, the municipality and the contractor, must be joint applicants.

SPECIAL CONDITIONS

This permit is granted subject to the restrictions and conditions on the back of the permit, with particular attention given to the Special Conditions listed below and the executed *Inspection Agreement* between Hartmont LLC and the State of Vermont executed on May 11, 2017. This permit pertains only to the authority exercised by the Vermont Agency of Transportation (Agency) under Vermont Statutes Annotated, Title 19, Section 1111, and does not relieve the Permit Holder from the requirements of otherwise applicable statutes, rules, regulations or ordinances (*e.g.,* Act 250, zoning, etc.). The Permit Holder shall observe and comply with all Federal and State laws and local bylaws, ordinances, and regulations in any manner affecting the conduct of the work and the action or operation of those engaged in the work, including all orders or decrees as exist at present and those which may be enacted later by bodies or tribunals having jurisdiction or authority over the work, and the Permit Holder shall defend, indemnify, and save harmless the State and all its officers, agents, and employees against any claim or liability arising from or based on the violation of any such law, bylaws, ordinances, regulations, order, or decree, whether by the Permit Holder in person, by an employee of the Permit Holder, by a person or entity hired by the Permit Holder, or by a Subcontractor or supplier.

As a condition of this permit, the Permit Holder is required to fulfill all the requirements, terms and conditions of the "Letter of Intent to Purchase Real Estate" as agreed between Hartmont, LLC and the State of Vermont, acting through its Agency of Transportation, executed on May 18, 2017. In the event the sale or lease of lands does not occur and the land within the described area is developed, the Permit Holder shall be responsible for the removal of any improvements made under this permit and restore the State-owned lands to turf, at the Permit Holder's expense.

A preconstruction meeting to discuss work to be completed must be held prior to the Permit Holder's employeeand VTrans Permitting Services Section at (802) 828-2473, a minimum of five (5) working days in advance of such meeting.

The Permit Holder shall accomplish all work under this permit in accordance with Detail C and the profile and notes of VTrans standard drawing B-71 (copy attached) and the attached plans dated October 10, 2016 and last revised November 18, 2016 (Sheet TCP-1), February 23, 2017 (Sheet 2 and Sheet 5), March 23, 2017 (Sheet 3), April 7, 2017 (Sheet 4) and April 24, 2017 (Sheet 6) unless otherwise specified by the conditions of this permit. **Any revisions to these plans prior to or during construction shall be submitted and approved by the Agency prior to construction within the State highway right-of-way.**

Please note that many municipalities and the Vermont Agency of Transportation are not a member of Dig Safe. The Permit Holder shall contact VTrans Signals Technician, Steve Guyette (802) 343-2188 and the local municipal Public Works Department so they may locate and mark all existing buried utility facilities owned by each entity in the project area.

Prior to the start of construction, the Permit Holder shall provide the Agency the contact information for the individual and/or company that will serve as the project's public relations contact for the project work. This individual / company shall serve as the point of contact for communication with the public and media regarding the project activity. The Permit Holder and/or their assignee shall keep the Agency's Project Inspector apprised of the project schedule; specifically, any changes related to traffic control, major construction activities and other milestones as deemed necessary by the Agency's Project Inspector.

All materials and construction practices shall be in accordance with the Vermont Agency of Transportation *2011 Standard Specifications for Construction*, with the latest amendments and all applicable Vermont Agency of Transportation Standard Drawings.

The Permit Holder shall arrange for and provide inspection and material testing by qualified engineering personnel and testing laboratories to ensure that all work conforms to the Agency standards and the design plans. All results shall be provided to the Agency's Project Inspector. Any materials or tests failing Agency standards may be required to be removed and replaced in their entirety at the owner's expense.

The Agency reserves the right to retain material items removed from the State highway right-of-way and which are deemed property of the State. These items may include but are not limited to pavement grindings and signage. These items shall be delivered to the Agency's District Transportation Office in White River Junction, or other specified location by the Agency, by the Permit Holder and/or their agent. Items not salvaged for State use shall be removed and appropriately disposed of by the Permit Holder and/or their Contractor.

The Permit Holder must exercise extreme care when working adjacent to and extending existing storm drainage pipes owned by the State. Any damage caused by the Permit Holder to the storm drainage system must be repaired using new materials at the expense of the Permit Holder. Repairs must be inspected by the Agency Project Inspector.

Relocated and/or new sign assemblies shall be installed in accordance with the Manual of Uniform Traffic Control Devices (MUTCD). Any damage by the Contractor to existing signs, posts, and/or bases shall be repaired or replaced at the expense of the Permit Holder and the to the satisfaction of the Agency Project Inspector.

The Permit Holder shall contact the Agency's Motor Vehicles' Oversize Permit section prior to construction if any roadway restrictions will be associated with the project's construction; this includes but is not limited to restricted travel widths less than 14 feet in width.

Any disturbed boundary markers shall be reset by a licensed Vermont Land Surveyor.

The Permit Holder shall restore any abutting property owner's lawn and/or drive that is disturbed by the project, to the satisfaction of its owner.

The Permit Holder shall erect and maintain all necessary site erosion prevention and sediment control measures to maintain compliance with Vermont Water Quality Standards within the State Highway right-of-way. All exposed earth areas having erosion potential must be temporarily or permanently stabilized within seven (7) days of disturbance or as necessary to prevent sediment from entering the Agency's State Highway stormwater management system. Slopes steeper than 1:3 shall make use of appropriate erosion matting.

Roadway shoulder areas must be maintained free of unnecessary obstructions, including parked vehicles, at all times while work is being performed under this permit.

All grading within the State Highway right-of-way associated with the proposed construction shall be subject to inspection and approval by the District Transportation Administrator or his or her staff. The Permit Holder shall be responsible for ensuring that all grading work in or on the State Highway right-of-way complies with applicable statutes, rules, regulations or ordinances.

In areas to be grass covered, the Permit Holder shall restore turf by preparing the area and applying the necessary topsoil, limestone, fertilizer, seed, and mulch, all to the satisfaction of the District Transportation Administrator. The Permit Holder shall be responsible for ensuring that all turf restoration work in or on the State Highway right-of-way is in compliance with applicable statutes, rules, regulations or ordinances.

Prior to placing any landscaping in the State right-of-way, the Permit Applicant shall submit a plan to the Agency for approval. Any landscaping (e.g. plants, shrubs, trees) placed in the highway right-of-way shall have a mature height not to exceed 24" unless otherwise approved by the Agency. No fences, bollards or other fixed objects shall be placed within the right-of-way unless otherwise approved by the Agency. [Landscaping may be performed under a separate permit by the Town of Hartford at a later date.]

The Permit Holder shall use methods that will minimize tracking of material onto the State highways. If tracking does occur, it will be immediately cleaned up so that the travel conditions and safety of highway users is not compromised. Clean-up shall be done with the appropriate apparatus as directed / approved by the Agency's Project Inspector.

The Permit Holder must install temporary pavement prior to weekend shutdown after completion of backfilling where an open cut excavation has been made through a roadway subject to vehicular traffic or where construction for any roadway widening for turn lanes has been brought to grade, unless an otherwise alternative option is presented, reviewed and found to be acceptable by the Agency Project Inspector. The temporary pavement shall consist of, at least, 2 inches of compacted bituminous concrete. Temporary pavement shall be properly maintained and shall be replaced with permanent pavement prior to completion of the project or suspension of work for the winter season.

The Permit Holder must backfill all open trenches or pits at the end of each day. With permission from the District Transportation Administrator, trenches or pits may be left open for short periods of time if properly protected. In no case shall trenches or pits be left open over a weekend. The Permit Holder shall be responsible for ensuring that all trench or pit work in or on the State Highway right-of-way is in compliance with applicable statutes, rules, regulations or ordinances.

All signage and the placement, size, shape, and color of all pavement markings must be in accordance with the most recent editions of the MUTCD (Manual on Uniform Traffic Control Devices) and Vermont standards. All existing pavement markings that become disturbed or over-laid with pavement shall be replaced by the Permit Holder with **durable** markings unless otherwise approved by the District Transportation Administrator. The Permit Holder shall bear all costs associated with this work.

Upon completion of the work, the Permit Holder shall be responsible to schedule and hold a final inspection. The Permit Holder is required to notify the District Transportation Administrator five (5) working days in advance of such inspection.

The Permit Holder shall provide VTrans Permitting Services Section with a copy of as-built drawings <u>no later than 60 days</u> following the completion of the work, including any additional information regarding the location of the existing underground facilities owned by the Permit Holder and/or any underground facilities marked by DigSafe or independent utility owners, regardless of utility ownership, encountered during project construction.

In the event that area lighting from the newly established business proves to be a hazard to the traveling public, the Permit Holder will be ordered to remove or modify it at his or her expense to the satisfaction of the District Transportation Administrator.

This permit does not become effective until the Permit Holder records, in the office of the appropriate municipal clerk, the attached "Notice of Permit Action".

This access (L.S. 142+80 RT) will serve as the only access to this property and to any future subdivisions of this property unless approved otherwise by the Agency. The Permit Holder is required to allow a connection and to grant an associated right to pass between the access and adjoining properties (in the future) that will result in a combination of accesses to serve more than one property or lot. Future connection to nearby and/or adjacent streets and private roads may be required, if deemed to improve safety and/or provide traffic relief along the US5 corridor. By issuance of this permit, the Agency revokes all previous permits for access to this property.

The access (L.S. 142+80 RT) must be constructed in such a manner as to prevent water from flowing onto the State Highway. If the access is not constructed satisfactorily, the District Transportation Administrator can order reconstruction of the access at the Permit Holder's expense.

The Permit Holder must install curbing or other suitable physical barriers to restrict ingress and egress of vehicles to the approved access only.

In the event traffic from this project increases to the point where traffic signals, additional lanes for turning or any other modifications are necessary, the Permit Holder shall bear the expense of such improvements or facilities. The Agency may require the Permit Holder to update or provide a traffic study to determine if additional modifications are necessary.

The Permit Holder is responsible for access maintenance (beyond the edge of paved shoulder). "Access maintenance" will include, but not be limited to, the surface of the access, the replacement and maintenance of the culvert, as necessary, the trimming of vegetation, and the removal of snow banks to provide corner sight distance.

In conformance with Vermont Statutes Annotated, Title 19, Section 1111(f), the Agency may eliminate this access in the future where development has burdened the highway system to such an extent that a frontage road or other access improvements (which may serve more than one property or lot) must be constructed to alleviate this burden. The Permit Holder shall bear the expense of the frontage road or other access improvements. The Agency shall determine the need of a frontage road or other improvements based upon and justified by standard Agency procedures.

The Permit Holder shall pave the access (drive) from the edge of paved shoulder to the State Highway right-of-way.

In the event of the Permit Holder's failure to complete all the work, approved under this permit, by the "work completion date," the Agency, in addition to any other enforcement powers that may be provided for by law, may suspend this permit until compliance is obtained. If there is continued use or activity after suspension, the Agency may physically close the driveway or access point if, in the Agency's opinion, safety of highways users is or may be affected.

This permit approves the connection of the Permit Holder's stormwater management system to the Agency's State Highway stormwater management system at approximate L.S. 142+10 RT. This permit authorizes the replacement of the existing drainage pipe with a new 24" drainage pipe. The Permit Holder shall be responsible for all ownership and maintenance responsibilities of this pipe beginning at it connection at the Agency's drainage structure.

This permit only authorizes the Permit Holder's stormwater discharge from the defined area approved by the Agency and specified in the Permit Holder's application. The Permit Holder shall not connect (or allow the connection of) non-stormwater drainage systems, such as floor drains, to the stormwater management system that discharges, or has the potential to discharge, to the Agency's stormwater management system.

By acceptance of this permit, the Permit Holder agrees to defend, hold harmless and indemnify the Agency, the State of Vermont, and their officers and employees from and against all claims arising out of connections of the Permit Holder's stormwater management system to the Agency's State Highway stormwater management system.

The Permit Holder shall promptly and unconditionally pay for full repair and restoration of any and all damages to existing underground utility facilities (meaning any underground pipe, conduit, wire or cable, including appurtenances) that have been brought about by the execution of the permitted work. The Permit Holder also is required to pay for any costs to repair the highway following and resulting from any repairs to existing utilities occurring as a result of the work covered by this permit. Except with the specific, written permission of the Engineer, the Permit Holder or his or her contractor shall expose all underground facilities to verify their location and depth, at each location where the authorized boring or drilling work crosses a facility; and at reasonable intervals when closely paralleling a facility. Whenever possible, existing facilities should be crossed at a perpendicular angle. The Permit Holder shall be responsible for obtaining the modification of this permit, if necessary, for any additional survey work before initiating boring or drilling operations under the permit. The Agency will treat the Permit Holder's failure to fully, promptly, and conscientiously comply with all of conditions of this paragraph, including but not limited to the obligation to pay for repairs, as grounds for the Agency to refuse to grant any further requests by the Permit Holder for any other permits for subsurface work unless the Permit Holder furnishes irrevocable financial security, in a type and an amount deemed sufficient by the Agency in its sole discretion, prior to such future subsurface work.

The Permit Holder shall verify the appropriate safety measures needed, prior to construction, so proper devices and/or personnel are available when and as needed. Traffic control devices, shall be in conformance with the MUTCD (Manual on Uniform Traffic Control Devices), Agency standards and any additional traffic control deemed necessary by the District Transportation Administrator. The Permit Holder's failure to utilize proper measures shall be considered sufficient grounds for the District Transportation Administrator to order cessation of the work immediately.

The Permit Holder will perform construction in such a way as to minimize conflicts with normal highway traffic. When two-way traffic cannot be maintained, the Permit Holder shall provide a sign package that conforms to the MUTCD (Manual on Uniform Traffic Control Devices) or Agency standards, as well as trained Flaggers. The District Transportation Administrator may require a similar sign package with trained Flaggers whenever it is deemed necessary for the protection of the traveling public. In addition, the District Transportation Administrator may require the presence of Uniform Traffic Officers (UTOs); moreover, the presence of UTOs shall not excuse the Permit Holder from its obligation to provide the sign package and Flaggers.

Two-way traffic shall be maintained at all times unless permission is granted from the District Transportation Administrator. Whenever two-way, one-lane controlled traffic is authorized to be maintained by the Applicant's Contractor, **the traveling public shall not be delayed more than 10 minutes.**

Should traffic become so complex, as determined by the Agency's Project Inspector, that the traffic control plan submitted needs to be revised, the Permit Holder and / or their Contractor shall submit a revised plan to be reviewed and approved by the Agency.

The Permit Holder shall ensure that all workers exposed to the risks of moving highway traffic and/or construction equipment wear high-visibility safety apparel meeting the requirements of ISEA (International Safety Equipment Association) "American National Standards for High-Visibility Safety Apparel," and labeled as ANSI (American National Standards Institute) 107-2004, or latest revisions, for Performance Class 2 or 3 requirements. A competent person - one designated by the Permit Holder's Contractor to be responsible for worker safety within the activity area of the State highway right-of-way -shall select the appropriate class of garment. The Engineer may suspend this permit until compliance is obtained.

Independence; Liability: The Permit Holder will act in an independent capacity and not as officers or employees of the State.

The Permit Holder shall defend the State and its officers and employees against all claims or suits arising in whole or in part from any act or omission of the Permit Holder or of any agent of the Permit Holder. The State shall notify the Permit Holder in the event of any such claim or suit, and the Permit Holder shall immediately retain counsel and otherwise provide a complete defense against the entire claim or suit.

After a final judgment or settlement, the Permit Holder may request recoupment of specific defense costs and may file suit in the Washington Superior Court requesting recoupment. The Permit Holder shall be entitled to recoup costs only upon a showing that such costs were entirely unrelated to the defense of any claim arising from an act or omission of the Permit Holder.

The Permit Holder shall indemnify the State and its officers and employees in the event that the State, its officers or employees become legally obligated to pay any damages or losses arising from any act or omission of the Permit Holder.

Insurance: Before beginning any work under this Permit the Permit Holder must provide certificates of insurance to show that the following minimum coverages are in effect. It is the responsibility of the Permit Holder to maintain current certificates of insurance on file with the State for the duration of work under the Permit. No warranty is made that the coverages and limits listed herein are adequate to cover and protect the interests of the Permit Holder for the Permit Holder's operations. These are solely minimums that have been established to protect the interests of the State.

Workers' Compensation: With respect to all operations performed under the Permit, the Permit Holder shall carry workers' compensation insurance in accordance with the laws of the State of Vermont.

General Liability and Property Damage: With respect to all operations performed under the Permit, the Permit Holder shall carry general liability insurance having all major divisions of coverage including, but not limited to:

Premises - Operations
Products and Completed Operations
Personal Injury Liability
Contractual Liability

The policy shall be on an occurrence form and limits shall not be less than:

$2,000,000 Per Occurrence
$2,000,000 General Aggregate
$2,000,000 Products/Completed Operations Aggregate
$ 50,000 Fire/Legal Liability

Permit Holder shall name the State of Vermont and its officers and employees as additional insureds for liability arising out of this Permit.

Automotive Liability: The Permit Holder shall carry automotive liability insurance covering all motor vehicles, including hired and non-owned coverage, used in connection with the Permit. Limits of coverage shall not be less than: $1,000,000 combined single limit.

Permit Holder shall name the State of Vermont and its officers and employees as additional insureds for liability arising out of this Permit.

LETTER OF INTENT TO PURCHASE REAL ESTATE
THIS IS A BINDING LEGAL CONTRACT

Seller: State of Vermont, Acting Through and By the Agency of Transportation (Seller) (VTrans)

Buyer: Hartmont, LLC (Buyer)

Property: An irregular shaped piece of right of way on the southerly side of US 4 (North Hartland Road), and easterly of Ballardvale Drive. A drawing is included showing an approximate area to be purchased, pending a survey accepted and approved by the Right of Way Chief of Survey.

Buyer agrees to purchase the described above under the following terms and conditions:

1. The Buyer will hire a Vermont Licensed Surveyor to complete the survey suitable for recording however the surveyor must coordinate with the Chief of Survey regarding standards and expectations prior to any work beginning. VTrans Chief of Survey will have the final acceptance and approval of the survey.

2. The buyer will hire an appraiser from the list of VTrans approved appraisers. The Right of Way Chief of Appraisal will have the final acceptance and approval of the appraisal.

3. Buyer is responsible for paying all recording fees for the land records. Due at closing.

4. Buyer is responsible for obtaining (including cost) any subdivision or boundary line adjustment permit(s) if required.

5. VTrans will not begin its process for approval of a Categorical Exclusion (CE) with clearances from VTrans Environmental Section as well as approval from Federal Highway Administration until buyer advises in writing they accept the fair market value.

6. The Buyer is responsible for any Drive permits associated with the existing driveway. Including application and costs.

7. Upon all approvals, appraisal and survey, VTrans will prepare the Quit-Claim Deed for signature by both Buyer and Seller.

8. Should approval of sale be rejected by the Categorical Exclusion and/or Federal Highway the Buyer agrees to lease (if applicable) said area. If no lease or purchase is completed then Buyer agrees to, not build within said area. If work has been done in the proposed area and no lease or purchase is completed the lands will restored back to grass (turf) at the Buyer's expense.

9. If appraisal amount is suitable and the CE approved the Buyer agrees to close on said sale within ninety days (90) from the date of the Categorical Exclusion approval.

LETTER OF INTENT TO PURCHASE REAL ESTATE
THIS IS A BINDING LEGAL CONTRACT

The parties shall use good faith efforts to negotiate exclusively to finalize an Option Agreement containing these and other commercially reasonable terms as the parties may request, within 30 days hereof.

Buyer:

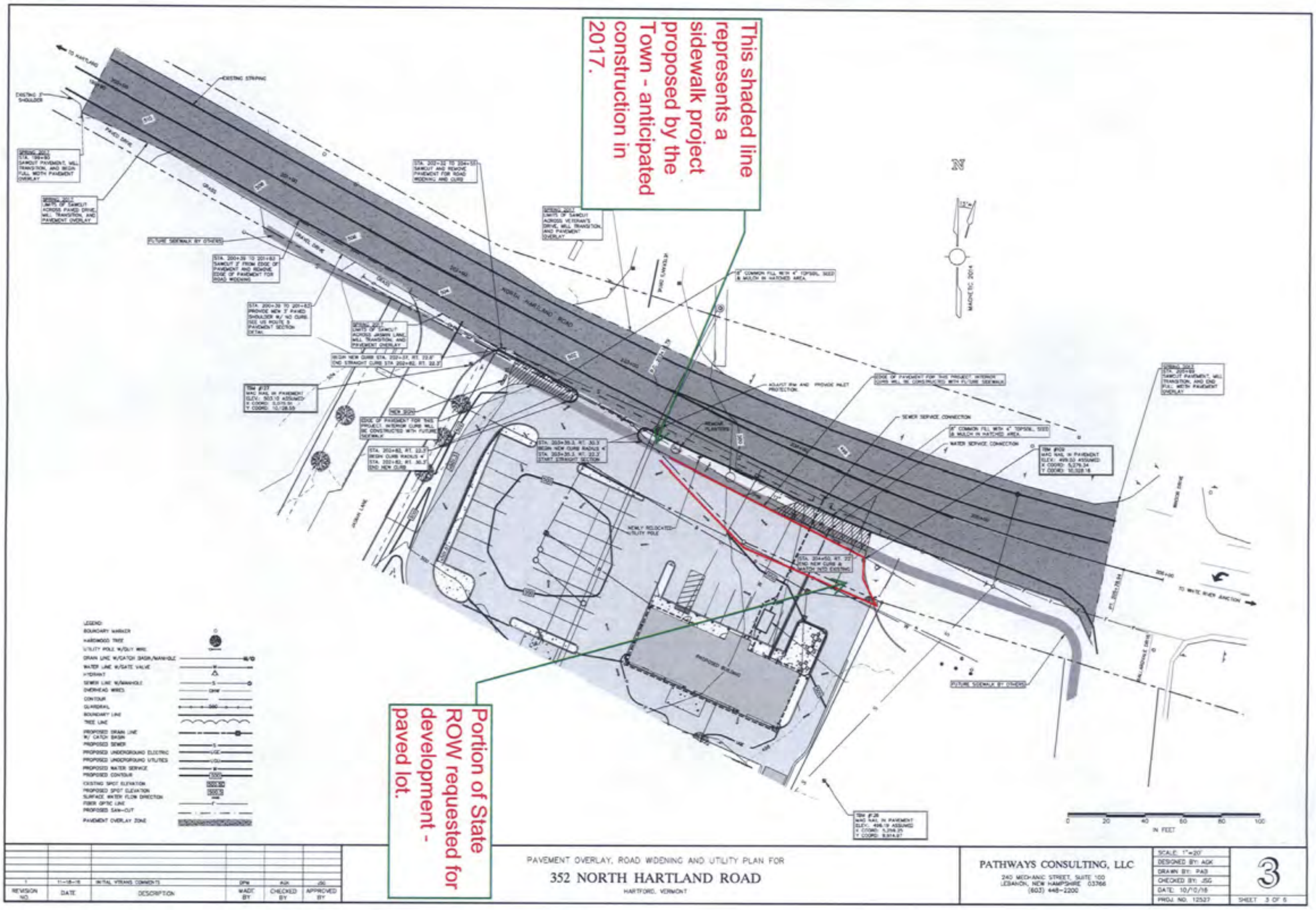
Hartmont, LLC

Seller:

Joe Flynn
Secretary of Transportation and/or its duly authorized agent

Approved As To Form:
Date: 5/18/17

Assistant Attorney General


This shaded line represents a sidewalk project proposed by the Town - anticipated construction in 2017.
Portion of State ROW requested for development - paved lot.
NORTH HARTLAND ROAD
TO HARTLAND
TO WHITE RIVER JUNCTION
FUTURE SIDEWALK BY OTHERS
PROPOSED BUILDING
PAVEMENT OVERLAY, ROAD WIDENING AND UTILITY PLAN FOR
352 NORTH HARTLAND ROAD
HARTFORD, VERMONT
PATHWAYS CONSULTING, LLC
240 MECHANIC STREET, SUITE 100
LEBANON, NEW HAMPSHIRE 03766
(603) 448-2200
SCALE: 1"=20'
DESIGNED BY: AGK
DRAWN BY: PAS
CHECKED BY: JSG
DATE: 10/10/16
PROJ. NO. 12527
3
SHEET 3 OF 6

US ROUTE 5 TURN LANE IMPROVEMENT PLAN FOR

352 NORTH HARTLAND ROAD

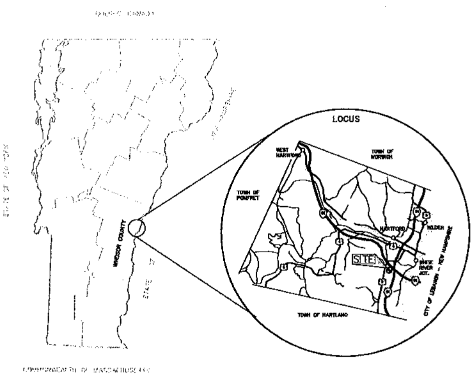
HARTFORD, VERMONT

OCTOBER 10, 2016

LAST REVISED FEBRUARY 23, 2017

THE PROJECT IS LOCATED IN THE TOWN OF HARTFORD ALONG ROUTE NO. 5 (NORTH HARTLAND ROAD) NEAR MILE MARKER 2.71. BEGINNING AT THE INTERSECTION WITH THE DRIVEWAY TO 442 NORTH HARTLAND ROAD AND FOLLOWING U.S. ROUTE NO. 5 TO THE INTERSECTION WITH BALLARDVALE DRIVE. WORK TO BE PERFORMED INCLUDES PAVEMENT MARKINGS, SIGNAGE, DRAINAGE, ROAD WIDENING, PAVEMENT OVERLAY, AND ASSOCIATED CURB AND PAVEMENT REPAIR TO ADD A LEFT TURN LANE INTO 352 NORTH HARTLAND ROAD (US ROUTE 5).

PATHWAYS CONSULTING, LLC
PLANNING • ENGINEERING • SURVEYING • CONSTRUCTION ASSISTANCE
240 MECHANIC STREET, SUITE 100
LEBANON, NEW HAMPSHIRE 03766
(603) 448-2200 • FAX: (603) 448-1221



GENERAL NOTES

(1) DRAWING IS REFERENCED TO MAGNETIC NORTH.

(2) ELEVATIONS AND COORDINATES ARE REFERENCED TO AN ASSUMED DATUM. REFER TO BENCHMARKS ON SHEET 2.

(3) THE CONTRACTOR SHALL CONTACT DIG-SAFE AND THE TOWN OF HARTFORD PRIOR TO ANY CONSTRUCTION AND MAKE APPROPRIATE PLANS IF NEEDED WITH ANY UTILITIES FOR THE RELOCATION OR TEMPORARY STABILIZATION OF ANY UTILITIES LOCATED WITHIN THE RIGHT OF WAY.

(4) THE CONTRACTOR SHALL BE RESPONSIBLE FOR TAKING PRE-CONSTRUCTION PHOTOS AND ESTABLISHING AN INVENTORY LIST OF ALL ITEMS TO BE DISTURBED AND RECLAIMED, REPAIRED OR REPLACED WITHIN THE RIGHT OF WAY.

(5) NO CONSTRUCTION WILL COMMENCE WITHOUT A PRIOR PRE-CONSTRUCTION MEETING WITH VTRANS. CONTRACTOR SHALL BE CO-APPLICANT TO THE S.1111 PERMIT.

(6) THE CONTRACTOR SHALL NOTIFY THE ENGINEER PRIOR TO CONSTRUCTION IF THERE ARE ANY DISCREPANCIES IN THE PLANS OR EXISTING DATA. NO CONSTRUCTION SHALL PROCEED WITHOUT THE WRITTEN PERMISSION FROM THE ENGINEER.

(7) LOCATIONS AND SIZES OF EXISTING UTILITIES, WERE TAKEN FROM FIELD OBSERVATIONS. FURTHER THESE LOCATIONS ARE NOT WARRANTED TO BE COMPLETE OR ACCURATE AND ARE ONLY INTENDED AS A PERMIT AND CONSTRUCTION GUIDE.

(8) THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY AND ALL EXPLORATORY EXCAVATION REQUIRED PRIOR TO ANY PORTION OF CONSTRUCTION REQUIRED FOR FINAL ALIGNMENT OF ANY NEW OR RECONSTRUCTED UTILITY.

(9) THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL LAYOUT SERVICES.

(10) THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING AND COORDINATING ANY REQUIRED TRAFFIC CONTROL. PRIOR TO THE START OF CONSTRUCTION THE CONTRACTOR SHALL PROVIDE A SITE SPECIFIC TRAFFIC CONTROL PLAN TO VTRANS FOR REVIEW AND APPROVAL.

(11) THE CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTAINING CLEANING, STABILIZING AND RECLAIMING ALL DITCHES AND OTHER RUN-OFF COLLECTION AREAS DURING AND AFTER CONSTRUCTION TO ENSURE PROPER REMOVAL OF SEDIMENTS FROM RUN-OFF DURING AND AFTER CONSTRUCTION.

(12) THE CONTRACTOR SHALL BE RESPONSIBLE FOR ENSURING THAT ALL CONSTRUCTION IS IN ACCORDANCE WITH THE "LOW RISK SITE HANDBOOK FOR EROSION PREVENTION AND SEDIMENT CONTROL".

(13) THE CONTRACTOR SHALL SUBMIT SHOP DRAWINGS AND SUBMITTALS OF ALL ITEMS TO BE INSTALLED TO THE ENGINEER FOR APPROVAL.

(14) THE CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTAINING A SET OF APPROVED PLANS AND APPLICABLE VERMONT AGENCY OF TRANSPORTATION STANDARDS ONSITE AT ALL TIME DURING CONSTRUCTION. RECORD DRAWINGS SHALL BE REQUIRED FOLLOWING CONSTRUCTION.

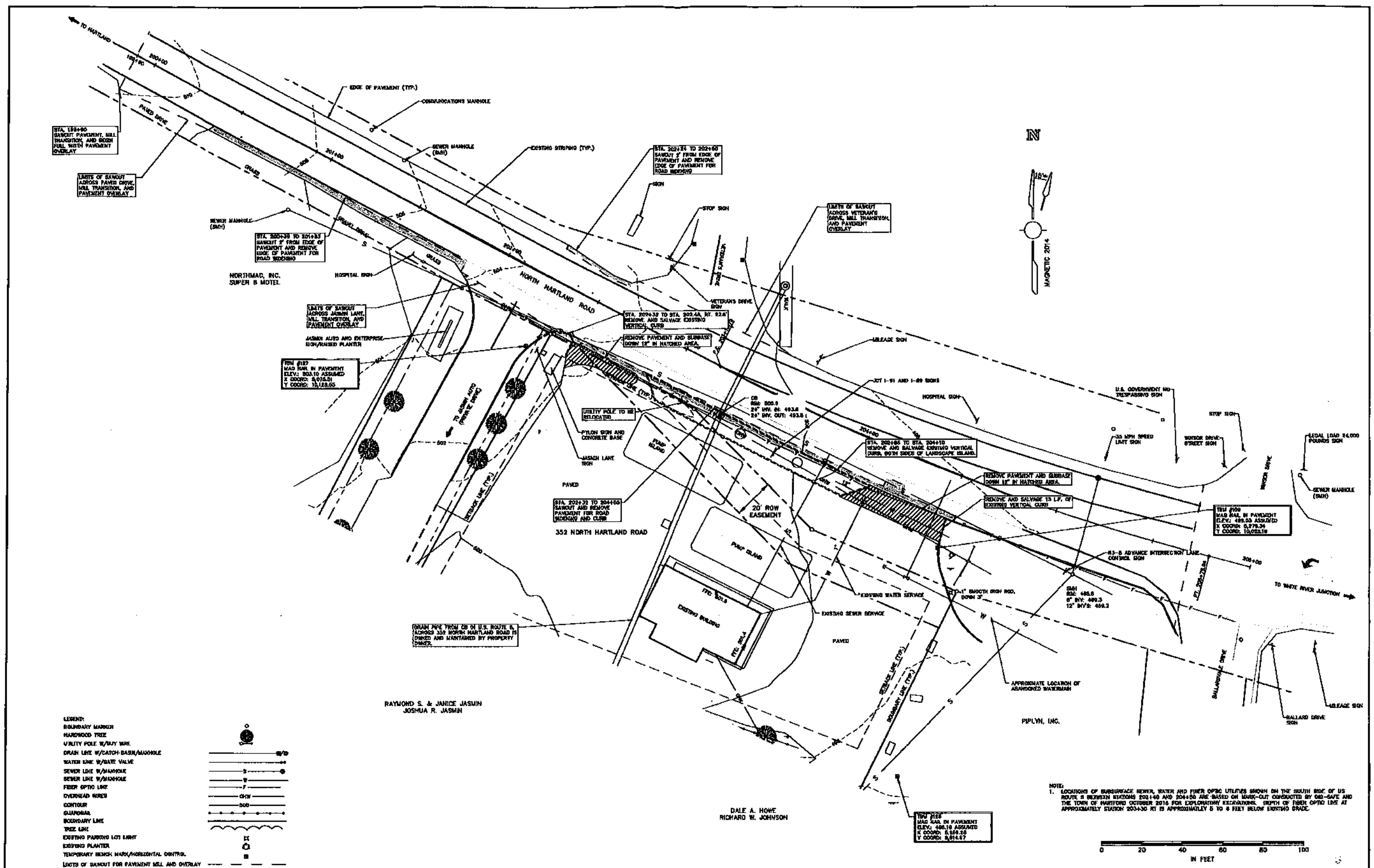
INDEX OF APPLICABLE VTRANS STANDARD DRAWINGS

STANDARD	APPLICABLE SECTION(S)
E-181	PAVEMENT MARKING DETAILS
E-182	PAVEMENT MARKING DETAILS
E-183	PAVEMENT MARKING DETAILS
T-1	TEMPORARY TRAFFIC CONTROL GENERAL NOTES
T-10	CONVENTIONAL ROADS CONSTRUCTION APPROACH SIGNING
T-28	CONSTRUCTION SIGN DETAILS
B-71	STANDARDS FOR RESIDENTIAL AND COMMERCIAL DRIVES
C-10	CURBING

INDEX OF SHEETS

SHEET	TITLE
1 OF 6	COVER SHEET
2 OF 6	EXISTING CONDITIONS & DEMOLITION PLAN
3 OF 6	PAVEMENT OVERLAY, ROAD WIDENING AND UTILITY PLAN
3 OF 6	TEMPORARY AND PERMANENT PAVEMENT MARKINGS AND SIGNS
5 OF 6	EROSION PREVENTION, SEDIMENT AND MISCELLANOUS DETAILS
6 OF 6	TRAFFIC CONTROL PLAN FOR US ROUTE 5

CIVIL ENGINEER
PATHWAYS CONSULTING, LLC.
240 MECHANIC STREET, SUITE 100
LEBANON, NEW HAMPSHIRE 03766
(603) 448-2200



2	02-23-17	VTRANS COMMENTS FROM 2/10/17	DPM	AGK	JSG
1	11-18-16	INITIAL VTRANS COMMENTS	DPM	AGK	JSG
REVISION NO.	DATE	DESCRIPTION	MADE BY	CHECKED BY	APPROVED BY

EXISTING CONDITIONS & DEMOLITION PLAN

352 NORTH HARTLAND ROAD

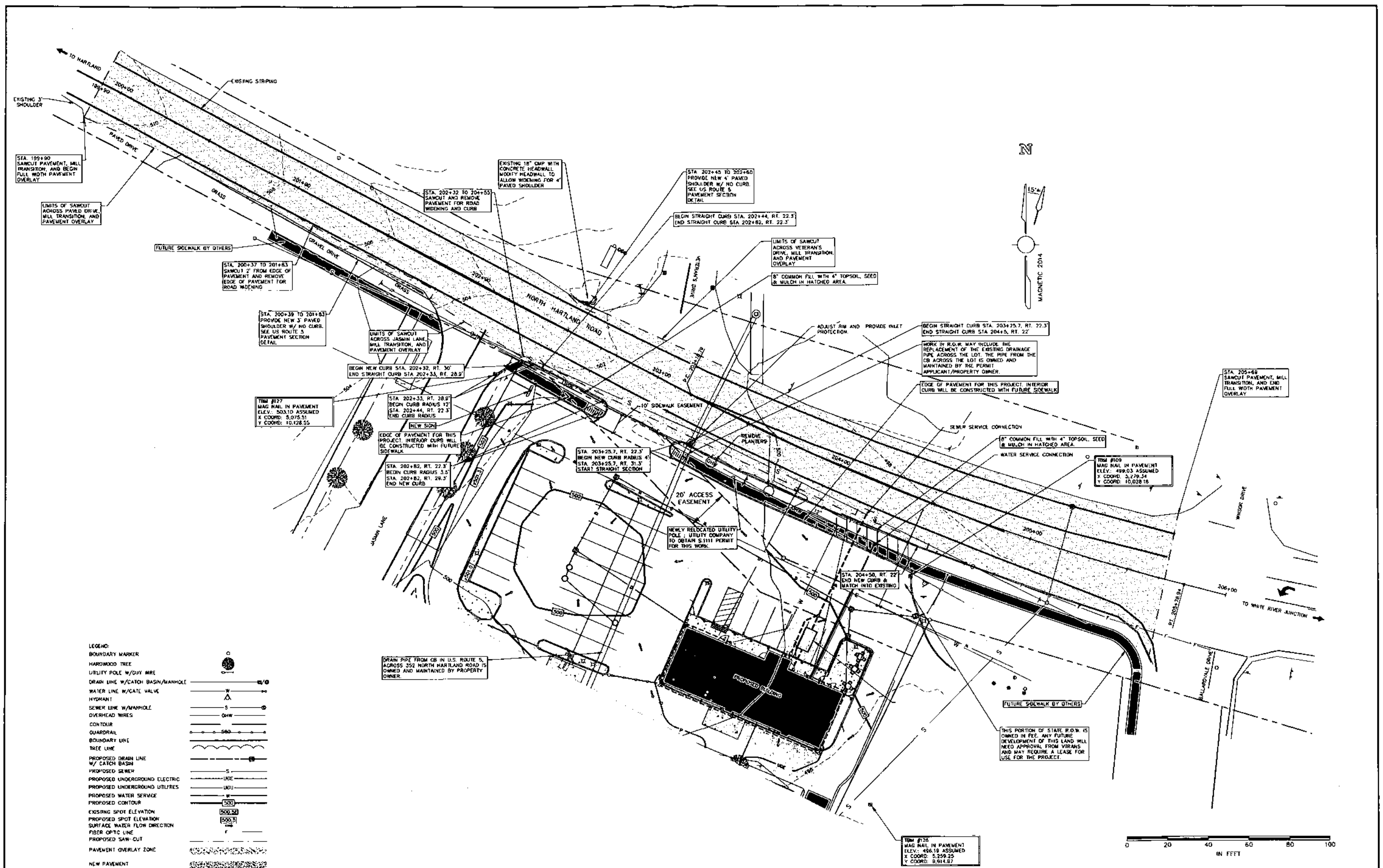
HARTFORD, VERMONT

PATHWAYS CONSULTING, LLC
240 MECHANIC STREET, SUITE 100
LEBANON, NEW HAMPSHIRE 03766
(603) 448-2200

SCALE: 1"=20'
DESIGNED BY: AGK
DRAWN BY: PAB
CHECKED BY: JSG
DATE: 10/10/16
PROJ. NO. 12527

2

SHEET 2 OF 6



REVISION NO.	DATE	DESCRIPTION	MADE BY	CHECKED BY	APPROVED BY
3	03-23-17	SIDEWALK ALIGNMENT	PAB	ACK	JSG
2	02-23-17	VTRANS COMMENTS FROM 2/10/17	CRM	ACK	JSG
1	11-18-16	INITIAL VTRANS COMMENTS	DPM	ACK	JSG

PAVEMENT OVERLAY, ROAD WIDENING AND UTILITY PLAN FOR

352 NORTH HARTLAND ROAD

HARTFORD, VERMONT

PATHWAYS CONSULTING, LLC
240 MECHANIC STREET, SUITE 100
LEBANON, NEW HAMPSHIRE 03766
(603) 448-2200

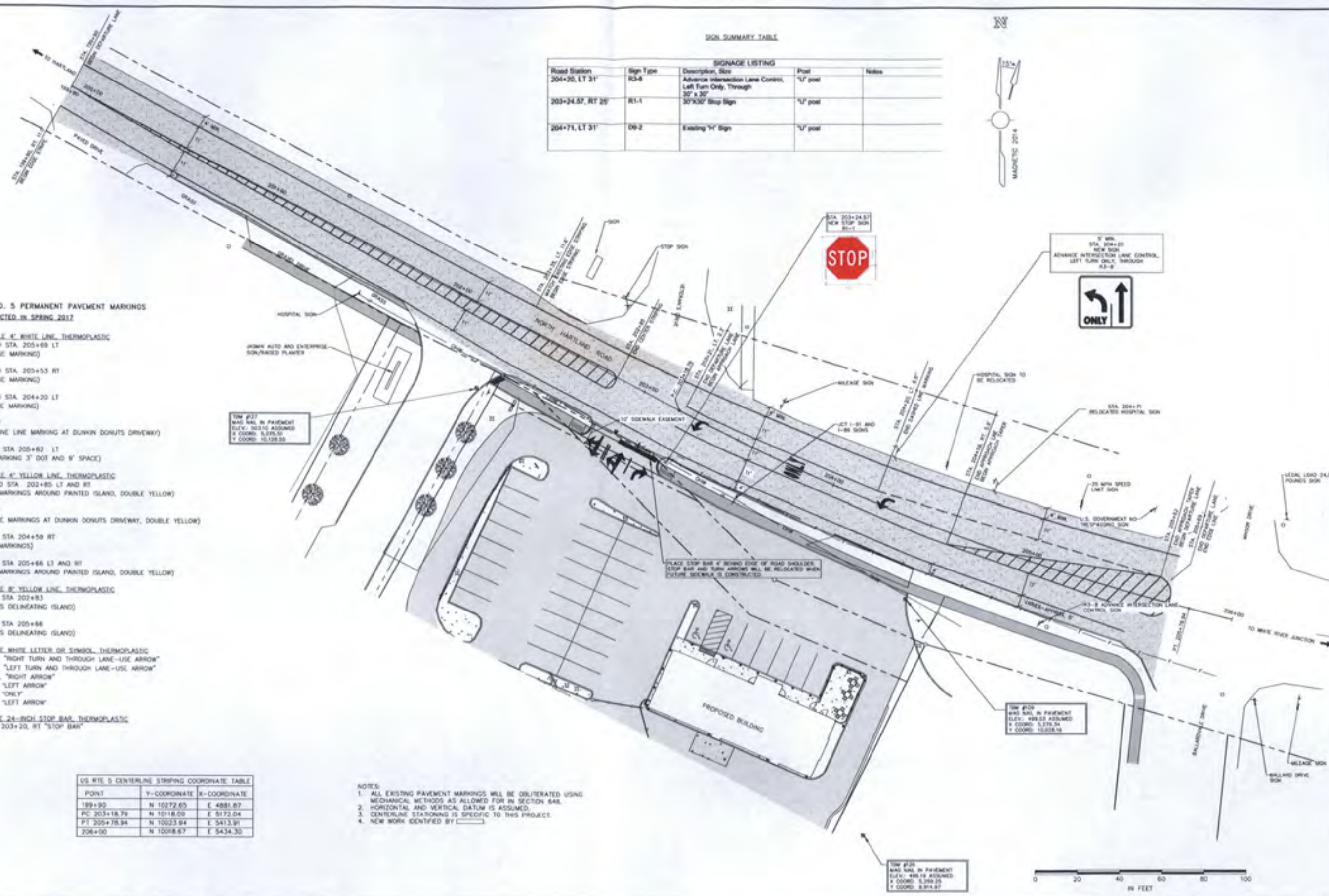
SCALE: 1"=20'
DESIGNED BY: ACK
DRAWN BY: PAB
CHECKED BY: JSG
DATE: 10/10/16
PROJ. NO. 12527

3

SHEET 3 OF 6

SIGN SUMMARY TABLE

SIGNAGE LISTING				
Road Station	Sign Type	Description, Size	Post	Notes
204+20, LT 31'	R3-8	Advance Intersection Lane Control, Left Turn Only, Through 30" x 30"	"U" post	
203+24.57, RT 25'	R1-1	30"X30" Stop Sign	"U" post	
204+71, LT 31'	D9-2	Existing "H" Sign	"U" post	



U.S. ROUTE NO. 5 PERMANENT PAVEMENT MARKINGS
TO BE CONSTRUCTED IN SPRING 2017

646.402 DURABLE 4" WHITE LINE, THERMOPLASTIC
STA. 202+35 TO STA. 205+69 LT
(SOLID EDGE LINE MARKING)

STA. 199+90 TO STA. 205+53 RT
(SOLID EDGE LINE MARKING)

STA. 203+21 TO STA. 204+20 LT
(SOLID LANE LINE MARKING)

STA. 203+06 RT
(WHITE SOLID LANE LINE MARKING AT DUNKIN DONUTS DRIVEWAY)

STA 204+20 TO STA 205+62 LT
(DOTTED LINE MARKING 3' DOT AND 9' SPACE)

646.412 DURABLE 4" YELLOW LINE, THERMOPLASTIC
STA 199+90 TO STA 202+85 LT AND RT
(SOLID CENTER MARKINGS AROUND PAINTED ISLAND, DOUBLE YELLOW)

STA 202+94 RT
(SOLID LANE LINE MARKINGS AT DUNKIN DONUTS DRIVEWAY, DOUBLE YELLOW)

STA 203+21 TO STA 204+59 RT
(SOLID CENTER MARKINGS)

STA 204+59 TO STA 205+66 LT AND RT
(SOLID CENTER MARKINGS AROUND PAINTED ISLAND, DOUBLE YELLOW)

646.452 DURABLE 8" YELLOW LINE, THERMOPLASTIC
STA 202+20 TO STA 202+83
(SOLID DIAGONALS DELINEATING ISLAND)

STA 204+59 TO STA 205+66
(SOLID DIAGONALS DELINEATING ISLAND)

646.492 DURABLE WHITE LETTER OR SYMBOL, THERMOPLASTIC
STA 202+88, RT "RIGHT TURN AND THROUGH LANE-USE ARROW"
STA 203+00, RT "LEFT TURN AND THROUGH LANE-USE ARROW"
STA 203+12, RT, "RIGHT ARROW"
STA 203+30, LT "LEFT ARROW"
STA 203+80, LT "ONLY"
STA 204+25, LT "LEFT ARROW"

646.482 DURABLE 24-INCH STOP BAR, THERMOPLASTIC
STA 203+00 TO 203+20, RT "STOP BAR"

US RTE 5 CENTERLINE STRIPING COORDINATE TABLE		
POINT	Y-COORDINATE	X-COORDINATE
199+90	N 10272.65	E 4881.87
PC 203+18.79	N 10118.09	E 5172.04
PT 205+78.94	N 10023.94	E 5413.91
206+00	N 10018.67	E 5434.30

NOTES:
1. ALL EXISTING PAVEMENT MARKINGS WILL BE OBLITERATED USING MECHANICAL METHODS AS ALLOWED FOR IN SECTION 646.
2. HORIZONTAL AND VERTICAL DATUM IS ASSUMED.
3. CENTERLINE STATIONING IS SPECIFIC TO THIS PROJECT.
4. NEW WORK IDENTIFIED BY

REVISION NO.	DATE	DESCRIPTION	MADE BY	CHECKED BY	APPROVED BY
4	04-07-17	VTRANS COMMENTS FROM 4/6/17	CRM	AGK	JSG
3	03-23-17	SIDEWALK ALIGNMENT	PAB	AGK	JSG
2	02-23-17	VTRANS COMMENTS FROM 2/10/17	CRM	AGK	JSG
1	11-18-16	INITIAL VTRANS COMMENTS	DPM	AGK	JSG

PERMANENT PAVEMENT MARKINGS AND SIGNS

352 NORTH HARTLAND ROAD

HARTFORD, VERMONT

PATHWAYS CONSULTING, LLC
240 MECHANIC STREET, SUITE 100
LEBANON, NEW HAMPSHIRE 03766
(603) 448-2200

SCALE: 1"=20'
DESIGNED BY: AGK
DRAWN BY: PAB
CHECKED BY: JSG
DATE: 10/10/16
PROJ. NO. 12527

4

EROSION CONTROL SPECIFICATIONS

1. SOIL EROSION AND SEDIMENT CONTROL MEASURES SHALL BE IN ACCORDANCE WITH THE VERMONT HANDBOOK FOR SOIL EROSION AND SEDIMENT CONTROL ON CONSTRUCTION SITES AND THE MOST CURRENT EDITION OF THE "LOW RISK SITE HANDBOOK FOR EROSION PREVENTION AND SEDIMENT CONTROL" PUBLISHED BY THE VERMONT DEPARTMENT OF ENVIRONMENTAL SERVICES.

2. RECOGNIZING THAT IMMEDIATE ATTENTION TO EROSION CONTROL PRACTICES DRAMATICALLY IMPROVES SOIL AND MOISTURE CONSERVATION AND REDUCES NEGATIVE IMPACTS ON WATER QUALITY, THE CONTRACTOR SHALL GIVE HIGH PRIORITY TO THE DAILY AND TIMELY INSTALLATION OF BOTH TEMPORARY AND PERMANENT EROSION AND SEDIMENT CONTROL MEASURES. IMMEDIATE INSTALLATION OF PRACTICES USUALLY REDUCES LONG TERM COSTS TO THE CONTRACTOR AND PROVIDES BENEFITS TO THE DEVELOPER AND THE PUBLIC GOOD.

3. EROSION CONTROL PRACTICES ARE SHOWN ON THE PLANS WITH RESPECT TO LOCATION AS DETERMINED FROM EXISTING TOPOGRAPHY. CHANGES MAY BE INDICATED IN THE FIELD TO IMPROVE EROSION AND SEDIMENT CONTROL.

4. CONSTRUCTION SHALL PROCEED UNIT BY UNIT TO FACILITATE INSTALLATION OF EROSION CONTROL MEASURES AND THE COMPLETION OF GRADING, SEEDING, AND LANDSCAPING AS SOON AS POSSIBLE WITHIN A UNIT. THIS PROCEDURE SHOULD RESULT IN THE EXPOSURE OF THE SMALLEST PRACTICAL LAND AREA AT ANY ONE TIME.

5. CUT AND FILL SLOPES BOTH CALL FOR INTENSIVE EROSION CONTROL MEASURES.

6. ALL DISTURBED AREAS SHALL HAVE TOPSOIL SPREAD (4" MINIMUM) AND BE LIMED, FERTILIZED, TILLED, SEEDED AND MULCHED. ALL SLOPES 3:1 (1 RISE ON 3 RUN) AND STEEPER SHALL HAVE MULCH HELD IN PLACE WITH BIODEGRADABLE JUTE NETTING STAPLED AND STAKED. EACH AREA SHALL BE FERTILIZED, PREPARED, SEEDED AND MULCHED (WITH ANCHORED NETTING IF REQUIRED) WITHIN 72 HOURS OF FINAL GRADING. WHEN PERMANENT SEEDING CANNOT BE INSTALLED BY SEPTEMBER 15, TEMPORARY SEEDING AND MULCHING OF ALL DISTURBED AREAS SHALL BE INSTALLED IMMEDIATELY AND MAINTAINED IN THAT CONDITION UNTIL PERMANENT PRACTICES CAN BE INSTALLED IN THE FOLLOWING PLANTING SEASON.

7. TEMPORARY SEEDING AND MULCHING OF ALL DISTURBED AREAS SHALL BE INSTALLED IMMEDIATELY AND MAINTAINED IN THAT CONDITION UNTIL PERMANENT PRACTICES CAN BE INSTALLED IN THE FOLLOWING PLANTING SEASON. TEMPORARY STABILIZATION OF DISTURBED AREAS: SEED BED PREPARATION: TILL THREE INCHES DEEP MIXING IN FERTILIZER. APPLY LIME 2 TONS/ACRE (100#/1,000 SQ. FT.) FERTILIZE: UNIFORMLY APPLY NOT LESS THAN 300#/ACRE (7#/1,000 SQ.FT.) OF 10-20-20 OR EQUIVALENT. SEEDING: SELECT APPROPRIATE SEEDING MIXTURE FROM TABLE I BELOW. SPREAD SEED UNIFORMLY. FIRM SOIL BY ROLLING OR PACKING; IF NOT FEASIBLE, THEN RAKE LIGHTLY TO COVER SEEDS. MULCHING: MULCH ALL DISTURBED AREAS WITH 1-1/2 TO 2 TONS OF HAY OR STRAW PER ACRE (70-90#/1000 SQ. FT.) ANCHOR ON ALL SLOPES 3:1 OR STEEPER AND FLATTER SLOPES SUBJECT TO WASH OR WIND BLOWN. JUTE OR OTHER BIODEGRADABLE (NOT PHOTO-BIODEGRADABLE) NETTING, STAKING AND STAPLING MAY BE REQUIRED.

TABLE I
PLANT SELECTION AND SEEDING RATES

SPECIES REMARKS	PER ACRE	PER 1000 SQ.FT.	
WINTER RYE SEEDING	2 BU OR 112 LBS.	2.5 LBS.	BEST FOR FALL SEED AUGUST 15 TO SEPTEMBER 15 FOR BEST COVER. SEED TO DEPTH OF ONE INCH.
OATS	2 1/2 BU OR 80 LBS.	2 LBS.	BEST FOR SPRING SEEDING LATER SUMMER PROTECTION. SEED TO DEPTH OF ONE INCH.
ANNUAL RYE	40 LBS.	1 LB.	GROWS QUICKLY, BUT IS SHORT GRASS DURATION. USE WHERE APPEARANCES ARE IMPORTANT, COVER SEED WITH NO MORE THAN 1/4 INCH OF SOIL. WITH MULCH, SEEDING MAY BE DONE THROUGHOUT GROWING SEASON. OTHERWISE SEED EARLY SPRING OR BETWEEN AUGUST 15 & SEPTEMBER 15.

10. PERMANENT STABILIZATION OF DISTURBED AREAS: SEED BED PREPARATION: TOPSOIL (SANDY LOAM, LOAM, OR SILT LOAM) FRIABLE, FREE OF TREE ROOTS, WEEDS, STONES MORE THAN 1-1/2 INCHES IN DIAMETER OR LENGTH SHALL BE PLACED OVER ALL DISTURBED AREAS IN A 4" (MINIMUM) THICK LAYER. TOPSOIL SHALL BE FREE OF HERBICIDES AND TOXIC MATERIALS. TILL THREE INCHES DEEP MIXING IN THE FERTILIZER AND LIME. APPLY LIME 2 TONS/ACRE (100#/1,000 SQ. FT.) FERTILIZE: UNIFORMLY APPLY NOT LESS THAN 500#/ACRE (12#/1,000 SQ.FT.) OF 10-20-20 OR EQUIVALENT. SEEDING: SELECT APPROPRIATE SEEDING MIXTURE FROM TABLE 2 BELOW. SPREAD SEED UNIFORMLY FIRM SOIL BY ROLLING OR PACKING; IF NOT FEASIBLE, THEN RAKE LIGHTLY TO COVER SEEDS. MULCHING: MULCH ALL DISTURBED AREAS WITH 1-1/2 TO 2 TONS OF HAY OR STRAW PER ACRE (70 - 90#/1,000 SQ.FT.). ANCHOR ON ALL SLOPES 3:1 OR STEEPER AND ON FLATTER SLOPES SUBJECT TO WASH (WATERWAYS AND/OR WINDBLOWN USING JUTE OR OTHER BIODEGRADABLE (NOT NOT PHOTO-BIODEGRADEABLE) NETTING, STAKING, AND STAPLING.

TABLE 2
SEEDING RATES

MIXTURE		POUNDS PER ACRES	POUNDS PER 1,000 SQ.FT.
A. PARK AND LAWN AREAS			
NASSAU KENTUCKY BLUEGRASS	60%	96	
JAMESTOWN 2 CHEWINGS FESCUE	20%	32	
PALMER 2 PERENNIAL RYEGRASS	20%	32	
TOTAL	100%	160	
B. SLOPE AREAS			
REBEL 2 TALL FESCUE	40%	64	
WEEPING LOVEGRASS	20%	32	
RELIANT 2 HARD FESCUE	10%	16	
JAMESTOWN 2 CHEWINGS FESCUE	10%	16	
PALMER 2 PERENNIAL RYEGRASS	10%	16	
WHITE CLOVER	5%	8	
BLACKWELL SWITCHGRASS	5%	8	
TOTAL	100%	160	

11. TEMPORARY EROSION CONTROL MEASURES SHALL NOT BE REMOVED UNTIL ALL DISTURBED AREAS HAVE BEEN STABILIZED.

12. MAINTENANCE: DURING THE CONSTRUCTION PERIOD AND UNTIL SUCH TIME AS THE LONG TERM VEGETATION IS ESTABLISHED.
  A. DISTURBED AREAS WILL BE FERTILIZED AND RESEEDED.
  B. STONE CHECKS, SILT FENCE AND BALED HAY CHECKS WILL BE CHECKED AND CLEANED AS NECESSARY.
  C. DRAINAGE AND GRASS TREATMENT SWALES SHALL BE CHECKED FREQUENTLY AND CLEANED AS REQUIRED.
  D. THE SILT FENCES AND HAY BALE DIKES WILL BE CHECKED ON A REGULAR BASIS AND REPAIRED AS NECESSARY TO CORRECT ANY DAMAGE, DETERIORATION, AND SHORT CIRCUITING.

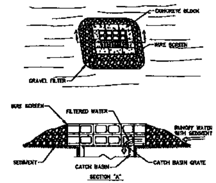
13. REFER TO "GRADING AND UTILITY PLANS" PRIOR TO ANY SITE DISTURBANCE. CONTACT ENGINEER FOR COPIES OF PLAN.

14. INSPECTIONS-. THE ENGINEER SHALL BE CONTACTED ON A REGULAR BASIS TO INSPECT ALL EROSION CONTROL PRACTICES AS WELL AS THE MAINTENANCE OF THE EROSION CONTROL COMPONENTS. REFER TO CONSTRUCTION EROSION CONTROL SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS. EROSION CONTROL PRACTICES SHALL BE IN STRICT ACCORDANCE WITH THE APPROVED PLANS AND SPECIFICATIONS.

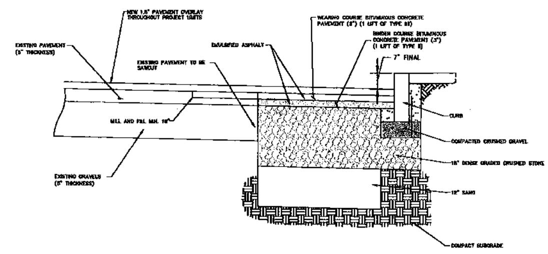
15. ALL DITCHES SHALL BE STABILIZED PRIOR TO DIRECTING RUNOFF TO THEM.

16. THE MAXIMUM AMOUNT OF AREA TO BE DISTURBED AND UNSTABILIZED SHALL BE 1 ACRE AT ANY TIME.

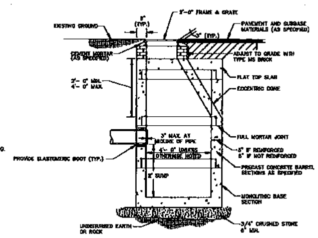
17. THE MAXIMUM AMOUNT OF TIME ANY AREA MAY BE DISTURBED WITHOUT STABILIZATION SHALL BE 30 DAYS.



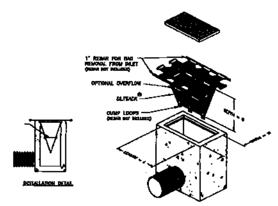
BLOCK & STONE INLET SEDIMENT FILTER DETAIL
N.T.S.



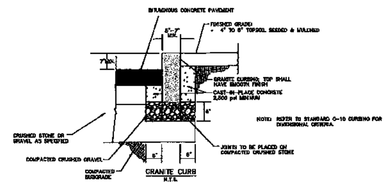
U.S. ROUTE 5 PAVEMENT SECTION
N.T.S.



PRECAST CONCRETE CATCH BASIN
N.T.S.



SILTSACK – INLET FILTER BAG
N.T.S.



GRANITE CURB
N.T.S.

2	02-23-17	VTRANS COMMENTS FROM 2/10/17	CRM	AOK	JSO
1	11-18-16	INITIAL VTRANS COMMENTS	DPM	AOK	JSO
REVISION NO.	DATE	DESCRIPTION	MADE BY	CHECKED BY	APPROVED BY

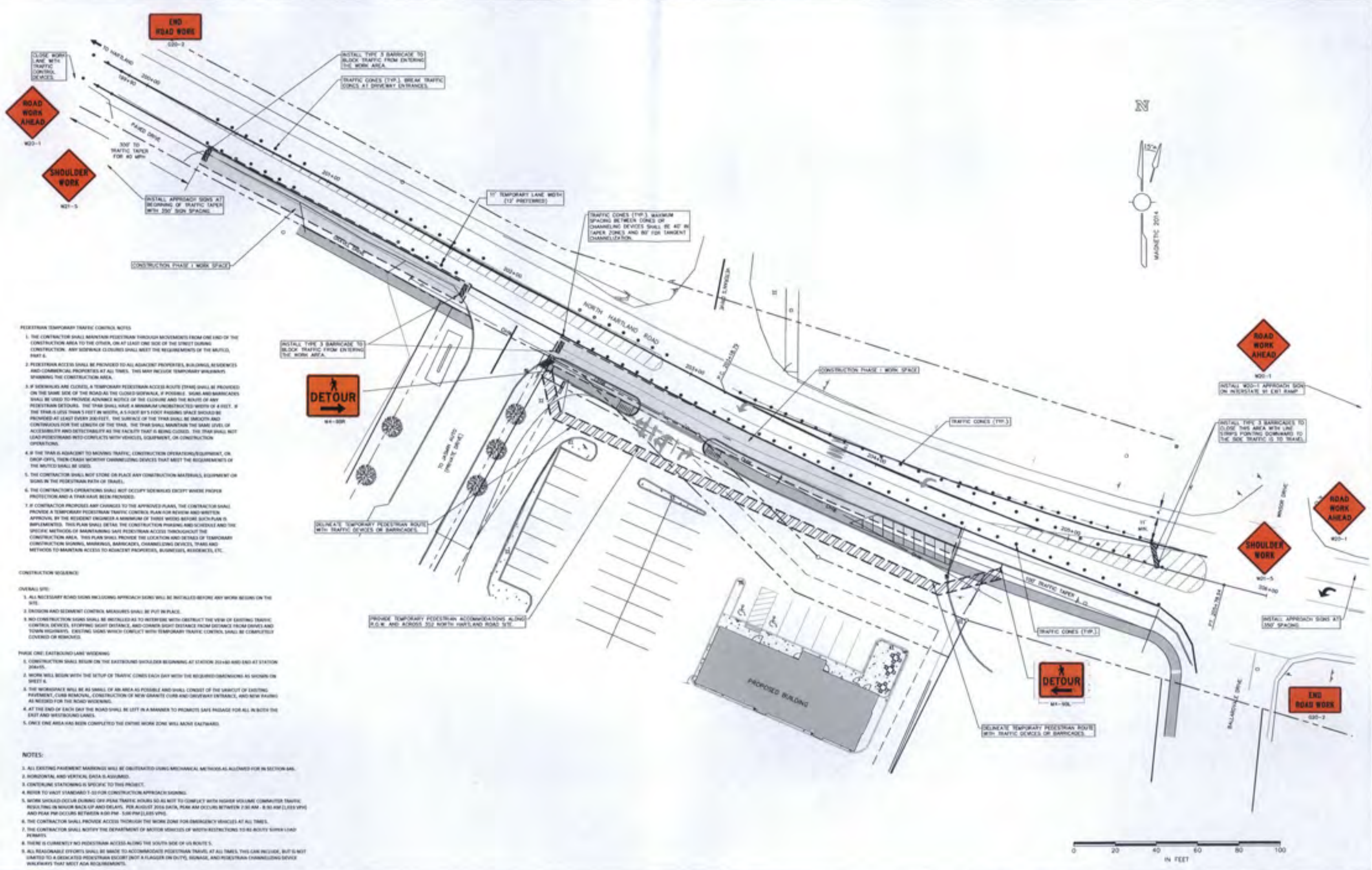
EROSION PREVENTION, SEDIMENT AND MISCELLANEOUS DETAILS
352 NORTH HARTLAND ROAD
HARTFORD, VERMONT

PATHWAYS CONSULTING, LLC
240 MECHANIC STREET, SUITE 100
LEBANON, NEW HAMPSHIRE 03766
(603) 448-2200

SCALE: N.T.S.
DESIGNED BY: AOK
DRAWN BY: PAB
CHECKED BY: JSO
DATE: 10/10/16
PROJ. NO. 12527

5

SHEET 5 OF 6



PEDESTRIAN TEMPORARY TRAFFIC CONTROL NOTES

1. THE CONTRACTOR SHALL MAINTAIN PEDESTRIAN THROUGH MOVEMENTS FROM ONE END OF THE CONSTRUCTION AREA TO THE OTHER, ON AT LEAST ONE SIDE OF THE STREET DURING CONSTRUCTION. ANY SIDEWALK CLOSURES SHALL MEET THE REQUIREMENTS OF THE MUTCD, PART 6.
2. PEDESTRIAN ACCESS SHALL BE PROVIDED TO ALL ADJACENT PROPERTIES, BUILDINGS, RESIDENCES AND COMMERCIAL PROPERTIES AT ALL TIMES. THIS MAY INCLUDE TEMPORARY WALKWAYS SPANNING THE CONSTRUCTION AREA.
3. IF SIDEWALKS ARE CLOSED, A TEMPORARY PEDESTRIAN ACCESS ROUTE (TPAR) SHALL BE PROVIDED ON THE SAME SIDE OF THE ROAD AS THE CLOSED SIDEWALK, IF POSSIBLE. SIGNS AND BARRICADES SHALL BE USED TO PROVIDE ADVANCE NOTICE OF THE CLOSURE AND THE ROUTE OF ANY PEDESTRIAN DETOURS. THE TPAR SHALL HAVE A MINIMUM UNOBSTRUCTED WIDTH OF 4 FEET. IF THE TPAR IS LESS THAN 5 FEET IN WIDTH, A 5-FOOT BY 5 FOOT PASSING SPACE SHOULD BE PROVIDED AT LEAST EVERY 200 FEET. THE SURFACE OF THE TPAR SHALL BE SMOOTH AND CONTINUOUS FOR THE LENGTH OF THE TPAR. THE TPAR SHALL MAINTAIN THE SAME LEVEL OF ACCESSIBILITY AND DETECTABILITY AS THE FACILITY THAT IS BEING CLOSED. THE TPAR SHALL NOT LEAD PEDESTRIANS INTO CONFLICTS WITH VEHICLES, EQUIPMENT, OR CONSTRUCTION OPERATIONS.
4. IF THE TPAR IS ADJACENT TO MOVING TRAFFIC, CONSTRUCTION OPERATIONS/EQUIPMENT, OR DROP-OFFS, THEN CRASH WORTHY CHANNELIZING DEVICES THAT MEET THE REQUIREMENTS OF THE MUTCD SHALL BE USED.
5. THE CONTRACTOR SHALL NOT STORE OR PLACE ANY CONSTRUCTION MATERIALS, EQUIPMENT OR SIGNS IN THE PEDESTRIAN PATH OF TRAVEL.
6. THE CONTRACTOR'S OPERATIONS SHALL NOT OCCUPY SIDEWALKS EXCEPT WHERE PROPER PROTECTION AND A TPAR HAVE BEEN PROVIDED.
7. IF CONTRACTOR PROPOSES ANY CHANGES TO THE APPROVED PLANS, THE CONTRACTOR SHALL PROVIDE A TEMPORARY PEDESTRIAN TRAFFIC CONTROL PLAN FOR REVIEW AND WRITTEN APPROVAL BY THE RESIDENT ENGINEER A MINIMUM OF THREE WEEKS BEFORE SUCH PLAN IS IMPLEMENTED. THIS PLAN SHALL DETAIL THE CONSTRUCTION PHASING AND SCHEDULE AND THE SPECIFIC METHODS OF MAINTAINING SAFE PEDESTRIAN ACCESS THROUGHOUT THE CONSTRUCTION AREA. THIS PLAN SHALL PROVIDE THE LOCATION AND DETAILS OF TEMPORARY CONSTRUCTION SIGNING, MARKINGS, BARRICADES, CHANNELIZING DEVICES, TPARS AND METHODS TO MAINTAIN ACCESS TO ADJACENT PROPERTIES, BUSINESSES, RESIDENCES, ETC.

CONSTRUCTION SEQUENCE:

OVERALL SITE:

1. ALL NECESSARY ROAD SIGNS INCLUDING APPROACH SIGNS WILL BE INSTALLED BEFORE ANY WORK BEGINS ON THE SITE.
2. EROSION AND SEDIMENT CONTROL MEASURES SHALL BE PUT IN PLACE.
3. NO CONSTRUCTION SIGNS SHALL BE INSTALLED AS TO INTERFERE WITH OBSTRUCT THE VIEW OF EXISTING TRAFFIC CONTROL DEVICES, STOPPING SIGHT DISTANCE, AND CORNER SIGHT DISTANCE FROM DISTANCE FROM DRIVES AND TOWN HIGHWAYS. EXISTING SIGNS WHICH CONFLICT WITH TEMPORARY TRAFFIC CONTROL SHALL BE COMPLETELY COVERED OR REMOVED.

PHASE ONE: EASTBOUND LANE WIDENING

1. CONSTRUCTION SHALL BEGIN ON THE EASTBOUND SHOULDER BEGINNING AT STATION 203+60 AND END AT STATION 206+55.
2. WORK WILL BEGIN WITH THE SETUP OF TRAFFIC CONES EACH DAY WITH THE REQUIRED DIMENSIONS AS SHOWN ON SHEET 6.
3. THE WORKSPACE WILL BE AS SMALL OF AN AREA AS POSSIBLE AND SHALL CONSIST OF THE SAWCUT OF EXISTING PAVEMENT, CURB REMOVAL, CONSTRUCTION OF NEW GRANITE CURB AND DRIVEWAY ENTRANCE, AND NEW PAVING AS NEEDED FOR THE ROAD WIDENING.
4. AT THE END OF EACH DAY THE ROAD SHALL BE LEFT IN A MANNER TO PROMOTE SAFE PASSAGE FOR ALL IN BOTH THE EAST AND WESTBOUND LANES.
5. ONCE ONE AREA HAS BEEN COMPLETED THE ENTIRE WORK ZONE WILL MOVE EASTWARD.

NOTES:

1. ALL EXISTING PAVEMENT MARKINGS WILL BE OBLITERATED USING MECHANICAL METHODS AS ALLOWED FOR IN SECTION 646.
2. HORIZONTAL AND VERTICAL DATA IS ASSUMED.
3. CENTERLINE STATIONING IS SPECIFIC TO THIS PROJECT.
4. REFER TO VAOT STANDARD T-10 FOR CONSTRUCTION APPROACH SIGNING.
5. WORK SHOULD OCCUR DURING OFF-PEAK TRAFFIC HOURS SO AS NOT TO CONFLICT WITH HIGHER VOLUME COMMUTER TRAFFIC RESULTING IN MAJOR BACK-UP AND DELAYS. PER AUGUST 2016 DATA, PEAK AM OCCURS BETWEEN 7:30 AM - 8:30 AM (1,033 VPH) AND PEAK PM OCCURS BETWEEN 4:00 PM - 5:00 PM (1,035 VPH).
6. THE CONTRACTOR SHALL PROVIDE ACCESS THROUGH THE WORK ZONE FOR EMERGENCY VEHICLES AT ALL TIMES.
7. THE CONTRACTOR SHALL NOTIFY THE DEPARTMENT OF MOTOR VEHICLES OF WIDTH RESTRICTIONS TO RE-ROUTE SUPER LOAD PERMITS.
8. THERE IS CURRENTLY NO PEDESTRIAN ACCESS ALONG THE SOUTH SIDE OF US ROUTE 5.
9. ALL REASONABLE EFFORTS SHALL BE MADE TO ACCOMMODATE PEDESTRIAN TRAVEL AT ALL TIMES. THIS CAN INCLUDE, BUT IS NOT LIMITED TO A DEDICATED PEDESTRIAN ESCORT (NOT A FLAGGER ON DUTY), SIGNAGE, AND PEDESTRIAN CHANNELIZING DEVICE WALKWAYS THAT MEET ADA REQUIREMENTS.

REVISION NO.	DATE	DESCRIPTION	MADE BY	CHECKED BY	APPROVED BY
5	04-24-17	VTRANS COMMENTS FROM 4/13/17	CRM	AGK	JSG
4	04-07-17	VTRANS COMMENTS FROM 4/6/17	CRM	AGK	JSG
3	02-23-17	VTRANS COMMENTS FROM 2/10/17	CRM	AGK	JSG
2	12-15-16	VTRANS WORK ZONE ENGINEER COMMENTS	CRM	AGK	JSG
1	11-18-16	INITIAL VTRANS COMMENTS	DPM	AGK	JSG

TRAFFIC CONTROL PLAN FOR U.S. ROUTE 5

352 NORTH HARTLAND ROAD

HARTFORD, VERMONT

PATHWAYS CONSULTING, LLC
240 MECHANIC STREET, SUITE 100
LEBANON, NEW HAMPSHIRE 03766
(603) 448-2200

SCALE: 1"=20'
DESIGNED BY: AGK
DRAWN BY: PAB
CHECKED BY: JSG
DATE: 10/10/16
PROJ. NO. 12527

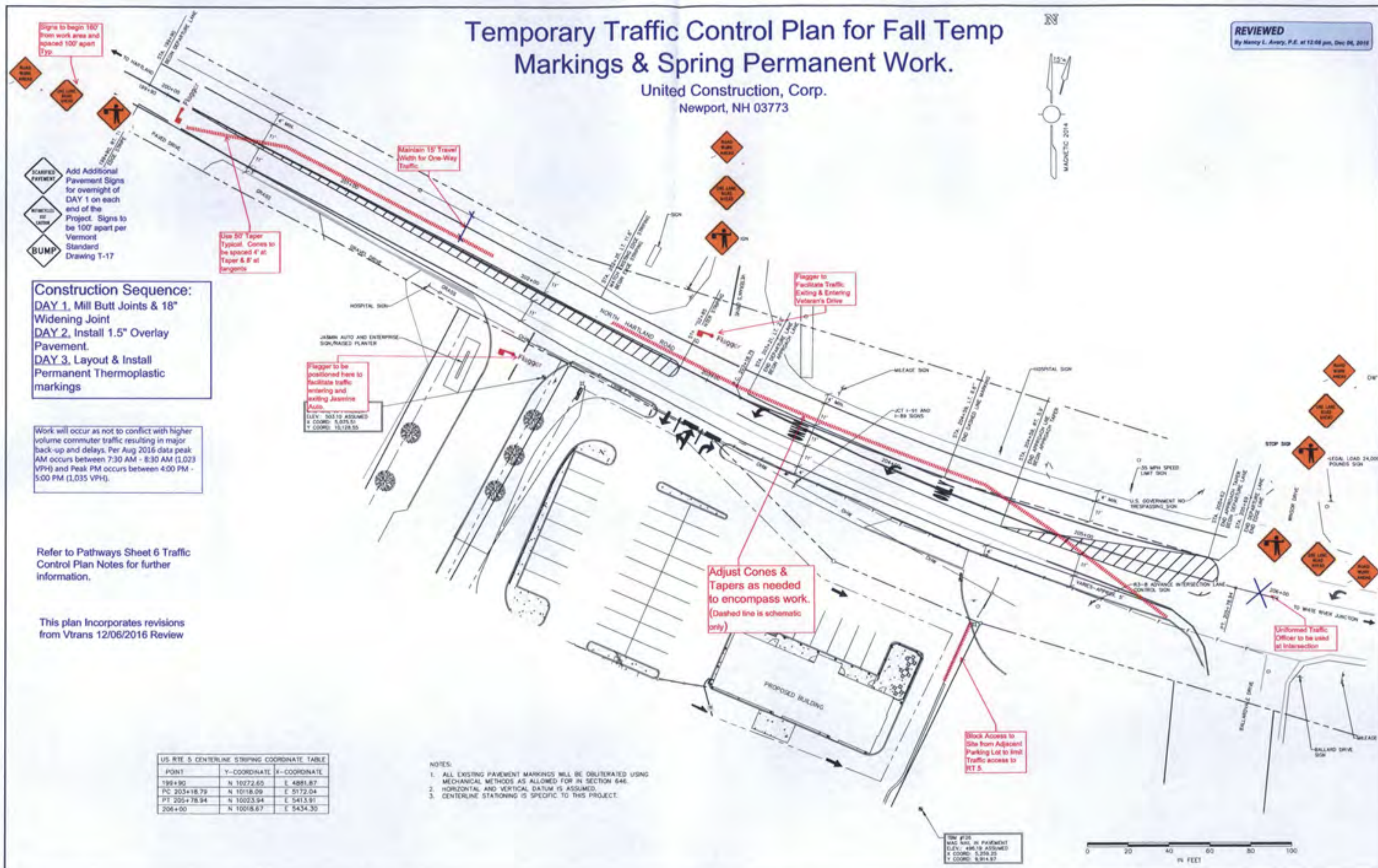
6

SHEET 6 OF 6

Temporary Traffic Control Plan for Fall Temp Markings & Spring Permanent Work.

United Construction, Corp.
Newport, NH 03773

REVIEWED



Add Additional Pavement Signs for overnight of DAY 1 on each end of the Project. Signs to be 100' apart per Vermont Standard Drawing T-17

BUMP

Construction Sequence:

DAY 1. Mill Butt Joints & 18" Widening Joint
DAY 2. Install 1.5" Overlay Pavement.
DAY 3. Layout & Install Permanent Thermoplastic markings

Work will occur as not to conflict with higher volume commuter traffic resulting in major back-up and delays. Per Aug 2016 data peak AM occurs between 7:30 AM - 8:30 AM (1,023 VPH) and Peak PM occurs between 4:00 PM - 5:00 PM (1,035 VPH).

Refer to Pathways Sheet 6 Traffic Control Plan Notes for further information.

This plan Incorporates revisions from Vtrans 12/06/2016 Review

US RTE 5 CENTERLINE STRIPING COORDINATE TABLE		
POINT	Y-COORDINATE	X-COORDINATE
199+90	N 10272.65	E 4881.87
PC 203+18.79	N 10118.09	E 5172.04
PT 205+78.94	N 10023.94	E 5413.91
206+00	N 10018.67	E 5434.30

NOTES:

1. ALL EXISTING PAVEMENT MARKINGS WILL BE OBLITERATED USING MECHANICAL METHODS AS ALLOWED FOR IN SECTION 646.
2. HORIZONTAL AND VERTICAL DATUM IS ASSUMED.
3. CENTERLINE STATIONING IS SPECIFIC TO THIS PROJECT.

REVISION NO.	DATE	DESCRIPTION	MADE BY	CHECKED BY	APPROVED BY
1	11-18-16	INITIAL VTRANS COMMENTS	DPM	AGK	JSG

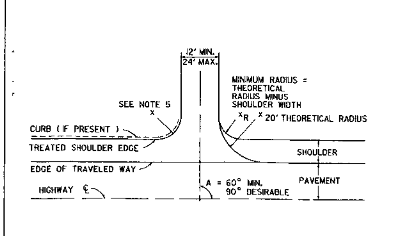
TEMPORARY AND PERMANENT PAVEMENT MARKINGS AND SIGNS
352 NORTH HARTLAND ROAD
HARTFORD, VERMONT

PATHWAYS CONSULTING, LLC
240 MECHANIC STREET, SUITE 100
LEBANON, NEW HAMPSHIRE 03766
(603) 448-2200

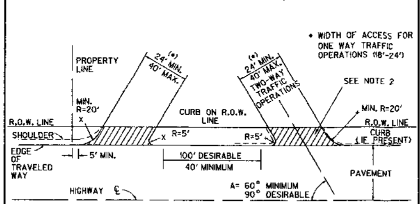
SCALE: 1"=20'
DESIGNED BY: AGK
DRAWN BY: PAB
CHECKED BY: JSG
DATE: 10/10/16
PROJ. NO. 12527

TCP-1

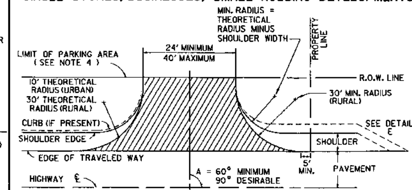
DETAIL A RESIDENTIAL DRIVE



DETAIL B DUAL COMMERCIAL DRIVE TO BE USED ONLY UNDER SPECIAL CONDITIONS

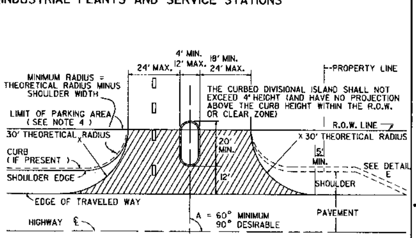


DETAIL C TWO-WAY UNDIVIDED COMMERCIAL DRIVE FOR SINGLE STORES, BUSINESSES, SMALL HOUSING DEVELOPMENTS

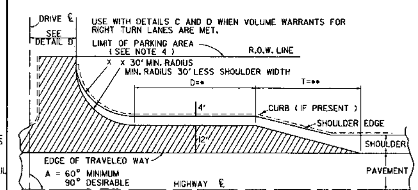


THIS DETAIL WILL ALSO APPLY TO COMMERCIAL SERVICE DRIVES,WHEN AUTHORIZED,HAVING A MAXIMUM WIDTH OF 20'. THE SERVICE DRIVE WILL HAVE A "SERVICE VEHICLES ONLY" SIGN PLACED AT THE HIGHWAY ROW LINE.SIGN SHALL BE 18"X 24" AS PRESCRIBED IN THE "STANDARD HIGHWAY SIGNS BOOK", A SUPPLEMENTAL PUBLICATION TO MUTCD.

DETAIL D TWO-WAY COMMERCIAL DRIVE WITH DIVISIONAL ISLAND FOR SHOPPING CENTERS, LARGE HOUSING DEVELOPMENTS, INDUSTRIAL PLANTS AND SERVICE STATIONS



DETAIL E RIGHT TURN LANE FOR COMMERCIAL DRIVE (UNSIGNALIZED INTERSECTIONS ONLY)

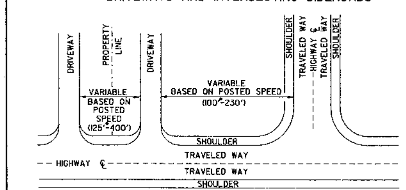


* STORAGE LENGTH IS VARIABLE DEPENDING ON TRAFFIC VOLUME AND MUST BE ADJUSTED TO PROVIDE PROPER DECELERATION LENGTH. REFER TO VAOT STANDARD E-192

TAPERS

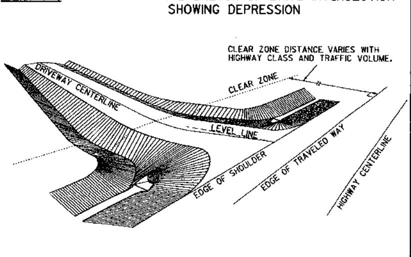
SPEED (MPH)	30	35	40	50
**LENGTH (MIN)(FT)(T)	100	120	140	180
RATE	8:1	10:1	12:1	15:1

DETAIL F MINIMUM HORIZONTAL SEPARATION BETWEEN DRIVEWAYS AND INTERSECTING SIDEROADS

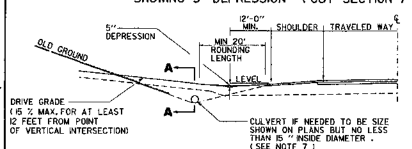


* MINIMUM UNLESS NO OTHER REASONABLE ACCESS IS AVAILABLE AND PRIOR APPROVAL IS GRANTED BY THE VAOT ITEMS SUCH AS TRAFFIC SIGNALS, HIGH TRAFFIC VOLUMES, OR FUNCTIONAL CLASS OF HIGHWAY SHOULD BE CONSIDERED WHEN DETERMINING APPROPRIATE SEPARATION DISTANCE. WHEN CURRENT RECOMMENDED SEPARATION DISTANCE CANNOT BE OBTAINED RESTRICTION OF TURNING MOVEMENTS MAY BE REQUIRED.

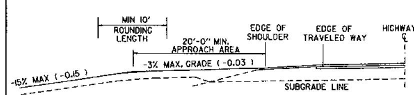
DETAIL G PERSPECTIVE SKETCH OF DRIVE INTERSECTION SHOWING DEPRESSION



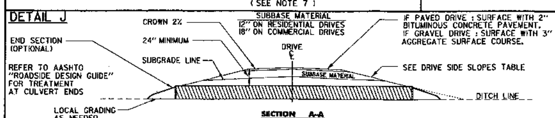
DETAIL H PROFILE OF DRIVE INTERSECTION SHOWING 5" DEPRESSION (CUT SECTION)



DETAIL I PROFILE OF DRIVE INTERSECTION (FILL SECTION)



DETAIL J



DRIVE SIDE SLOPES

LOCATION OF SLOPE	SLOPE RATE
V > 40 MPH	1:6 OR FLATTER
URBAN AREAS, OR V ≤ 40 MPH	1:4 DESIRABLE 1:2 ALLOWABLE
OUTSIDE CLEAR ZONE	1:2 OR FLATTER

NOTES:

1. THIS SHEET IS INTENDED FOR USE BY DESIGNERS ON HIGHWAY PROJECTS AND IN CONJUNCTION WITH A PERMIT FOR WORK WITHIN HIGHWAY RIGHTS OF WAY (FORM TA 210). ALL CONSTRUCTION REQUIRED BY THE PERMIT AND INDICATED ON THIS SHEET SHALL BE THE RESPONSIBILITY OF THE APPLICANT AND IS SUBJECT TO THE APPROVAL OF THE VT. AGENCY OF TRANSPORTATION. WHEN USED WITH THE PLANS FOR A HIGHWAY CONSTRUCTION PROJECT. THIS SHEET IS INTENDED TO BE A GUIDE FOR THE DESIGNER CONCERNING DRIVE WIDTHS, HORIZONTAL, VERTICAL AND GEOMETRIC CHARACTERISTICS.
2. ALL COMMERCIAL DRIVES SHALL BE PAVED FROM THE EDGE OF THE TRAVELED WAY TO THE HIGHWAY RIGHT-OF-WAY, TO THE FARTHEST POINT OF CURVATURE ON THE DRIVEWAY EDGE OR AS DIRECTED BY THE DISTRICT TRANSPORTATION ADMINISTRATOR. THIS PAVING IS INDICATED IN DETAILS (B THRU E) BY HATCHING.
3. DEPTH OF SUBBASE AND PAVEMENT TO BE THE SAME AS HIGHWAY OR AS SHOWN IN DETAIL J WITHIN THE LIMITS OF THE HIGHWAY RIGHT-OF-WAY.
4. VEHICULAR ACCESS FROM PARKING AREAS TO THE RIGHT-OF-WAY AT OTHER THAN APPROVED ACCESS POINTS WILL BE PREVENTED BY THE CONSTRUCTION OF CURBING OR OTHER SUITABLE PHYSICAL BARRIER.
5. IF CURB IS PRESENT, SEE APPROPRIATE CURB DETAIL STANDARD OR MATCH TOWN/CITY STANDARD CURB TREATMENT.
6. WHERE TRAFFIC VOLUME FOR A PROJECT IS SUBSTANTIAL THE AGENCY MAY REQUIRE SPECIAL LANES FOR TURNING, SIGNALS OR OTHER MODIFICATIONS. BASED ON TRAFFIC STUDIES THE AGENCY WILL DETERMINE SPECIFIC TREATMENT TO BE USED. ON DEVELOPER PROJECTS THE AGENCY WILL WORK WITH THE APPLICANT TO IMPLEMENT CHANGES TO THE STATE HIGHWAY.
7. CIRCULAR DRAINAGE CULVERTS UNDER DRIVES SHALL HAVE A MINIMUM INSIDE DIAMETER (I.D.) OF 15". PIPE ARCHES USED UNDER DRIVES SHALL HAVE A MINIMUM INSIDE CROSS-SECTIONAL AREA EQUIVALENT TO THAT PROVIDED BY A 15" CIRCULAR PIPE.
8. THE OFFSET BETWEEN THE PROPERTY LINE AND THE EDGE OF THE DRIVEWAY MAY BE GOVERNED BY LOCAL ZONING LAWS. DRIVEWAY WIDTH RESTRICTIONS SHOWN PERTAIN ONLY TO THE AREA WITHIN THE HIGHWAY R.O.W. OR THE END OF THE TURNING RADIUS WHICHEVER IS GREATEST.
9. DRIVEWAY GRADES STEEPER THAN THOSE SHOWN MAY BE ALLOWED AS LONG AS A 20' APPROACH AREA IS ACHIEVED FOR THE VEHICLE TO PAUSE BEFORE ENTERING THE HIGHWAY. (WHERE CURB & SIDEWALKS EXIST, SEE STANDARDS C-2A & C-2B)
10. INTERSECTION SIGHT DISTANCES, EQUAL TO OR GREATER THAN THOSE SHOWN BELOW, SHOULD BE PROVIDED IN BOTH DIRECTIONS FOR ALL DRIVES ENTERING ON PUBLIC HIGHWAYS, UNLESS OTHERWISE APPROVED BY THE AGENCY OF TRANSPORTATION. INTERSECTION SIGHT DISTANCE IS MEASURED FROM A POINT ON THE DRIVE AT LEAST 15 FEET FROM THE EDGE OF TRAVELED WAY OF THE ADJACENT ROADWAY AND MEASURED FROM A HEIGHT OF EYE OF 3.5 FEET ON THE DRIVE TO A HEIGHT OF 3.50 FEET ON THE ROADWAY.

SIGHT DISTANCE CHART

POSTED SPEED OR DESIGN SPEED (M.P.H.)	MINIMUM STOPPING SIGHT DISTANCE (FT)	MINIMUM INTERSECTION SIGHT DISTANCE * (FT)
25	155	280
30	200	335
35	250	390
40	305	445
45	360	500
50	425	555
55	495	610
60	570	665
65	645	720

THE ABOVE VALUES ARE TAKEN FROM THE 2004 AASHTO "A POLICY ON GEOMETRIC DESIGN OF HIGHWAYS & STREETS."

NOTE : ADVANCE WARNING SIGNS WILL BE REQUIRED IF OBTAINABLE INTERSECTION SIGHT DISTANCES ARE BELOW MINIMUM STOPPING SIGHT DISTANCES.

THE CHART IS ENTERED TO SELECT DESIGN VALUES BASED ON THE POSTED SPEED LIMIT IN MPH. VALUES FOR DESIGN ARE CALCULATED BASED ON THE DESIGN SPEED IN MPH.

* ASSUMES A GAP OF 7.5 SECONDS IN THE TRAFFIC STREAM ON THE HIGHWAY MAINLINE BASED ON THE HIGHWAY DESIGN SPEED IN MPH. THIS ALLOWS A STOPPED PASSENGER VEHICLE TO ENTER THE MAINLINE FROM THE DRIVE WITHOUT UNDULY INTERFERING WITH THE HIGHWAY OPERATIONS.

REVISIONS AND CORRECTIONS

DEC. 11, 1992 - THIS STANDARD SUPERCEDES B-71 (7/23/80R), B-71A (3/12/90), AND B-13 (12/14/71).
JUNE 1, 1994 - REISSUED, WITHOUT CHANGE, UNDER NEW SIGNATURES.
MAR. 10, 1995 - REISSUED, WITHOUT CHANGE, UNDER NEW SIGNATURES.
NOV. 16, 2000 - CHANGES MADE TO CONFORM WITH LANGUAGE AND DIMENSIONS IN ACCESS MANAGEMENT PROGRAM GUIDELINES.
FEB 1, 2004 - CHANGES MADE TO SIGHT DISTANCE CHART TO CONFORM WITH NEWEST AASHTO CRITERIA.
JULY 8, 2005 - CHANGE MADE TO OBJECT HEIGHT TO CONFORM WITH NEWEST AASHTO CRITERIA

APPROVED

Richard Tetreault
DIRECTOR OF PROGRAM DEVELOPMENT

Craig S Keller
CHIEF OF UTILITIES AND PERMITS

Michael Conner
FEDERAL HIGHWAY ADMINISTRATION

STANDARDS FOR RESIDENTIAL AND COMMERCIAL DRIVES

VERMONT AGENCY OF TRANSPORTATION

STANDARD

B-71

VERMONT

State of Vermont
Policy, Planning & Intermodal Development Division
Policy, Planning and Research Bureau
Development Review & Permitting Services Section
One National Life Drive
Montpelier, VT 05633-5001
vtrans.vermont.gov

[phone] 802-828-2653
[fax] 802-828-2456
[ttd] 800-253-0191

Agency of Transportation

May 23, 2017

Hartmont LLC
Constantine G. Scrivanos
3 Pluff Avenue
North Reading, MA 01864

Subject: Hartford, US5, L.S. 139+50 ~ 146+00 LT & RT

Dear Mr. Scrivanos:

Your application for a permit to work within the State Highway right-of-way to modify the access serving an existing lot from two accesses to a single access at L.S. 142+80 RT (directly across from Veterans Drive) to serve a new Dunkin Donuts restaurant has been processed by this office and is enclosed. Work includes the construction of a left-hand turn lane and all associated signage and pavement markings, replacement of a drainage pipe attached to a VTrans catch basin and service connections to the municipal utilities.

Please contact the District Transportation Office #4 prior to starting work in the state highway right-of-way. The telephone number in White River Junction is (802) 295-8888.

Sincerely,

Theresa Gilman
Permitting Services Supervisor
Permitting Services Section

Enclosures

cc: District Transportation Office #4
Cary Whipple, United Construction Corporation
Ann Kynor, Pathways Consulting LLC
Jo-Ann Ells, Town of Hartford

VERMONT AGENCY OF TRANSPORTATION
NOTICE OF PERMIT ACTION

Grantor (Owner/Applicant): HARTMONT LLC
Address: Street: 3 PLUFF AVENUE
City/State/ZIP: NORTH READING, MA 01864

Location of Work:

<u>Location Start</u>
Town: Hartford
Route: US5
Log Station/MM: 0139+50 ~ 0146+00 / 2.64 + 2.77

<u>Location End</u>
Town:
Route:
Log Station/MM:

Property Deed Reference: Book: 495 Page: 719

Permit ID #: 41597

Description of Work: MODIFY THE ACCESS SERVING AN EXISTING LOT FROM TWO ACCESSES TO A SINGLE ACCESS AT L.S. 142+80 RT (DIRECTLY ACROSS FROM VETERANS DRIVE) TO SERVE A NEW DUNKIN DONUTS RESTAURANT. WORK SHALL INCLUDE THE CONSTRUCTION OF A LEFT-HAND TURN LANE AND ALL ASSOCIATED SIGNAGE AND PAVEMENT MARKINGS, REPLACEMENT OF A DRAINAGE PIPE ATTACHED TO A VTRANS CATCH BASIN AND SERVICE CONNECTIONS TO THE MUNICIPAL UTILITIES

[X] Issued Permit [ ] Notice of Violation
[ ] Suspension of Permit [ ] Withdrawn

Action Date: May 23, 2017

Signature: Wayne Symonds
Authorized Representative for
the Secretary of Transportation

Location of Record: Vermont Agency of Transportation
Development Review & Permitting Services Section
One National Life Drive
Montpelier, Vermont 05633-5001

Town/City of ____________________ Clerk's Office
Received ______________ at __________ a.m./p.m.
and recorded in Book ___________ on Page ______
of land records. ______________________________
Attest: ______________________________________
Assistant Town/City Clerk

ORIGINAL

RECEIVED

AUG 27 2018

TOWN OF HARTFORD
10:36 AM

VERMONT AGENCY OF TRANSPORTATION

QUIT-CLAIM DEED

KNOW ALL TO WHOM THESE PRESENTS COME:

THAT the State of Vermont, a sovereign state, Grantor, acting by and through its Agency of Transportation, in consideration of Eleven Thousand Three Hundred Eighty Eight and No/100 Dollars ($11,388.00) paid to its full satisfaction by Hartmont, LLC, a Vermont Limited Liability Company, with a principal place of business in White River Junction, in the County of Windsor and State of Vermont, Grantee, has REMISED, RELEASED AND FOREVER QUIT-CLAIMED unto Hartmont, LLC, its successors and assigns, all right, title and interest which it, the State of Vermont, or its successors have in and to a certain parcel of land and rights therein, located in the Town of Hartford, in the County of Windsor and State of Vermont and being more particularly described as follows, *viz*:

Being part of the same land and premises conveyed to the State of Vermont by the Warranty Deed of Cashman-Cairne, Incorporated, dated March 30, 1965 and recorded in Book 60, Page 574 of the Town of Hartford land records.

Being 1,898 square feet, more or less, in the Town of Hartford, Vermont, as depicted on the survey plan entitled "Lot Line Adjustment Plan for Hartmont, LLC & State of Vermont, 352 North Hartland Road – Hartford, Vermont" dated August 25, 2017 by Pathways Consulting, LLC, to be filed in the office of the Clerk of the Town of Hartford and being more particularly described as follows:

> Beginning at an existing mag nail labeled C, thence S65°51'50"E a distance of 126.43 feet to a capped rebar, thence S25°58'20"W a distance of 17.78 feet to an iron rod, thence N66°48'50"W a distance of 78.06 feet to an iron rod, thence N44°07'30"W a distance of 51.48 to the point of beginning.

The Grantee hereby acknowledges the Grantor is not responsible for any boundary line adjustments or sub-division permits that may be required by the Town of Hartford. The Grantee also acknowledges that the Grantor is not responsible for any access permits required by the State of Vermont.

Notice of Permit Requirements. In order to comply with applicable State rules concerning potable water supplies and wastewater systems, a person shall not construct or erect a structure or building on the parcel of land described in this deed if the use or useful occupancy of that structure or building will require the installation of or connection to a potable water supply or wastewater system, without first complying with the applicable rules and obtaining any required permit. Any person who owns this property acknowledges that this lot may not be able to meet the standards for a potable water supply or wastewater system and therefore this lot may not be able to be improved.

TO HAVE AND TO HOLD all its right, title and interest in and to said quit-claimed premises, with the appurtenances, thereof, to Hartmont, LLC, its successors and assigns, forever.

HARTFORD TOWN CLERK'S OFFICE
This 27 day of August 2018
at 10:30 AM
Recorded in Bk 552 Pg 001-002
Sherry Wilson Town Clerk

ACKNOWLEDGEMENT RETURN RECEIVED
INCLUDE CERTIFICATES AND IF REQUIRED, ACT 250 DISCLOSURE STATEMENT
SIGNED Wilson CLERK
DATE 8/27/2018

AND FURTHERMORE, it said State of Vermont does for itself, its successors and assigns, covenant with Hartmont, LLC, its successors and assigns, that from and after the ensealing of these presents, it, the said State of Vermont, will have and claim no right in, or to, the quit-claimed parcel of land.

IN WITNESS WHEREOF, the State of Vermont has caused its name to be subscribed this 13th day of June, 20 18, by Joe Flynn, its Secretary of Transportation and duly authorized agent.

STATE OF VERMONT
AGENCY OF TRANSPORTATION

By: Joe Flynn
Joe Flynn, its Secretary of Transportation and Duly Authorized Agent

STATE OF VERMONT
Washington County, ss.

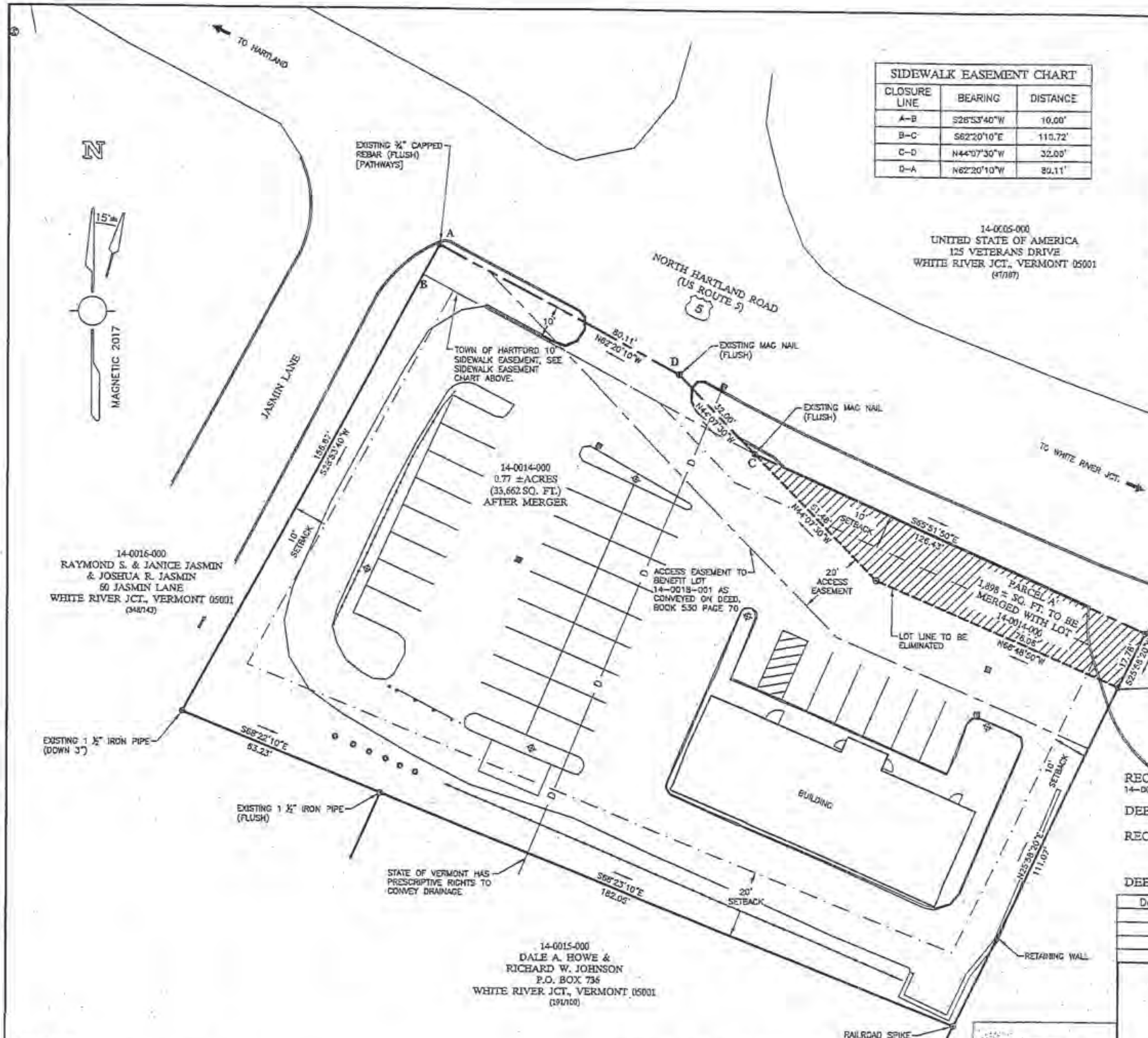
At Montpelier, this 13th day of June, 20 18, personally appeared Joe Flynn, Secretary of Transportation, and acknowledged the foregoing instrument by him, as Secretary of Transportation and duly authorized agent of the State of Vermont executed, to be his free act and deed and the free act and deed of the State of Vermont.

Before me,
Jo Ann Maguire
Notary Public
(My commission expires 2-10-19)

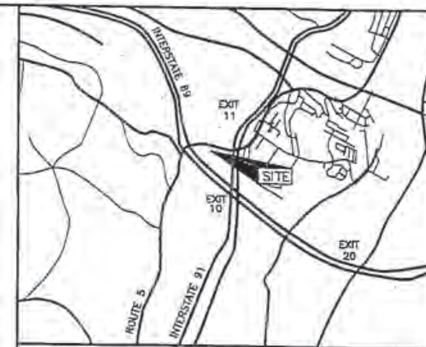
APPROVED AS TO FORM:

DATED: 6/13/2018

ASSISTANT ATTORNEY GENERAL



SIDEWALK EASEMENT CHART		
CLOSURE LINE	BEARING	DISTANCE
A–B	S28°53'40"W	10.00'
B–C	S62°20'10"E	110.72'
C–D	N44°07'30"W	32.00'
D–A	N62°20'10"W	80.11'



SITE LOCATION PLAN

PLANS OF REFERENCE:

1. THE FOLLOWING PLAN IS RECORDED IN THE HARTFORD TOWN CLERK'S OFFICE:
   A. PLAN SLIDE 781 ENTITLED "WINDSOR C. & BERTHA C. BROWN, ROUTE 5, WHITE RIVER JCT., VT." PREPARED BY K.A. LECLAIR ASSOC. INC., DATED AUGUST 23, 1977 AND LAST REVISED AUGUST 12, 1980, PROJECT NUMBER 76877.
2. REFERENCE IS MADE TO THE FOLLOWING PLANS:
   A. VERMONT AGENCY OF TRANSPORTATION RIGHT OF WAY PLAN I 91–2(2), DATED 1967.
   B. PLAN ENTITLED "SITE PLAN, ASSESSORS MAP 14 – LOT 14, U.S. ROUTE 5, WHITE RIVER JUNCTION, VERMONT," PREPARED BY MHF DESIGN CONSULTANTS, INC., DATED OCTOBER 15, 1998 AND LAST REVISED NOVEMBER 18, 1998, PROJECT NUMBER 28595.

RECORD OWNER: HARTMONT, LLC
14–0014–000
3 PLUFF AVENUE
NORTH READING, MA 01864
DEED REFERENCE: BOOK 527, PAGE 072

RECORD OWNER: STATE OF VERMONT
AGENCY OF TRANSPORTATION
133 STATE STREET
MONTPELIER, VERMONT 05602
DEED REFERENCE: BOOK 60, PAGE 574

Date	Revision	By

LEGEND:

EXISTING IRON PIPE OR REBAR	AS NOTED
UTILITY POLE	
RIGHT–OF–WAY LINE	
BOUNDARY LINE	
EASEMENT LINE	
BUILDING SETBACK	
DEED REFERENCE	(BOOK/PAGE)

SCAN REFERENCE #
N662C20170825HartmontVtAgencyTrans

I HEREBY CERTIFY TO THE BEST OF MY KNOWLEDGE AND ABILITY THAT A VERMONT RURAL CLASS SURVEY WAS PERFORMED ON PARCEL A SHOWN HEREON. THIS SURVEY IS BASED ON THE FIELD NOTES OF SAID SURVEY AND THE BOUNDARY LINES ARE CONSISTENT WITH EXISTING MONUMENTATION AND THE REFERENCED DEEDS AND PLANS EXCEPT AS NOTED. I FURTHER CERTIFY THIS PLAT CONFORMS TO 27 VSA 1403 (a) AND (b).

July 19, 2018
DATE

J.E. Nelson
LICENSED LAND SURVEYOR

STATE OF VERMONT JOSEPH ... LAND SURVEYOR

LOT LINE ADJUSTMENT PLAN FOR
HARTMONT, LLC &
STATE OF VERMONT
352 NORTH HARTLAND ROAD – HARTFORD, VERMONT

0 20 40 60 80 100

AUGUST 25, 2017 SCALE: 1"= 20' PROJ. NO. 12527

PATHWAYS CONSULTING, LLC
240 MECHANIC STREET, SUITE 100
LEBANON, NEW HAMPSHIRE 03766 N662C

Received and Recorded by Tracy Allen Asst Town Clerk August 27, 2018 @ 10:30 AM

APPENDIX E
Environmental-Cultural Resources

VERMONT

Brennan Gauthier
VTrans Archaeologist
Vermont Agency of Transportation
Project Delivery Bureau
Environmental Section
1 National Life Drive
Montpelier, VT 05633
tel. 802-279-1460
Brennan.Gauthier@Vermont.gov

To:	Lee Goldstein, VTrans Environmental Specialist
From:	Brennan Gauthier, VTrans Senior Archaeologist
Date:	January 28th, 2019
Subject:	Hartford HES 0113 (77) - Archaeological Resource ID

Dear Lee,

I have completed my background investigation of the safety scoping project of VT US-5 in Hartford, Windsor County, Vermont. The scope of the project has yet to be identified.

In order to determine archaeological sensitivity within the projects' area of potential effect (APE), I conducted preliminary desk review of the site and neighboring resources consulting the VDHP Environmental Predictive Model, the Online Resource Center (ORC), Historic Maps such as Beers and Wallings, and additional documentation on the history of Hartford and the construction of US-5. Due to an undefined scope, the assumed APE was 50m from the surrounding roadways.

Much of the area consists of dense urbanization, with consistent industrialization to surrounding natural environments. This proves consistent throughout the history of Hartford and White River Junction according to details from historic maps that depict similar circumstances in certain locations within the APE. A visual analysis of the immediate roadway identifies drainage slopes, and soils that appear manipulated and disrupted as a result of persistent construction and development projects both state and privately funded; in fact, this project proposed by VTrans overlaps with multiple alternative VTrans nominated projects established to improve the condition of the roadway and/or neighboring structures. Therefore, it is predicted the soils surrounding the immediate roadway contain heavy disturbances that exempt most of the project area and APE from archaeological consideration at this time.

However, a distinguished area located near the southern end of the project contains evidence supporting archaeological potential. Class 2 wetlands neighbor this area, along with apparent natural, undisturbed areas (Figure). Should the scope of the project exceed the predicted APE, a new assessment of archaeological impacts will be required. As always, feel free to reach out with any questions or comments as they arise.

Sincerely,

Brennan

Brennan

Resource ID prepared by Alexandria Crowell, Archaeology Apprentice III

VTrans Working to Get You There
Vermont Agency of Transportation

Images and Illustrations

Figure 1: Orthoimage of project location (red).

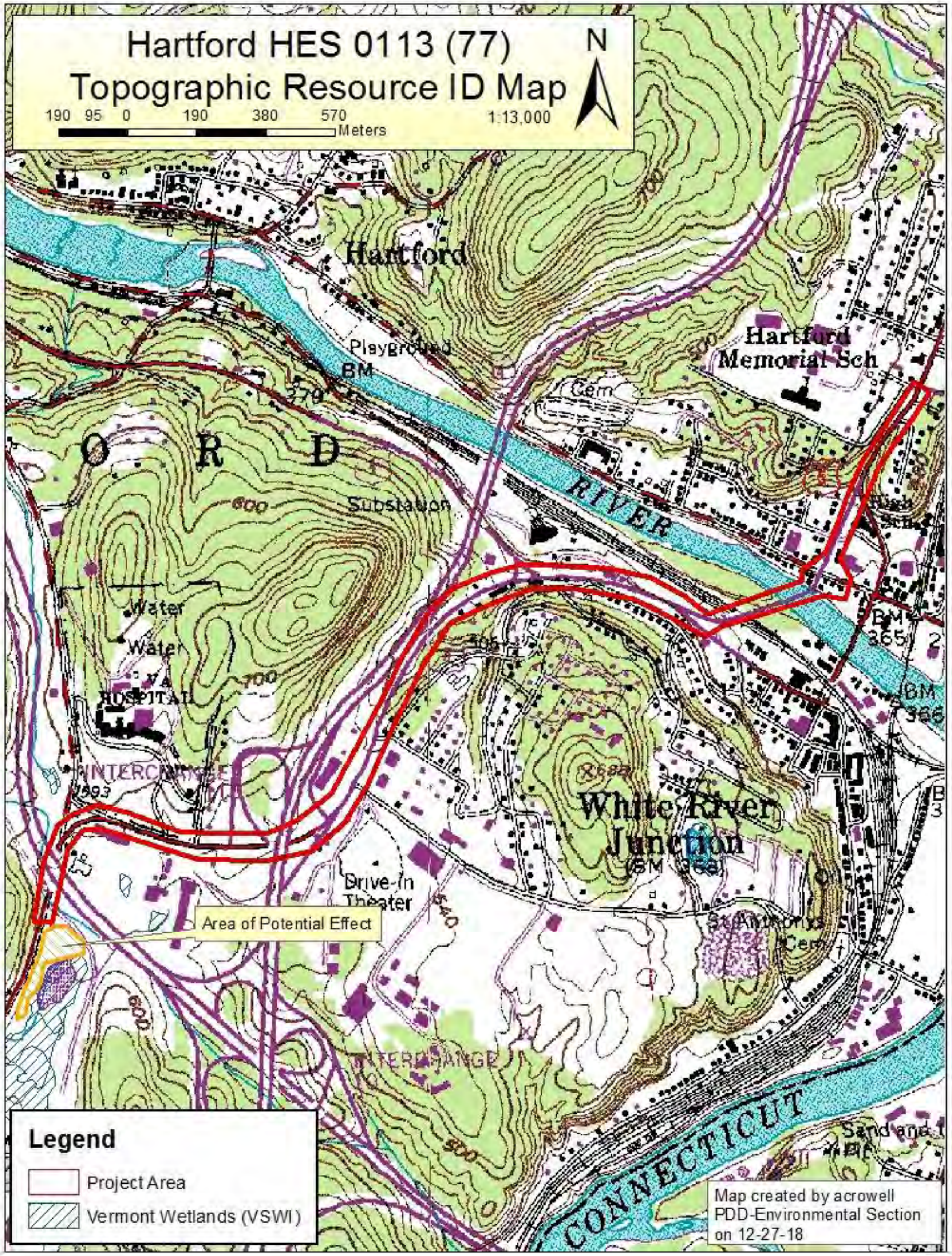


Figure 2: Topographic map depicting project location (red), and surrounding area.

Figure 3: Orthoimage depicting area of undisturbed soils predicted as archaeologically sensitive (orange) in relation to neighboring wetlands (blue) and the project location & APE (red).

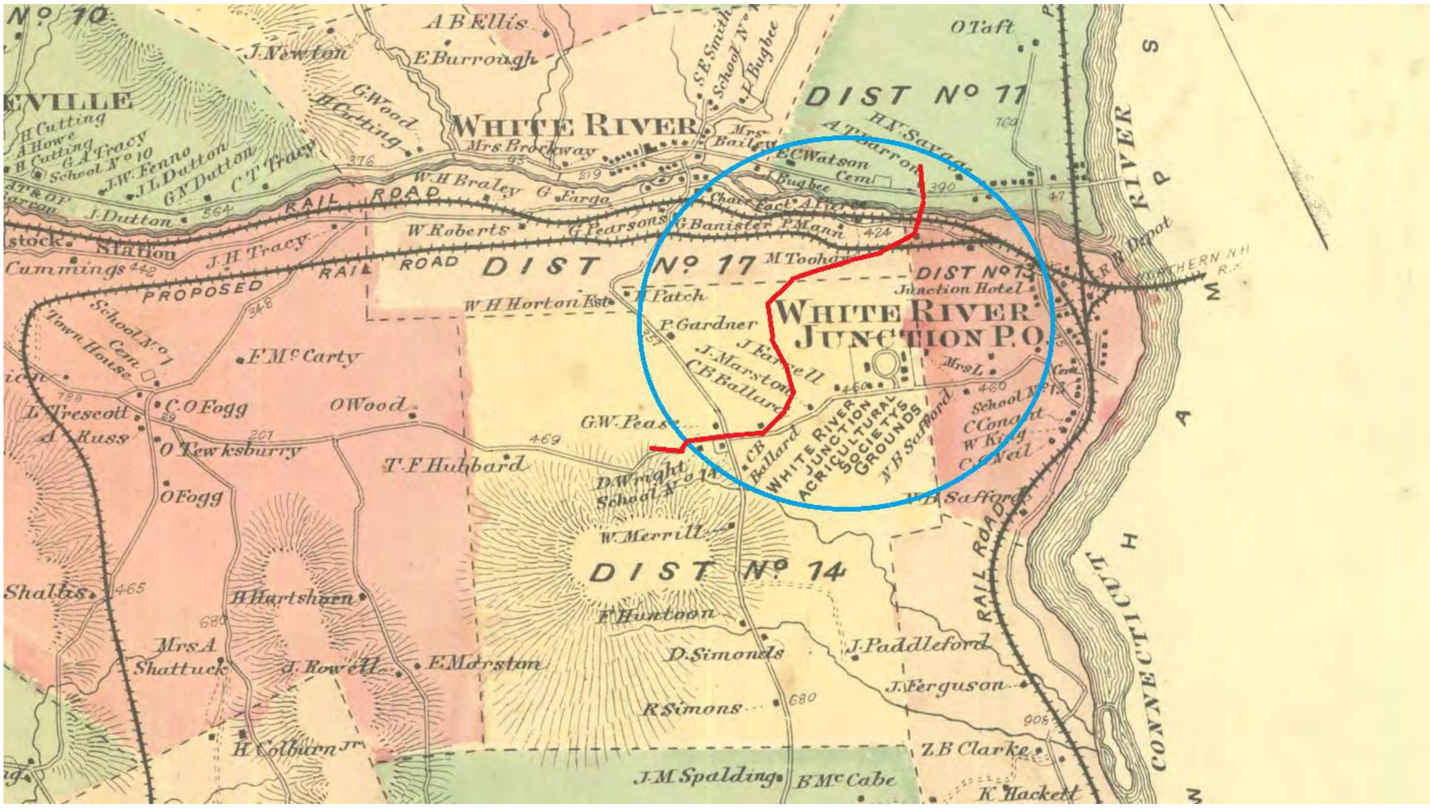
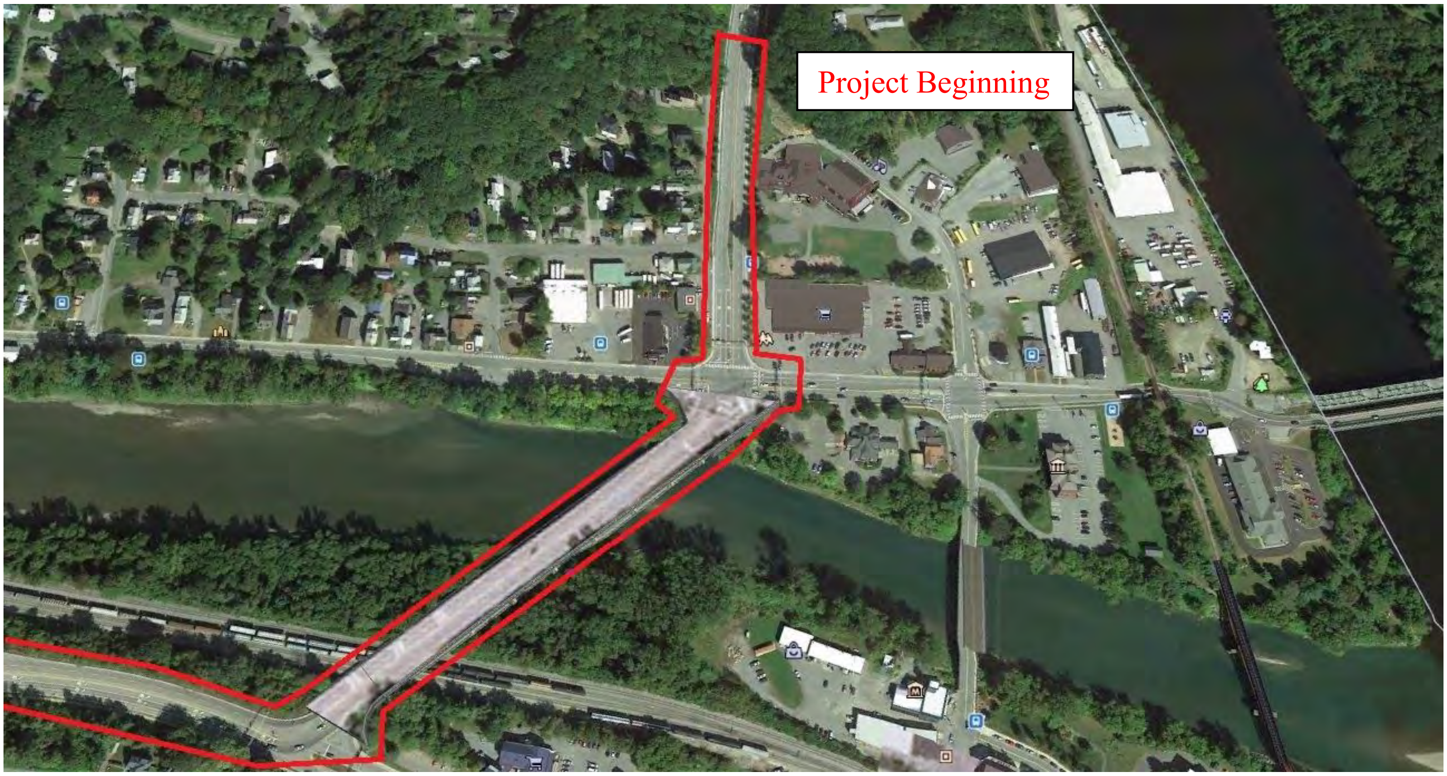
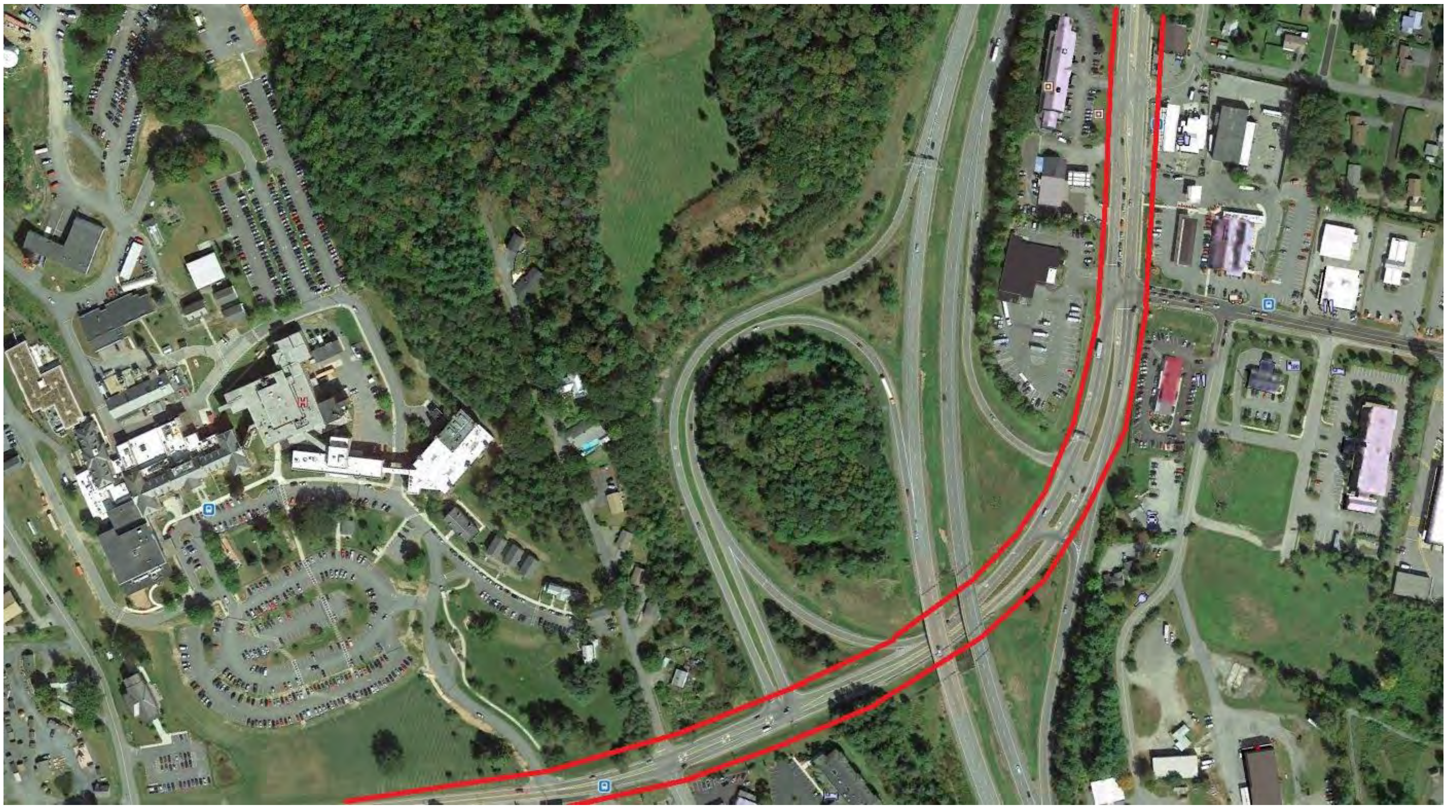
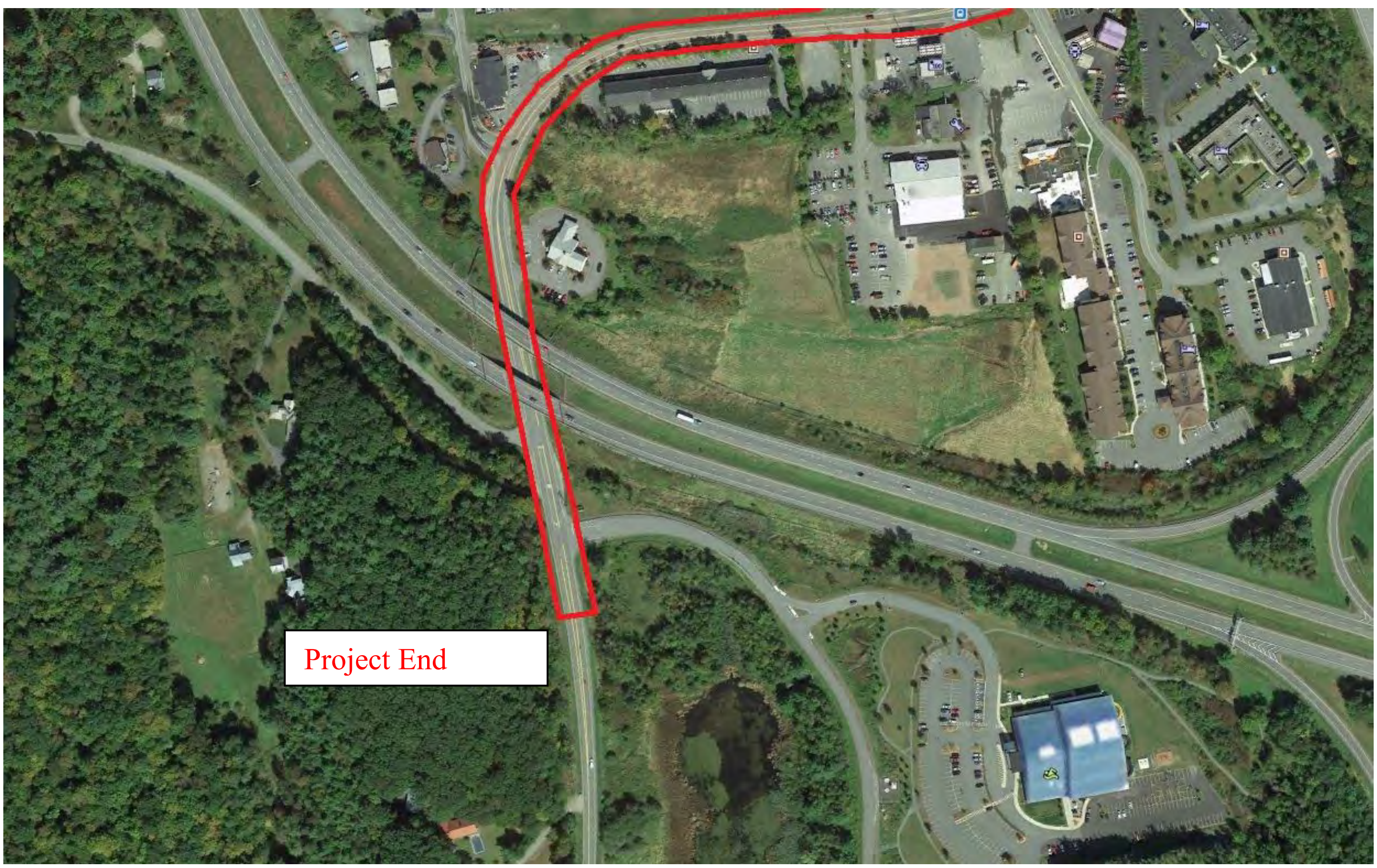


Figure 4: Historic Beers Map depicting White River Junction and project area (red). Area of heavy urbanization depicted in both northern and southern regions of the project.

Images below captured from Google Earth
to better depict level of urbanization and industrialization of area.
Project boundaries illustrated in red.






Project End

Alexandria Crowell
VTrans Archaeology Technician Apprentice III

Vermont Agency of Transportation

alexandria.crowell@vermont.gov

Project Delivery Bureau - Environmental Section
One National Life Drive
Montpelier, VT 05633-5001

www.vtrans.vermont.gov

Historic Preservation Resource Identification Memo

To: Lee Goldstein, VTrans Environmental Specialist

Cc: Kyle Obenauer, VTrans Historic Preservation Officer

Date: February 22nd, 2019

Subject: Hartford HES 0113 (77) 18T173

Lee,

This Resource Identification effort is being undertaken to identify cultural resources within multiple broad preliminary survey areas that could possibly be impacted by a future VTrans project along Vermont US-5 and US-4 in Hartford, Windsor County, Vermont. Once a project has been defined at the conceptual design phase, VTrans' Cultural Resources staff will be able to determine a formal APE for purposes of Section 106 and Section 4(f) review.

Multiple historic resources (Figure 1) were identified within the surrounding environment of the project Area of Potential Effect (APE):

i. Hartford High School
ii. Wright Tomb
iii. 66 Barnes Ave Residence; and,
iv. Terraces Historic District

<u>The historic resources identified would be unaffected by a future project within the preliminary survey area at Figure 1, below.</u>

In order to determine eligibility, VTrans' Cultural Resources staff performed preliminary archival research by consulting multiple agents such as the National and State Registers of Historic Places (NRHP/SRHP), the Vermont Division for Historic Preservation's Online Resource Center, as well as further documentation regarding the history of Hartford and White River Junction. Furthermore, staff conducted a field visit on February 8th, 2019 to identify historic resources in relation to the project's estimated scope. Furthermore, past planning; the magnitude and nature of the potential undertaking(s) and the degree of federal involvement; the nature and extent of potential effects on historic properties; and, the likely nature and location of historic properties within each survey area have also been considered.

Former Hartford High School

The former Hartford High School is a 20th century Georgian revival building located to the north of the White River along US-5 (Figure 4). The building sits in a heavily developed area and the property is bordered by a modern chain link fence (Figure 5). The school currently serves as the White River Elementary School and has a playground on the property grounds; however, this playground is exempt from independent Section 4f consideration as it remains within the chain link fence and is a private playground owned by the school (Figure 6).

Wright Tomb

The Wright Tomb possesses historic significance as it holds the remains of the American Revolutionary War Major David Wright, a resident of Hartford, VT, and his immediate family. The tomb originally was a dry wall construction, with mortar added later. The burial is half-domed, under a mound, and the entrance is covered with a block of marble installed before 1977, with little known regarding the previous entry. The front façade is made of stones which were split before they were fitted into place (Figure 7). This historic burial resides along Veterans Administration Road and lies outside the estimated APE, approximately 50m. from the project location on US-5. Both historic structures lie outside the White River Junction Historic district (Figure 3).

Residence at 66 Barnes Ave

The residence at 66 Barnes Ave is not listed under the State nor National Register of Historic Places; however, it possesses historic significance as presented under the National Register of Historic Places criteria (Figure 11a). The building was established 119 years ago and retains original interior and exterior features and expresses a Gambrel style home which was common during 1900. Barnes Ave runs parallel to US-5, separated by thin vegetation and a chain link fence (Figure 11b).

Terraces Historic District

As illustrated in the National Register of Historic Places, the Terraces Historic District is comprised of Fairview Terrace, Hillcrest Terrace, Maplewood Terrace, Forest Hills Ave, and Chellis Street. In relation to the project location, Fairview and Maplewood Terrace are within proximity to the area of potential affect, as they run parallel to US-5. Most of these properties are separated by steep slopes covered with vegetation. The Terraces Historic District contains 62 contributing properties as recognized under the State and National Register of Historic Places (Figure 14).

Round House

One additional structure over 45 years of age was identified within the survey area: a round house resides along the railway currently situated near an unidentified private road stemming from US-5. The roundhouse was built in 1929, and aimed to house type 2-10-4 steam locomotives, the largest trains moving through New England at the time [1]. Although this building existed as one of the remaining two round houses in the state of Vermont (Figure 15), it does not retain sufficient historic integrity for inclusion in the NRHP, or as a contributing resource to a current or

[1] "The CV Roundhouse". *Hartford Historical Society Newsletter*; Volume 21, No. 4. March-April 2009.

potential historic district due to severe alterations and extensive internal and structural damage as the result of a tire fire on November 2nd, 2008 (Figure 16). No other buildings, structures, or objects over 45 years of age were identified within the preliminary survey areas.

Historic Context

Hartford and White River Junction maintain rich historic integrity dating back to the town's charter in 1761. Once a farming community, White River Junction is renowned for its industrial boom and economic inflation. Five railroad lines from 1847-1960 established White River Junction as an essential railroad community to the state of Vermont: the Vermont Central Railway and Connecticut Railroad, Connecticut and Passumpsic Rivers Railroad, the Northern New Hampshire Railroad, and Woodstock Railroad. Utilizing both passenger and cargo trains, the area grew into a community centralized around rail and mechanic production and the wealth of urbanization custom of rail development. This growth was gradual and linear, and by the 20th century "(White River Junction) became the primary cultural, political, and commercial center of Harford" [2]. White River Junction therefore proves notorious and a key influencer in Vermont's industrial age, and currently remains one of the states most provincial and economically stable areas.

Former Hartford High School

As illustrated in the provided historical context, Hartford and White River Junction underwent a prosperous socioeconomic inflation caused by its role as a major railroad junction. Constructed in 1907, the Hartford High School portrays the period of economic commerce that occurred between 1900-1925, and booming prosperity in Hartford and White River Junction from 1900-1925. During this time, the Hartford School Board erected four new school buildings, and as a result of this economic expansion much of the architectural design was influenced by the school boards' desire to establish "modern educational facilities"[3].

Due to this desire in producing an aesthetic complimentary of the social and economic circumstances of the time, the Hartford High School possesses the characteristics of the Georgian Revival style. This style is a popular structure design frequent during the turn of the 20th century, which mimics classical architecture and serves as a symbol of affluence. The walls are made of brick with asphalt tiles and a hip-roof design. Due to the nature of its construction, the structure retains high local significance as an acute representation of the prosperous economy at the time; therefore, the structure retains historic integrity and significance necessary for inclusion in the National Register of Historic Places (NRHP) under Criteria A and C (refer to above).

Wright Tomb

Major David Wright (Figure 10) served in the Continental Army during the American Revolutionary War from 1775-1783. Born in 1749, Major Wright played an incalculable role in the establishment of Hartford and is currently regarded as one of the town's founding members. Along with his wife Hannah (Figure 11), he occupied 600 acres of land primarily utilized for agriculture, where he built a large home that was "said to be the best house in town," and

---

[2] White River Junction Historic District; *Historic Tour No. 1 in the Town of Hartford, Vermont Brochure*; 2015.

[3] State Register of Historic Places, Hartford, Vermont; 1977. Pg. 253.

"included a Masonic hall where Masonic meetings were held" [4]. While the home is no longer standing, the tomb remains as a final resting place for Major David Wright, his wife Hannah Bailey Wright, their son David Wright and his wife Elizabeth, and their son Bela Wright with his wife Betsy Wright. Detailed both primary and secondary accounts say Major David Wright pursued agricultural work following the war; however, it is suggested during times of strife, such as conflict with indigenous peoples, the Wright family were regarded as leaders among their neighbors.

Therefore, it is indicative Major David Wright and family served as significant members of early Vermont colonialist society, fortifying the area of Hartford and White River Junction into a new township. Assuredly it is presumed Major David Wright is the progenitor of the modern Wright generation who live in Hartford and the surrounding areas. Major Wright is not only an important local figure in Hartford history, but his family and their narrative portray Vermont life during the Revolutionary War and the fortification of Vermont as the 14th colony in the newly developed United States.

Furthermore, the Historic Context of Vermont: Burial Vaults provides concise qualifications to properly deem burials, tombs, or resting vaults as retaining historic significance under guidelines erected by the State of Vermont. The document, written in 1977, provides details and examples pertaining to the criteria in which burial vaults are considered historically significant as found under the National and State Registers of Vermont (Figure 9). The Wright Burial Tomb is listed under the historic context as an example of such burial vaults, acting as a "comparative type" to assist in future consideration processes. Thus, its consideration for inclusion in the NRHP falls under Criteria A, B, & C, as indicative of its attachments to:

A. specific moment in Vermont history such as the American Revolutionary War and settlement of Hartford, Vermont; and,
B. a person or persons of outstanding historic importance; and,
C. possesses the qualities necessary to be deemed architecturally significant.

66 Barnes Ave

The residence located at 66 Barnes Ave remains the only historic building with features that qualify the building as historically significant as listed according to criteria under the National Register for Historic Places. Much of the interior and exterior of the home, aside aesthetic alterations, is that of original construction 119 years ago (Figure 13). The two-story residential building with a tall, shingle roof ending in a flared eave and a cornice return. The exterior is a clapboard shake, wood siding and sits atop a granite foundation. Built in 1900, the residence exemplifies a classic gambrel style colonial, a sub-type of the Colonial Revival style and a popular design common during the 19th-20th century (Figure 12). The colonial revival symbolized a patriotic growth in American history, and a desired simplicity reflective of the 18th and 19th century. Thus, the residence qualifies as historically significant and a contributing property under Criteria C in the National Register of Historic Places.

---

[4] The Old and the New: An Occasional Magazine Devoted to the Institutions and History of the Town of Hartford, Vermont, Volumes 1-3; 1900; pgs 25-30.

If scope is expected to change, further evaluation of historic resources may be necessary. Please let me know if there are any questions.

Sincerely,

ALEXANDRIA CROWELL

Alexandria Crowell
VTrans Archaeology Technician Apprentice III
alexandria.crowell@vermont.gov

Images and Tables

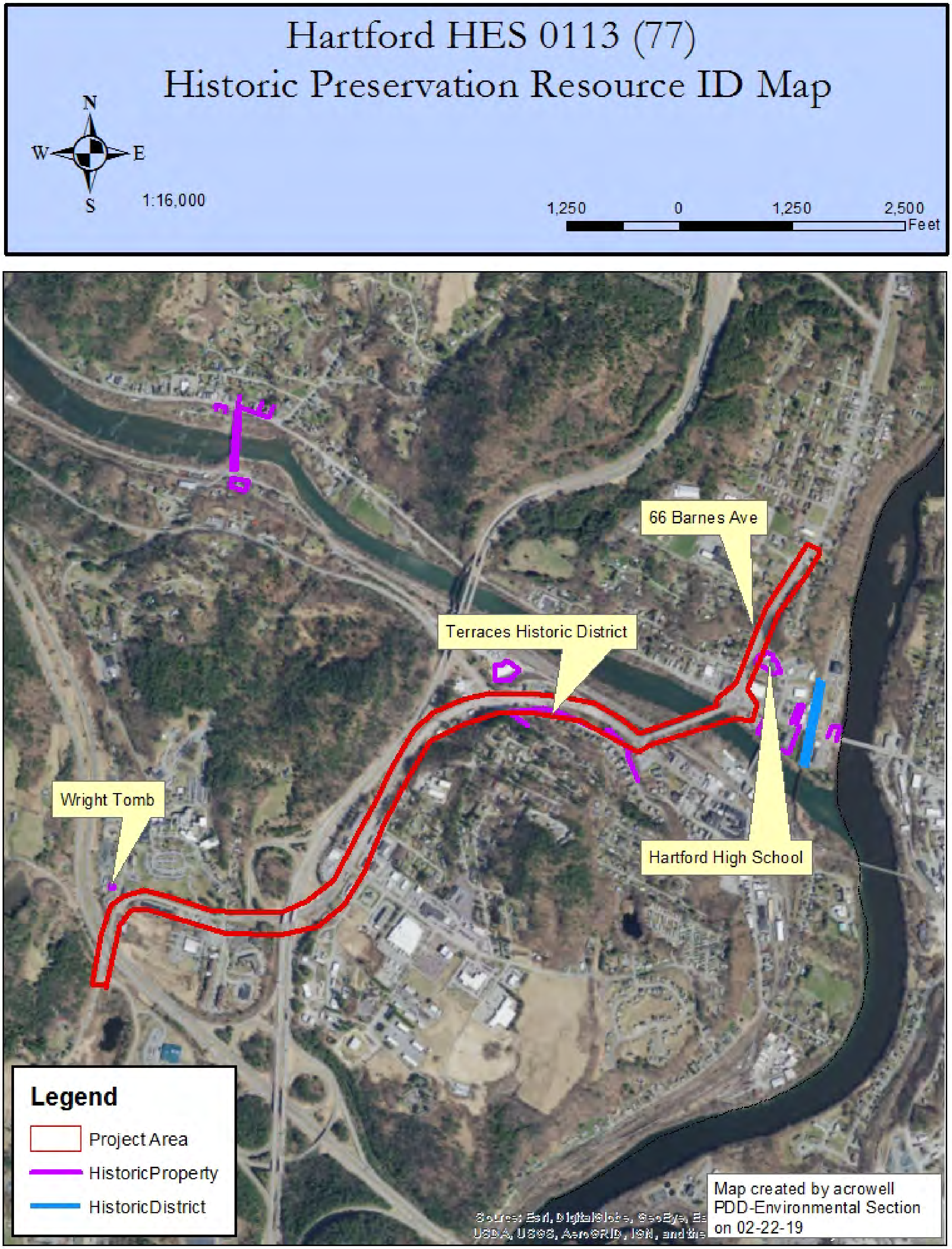


Figure 1. Orthophoto map portraying identified historic resources

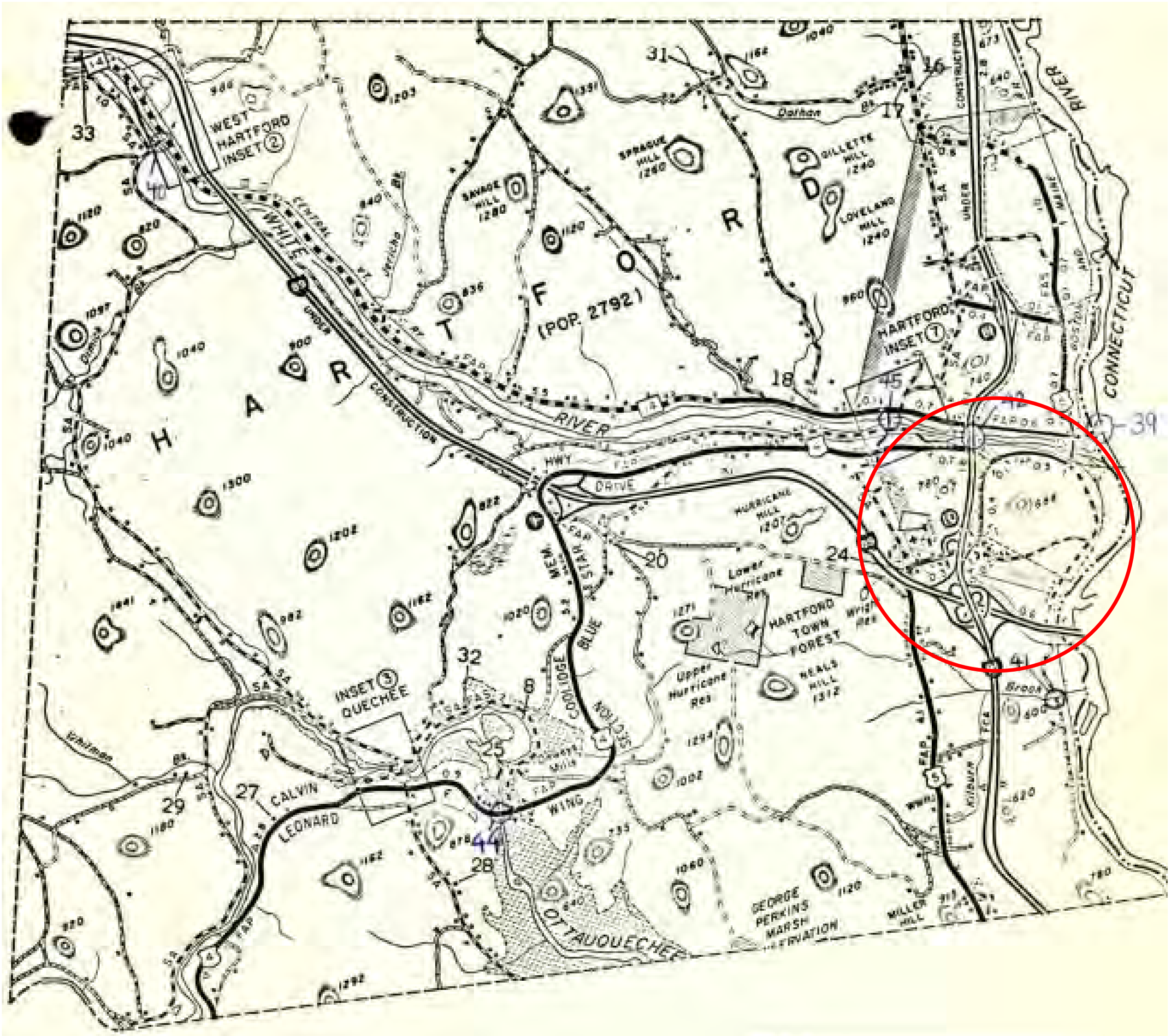


Figure 2. Aerial map of Hartford, VT, with project area circled in red. Map taken from State Register of Historic Places, 1979.

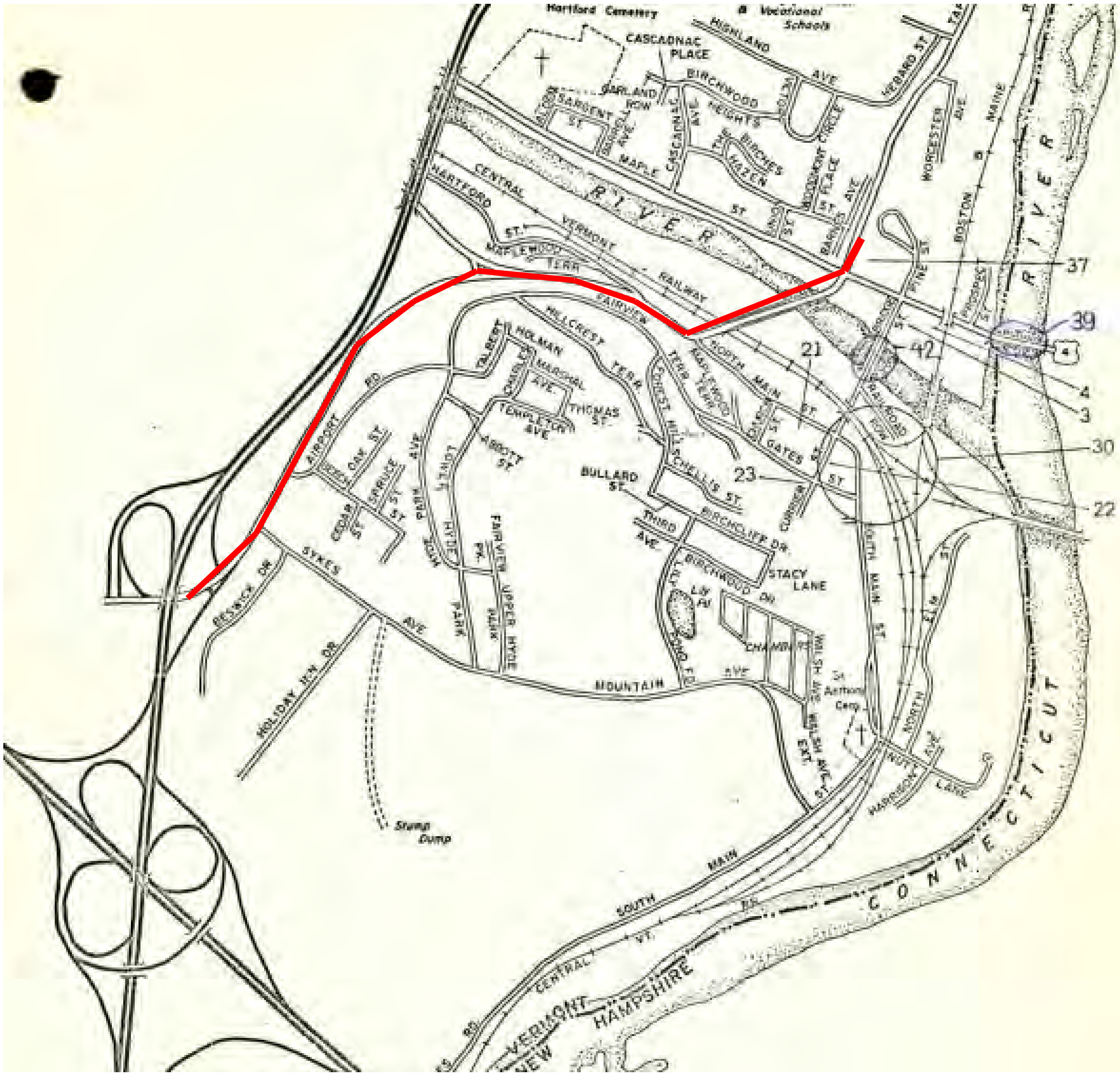


Figure 3. Focused aerial map of project area (red) and neighboring historic resources plotted on map. Hartford historic district circled in black, containing historic property 22 and 30 in the State Register of Historic Places (SRHP).

Figure 4. Image depicting Hartford High School, dated to 1960s. Georgian revival style clearly identifiable. Photograph taken from SRHP.

Figure 5. Image depicting Hartford High School in proximity to US-5. Chain link fence is visible, and distance from the roadway to the property clearly defined. Photograph taken during field visit on February 8th, 2019.

Figure 6. Image depicting the Hartford school's playground in proximity to a bus stop. Photograph taken from the sidewalk adjacent to US-5, facing east; February 8th, 2019.

Figure 7. Image of Wright's Tomb; February 8th, 2019.

Figure 8. Image depicting Wright's Tomb in proximity to the intersection of US-5 and Veterans Administration Road. Neighboring urbanization visible.

Figure 9. Wright's Tomb exemplifies a half-mound burial with tightly laid stones and marble work at its front: a classic burial vault type as listed in the Historic Context of Burial Vaults for the State of Vermont.

MAJOR DAVID WRIGHT.

Figure 10. Image of Major David Wright; taken from The Old and the New: An Occasional Magazine Devoted to the Institutions and History of the Town of Hartford, Vermont, c. 1900.

Major DAVID WRIGHT'S WIFE.

Figure 10. Image of Hannah Wright, wife of Major David Wright; taken from The Old and the New: An Occasional Magazine Devoted to the Institutions and History of the Town of Hartford, Vermont, c. 1900.

Figure 11a. Image depicting the residence at 66 Barnes Ave, built in 1900.

Figure 11b. Image capturing chain link fence and US-5 in proximity to 66 Barnes Ave.

Figure 12. 66 Barnes Ave facing front gable, with exterior features magnified.

Figure 13. Interior of building located at 66 Barnes Ave. Original features visible with minor modifications.

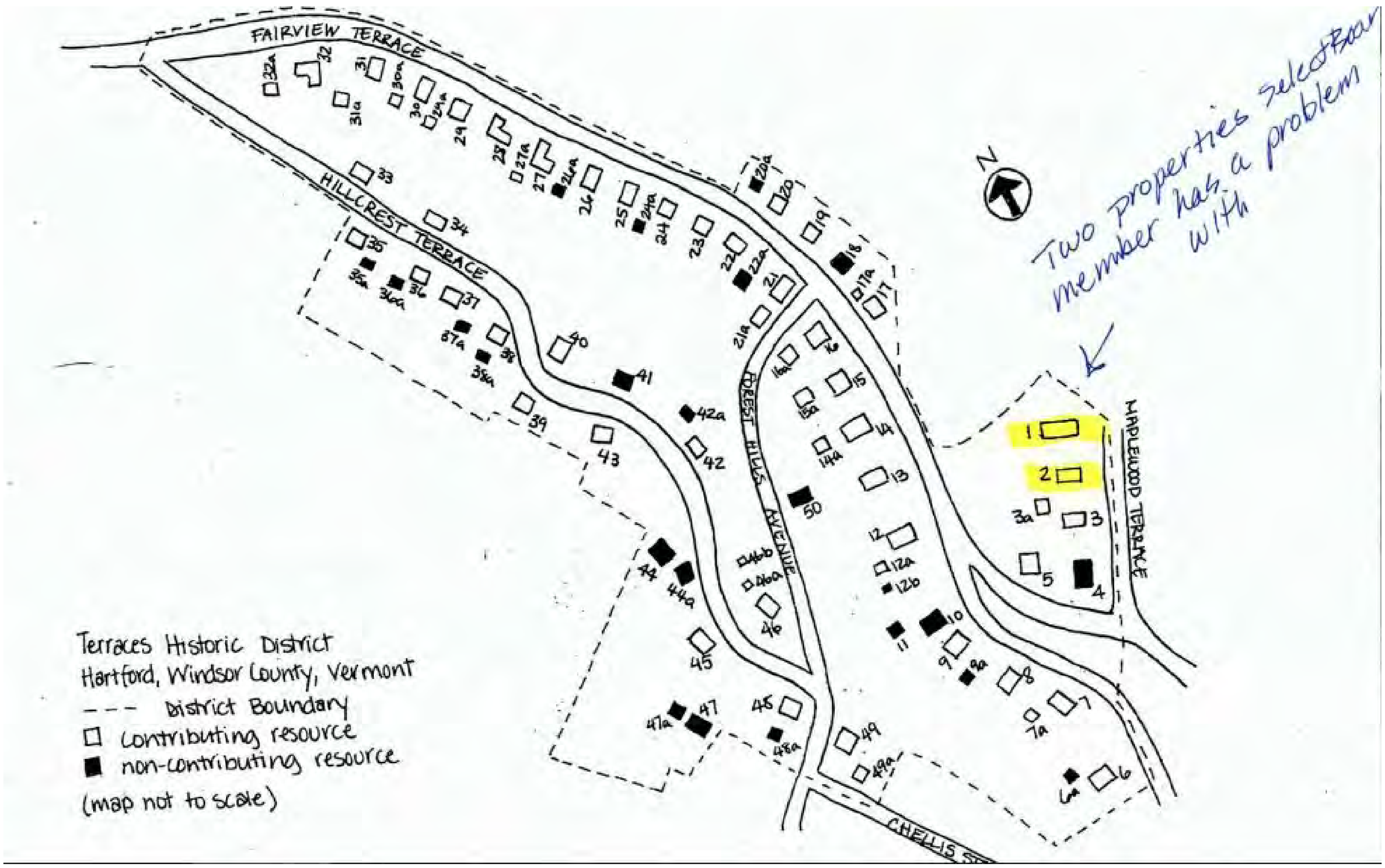


Figure 14. Terraces Historic District with mapped contributing and non-contributing resources. Image captured from the National Register of Historic Places.

Figure 15. Image of the Roundhouse in Hartford, c. 1960s. Photograph taken from SRHP.

Figure 16. Image depicting remains of Roundhouse in Hartford after tire fire damaged most of interior and part of exterior.

State of Vermont *Agency of Transportation*
Environmental Section
One National Life Drive [phone] 802-279-0583
Montpelier, VT 05633-5001 [fax] 802-828-2334
www.aot.state.vt.us [ttd] 800-253-0191

To: Lee Goldstein, VTrans Environmental Specialist
From: Emily Peck, VTrans Stormwater Management Engineer
Date: February 12th, 2019
Subject: Hartford HES 0113(77) - Stormwater Resource ID Review

Project Description: I have reviewed the project area for Hartford HES 0113(77)) for stormwater related regulatory and water quality concerns. The project involves a two-mile corridor of US 5 in Hartford, VT. My evaluation has included the review of existing imagery and mapping (ANR Natural Resource Atlas, VTrans Operational Stormwater Permits & VTrans Corridor Needs) to capture existing stormwater features and existing drainage. A field visit was completed on 2/8/18 for reconnaissance.

Figure 1.

Regulatory Considerations

Permits

There are three stormwater permits near the proposed site area and effort to avoid impacting these permits should be made.

The ✚ symbol in figure 1 shows the location of three operational stormwater permits.

- 1 Permit number 7824-9015 is located at the intersection of US 5 and Sykes Mountain Ave. This is a VTrans operational stormwater permit issued to the town of Hartford for 2.43 acres of impervious. A copy of the authorization can be found at the end of this document.
- 2 Permit number 3004-9010 is located adjacent to the project area in the southwest region of the I-91 interchange.
- 3 Permit number 3824-9010 is located adjacent to the project area.

Watershed Regions

The attached Watershed Map shows the delineation of the tactical basin regions. The western section of the corridor is in the Ottauquechee-Black-CT Direct region and the eastern section of the corridor is in the White Region.

Impaired and Stressed Waters

The Connecticut River is listed as an impaired water due to altered flow from the Wilder Dam. This should not be a concern for this project and no specific treatment is required for discharges to this receiving water.

The White River is listed as a stressed water due to elevated bacteria levels. The pollutant has been identified as E.Coli however, the sources are unknown. Should stormwater treatment be required in areas where the White River is identified as the receiving water treatment options with bacteria removal efficiencies should be evaluated.

Designated Areas

The area shaded in light blue ( ) in figure 2 and in the Watershed Map show the areas that are designated as class A Public Water Supplies.

Figure 2.

The following are not noteworthy stormwater regulatory concerns at this time.

This project site is not within an MS4 area.

Existing Drainage
This corridor is in an urbanized area where most of the roadway within the proposed limits is curbed; stormwater runoff is collected in closed drainage systems.

Left: Looking South on US 5 at the intersection with Maple St. Straight ahead is the US5 bridge over the White River.

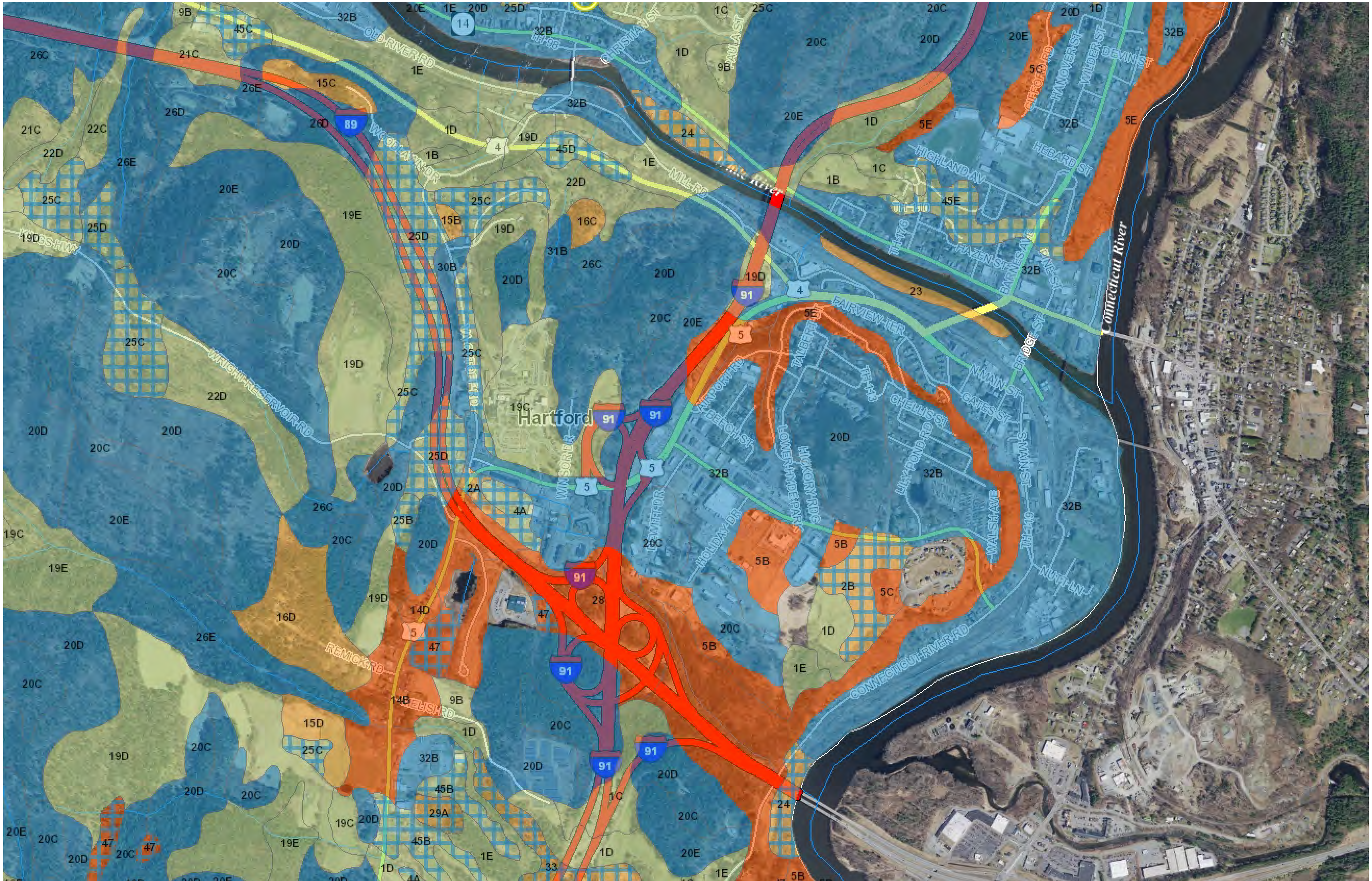
Right: Looking South on US 5 at the intersection with US 5 and Sykes Mountain Ave. Location of Town of Hartford Operational stormwater permit 7824-9015.

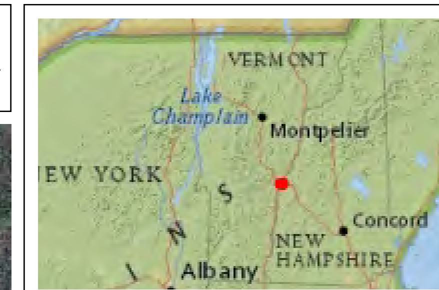
Hydrologic Soils
As it is possible that this corridor may require operati
the project corridor was performed using the ANR atl
the next page. It was found that the soils along the pr
soils.

Hydrologic Soils Map

Vermont Agency of Natural Resources

vermont.gov





LEGEND

Soils - Hydrologic Groups

- A
- A/D
- B
- B/D
- C
- C/D
- D

Roads

- Interstate
- Principal Arterial
- Minor Arterial
- Major Collector
- Minor Collector
- Local
- Not part of function Classification System

Stream

Town Boundary

1: 15,630

1in = 1302 ft.
1cm = 156 meters

794.0 | 0 | 397.00 | 794.0 Meters

WGS_1984_Web_Mercator_Auxiliary_Sphere

DISCLAIMER: This map is for general reference only. Data layers that appear on this map may or may not be accurate, current, or otherwise reliable. ANR and the State of Vermont make no representations of any kind, including but not limited to, the warranties of merchantability, or fitness for a particular use, nor are any such warranties to be implied with respect to the data on this map.

THIS MAP IS NOT TO BE USED FOR NAVIGATION

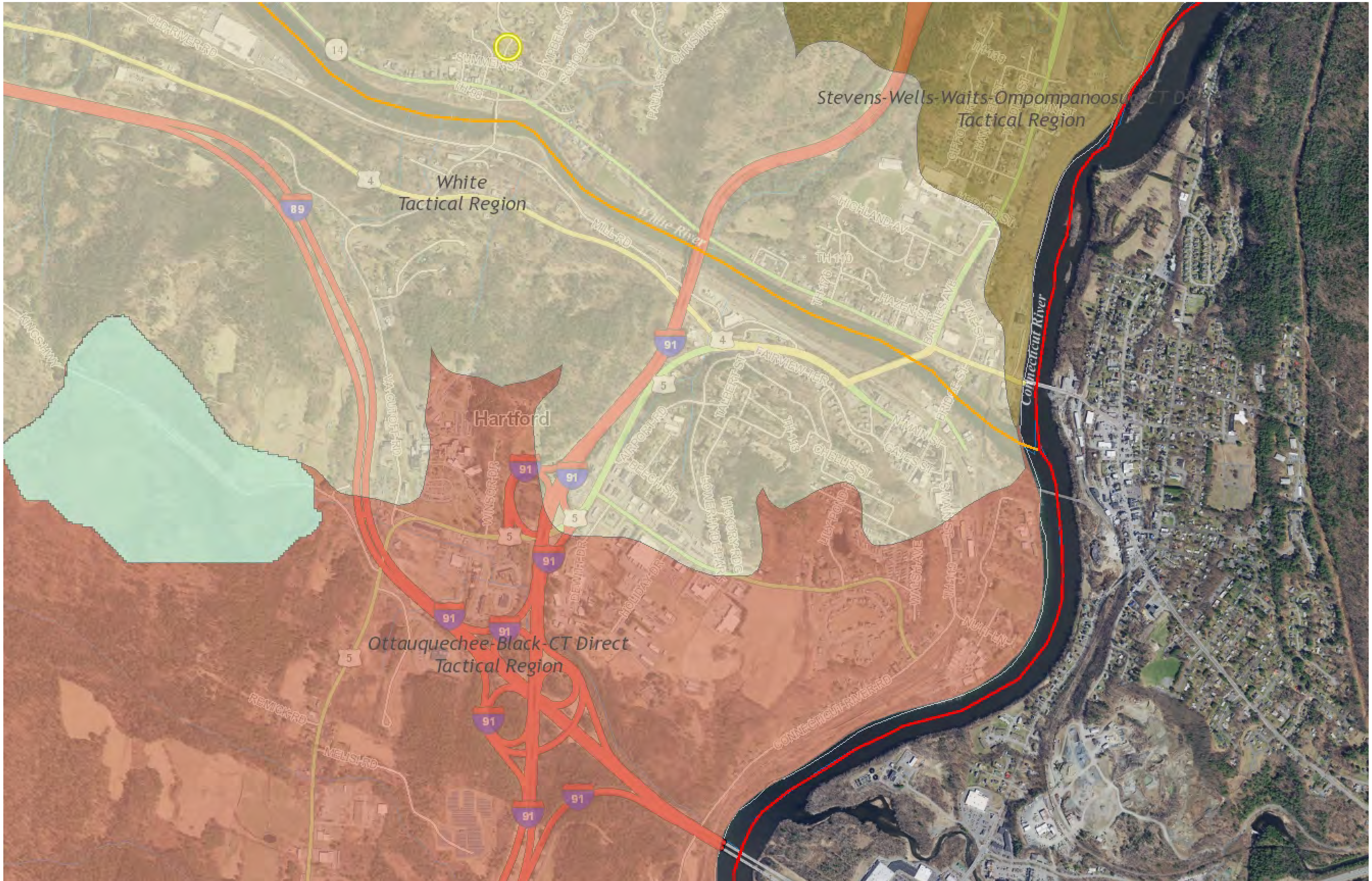
NOTES

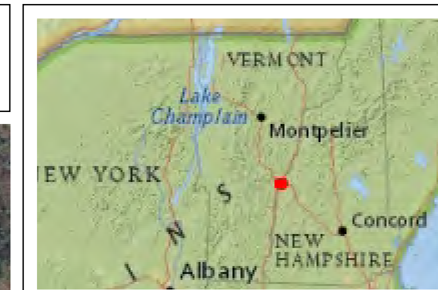
Map created using ANR's Natural Resources Atlas

Watershed Map

Vermont Agency of Natural Resources

vermont.gov





LEGEND

- 303(d) List of Impaired Streams and Riv
- Priority Waters List (Streams and River
  - Part B (impaired TMDL not required)
  - Part D (impaired with approved TMDL)
  - Part E (altered exotic species)
  - Part F (altered flow regulation)
- Stressed Waters List (Streams and Rive
- Class A(1) Ecological Waters
- Class A(2) Public Water Supplies
- Mixed Classifications for Uses
- Tactical Basin Planning
  - Batten Kill-Walloomsac-Hoosic
  - Lake Memphremagog
  - Lamoille
  - Missisquoi
  - Northern Lake Champlain
  - Southern Lake Champlain
  - Winooski
  - Otter Creek-Little Otter Creek-Lewis Creek
  - Deerfield-Connecticut Direct
  - Ottauquechee-Black-CT Direct
  - Stevens-Wells-Waits-Ompompanoosuc-CT Dire
  - Passumpsic
  - Upper Connecticut
  - West-Williams-Saxtons-CT Direct
  - White
- Roads
  - Interstate
  - Principal Arterial
  - Minor Arterial
  - Major Collector
  - Minor Collector
  - Local
  - Not part of function Classification System
- Stream
- Town Boundary

1: 15,630

1in = 1302 ft.
1cm = 156 meters

794.0 0 397.00 794.0 Meters

WGS_1984_Web_Mercator_Auxiliary_Sphere

DISCLAIMER: This map is for general reference only. Data layers that appear on this map may or may not be accurate, current, or otherwise reliable. ANR and the State of Vermont make no representations of any kind, including but not limited to, the warranties of merchantability, or fitness for a particular use, nor are any such warranties to be implied with respect to the data on this map.

THIS MAP IS NOT TO BE USED FOR NAVIGATION

NOTES

Map created using ANR's Natural Resources Atlas

Permit Number: 7824-9015
PIN: NS17-0025

VERMONT DEPARTMENT OF ENVIRONMENTAL CONSERVATION
AUTHORIZATION TO DISCHARGE UNDER
GENERAL PERMIT 3-9015

A determination has been made that the applicant(s):

Town of Hartford
173 Airport Road
White River Junction, VT 05001

And

Vermont Agency of Transportation
1 National Life Drive
Montpelier, VT 05633

Impervious Area: 2.43 acres

meets the criteria necessary for inclusion under General Permit 3-9015. Hereinafter the named applicant shall be referred to as the permittee. Subject to the conditions of General Permit No. 3-9015, the permittee is authorized to discharge stormwater as described herein:

Project Name:	Hartford STP 0113(59)S
Project Location:	Intersection of US Route 5 and Sykes Mountain Avenue in Hartford, Vermont
Receiving Waters:	White River
Manner of Discharge:	S/N 001: This discharge point collects stormwater runoff from the entire proposed project via a closed drainage system and outlets to the pre-treatment area of a proposed gravel wetland. The proposed gravel wetland discharges to the same ditch as the existing closed drainage system that flows to an unnamed tributary to the White River. The proposed closed drainage system collects additional stormwater runoff flowing from the two other closed systems that did not previously discharge to the swale mentioned above. This additional flow will receive water quality treatment where it previously had no treatment.
Design:	This project shall be constructed and operated in accordance with the site plans and details designed by McFarland Johnson, (Sheets 4 & 5, Typical Section- US Route 5, both dated 6/6/2017; Sheets 6 & 7, Typical Section- Roundabouts, both dated 6/6/2017; Sheet 8, Typical Section- Sykes Mountain Avenue, dated 6/6/2017; Sheet 9, Typical Section- Side Roads, dated 6/6/2017; Sheets 13 & 14, Gravel Wetland Details, both dated 6/6/2017; Sheet 22, Layout Plan 1, dated 6/6/2017; Sheet 24, Layout Plan 2, dated 6/6/2017; Sheet 25, Layout Plan 3, dated 6/6/2017; Sheet 26, Layout Plan 4, dated 6/6/2017; Sheet 27, Layout Plan 5, dated 6/6/2017; Sheets 33-35, Profile- Sykes Mountain Avenue, all dated 6/6/2017; Sheet 36, Profile- Beswick Drive, dated 6/6/2017; Sheet 37, Profile- Ralph Lehman Drive, dated 6/6/2017; Sheets 38 & 39, Profile- US Route 5, both dated 6/6/2017; Sheet 66, Gravel Wetland Grading Plan, dated 6/6/2017; Sheet 67, Landscape Plan 1, dated 6/6/2017; Sheet 68, Landscape Plan 2, dated 6/6/2017; Sheet 69, Landscape Plan 3, dated 6/6/2017; Sheet 70, Landscape Plan 4, dated 6/6/2017; Sheet 71, Landscape Plan 5, dated 6/6/2017; Sheets 78-82, US Route 5 Cross Sections, all dated 6/6/2017; Sheets 83-87, Sykes Mountain Ave. Cross Sections, all dated 6/6/2017; Sheet 88, Ralph Lehman Cross Sections, dated 6/6/2017; Sheet 89, Beswick Drive Cross Sections, dated 6/6/2017) and all supporting information. By reference, the above noted plans are made part of this authorization.

Compliance with General Permit 3-9015 and this Authorization

The permittee shall comply with this authorization and all the terms and conditions of General Permit 3-9015, including the payment of annual operating fees to the Department. A billing statement for such fees will be sent to the permittee each year. The first year's statement is enclosed. Any permit non-compliance, including a failure to pay the annual operating fee, constitutes a violation of 10 V.S.A. Chapter 47 and may be grounds for an enforcement action or revocation of this authorization to discharge.

Transferability

This authorization to discharge is not transferable to any person except in compliance with Part VI.D. of General Permit 3-9015. A copy of General Permit 3-9015 is available from the Department via the internet at http://dec.vermont.gov/sites/dec/files/wsm/stormwater/docs/GeneralPermit9015/sw_3-9015_final_signed.pdf.

Changes to Permitted Development

In accordance with Part V.G. of General Permit 3-9015, the permittee shall notify the Department of any planned development or facility expansions or changes that may result in new or increased stormwater discharges. The Department shall determine the appropriateness of continued inclusion under General Permit 3-9015 by the modified development or facility.

Annual Inspection and Report

The stormwater collection, treatment and control system shall be properly operated. The permittee shall submit an annual inspection report on the operation, maintenance and condition of the stormwater collection, treatment and control system. The inspection report shall be submitted regardless of whether the project has been constructed. The inspection shall be conducted between the conclusion of spring snow melt and June 15th of each year and the inspection report shall be submitted to the Secretary by July 15th of each year, or by July 30th if performed by a utility or municipality pursuant to a duly adopted stormwater management ordinance. The inspection report shall note all problem areas and all measures taken to correct any problems and to prevent future problems. The online submittal system, ANR Online, can be accessed at https://anronline.vermont.gov.

Initial Statement of Compliance

An initial statement of compliance, signed by a designer, must be submitted to the Stormwater Management Program no later than 6 months following completion of construction of the stormwater management system. Failure to submit an initial statement of compliance shall constitute a violation of General Permit 3-9015 and may result in the revocation of this authorization to discharge. Forms for completing this requirement are available on the Stormwater Management Program's website. The online submittal system, ANR Online, can be accessed at https://anronline.vermont.gov.

Renewable Energy Projects – Right to Appeal to Public Utility Commission

Any appeal of this decision must be filed with the clerk of the Vermont Public Utility Commission pursuant to 10 V.S.A. §8506 within 30 days of the date of this decision. The appellant must file with the Clerk an original and six copies of its appeal. The appellant shall provide notice of the filing of an appeal in accordance with 10 V.S.A. §8504(c)(2), and shall also serve a copy of the Notice of Appeal on the Vermont Department of Public Service. For information, see the Rules and General orders of the Public Utility Commission available on line at http://puc.vermont.gov/. The address for the Public Utility Commission is 112 State Street Montpelier, Vermont 05620-2701 (Tel. #802-828-2358).

All Other Projects – Right to Appeal to the Environmental Court

Pursuant to 10 V.S.A. Chapter 220, any appeal of this decision must be filed with the clerk of the Environmental Court within 30 days of the date of the decision. The appellant must attach to the Notice of Appeal the entry fee of $250.00, payable to the state of Vermont. The Notice of Appeal must specify the parties taking the appeal and the statutory provision under which each party claims party status; must designate the act or decision appealed from; must name the Environmental Court; and must be signed by the appellant or their attorney. In addition, the appeal must give the address or location and description of the property, project or facility with which the appeal is concerned and the name of the applicant or any permit involved in the appeal. The appellant must also serve a copy of the Notice of Appeal in accordance with Rule 5(b)(4)(B) of the Vermont Rules for Environmental Court Proceedings. For further information, see the Vermont Rules for Environmental Court Proceedings, available on line at www.vermontjudiciary.org. The address for the Environmental Court is 32 Cherry Street, 2nd Floor Suite 303 Burlington, Vermont 05401 (Tel. # 802-951-1740).

Effective Date and Expiration Date of this Authorization
This authorization to discharge shall become effective on August 14, 2017 and shall continue until August 14, 2022. The permittee shall reapply for coverage at least sixty (60) days prior to August 14, 2022.

Dated Monday, August 14, 2017

Emily Boedecker, Commissioner
Department of Environmental Conservation

By: Padraic Monks

Padraic Monks, Stormwater Program Manager
Stormwater Management Program

Clear Form

OFFICE MEMORANDUM

AOT - PDB - ENVIRONMENTAL SECTION

RESOURCE IDENTIFICATION COMPLETION MEMO

To:	Erin Parizo, Project Manager
From:	Lee Goldstein, Environmental Specialist
Date:	03/28/2019
Project:	**Hartford HES 0113(77)**

Environmental Resources:

	Yes	No	
Archaeological Site:	X		See Archaeological Resource ID Memo: 01/28/2019 Sensitive resources in area; see .dgn for clarification
Historic/Historic District:	X		See Historic Resource ID Memo: 02/22/2019 Historic properties identified within general area; impacts unlikely but need to see project limits for NEPA.
4(f) Property:	X		Possible, depending upon impacts, if any.
Wetlands:	X		See Natural Resource ID Memo: 03/07/2019 Two wetland locations identified; map provided in Memo, wetlands on .dgn.
Agricultural Land:	X		Several areas mapped as 'Prime'; see Memo
Fish & Wildlife Habitat:	X		Resources present; see ANR map and Natural Resource ID Memo
Wildlife Habitat Connectivity:	X		See ANR map; measures encouraged to provide passage
Endangered Species:	X		NLEB language will be provided for the Contract;T&E identified--see NR Memo
Stormwater:	X		Possibly, 3 adjacent permits exist; see OSW Memo dated 02/12/2019
Landscaping:		X	Unknown at this time; there may be invasive species located within project limits
6(f) Property:	X		Depending upon project SOW, impacts could occur, as there are several grant-related properties within this region. This will need to be determined as project limits are
Hazardous Waste:	X		Multiple sites adjacent
Development Soils:	X		Entire region; coordination needed regarding VT LRS for this site
USDA-Forest Service Lands:		X	

	Yes	No	
Scenic Highway/Byway:		X	
Act 250 Permits:	X		Multiple adjacent
FEMA Floodplains:	X		See ANR map; White River present
Flood Hazard Area/River Corridor:	X		AE Flood Hazard Area and River Corridor; will require FHARC coordination/permit; see ANR map
US Coast Guard:		X	
Lakes and Ponds:		X	
Environmental Justice:		X	
303D List/ Class A Water/ Outstanding Resource Water:	X		See OSW Resource ID Memo for discussion regarding this topic; will require Operational Stormwater permit.
Source Protection Area:		X	
Public Water Sources/ Private Wells:	X		several private in area
Other:	X		public sewer covers large area

CC: Project File

VERMONT

State of Vermont
Program Development Division
One National Life Drive
Montpelier, VT 05633-5001
vtrans.vermont.gov

[phone] 802-279-2562
[fax] 802-828-2334
[ttd] 800-253-0191

Agency of Transportation

To: Lee Goldstein, VTrans Environmental Specialist

From: James Brady, VTrans Environmental Biologist

Date: March 7, 2019

Subject: Hartford HES 0113(77) - Natural Resource ID

I have completed my natural resource report for the above referenced project. My evaluation has included wetlands, wildlife habitat, agricultural soils and rare, threatened and endangered species.

Wetlands/Watercourses
There is one small wetland complex south of I-89 and east of US5. There is one larger wetland north of I-89 and east of US Route 5. See attached map.

There are two small unnamed streams and the White River within the project corridor. See attached map for blue lines showing streams. Riparian areas along each of these streams should be protected or enhanced if impacts are anticipated.

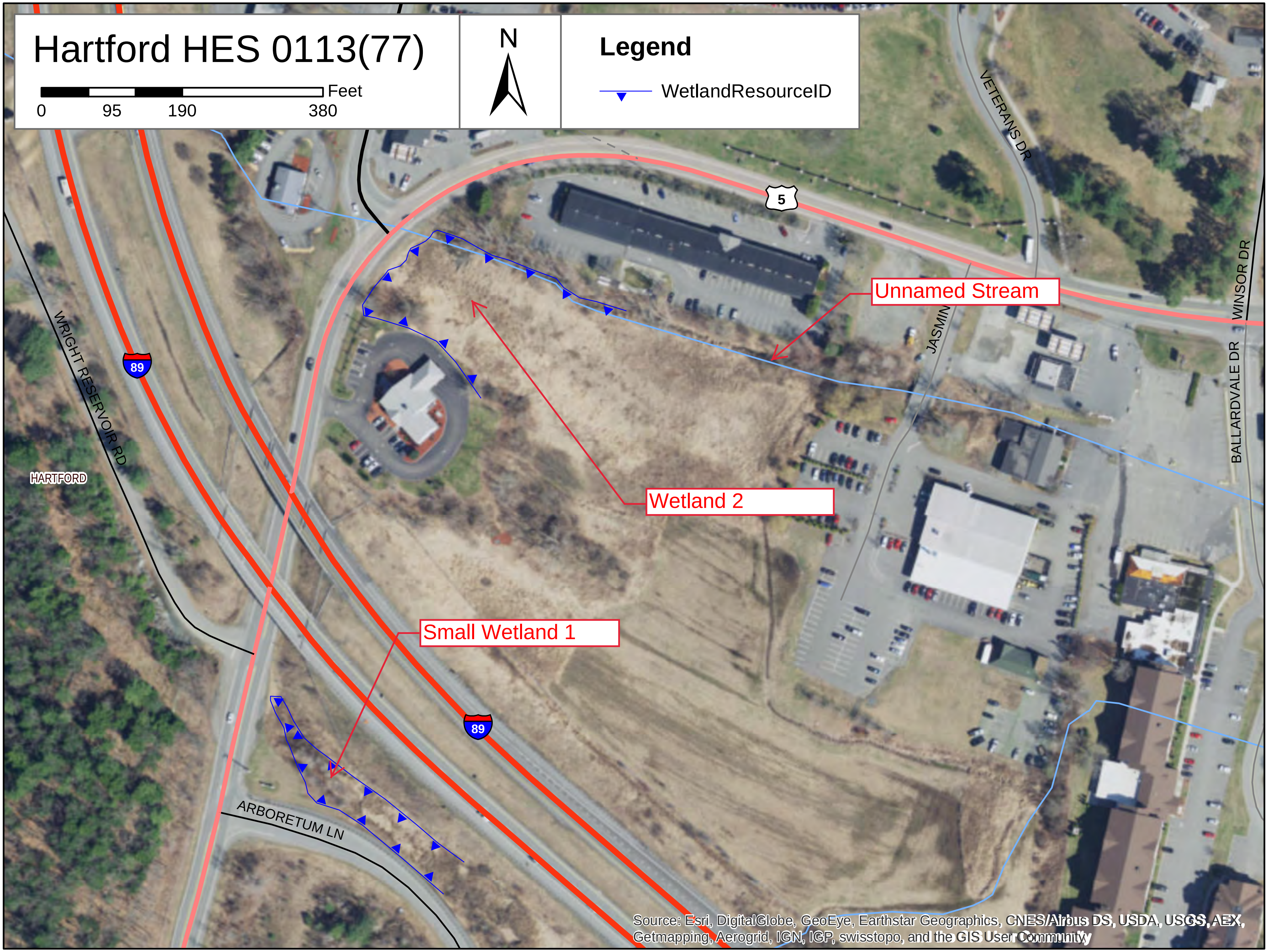
Wildlife Habitat
The larger wetland complex is likely home to wildlife and impacts should be minimized.

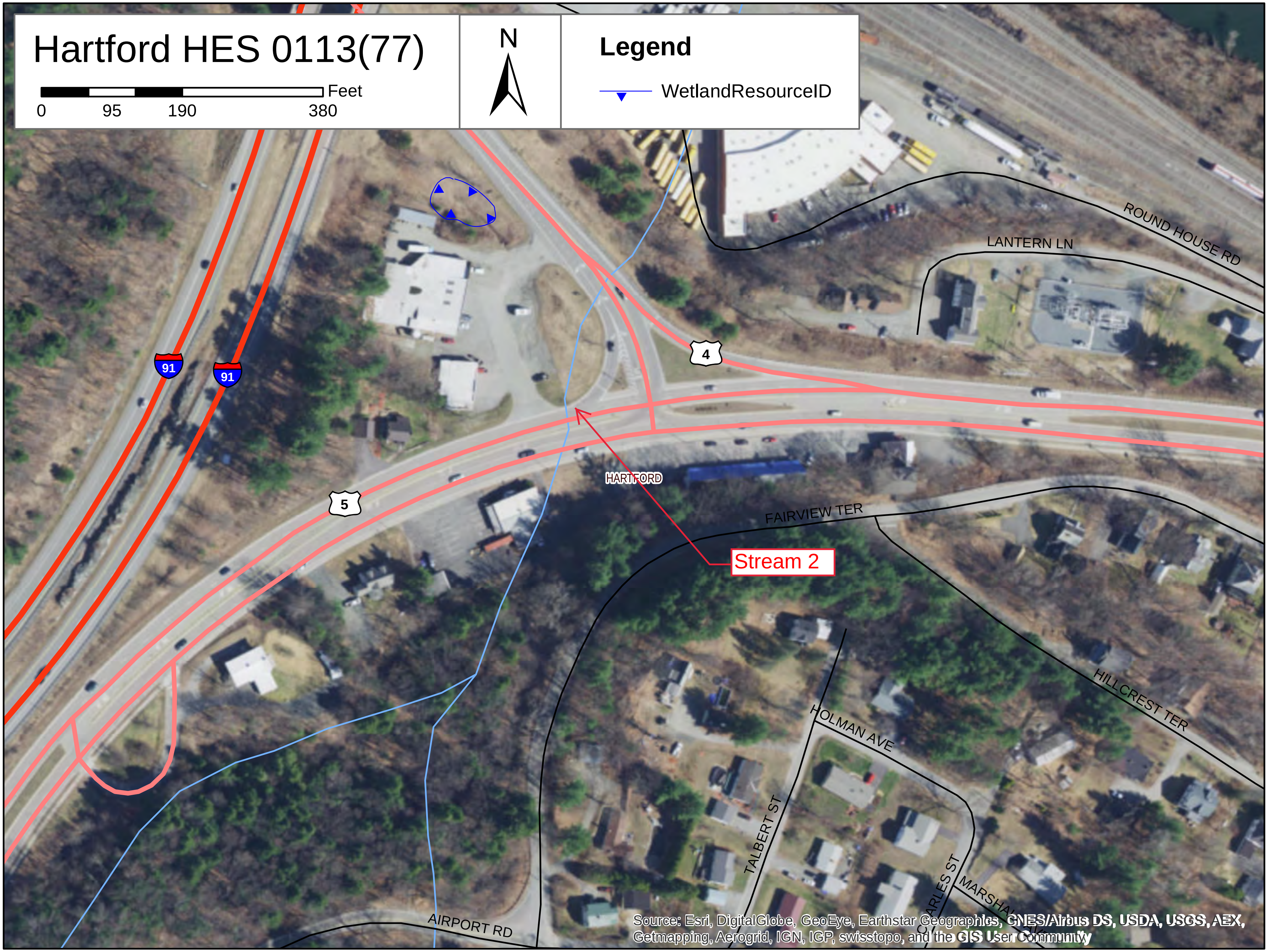
Each stream, especially the White River, likely provides habitat for aquatic organisms and terrestrial wildlife along the riparian corridor. Larger structures installed on the smaller streams where they cross US Route 5 streams would improve aquatic organism passage and terrestrial wildlife movement. Maintaining a healthy riparian area along the White River would help ensure terrestrial wildlife movement along the stream.

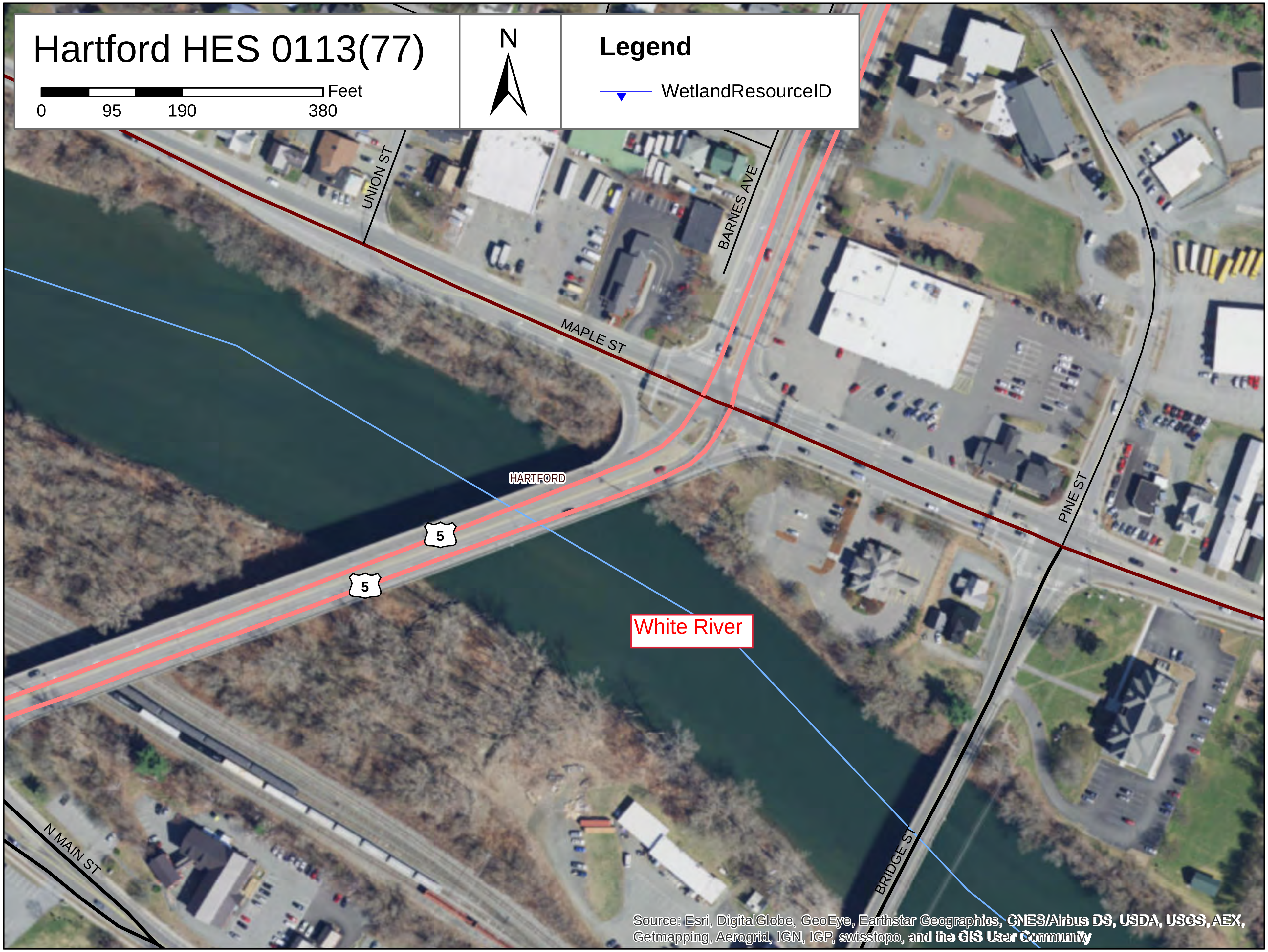
Rare, Threatened and Endangered Species
The project area is within the historic range of the state endangered Fowler's toad. It is unlikely that this project will impact this species, although further coordination will be required with Vermont Fish & Wildlife Department.

The project is also within the known range the of the federally threatened northern long-eared bat. No restrictions from this species are anticipated.

Agricultural Soils:
There are several areas mapped as prime agricultural soil along the project area, see attached map.


Hartford HES 0113(77)
0
95
190
380
Feet
N
Legend
WetlandResourceID
Unnamed Stream
Wetland 2
Small Wetland 1
5
89
89
VETERANS DR
WINSOR DR
BALLARDVALE DR
JASMIN
WRIGHT RESERVOIR RD
HARTFORD
ARBORETUM LN
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

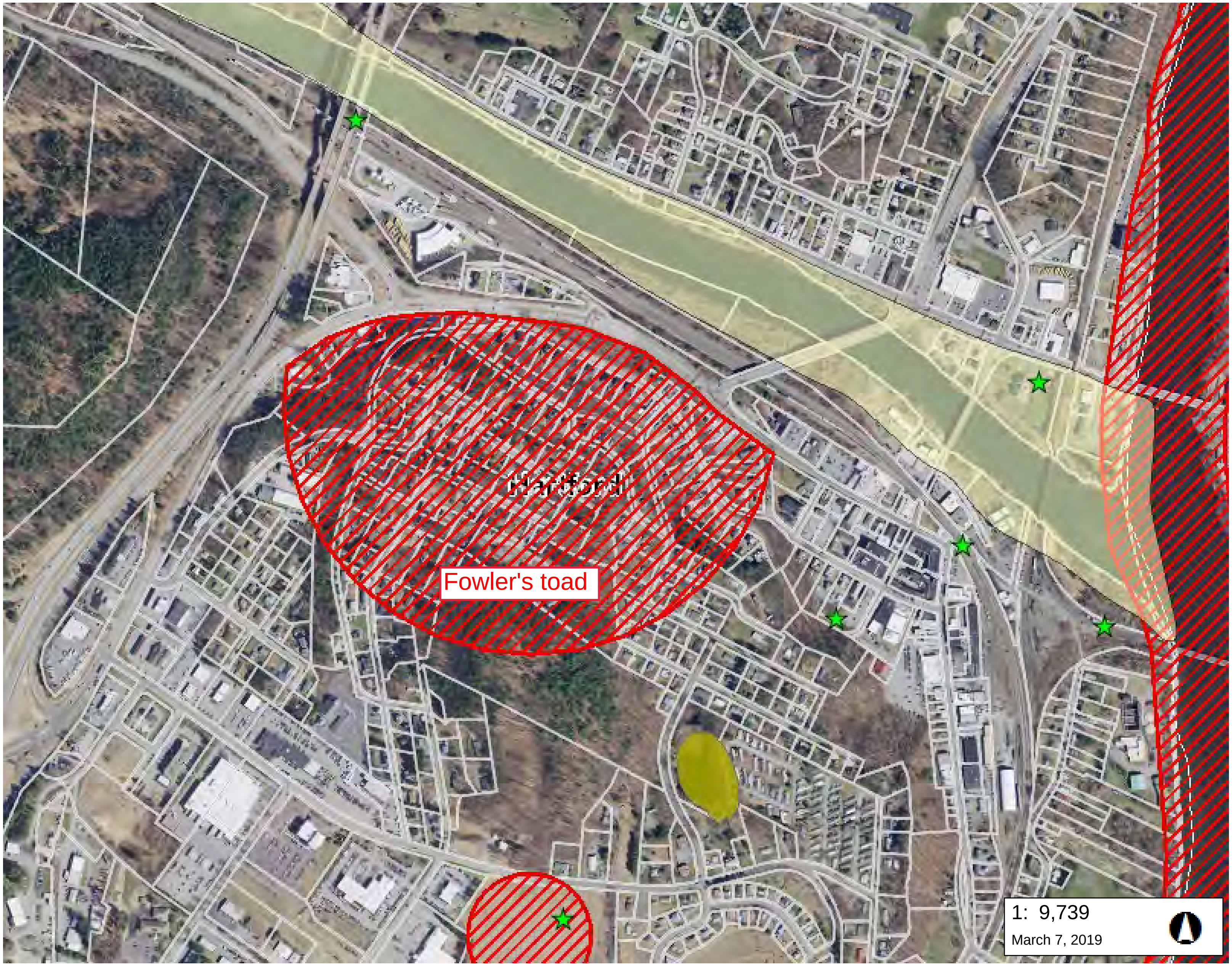

Hartford HES 0113(77)
0
95
190
380
Feet
N
Legend
WetlandResourceID
91
91
4
5
HARTFORD
Stream 2
ROUND HOUSE RD
LANTERN LN
FAIRVIEW TER
HILLCREST TER
HOLMAN AVE
TALBERT ST
AIRPORT RD
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community


Hartford HES 0113(77)
Feet
0
95
190
380
N
Legend
WetlandResourceID
UNION ST
BARNES AVE
MAPLE ST
HARTFORD
5
5
White River
PINE ST
BRIDGE ST
N MAIN ST
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Hartford HES 0113(77)

Vermont Agency of Natural Resources

vermont.gov



LEGEND

- Vernal Pools Confirmed – AE/\
- Vernal Pools Unconfirmed – Al
- Wetland Projects
- Wetland - VSWI
  - Class 1 Wetland
  - Class 2 Wetland
  - Buffer
- River Corridors (Jan 2, 2015)
- Soils - Hydric
- Rare Threatened Endangered
  - Threatened or Endangered
  - Rare
- Indiana Bat Hibernacula
- Indiana Bat Summer Range
  - Observed
  - Potential
- Parcels (standardized)
- Parcels (non-standardized)
- Town Boundary

1: 9,739

March 7, 2019

495.0 0 248.00 495.0 Meters

WGS_1984_Web_Mercator_Auxiliary_Sphere 1" = 812 Ft. 1cm = 97 Meters

THIS MAP IS NOT TO BE USED FOR NAVIGATION

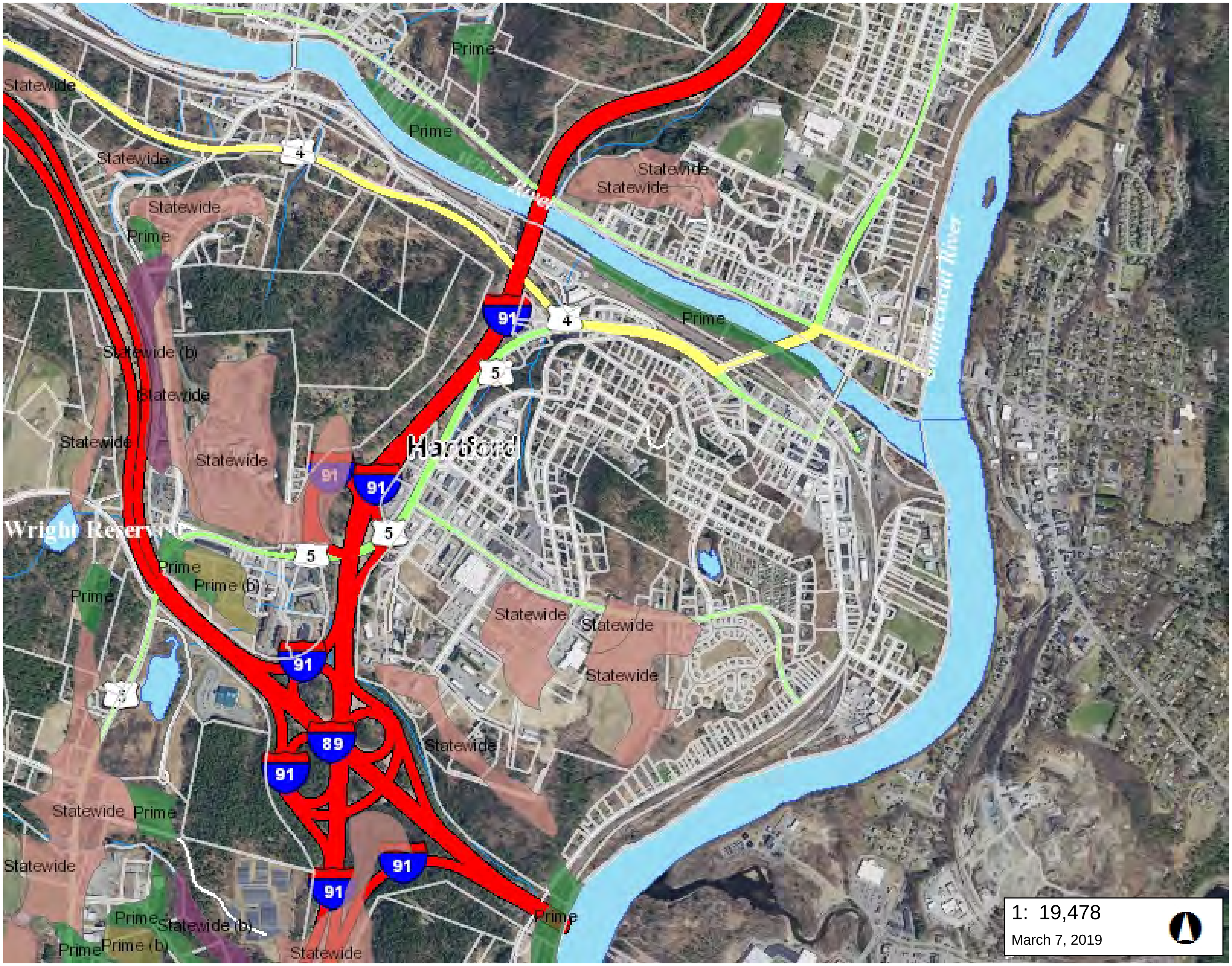
NOTES

Map created using ANR's Natural Resources Atlas

Hartford HES 0113(77)

Vermont Agency of Natural Resources

vermont.gov



LEGEND

- Commercial Mining
- Dredging
- Gravel Mining
- Dam
- Ledge
- Waterfall
- Weir
- Avulsion
- Braiding
- Flood Chute
- Neck Cut Off
- Migration
- Animal Crossing
- Stream Ford
- Berm
- Road
- Improved Path
- Railroad
- Bank Erosion
- Mass Failure
- Soils - Prime Agricultural
  - Local
  - Local (b)
  - Not rated
  - Prime
  - Prime (b)
  - Prime (f)

990.0 0 495.00 990.0 Meters

WGS_1984_Web_Mercator_Auxiliary_Sphere 1" = 1623 Ft. 1cm = 195 Meters

THIS MAP IS NOT TO BE USED FOR NAVIGATION

NOTES

Map created using ANR's Natural Resources Atlas

APPENDIX F

Traffic Analysis Reports

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	85	50	40	290	260	65
Future Volume (Veh/h)	85	50	40	290	260	65
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	85	50	40	290	260	65
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	662	292	325			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	662	292	325			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	79	93	97			
cM capacity (veh/h)	413	747	1235			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	135	330	325
Volume Left	85	40	0
Volume Right	50	0	65
cSH	495	1235	1700
Volume to Capacity	0.27	0.03	0.19
Queue Length 95th (ft)	27	3	0
Control Delay (s)	15.0	1.2	0.0
Lane LOS	B	A	
Approach Delay (s)	15.0	1.2	0.0
Approach LOS	B		

Intersection Summary			
Average Delay	3.1		
Intersection Capacity Utilization	52.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	35	0	10	25	20	80	15	320	40	90	320	260
Future Volume (Veh/h)	35	0	10	25	20	80	15	320	40	90	320	260
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	35	0	10	25	20	80	15	320	40	90	320	260
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)						1						
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1050	1020	450	1010	1130	340	580			360		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1050	1020	450	1010	1130	340	580			360		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	78	100	98	88	89	89	98			92		
cM capacity (veh/h)	156	216	609	200	186	702	994			1199		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	45	125	375	670
Volume Left	35	25	15	90
Volume Right	10	80	40	260
cSH	186	538	994	1199
Volume to Capacity	0.24	0.23	0.02	0.08
Queue Length 95th (ft)	23	22	1	6
Control Delay (s)	30.3	17.4	0.5	1.9
Lane LOS	D	C	A	A
Approach Delay (s)	30.3	17.4	0.5	1.9
Approach LOS	D	C		

Intersection Summary			
Average Delay	4.1		
Intersection Capacity Utilization	77.0%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	20	0	70	0	420	15	35	645	0
Future Volume (Veh/h)	0	0	0	20	0	70	0	420	15	35	645	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	0	20	0	70	0	420	15	35	645	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1212	1150	645	1142	1142	428	645			435		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1212	1150	645	1142	1142	428	645			435		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	88	100	89	100			97		
cM capacity (veh/h)	138	192	472	173	194	627	940			1125		

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	SB 1	SB 2
Volume Total	0	20	70	435	35	645
Volume Left	0	20	0	0	35	0
Volume Right	0	0	70	15	0	0
cSH	1700	173	627	940	1125	1700
Volume to Capacity	0.00	0.12	0.11	0.00	0.03	0.38
Queue Length 95th (ft)	0	10	9	0	2	0
Control Delay (s)	0.0	28.5	11.5	0.0	8.3	0.0
Lane LOS	A	D	B		A	
Approach Delay (s)	0.0	15.2		0.0	0.4	
Approach LOS	A	C				

Intersection Summary			
Average Delay	1.4		
Intersection Capacity Utilization	44.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	45	160	215	275	570	240
Future Volume (Veh/h)	45	160	215	275	570	240
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	45	160	215	275	570	240
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1275	570	810			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1275	570	810			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	67	69	74			
cM capacity (veh/h)	136	521	816			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	205	215	275	570	240
Volume Left	45	215	0	0	0
Volume Right	160	0	0	0	240
cSH	321	816	1700	1700	1700
Volume to Capacity	0.64	0.26	0.16	0.34	0.14
Queue Length 95th (ft)	103	26	0	0	0
Control Delay (s)	34.1	11.0	0.0	0.0	0.0
Lane LOS	D	B			
Approach Delay (s)	34.1	4.8		0.0	
Approach LOS	D				

Intersection Summary			
Average Delay	6.2		
Intersection Capacity Utilization	64.3%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	425	15	325	0	0	390
Future Volume (Veh/h)	425	15	325	0	0	390
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	425	15	325	0	0	390
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						560
pX, platoon unblocked						
vC, conflicting volume	520	325			325	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	520	325			325	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	13	98			100	
cM capacity (veh/h)	486	671			1231	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	440	325	195	195
Volume Left	425	0	0	0
Volume Right	15	0	0	0
cSH	490	1700	1700	1700
Volume to Capacity	0.90	0.19	0.11	0.11
Queue Length 95th (ft)	252	0	0	0
Control Delay (s)	48.4	0.0	0.0	0.0
Lane LOS	E			
Approach Delay (s)	48.4	0.0	0.0	
Approach LOS	E			

Intersection Summary			
Average Delay	18.4		
Intersection Capacity Utilization	48.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	0	80	260	390	55
Future Volume (Veh/h)	0	0	80	260	390	55
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	80	260	390	55
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)					370	
pX, platoon unblocked						
vC, conflicting volume	810	195	445			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	810	195	445			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	100	93			
cM capacity (veh/h)	295	814	1112			

Direction, Lane #	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	80	260	195	195	55
Volume Left	80	0	0	0	0
Volume Right	0	0	0	0	55
cSH	1112	1700	1700	1700	1700
Volume to Capacity	0.07	0.15	0.11	0.11	0.03
Queue Length 95th (ft)	6	0	0	0	0
Control Delay (s)	8.5	0.0	0.0	0.0	0.0
Lane LOS	A				
Approach Delay (s)	2.0		0.0		
Approach LOS					

Intersection Summary			
Average Delay	0.9		
Intersection Capacity Utilization	21.9%	ICU Level of Service	A
Analysis Period (min)	15		

Intersection Sign configuration not allowed in HCM analysis.

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	87	272	353	136	76	130
v/c Ratio	0.28	0.29	0.60	0.14	0.14	0.08
Control Delay	15.4	1.8	19.9	5.6	14.5	0.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	15.4	1.8	19.9	5.6	14.5	0.1
Queue Length 50th (ft)	15	0	32	12	6	0
Queue Length 95th (ft)	41	21	#78	33	20	0
Internal Link Dist (ft)	418			844	275	
Turn Bay Length (ft)						
Base Capacity (vph)	447	803	600	1008	638	1583
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.19	0.34	0.59	0.13	0.12	0.08

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	80	250	325	125	70	120
Future Volume (vph)	80	250	325	125	70	120
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.9	6.7	6.7	5.5	5.5	4.0
Lane Util. Factor	1.00	1.00	0.97	1.00	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	3433	1863	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	3433	1863	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	87	272	353	136	76	130
RTOR Reduction (vph)	0	177	0	0	0	0
Lane Group Flow (vph)	87	95	353	136	76	130
Turn Type	Prot	pt+ov	Prot	NA	NA	Free
Protected Phases	4	1 4	1	6	2	
Permitted Phases						Free
Actuated Green, G (s)	6.4	18.5	6.2	18.3	5.4	36.1
Effective Green, g (s)	6.4	12.6	6.2	18.3	5.4	36.1
Actuated g/C Ratio	0.18	0.35	0.17	0.51	0.15	1.00
Clearance Time (s)	5.9		6.7	5.5	5.5	
Vehicle Extension (s)	2.0		2.0	2.0	2.0	
Lane Grp Cap (vph)	313	552	589	944	529	1583
v/s Ratio Prot	c0.05	0.06	c0.10	c0.07	0.02	
v/s Ratio Perm						0.08
v/c Ratio	0.28	0.17	0.60	0.14	0.14	0.08
Uniform Delay, d1	12.9	8.1	13.8	4.7	13.3	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.2	0.1	1.1	0.0	0.0	0.1
Delay (s)	13.0	8.2	14.9	4.8	13.4	0.1
Level of Service	B	A	B	A	B	A
Approach Delay (s)	9.4			12.1	5.0	
Approach LOS	A			B	A	

Intersection Summary			
HCM 2000 Control Delay	9.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.37		
Actuated Cycle Length (s)	36.1	Sum of lost time (s)	18.1
Intersection Capacity Utilization	29.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	54	163	33	141	65	207	316	168	310	185	38
v/c Ratio	0.28	0.59	0.09	0.62	0.10	0.30	0.84	0.51	0.78	0.24	0.05
Control Delay	38.3	44.0	0.5	47.3	20.2	4.9	57.6	13.2	47.0	19.7	0.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	38.3	44.0	0.5	47.3	20.2	4.9	57.6	13.2	47.0	19.7	0.1
Queue Length 50th (ft)	21	67	0	60	18	0	73	0	129	49	0
Queue Length 95th (ft)	78	#217	0	#168	68	54	#240	65	#435	168	0
Internal Link Dist (ft)		359			562		394			1014	
Turn Bay Length (ft)	295		50	240				30	200		
Base Capacity (vph)	226	319	411	327	811	795	375	327	397	787	712
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.24	0.51	0.08	0.43	0.08	0.26	0.84	0.51	0.78	0.24	0.05

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	50	150	30	130	60	190	30	260	155	285	170	35
Future Volume (vph)	50	150	30	130	60	190	30	260	155	285	170	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00		0.95	1.00	1.00	1.00	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.98		1.00	0.96	1.00	1.00	0.97
Flpb, ped/bikes	0.99	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.99	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1753	1863	1583	1770	1863	1558		3515	1519	1770	1863	1542
Flt Permitted	0.71	1.00	1.00	0.95	1.00	1.00		0.89	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1319	1863	1583	1770	1863	1558		3160	1519	1770	1863	1542
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	54	163	33	141	65	207	33	283	168	310	185	38
RTOR Reduction (vph)	0	0	28	0	0	134	0	0	148	0	0	22
Lane Group Flow (vph)	54	163	5	141	65	73	0	316	20	310	185	16
Confl. Peds. (#/hr)	5					5	5		5	5		5
Turn Type	Perm	NA	Perm	Prot	NA	Perm	Perm	NA	Perm	Prot	NA	Perm
Protected Phases		8		7	4			6		5	2	
Permitted Phases	8		8			4	6		6			2
Actuated Green, G (s)	11.8	11.8	11.8	10.2	28.0	28.0		9.6	9.6	17.6	33.2	33.2
Effective Green, g (s)	11.8	11.8	11.8	10.2	28.0	28.0		9.6	9.6	17.6	33.2	33.2
Actuated g/C Ratio	0.15	0.15	0.15	0.13	0.35	0.35		0.12	0.12	0.22	0.42	0.42
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	195	275	234	226	654	547		380	182	390	776	642
v/s Ratio Prot		c0.09		c0.08	0.03					c0.18	0.10	
v/s Ratio Perm	0.04		0.00			0.05		c0.10	0.01			0.01
v/c Ratio	0.28	0.59	0.02	0.62	0.10	0.13		0.83	0.11	0.79	0.24	0.02
Uniform Delay, d1	30.2	31.7	29.0	32.9	17.4	17.6		34.3	31.2	29.3	15.1	13.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.8	3.4	0.0	3.8	0.0	0.0		18.7	1.2	10.0	0.7	0.1
Delay (s)	30.9	35.1	29.0	36.8	17.4	17.6		53.0	32.5	39.3	15.8	13.8
Level of Service	C	D	C	D	B	B		D	C	D	B	B
Approach Delay (s)		33.4			24.1			45.9			29.3	
Approach LOS		C			C			D			C	

Intersection Summary			
HCM 2000 Control Delay	33.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	79.7	Sum of lost time (s)	26.0
Intersection Capacity Utilization	58.9%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	EBR	WBT	NBT	SBT	SBR
Lane Group Flow (vph)	114	179	244	212	353	239
v/c Ratio	0.92	0.41	0.71	0.09	0.29	0.22
Control Delay	106.2	8.0	53.6	11.6	13.9	4.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	106.2	8.0	53.6	11.6	13.9	4.2
Queue Length 50th (ft)	82	0	167	21	79	5
Queue Length 95th (ft)	#157	54	230	85	303	70
Internal Link Dist (ft)	379		511	1014	294	
Turn Bay Length (ft)		70				140
Base Capacity (vph)	186	567	514	2298	1210	1074
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.61	0.32	0.47	0.09	0.29	0.22

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	105	0	165	0	220	5	0	195	0	0	325	220
Future Volume (vph)	105	0	165	0	220	5	0	195	0	0	325	220
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0	6.0		6.0			6.0			6.0	6.0
Lane Util. Factor		1.00	1.00		1.00			0.95			1.00	1.00
Frpb, ped/bikes		1.00	1.00		1.00			1.00			1.00	0.98
Flpb, ped/bikes		1.00	1.00		1.00			1.00			1.00	1.00
Frt		1.00	0.85		1.00			1.00			1.00	0.85
Flt Protected		0.95	1.00		1.00			1.00			1.00	1.00
Satd. Flow (prot)		1761	1583		1857			3539			1863	1546
Flt Permitted		0.36	1.00		1.00			1.00			1.00	1.00
Satd. Flow (perm)		674	1583		1857			3539			1863	1546
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	114	0	179	0	239	5	0	212	0	0	353	239
RTOR Reduction (vph)	0	0	146	0	1	0	0	0	0	0	0	77
Lane Group Flow (vph)	0	114	33	0	243	0	0	212	0	0	353	162
Confl. Peds. (#/hr)	5					5	5					5
Turn Type	Perm	NA	Perm		NA			NA		Perm	NA	Perm
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8						6		6
Actuated Green, G (s)		20.7	20.7		20.7			71.1			71.1	71.1
Effective Green, g (s)		20.7	20.7		20.7			71.1			71.1	71.1
Actuated g/C Ratio		0.18	0.18		0.18			0.63			0.63	0.63
Clearance Time (s)		6.0	6.0		6.0			6.0			6.0	6.0
Vehicle Extension (s)		3.0	3.0		3.0			2.0			2.0	2.0
Lane Grp Cap (vph)		124	292		343			2246			1182	981
v/s Ratio Prot					0.13			0.06			c0.19	
v/s Ratio Perm		c0.17	0.02									0.10
v/c Ratio		0.92	0.11		0.71			0.09			0.30	0.16
Uniform Delay, d1		44.8	38.0		42.8			7.9			9.2	8.3
Progression Factor		1.00	1.00		1.00			1.00			1.00	1.00
Incremental Delay, d2		55.8	0.2		6.6			0.1			0.6	0.4
Delay (s)		100.6	38.2		49.4			8.0			9.9	8.7
Level of Service		F	D		D			A			A	A
Approach Delay (s)		62.5			49.4			8.0			9.4	
Approach LOS		E			D			A			A	

Intersection Summary			
HCM 2000 Control Delay	28.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.41		
Actuated Cycle Length (s)	112.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	54.2%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBT	NBT	NBR	SBT
Lane Group Flow (vph)	33	690	462	27	22	54
v/c Ratio	0.06	0.62	0.29	0.14	0.08	0.23
Control Delay	4.4	9.1	5.2	20.0	4.0	14.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	4.4	9.1	5.2	20.0	4.0	14.5
Queue Length 50th (ft)	3	98	26	7	0	7
Queue Length 95th (ft)	12	195	48	24	8	31
Internal Link Dist (ft)		562	244	347		382
Turn Bay Length (ft)	245				45	
Base Capacity (vph)	549	1115	1610	761	896	846
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.06	0.62	0.29	0.04	0.02	0.06

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	30	565	70	80	330	15	25	0	20	20	5	25
Future Volume (vph)	30	565	70	80	330	15	25	0	20	20	5	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0			6.0			6.0	6.0		6.0	
Lane Util. Factor	1.00	1.00			0.95			1.00	1.00		1.00	
Frpb, ped/bikes	1.00	1.00			1.00			1.00	0.96		0.99	
Flpb, ped/bikes	1.00	1.00			1.00			0.99	1.00		0.99	
Frt	1.00	0.98			0.99			1.00	0.85		0.93	
Flt Protected	0.95	1.00			0.99			0.95	1.00		0.98	
Satd. Flow (prot)	1766	1827			3484			1753	1525		1673	
Flt Permitted	0.49	1.00			0.75			0.72	1.00		0.86	
Satd. Flow (perm)	904	1827			2640			1332	1525		1460	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	33	614	76	87	359	16	27	0	22	22	5	27
RTOR Reduction (vph)	0	4	0	0	2	0	0	0	19	0	23	0
Lane Group Flow (vph)	33	686	0	0	460	0	0	27	3	0	31	0
Confl. Peds. (#/hr)	5		5	5		5	5		5	5		5
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2		2	6		
Actuated Green, G (s)	30.0	30.0			30.0			7.3	7.3		7.3	
Effective Green, g (s)	30.0	30.0			30.0			7.3	7.3		7.3	
Actuated g/C Ratio	0.61	0.61			0.61			0.15	0.15		0.15	
Clearance Time (s)	6.0	6.0			6.0			6.0	6.0		6.0	
Vehicle Extension (s)	3.0	3.0			3.0			3.0	3.0		3.0	
Lane Grp Cap (vph)	550	1111			1606			197	225		216	
v/s Ratio Prot		c0.38										
v/s Ratio Perm	0.04				0.17			0.02	0.00		c0.02	
v/c Ratio	0.06	0.62			0.29			0.14	0.01		0.14	
Uniform Delay, d1	3.9	6.0			4.6			18.3	17.9		18.3	
Progression Factor	1.00	1.00			1.00			1.00	1.00		1.00	
Incremental Delay, d2	0.2	2.6			0.4			0.3	0.0		0.3	
Delay (s)	4.1	8.6			5.0			18.6	18.0		18.6	
Level of Service	A	A			A			B	B		B	
Approach Delay (s)		8.4			5.0			18.3			18.6	
Approach LOS		A			A			B			B	

Intersection Summary			
HCM 2000 Control Delay	8.0	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	49.3	Sum of lost time (s)	12.0
Intersection Capacity Utilization	82.2%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	175	65	35	240	320	75
Future Volume (Veh/h)	175	65	35	240	320	75
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	175	65	35	240	320	75
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	668	358	395			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	668	358	395			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	57	91	97			
cM capacity (veh/h)	411	687	1164			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	240	275	395
Volume Left	175	35	0
Volume Right	65	0	75
cSH	461	1164	1700
Volume to Capacity	0.52	0.03	0.23
Queue Length 95th (ft)	74	2	0
Control Delay (s)	21.0	1.3	0.0
Lane LOS	C	A	
Approach Delay (s)	21.0	1.3	0.0
Approach LOS	C		

Intersection Summary			
Average Delay	5.9		
Intersection Capacity Utilization	59.6%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	190	5	20	5	0	40	0	450	10	35	405	40
Future Volume (Veh/h)	190	5	20	5	0	40	0	450	10	35	405	40
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	190	5	20	5	0	40	0	450	10	35	405	40
Pedestrians					5			5			5	
Lane Width (ft)					12.0			12.0			12.0	
Walking Speed (ft/s)					3.5			3.5			3.5	
Percent Blockage					0			0			0	
Right turn flare (veh)						1						
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	975	960	430	962	975	465	445			465		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	975	960	430	962	975	465	445			465		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	9	98	97	98	100	93	100			97		
cM capacity (veh/h)	208	247	622	216	242	592	1115			1091		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1	SB 2
Volume Total	215	45	460	35	445
Volume Left	190	5	0	35	0
Volume Right	20	40	10	0	40
cSH	223	666	1115	1091	1700
Volume to Capacity	0.97	0.07	0.00	0.03	0.26
Queue Length 95th (ft)	213	5	0	2	0
Control Delay (s)	97.5	12.7	0.0	8.4	0.0
Lane LOS	F	B		A	
Approach Delay (s)	97.5	12.7	0.0	0.6	
Approach LOS	F	B			

Intersection Summary			
Average Delay	18.2		
Intersection Capacity Utilization	54.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	5	0	15	5	60	5	670	20	65	435	5
Future Volume (Veh/h)	0	5	0	15	5	60	5	670	20	65	435	5
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	5	0	15	5	60	5	670	20	65	435	5
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1320	1268	438	1258	1260	680	440			690		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1320	1268	438	1258	1260	680	440			690		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	97	100	89	97	87	100			93		
cM capacity (veh/h)	107	156	619	136	157	451	1120			905		

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	SB 1	SB 2
Volume Total	5	15	65	695	65	440
Volume Left	0	15	0	5	65	0
Volume Right	0	0	60	20	0	5
cSH	156	136	394	1120	905	1700
Volume to Capacity	0.03	0.11	0.16	0.00	0.07	0.26
Queue Length 95th (ft)	2	9	15	0	6	0
Control Delay (s)	28.9	34.8	15.9	0.1	9.3	0.0
Lane LOS	D	D	C	A	A	
Approach Delay (s)	28.9	19.5		0.1	1.2	
Approach LOS	D	C				

Intersection Summary			
Average Delay	1.9		
Intersection Capacity Utilization	62.9%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	35	105	375	355	405	425
Future Volume (Veh/h)	35	105	375	355	405	425
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	35	105	375	355	405	425
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1510	405	830			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1510	405	830			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	50	84	53			
cM capacity (veh/h)	71	646	802			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	140	375	355	405	425
Volume Left	35	375	0	0	0
Volume Right	105	0	0	0	425
cSH	213	802	1700	1700	1700
Volume to Capacity	0.66	0.47	0.21	0.24	0.25
Queue Length 95th (ft)	100	63	0	0	0
Control Delay (s)	49.6	13.4	0.0	0.0	0.0
Lane LOS	E	B			
Approach Delay (s)	49.6	6.9		0.0	
Approach LOS	E				

Intersection Summary			
Average Delay	7.0		
Intersection Capacity Utilization	60.5%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	220	0	380	0	0	610
Future Volume (Veh/h)	220	0	380	0	0	610
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	220	0	380	0	0	610
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						560
pX, platoon unblocked						
vC, conflicting volume	685	380			380	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	685	380			380	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	42	100			100	
cM capacity (veh/h)	382	618			1175	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	220	380	305	305
Volume Left	220	0	0	0
Volume Right	0	0	0	0
cSH	382	1700	1700	1700
Volume to Capacity	0.58	0.22	0.18	0.18
Queue Length 95th (ft)	87	0	0	0
Control Delay (s)	26.5	0.0	0.0	0.0
Lane LOS	D			
Approach Delay (s)	26.5	0.0	0.0	
Approach LOS	D			

Intersection Summary			
Average Delay	4.8		
Intersection Capacity Utilization	38.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	0	80	300	610	80
Future Volume (Veh/h)	0	0	80	300	610	80
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	80	300	610	80
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)					370	
pX, platoon unblocked						
vC, conflicting volume	1070	305	690			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1070	305	690			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	100	91			
cM capacity (veh/h)	197	691	900			

Direction, Lane #	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	80	300	305	305	80
Volume Left	80	0	0	0	0
Volume Right	0	0	0	0	80
cSH	900	1700	1700	1700	1700
Volume to Capacity	0.09	0.18	0.18	0.18	0.05
Queue Length 95th (ft)	7	0	0	0	0
Control Delay (s)	9.4	0.0	0.0	0.0	0.0
Lane LOS	A				
Approach Delay (s)	2.0		0.0		
Approach LOS					

Intersection Summary			
Average Delay	0.7		
Intersection Capacity Utilization	28.0%	ICU Level of Service	A
Analysis Period (min)	15		

Intersection Sign configuration not allowed in HCM analysis.

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	76	391	391	136	179	212
v/c Ratio	0.22	0.41	0.56	0.14	0.34	0.13
Control Delay	15.3	4.2	18.8	6.2	18.6	0.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	15.3	4.2	18.8	6.2	18.6	0.2
Queue Length 50th (ft)	15	22	41	14	20	0
Queue Length 95th (ft)	39	52	82	40	46	0
Internal Link Dist (ft)	567			618	281	
Turn Bay Length (ft)						
Base Capacity (vph)	710	968	795	1044	573	1583
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.11	0.40	0.49	0.13	0.31	0.13

Intersection Summary

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	70	360	360	125	165	195
Future Volume (vph)	70	360	360	125	165	195
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.9	6.7	6.7	5.5	5.5	4.0
Lane Util. Factor	1.00	1.00	0.97	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	3433	1863	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	3433	1863	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	76	391	391	136	179	212
RTOR Reduction (vph)	0	107	0	0	0	0
Lane Group Flow (vph)	76	284	391	136	179	212
Confl. Peds. (#/hr)	5					
Turn Type	Prot	pt+ov	Prot	NA	NA	Free
Protected Phases	4	1 4	1	6	2	
Permitted Phases						Free
Actuated Green, G (s)	8.0	22.1	8.2	21.0	6.1	40.4
Effective Green, g (s)	8.0	16.2	8.2	21.0	6.1	40.4
Actuated g/C Ratio	0.20	0.40	0.20	0.52	0.15	1.00
Clearance Time (s)	5.9		6.7	5.5	5.5	
Vehicle Extension (s)	2.0		2.0	2.0	2.0	
Lane Grp Cap (vph)	350	634	696	968	534	1583
v/s Ratio Prot	0.04	c0.18	c0.11	0.07	c0.05	
v/s Ratio Perm						0.13
v/c Ratio	0.22	0.45	0.56	0.14	0.34	0.13
Uniform Delay, d1	13.6	8.8	14.5	5.0	15.3	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.1	0.2	0.6	0.0	0.1	0.2
Delay (s)	13.7	9.0	15.1	5.0	15.5	0.2
Level of Service	B	A	B	A	B	A
Approach Delay (s)	9.8			12.5	7.2	
Approach LOS	A			B	A	

Intersection Summary			
HCM 2000 Control Delay	10.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	40.4	Sum of lost time (s)	18.1
Intersection Capacity Utilization	37.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	49	136	43	288	201	315	375	228	277	147	49
v/c Ratio	0.32	0.56	0.12	0.92	0.28	0.39	1.08	0.71	0.73	0.20	0.07
Control Delay	41.7	45.3	0.7	70.8	21.2	4.6	107.3	25.9	45.2	20.1	0.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	41.7	45.3	0.7	70.8	21.2	4.6	107.3	25.9	45.2	20.1	0.2
Queue Length 50th (ft)	21	59	0	131	60	0	~94	25	118	41	0
Queue Length 95th (ft)	73	#163	0	#432	179	64	#293	#169	#378	136	0
Internal Link Dist (ft)		359			564		394			1014	
Turn Bay Length (ft)	295		50	240				30	200		
Base Capacity (vph)	193	306	401	313	776	843	348	320	380	753	686
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.25	0.44	0.11	0.92	0.26	0.37	1.08	0.71	0.73	0.20	0.07

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	45	125	40	265	185	290	60	285	210	255	135	45
Future Volume (vph)	45	125	40	265	185	290	60	285	210	255	135	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00		0.95	1.00	1.00	1.00	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00		1.00	0.96	1.00	1.00	0.97
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.99	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583		3498	1518	1770	1863	1542
Flt Permitted	0.63	1.00	1.00	0.95	1.00	1.00		0.87	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1177	1863	1583	1770	1863	1583		3071	1518	1770	1863	1542
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	49	136	43	288	201	315	65	310	228	277	147	49
RTOR Reduction (vph)	0	0	37	0	0	197	0	0	150	0	0	30
Lane Group Flow (vph)	49	136	6	288	201	118	0	375	78	277	147	19
Confl. Peds. (#/hr)							5		5	5		5
Turn Type	Perm	NA	Perm	Prot	NA	Perm	Perm	NA	Perm	Prot	NA	Perm
Protected Phases		8		7	4			6		5	2	
Permitted Phases	8		8			4	6		6			2
Actuated Green, G (s)	10.7	10.7	10.7	14.4	31.1	31.1		9.4	9.4	17.5	32.9	32.9
Effective Green, g (s)	10.7	10.7	10.7	14.4	31.1	31.1		9.4	9.4	17.5	32.9	32.9
Actuated g/C Ratio	0.13	0.13	0.13	0.17	0.38	0.38		0.11	0.11	0.21	0.40	0.40
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	152	241	204	308	700	595		349	172	374	741	613
v/s Ratio Prot		c0.07		c0.16	0.11					c0.16	0.08	
v/s Ratio Perm	0.04		0.00			0.07		c0.12	0.05			0.01
v/c Ratio	0.32	0.56	0.03	0.94	0.29	0.20		1.07	0.45	0.74	0.20	0.03
Uniform Delay, d1	32.7	33.8	31.5	33.7	18.0	17.4		36.6	34.3	30.5	16.3	15.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.2	3.0	0.1	34.0	0.1	0.1		69.4	8.4	6.8	0.6	0.1
Delay (s)	33.9	36.8	31.5	67.7	18.1	17.5		106.1	42.7	37.2	16.9	15.3
Level of Service	C	D	C	E	B	B		F	D	D	B	B
Approach Delay (s)		35.2			35.6			82.1			28.6	
Approach LOS		D			D			F			C	

Intersection Summary			
HCM 2000 Control Delay	47.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	82.7	Sum of lost time (s)	26.0
Intersection Capacity Utilization	65.0%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	EBR	WBT	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	33	54	43	516	5	424	27
v/c Ratio	0.33	0.32	0.30	0.19	0.01	0.30	0.02
Control Delay	57.0	18.0	49.3	6.3	9.0	7.8	1.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	57.0	18.0	49.3	6.3	9.0	7.8	1.6
Queue Length 50th (ft)	23	0	26	31	1	54	0
Queue Length 95th (ft)	54	39	61	148	8	277	7
Internal Link Dist (ft)	379		511	1014		294	
Turn Bay Length (ft)		70					140
Base Capacity (vph)	373	477	509	2686	651	1414	1213
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.09	0.11	0.08	0.19	0.01	0.30	0.02

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	30	0	50	0	35	5	0	475	0	5	390	25
Future Volume (vph)	30	0	50	0	35	5	0	475	0	5	390	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0	6.0		6.0			6.0		6.0	6.0	6.0
Lane Util. Factor		1.00	1.00		1.00			0.95		1.00	1.00	1.00
Frpb, ped/bikes		1.00	1.00		1.00			1.00		1.00	1.00	1.00
Flpb, ped/bikes		0.98	1.00		1.00			1.00		1.00	1.00	1.00
Frt		1.00	0.85		0.98			1.00		1.00	1.00	0.85
Flt Protected		0.95	1.00		1.00			1.00		0.95	1.00	1.00
Satd. Flow (prot)		1736	1583		1827			3539		1770	1863	1583
Flt Permitted		0.73	1.00		1.00			1.00		0.46	1.00	1.00
Satd. Flow (perm)		1332	1583		1827			3539		859	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	33	0	54	0	38	5	0	516	0	5	424	27
RTOR Reduction (vph)	0	0	50	0	5	0	0	0	0	0	0	7
Lane Group Flow (vph)	0	33	4	0	38	0	0	516	0	5	424	20
Confl. Peds. (#/hr)	5					5						
Turn Type	Perm	NA	Perm		NA			NA		Perm	NA	Perm
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8						6		6
Actuated Green, G (s)		8.4	8.4		8.4			83.4		83.4	83.4	83.4
Effective Green, g (s)		8.4	8.4		8.4			83.4		83.4	83.4	83.4
Actuated g/C Ratio		0.08	0.08		0.08			0.74		0.74	0.74	0.74
Clearance Time (s)		6.0	6.0		6.0			6.0		6.0	6.0	6.0
Vehicle Extension (s)		3.0	3.0		3.0			2.0		2.0	2.0	2.0
Lane Grp Cap (vph)		99	118		137			2635		639	1387	1178
v/s Ratio Prot					0.02			0.15			c0.23	
v/s Ratio Perm		c0.02	0.00							0.01		0.01
v/c Ratio		0.33	0.03		0.28			0.20		0.01	0.31	0.02
Uniform Delay, d1		49.1	48.0		48.9			4.3		3.7	4.7	3.7
Progression Factor		1.00	1.00		1.00			1.00		1.00	1.00	1.00
Incremental Delay, d2		2.0	0.1		1.1			0.2		0.0	0.6	0.0
Delay (s)		51.1	48.2		50.1			4.4		3.7	5.3	3.7
Level of Service		D	D		D			A		A	A	A
Approach Delay (s)		49.3			50.1			4.4			5.2	
Approach LOS		D			D			A			A	

Intersection Summary			
HCM 2000 Control Delay	10.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.29		
Actuated Cycle Length (s)	112.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	45.5%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBT	NBT	NBR	SBT
Lane Group Flow (vph)	76	679	842	60	87	147
v/c Ratio	0.21	0.62	0.53	0.24	0.26	0.48
Control Delay	7.4	10.3	8.0	20.5	7.3	17.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	7.4	10.3	8.0	20.5	7.3	17.2
Queue Length 50th (ft)	9	104	62	16	0	22
Queue Length 95th (ft)	31	235	124	41	28	62
Internal Link Dist (ft)		564	303	200		268
Turn Bay Length (ft)	245				45	
Base Capacity (vph)	358	1092	1592	787	889	832
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.21	0.62	0.53	0.08	0.10	0.18

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	70	590	35	90	635	50	45	10	80	55	20	60
Future Volume (vph)	70	590	35	90	635	50	45	10	80	55	20	60
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0			6.0			6.0	6.0		6.0	
Lane Util. Factor	1.00	1.00			0.95			1.00	1.00		1.00	
Frpb, ped/bikes	1.00	1.00			1.00			1.00	0.97		0.99	
Flpb, ped/bikes	1.00	1.00			1.00			0.99	1.00		0.99	
Frt	1.00	0.99			0.99			1.00	0.85		0.94	
Flt Protected	0.95	1.00			0.99			0.96	1.00		0.98	
Satd. Flow (prot)	1767	1845			3479			1780	1529		1692	
Flt Permitted	0.33	1.00			0.77			0.77	1.00		0.84	
Satd. Flow (perm)	607	1845			2688			1423	1529		1450	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	76	641	38	98	690	54	49	11	87	60	22	65
RTOR Reduction (vph)	0	2	0	0	5	0	0	0	72	0	54	0
Lane Group Flow (vph)	76	677	0	0	837	0	0	60	15	0	93	0
Confl. Peds. (#/hr)	5		5	5		5	5		5	5		5
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2		2	6		
Actuated Green, G (s)	30.0	30.0			30.0			8.8	8.8		8.8	
Effective Green, g (s)	30.0	30.0			30.0			8.8	8.8		8.8	
Actuated g/C Ratio	0.59	0.59			0.59			0.17	0.17		0.17	
Clearance Time (s)	6.0	6.0			6.0			6.0	6.0		6.0	
Vehicle Extension (s)	3.0	3.0			3.0			3.0	3.0		3.0	
Lane Grp Cap (vph)	358	1089			1587			246	264		251	
v/s Ratio Prot		c0.37										
v/s Ratio Perm	0.13				0.31			0.04	0.01		c0.06	
v/c Ratio	0.21	0.62			0.53			0.24	0.06		0.37	
Uniform Delay, d1	4.9	6.7			6.2			18.1	17.5		18.6	
Progression Factor	1.00	1.00			1.00			1.00	1.00		1.00	
Incremental Delay, d2	1.3	2.7			1.3			0.5	0.1		0.9	
Delay (s)	6.2	9.4			7.4			18.6	17.6		19.5	
Level of Service	A	A			A			B	B		B	
Approach Delay (s)		9.1			7.4			18.0			19.5	
Approach LOS		A			A			B			B	

Intersection Summary			
HCM 2000 Control Delay	9.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	50.8	Sum of lost time (s)	12.0
Intersection Capacity Utilization	86.2%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	NBT	SBT
Lane Group Flow (vph)	190	380	355
v/c Ratio	0.48	0.38	0.33
Control Delay	15.1	8.7	7.4
Queue Delay	0.0	0.0	0.0
Total Delay	15.1	8.7	7.4
Queue Length 50th (ft)	28	50	41
Queue Length 95th (ft)	68	122	102
Internal Link Dist (ft)	529	129	630
Turn Bay Length (ft)			
Base Capacity (vph)	755	997	1091
Starvation Cap Reductn	0	0	0
Spillback Cap Reductn	0	0	0
Storage Cap Reductn	0	0	0
Reduced v/c Ratio	0.25	0.38	0.33

Intersection Summary

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	135	55	60	320	285	70
Future Volume (vph)	135	55	60	320	285	70
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0			6.0	6.0	
Lane Util. Factor	1.00			1.00	1.00	
Frt	0.96			1.00	0.97	
Flt Protected	0.97			0.99	1.00	
Satd. Flow (prot)	1729			1848	1813	
Flt Permitted	0.97			0.90	1.00	
Satd. Flow (perm)	1729			1673	1813	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	135	55	60	320	285	70
RTOR Reduction (vph)	38	0	0	0	13	0
Lane Group Flow (vph)	152	0	0	380	342	0
Turn Type	Prot		Perm	NA	NA	
Protected Phases	4			2	6	
Permitted Phases			2			
Actuated Green, G (s)	7.8			24.2	24.2	
Effective Green, g (s)	7.8			24.2	24.2	
Actuated g/C Ratio	0.18			0.55	0.55	
Clearance Time (s)	6.0			6.0	6.0	
Vehicle Extension (s)	3.0			3.0	3.0	
Lane Grp Cap (vph)	306			920	997	
v/s Ratio Prot	c0.09				0.19	
v/s Ratio Perm				c0.23		
v/c Ratio	0.50			0.41	0.34	
Uniform Delay, d1	16.3			5.8	5.5	
Progression Factor	1.00			1.00	1.00	
Incremental Delay, d2	1.3			1.4	0.9	
Delay (s)	17.6			7.1	6.4	
Level of Service	B			A	A	
Approach Delay (s)	17.6			7.1	6.4	
Approach LOS	B			A	A	

Intersection Summary			
HCM 2000 Control Delay	9.0	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	44.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	65.3%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	10	30	20	90	0	350	45	100	350	285
Future Volume (Veh/h)	0	0	10	30	20	90	0	350	45	100	350	285
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	10	30	20	90	0	350	45	100	350	285
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								710			890	
pX, platoon unblocked	0.85	0.85	0.85	0.85	0.85		0.85					
vC, conflicting volume	1165	1088	492	1075	1208	372	635			395		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1108	1017	321	1003	1158	372	488			395		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	98	83	87	87	100			91		
cM capacity (veh/h)	117	186	615	174	153	673	919			1164		

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	SB 1
Volume Total	10	50	90	395	735
Volume Left	0	30	0	0	100
Volume Right	10	0	90	45	285
cSH	615	165	673	1700	1164
Volume to Capacity	0.02	0.30	0.13	0.23	0.09
Queue Length 95th (ft)	1	30	11	0	7
Control Delay (s)	11.0	36.1	11.2	0.0	2.1
Lane LOS	B	E	B		A
Approach Delay (s)	11.0	20.1		0.0	2.1
Approach LOS	B	C			

Intersection Summary			
Average Delay	3.5		
Intersection Capacity Utilization	75.8%	ICU Level of Service	D
Analysis Period (min)	15		

Lane Group	EBL	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	225	235	305	625	265
v/c Ratio	0.57	0.55	0.26	0.54	0.24
Control Delay	12.0	13.7	5.9	8.6	1.6
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	12.0	13.7	5.9	8.6	1.6
Queue Length 50th (ft)	13	32	33	85	0
Queue Length 95th (ft)	60	#145	84	206	24
Internal Link Dist (ft)	747		221	665	
Turn Bay Length (ft)		230			
Base Capacity (vph)	677	426	1160	1160	1085
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.33	0.55	0.26	0.54	0.24

Intersection Summary

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	50	175	235	305	625	265
Future Volume (vph)	50	175	235	305	625	265
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0		6.0	6.0	6.0	6.0
Lane Util. Factor	1.00		1.00	1.00	1.00	1.00
Frt	0.90		1.00	1.00	1.00	0.85
Flt Protected	0.99		0.95	1.00	1.00	1.00
Satd. Flow (prot)	1649		1770	1863	1863	1583
Flt Permitted	0.99		0.37	1.00	1.00	1.00
Satd. Flow (perm)	1649		685	1863	1863	1583
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	50	175	235	305	625	265
RTOR Reduction (vph)	149	0	0	0	0	100
Lane Group Flow (vph)	76	0	235	305	625	165
Turn Type	Prot		Perm	NA	NA	Perm
Protected Phases	4			2	6	
Permitted Phases			2			6
Actuated Green, G (s)	8.0		33.1	33.1	33.1	33.1
Effective Green, g (s)	8.0		33.1	33.1	33.1	33.1
Actuated g/C Ratio	0.15		0.62	0.62	0.62	0.62
Clearance Time (s)	6.0		6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	248		426	1161	1161	986
v/s Ratio Prot	c0.05			0.16	0.34	
v/s Ratio Perm			c0.34			0.10
v/c Ratio	0.31		0.55	0.26	0.54	0.17
Uniform Delay, d1	20.1		5.7	4.5	5.7	4.2
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	0.7		5.1	0.6	1.8	0.4
Delay (s)	20.8		10.8	5.1	7.5	4.6
Level of Service	C		B	A	A	A
Approach Delay (s)	20.8			7.6	6.6	
Approach LOS	C			A	A	

Intersection Summary			
HCM 2000 Control Delay	8.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	53.1	Sum of lost time (s)	12.0
Intersection Capacity Utilization	74.5%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	WBL	WBR	NBT	SBT
Lane Group Flow (vph)	470	475	355	430
v/c Ratio	0.77	0.62	0.48	0.58
Control Delay	23.6	8.3	14.1	15.8
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	23.6	8.3	14.1	15.8
Queue Length 50th (ft)	111	29	76	97
Queue Length 95th (ft)	#211	93	138	172
Internal Link Dist (ft)	168		665	225
Turn Bay Length (ft)				
Base Capacity (vph)	708	828	745	745
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.66	0.57	0.48	0.58

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	470	475	355	0	0	430
Future Volume (vph)	470	475	355	0	0	430
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0			6.0
Lane Util. Factor	1.00	1.00	1.00			1.00
Frt	1.00	0.85	1.00			1.00
Flt Protected	0.95	1.00	1.00			1.00
Satd. Flow (prot)	1770	1583	1863			1863
Flt Permitted	0.95	1.00	1.00			1.00
Satd. Flow (perm)	1770	1583	1863			1863
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	470	475	355	0	0	430
RTOR Reduction (vph)	0	212	0	0	0	0
Lane Group Flow (vph)	470	263	355	0	0	430
Turn Type	Prot	Perm	NA			NA
Protected Phases	8		2			6
Permitted Phases		8				
Actuated Green, G (s)	16.5	16.5	19.1			19.1
Effective Green, g (s)	16.5	16.5	19.1			19.1
Actuated g/C Ratio	0.35	0.35	0.40			0.40
Clearance Time (s)	6.0	6.0	6.0			6.0
Vehicle Extension (s)	3.0	3.0	3.0			3.0
Lane Grp Cap (vph)	613	548	747			747
v/s Ratio Prot	c0.27		0.19			c0.23
v/s Ratio Perm		0.17				
v/c Ratio	0.77	0.48	0.48			0.58
Uniform Delay, d1	13.8	12.2	10.5			11.1
Progression Factor	1.00	1.00	1.00			1.00
Incremental Delay, d2	5.7	0.7	2.2			3.2
Delay (s)	19.5	12.8	12.7			14.3
Level of Service	B	B	B			B
Approach Delay (s)	16.2		12.7			14.3
Approach LOS	B		B			B

Intersection Summary			
HCM 2000 Control Delay	15.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	47.6	Sum of lost time (s)	12.0
Intersection Capacity Utilization	58.7%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBT	NBT	NBR	SBT
Lane Group Flow (vph)	38	756	511	33	22	60
v/c Ratio	0.06	0.56	0.28	0.17	0.08	0.24
Control Delay	5.7	9.1	5.5	25.4	2.5	15.5
Queue Delay	0.0	0.2	0.0	0.0	0.0	0.0
Total Delay	5.7	9.3	5.5	25.4	2.5	15.5
Queue Length 50th (ft)	4	116	30	13	0	11
Queue Length 95th (ft)	21	393	97	31	6	35
Internal Link Dist (ft)		513	406	230		149
Turn Bay Length (ft)	245				45	
Base Capacity (vph)	638	1355	1847	435	549	508
Starvation Cap Reductn	0	111	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.06	0.61	0.28	0.08	0.04	0.12

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	35	620	75	90	365	15	30	0	20	20	5	30
Future Volume (vph)	35	620	75	90	365	15	30	0	20	20	5	30
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0			6.0			6.0	6.0		6.0	
Lane Util. Factor	1.00	1.00			0.95			1.00	1.00		1.00	
Frt	1.00	0.98			1.00			1.00	0.85		0.93	
Flt Protected	0.95	1.00			0.99			0.95	1.00		0.98	
Satd. Flow (prot)	1770	1832			3489			1770	1583		1693	
Flt Permitted	0.46	1.00			0.71			0.72	1.00		0.87	
Satd. Flow (perm)	864	1832			2501			1337	1583		1492	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	38	674	82	98	397	16	33	0	22	22	5	33
RTOR Reduction (vph)	0	2	0	0	1	0	0	0	19	0	29	0
Lane Group Flow (vph)	38	754	0	0	510	0	0	33	3	0	31	0
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2		2	6		
Actuated Green, G (s)	48.9	48.9			48.9			8.4	8.4		8.4	
Effective Green, g (s)	48.9	48.9			48.9			8.4	8.4		8.4	
Actuated g/C Ratio	0.71	0.71			0.71			0.12	0.12		0.12	
Clearance Time (s)	6.0	6.0			6.0			6.0	6.0		6.0	
Vehicle Extension (s)	3.0	3.0			3.0			3.0	3.0		3.0	
Lane Grp Cap (vph)	609	1292			1764			162	191		180	
v/s Ratio Prot		c0.41										
v/s Ratio Perm	0.04				0.20			c0.02	0.00		0.02	
v/c Ratio	0.06	0.58			0.29			0.20	0.01		0.17	
Uniform Delay, d1	3.1	5.1			3.8			27.4	26.8		27.3	
Progression Factor	1.00	1.00			1.00			1.00	1.00		1.00	
Incremental Delay, d2	0.2	1.9			0.4			0.6	0.0		0.5	
Delay (s)	3.3	7.0			4.2			28.1	26.8		27.8	
Level of Service	A	A			A			C	C		C	
Approach Delay (s)		6.9			4.2			27.6			27.8	
Approach LOS		A			A			C			C	

Intersection Summary			
HCM 2000 Control Delay	7.6	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	69.3	Sum of lost time (s)	14.0
Intersection Capacity Utilization	85.4%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	95	55	45	320	285	70
Future Volume (Veh/h)	95	55	45	320	285	70
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	95	55	45	320	285	70
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)		2				
Median type				None	None	
Median storage veh)						
Upstream signal (ft)					710	
pX, platoon unblocked						
vC, conflicting volume	730	320	355			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	730	320	355			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	75	92	96			
cM capacity (veh/h)	375	721	1204			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	150	365	355
Volume Left	95	45	0
Volume Right	55	0	70
cSH	592	1204	1700
Volume to Capacity	0.25	0.04	0.21
Queue Length 95th (ft)	25	3	0
Control Delay (s)	15.1	1.3	0.0
Lane LOS	C	A	
Approach Delay (s)	15.1	1.3	0.0
Approach LOS	C		

Intersection Summary			
Average Delay	3.2		
Intersection Capacity Utilization	53.8%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBT	WBT	WBR	NBT	SBL	SBT
Lane Group Flow (vph)	50	50	90	410	100	635
v/c Ratio	0.23	0.23	0.29	0.31	0.13	0.49
Control Delay	12.2	19.4	7.5	4.3	4.0	5.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	12.2	19.4	7.5	4.3	4.0	5.2
Queue Length 50th (ft)	4	11	0	34	8	51
Queue Length 95th (ft)	25	33	27	77	23	126
Internal Link Dist (ft)	369	235		630		509
Turn Bay Length (ft)			20		100	
Base Capacity (vph)	528	561	661	1302	768	1288
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.09	0.09	0.14	0.31	0.13	0.49

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	40	0	10	30	20	90	15	350	45	100	350	285
Future Volume (vph)	40	0	10	30	20	90	15	350	45	100	350	285
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.5			4.5	4.5		4.5		4.5	4.5	
Lane Util. Factor		1.00			1.00	1.00		1.00		1.00	1.00	
Frt		0.97			1.00	0.85		0.99		1.00	0.93	
Flt Protected		0.96			0.97	1.00		1.00		0.95	1.00	
Satd. Flow (prot)		1743			1808	1583		1832		1770	1737	
Flt Permitted		0.73			0.79	1.00		0.98		0.57	1.00	
Satd. Flow (perm)		1332			1466	1583		1794		1061	1737	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	40	0	10	30	20	90	15	350	45	100	350	285
RTOR Reduction (vph)	0	26	0	0	0	79	0	5	0	0	33	0
Lane Group Flow (vph)	0	24	0	0	50	11	0	405	0	100	602	0
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8		8	2			6		
Actuated Green, G (s)		5.9			5.9	5.9		33.7		33.7	33.7	
Effective Green, g (s)		5.9			5.9	5.9		33.7		33.7	33.7	
Actuated g/C Ratio		0.12			0.12	0.12		0.69		0.69	0.69	
Clearance Time (s)		4.5			4.5	4.5		4.5		4.5	4.5	
Vehicle Extension (s)		3.0			3.0	3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)		161			177	192		1243		735	1204	
v/s Ratio Prot											c0.35	
v/s Ratio Perm		0.02			c0.03	0.01		0.23		0.09		
v/c Ratio		0.15			0.28	0.06		0.33		0.14	0.50	
Uniform Delay, d1		19.1			19.4	18.9		3.0		2.5	3.5	
Progression Factor		1.00			1.00	1.00		1.00		1.00	1.00	
Incremental Delay, d2		0.4			0.9	0.1		0.7		0.4	1.5	
Delay (s)		19.5			20.3	19.0		3.6		2.9	5.0	
Level of Service		B			C	B		A		A	A	
Approach Delay (s)		19.5			19.5			3.6			4.7	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	6.5	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	48.6	Sum of lost time (s)	9.0
Intersection Capacity Utilization	70.6%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	WBT	WBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	486	460	76	285	430	65
v/c Ratio	0.75	0.55	0.24	0.38	0.57	0.10
Control Delay	22.7	4.9	14.1	13.7	16.7	4.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	22.7	4.9	14.1	13.7	16.7	4.1
Queue Length 50th (ft)	126	8	16	65	109	0
Queue Length 95th (ft)	217	57	43	119	187	19
Internal Link Dist (ft)	168			780	110	
Turn Bay Length (ft)			100			
Base Capacity (vph)	753	910	318	753	753	679
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.65	0.51	0.24	0.38	0.57	0.10

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	470	15	460	70	285	0	0	430	60
Future Volume (vph)	0	0	0	470	15	460	70	285	0	0	430	60
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					6.0	6.0	6.0	6.0			6.0	6.0
Lane Util. Factor					1.00	1.00	1.00	1.00			1.00	1.00
Frt					1.00	0.85	1.00	1.00			1.00	0.85
Flt Protected					0.95	1.00	0.95	1.00			1.00	1.00
Satd. Flow (prot)					1777	1583	1770	1863			1863	1583
Flt Permitted					0.95	1.00	0.42	1.00			1.00	1.00
Satd. Flow (perm)					1777	1583	785	1863			1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	1.00	0.92	1.00	0.92	1.00	1.00	1.00	1.00	0.92
Adj. Flow (vph)	0	0	0	470	16	460	76	285	0	0	430	65
RTOR Reduction (vph)	0	0	0	0	0	264	0	0	0	0	0	39
Lane Group Flow (vph)	0	0	0	0	486	196	76	285	0	0	430	26
Turn Type				Split	NA	Perm	Perm	NA			NA	Perm
Protected Phases				8	8			2			6	
Permitted Phases						8	2					6
Actuated Green, G (s)					19.0	19.0	21.1	21.1			21.1	21.1
Effective Green, g (s)					19.0	19.0	21.1	21.1			21.1	21.1
Actuated g/C Ratio					0.36	0.36	0.40	0.40			0.40	0.40
Clearance Time (s)					6.0	6.0	6.0	6.0			6.0	6.0
Vehicle Extension (s)					3.0	3.0	3.0	3.0			3.0	3.0
Lane Grp Cap (vph)					648	577	317	754			754	641
v/s Ratio Prot					c0.27			0.15			c0.23	
v/s Ratio Perm						0.12	0.10					0.02
v/c Ratio					0.75	0.34	0.24	0.38			0.57	0.04
Uniform Delay, d1					14.5	12.0	10.2	10.9			12.0	9.4
Progression Factor					1.00	1.00	1.00	1.00			1.00	1.00
Incremental Delay, d2					4.9	0.4	1.8	1.4			3.1	0.1
Delay (s)					19.3	12.4	12.0	12.3			15.1	9.5
Level of Service					B	B	B	B			B	A
Approach Delay (s)		0.0			15.9			12.3			14.4	
Approach LOS		A			B			B			B	

Intersection Summary			
HCM 2000 Control Delay	14.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	52.1	Sum of lost time (s)	12.0
Intersection Capacity Utilization	68.6%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	WBL	WBT	NBT	NBR	SBT
Lane Group Flow (vph)	794	98	413	33	22	60
v/c Ratio	0.31	0.19	0.15	0.16	0.08	0.24
Control Delay	5.0	6.8	4.3	24.7	4.8	15.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	5.0	6.8	4.3	24.7	4.8	15.4
Queue Length 50th (ft)	48	11	22	13	0	11
Queue Length 95th (ft)	146	53	70	31	10	35
Internal Link Dist (ft)	513		86	304		401
Turn Bay Length (ft)		75			45	
Base Capacity (vph)	2533	516	2778	698	845	795
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.31	0.19	0.15	0.05	0.03	0.08

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	35	620	75	90	365	15	30	0	20	20	5	30
Future Volume (vph)	35	620	75	90	365	15	30	0	20	20	5	30
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0		6.0	6.0			6.0	6.0		6.0	
Lane Util. Factor		0.95		1.00	0.95			1.00	1.00		1.00	
Frt		0.98		1.00	0.99			1.00	0.85		0.93	
Flt Protected		1.00		0.95	1.00			0.95	1.00		0.98	
Satd. Flow (prot)		3476		1770	3519			1770	1583		1693	
Flt Permitted		0.92		0.35	1.00			0.72	1.00		0.87	
Satd. Flow (perm)		3204		655	3519			1337	1583		1492	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	38	674	82	98	397	16	33	0	22	22	5	33
RTOR Reduction (vph)	0	5	0	0	2	0	0	0	20	0	30	0
Lane Group Flow (vph)	0	789	0	98	411	0	0	33	2	0	30	0
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2		2	6		
Actuated Green, G (s)		49.1		49.1	49.1			6.9	6.9		6.9	
Effective Green, g (s)		49.1		49.1	49.1			6.9	6.9		6.9	
Actuated g/C Ratio		0.72		0.72	0.72			0.10	0.10		0.10	
Clearance Time (s)		6.0		6.0	6.0			6.0	6.0		6.0	
Vehicle Extension (s)		3.0		3.0	3.0			3.0	3.0		3.0	
Lane Grp Cap (vph)		2313		472	2540			135	160		151	
v/s Ratio Prot					0.12							
v/s Ratio Perm		c0.25		0.15				c0.02	0.00		0.02	
v/c Ratio		0.34		0.21	0.16			0.24	0.01		0.20	
Uniform Delay, d1		3.5		3.1	3.0			28.1	27.5		28.0	
Progression Factor		1.00		1.00	1.00			1.00	1.00		1.00	
Incremental Delay, d2		0.4		1.0	0.1			0.9	0.0		0.7	
Delay (s)		3.9		4.1	3.1			29.1	27.5		28.7	
Level of Service		A		A	A			C	C		C	
Approach Delay (s)		3.9			3.3			28.5			28.7	
Approach LOS		A			A			C			C	

Intersection Summary			
HCM 2000 Control Delay	5.7	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.33		
Actuated Cycle Length (s)	68.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	71.5%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	470	475	355	0	0	430
Future Volume (Veh/h)	470	475	355	0	0	430
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	470	475	355	0	0	430
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						560
pX, platoon unblocked						
vC, conflicting volume	570	355			355	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	570	355			355	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	0	26			100	
cM capacity (veh/h)	452	641			1200	

Direction, Lane #	WB 1	WB 2	NB 1	SB 1	SB 2
Volume Total	470	475	355	215	215
Volume Left	470	0	0	0	0
Volume Right	0	475	0	0	0
cSH	452	641	1700	1700	1700
Volume to Capacity	1.04	0.74	0.21	0.13	0.13
Queue Length 95th (ft)	362	163	0	0	0
Control Delay (s)	83.9	24.9	0.0	0.0	0.0
Lane LOS	F	C			
Approach Delay (s)	54.2		0.0	0.0	
Approach LOS	F				

Intersection Summary			
Average Delay	29.6		
Intersection Capacity Utilization	54.8%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	397	391	152	82	141
v/c Ratio	0.74	0.68	0.17	0.32	0.09
Control Delay	21.7	26.1	8.3	30.9	0.1
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	21.7	26.1	8.3	30.9	0.1
Queue Length 50th (ft)	73	118	23	27	0
Queue Length 95th (ft)	188	263	64	78	0
Internal Link Dist (ft)	559		977	244	
Turn Bay Length (ft)					
Base Capacity (vph)	918	898	1671	945	1583
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.43	0.44	0.09	0.09	0.09

Intersection Summary

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	90	275	360	140	75	130
Future Volume (vph)	90	275	360	140	75	130
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0		6.0	6.0	6.0	4.0
Lane Util. Factor	1.00		1.00	1.00	1.00	1.00
Frt	0.90		1.00	1.00	1.00	0.85
Flt Protected	0.99		0.95	1.00	1.00	1.00
Satd. Flow (prot)	1653		1770	1863	1863	1583
Flt Permitted	0.99		0.95	1.00	1.00	1.00
Satd. Flow (perm)	1653		1770	1863	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	98	299	391	152	82	141
RTOR Reduction (vph)	121	0	0	0	0	0
Lane Group Flow (vph)	276	0	391	152	82	141
Turn Type	Prot		Prot	NA	NA	Free
Protected Phases	4		1	6	2	
Permitted Phases						Free
Actuated Green, G (s)	14.3		18.2	30.0	5.8	56.3
Effective Green, g (s)	14.3		18.2	30.0	5.8	56.3
Actuated g/C Ratio	0.25		0.32	0.53	0.10	1.00
Clearance Time (s)	6.0		6.0	6.0	6.0	
Vehicle Extension (s)	2.0		2.0	2.0	2.0	
Lane Grp Cap (vph)	419		572	992	191	1583
v/s Ratio Prot	c0.17		c0.22	0.08	c0.04	
v/s Ratio Perm						0.09
v/c Ratio	0.66		0.68	0.15	0.43	0.09
Uniform Delay, d1	18.8		16.5	6.7	23.7	0.0
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	2.9		2.7	0.0	0.6	0.1
Delay (s)	21.7		19.2	6.7	24.3	0.1
Level of Service	C		B	A	C	A
Approach Delay (s)	21.7			15.7	9.0	
Approach LOS	C			B	A	

Intersection Summary			
HCM 2000 Control Delay	16.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	56.3	Sum of lost time (s)	18.0
Intersection Capacity Utilization	58.5%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	60	179	38	158	299	38	217	283	342	244
v/c Ratio	0.38	0.64	0.10	0.41	0.23	0.18	0.62	0.45	0.67	0.29
Control Delay	33.7	39.2	0.5	18.9	4.9	24.8	33.4	17.4	19.3	11.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	33.7	39.2	0.5	18.9	4.9	24.8	33.4	17.4	19.3	11.7
Queue Length 50th (ft)	23	71	0	45	10	13	82	81	88	56
Queue Length 95th (ft)	57	#150	0	87	34	37	146	142	148	100
Internal Link Dist (ft)		359			513		394			506
Turn Bay Length (ft)	295		75	240				75	200	
Base Capacity (vph)	159	281	396	390	1282	238	393	581	513	882
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.38	0.64	0.10	0.41	0.23	0.16	0.55	0.49	0.67	0.28

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	55	165	35	145	65	210	35	200	260	315	185	40
Future Volume (vph)	55	165	35	145	65	210	35	200	260	315	185	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0	6.0	6.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95		1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.89		1.00	1.00	0.85	1.00	0.97	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	1863	1583	1770	3134		1770	1863	1583	1770	1814	
Flt Permitted	0.57	1.00	1.00	0.40	1.00		0.61	1.00	1.00	0.37	1.00	
Satd. Flow (perm)	1060	1863	1583	738	3134		1131	1863	1583	694	1814	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	60	179	38	158	71	228	38	217	283	342	201	43
RTOR Reduction (vph)	0	0	32	0	146	0	0	0	0	0	6	0
Lane Group Flow (vph)	60	179	6	158	153	0	38	217	283	342	238	0
Turn Type	Perm	NA	Perm	pm+pt	NA		Perm	NA	pt+ov	pm+pt	NA	
Protected Phases		8		7	4			6	6 7	5	2	
Permitted Phases	8		8	4			6			2		
Actuated Green, G (s)	10.1	10.1	10.1	23.9	23.9		12.4	12.4	26.2	30.4	30.4	
Effective Green, g (s)	10.1	10.1	10.1	23.9	23.9		12.4	12.4	26.2	30.4	30.4	
Actuated g/C Ratio	0.15	0.15	0.15	0.36	0.36		0.19	0.19	0.40	0.46	0.46	
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0	3.0	2.0	2.0		2.0	2.0		2.0	2.0	
Lane Grp Cap (vph)	161	283	241	387	1129		211	348	625	512	831	
v/s Ratio Prot		c0.10		0.05	0.05			0.12	c0.18	c0.12	0.13	
v/s Ratio Perm	0.06		0.00	0.10			0.03			c0.19		
v/c Ratio	0.37	0.63	0.02	0.41	0.14		0.18	0.62	0.45	0.67	0.29	
Uniform Delay, d1	25.3	26.4	23.9	15.2	14.3		22.7	24.8	14.8	12.6	11.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	1.5	4.6	0.0	0.3	0.0		0.1	2.5	0.2	2.6	0.1	
Delay (s)	26.7	30.9	23.9	15.5	14.3		22.8	27.3	15.0	15.2	11.3	
Level of Service	C	C	C	B	B		C	C	B	B	B	
Approach Delay (s)		29.1			14.7			20.5			13.6	
Approach LOS		C			B			C			B	

Intersection Summary			
HCM 2000 Control Delay	18.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	66.3	Sum of lost time (s)	26.0
Intersection Capacity Utilization	64.7%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	EBR	WBT	NBL	NBT	SBT
Lane Group Flow (vph)	125	196	5	261	234	391
v/c Ratio	0.41	0.40	0.01	0.47	0.11	0.56
Control Delay	22.8	5.5	0.0	10.2	6.8	20.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	22.8	5.5	0.0	10.2	6.8	20.3
Queue Length 50th (ft)	39	0	0	37	17	114
Queue Length 95th (ft)	70	37	0	92	40	#210
Internal Link Dist (ft)	379		511		428	294
Turn Bay Length (ft)		70				
Base Capacity (vph)	456	646	787	552	2070	703
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.27	0.30	0.01	0.47	0.11	0.56

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	115	0	180	0	0	5	240	215	0	0	360	0
Future Volume (vph)	115	0	180	0	0	5	240	215	0	0	360	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0	6.0		6.0		4.5	6.0			6.0	
Lane Util. Factor		1.00	1.00		1.00		1.00	0.95			1.00	
Frt		1.00	0.85		0.86		1.00	1.00			1.00	
Flt Protected		0.95	1.00		1.00		0.95	1.00			1.00	
Satd. Flow (prot)		1770	1583		1611		1770	3539			1863	
Flt Permitted		0.75	1.00		1.00		0.36	1.00			1.00	
Satd. Flow (perm)		1405	1583		1611		665	3539			1863	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	125	0	196	0	0	5	261	234	0	0	391	0
RTOR Reduction (vph)	0	0	154	0	4	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	125	42	0	1	0	261	234	0	0	391	0
Turn Type	pm+pt	NA	Perm		NA		pm+pt	NA		Perm	NA	Perm
Protected Phases	7	4			8		5	2			6	
Permitted Phases	4		4	8			2			6		6
Actuated Green, G (s)		12.9	12.9		12.9		35.1	35.1			22.6	
Effective Green, g (s)		12.9	12.9		12.9		35.1	35.1			22.6	
Actuated g/C Ratio		0.22	0.22		0.22		0.59	0.59			0.38	
Clearance Time (s)		6.0	6.0		6.0		4.5	6.0			6.0	
Vehicle Extension (s)		3.0	3.0		3.0		3.0	2.0			2.0	
Lane Grp Cap (vph)		302	340		346		536	2070			701	
v/s Ratio Prot					0.00		c0.06	0.07			c0.21	
v/s Ratio Perm		c0.09	0.03				0.22					
v/c Ratio		0.41	0.12		0.00		0.49	0.11			0.56	
Uniform Delay, d1		20.3	19.0		18.5		7.0	5.5			14.8	
Progression Factor		1.00	1.00		1.00		1.00	1.00			1.00	
Incremental Delay, d2		0.9	0.2		0.0		0.7	0.1			3.2	
Delay (s)		21.2	19.2		18.5		7.7	5.6			17.9	
Level of Service		C	B		B		A	A			B	
Approach Delay (s)		20.0			18.5			6.7			17.9	
Approach LOS		B			B			A			B	

Intersection Summary			
HCM 2000 Control Delay	13.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	21.0
Intersection Capacity Utilization	59.0%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	30	485	60	90	285	15	20	0	20	20	5	20
Future Volume (Veh/h)	30	485	60	90	285	15	20	0	20	20	5	20
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	33	527	65	98	310	16	22	0	22	22	5	22
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)									2			
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		593										
pX, platoon unblocked				0.93			0.93	0.93	0.93	0.93	0.93	
vC, conflicting volume	326			592			1001	1148	560	1118	1172	163
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	326			524			964	1121	489	1089	1148	163
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	97			90			87	100	95	84	97	97
cM capacity (veh/h)	1230			966			168	167	488	136	161	853

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1
Volume Total	33	592	253	171	44	49
Volume Left	33	0	98	0	22	22
Volume Right	0	65	0	16	22	22
cSH	1230	1700	966	1700	336	224
Volume to Capacity	0.03	0.35	0.10	0.10	0.13	0.22
Queue Length 95th (ft)	2	0	8	0	11	20
Control Delay (s)	8.0	0.0	4.2	0.0	21.2	25.5
Lane LOS	A		A		C	D
Approach Delay (s)	0.4		2.5		21.2	25.5
Approach LOS					C	D

Intersection Summary			
Average Delay	3.1		
Intersection Capacity Utilization	59.4%	ICU Level of Service	B
Analysis Period (min)	15		

Lane Group	EBT	WBL	WBT	NBT	NBR	SBT
Lane Group Flow (vph)	794	98	413	33	22	60
v/c Ratio	0.30	0.18	0.27	0.12	0.08	0.24
Control Delay	3.3	4.8	3.8	18.3	2.6	13.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	3.3	4.8	3.8	18.3	2.6	13.1
Queue Length 50th (ft)	0	0	0	8	0	7
Queue Length 95th (ft)	82	32	96	26	6	31
Internal Link Dist (ft)	513		406	230		149
Turn Bay Length (ft)		145			45	
Base Capacity (vph)	2687	545	1545	693	623	575
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.30	0.18	0.27	0.05	0.04	0.10

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	35	620	75	90	365	15	30	0	20	20	5	30
Future Volume (vph)	35	620	75	90	365	15	30	0	20	20	5	30
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0		6.0	6.0			6.0	6.0		6.0	
Lane Util. Factor		0.95		1.00	1.00			1.00	1.00		1.00	
Frt		0.98		1.00	0.99			1.00	0.85		0.93	
Flt Protected		1.00		0.95	1.00			0.95	1.00		0.98	
Satd. Flow (prot)		3476		1770	1852			1770	1583		1693	
Flt Permitted		0.92		0.35	1.00			1.00	1.00		0.87	
Satd. Flow (perm)		3216		655	1852			1863	1583		1492	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	38	674	82	98	397	16	33	0	22	22	5	33
RTOR Reduction (vph)	0	8	0	0	1	0	0	0	21	0	31	0
Lane Group Flow (vph)	0	786	0	98	412	0	0	33	1	0	29	0
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2		2	6		
Actuated Green, G (s)		36.8		36.8	36.8			3.2	3.2		3.2	
Effective Green, g (s)		36.8		36.8	36.8			3.2	3.2		3.2	
Actuated g/C Ratio		0.71		0.71	0.71			0.06	0.06		0.06	
Clearance Time (s)		6.0		6.0	6.0			6.0	6.0		6.0	
Vehicle Extension (s)		3.0		3.0	3.0			3.0	3.0		3.0	
Lane Grp Cap (vph)		2275		463	1310			114	97		91	
v/s Ratio Prot					0.22							
v/s Ratio Perm		c0.24		0.15				0.02	0.00		c0.02	
v/c Ratio		0.35		0.21	0.31			0.29	0.01		0.32	
Uniform Delay, d1		2.9		2.6	2.9			23.3	22.9		23.4	
Progression Factor		1.00		1.00	1.00			1.00	1.00		1.00	
Incremental Delay, d2		0.4		1.0	0.6			1.4	0.1		2.0	
Delay (s)		3.4		3.7	3.5			24.7	23.0		25.4	
Level of Service		A		A	A			C	C		C	
Approach Delay (s)		3.4			3.5			24.0			25.4	
Approach LOS		A			A			C			C	

Intersection Summary			
HCM 2000 Control Delay	5.1	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.34		
Actuated Cycle Length (s)	52.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	71.5%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	60	179	38	158	71	228	255	283	342	244
v/c Ratio	0.43	0.91	0.10	0.56	0.15	0.32	0.42	0.35	0.73	0.27
Control Delay	45.8	84.4	0.6	32.0	22.5	2.9	30.4	4.2	30.7	17.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	45.8	84.4	0.6	32.0	22.5	2.9	30.4	4.2	30.7	17.0
Queue Length 50th (ft)	31	96	0	64	27	0	92	0	94	60
Queue Length 95th (ft)	70	#215	0	114	58	28	#374	62	#417	194
Internal Link Dist (ft)		359			513		394			546
Turn Bay Length (ft)	295		75	240				150	200	
Base Capacity (vph)	140	197	362	302	569	709	605	818	470	902
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.43	0.91	0.10	0.52	0.12	0.32	0.42	0.35	0.73	0.27

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	55	165	35	145	65	210	35	200	260	315	185	40
Future Volume (vph)	55	165	35	145	65	210	35	200	260	315	185	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1500	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0	6.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85	1.00	0.97	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.99	1.00	0.95	1.00	
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583		1849	1250	1770	1814	
Flt Permitted	0.71	1.00	1.00	0.28	1.00	1.00		0.92	1.00	0.44	1.00	
Satd. Flow (perm)	1324	1863	1583	529	1863	1583		1715	1250	816	1814	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	60	179	38	158	71	228	38	217	283	342	201	43
RTOR Reduction (vph)	0	0	34	0	0	145	0	0	155	0	6	0
Lane Group Flow (vph)	60	179	4	158	71	83	0	255	128	342	238	0
Turn Type	Perm	NA	Perm	pm+pt	NA	pm+ov	Perm	NA	pm+ov	pm+pt	NA	
Protected Phases		8		7	4	5		6	7	5	2	
Permitted Phases	8		8	4		4	6		6	2		
Actuated Green, G (s)	9.0	9.0	9.0	25.0	25.0	31.0		28.4	38.4	40.4	40.4	
Effective Green, g (s)	9.0	9.0	9.0	25.0	25.0	31.0		28.4	38.4	40.4	40.4	
Actuated g/C Ratio	0.11	0.11	0.11	0.29	0.29	0.36		0.33	0.45	0.48	0.48	
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0	6.0	
Vehicle Extension (s)	3.0	3.0	3.0	2.0	2.0	2.0		2.0	2.0	2.0	2.0	
Lane Grp Cap (vph)	140	197	167	301	547	577		573	652	455	862	
v/s Ratio Prot		c0.10		c0.06	0.04	0.01			0.02	c0.05	0.13	
v/s Ratio Perm	0.05		0.00	0.09		0.04		0.15	0.08	c0.30		
v/c Ratio	0.43	0.91	0.02	0.52	0.13	0.14		0.45	0.20	0.75	0.28	
Uniform Delay, d1	35.6	37.6	34.1	23.7	22.0	18.1		22.1	14.0	18.8	13.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	
Incremental Delay, d2	2.1	39.1	0.1	0.8	0.0	0.0		2.5	0.1	6.1	0.8	
Delay (s)	37.7	76.7	34.1	24.5	22.1	18.1		24.6	14.1	24.9	14.3	
Level of Service	D	E	C	C	C	B		C	B	C	B	
Approach Delay (s)		62.4			20.9			19.1			20.5	
Approach LOS		E			C			B			C	

Intersection Summary			
HCM 2000 Control Delay	26.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	85.0	Sum of lost time (s)	26.0
Intersection Capacity Utilization	66.6%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	EBR	WBT	NBT	SBT	SBR
Lane Group Flow (vph)	125	196	266	234	391	261
v/c Ratio	0.62	0.37	0.60	0.12	0.39	0.27
Control Delay	41.7	6.0	33.0	13.3	17.7	4.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	41.7	6.0	33.0	13.3	17.7	4.4
Queue Length 50th (ft)	55	0	116	25	96	3
Queue Length 95th (ft)	113	48	191	83	#358	65
Internal Link Dist (ft)	379		511	388	294	
Turn Bay Length (ft)		70				140
Base Capacity (vph)	224	568	444	1924	1012	971
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.56	0.35	0.60	0.12	0.39	0.27

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	115	0	180	0	240	5	0	215	0	0	360	240
Future Volume (vph)	115	0	180	0	240	5	0	215	0	0	360	240
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0	6.0		6.0			6.0			6.0	6.0
Lane Util. Factor		1.00	1.00		1.00			0.95			1.00	1.00
Frt		1.00	0.85		1.00			1.00			1.00	0.85
Flt Protected		0.95	1.00		1.00			1.00			1.00	1.00
Satd. Flow (prot)		1770	1583		1858			3539			1863	1583
Flt Permitted		0.45	1.00		1.00			1.00			1.00	1.00
Satd. Flow (perm)		836	1583		1858			3539			1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	125	0	196	0	261	5	0	234	0	0	391	261
RTOR Reduction (vph)	0	0	149	0	1	0	0	0	0	0	0	116
Lane Group Flow (vph)	0	125	47	0	265	0	0	234	0	0	391	145
Turn Type	pm+pt	NA	Perm		NA			NA		Perm	NA	Perm
Protected Phases	7	4			8			2			6	
Permitted Phases	4		4	8						6		6
Actuated Green, G (s)		19.6	19.6		19.6			43.0			43.0	43.0
Effective Green, g (s)		19.6	19.6		19.6			43.0			43.0	43.0
Actuated g/C Ratio		0.24	0.24		0.24			0.52			0.52	0.52
Clearance Time (s)		6.0	6.0		6.0			6.0			6.0	6.0
Vehicle Extension (s)		3.0	3.0		3.0			2.0			2.0	2.0
Lane Grp Cap (vph)		199	378		444			1855			976	830
v/s Ratio Prot					0.14			0.07			c0.21	
v/s Ratio Perm		c0.15	0.03									0.09
v/c Ratio		0.63	0.12		0.60			0.13			0.40	0.17
Uniform Delay, d1		27.9	24.5		27.7			9.9			11.7	10.2
Progression Factor		1.00	1.00		1.00			1.00			1.00	1.00
Incremental Delay, d2		6.1	0.1		2.2			0.1			1.2	0.5
Delay (s)		34.0	24.6		29.9			10.1			13.0	10.7
Level of Service		C	C		C			B			B	B
Approach Delay (s)		28.3			29.9			10.1			12.0	
Approach LOS		C			C			B			B	

Intersection Summary			
HCM 2000 Control Delay	18.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	82.0	Sum of lost time (s)	19.0
Intersection Capacity Utilization	58.0%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	95	55	45	320	285	70
Future Volume (Veh/h)	95	55	45	320	285	70
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	95	55	45	320	285	70
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	730	320	355			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	730	320	355			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	75	92	96			
cM capacity (veh/h)	375	721	1204			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	150	365	355
Volume Left	95	45	0
Volume Right	55	0	70
cSH	455	1204	1700
Volume to Capacity	0.33	0.04	0.21
Queue Length 95th (ft)	36	3	0
Control Delay (s)	16.8	1.3	0.0
Lane LOS	C	A	
Approach Delay (s)	16.8	1.3	0.0
Approach LOS	C		

Intersection Summary			
Average Delay	3.4		
Intersection Capacity Utilization	57.2%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	40	0	10	30	20	90	15	350	45	100	350	285
Future Volume (Veh/h)	40	0	10	30	20	90	15	350	45	100	350	285
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	40	0	10	30	20	90	15	350	45	100	350	285
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)						1						
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1150	1118	492	962	1238	372	635			395		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1150	1118	492	962	1238	372	635			395		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	68	100	98	86	87	87	98			91		
cM capacity (veh/h)	127	186	576	213	158	673	948			1164		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1	SB 2
Volume Total	50	140	410	100	635
Volume Left	40	30	15	100	0
Volume Right	10	90	45	0	285
cSH	150	536	948	1164	1700
Volume to Capacity	0.33	0.26	0.02	0.09	0.37
Queue Length 95th (ft)	34	26	1	7	0
Control Delay (s)	40.5	18.0	0.5	8.4	0.0
Lane LOS	E	C	A	A	
Approach Delay (s)	40.5	18.0	0.5	1.1	
Approach LOS	E	C			

Intersection Summary			
Average Delay	4.2		
Intersection Capacity Utilization	69.8%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	20	0	75	0	460	15	40	710	0
Future Volume (Veh/h)	0	0	0	20	0	75	0	460	15	40	710	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	0	20	0	75	0	460	15	40	710	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1332	1265	710	1258	1258	468	710			475		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1332	1265	710	1258	1258	468	710			475		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	86	100	87	100			96		
cM capacity (veh/h)	111	163	434	144	165	595	889			1087		

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	SB 1	SB 2
Volume Total	0	20	75	475	40	710
Volume Left	0	20	0	0	40	0
Volume Right	0	0	75	15	0	0
cSH	1700	144	595	889	1087	1700
Volume to Capacity	0.00	0.14	0.13	0.00	0.04	0.42
Queue Length 95th (ft)	0	12	11	0	3	0
Control Delay (s)	0.0	34.1	11.9	0.0	8.4	0.0
Lane LOS	A	D	B		A	
Approach Delay (s)	0.0	16.6		0.0	0.5	
Approach LOS	A	C				

Intersection Summary			
Average Delay	1.4		
Intersection Capacity Utilization	48.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	50	175	235	305	625	265
Future Volume (Veh/h)	50	175	235	305	625	265
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	50	175	235	305	625	265
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1400	625	890			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1400	625	890			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	53	64	69			
cM capacity (veh/h)	107	485	761			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	225	235	305	625	265
Volume Left	50	235	0	0	0
Volume Right	175	0	0	0	265
cSH	272	761	1700	1700	1700
Volume to Capacity	0.83	0.31	0.18	0.37	0.16
Queue Length 95th (ft)	168	33	0	0	0
Control Delay (s)	59.9	11.8	0.0	0.0	0.0
Lane LOS	F	B			
Approach Delay (s)	59.9	5.1		0.0	
Approach LOS	F				

Intersection Summary			
Average Delay	9.8		
Intersection Capacity Utilization	69.5%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	470	15	355	0	0	430
Future Volume (Veh/h)	470	15	355	0	0	430
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	470	15	355	0	0	430
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						560
pX, platoon unblocked						
vC, conflicting volume	570	355			355	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	570	355			355	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	0	98			100	
cM capacity (veh/h)	452	641			1200	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	485	355	215	215
Volume Left	470	0	0	0
Volume Right	15	0	0	0
cSH	456	1700	1700	1700
Volume to Capacity	1.06	0.21	0.13	0.13
Queue Length 95th (ft)	386	0	0	0
Control Delay (s)	90.4	0.0	0.0	0.0
Lane LOS	F			
Approach Delay (s)	90.4	0.0	0.0	
Approach LOS	F			

Intersection Summary			
Average Delay	34.5		
Intersection Capacity Utilization	52.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	0	85	285	430	60
Future Volume (Veh/h)	0	0	85	285	430	60
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	85	285	430	60
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)					370	
pX, platoon unblocked						
vC, conflicting volume	885	430	490			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	885	430	490			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	100	92			
cM capacity (veh/h)	290	625	1073			

Direction, Lane #	NB 1	NB 2	SB 1	SB 2
Volume Total	85	285	430	60
Volume Left	85	0	0	0
Volume Right	0	0	0	60
cSH	1073	1700	1700	1700
Volume to Capacity	0.08	0.17	0.25	0.04
Queue Length 95th (ft)	6	0	0	0
Control Delay (s)	8.6	0.0	0.0	0.0
Lane LOS	A			
Approach Delay (s)	2.0		0.0	
Approach LOS				

Intersection Summary			
Average Delay	0.9		
Intersection Capacity Utilization	34.0%	ICU Level of Service	A
Analysis Period (min)	15		

Intersection Sign configuration not allowed in HCM analysis.

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	98	299	391	152	82	141
v/c Ratio	0.32	0.30	0.57	0.16	0.16	0.09
Control Delay	16.9	1.7	17.8	5.6	15.8	0.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	16.9	1.7	17.8	5.6	15.8	0.1
Queue Length 50th (ft)	19	0	38	14	8	0
Queue Length 95th (ft)	48	21	76	37	22	0
Internal Link Dist (ft)	595			769	206	
Turn Bay Length (ft)						
Base Capacity (vph)	566	961	753	1058	608	1583
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.17	0.31	0.52	0.14	0.13	0.09

Intersection Summary

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	90	275	360	140	75	130
Future Volume (vph)	90	275	360	140	75	130
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.9	6.7	6.7	5.5	5.5	4.0
Lane Util. Factor	1.00	1.00	0.97	1.00	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	3433	1863	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	3433	1863	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	98	299	391	152	82	141
RTOR Reduction (vph)	0	186	0	0	0	0
Lane Group Flow (vph)	98	113	391	152	82	141
Turn Type	Prot	pt+ov	Prot	NA	NA	Free
Protected Phases	4	1 4	1	6	2	
Permitted Phases						Free
Actuated Green, G (s)	6.7	20.2	7.6	19.9	5.6	38.0
Effective Green, g (s)	6.7	14.3	7.6	19.9	5.6	38.0
Actuated g/C Ratio	0.18	0.38	0.20	0.52	0.15	1.00
Clearance Time (s)	5.9		6.7	5.5	5.5	
Vehicle Extension (s)	2.0		2.0	2.0	2.0	
Lane Grp Cap (vph)	312	595	686	975	521	1583
v/s Ratio Prot	c0.06	0.07	c0.11	c0.08	0.02	
v/s Ratio Perm						0.09
v/c Ratio	0.31	0.19	0.57	0.16	0.16	0.09
Uniform Delay, d1	13.6	8.0	13.7	4.7	14.1	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.2	0.1	0.7	0.0	0.1	0.1
Delay (s)	13.9	8.0	14.4	4.7	14.2	0.1
Level of Service	B	A	B	A	B	A
Approach Delay (s)	9.5			11.7	5.3	
Approach LOS	A			B	A	

Intersection Summary			
HCM 2000 Control Delay	9.7	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.39		
Actuated Cycle Length (s)	38.0	Sum of lost time (s)	18.1
Intersection Capacity Utilization	31.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	60	179	38	158	71	228	348	190	342	201	43
v/c Ratio	0.30	0.63	0.10	0.64	0.10	0.31	0.95	0.57	0.88	0.26	0.06
Control Delay	38.7	45.5	0.5	48.2	20.0	4.7	74.8	16.8	57.9	20.4	0.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	38.7	45.5	0.5	48.2	20.0	4.7	74.8	16.8	57.9	20.4	0.1
Queue Length 50th (ft)	24	76	0	69	20	0	84	9	151	57	0
Queue Length 95th (ft)	84	#245	0	#203	73	56	#268	#91	#488	182	0
Internal Link Dist (ft)		359			513		394			1014	
Turn Bay Length (ft)	295			240				30	200		
Base Capacity (vph)	222	313	406	320	794	805	366	333	388	770	718
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.27	0.57	0.09	0.49	0.09	0.28	0.95	0.57	0.88	0.26	0.06

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	55	165	35	145	65	210	35	285	175	315	185	40
Future Volume (vph)	55	165	35	145	65	210	35	285	175	315	185	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00		0.95	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.99	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583		3520	1583	1770	1863	1583
Flt Permitted	0.71	1.00	1.00	0.95	1.00	1.00		0.89	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1324	1863	1583	1770	1863	1583		3149	1583	1770	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	60	179	38	158	71	228	38	310	190	342	201	43
RTOR Reduction (vph)	0	0	32	0	0	145	0	0	149	0	0	26
Lane Group Flow (vph)	60	179	6	158	71	83	0	348	41	342	201	17
Turn Type	Perm	NA	Perm	Prot	NA	Perm	Perm	NA	Perm	Prot	NA	Perm
Protected Phases		8		7	4			6		5	2	
Permitted Phases	8		8			4	6		6			2
Actuated Green, G (s)	12.5	12.5	12.5	11.1	29.6	29.6		9.4	9.4	17.6	33.0	33.0
Effective Green, g (s)	12.5	12.5	12.5	11.1	29.6	29.6		9.4	9.4	17.6	33.0	33.0
Actuated g/C Ratio	0.15	0.15	0.15	0.14	0.36	0.36		0.12	0.12	0.22	0.41	0.41
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	203	286	243	241	679	577		364	183	383	757	643
v/s Ratio Prot		c0.10		c0.09	0.04					c0.19	0.11	
v/s Ratio Perm	0.05		0.00			0.05		c0.11	0.03			0.01
v/c Ratio	0.30	0.63	0.02	0.66	0.10	0.14		0.96	0.22	0.89	0.27	0.03
Uniform Delay, d1	30.4	32.2	29.2	33.2	17.0	17.3		35.7	32.6	30.9	16.0	14.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.8	4.2	0.0	4.8	0.0	0.0		37.3	2.8	21.7	0.9	0.1
Delay (s)	31.3	36.4	29.2	38.1	17.1	17.3		73.0	35.4	52.6	16.9	14.5
Level of Service	C	D	C	D	B	B		E	D	D	B	B
Approach Delay (s)		34.3			24.5			59.7			37.5	
Approach LOS		C			C			E			D	

Intersection Summary			
HCM 2000 Control Delay	40.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	81.2	Sum of lost time (s)	26.0
Intersection Capacity Utilization	63.1%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	EBR	WBT	NBT	SBT	SBR
Lane Group Flow (vph)	125	196	266	234	391	261
v/c Ratio	0.98	0.41	0.71	0.10	0.33	0.24
Control Delay	117.6	7.4	51.4	12.4	15.3	5.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	117.6	7.4	51.4	12.4	15.3	5.1
Queue Length 50th (ft)	90	0	180	26	98	11
Queue Length 95th (ft)	#176	54	245	95	349	92
Internal Link Dist (ft)	379		511	1014	294	
Turn Bay Length (ft)		70				140
Base Capacity (vph)	176	579	514	2239	1178	1078
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.71	0.34	0.52	0.10	0.33	0.24

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	115	0	180	0	240	5	0	215	0	0	360	240
Future Volume (vph)	115	0	180	0	240	5	0	215	0	0	360	240
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0	6.0		6.0			6.0			6.0	6.0
Lane Util. Factor		1.00	1.00		1.00			0.95			1.00	1.00
Frt		1.00	0.85		1.00			1.00			1.00	0.85
Flt Protected		0.95	1.00		1.00			1.00			1.00	1.00
Satd. Flow (prot)		1770	1583		1858			3539			1863	1583
Flt Permitted		0.34	1.00		1.00			1.00			1.00	1.00
Satd. Flow (perm)		640	1583		1858			3539			1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	125	0	196	0	261	5	0	234	0	0	391	261
RTOR Reduction (vph)	0	0	157	0	1	0	0	0	0	0	0	80
Lane Group Flow (vph)	0	125	39	0	265	0	0	234	0	0	391	181
Turn Type	Perm	NA	Perm		NA			NA		Perm	NA	Perm
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8						6		6
Actuated Green, G (s)		22.5	22.5		22.5			69.3			69.3	69.3
Effective Green, g (s)		22.5	22.5		22.5			69.3			69.3	69.3
Actuated g/C Ratio		0.20	0.20		0.20			0.62			0.62	0.62
Clearance Time (s)		6.0	6.0		6.0			6.0			6.0	6.0
Vehicle Extension (s)		3.0	3.0		3.0			2.0			2.0	2.0
Lane Grp Cap (vph)		128	318		373			2189			1152	979
v/s Ratio Prot					0.14			0.07			c0.21	
v/s Ratio Perm		c0.20	0.02									0.11
v/c Ratio		0.98	0.12		0.71			0.11			0.34	0.19
Uniform Delay, d1		44.5	36.7		41.7			8.7			10.3	9.2
Progression Factor		1.00	1.00		1.00			1.00			1.00	1.00
Incremental Delay, d2		71.6	0.2		6.3			0.1			0.8	0.4
Delay (s)		116.1	36.8		48.0			8.8			11.1	9.6
Level of Service		F	D		D			A			B	A
Approach Delay (s)		67.7			48.0			8.8			10.5	
Approach LOS		E			D			A			B	

Intersection Summary			
HCM 2000 Control Delay	29.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	112.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	58.0%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBT	NBT	NBR	SBT
Lane Group Flow (vph)	38	756	511	33	22	60
v/c Ratio	0.07	0.68	0.34	0.17	0.08	0.24
Control Delay	4.6	10.4	5.6	20.4	3.9	13.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	4.6	10.4	5.6	20.4	3.9	13.8
Queue Length 50th (ft)	4	114	30	9	0	7
Queue Length 95th (ft)	13	231	55	28	8	32
Internal Link Dist (ft)		513	406	230		334
Turn Bay Length (ft)	245				45	
Base Capacity (vph)	524	1118	1496	758	917	860
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.07	0.68	0.34	0.04	0.02	0.07

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	35	620	75	90	365	15	30	0	20	20	5	30
Future Volume (vph)	35	620	75	90	365	15	30	0	20	20	5	30
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0			6.0			6.0	6.0		6.0	
Lane Util. Factor	1.00	1.00			0.95			1.00	1.00		1.00	
Frt	1.00	0.98			1.00			1.00	0.85		0.93	
Flt Protected	0.95	1.00			0.99			0.95	1.00		0.98	
Satd. Flow (prot)	1770	1832			3489			1770	1583		1693	
Flt Permitted	0.46	1.00			0.70			0.72	1.00		0.87	
Satd. Flow (perm)	864	1832			2460			1337	1583		1492	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	38	674	82	98	397	16	33	0	22	22	5	33
RTOR Reduction (vph)	0	4	0	0	2	0	0	0	19	0	28	0
Lane Group Flow (vph)	38	752	0	0	509	0	0	33	3	0	32	0
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2		2	6		
Actuated Green, G (s)	30.0	30.0			30.0			7.4	7.4		7.4	
Effective Green, g (s)	30.0	30.0			30.0			7.4	7.4		7.4	
Actuated g/C Ratio	0.61	0.61			0.61			0.15	0.15		0.15	
Clearance Time (s)	6.0	6.0			6.0			6.0	6.0		6.0	
Vehicle Extension (s)	3.0	3.0			3.0			3.0	3.0		3.0	
Lane Grp Cap (vph)	524	1112			1493			200	237		223	
v/s Ratio Prot		c0.41										
v/s Ratio Perm	0.04				0.21			c0.02	0.00		0.02	
v/c Ratio	0.07	0.68			0.34			0.17	0.01		0.14	
Uniform Delay, d1	4.0	6.5			4.8			18.3	17.9		18.2	
Progression Factor	1.00	1.00			1.00			1.00	1.00		1.00	
Incremental Delay, d2	0.3	3.3			0.6			0.4	0.0		0.3	
Delay (s)	4.3	9.8			5.4			18.7	17.9		18.5	
Level of Service	A	A			A			B	B		B	
Approach Delay (s)		9.5			5.4			18.4			18.5	
Approach LOS		A			A			B			B	

Intersection Summary			
HCM 2000 Control Delay	8.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	49.4	Sum of lost time (s)	12.0
Intersection Capacity Utilization	85.4%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	NBT	SBT
Lane Group Flow (vph)	480	305	435
v/c Ratio	0.78	0.43	0.56
Control Delay	24.0	14.2	15.1
Queue Delay	0.0	0.0	0.0
Total Delay	24.0	14.2	15.1
Queue Length 50th (ft)	118	63	89
Queue Length 95th (ft)	209	132	184
Internal Link Dist (ft)	529	129	630
Turn Bay Length (ft)			
Base Capacity (vph)	776	702	772
Starvation Cap Reductn	0	0	0
Spillback Cap Reductn	0	0	0
Storage Cap Reductn	0	0	0
Reduced v/c Ratio	0.62	0.43	0.56

Intersection Summary

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	410	70	40	265	350	85
Future Volume (vph)	410	70	40	265	350	85
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0			6.0	6.0	
Lane Util. Factor	1.00			1.00	1.00	
Frt	0.98			1.00	0.97	
Flt Protected	0.96			0.99	1.00	
Satd. Flow (prot)	1751			1851	1814	
Flt Permitted	0.96			0.90	1.00	
Satd. Flow (perm)	1751			1683	1814	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	410	70	40	265	350	85
RTOR Reduction (vph)	12	0	0	0	15	0
Lane Group Flow (vph)	468	0	0	305	420	0
Turn Type	Prot		Perm	NA	NA	
Protected Phases	4			2	6	
Permitted Phases			2			
Actuated Green, G (s)	17.4			21.2	21.2	
Effective Green, g (s)	17.4			21.2	21.2	
Actuated g/C Ratio	0.34			0.42	0.42	
Clearance Time (s)	6.0			6.0	6.0	
Vehicle Extension (s)	3.0			3.0	3.0	
Lane Grp Cap (vph)	602			705	760	
v/s Ratio Prot	c0.27				c0.23	
v/s Ratio Perm				0.18		
v/c Ratio	0.78			0.43	0.55	
Uniform Delay, d1	14.9			10.4	11.1	
Progression Factor	1.00			1.00	1.00	
Incremental Delay, d2	6.2			1.9	2.9	
Delay (s)	21.1			12.4	14.0	
Level of Service	C			B	B	
Approach Delay (s)	21.1			12.4	14.0	
Approach LOS	C			B	B	

Intersection Summary			
HCM 2000 Control Delay	16.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	50.6	Sum of lost time (s)	12.0
Intersection Capacity Utilization	81.7%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	20	5	0	45	0	495	10	40	445	45
Future Volume (Veh/h)	0	0	20	5	0	45	0	495	10	40	445	45
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	20	5	0	45	0	495	10	40	445	45
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)						1						
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								710			890	
pX, platoon unblocked												
vC, conflicting volume	1070	1052	468	1068	1070	500	490			505		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1070	1052	468	1068	1070	500	490			505		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	97	97	100	92	100			96		
cM capacity (veh/h)	178	218	595	187	213	571	1073			1060		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	20	50	505	530
Volume Left	0	5	0	40
Volume Right	20	45	10	45
cSH	595	634	1700	1060
Volume to Capacity	0.03	0.08	0.30	0.04
Queue Length 95th (ft)	3	6	0	3
Control Delay (s)	11.3	13.1	0.0	1.1
Lane LOS	B	B		A
Approach Delay (s)	11.3	13.1	0.0	1.1
Approach LOS	B	B		

Intersection Summary			
Average Delay	1.3		
Intersection Capacity Utilization	68.4%	ICU Level of Service	C
Analysis Period (min)	15		

Lane Group	EBL	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	155	415	390	445	470
v/c Ratio	0.51	0.59	0.28	0.32	0.36
Control Delay	15.0	11.1	4.7	5.0	1.4
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	15.0	11.1	4.7	5.0	1.4
Queue Length 50th (ft)	14	67	45	53	0
Queue Length 95th (ft)	58	#211	101	117	27
Internal Link Dist (ft)	747		221	780	
Turn Bay Length (ft)		230			
Base Capacity (vph)	557	698	1385	1385	1298
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.28	0.59	0.28	0.32	0.36

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	40	115	415	390	445	470
Future Volume (vph)	40	115	415	390	445	470
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0		6.0	6.0	6.0	6.0
Lane Util. Factor	1.00		1.00	1.00	1.00	1.00
Frt	0.90		1.00	1.00	1.00	0.85
Flt Protected	0.99		0.95	1.00	1.00	1.00
Satd. Flow (prot)	1655		1770	1863	1863	1583
Flt Permitted	0.99		0.50	1.00	1.00	1.00
Satd. Flow (perm)	1655		939	1863	1863	1583
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	40	115	415	390	445	470
RTOR Reduction (vph)	103	0	0	0	0	136
Lane Group Flow (vph)	52	0	415	390	445	334
Turn Type	Prot		Perm	NA	NA	Perm
Protected Phases	4			2	6	
Permitted Phases			2			6
Actuated Green, G (s)	6.5		45.4	45.4	45.4	45.4
Effective Green, g (s)	6.5		45.4	45.4	45.4	45.4
Actuated g/C Ratio	0.10		0.71	0.71	0.71	0.71
Clearance Time (s)	6.0		6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	168		667	1323	1323	1124
v/s Ratio Prot	c0.03			0.21	0.24	
v/s Ratio Perm			c0.44			0.21
v/c Ratio	0.31		0.62	0.29	0.34	0.30
Uniform Delay, d1	26.6		4.8	3.4	3.5	3.4
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	1.0		4.3	0.6	0.7	0.7
Delay (s)	27.7		9.1	4.0	4.2	4.1
Level of Service	C		A	A	A	A
Approach Delay (s)	27.7			6.6	4.1	
Approach LOS	C			A	A	

Intersection Summary			
HCM 2000 Control Delay	7.1	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	63.9	Sum of lost time (s)	12.0
Intersection Capacity Utilization	70.7%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	WBL	NBT	SBT
Lane Group Flow (vph)	240	420	670
v/c Ratio	0.61	0.40	0.63
Control Delay	26.3	9.2	12.8
Queue Delay	0.0	0.0	0.0
Total Delay	26.3	9.2	12.8
Queue Length 50th (ft)	69	70	134
Queue Length 95th (ft)	126	153	290
Internal Link Dist (ft)	168	780	110
Turn Bay Length (ft)			
Base Capacity (vph)	553	1059	1059
Starvation Cap Reductn	0	0	0
Spillback Cap Reductn	0	0	0
Storage Cap Reductn	0	0	0
Reduced v/c Ratio	0.43	0.40	0.63

Intersection Summary

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	240	0	420	0	0	670
Future Volume (vph)	240	0	420	0	0	670
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0		6.0			6.0
Lane Util. Factor	1.00		1.00			1.00
Frt	1.00		1.00			1.00
Flt Protected	0.95		1.00			1.00
Satd. Flow (prot)	1770		1863			1863
Flt Permitted	0.95		1.00			1.00
Satd. Flow (perm)	1770		1863			1863
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	240	0	420	0	0	670
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	240	0	420	0	0	670
Turn Type	Prot	Perm	NA			NA
Protected Phases	8		2			6
Permitted Phases		8				
Actuated Green, G (s)	12.9		32.9			32.9
Effective Green, g (s)	12.9		32.9			32.9
Actuated g/C Ratio	0.22		0.57			0.57
Clearance Time (s)	6.0		6.0			6.0
Vehicle Extension (s)	3.0		3.0			3.0
Lane Grp Cap (vph)	395		1060			1060
v/s Ratio Prot	c0.14		0.23			c0.36
v/s Ratio Perm						
v/c Ratio	0.61		0.40			0.63
Uniform Delay, d1	20.2		6.9			8.4
Progression Factor	1.00		1.00			1.00
Incremental Delay, d2	2.6		1.1			2.9
Delay (s)	22.8		8.0			11.2
Level of Service	C		A			B
Approach Delay (s)	22.8		8.0			11.2
Approach LOS	C		A			B

Intersection Summary			
HCM 2000 Control Delay	12.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	57.8	Sum of lost time (s)	12.0
Intersection Capacity Utilization	58.6%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBT	NBT	NBR	SBT
Lane Group Flow (vph)	82	717	930	65	98	158
v/c Ratio	0.24	0.60	0.56	0.30	0.28	0.53
Control Delay	9.0	10.8	9.1	25.4	7.2	21.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	9.0	10.8	9.1	25.4	7.2	21.6
Queue Length 50th (ft)	11	125	81	22	0	35
Queue Length 95th (ft)	47	355	211	51	32	82
Internal Link Dist (ft)		513	406	230		149
Turn Bay Length (ft)	245				45	
Base Capacity (vph)	345	1195	1664	426	592	524
Starvation Cap Reductn	0	16	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.24	0.61	0.56	0.15	0.17	0.30

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	75	620	40	100	700	55	50	10	90	60	20	65
Future Volume (vph)	75	620	40	100	700	55	50	10	90	60	20	65
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0			6.0			6.0	6.0		6.0	
Lane Util. Factor	1.00	1.00			0.95			1.00	1.00		1.00	
Frt	1.00	0.99			0.99			1.00	0.85		0.94	
Flt Protected	0.95	1.00			0.99			0.96	1.00		0.98	
Satd. Flow (prot)	1770	1846			3485			1788	1583		1714	
Flt Permitted	0.29	1.00			0.73			0.69	1.00		0.84	
Satd. Flow (perm)	535	1846			2570			1279	1583		1464	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	82	674	43	109	761	60	54	11	98	65	22	71
RTOR Reduction (vph)	0	2	0	0	5	0	0	0	81	0	46	0
Lane Group Flow (vph)	82	715	0	0	925	0	0	65	17	0	112	0
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2		2	6		
Actuated Green, G (s)	43.0	43.0			43.0			11.5	11.5		11.5	
Effective Green, g (s)	43.0	43.0			43.0			11.5	11.5		11.5	
Actuated g/C Ratio	0.65	0.65			0.65			0.17	0.17		0.17	
Clearance Time (s)	6.0	6.0			6.0			6.0	6.0		6.0	
Vehicle Extension (s)	3.0	3.0			3.0			3.0	3.0		3.0	
Lane Grp Cap (vph)	345	1193			1661			221	273		253	
v/s Ratio Prot		c0.39										
v/s Ratio Perm	0.15				0.36			0.05	0.01		c0.08	
v/c Ratio	0.24	0.60			0.56			0.29	0.06		0.44	
Uniform Delay, d1	4.9	6.8			6.5			24.0	23.0		24.6	
Progression Factor	1.00	1.00			1.00			1.00	1.00		1.00	
Incremental Delay, d2	1.6	2.2			1.4			0.7	0.1		1.2	
Delay (s)	6.5	9.0			7.8			24.7	23.1		25.9	
Level of Service	A	A			A			C	C		C	
Approach Delay (s)		8.7			7.8			23.7			25.9	
Approach LOS		A			A			C			C	

Intersection Summary			
HCM 2000 Control Delay	10.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	66.5	Sum of lost time (s)	12.0
Intersection Capacity Utilization	89.1%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	195	70	40	265	350	85
Future Volume (Veh/h)	195	70	40	265	350	85
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	195	70	40	265	350	85
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)		2				
Median type				None	None	
Median storage veh)						
Upstream signal (ft)					710	
pX, platoon unblocked	0.93	0.93	0.93			
vC, conflicting volume	738	392	435			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	681	310	356			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	48	90	96			
cM capacity (veh/h)	373	679	1120			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	265	305	435
Volume Left	195	40	0
Volume Right	70	0	85
cSH	508	1120	1700
Volume to Capacity	0.52	0.04	0.26
Queue Length 95th (ft)	75	3	0
Control Delay (s)	21.1	1.4	0.0
Lane LOS	C	A	
Approach Delay (s)	21.1	1.4	0.0
Approach LOS	C		

Intersection Summary			
Average Delay	6.0		
Intersection Capacity Utilization	60.5%	ICU Level of Service	B
Analysis Period (min)	15		

Lane Group	EBT	WBT	WBR	NBT	SBL	SBT
Lane Group Flow (vph)	235	5	45	505	40	490
v/c Ratio	0.58	0.01	0.09	0.48	0.09	0.47
Control Delay	16.8	8.8	4.1	10.6	8.2	10.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	16.8	8.8	4.1	10.6	8.2	10.0
Queue Length 50th (ft)	39	1	0	68	4	64
Queue Length 95th (ft)	84	5	13	#183	20	172
Internal Link Dist (ft)	369	235		630		509
Turn Bay Length (ft)			20		100	
Base Capacity (vph)	634	604	749	1048	432	1041
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.37	0.01	0.06	0.48	0.09	0.47

Intersection Summary

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	210	5	20	5	0	45	0	495	10	40	445	45
Future Volume (vph)	210	5	20	5	0	45	0	495	10	40	445	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.5			4.5	4.5		4.5		4.5	4.5	
Lane Util. Factor		1.00			1.00	1.00		1.00		1.00	1.00	
Frt		0.99			1.00	0.85		1.00		1.00	0.99	
Flt Protected		0.96			0.95	1.00		1.00		0.95	1.00	
Satd. Flow (prot)		1763			1770	1583		1858		1770	1837	
Flt Permitted		0.75			0.71	1.00		1.00		0.41	1.00	
Satd. Flow (perm)		1372			1319	1583		1858		767	1837	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	210	5	20	5	0	45	0	495	10	40	445	45
RTOR Reduction (vph)	0	9	0	0	0	34	0	1	0	0	6	0
Lane Group Flow (vph)	0	226	0	0	5	11	0	504	0	40	484	0
Turn Type	Perm	NA		Perm	NA	Perm		NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8		8	2			6		
Actuated Green, G (s)		10.1			10.1	10.1		21.3		21.3	21.3	
Effective Green, g (s)		10.1			10.1	10.1		21.3		21.3	21.3	
Actuated g/C Ratio		0.25			0.25	0.25		0.53		0.53	0.53	
Clearance Time (s)		4.5			4.5	4.5		4.5		4.5	4.5	
Vehicle Extension (s)		3.0			3.0	3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)		343			329	395		979		404	968	
v/s Ratio Prot								c0.27			0.26	
v/s Ratio Perm		c0.16			0.00	0.01				0.05		
v/c Ratio		0.66			0.02	0.03		0.51		0.10	0.50	
Uniform Delay, d1		13.6			11.4	11.4		6.2		4.8	6.1	
Progression Factor		1.00			1.00	1.00		1.00		1.00	1.00	
Incremental Delay, d2		4.5			0.0	0.0		1.9		0.5	1.8	
Delay (s)		18.1			11.4	11.5		8.1		5.3	8.0	
Level of Service		B			B	B		A		A	A	
Approach Delay (s)		18.1			11.5			8.1			7.8	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	9.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	40.4	Sum of lost time (s)	9.0
Intersection Capacity Utilization	60.5%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	WBT	WBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	240	540	98	330	670	98
v/c Ratio	0.55	0.73	0.35	0.33	0.67	0.11
Control Delay	23.1	10.0	13.3	9.4	14.6	2.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	23.1	10.0	13.3	9.4	14.6	2.5
Queue Length 50th (ft)	69	19	18	60	156	0
Queue Length 95th (ft)	126	99	55	116	290	19
Internal Link Dist (ft)	168			780	110	
Turn Bay Length (ft)						
Base Capacity (vph)	571	826	283	1001	1001	896
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.42	0.65	0.35	0.33	0.67	0.11

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	240	0	540	90	330	0	0	670	90
Future Volume (vph)	0	0	0	240	0	540	90	330	0	0	670	90
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					6.0	6.0	6.0	6.0			6.0	6.0
Lane Util. Factor					1.00	1.00	1.00	1.00			1.00	1.00
Frt					1.00	0.85	1.00	1.00			1.00	0.85
Flt Protected					0.95	1.00	0.95	1.00			1.00	1.00
Satd. Flow (prot)					1770	1583	1770	1863			1863	1583
Flt Permitted					0.95	1.00	0.28	1.00			1.00	1.00
Satd. Flow (perm)					1770	1583	527	1863			1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	1.00	0.92	1.00	0.92	1.00	1.00	1.00	1.00	0.92
Adj. Flow (vph)	0	0	0	240	0	540	98	330	0	0	670	98
RTOR Reduction (vph)	0	0	0	0	0	351	0	0	0	0	0	45
Lane Group Flow (vph)	0	0	0	0	240	189	98	330	0	0	670	53
Turn Type				Split	NA	Perm	Perm	NA			NA	Perm
Protected Phases				8	8			2			6	
Permitted Phases						8	2					6
Actuated Green, G (s)					13.9	13.9	30.2	30.2			30.2	30.2
Effective Green, g (s)					13.9	13.9	30.2	30.2			30.2	30.2
Actuated g/C Ratio					0.25	0.25	0.54	0.54			0.54	0.54
Clearance Time (s)					6.0	6.0	6.0	6.0			6.0	6.0
Vehicle Extension (s)					3.0	3.0	3.0	3.0			3.0	3.0
Lane Grp Cap (vph)					438	392	283	1002			1002	852
v/s Ratio Prot					c0.14			0.18			c0.36	
v/s Ratio Perm						0.12	0.19					0.03
v/c Ratio					0.55	0.48	0.35	0.33			0.67	0.06
Uniform Delay, d1					18.4	18.0	7.3	7.3			9.3	6.2
Progression Factor					1.00	1.00	1.00	1.00			1.00	1.00
Incremental Delay, d2					1.4	0.9	3.3	0.9			3.5	0.1
Delay (s)					19.8	19.0	10.7	8.1			12.9	6.3
Level of Service					B	B	B	A			B	A
Approach Delay (s)		0.0			19.2			8.7			12.0	
Approach LOS		A			B			A			B	

Intersection Summary			
HCM 2000 Control Delay	14.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	56.1	Sum of lost time (s)	12.0
Intersection Capacity Utilization	68.5%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	WBL	WBT	NBT	NBR	SBT
Lane Group Flow (vph)	799	109	821	65	98	158
v/c Ratio	0.44	0.26	0.35	0.33	0.30	0.58
Control Delay	7.2	8.2	6.2	26.9	7.7	24.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	7.2	8.2	6.2	26.9	7.7	24.0
Queue Length 50th (ft)	52	12	50	22	0	35
Queue Length 95th (ft)	161	59	147	51	32	82
Internal Link Dist (ft)	513		75	230		149
Turn Bay Length (ft)		75			45	
Base Capacity (vph)	1825	422	2313	674	879	796
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.44	0.26	0.35	0.10	0.11	0.20

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	75	620	40	100	700	55	50	10	90	60	20	65
Future Volume (vph)	75	620	40	100	700	55	50	10	90	60	20	65
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0		6.0	6.0			6.0	6.0		6.0	
Lane Util. Factor		0.95		1.00	0.95			1.00	1.00		1.00	
Frt		0.99		1.00	0.99			1.00	0.85		0.94	
Flt Protected		0.99		0.95	1.00			0.96	1.00		0.98	
Satd. Flow (prot)		3493		1770	3500			1788	1583		1714	
Flt Permitted		0.79		0.34	1.00			0.69	1.00		0.84	
Satd. Flow (perm)		2763		640	3500			1282	1583		1464	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	82	674	43	109	761	60	54	11	98	65	22	71
RTOR Reduction (vph)	0	3	0	0	4	0	0	0	83	0	47	0
Lane Group Flow (vph)	0	796	0	109	817	0	0	65	15	0	111	0
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2		2	6		
Actuated Green, G (s)		43.1		43.1	43.1			10.1	10.1		10.1	
Effective Green, g (s)		43.1		43.1	43.1			10.1	10.1		10.1	
Actuated g/C Ratio		0.66		0.66	0.66			0.15	0.15		0.15	
Clearance Time (s)		6.0		6.0	6.0			6.0	6.0		6.0	
Vehicle Extension (s)		3.0		3.0	3.0			0.2	0.2		0.2	
Lane Grp Cap (vph)		1826		423	2313			198	245		226	
v/s Ratio Prot					0.23							
v/s Ratio Perm		c0.29		0.17				0.05	0.01		c0.08	
v/c Ratio		0.44		0.26	0.35			0.33	0.06		0.49	
Uniform Delay, d1		5.3		4.5	4.9			24.5	23.5		25.2	
Progression Factor		1.00		1.00	1.00			1.00	1.00		1.00	
Incremental Delay, d2		0.8		1.5	0.4			0.4	0.0		0.6	
Delay (s)		6.0		6.0	5.3			24.9	23.5		25.8	
Level of Service		A		A	A			C	C		C	
Approach Delay (s)		6.0			5.4			24.1			25.8	
Approach LOS		A			A			C			C	

Intersection Summary			
HCM 2000 Control Delay	8.7	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.45		
Actuated Cycle Length (s)	65.2	Sum of lost time (s)	12.0
Intersection Capacity Utilization	76.7%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	240	540	420	0	0	670
Future Volume (Veh/h)	240	540	420	0	0	670
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	240	540	420	0	0	670
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						560
pX, platoon unblocked						
vC, conflicting volume	755	420			420	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	755	420			420	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	30	7			100	
cM capacity (veh/h)	345	582			1136	

Direction, Lane #	WB 1	WB 2	NB 1	SB 1	SB 2
Volume Total	240	540	420	335	335
Volume Left	240	0	0	0	0
Volume Right	0	540	0	0	0
cSH	345	582	1700	1700	1700
Volume to Capacity	0.70	0.93	0.25	0.20	0.20
Queue Length 95th (ft)	125	296	0	0	0
Control Delay (s)	36.3	48.3	0.0	0.0	0.0
Lane LOS	E	E			
Approach Delay (s)	44.6		0.0	0.0	
Approach LOS	E				

Intersection Summary			
Average Delay	18.6		
Intersection Capacity Utilization	62.2%	ICU Level of Service	B
Analysis Period (min)	15		

Lane Group	EBL	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	511	429	152	196	234
v/c Ratio	0.85	0.78	0.17	0.60	0.15
Control Delay	26.6	35.2	8.4	37.0	0.2
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	26.6	35.2	8.4	37.0	0.2
Queue Length 50th (ft)	99	164	27	83	0
Queue Length 95th (ft)	#247	#376	64	161	0
Internal Link Dist (ft)	374		617	175	
Turn Bay Length (ft)					
Base Capacity (vph)	796	674	1507	710	1583
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.64	0.64	0.10	0.28	0.15

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	75	395	395	140	180	215
Future Volume (vph)	75	395	395	140	180	215
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0		6.0	6.0	6.0	4.0
Lane Util. Factor	1.00		1.00	1.00	1.00	1.00
Frt	0.89		1.00	1.00	1.00	0.85
Flt Protected	0.99		0.95	1.00	1.00	1.00
Satd. Flow (prot)	1638		1770	1863	1863	1583
Flt Permitted	0.99		0.95	1.00	1.00	1.00
Satd. Flow (perm)	1638		1770	1863	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	82	429	429	152	196	234
RTOR Reduction (vph)	210	0	0	0	0	0
Lane Group Flow (vph)	301	0	429	152	196	234
Turn Type	Prot		Prot	NA	NA	Free
Protected Phases	4		1	6	2	
Permitted Phases						Free
Actuated Green, G (s)	16.5		21.6	39.7	12.1	68.2
Effective Green, g (s)	16.5		21.6	39.7	12.1	68.2
Actuated g/C Ratio	0.24		0.32	0.58	0.18	1.00
Clearance Time (s)	6.0		6.0	6.0	6.0	
Vehicle Extension (s)	2.0		2.0	2.0	2.0	
Lane Grp Cap (vph)	396		560	1084	330	1583
v/s Ratio Prot	c0.18		c0.24	0.08	c0.11	
v/s Ratio Perm						0.15
v/c Ratio	0.76		0.77	0.14	0.59	0.15
Uniform Delay, d1	24.0		21.0	6.5	25.8	0.0
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	7.5		5.6	0.0	1.9	0.2
Delay (s)	31.6		26.6	6.5	27.7	0.2
Level of Service	C		C	A	C	A
Approach Delay (s)	31.6			21.4	12.7	
Approach LOS	C			C	B	

Intersection Summary			
HCM 2000 Control Delay	22.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	68.2	Sum of lost time (s)	18.0
Intersection Capacity Utilization	74.9%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	54	152	49	315	571	71	217	375	304	217
v/c Ratio	0.44	0.54	0.13	0.78	0.42	0.35	0.66	0.62	0.54	0.25
Control Delay	40.9	37.0	0.7	35.5	7.7	33.7	40.7	25.1	16.3	11.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	40.9	37.0	0.7	35.5	7.7	33.7	40.7	25.1	16.3	11.6
Queue Length 50th (ft)	23	67	0	115	37	30	96	142	83	51
Queue Length 95th (ft)	58	122	0	#220	73	70	#194	245	146	98
Internal Link Dist (ft)		359			513		394			506
Turn Bay Length (ft)	295		75	240				75	200	
Base Capacity (vph)	155	354	438	402	1479	204	329	602	588	911
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.35	0.43	0.11	0.78	0.39	0.35	0.66	0.62	0.52	0.24

Intersection Summary

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	50	140	45	290	205	320	65	200	345	280	150	50
Future Volume (vph)	50	140	45	290	205	320	65	200	345	280	150	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0	6.0	6.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95		1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.91		1.00	1.00	0.85	1.00	0.96	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	1863	1583	1770	3216		1770	1863	1583	1770	1793	
Flt Permitted	0.44	1.00	1.00	0.43	1.00		0.62	1.00	1.00	0.35	1.00	
Satd. Flow (perm)	815	1863	1583	801	3216		1160	1863	1583	654	1793	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	54	152	49	315	223	348	71	217	375	304	163	54
RTOR Reduction (vph)	0	0	42	0	224	0	0	0	0	0	8	0
Lane Group Flow (vph)	54	152	7	315	347	0	71	217	375	304	209	0
Turn Type	Perm	NA	Perm	pm+pt	NA		Perm	NA	pt+ov	pm+pt	NA	
Protected Phases		8		7	4			6	6 7	5	2	
Permitted Phases	8		8	4			6			2		
Actuated Green, G (s)	11.2	11.2	11.2	26.2	26.2		13.1	13.1	28.1	35.6	35.6	
Effective Green, g (s)	11.2	11.2	11.2	26.2	26.2		13.1	13.1	28.1	35.6	35.6	
Actuated g/C Ratio	0.15	0.15	0.15	0.36	0.36		0.18	0.18	0.38	0.48	0.48	
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0	3.0	2.0	2.0		2.0	2.0		2.0	2.0	
Lane Grp Cap (vph)	123	282	240	402	1141		205	330	602	564	864	
v/s Ratio Prot		0.08		c0.10	0.11			0.12	c0.24	c0.12	0.12	
v/s Ratio Perm	0.07		0.00	c0.18			0.06			0.14		
v/c Ratio	0.44	0.54	0.03	0.78	0.30		0.35	0.66	0.62	0.54	0.24	
Uniform Delay, d1	28.4	28.9	26.7	19.7	17.2		26.6	28.3	18.5	12.6	11.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	2.5	2.0	0.1	8.9	0.1		0.4	3.6	1.4	0.5	0.1	
Delay (s)	30.9	30.9	26.7	28.6	17.3		27.0	31.8	20.0	13.1	11.2	
Level of Service	C	C	C	C	B		C	C	B	B	B	
Approach Delay (s)		30.1			21.3			24.6			12.3	
Approach LOS		C			C			C			B	

Intersection Summary			
HCM 2000 Control Delay	21.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	73.8	Sum of lost time (s)	26.0
Intersection Capacity Utilization	69.5%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	EBR	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	38	60	5	43	571	5	467	33
v/c Ratio	0.18	0.16	0.01	0.07	0.21	0.01	0.37	0.03
Control Delay	21.0	1.0	0.0	4.2	4.2	10.4	10.9	0.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	21.0	1.0	0.0	4.2	4.2	10.4	10.9	0.0
Queue Length 50th (ft)	11	0	0	4	34	1	60	0
Queue Length 95th (ft)	30	0	0	14	68	7	#233	0
Internal Link Dist (ft)	379		511		428		294	
Turn Bay Length (ft)		70						140
Base Capacity (vph)	395	553	525	655	2695	554	1267	1153
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.10	0.11	0.01	0.07	0.21	0.01	0.37	0.03

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	35	0	55	0	0	5	40	525	0	5	430	30
Future Volume (vph)	35	0	55	0	0	5	40	525	0	5	430	30
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0	6.0		6.0		4.5	6.0		6.0	6.0	6.0
Lane Util. Factor		1.00	1.00		1.00		1.00	0.95		1.00	1.00	1.00
Frt		1.00	0.85		0.86		1.00	1.00		1.00	1.00	0.85
Flt Protected		0.95	1.00		1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1770	1583		1611		1770	3539		1770	1863	1583
Flt Permitted		0.75	1.00		1.00		0.39	1.00		0.44	1.00	1.00
Satd. Flow (perm)		1405	1583		1611		727	3539		815	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	38	0	60	0	0	5	43	571	0	5	467	33
RTOR Reduction (vph)	0	0	54	0	4	0	0	0	0	0	0	15
Lane Group Flow (vph)	0	38	6	0	1	0	43	571	0	5	467	18
Turn Type	pm+pt	NA	Perm		NA		pm+pt	NA		Perm	NA	Perm
Protected Phases	7	4			8		5	2			6	
Permitted Phases	4		4	8			2			6		6
Actuated Green, G (s)		5.9	5.9		5.9		37.1	37.1		29.9	29.9	29.9
Effective Green, g (s)		5.9	5.9		5.9		37.1	37.1		29.9	29.9	29.9
Actuated g/C Ratio		0.11	0.11		0.11		0.67	0.67		0.54	0.54	0.54
Clearance Time (s)		6.0	6.0		6.0		4.5	6.0		6.0	6.0	6.0
Vehicle Extension (s)		3.0	3.0		3.0		3.0	2.0		2.0	2.0	2.0
Lane Grp Cap (vph)		150	169		172		541	2387		443	1012	860
v/s Ratio Prot					0.00		0.00	c0.16			c0.25	
v/s Ratio Perm		c0.03	0.00				0.05			0.01		0.01
v/c Ratio		0.25	0.04		0.00		0.08	0.24		0.01	0.46	0.02
Uniform Delay, d1		22.5	22.0		21.9		3.5	3.5		5.8	7.6	5.8
Progression Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2		0.9	0.1		0.0		0.1	0.2		0.0	1.5	0.0
Delay (s)		23.4	22.1		21.9		3.6	3.7		5.8	9.2	5.8
Level of Service		C	C		C		A	A		A	A	A
Approach Delay (s)		22.6			21.9			3.7			8.9	
Approach LOS		C			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	7.4	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	21.0
Intersection Capacity Utilization	49.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	65	565	35	100	640	55	45	10	90	60	20	60
Future Volume (Veh/h)	65	565	35	100	640	55	45	10	90	60	20	60
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	71	614	38	109	696	60	49	11	98	65	22	65
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)									2			
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		593										
pX, platoon unblocked				0.93			0.93	0.93	0.93	0.93	0.93	
vC, conflicting volume	756			652			1417	1749	633	1754	1738	378
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	756			588			1411	1768	568	1774	1756	378
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	92			88			5	82	77	0	65	90
cM capacity (veh/h)	851			914			51	62	434	28	63	620

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1
Volume Total	71	652	457	408	158	152
Volume Left	71	0	109	0	49	65
Volume Right	0	38	0	60	98	65
cSH	851	1700	914	1700	124	55
Volume to Capacity	0.08	0.38	0.12	0.24	1.27	2.78
Queue Length 95th (ft)	7	0	10	0	252	395
Control Delay (s)	9.6	0.0	3.3	0.0	237.2	964.8
Lane LOS	A		A		F	F
Approach Delay (s)	0.9		1.8		237.2	964.8
Approach LOS					F	F

Intersection Summary			
Average Delay	98.2		
Intersection Capacity Utilization	78.9%	ICU Level of Service	D
Analysis Period (min)	15		

Lane Group	EBT	WBL	WBT	NBT	NBR	SBT
Lane Group Flow (vph)	799	109	821	65	98	158
v/c Ratio	0.42	0.24	0.63	0.31	0.29	0.56
Control Delay	6.4	7.3	10.1	26.7	8.0	23.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	6.4	7.3	10.1	26.7	8.0	23.5
Queue Length 50th (ft)	63	14	159	22	0	35
Queue Length 95th (ft)	126	47	358	53	33	85
Internal Link Dist (ft)	513		406	230		149
Turn Bay Length (ft)		145			45	
Base Capacity (vph)	1908	457	1307	370	525	461
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.42	0.24	0.63	0.18	0.19	0.34

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	75	620	40	100	700	55	50	10	90	60	20	65
Future Volume (vph)	75	620	40	100	700	55	50	10	90	60	20	65
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0		6.0	6.0			6.0	6.0		6.0	
Lane Util. Factor		0.95		1.00	1.00			1.00	1.00		1.00	
Frt		0.99		1.00	0.99			1.00	0.85		0.94	
Flt Protected		0.99		0.95	1.00			0.96	1.00		0.98	
Satd. Flow (prot)		3493		1770	1842			1788	1583		1714	
Flt Permitted		0.77		0.35	1.00			0.69	1.00		0.84	
Satd. Flow (perm)		2690		647	1842			1286	1583		1464	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	82	674	43	109	761	60	54	11	98	65	22	71
RTOR Reduction (vph)	0	5	0	0	3	0	0	0	85	0	48	0
Lane Group Flow (vph)	0	794	0	109	818	0	0	65	13	0	110	0
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2		2	6		
Actuated Green, G (s)		43.2		43.2	43.2			8.7	8.7		8.7	
Effective Green, g (s)		43.2		43.2	43.2			8.7	8.7		8.7	
Actuated g/C Ratio		0.68		0.68	0.68			0.14	0.14		0.14	
Clearance Time (s)		6.0		6.0	6.0			6.0	6.0		6.0	
Vehicle Extension (s)		3.0		3.0	3.0			3.0	3.0		3.0	
Lane Grp Cap (vph)		1818		437	1245			175	215		199	
v/s Ratio Prot					c0.44							
v/s Ratio Perm		0.30		0.17				0.05	0.01		c0.07	
v/c Ratio		0.44		0.25	0.66			0.37	0.06		0.55	
Uniform Delay, d1		4.8		4.0	6.0			25.1	24.0		25.8	
Progression Factor		1.00		1.00	1.00			1.00	1.00		1.00	
Incremental Delay, d2		0.8		1.4	2.7			1.3	0.1		3.3	
Delay (s)		5.5		5.4	8.8			26.4	24.2		29.1	
Level of Service		A		A	A			C	C		C	
Approach Delay (s)		5.5			8.4			25.1			29.1	
Approach LOS		A			A			C			C	

Intersection Summary			
HCM 2000 Control Delay	10.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	63.9	Sum of lost time (s)	12.0
Intersection Capacity Utilization	93.5%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	54	152	49	315	223	348	288	375	304	217
v/c Ratio	0.45	0.78	0.14	0.92	0.39	0.40	0.52	0.53	0.71	0.25
Control Delay	48.3	65.2	0.8	60.7	25.9	2.8	32.6	5.7	30.8	16.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	48.3	65.2	0.8	60.7	25.9	2.8	32.6	5.7	30.8	16.5
Queue Length 50th (ft)	28	80	0	141	93	0	107	0	82	50
Queue Length 95th (ft)	65	#177	0	#252	156	33	#423	92	#374	169
Internal Link Dist (ft)		359			513		394			506
Turn Bay Length (ft)	295		75	240				150	200	
Base Capacity (vph)	122	197	362	342	569	881	549	714	427	876
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.44	0.77	0.14	0.92	0.39	0.40	0.52	0.53	0.71	0.25

Intersection Summary

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	50	140	45	290	205	320	65	200	345	280	150	50
Future Volume (vph)	50	140	45	290	205	320	65	200	345	280	150	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1200	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0	6.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85	1.00	0.96	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.99	1.00	0.95	1.00	
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583		1840	1000	1770	1793	
Flt Permitted	0.62	1.00	1.00	0.35	1.00	1.00		0.86	1.00	0.39	1.00	
Satd. Flow (perm)	1153	1863	1583	651	1863	1583		1604	1000	731	1793	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	54	152	49	315	223	348	71	217	375	304	163	54
RTOR Reduction (vph)	0	0	44	0	0	217	0	0	205	0	9	0
Lane Group Flow (vph)	54	152	5	315	223	131	0	288	170	304	208	0
Turn Type	Perm	NA	Perm	pm+pt	NA	pm+ov	Perm	NA	pm+ov	pm+pt	NA	
Protected Phases		8		7	4	5		6	7	5	2	
Permitted Phases	8		8	4		4	6		6	2		
Actuated Green, G (s)	8.9	8.9	8.9	25.9	25.9	31.9		27.5	38.5	39.5	39.5	
Effective Green, g (s)	8.9	8.9	8.9	25.9	25.9	31.9		27.5	38.5	39.5	39.5	
Actuated g/C Ratio	0.10	0.10	0.10	0.30	0.30	0.38		0.32	0.45	0.46	0.46	
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0	6.0	
Vehicle Extension (s)	3.0	3.0	3.0	2.0	2.0	2.0		2.0	2.0	2.0	2.0	
Lane Grp Cap (vph)	120	195	165	343	567	594		518	523	413	833	
v/s Ratio Prot		0.08		c0.12	0.12	0.02			0.04	c0.05	0.12	
v/s Ratio Perm	0.05		0.00	c0.16		0.07		0.18	0.13	c0.29		
v/c Ratio	0.45	0.78	0.03	0.92	0.39	0.22		0.56	0.32	0.74	0.25	
Uniform Delay, d1	35.8	37.1	34.2	26.4	23.3	18.1		23.7	14.9	18.9	13.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	
Incremental Delay, d2	2.7	17.7	0.1	28.1	0.2	0.1		4.3	0.1	5.8	0.7	
Delay (s)	38.4	54.8	34.3	54.4	23.5	18.1		28.0	15.0	24.7	14.5	
Level of Service	D	D	C	D	C	B		C	B	C	B	
Approach Delay (s)		47.4			32.4			20.7			20.5	
Approach LOS		D			C			C			C	

Intersection Summary			
HCM 2000 Control Delay	28.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	85.0	Sum of lost time (s)	26.0
Intersection Capacity Utilization	73.1%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	EBR	WBT	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	38	60	48	571	5	467	33
v/c Ratio	0.25	0.25	0.23	0.23	0.01	0.35	0.03
Control Delay	35.8	10.3	31.7	8.5	12.0	11.0	0.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	35.8	10.3	31.7	8.5	12.0	11.0	0.0
Queue Length 50th (ft)	18	0	21	37	1	64	0
Queue Length 95th (ft)	44	28	49	168	9	#334	0
Internal Link Dist (ft)	379		511	428		294	
Turn Bay Length (ft)		70					140
Base Capacity (vph)	362	473	262	2525	581	1329	1171
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.10	0.13	0.18	0.23	0.01	0.35	0.03

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	35	0	55	0	40	5	0	525	0	5	430	30
Future Volume (vph)	35	0	55	0	40	5	0	525	0	5	430	30
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0	6.0		6.0			6.0		6.0	6.0	6.0
Lane Util. Factor		1.00	1.00		1.00			0.95		1.00	1.00	1.00
Frt		1.00	0.85		0.99			1.00		1.00	1.00	0.85
Flt Protected		0.95	1.00		1.00			1.00		0.95	1.00	1.00
Satd. Flow (prot)		1770	1583		1837			3539		1770	1863	1583
Flt Permitted		0.73	1.00		1.00			1.00		0.44	1.00	1.00
Satd. Flow (perm)		1352	1583		1837			3539		815	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	38	0	60	0	43	5	0	571	0	5	467	33
RTOR Reduction (vph)	0	0	54	0	5	0	0	0	0	0	0	11
Lane Group Flow (vph)	0	38	6	0	43	0	0	571	0	5	467	22
Turn Type	pm+pt	NA	Perm		NA			NA		Perm	NA	Perm
Protected Phases	7	4			8			2			6	
Permitted Phases	4		4	8						6		6
Actuated Green, G (s)		8.1	8.1		8.1			54.5		54.5	54.5	54.5
Effective Green, g (s)		8.1	8.1		8.1			54.5		54.5	54.5	54.5
Actuated g/C Ratio		0.10	0.10		0.10			0.66		0.66	0.66	0.66
Clearance Time (s)		6.0	6.0		6.0			6.0		6.0	6.0	6.0
Vehicle Extension (s)		3.0	3.0		3.0			2.0		2.0	2.0	2.0
Lane Grp Cap (vph)		133	156		181			2352		541	1238	1052
v/s Ratio Prot					0.02			0.16			c0.25	
v/s Ratio Perm		c0.03	0.00							0.01		0.01
v/c Ratio		0.29	0.04		0.24			0.24		0.01	0.38	0.02
Uniform Delay, d1		34.3	33.4		34.1			5.5		4.6	6.2	4.7
Progression Factor		1.00	1.00		1.00			1.00		1.00	1.00	1.00
Incremental Delay, d2		1.2	0.1		0.7			0.2		0.0	0.9	0.0
Delay (s)		35.5	33.5		34.8			5.7		4.7	7.0	4.7
Level of Service		D	C		C			A		A	A	A
Approach Delay (s)		34.3			34.8			5.7			6.9	
Approach LOS		C			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	9.6	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.37		
Actuated Cycle Length (s)	82.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	47.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	195	70	40	265	350	85
Future Volume (Veh/h)	195	70	40	265	350	85
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	195	70	40	265	350	85
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	738	392	435			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	738	392	435			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	48	89	96			
cM capacity (veh/h)	372	656	1125			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	265	305	435
Volume Left	195	40	0
Volume Right	70	0	85
cSH	420	1125	1700
Volume to Capacity	0.63	0.04	0.26
Queue Length 95th (ft)	105	3	0
Control Delay (s)	27.1	1.4	0.0
Lane LOS	D	A	
Approach Delay (s)	27.1	1.4	0.0
Approach LOS	D		

Intersection Summary			
Average Delay	7.6		
Intersection Capacity Utilization	64.8%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	210	5	20	5	0	45	0	495	10	40	445	45
Future Volume (Veh/h)	210	5	20	5	0	45	0	495	10	40	445	45
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	210	5	20	5	0	45	0	495	10	40	445	45
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)						1						
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1070	1052	468	1048	1070	500	490			505		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1070	1052	468	1048	1070	500	490			505		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	0	98	97	97	100	92	100			96		
cM capacity (veh/h)	178	218	595	190	213	571	1073			1060		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1	SB 2
Volume Total	235	50	505	40	490
Volume Left	210	5	0	40	0
Volume Right	20	45	10	0	45
cSH	190	634	1073	1060	1700
Volume to Capacity	1.24	0.08	0.00	0.04	0.29
Queue Length 95th (ft)	315	6	0	3	0
Control Delay (s)	193.2	13.1	0.0	8.5	0.0
Lane LOS	F	B		A	
Approach Delay (s)	193.2	13.1	0.0	0.6	
Approach LOS	F	B			

Intersection Summary			
Average Delay	35.1		
Intersection Capacity Utilization	59.7%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	5	0	15	5	65	5	735	20	70	480	5
Future Volume (Veh/h)	0	5	0	15	5	65	5	735	20	70	480	5
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	5	0	15	5	65	5	735	20	70	480	5
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1445	1388	482	1378	1380	745	485			755		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1445	1388	482	1378	1380	745	485			755		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	96	100	86	96	84	100			92		
cM capacity (veh/h)	84	130	584	111	132	414	1078			855		

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	SB 1	SB 2
Volume Total	5	15	70	760	70	485
Volume Left	0	15	0	5	70	0
Volume Right	0	0	65	20	0	5
cSH	130	111	359	1078	855	1700
Volume to Capacity	0.04	0.14	0.19	0.00	0.08	0.29
Queue Length 95th (ft)	3	11	18	0	7	0
Control Delay (s)	33.7	42.5	17.4	0.1	9.6	0.0
Lane LOS	D	E	C	A	A	
Approach Delay (s)	33.7	21.9		0.1	1.2	
Approach LOS	D	C				

Intersection Summary			
Average Delay	2.0		
Intersection Capacity Utilization	67.1%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	40	470	415	390	445	470
Future Volume (Veh/h)	40	470	415	390	445	470
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	40	470	415	390	445	470
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1665	445	915			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1665	445	915			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	15	23	44			
cM capacity (veh/h)	47	613	745			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	510	415	390	445	470
Volume Left	40	415	0	0	0
Volume Right	470	0	0	0	470
cSH	316	745	1700	1700	1700
Volume to Capacity	1.62	0.56	0.23	0.26	0.28
Queue Length 95th (ft)	764	87	0	0	0
Control Delay (s)	320.5	15.7	0.0	0.0	0.0
Lane LOS	F	C			
Approach Delay (s)	320.5	8.1		0.0	
Approach LOS	F				

Intersection Summary			
Average Delay	76.2		
Intersection Capacity Utilization	87.7%	ICU Level of Service	E
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	240	0	420	0	0	670
Future Volume (Veh/h)	240	0	420	0	0	670
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	240	0	420	0	0	670
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						560
pX, platoon unblocked						
vC, conflicting volume	755	420			420	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	755	420			420	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	30	100			100	
cM capacity (veh/h)	345	582			1136	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	240	420	335	335
Volume Left	240	0	0	0
Volume Right	0	0	0	0
cSH	345	1700	1700	1700
Volume to Capacity	0.70	0.25	0.20	0.20
Queue Length 95th (ft)	125	0	0	0
Control Delay (s)	36.3	0.0	0.0	0.0
Lane LOS	E			
Approach Delay (s)	36.3	0.0	0.0	
Approach LOS	E			

Intersection Summary			
Average Delay	6.5		
Intersection Capacity Utilization	42.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	0	90	330	670	90
Future Volume (Veh/h)	0	0	90	330	670	90
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	90	330	670	90
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)					370	
pX, platoon unblocked						
vC, conflicting volume	1180	670	760			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1180	670	760			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	100	89			
cM capacity (veh/h)	188	457	852			

Direction, Lane #	NB 1	NB 2	SB 1	SB 2
Volume Total	90	330	670	90
Volume Left	90	0	0	0
Volume Right	0	0	0	90
cSH	852	1700	1700	1700
Volume to Capacity	0.11	0.19	0.39	0.05
Queue Length 95th (ft)	9	0	0	0
Control Delay (s)	9.7	0.0	0.0	0.0
Lane LOS	A			
Approach Delay (s)	2.1		0.0	
Approach LOS				

Intersection Summary			
Average Delay	0.7		
Intersection Capacity Utilization	46.9%	ICU Level of Service	A
Analysis Period (min)	15		

Intersection Sign configuration not allowed in HCM analysis.

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	82	429	429	152	196	234
v/c Ratio	0.23	0.45	0.64	0.16	0.37	0.15
Control Delay	14.9	4.7	21.4	6.5	18.7	0.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	14.9	4.7	21.4	6.5	18.7	0.2
Queue Length 50th (ft)	16	26	47	16	22	0
Queue Length 95th (ft)	41	60	#94	44	47	0
Internal Link Dist (ft)	571			571	178	
Turn Bay Length (ft)						
Base Capacity (vph)	532	904	708	996	572	1583
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.15	0.47	0.61	0.15	0.34	0.15

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	75	395	395	140	180	215
Future Volume (vph)	75	395	395	140	180	215
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.9	6.7	6.7	5.5	5.5	4.0
Lane Util. Factor	1.00	1.00	0.97	1.00	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1583	3433	1863	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	1770	1583	3433	1863	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	82	429	429	152	196	234
RTOR Reduction (vph)	0	110	0	0	0	0
Lane Group Flow (vph)	82	319	429	152	196	234
Turn Type	Prot	pt+ov	Prot	NA	NA	Free
Protected Phases	4	1 4	1	6	2	
Permitted Phases						Free
Actuated Green, G (s)	8.4	22.2	7.9	20.7	6.1	40.5
Effective Green, g (s)	8.4	16.3	7.9	20.7	6.1	40.5
Actuated g/C Ratio	0.21	0.40	0.20	0.51	0.15	1.00
Clearance Time (s)	5.9		6.7	5.5	5.5	
Vehicle Extension (s)	2.0		2.0	2.0	2.0	
Lane Grp Cap (vph)	367	637	669	952	533	1583
v/s Ratio Prot	0.05	c0.20	c0.12	0.08	c0.06	
v/s Ratio Perm						0.15
v/c Ratio	0.22	0.50	0.64	0.16	0.37	0.15
Uniform Delay, d1	13.3	9.1	15.0	5.3	15.5	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.1	0.2	1.6	0.0	0.2	0.2
Delay (s)	13.5	9.3	16.6	5.3	15.6	0.2
Level of Service	B	A	B	A	B	A
Approach Delay (s)	10.0			13.6	7.2	
Approach LOS	A			B	A	

Intersection Summary			
HCM 2000 Control Delay	10.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	40.5	Sum of lost time (s)	18.1
Intersection Capacity Utilization	39.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	54	152	49	315	223	348	413	250	304	163	54
v/c Ratio	0.32	0.55	0.13	0.96	0.29	0.40	1.12	0.74	0.76	0.21	0.07
Control Delay	33.7	37.6	0.7	73.9	15.8	3.3	118.8	27.0	42.0	14.9	0.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	33.7	37.6	0.7	73.9	15.8	3.3	118.8	27.0	42.0	14.9	0.6
Queue Length 50th (ft)	23	67	0	148	67	0	~121	36	134	47	0
Queue Length 95th (ft)	56	123	0	#308	115	45	#212	#143	#258	88	4
Internal Link Dist (ft)		359			513		394			1014	
Turn Bay Length (ft)	295			240				30	200		
Base Capacity (vph)	199	322	413	329	818	890	368	338	400	793	736
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.27	0.47	0.12	0.96	0.27	0.39	1.12	0.74	0.76	0.21	0.07

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	50	140	45	290	205	320	65	315	230	280	150	50
Future Volume (vph)	50	140	45	290	205	320	65	315	230	280	150	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0	6.0	6.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00		0.95	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.99	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583		3509	1583	1770	1863	1583
Flt Permitted	0.62	1.00	1.00	0.95	1.00	1.00		0.87	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1153	1863	1583	1770	1863	1583		3073	1583	1770	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	54	152	49	315	223	348	71	342	250	304	163	54
RTOR Reduction (vph)	0	0	42	0	0	204	0	0	149	0	0	31
Lane Group Flow (vph)	54	152	7	315	223	144	0	413	101	304	163	23
Turn Type	Perm	NA	Perm	Prot	NA	Perm	Perm	NA	Perm	Prot	NA	Perm
Protected Phases		8		7	4			6		5	2	
Permitted Phases	8		8			4	6		6			2
Actuated Green, G (s)	11.2	11.2	11.2	14.0	31.2	31.2		9.0	9.0	17.0	32.0	32.0
Effective Green, g (s)	11.2	11.2	11.2	14.0	31.2	31.2		9.0	9.0	17.0	32.0	32.0
Actuated g/C Ratio	0.15	0.15	0.15	0.19	0.41	0.41		0.12	0.12	0.23	0.43	0.43
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	171	277	235	329	772	656		367	189	400	792	673
v/s Ratio Prot		c0.08		c0.18	0.12					c0.17	0.09	
v/s Ratio Perm	0.05		0.00			0.09		c0.13	0.06			0.01
v/c Ratio	0.32	0.55	0.03	0.96	0.29	0.22		1.13	0.54	0.76	0.21	0.03
Uniform Delay, d1	28.6	29.7	27.4	30.3	14.6	14.2		33.1	31.1	27.2	13.6	12.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.1	2.2	0.1	37.7	0.1	0.1		85.5	10.5	7.5	0.6	0.1
Delay (s)	29.6	31.9	27.4	68.0	14.7	14.2		118.6	41.6	34.7	14.2	12.7
Level of Service	C	C	C	E	B	B		F	D	C	B	B
Approach Delay (s)		30.5			33.5			89.5			26.0	
Approach LOS		C			C			F			C	

Intersection Summary			
HCM 2000 Control Delay	47.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	75.2	Sum of lost time (s)	26.0
Intersection Capacity Utilization	69.5%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	EBR	WBT	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	38	60	48	571	5	467	33
v/c Ratio	0.36	0.34	0.32	0.21	0.01	0.33	0.03
Control Delay	57.6	17.3	49.7	6.6	9.2	8.3	2.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	57.6	17.3	49.7	6.6	9.2	8.3	2.3
Queue Length 50th (ft)	26	0	30	36	1	63	0
Queue Length 95th (ft)	60	40	67	167	8	317	11
Internal Link Dist (ft)	379		511	1014		294	
Turn Bay Length (ft)		70					140
Base Capacity (vph)	374	481	512	2674	615	1408	1208
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.10	0.12	0.09	0.21	0.01	0.33	0.03

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	35	0	55	0	40	5	0	525	0	5	430	30
Future Volume (vph)	35	0	55	0	40	5	0	525	0	5	430	30
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0	6.0		6.0			6.0		6.0	6.0	6.0
Lane Util. Factor		1.00	1.00		1.00			0.95		1.00	1.00	1.00
Frt		1.00	0.85		0.99			1.00		1.00	1.00	0.85
Flt Protected		0.95	1.00		1.00			1.00		0.95	1.00	1.00
Satd. Flow (prot)		1770	1583		1837			3539		1770	1863	1583
Flt Permitted		0.73	1.00		1.00			1.00		0.44	1.00	1.00
Satd. Flow (perm)		1352	1583		1837			3539		815	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	38	0	60	0	43	5	0	571	0	5	467	33
RTOR Reduction (vph)	0	0	55	0	5	0	0	0	0	0	0	9
Lane Group Flow (vph)	0	38	5	0	43	0	0	571	0	5	467	24
Turn Type	Perm	NA	Perm		NA			NA		Perm	NA	Perm
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8						6		6
Actuated Green, G (s)		8.8	8.8		8.8			83.0		83.0	83.0	83.0
Effective Green, g (s)		8.8	8.8		8.8			83.0		83.0	83.0	83.0
Actuated g/C Ratio		0.08	0.08		0.08			0.74		0.74	0.74	0.74
Clearance Time (s)		6.0	6.0		6.0			6.0		6.0	6.0	6.0
Vehicle Extension (s)		3.0	3.0		3.0			2.0		2.0	2.0	2.0
Lane Grp Cap (vph)		106	124		144			2622		603	1380	1173
v/s Ratio Prot					0.02			0.16			c0.25	
v/s Ratio Perm		c0.03	0.00							0.01		0.02
v/c Ratio		0.36	0.04		0.30			0.22		0.01	0.34	0.02
Uniform Delay, d1		48.9	47.7		48.7			4.5		3.8	5.0	3.8
Progression Factor		1.00	1.00		1.00			1.00		1.00	1.00	1.00
Incremental Delay, d2		2.1	0.1		1.2			0.2		0.0	0.7	0.0
Delay (s)		51.0	47.8		49.9			4.7		3.8	5.7	3.8
Level of Service		D	D		D			A		A	A	A
Approach Delay (s)		49.0			49.9			4.7			5.5	
Approach LOS		D			D			A			A	

Intersection Summary			
HCM 2000 Control Delay	10.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.32		
Actuated Cycle Length (s)	112.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	47.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBT	NBT	NBR	SBT
Lane Group Flow (vph)	82	717	930	65	98	158
v/c Ratio	0.26	0.66	0.62	0.27	0.27	0.50
Control Delay	8.6	11.3	9.4	20.8	7.0	17.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	8.6	11.3	9.4	20.8	7.0	17.2
Queue Length 50th (ft)	10	116	75	17	0	23
Queue Length 95th (ft)	36	264	154	44	29	66
Internal Link Dist (ft)		513	406	230		284
Turn Bay Length (ft)	245				45	
Base Capacity (vph)	315	1089	1508	767	913	835
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.26	0.66	0.62	0.08	0.11	0.19

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	75	620	40	100	700	55	50	10	90	60	20	65
Future Volume (vph)	75	620	40	100	700	55	50	10	90	60	20	65
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0			6.0			6.0	6.0		6.0	
Lane Util. Factor	1.00	1.00			0.95			1.00	1.00		1.00	
Frt	1.00	0.99			0.99			1.00	0.85		0.94	
Flt Protected	0.95	1.00			0.99			0.96	1.00		0.98	
Satd. Flow (prot)	1770	1846			3485			1788	1583		1714	
Flt Permitted	0.29	1.00			0.73			0.75	1.00		0.84	
Satd. Flow (perm)	537	1846			2554			1397	1583		1464	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	82	674	43	109	761	60	54	11	98	65	22	71
RTOR Reduction (vph)	0	2	0	0	5	0	0	0	81	0	58	0
Lane Group Flow (vph)	82	715	0	0	925	0	0	65	17	0	100	0
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2		2	6		
Actuated Green, G (s)	30.1	30.1			30.1			9.0	9.0		9.0	
Effective Green, g (s)	30.1	30.1			30.1			9.0	9.0		9.0	
Actuated g/C Ratio	0.59	0.59			0.59			0.18	0.18		0.18	
Clearance Time (s)	6.0	6.0			6.0			6.0	6.0		6.0	
Vehicle Extension (s)	3.0	3.0			3.0			3.0	3.0		3.0	
Lane Grp Cap (vph)	316	1087			1504			246	278		257	
v/s Ratio Prot		c0.39										
v/s Ratio Perm	0.15				0.36			0.05	0.01		c0.07	
v/c Ratio	0.26	0.66			0.61			0.26	0.06		0.39	
Uniform Delay, d1	5.1	7.0			6.8			18.2	17.5		18.6	
Progression Factor	1.00	1.00			1.00			1.00	1.00		1.00	
Incremental Delay, d2	2.0	3.1			1.9			0.6	0.1		1.0	
Delay (s)	7.1	10.2			8.7			18.8	17.6		19.6	
Level of Service	A	B			A			B	B		B	
Approach Delay (s)		9.8			8.7			18.1			19.6	
Approach LOS		A			A			B			B	

Intersection Summary			
HCM 2000 Control Delay	10.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	51.1	Sum of lost time (s)	12.0
Intersection Capacity Utilization	89.1%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

APPENDIX G
Signal Warrant Analysis

Traffic Signal Warrants Analysis on US 5, Hartford VT **11/09/18**

Vermont Agency of Transportation (VTrans) guidelines regarding the justification of a traffic control signal refer to the need for a signal warrant analysis performed in accordance with the latest Manual on Uniform Traffic Control Devices (2009 MUTCD). Consistent with the MUTCD, VTrans recommends application of average weekday traffic volumes. Furthermore, if a signal is warranted, an assessment of the need for and design of pedestrian phases should be included. Pedestrian phases would normally be included only if pedestrian facilities lead up to the leg of the intersection on which the pedestrian phase would be provided.

MUTCD Requirements

The 2009 MUTCD states that an engineering study of traffic conditions, pedestrian characteristics, and physical characteristics of the location shall be performed and the investigation of the need for a traffic control signal shall include an analysis of factors related to the existing operation and safety at the study location and the potential to improve these conditions, and the applicable factors contained in nine traffic signal warrants. These warrants are:

Warrant 1, Eight-Hour Vehicular Volume
Warrant 2, Four-Hour Vehicular Volume
Warrant 3, Peak Hour
Warrant 4, Pedestrian Volume
Warrant 5, School Crossing
Warrant 6, Coordinated Signal System
Warrant 7, Crash Experience
Warrant 8, Roadway Network
Warrant 9, Intersection Near a Grade Crossing

The 2009 MUTCD also states that satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal. Moreover, the engineering study should identify if the overall safety of the intersection is improved; if progressive traffic flow is disrupted; if right turns on the minor approach are to be included in the analysis.

Warrant 1, Minimum Vehicular Volume, (Condition A) is intended for application at locations where a large volume of intersecting (minor approach) traffic is the principal consideration. Warrant 1 requires that traffic volumes during eight hours of an average day meets or exceeds the volume thresholds. Warrant 1, Interruption of Continuous Traffic, (Condition B) is intended where traffic volume on the major street is so heavy that traffic on a minor intersecting street suffers excessive delay or conflict in entering or crossing the major street. Condition A and B generally requires 80 percent of the Condition A and Condition B requirements. Further reducing adjustments may be applied if the 85^{th} percentile speed on the major roadway is greater than 40 mph or if the intersection lies within the built-up area of an isolated community having a population of less than 10,000.

Warrant 2, Four-Hour Vehicle Volume generally relates to a higher minor intersecting street volume and specifically to plotted curves of minor and major street volumes. Similar speed and population adjustments as stated with respect to Warrant 1 apply.

Warrant 3, Peak Hour relates to particularly high volumes on the minor street such as that associated with manufacturing plants, office or industrial complexes, etc. Similar plotted curves as related to Warrant 2 apply; and speed and population adjustments as stated with respect to Warrant 1 apply.

Warrant 4, Pedestrian Volume signal warrant is intended for application where traffic volumes on a major street is so heavy that pedestrians experience excessive delay in crossing the major street in accordance with plotted volume and pedestrian volume curves relating to speeds and population. Both four-hour and one-hour thresholds exist. Generally, on the US 5 corridor 100 to 200 pedestrian crossings per hour would be the warranting threshold. Similar threshold reductions due to speed apply.

Warrant 5, School Crossing signal warrant is intended where there is an established school crossing and where adequate gaps for the schoolchildren when they are wanting to cross are fewer than one per minute and there is a minimum of 20 children crossing during the highest crossing hour. There are also other requirements relating to the location of the crossing.

Warrant 6, Coordinated Signal System relates to the condition where progressive movement in a coordinated signal system necessitates a traffic signal to maintain the traffic platoon.

Warrant 7, Crash Experience signal warrant is intended for application where the severity and frequency of crashes are the principal consideration. A key criterion is five or more crashes during a 12-month period that would be prevented with a traffic signal.

Warrant 8, Roadway Network supports the installation of a traffic signal to encourage concentration and organization of traffic flow within a network. A roadway network as intended by this warrant does not include the intersections on this US 5 corridor.

Warrant 9, Intersection Near a Grade Crossing signal warrant is intended for use where no other warrant applies but the proximity to a grade crossing of an approach where STOP or YIELD sign control is reason to consider traffic signal control.

US 5 Corridor Intersections

The intersections along the US 5 corridor requiring the consideration of the above described traffic signal control warrants analysis are:

- US 5 at VA Cutoff Road;
- US 5 at Veterans Road;
- US 5 at Ballardvale Drive and Windsor Drive;
- US 5 at I-91 SB Off and On Ramps;
- US 5 at I-91 NB Off Ramp;
- US 5 at Airport Road.

Each of these intersections were analyzed applying traffic count data available on VTrans website. The US 5 travel speed for each is based on the 35-mph speed limit shown on the Route Log which is also available on the Vtrans website.

At all but the Airport Road intersection the major roadway, US 5, is a two-lane roadway; at Airport Road, US 5 is a four-lane roadway. Most minor streets are single lane approaches; Ballardvale Drive is a two-lane minor street approach; and the I-91 NB offramp includes a left turn lane and a separate right lane. Detailed signal warrant analysis summary sheets for each intersection including the hourly traffic volumes, Warrants 1, 2 and 3 thresholds, and the hours meeting those thresholds are provided in the report appendix. The actual traffic counts are also provided in the appendix.

Warrant Analysis Results

Table 1 is a summary indicating where traffic signal warrants are met under existing conditions, where conditions may change and where traffic signals may be warranted under future conditions, and where other future conditions may change to no longer warrant a traffic signal. Only the US 5 intersections at I-91 NB ramps intersection and the I-91 SB Ramps intersection warrant traffic signals under existing conditions.

At the I-91 SB Ramp intersection right turn volumes are much heavier than left turn volumes. Right turn volumes were included in the minor approach volume because there is just a single lane approach and delays do occur due to right turns waiting for a left turning vehicle at the front of the queue.

At the I-91 NB Ramp intersection the right turn and left turn volumes are both heavy. There are separate lanes for left turns and right turns. The analysis does not include the right turn volumes.

Under future conditions:

At the SB Ramp intersection -if a right turn lane is added to the SB ramp approach the traffic signal would not be warranted;

At the VA Cutoff Road, Veterans Drive and Ballardvale Avenue intersections 20-25 percent increases in the US 5 traffic volume or 85th percentile speeds exceeding 40 mph on US 5 would be enough change to warrant a traffic signal under Warrant 1.

At Airport Road, it is estimated that both the major and minor roadway volumes would need increase by 25 percent to warrant a traffic signal.

Table 1 US 5 Hartford Traffic Signal Warrant Summary

US 5 Location	**Signal Warrants satisfied under Existing Conditions**	**Change to satisfy Future Conditions Signal Warrants**	**Changes to <u>not</u> satisfy Future Conditions Signal Warrants**	**Notes**
VA Cutoff	None	To meet Warrant 1B: On US 5 (1) 25% volume increase OR (2) 85th % speed greater than 40 mph To meet Warrant 3-a minor diversion (15 vehicles) to VA Cutoff	NA	Addition of right turn lane on VA Cutoff would reduce delay. Rights not included in traffic signal warrants analysis.
Veterans Drive	None	To meet Warrant 1B: On US 5 (1) 20% volume increase OR (2) 85th % speed greater than 40 mph	Traffic signal installed at VA Cutoff, reduces need due to accessibility to VA Cutoff and gaps produced by that traffic signal.	Light volume right turns from Veterans Drive.
Ballardvale Avenue	None	To meet Warrant 1B: On US 5 (1) 25% volume increase OR (2) 85th % speed greater than 40 mph	NA	Right turns from existing separate right turn lane on Ballardvale Ave not included in warrants analysis.
I-91 SB Ramps	1A, 1B, 2,3	NA	Right turn lane on ramp	
I-91 NB Ramps	1A, 1B, 2,3	NA	NA	Right turns from existing separate right turn lane on from Ramp not critical to warrants analysis.
Airport Road	None	To meet Warrant 1B 25% volume increase on US 5 and Airport Road	Peak Hour left turn prohibition from Airport Road or right turn lane on Airport Road.	12–hour turning movement count not available.

Vermont Agency of Transportation

Traffic Research/Highway Division
Turning Movement Report

Counted By: N Bredice
Weather: Sunny
Town: 5-19.6 Hartford

File Name : 5-19_6am18
Site Code : 31408740
Start Date : 7/20/2018
Page No : 1

Groups Printed- Auto - Medium - Heavy

	US 5 from US 4 From North					From East					US 5 from Hartland From South					VA Cutoff Rd from US 4 From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
06:00 AM	5	22	0	0	27	0	0	0	0	0	0	21	2	0	23	3	0	10	0	13	63
06:15 AM	10	20	0	1	31	0	0	0	0	0	0	14	7	0	21	4	0	4	0	8	60
06:30 AM	6	23	0	0	29	0	0	0	0	0	0	30	2	0	32	7	0	9	0	16	77
06:45 AM	15	55	0	0	70	0	0	0	0	0	0	43	12	0	55	6	0	16	0	22	147
Total	36	120	0	1	157	0	0	0	0	0	0	108	23	0	131	20	0	39	0	59	347
07:00 AM	8	30	0	0	38	0	0	0	0	0	0	43	9	0	52	4	0	17	0	21	111
07:15 AM	14	38	0	0	52	0	0	0	0	0	0	60	9	0	69	4	0	19	0	23	144
07:30 AM	29	51	0	0	80	0	0	0	0	0	0	73	9	1	83	6	0	18	0	24	187
07:45 AM	36	68	0	0	104	0	0	0	0	0	0	68	16	0	84	14	0	21	0	35	223
Total	87	187	0	0	274	0	0	0	0	0	0	244	43	1	288	28	0	75	0	103	665
08:00 AM	25	67	0	1	93	0	0	0	0	0	0	71	13	0	84	10	0	20	0	30	207
08:15 AM	14	44	0	0	58	0	0	0	0	0	0	52	14	0	66	10	0	22	0	32	156
08:30 AM	6	71	0	0	77	0	0	0	0	0	0	66	8	0	74	7	0	24	0	31	182
08:45 AM	22	77	0	0	99	0	0	0	0	0	0	75	12	0	87	21	0	19	0	40	226
Total	67	259	0	1	327	0	0	0	0	0	0	264	47	0	311	48	0	85	0	133	771
09:00 AM	18	63	0	0	81	0	0	0	0	0	0	76	9	0	85	13	0	20	0	33	199
09:15 AM	18	47	0	0	65	0	0	0	0	0	0	75	12	0	87	11	0	22	0	33	185
09:30 AM	11	50	0	0	61	0	0	0	0	0	0	57	14	0	71	11	0	22	0	33	165
09:45 AM	12	56	0	0	68	0	0	0	0	0	0	59	8	0	67	11	0	18	0	29	164
Total	59	216	0	0	275	0	0	0	0	0	0	267	43	0	310	46	0	82	0	128	713
10:00 AM	13	57	0	1	71	0	0	0	0	0	0	71	7	0	78	11	0	18	0	29	178
10:15 AM	17	58	0	0	75	0	0	0	0	0	0	70	8	0	78	9	0	19	0	28	181
10:30 AM	20	58	0	0	78	0	0	0	0	0	0	68	9	0	77	7	0	18	0	25	180
10:45 AM	20	54	0	0	74	0	0	0	0	0	0	50	12	0	62	7	0	19	0	26	162
Total	70	227	0	1	298	0	0	0	0	0	0	259	36	0	295	34	0	74	0	108	701
11:00 AM	12	59	0	0	71	0	0	0	0	0	0	56	8	0	64	13	0	18	0	31	166
11:15 AM	14	67	0	0	81	0	0	0	0	0	0	67	15	0	82	14	0	14	0	28	191
11:30 AM	15	70	0	0	85	0	0	0	0	0	0	65	15	0	80	12	0	18	0	30	195
11:45 AM	16	70	0	0	86	0	0	0	0	0	0	61	14	0	75	10	0	22	0	32	193
Total	57	266	0	0	323	0	0	0	0	0	0	249	52	0	301	49	0	72	0	121	745
Grand Total	376	1275	0	3	1654	0	0	0	0	0	0	1391	244	1	1636	225	0	427	0	652	3942
Apprch %	22.7	77.1	0	0.2		0	0	0	0		0	85	14.9	0.1		34.5	0	65.5	0		
Total %	9.5	32.3	0	0.1	42	0	0	0	0	0	0	35.3	6.2	0	41.5	5.7	0	10.8	0	16.5	
Auto	353	1060	0	3	1416	0	0	0	0	0	0	1170	216	1	1387	206	0	399	0	605	3408
% Auto	93.9	83.1	0	100	85.6	0	0	0	0	0	0	84.1	88.5	100	84.8	91.6	0	93.4	0	92.8	86.5
Medium	19	185	0	0	204	0	0	0	0	0	0	196	27	0	223	19	0	24	0	43	470
% Medium	5.1	14.5	0	0	12.3	0	0	0	0	0	0	14.1	11.1	0	13.6	8.4	0	5.6	0	6.6	11.9
Heavy	4	30	0	0	34	0	0	0	0	0	0	25	1	0	26	0	0	4	0	4	64
% Heavy	1.1	2.4	0	0	2.1	0	0	0	0	0	0	1.8	0.4	0	1.6	0	0	0.9	0	0.6	1.6

Vermont Agency of Transportation

Traffic Research/Highway Division
Turning Movement Report

Counted By: N Bredice
Weather: Sunny
Town: 5-19.6 Hartford

File Name : 5-19_6pm18
Site Code : 31408740
Start Date : 7/19/2018
Page No : 1

Groups Printed- Auto - Medium - Heavy

	US 5 from US 4 From North					From East					US 5 from Hartland From South					VA Cutoff Rd from US 4 From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
12:00 PM	18	73	0	0	91	0	0	0	1	1	0	115	10	0	125	12	0	21	0	33	250
12:15 PM	12	60	0	1	73	0	0	0	0	0	0	67	10	0	77	11	0	20	3	34	184
12:30 PM	12	70	0	0	82	0	0	0	0	0	0	69	11	0	80	7	0	25	1	33	195
12:45 PM	13	71	0	0	84	0	0	0	0	0	0	61	10	1	72	12	0	19	0	31	187
Total	55	274	0	1	330	0	0	0	1	1	0	312	41	1	354	42	0	85	4	131	816
01:00 PM	10	55	0	1	66	0	0	0	0	0	0	59	7	0	66	15	0	8	1	24	156
01:15 PM	12	54	0	0	66	0	0	0	0	0	0	53	6	1	60	11	0	4	0	15	141
01:30 PM	9	74	0	0	83	0	0	0	0	0	0	66	9	0	75	10	0	20	0	30	188
01:45 PM	14	53	0	0	67	0	0	0	0	0	0	57	10	0	67	18	0	14	0	32	166
Total	45	236	0	1	282	0	0	0	0	0	0	235	32	1	268	54	0	46	1	101	651
02:00 PM	7	59	0	0	66	0	0	0	0	0	0	41	10	0	51	9	0	15	0	24	141
02:15 PM	18	51	0	0	69	0	0	0	0	0	0	52	10	0	62	10	0	20	0	30	161
02:30 PM	13	51	0	0	64	0	0	0	0	0	0	45	7	0	52	8	0	17	1	26	142
02:45 PM	17	49	0	0	66	0	0	0	0	0	0	55	18	0	73	9	0	10	0	19	158
Total	55	210	0	0	265	0	0	0	0	0	0	193	45	0	238	36	0	62	1	99	602
03:00 PM	19	61	0	0	80	0	0	0	0	0	0	57	15	0	72	11	0	11	0	22	174
03:15 PM	20	70	0	0	90	0	0	0	0	0	0	57	11	0	68	12	0	12	0	24	182
03:30 PM	13	51	0	0	64	0	0	0	0	0	0	67	11	0	78	13	0	26	0	39	181
03:45 PM	21	68	0	0	89	0	0	0	0	0	0	53	6	0	59	6	0	31	0	37	185
Total	73	250	0	0	323	0	0	0	0	0	0	234	43	0	277	42	0	80	0	122	722
04:00 PM	13	79	0	0	92	0	0	0	0	0	0	57	8	0	65	14	0	47	0	61	218
04:15 PM	23	82	0	0	105	0	0	0	0	0	0	59	6	0	65	16	0	29	0	45	215
04:30 PM	17	76	0	0	93	0	0	0	0	0	0	75	9	0	84	19	0	63	0	82	259
04:45 PM	23	81	0	0	104	0	0	0	0	0	0	50	12	0	62	15	0	38	0	53	219
Total	76	318	0	0	394	0	0	0	0	0	0	241	35	0	276	64	0	177	0	241	911
05:00 PM	19	79	0	0	98	0	0	0	0	0	0	47	11	0	58	16	0	33	0	49	205
05:15 PM	14	77	0	0	91	0	0	0	0	0	0	43	10	0	53	17	0	27	0	44	188
05:30 PM	15	68	0	0	83	0	0	0	0	0	0	54	11	0	65	16	0	18	0	34	182
05:45 PM	12	66	0	0	78	0	0	0	0	0	0	49	9	0	58	8	0	11	0	19	155
Total	60	290	0	0	350	0	0	0	0	0	0	193	41	0	234	57	0	89	0	146	730
Grand Total	364	1578	0	2	1944	0	0	0	1	1	0	1408	237	2	1647	295	0	539	6	840	4432
Apprch %	18.7	81.2	0	0.1		0	0	0	100		0	85.5	14.4	0.1		35.1	0	64.2	0.7		
Total %	8.2	35.6	0	0	43.9	0	0	0	0	0	0	31.8	5.3	0	37.2	6.7	0	12.2	0.1	19	
Auto	346	1427	0	2	1775	0	0	0	1	1	0	1257	218	2	1477	270	0	518	6	794	4047
% Auto	95.1	90.4	0	100	91.3	0	0	0	100	100	0	89.3	92	100	89.7	91.5	0	96.1	100	94.5	91.3
Medium	15	123	0	0	138	0	0	0	0	0	0	126	19	0	145	24	0	20	0	44	327
% Medium	4.1	7.8	0	0	7.1	0	0	0	0	0	0	8.9	8	0	8.8	8.1	0	3.7	0	5.2	7.4
Heavy	3	28	0	0	31	0	0	0	0	0	0	25	0	0	25	1	0	1	0	2	58
% Heavy	0.8	1.8	0	0	1.6	0	0	0	0	0	0	1.8	0	0	1.5	0.3	0	0.2	0	0.2	1.3

Vermont Agency of Transportation

Traffic Research/Highway Division
Turning Movement Report

Counted By: I Griffith
Weather: Sunny
Town: 5-19.75 Hartford

File Name : 5-19_75am18
Site Code : 31408745
Start Date : 7/20/2018
Page No : 1

Groups Printed- Auto - Medium - Heavy

	Veterans Dr from VA Hospital From North					US 5 from US 4 From East					Dunkin Donuts From South					US 5 from Hartland From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
06:00 AM	0	0	2	0	2	14	25	12	0	51	11	0	3	0	14	5	25	2	0	32	99
06:15 AM	0	1	2	0	3	24	29	18	0	71	12	6	5	1	24	1	20	0	0	21	119
06:30 AM	0	0	1	0	1	26	29	18	0	73	13	1	4	1	19	4	37	2	0	43	136
06:45 AM	0	1	5	0	6	50	71	19	0	140	18	1	2	2	23	7	56	2	0	65	234
Total	0	2	10	0	12	114	154	67	0	335	54	8	14	4	80	17	138	6	0	161	588
07:00 AM	2	0	3	0	5	67	34	18	2	121	18	1	3	0	22	7	55	7	0	69	217
07:15 AM	0	0	12	0	12	90	55	26	0	171	23	5	4	0	32	8	65	6	0	79	294
07:30 AM	1	0	6	0	7	60	77	27	0	164	15	4	3	0	22	9	74	3	0	86	279
07:45 AM	4	0	5	0	9	65	100	18	1	184	21	6	9	0	36	13	81	3	0	97	326
Total	7	0	26	0	33	282	266	89	3	640	77	16	19	0	112	37	275	19	0	331	1116
08:00 AM	6	1	11	0	18	46	88	17	0	151	20	3	7	0	30	11	99	2	0	112	311
08:15 AM	0	1	8	0	9	30	54	25	0	109	16	3	7	0	26	6	83	1	0	90	234
08:30 AM	2	0	13	0	15	25	70	30	1	126	26	0	9	2	37	9	92	2	0	103	281
08:45 AM	3	1	11	0	15	43	99	21	3	166	17	0	6	1	24	8	86	2	0	96	301
Total	11	3	43	0	57	144	311	93	4	552	79	6	29	3	117	34	360	7	0	401	1127
09:00 AM	3	0	8	0	11	24	79	17	0	120	19	3	4	2	28	6	92	3	1	102	261
09:15 AM	4	2	10	1	17	25	54	16	1	96	17	1	5	0	23	10	83	3	0	96	232
09:30 AM	1	0	15	0	16	29	64	12	0	105	27	0	5	0	32	7	80	0	1	88	241
09:45 AM	1	0	22	1	24	26	61	14	3	104	8	1	6	0	15	4	72	4	0	80	223
Total	9	2	55	2	68	104	258	59	4	425	71	5	20	2	98	27	327	10	2	366	957
10:00 AM	1	1	17	0	19	20	61	14	4	99	13	2	3	0	18	15	73	0	0	88	224
10:15 AM	3	0	13	0	16	21	70	16	0	107	20	0	2	0	22	4	59	3	0	66	211
10:30 AM	6	2	15	1	24	25	77	11	1	114	12	1	4	0	17	2	86	3	0	91	246
10:45 AM	5	1	27	1	34	18	71	11	0	100	12	2	2	0	16	3	76	1	0	80	230
Total	15	4	72	2	93	84	279	52	5	420	57	5	11	0	73	24	294	7	0	325	911
11:00 AM	2	2	15	0	19	16	79	14	2	111	13	0	1	0	14	4	74	5	0	83	227
11:15 AM	3	4	30	0	37	18	82	11	1	112	17	0	3	0	20	6	80	2	0	88	257
11:30 AM	5	0	18	1	24	10	75	8	0	93	12	2	3	0	17	2	78	2	0	82	216
11:45 AM	5	0	22	0	27	9	85	8	0	102	9	0	2	0	11	3	91	2	0	96	236
Total	15	6	85	1	107	53	321	41	3	418	51	2	9	0	62	15	323	11	0	349	936
Grand Total	57	17	291	5	370	781	1589	401	19	2790	389	42	102	9	542	154	1717	60	2	1933	5635
Apprch %	15.4	4.6	78.6	1.4		28	57	14.4	0.7		71.8	7.7	18.8	1.7		8	88.8	3.1	0.1		
Total %	1	0.3	5.2	0.1	6.6	13.9	28.2	7.1	0.3	49.5	6.9	0.7	1.8	0.2	9.6	2.7	30.5	1.1	0	34.3	
Auto	54	16	267	5	342	753	1337	395	19	2504	379	41	102	9	531	149	1452	59	2	1662	5039
% Auto	94.7	94.1	91.8	100	92.4	96.4	84.1	98.5	100	89.7	97.4	97.6	100	100	98	96.8	84.6	98.3	100	86	89.4
Medium	3	1	20	0	24	26	225	6	0	257	10	1	0	0	11	5	235	1	0	241	533
% Medium	5.3	5.9	6.9	0	6.5	3.3	14.2	1.5	0	9.2	2.6	2.4	0	0	2	3.2	13.7	1.7	0	12.5	9.5
Heavy	0	0	4	0	4	2	27	0	0	29	0	0	0	0	0	0	30	0	0	30	63
% Heavy	0	0	1.4	0	1.1	0.3	1.7	0	0	1	0	0	0	0	0	0	1.7	0	0	1.6	1.1

Vermont Agency of Transportation

Traffic Research/Highway Division
Turning Movement Report

Counted By: I Griffith
Weather: Sunny
Town: 5-19.75 Hartford

File Name : 5-19_75pm18
Site Code : 31408745
Start Date : 7/19/2018
Page No : 1

Groups Printed- Auto - Medium - Heavy

	Veterans Dr from VA Hospital From North					US 5 from US 4 From East					Dunkin Donuts From South					US 5 from Hartland From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
12:00 PM	3	0	31	5	39	17	86	9	0	112	9	0	2	0	11	5	134	0	0	139	301
12:15 PM	0	1	28	1	30	23	71	10	0	104	9	1	3	0	13	4	90	2	0	96	243
12:30 PM	6	1	25	1	33	26	75	8	1	110	8	0	5	1	14	4	96	0	0	100	257
12:45 PM	5	2	14	0	21	35	82	8	0	125	12	1	0	1	14	5	76	2	0	83	243
Total	14	4	98	7	123	101	314	35	1	451	38	2	10	2	52	18	396	4	0	418	1044
01:00 PM	2	0	17	1	20	17	67	8	1	93	5	0	1	0	6	6	68	2	0	76	195
01:15 PM	2	3	19	0	24	31	62	8	0	101	7	1	5	1	14	1	59	2	0	62	201
01:30 PM	2	1	14	0	17	24	88	8	0	120	6	1	3	2	12	2	81	2	0	85	234
01:45 PM	2	1	17	1	21	21	62	7	0	90	14	0	2	2	18	5	72	2	0	79	208
Total	8	5	67	2	82	93	279	31	1	404	32	2	11	5	50	14	280	8	0	302	838
02:00 PM	4	2	22	0	28	20	68	4	0	92	7	0	4	0	11	2	56	2	0	60	191
02:15 PM	6	0	29	0	35	15	62	7	0	84	8	0	1	0	9	2	76	0	0	78	206
02:30 PM	4	1	22	2	29	12	67	7	2	88	8	0	4	0	12	4	60	3	0	67	196
02:45 PM	3	0	27	0	30	25	65	2	2	94	6	1	1	0	8	2	70	2	0	74	206
Total	17	3	100	2	122	72	262	20	4	358	29	1	10	0	40	10	262	7	0	279	799
03:00 PM	3	0	39	0	42	16	94	5	0	115	3	0	4	2	9	3	51	0	1	55	221
03:15 PM	4	1	23	0	28	9	100	6	0	115	3	1	1	0	5	5	75	1	0	81	229
03:30 PM	8	2	49	0	59	14	70	8	0	92	13	0	3	0	16	7	103	0	0	110	277
03:45 PM	5	1	38	0	44	10	87	8	0	105	10	1	2	0	13	5	90	1	0	96	258
Total	20	4	149	0	173	49	351	27	0	427	29	2	10	2	43	20	319	2	1	342	985
04:00 PM	6	0	53	0	59	9	100	11	1	121	9	0	1	2	12	0	110	2	0	112	304
04:15 PM	3	2	46	1	52	9	108	8	0	125	11	0	1	0	12	5	93	0	0	98	287
04:30 PM	3	1	46	0	50	9	96	10	0	115	12	0	3	0	15	2	150	0	0	152	332
04:45 PM	6	2	44	0	52	12	103	5	0	120	9	0	0	0	9	3	98	0	0	101	282
Total	18	5	189	1	213	39	407	34	1	481	41	0	5	2	48	10	451	2	0	463	1205
05:00 PM	2	5	29	0	36	5	103	6	0	114	5	1	2	0	8	3	107	0	0	110	268
05:15 PM	5	0	17	0	22	6	95	5	0	106	11	2	0	0	13	0	71	0	0	71	212
05:30 PM	1	0	19	0	20	7	83	8	9	107	4	1	1	1	7	0	79	2	0	81	215
05:45 PM	1	0	18	0	19	6	78	5	0	89	8	0	4	0	12	2	65	1	0	68	188
Total	9	5	83	0	97	24	359	24	9	416	28	4	7	1	40	5	322	3	0	330	883
Grand Total	86	26	686	12	810	378	1972	171	16	2537	197	11	53	12	273	77	2030	26	1	2134	5754
Apprch %	10.6	3.2	84.7	1.5		14.9	77.7	6.7	0.6		72.2	4	19.4	4.4		3.6	95.1	1.2	0		
Total %	1.5	0.5	11.9	0.2	14.1	6.6	34.3	3	0.3	44.1	3.4	0.2	0.9	0.2	4.7	1.3	35.3	0.5	0	37.1	
Auto	86	25	666	12	789	355	1780	167	16	2318	194	11	53	12	270	76	1839	24	1	1940	5317
% Auto	100	96.2	97.1	100	97.4	93.9	90.3	97.7	100	91.4	98.5	100	100	100	98.9	98.7	90.6	92.3	100	90.9	92.4
Medium	0	1	20	0	21	23	164	3	0	190	3	0	0	0	3	1	162	2	0	165	379
% Medium	0	3.8	2.9	0	2.6	6.1	8.3	1.8	0	7.5	1.5	0	0	0	1.1	1.3	8	7.7	0	7.7	6.6
Heavy	0	0	0	0	0	0	28	1	0	29	0	0	0	0	0	0	29	0	0	29	58
% Heavy	0	0	0	0	0	0	1.4	0.6	0	1.1	0	0	0	0	0	0	1.4	0	0	1.4	1

Vermont Agency of Transportation

Traffic Research/Highway Division
Turning Movement Report

Counted By: E Parizo
Weather: Sunny
Town: 5-19.8 Hartford

File Name : 5-19_8am18
Site Code : 31408746
Start Date : 7/20/2018
Page No : 1

Groups Printed- Auto - Medium - Heavy

	Winsor Dr From North					US 5 from US 4 From East					Ballardvale Ave From South					US 5 from Hartland From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
06:00 AM	0	0	0	0	0	0	51	2	0	53	11	0	0	0	11	0	36	0	0	36	100
06:15 AM	0	0	1	0	1	0	68	2	0	70	5	0	2	1	8	0	34	0	0	34	113
06:30 AM	0	0	0	0	0	0	64	3	0	67	7	0	6	1	14	0	52	0	0	52	133
06:45 AM	1	0	0	0	1	1	123	6	0	130	13	0	4	0	17	5	76	0	0	81	229
Total	1	0	1	0	2	1	306	13	0	320	36	0	12	2	50	5	198	0	0	203	575
07:00 AM	0	0	0	0	0	0	111	9	0	120	14	0	1	1	16	1	79	0	0	80	216
07:15 AM	0	0	0	0	0	0	154	8	0	162	19	0	1	0	20	3	105	0	0	108	290
07:30 AM	0	0	1	0	1	0	158	3	0	161	13	0	7	0	20	2	95	0	0	97	279
07:45 AM	1	0	0	0	1	0	172	13	0	185	19	0	5	0	24	5	104	0	0	109	319
Total	1	0	1	0	2	0	595	33	0	628	65	0	14	1	80	11	383	0	0	394	1104
08:00 AM	0	0	0	0	0	0	137	11	0	148	19	0	5	0	24	3	132	0	0	135	307
08:15 AM	0	0	0	0	0	0	101	4	0	105	19	0	4	0	23	3	108	0	0	111	239
08:30 AM	0	1	1	0	2	0	120	11	0	131	13	0	4	1	18	7	125	0	0	132	283
08:45 AM	0	0	0	0	0	0	151	8	0	159	22	0	3	1	26	3	105	0	0	108	293
Total	0	1	1	0	2	0	509	34	0	543	73	0	16	2	91	16	470	0	0	486	1122
09:00 AM	0	0	1	0	1	0	108	7	0	115	17	0	4	1	22	3	123	0	1	127	265
09:15 AM	1	0	0	0	1	1	92	11	0	104	18	1	2	0	21	5	106	0	0	111	237
09:30 AM	1	0	0	0	1	2	106	3	0	111	16	0	3	0	19	1	113	0	0	114	245
09:45 AM	0	0	0	0	0	4	101	16	0	121	25	0	1	0	26	4	97	0	0	101	248
Total	2	0	1	0	3	7	407	37	0	451	76	1	10	1	88	13	439	0	1	453	995
10:00 AM	0	0	0	0	0	0	95	10	0	105	19	0	3	0	22	2	99	0	0	101	228
10:15 AM	0	0	1	0	1	3	104	8	0	115	10	0	3	0	13	5	95	0	0	100	229
10:30 AM	2	0	1	1	4	1	106	12	1	120	12	1	3	0	16	6	106	0	0	112	252
10:45 AM	0	0	0	1	1	0	87	13	1	101	21	0	3	0	24	4	98	0	0	102	228
Total	2	0	2	2	6	4	392	43	2	441	62	1	12	0	75	17	398	0	0	415	937
11:00 AM	0	0	1	0	1	1	103	8	0	112	18	0	4	0	22	6	92	0	0	98	233
11:15 AM	0	0	1	0	1	0	105	15	0	120	13	0	3	0	16	6	115	0	0	121	258
11:30 AM	0	0	1	0	1	1	86	6	0	93	13	0	0	0	13	2	90	0	0	92	199
11:45 AM	0	0	1	0	1	0	98	7	0	105	8	0	2	0	10	0	113	0	0	113	229
Total	0	0	4	0	4	2	392	36	0	430	52	0	9	0	61	14	410	0	0	424	919
Grand Total	6	1	10	2	19	14	2601	196	2	2813	364	2	73	6	445	76	2298	0	1	2375	5652
Apprch %	31.6	5.3	52.6	10.5		0.5	92.5	7	0.1		81.8	0.4	16.4	1.3		3.2	96.8	0	0		
Total %	0.1	0	0.2	0	0.3	0.2	46	3.5	0	49.8	6.4	0	1.3	0.1	7.9	1.3	40.7	0	0	42	
Auto	6	1	10	2	19	14	2384	186	2	2586	344	2	73	6	425	72	2057	0	1	2130	5160
% Auto	100	100	100	100	100	100	91.7	94.9	100	91.9	94.5	100	100	100	95.5	94.7	89.5	0	100	89.7	91.3
Medium	0	0	0	0	0	0	191	10	0	201	19	0	0	0	19	3	209	0	0	212	432
% Medium	0	0	0	0	0	0	7.3	5.1	0	7.1	5.2	0	0	0	4.3	3.9	9.1	0	0	8.9	7.6
Heavy	0	0	0	0	0	0	26	0	0	26	1	0	0	0	1	1	32	0	0	33	60
% Heavy	0	0	0	0	0	0	1	0	0	0.9	0.3	0	0	0	0.2	1.3	1.4	0	0	1.4	1.1

Vermont Agency of Transportation

Traffic Research/Highway Division
Turning Movement Report

Counted By: I Shea
Weather: Sunny
Town: 5-19.8 Hartford

File Name : 5-19_8pm18
Site Code : 31408746
Start Date : 7/19/2018
Page No : 1

Groups Printed- Auto - Medium - Heavy

	Winsor Dr From North					US 5 from US 4 From East					Ballardvale Ave From South					US 5 from Hartland From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
12:00 PM	0	0	1	0	1	1	92	14	0	107	16	1	3	0	20	1	158	0	1	160	288
12:15 PM	0	0	0	0	0	0	87	7	0	94	9	0	2	0	11	2	114	0	0	116	221
12:30 PM	0	0	1	0	1	0	93	10	0	103	9	0	5	0	14	3	117	0	0	120	238
12:45 PM	0	0	0	0	0	0	96	13	0	109	8	0	4	1	13	2	103	0	0	105	227
Total	0	0	2	0	2	1	368	44	0	413	42	1	14	1	58	8	492	0	1	501	974
01:00 PM	0	0	1	0	1	0	67	5	0	72	11	0	5	0	16	1	87	0	0	88	177
01:15 PM	0	0	0	0	0	0	70	3	0	73	4	0	3	1	8	0	81	0	0	81	162
01:30 PM	0	0	0	1	1	2	93	12	0	107	2	0	4	0	6	4	94	0	0	98	212
01:45 PM	0	0	0	0	0	1	63	8	0	72	8	0	1	1	10	1	83	0	0	84	166
Total	0	0	1	1	2	3	293	28	0	324	25	0	13	2	40	6	345	0	0	351	717
02:00 PM	0	0	0	0	0	0	90	6	0	96	5	0	2	0	7	1	93	0	0	94	197
02:15 PM	1	0	1	0	2	0	55	9	0	64	5	0	3	0	8	2	106	0	0	108	182
02:30 PM	0	0	0	0	0	0	69	7	0	76	7	0	0	1	8	1	78	0	0	79	163
02:45 PM	0	0	1	0	1	0	84	8	0	92	4	0	1	0	5	0	93	1	0	94	192
Total	1	0	2	0	3	0	298	30	0	328	21	0	6	1	28	4	370	1	0	375	734
03:00 PM	0	0	0	0	0	0	82	6	0	88	10	0	6	0	16	1	87	0	0	88	192
03:15 PM	1	0	1	0	2	0	87	5	0	92	10	0	3	0	13	3	89	0	0	92	199
03:30 PM	0	0	1	0	1	0	65	11	0	76	7	0	2	0	9	7	136	1	0	144	230
03:45 PM	0	0	0	0	0	0	84	9	0	93	15	0	1	0	16	1	135	0	0	136	245
Total	1	0	2	0	3	0	318	31	0	349	42	0	12	0	54	12	447	1	0	460	866
04:00 PM	0	1	1	0	2	0	80	17	0	97	18	0	4	0	22	8	155	1	0	164	285
04:15 PM	0	0	0	0	0	0	84	22	0	106	15	0	6	0	21	3	130	1	0	134	261
04:30 PM	0	0	0	0	0	3	106	8	0	117	10	0	2	0	12	4	182	0	0	186	315
04:45 PM	1	5	0	0	6	1	92	9	0	102	10	4	2	0	16	4	151	2	0	157	281
Total	1	6	1	0	8	4	362	56	0	422	53	4	14	0	71	19	618	4	0	641	1142
05:00 PM	1	3	0	0	4	1	94	15	0	110	12	2	2	0	16	3	124	2	0	129	259
05:15 PM	0	0	0	0	0	0	96	20	0	116	14	0	1	0	15	2	96	0	0	98	229
05:30 PM	0	0	0	0	0	0	89	13	0	102	12	0	0	0	12	2	98	0	0	100	214
05:45 PM	0	0	0	0	0	0	61	25	0	86	16	0	1	0	17	2	90	0	0	92	195
Total	1	3	0	0	4	1	340	73	0	414	54	2	4	0	60	9	408	2	0	419	897
Grand Total	4	9	8	1	22	9	1979	262	0	2250	237	7	63	4	311	58	2680	8	1	2747	5330
Apprch %	18.2	40.9	36.4	4.5		0.4	88	11.6	0		76.2	2.3	20.3	1.3		2.1	97.6	0.3	0		
Total %	0.1	0.2	0.2	0	0.4	0.2	37.1	4.9	0	42.2	4.4	0.1	1.2	0.1	5.8	1.1	50.3	0.2	0	51.5	
Auto	4	9	8	1	22	9	1821	247	0	2077	225	6	59	4	294	57	2484	6	1	2548	4941
% Auto	100	100	100	100	100	100	92	94.3	0	92.3	94.9	85.7	93.7	100	94.5	98.3	92.7	75	100	92.8	92.7
Medium	0	0	0	0	0	0	134	13	0	147	12	1	4	0	17	0	167	2	0	169	333
% Medium	0	0	0	0	0	0	6.8	5	0	6.5	5.1	14.3	6.3	0	5.5	0	6.2	25	0	6.2	6.2
Heavy	0	0	0	0	0	0	24	2	0	26	0	0	0	0	0	1	29	0	0	30	56
% Heavy	0	0	0	0	0	0	1.2	0.8	0	1.2	0	0	0	0	0	1.7	1.1	0	0	1.1	1.1

Vermont Agency of Transportation

Traffic Research/Highway Division
Turning Movement Report

Counted By: K Record
Weather: Sunny
Town: 91-11S Hartford

File Name : 91-11Sam18
Site Code : 31408925
Start Date : 7/20/2018
Page No : 1

Groups Printed- Auto - Medium - Heavy

	I-91 South Bound On/Off Ramps From North					US 5 from US 4 From East					From South					US 5 from Hartland From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
06:00 AM	13	0	4	0	17	20	39	0	0	59	0	0	0	0	0	0	20	29	0	49	125
06:15 AM	17	0	7	0	24	25	55	0	0	80	0	0	0	2	2	0	17	22	0	39	145
06:30 AM	10	0	11	0	21	27	60	0	0	87	0	0	0	1	1	0	22	33	0	55	164
06:45 AM	34	0	20	0	54	23	111	0	0	134	0	0	0	0	0	0	45	38	0	83	271
Total	74	0	42	0	116	95	265	0	0	360	0	0	0	3	3	0	104	122	0	226	705
07:00 AM	15	0	16	0	31	54	111	0	0	165	0	0	0	0	0	0	46	46	0	92	288
07:15 AM	48	0	8	0	56	45	126	0	0	171	0	0	0	0	0	0	61	49	0	110	337
07:30 AM	34	0	9	0	43	66	132	0	0	198	0	0	0	0	0	0	60	54	0	114	355
07:45 AM	39	0	10	0	49	63	154	0	0	217	0	0	0	2	2	0	68	53	0	121	389
Total	136	0	43	0	179	228	523	0	0	751	0	0	0	2	2	0	235	202	0	437	1369
08:00 AM	38	0	17	0	55	46	109	0	0	155	0	0	0	0	0	0	87	59	0	146	356
08:15 AM	24	0	14	0	38	47	86	0	0	133	0	0	0	0	0	0	66	55	0	121	292
08:30 AM	29	0	14	0	43	52	100	0	0	152	0	0	0	1	1	0	84	52	0	136	332
08:45 AM	35	0	15	0	50	56	134	0	0	190	0	0	0	1	1	0	82	52	0	134	375
Total	126	0	60	0	186	201	429	0	0	630	0	0	0	2	2	0	319	218	0	537	1355
09:00 AM	21	0	19	0	40	41	100	0	0	141	0	0	0	1	1	0	86	46	0	132	314
09:15 AM	16	0	11	0	27	58	87	0	0	145	0	0	0	0	0	0	73	54	0	127	299
09:30 AM	28	0	12	0	40	63	80	0	0	143	0	0	0	0	0	0	69	63	0	132	315
09:45 AM	19	0	11	1	31	62	91	0	0	153	0	0	0	0	0	0	73	51	0	124	308
Total	84	0	53	1	138	224	358	0	0	582	0	0	0	1	1	0	301	214	0	515	1236
10:00 AM	16	0	8	0	24	68	96	0	0	164	0	0	0	0	0	0	74	47	0	121	309
10:15 AM	18	0	10	0	28	53	99	0	0	152	0	0	0	0	0	0	58	45	0	103	283
10:30 AM	21	0	9	0	30	58	98	0	0	156	0	0	0	0	0	0	70	51	0	121	307
10:45 AM	19	0	16	0	35	67	87	0	0	154	0	0	0	1	1	0	70	60	0	130	320
Total	74	0	43	0	117	246	380	0	0	626	0	0	0	1	1	0	272	203	0	475	1219
11:00 AM	16	0	18	0	34	77	99	0	0	176	0	0	0	0	0	0	70	47	0	117	327
11:15 AM	19	0	20	0	39	62	102	0	0	164	0	0	0	1	1	0	68	74	0	142	346
11:30 AM	24	0	19	0	43	83	82	0	0	165	0	0	0	0	0	0	75	48	0	123	331
11:45 AM	21	0	21	0	42	73	87	0	0	160	0	0	0	1	1	0	83	44	0	127	330
Total	80	0	78	0	158	295	370	0	0	665	0	0	0	2	2	0	296	213	0	509	1334
Grand Total	574	0	319	1	894	1289	2325	0	0	3614	0	0	0	11	11	0	1527	1172	0	2699	7218
Apprch %	64.2	0	35.7	0.1		35.7	64.3	0	0		0	0	0	100		0	56.6	43.4	0		
Total %	8	0	4.4	0	12.4	17.9	32.2	0	0	50.1	0	0	0	0.2	0.2	0	21.2	16.2	0	37.4	
Auto	568	0	309	1	878	1194	2115	0	0	3309	0	0	0	11	11	0	1391	1063	0	2454	6652
% Auto	99	0	96.9	100	98.2	92.6	91	0	0	91.6	0	0	0	100	100	0	91.1	90.7	0	90.9	92.2
Medium	3	0	6	0	9	63	185	0	0	248	0	0	0	0	0	0	113	99	0	212	469
% Medium	0.5	0	1.9	0	1	4.9	8	0	0	6.9	0	0	0	0	0	0	7.4	8.4	0	7.9	6.5
Heavy	3	0	4	0	7	32	25	0	0	57	0	0	0	0	0	0	23	10	0	33	97
% Heavy	0.5	0	1.3	0	0.8	2.5	1.1	0	0	1.6	0	0	0	0	0	0	1.5	0.9	0	1.2	1.3

Vermont Agency of Transportation

Traffic Research/Highway Division
Turning Movement Report

Counted By: C Philbrook
Weather: Sunny
Town: 91-11S Hartford

File Name : 91-11Spm18
Site Code : 31408925
Start Date : 7/19/2018
Page No : 1

Groups Printed- Auto - Medium - Heavy

	I-91 South Bound On/Off Ramp From North					US 5 from US 4 From East					From South					US 5 from Hartland From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
12:00 PM	20	0	19	0	39	93	106	0	0	199	0	0	0	0	0	0	120	74	0	194	432
12:15 PM	16	0	16	0	32	70	100	0	0	170	0	0	0	0	0	0	89	48	0	137	339
12:30 PM	12	0	17	0	29	85	104	0	0	189	0	0	0	0	0	0	81	52	0	133	351
12:45 PM	19	0	11	0	30	78	111	0	0	189	0	0	0	0	0	0	67	44	0	111	330
Total	67	0	63	0	130	326	421	0	0	747	0	0	0	0	0	0	357	218	0	575	1452
01:00 PM	11	0	13	0	24	62	90	0	0	152	0	0	0	0	0	0	72	39	0	111	287
01:15 PM	18	0	13	0	31	64	90	0	0	154	0	0	0	0	0	0	54	34	0	88	273
01:30 PM	12	0	12	0	24	69	109	0	3	181	0	0	0	0	0	0	66	47	0	113	318
01:45 PM	13	0	18	0	31	67	85	0	0	152	0	0	0	0	0	0	69	30	0	99	282
Total	54	0	56	0	110	262	374	0	3	639	0	0	0	0	0	0	261	150	0	411	1160
02:00 PM	10	0	13	0	23	83	83	0	0	166	0	0	0	0	0	0	49	44	0	93	282
02:15 PM	17	0	11	0	28	68	74	0	0	142	0	0	0	0	0	0	73	50	0	123	293
02:30 PM	12	0	12	0	24	60	80	0	0	140	0	0	0	0	0	0	51	46	0	97	261
02:45 PM	16	0	14	0	30	85	80	0	0	165	0	0	0	0	0	0	81	27	0	108	303
Total	55	0	50	0	105	296	317	0	0	613	0	0	0	0	0	0	254	167	0	421	1139
03:00 PM	22	0	13	0	35	69	98	0	0	167	0	0	0	0	0	0	60	54	0	114	316
03:15 PM	20	0	14	1	35	61	94	0	0	155	0	0	0	0	0	0	70	52	0	122	312
03:30 PM	17	0	8	0	25	84	81	0	0	165	0	0	0	0	0	0	87	75	0	162	352
03:45 PM	21	0	7	0	28	106	93	0	0	199	0	0	0	0	0	0	78	84	0	162	389
Total	80	0	42	1	123	320	366	0	0	686	0	0	0	0	0	0	295	265	0	560	1369
04:00 PM	27	0	11	0	38	96	108	0	0	204	0	0	0	0	0	0	91	95	0	186	428
04:15 PM	34	0	10	0	44	95	106	0	0	201	0	0	0	0	0	0	81	75	0	156	401
04:30 PM	25	0	6	0	31	128	96	0	0	224	0	0	0	0	0	0	104	120	0	224	479
04:45 PM	28	0	16	0	44	95	97	0	0	192	0	0	0	0	0	0	63	87	0	150	386
Total	114	0	43	0	157	414	407	0	0	821	0	0	0	0	0	0	339	377	0	716	1694
05:00 PM	16	0	6	0	22	127	96	0	0	223	0	0	0	0	0	0	85	66	0	151	396
05:15 PM	19	0	21	0	40	109	113	0	0	222	0	0	0	0	0	0	52	59	0	111	373
05:30 PM	22	0	5	0	27	90	85	0	0	175	0	0	0	0	0	0	64	49	0	113	315
05:45 PM	16	0	11	0	27	77	91	0	0	168	0	0	0	0	0	0	51	52	0	103	298
Total	73	0	43	0	116	403	385	0	0	788	0	0	0	0	0	0	252	226	0	478	1382
Grand Total	443	0	297	1	741	2021	2270	0	3	4294	0	0	0	0	0	0	1758	1403	0	3161	8196
Apprch %	59.8	0	40.1	0.1		47.1	52.9	0	0.1		0	0	0	0		0	55.6	44.4	0		
Total %	5.4	0	3.6	0	9	24.7	27.7	0	0	52.4	0	0	0	0	0	0	21.4	17.1	0	38.6	
Auto	423	0	277	1	701	1921	2084	0	3	4008	0	0	0	0	0	0	1605	1360	0	2965	7674
% Auto	95.5	0	93.3	100	94.6	95.1	91.8	0	100	93.3	0	0	0	0	0	0	91.3	96.9	0	93.8	93.6
Medium	16	0	16	0	32	66	155	0	0	221	0	0	0	0	0	0	127	39	0	166	419
% Medium	3.6	0	5.4	0	4.3	3.3	6.8	0	0	5.1	0	0	0	0	0	0	7.2	2.8	0	5.3	5.1
Heavy	4	0	4	0	8	34	31	0	0	65	0	0	0	0	0	0	26	4	0	30	103
% Heavy	0.9	0	1.3	0	1.1	1.7	1.4	0	0	1.5	0	0	0	0	0	0	1.5	0.3	0	0.9	1.3

Vermont Agency of Transportation

Traffic Research/Highway Division
Turning Movement Report

Counter: Miovision
Counted By: R Gustafson
Weather: Sunny
Town: 91-11N Hartford

File Name : 91-11Nam18
Site Code : 31408926
Start Date : 7/20/2018
Page No : 1

Groups Printed- Lights - Mediums - Articulated Trucks

	I-91 Exit 11 NB on ramp to Norwich From North					US 5 to Hartford From East					I-91 Exit 11 NB off ramp from Hartland From South					US 5 to Hartland From West					
Start Time	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Int. Total
06:00 AM	0	0	0	0	0	8	38	0	0	46	35	0	22	0	57	0	18	5	0	23	126
06:15 AM	0	0	0	0	0	4	40	0	0	44	51	0	41	0	92	0	17	7	0	24	160
06:30 AM	0	0	0	0	0	4	50	0	0	54	44	0	37	0	81	0	26	11	0	37	172
06:45 AM	0	0	0	0	0	12	57	0	0	69	89	0	77	0	166	0	55	13	0	68	303
Total	0	0	0	0	0	28	185	0	0	213	219	0	177	0	396	0	116	36	0	152	761
07:00 AM	0	0	0	0	0	15	88	0	0	103	82	0	79	0	161	1	44	17	0	62	326
07:15 AM	0	0	0	0	0	17	84	0	0	101	104	0	88	0	192	0	59	19	0	78	371
07:30 AM	0	0	0	0	0	24	101	0	0	125	112	0	94	0	206	0	49	18	0	67	398
07:45 AM	0	0	0	0	0	20	109	0	0	129	151	0	102	0	253	0	66	14	2	82	464
Total	0	0	0	0	0	76	382	0	0	458	449	0	363	0	812	1	218	68	2	289	1559
08:00 AM	0	0	0	0	0	20	92	0	0	112	116	0	69	0	185	1	72	28	0	101	398
08:15 AM	0	0	0	0	0	23	85	0	0	108	96	0	48	0	144	0	63	19	1	83	335
08:30 AM	0	0	0	0	0	10	102	0	0	112	117	0	52	0	169	0	74	25	0	99	380
08:45 AM	0	0	0	0	0	20	108	0	0	128	101	0	84	0	185	0	76	20	0	96	409
Total	0	0	0	0	0	73	387	0	0	460	430	0	253	0	683	1	285	92	1	379	1522
09:00 AM	0	0	0	0	0	18	92	0	0	110	87	0	49	0	136	0	86	24	1	111	357
09:15 AM	0	0	0	0	0	24	98	0	0	122	82	0	50	0	132	0	61	29	0	90	344
09:30 AM	0	0	0	0	0	14	101	0	0	115	71	0	44	0	115	0	65	19	0	84	314
09:45 AM	0	0	0	0	0	17	95	0	0	112	94	0	59	0	153	0	68	15	1	84	349
Total	0	0	0	0	0	73	386	0	0	459	334	0	202	0	536	0	280	87	2	369	1364
10:00 AM	0	0	0	0	0	21	109	0	0	130	80	0	53	0	133	0	66	16	0	82	345
10:15 AM	0	0	0	0	0	15	104	0	0	119	71	0	52	0	123	0	58	15	0	73	315
10:30 AM	0	0	0	0	0	17	94	0	0	111	75	0	61	0	136	0	66	11	0	77	324
10:45 AM	0	0	0	0	0	15	100	0	0	115	94	0	53	0	147	0	65	20	3	88	350
Total	0	0	0	0	0	68	407	0	0	475	320	0	219	0	539	0	255	62	3	320	1334
11:00 AM	0	0	0	0	0	16	125	0	0	141	81	0	47	0	128	1	80	12	0	93	362
11:15 AM	0	0	0	0	0	23	125	0	0	148	105	0	38	0	143	0	73	16	0	89	380
11:30 AM	0	0	0	0	0	21	122	0	0	143	96	0	40	0	136	0	79	15	0	94	373
11:45 AM	0	0	0	0	0	30	119	0	0	149	114	0	36	0	150	0	83	25	0	108	407
Total	0	0	0	0	0	90	491	0	0	581	396	0	161	0	557	1	315	68	0	384	1522
Grand Total	0	0	0	0	0	408	2238	0	0	2646	2148	0	1375	0	3523	3	1469	413	8	1893	8062
Apprch %	0	0	0	0		15.4	84.6	0	0		61	0	39	0		0.2	77.6	21.8	0.4		
Total %	0	0	0	0	0	5.1	27.8	0	0	32.8	26.6	0	17.1	0	43.7	0	18.2	5.1	0.1	23.5	
Lights	0	0	0	0	0	382	2029	0	0	2411	2029	0	1233	0	3262	3	1317	399	8	1727	7400
% Lights	0	0	0	0	0	93.6	90.7	0	0	91.1	94.5	0	89.7	0	92.6	100	89.7	96.6	100	91.2	91.8
Mediums	0	0	0	0	0	17	153	0	0	170	84	0	131	0	215	0	129	10	0	139	524
% Mediums	0	0	0	0	0	4.2	6.8	0	0	6.4	3.9	0	9.5	0	6.1	0	8.8	2.4	0	7.3	6.5
Articulated Trucks	0	0	0	0	0	9	56	0	0	65	35	0	11	0	46	0	23	4	0	27	138
% Articulated Trucks	0	0	0	0	0	2.2	2.5	0	0	2.5	1.6	0	0.8	0	1.3	0	1.6	1	0	1.4	1.7

Vermont Agency of Transportation

Traffic Research/Highway Division
Turning Movement Report

Counter: Miovision
Counted By: R Gustafson
Weather: Sunny
Town: 91-11N Hartford

File Name : 91-11Npm18
Site Code : 31408926
Start Date : 7/19/2018
Page No : 1

Groups Printed- Lights - Mediums - Articulated Trucks

	I-91 Exit 11 NB on ramp to Norwich From North					US 5 to Hartford From East					I-91 Exit 11 NB off ramp from Hartland From South					US 5 to Hartland From West					
Start Time	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Right	Thru	Left	U-Turn	App. Total	Int. Total
12:00 PM	0	0	0	0	0	23	151	0	0	174	93	0	43	0	136	0	115	30	0	145	455
12:15 PM	0	0	0	0	0	27	129	0	0	156	95	0	42	0	137	0	79	28	0	107	400
12:30 PM	0	0	0	0	0	20	141	0	0	161	88	0	48	0	136	0	79	20	0	99	396
12:45 PM	0	0	0	0	0	25	141	0	0	166	99	0	50	0	149	0	66	16	1	83	398
Total	0	0	0	0	0	95	562	0	0	657	375	0	183	0	558	0	339	94	1	434	1649
01:00 PM	0	0	0	0	0	25	110	0	0	135	69	0	33	0	102	0	70	12	0	82	319
01:15 PM	0	0	0	0	0	28	116	0	0	144	86	0	45	0	131	0	54	11	0	65	340
01:30 PM	0	0	0	0	0	27	127	0	0	154	110	0	59	0	169	0	60	14	1	75	398
01:45 PM	0	0	0	0	0	16	111	0	0	127	99	0	45	0	144	0	74	16	1	91	362
Total	0	0	0	0	0	96	464	0	0	560	364	0	182	0	546	0	258	53	2	313	1419
02:00 PM	0	0	0	0	0	16	121	0	0	137	91	0	45	0	136	0	54	8	0	62	335
02:15 PM	0	0	0	0	0	19	103	0	0	122	69	0	32	0	101	1	65	13	1	80	303
02:30 PM	0	0	0	0	0	30	107	0	0	137	113	0	36	0	149	0	54	17	0	71	357
02:45 PM	0	0	0	0	0	23	115	0	0	138	111	0	53	0	164	0	67	21	0	88	390
Total	0	0	0	0	0	88	446	0	0	534	384	0	166	0	550	1	240	59	1	301	1385
03:00 PM	0	0	0	0	0	26	115	0	0	141	93	0	52	0	145	1	63	15	0	79	365
03:15 PM	0	0	0	0	0	19	110	0	0	129	100	0	46	0	146	0	67	18	0	85	360
03:30 PM	0	0	0	0	0	22	127	0	0	149	110	0	41	0	151	0	72	24	1	97	397
03:45 PM	0	0	0	0	0	22	145	0	0	167	90	0	55	0	145	0	67	10	1	78	390
Total	0	0	0	0	0	89	497	0	0	586	393	0	194	0	587	1	269	67	2	339	1512
04:00 PM	0	0	0	0	0	26	144	0	0	170	110	0	60	0	170	0	73	36	0	109	449
04:15 PM	0	0	0	0	0	30	139	0	0	169	113	0	58	0	171	0	70	25	0	95	435
04:30 PM	0	0	0	0	0	30	170	0	0	200	114	0	50	0	164	0	67	32	1	100	464
04:45 PM	0	0	0	0	0	24	145	0	0	169	125	0	52	0	177	0	63	24	2	89	435
Total	0	0	0	0	0	110	598	0	0	708	462	0	220	0	682	0	273	117	3	393	1783
05:00 PM	0	0	0	0	0	28	176	0	0	204	130	0	55	0	185	0	59	29	1	89	478
05:15 PM	0	0	0	0	0	29	158	0	0	187	120	0	52	0	172	0	58	22	2	82	441
05:30 PM	0	0	0	0	0	33	133	0	0	166	101	0	47	0	148	0	47	20	1	68	382
05:45 PM	0	0	0	0	0	12	114	0	0	126	86	0	54	0	140	0	47	16	0	63	329
Total	0	0	0	0	0	102	581	0	0	683	437	0	208	0	645	0	211	87	4	302	1630
Grand Total	0	0	0	0	0	580	3148	0	0	3728	2415	0	1153	0	3568	2	1590	477	13	2082	9378
Apprch %	0	0	0	0		15.6	84.4	0	0		67.7	0	32.3	0		0.1	76.4	22.9	0.6		
Total %	0	0	0	0	0	6.2	33.6	0	0	39.8	25.8	0	12.3	0	38	0	17	5.1	0.1	22.2	
Lights	0	0	0	0	0	563	2958	0	0	3521	2271	0	1101	0	3372	2	1454	463	13	1932	8825
% Lights	0	0	0	0	0	97.1	94	0	0	94.4	94	0	95.5	0	94.5	100	91.4	97.1	100	92.8	94.1
Mediums	0	0	0	0	0	13	136	0	0	149	111	0	47	0	158	0	112	9	0	121	428
% Mediums	0	0	0	0	0	2.2	4.3	0	0	4	4.6	0	4.1	0	4.4	0	7	1.9	0	5.8	4.6
Articulated Trucks	0	0	0	0	0	4	54	0	0	58	33	0	5	0	38	0	24	5	0	29	125
% Articulated Trucks	0	0	0	0	0	0.7	1.7	0	0	1.6	1.4	0	0.4	0	1.1	0	1.5	1	0	1.4	1.3

VERMONT
AGENCY OF TRANSPORTATION

MS2
Transportation Data Management System

Volume Count Report

LOCATION INFO	
Location ID	Y223_SB
Type	SPOT
Fnct'l Class	5
Located On	N Main St
Loc On Alias	US5
Direction	SB
County	Windsor
Community	Hartford
MPO ID	
HPMS ID	U005073.987
Agency	Vermont AOT

COUNT DATA INFO	
Count Status	Accepted
Start Date	Thu 5/19/2016
End Date	Fri 5/20/2016
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	
Notes	
Station	Y223_SB
Study	
Speed Limit	
Description	
Sensor Type	
Source	
Latitude,Longitude	

INTERVAL:15-MIN

Time	15-min Interval 1st	2nd	3rd	4th	Hourly Count
0:00-1:00	4	3	1	6	14
1:00-2:00	9	1	4	2	16
2:00-3:00	0	3	6	5	14
3:00-4:00	1	1	5	0	7
4:00-5:00	3	7	4	8	22
5:00-6:00	12	11	14	11	48
6:00-7:00	21	16	35	52	124
7:00-8:00	47	62	57	92	258
8:00-9:00	62	74	55	71	262
9:00-10:00	43	54	54	65	216
10:00-11:00	56	72	54	78	260
11:00-12:00	70	63	56	81	270
12:00-13:00	96	86	92	82	356
13:00-14:00	84	80	87	66	317
14:00-15:00	84	78	74	90	326
15:00-16:00	86	79	83	90	338
16:00-17:00	99	96	114	90	399
17:00-18:00	108	90	88	62	348
18:00-19:00	59	50	40	62	211
19:00-20:00	38	42	41	34	155
20:00-21:00	37	21	46	24	128
21:00-22:00	21	23	19	13	76
22:00-23:00	13	14	1	11	39
23:00-24:00	9	8	6	2	25
Total					4,229
AADT					3,726
AM Peak					11:45-12:45 355
PM Peak					16:15-17:15 408

NOTE

ASSUME SB APPROACH VOLUME AT AIRPORT ROAD.

Vermont Agency of Transportation

Traffic Research/Highway Division
Turning Movement Report

Counted By: M Carr
Weather: Sunny
Town: 5-19.9 Hartford

File Name : 5-19_9am18
Site Code : 31408750
Start Date : 7/20/2018
Page No : 1

Groups Printed- Auto - Medium - Heavy

	US 5 from US 4 From North					Sykes Mtn Ave from South Main St From East					US 5 from Exit 11 Ramps From South					Ryder Truck Parking Lot From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
06:00 AM	0	21	7	0	28	12	0	25	0	37	28	23	0	0	51	1	0	0	0	1	117
06:15 AM	0	16	7	0	23	13	0	27	1	41	39	28	0	0	67	0	0	0	0	0	131
06:30 AM	0	24	18	0	42	5	0	32	1	38	38	30	0	0	68	0	0	0	0	0	148
06:45 AM	0	25	21	0	46	13	0	47	0	60	95	37	0	0	132	0	0	0	0	0	238
Total	0	86	53	0	139	43	0	131	2	176	200	118	0	0	318	1	0	0	0	1	634
07:00 AM	0	55	24	0	79	10	1	50	0	61	101	36	0	0	137	0	0	0	0	0	277
07:15 AM	1	36	28	0	65	30	0	65	0	95	100	64	0	0	164	0	0	0	0	0	324
07:30 AM	0	47	34	0	81	27	1	78	2	108	86	63	3	0	152	0	0	0	0	0	341
07:45 AM	0	60	35	0	95	26	0	68	0	94	116	88	1	0	205	1	0	0	0	1	395
Total	1	198	121	0	320	93	2	261	2	358	403	251	4	0	658	1	0	0	0	1	1337
08:00 AM	0	46	23	0	69	34	0	66	0	100	112	80	0	0	192	0	0	1	0	1	362
08:15 AM	0	38	29	0	67	25	0	72	0	97	91	67	2	0	160	0	0	0	0	0	324
08:30 AM	0	42	22	0	64	44	0	66	0	110	101	82	4	0	187	0	0	0	0	0	361
08:45 AM	0	63	34	0	97	29	0	63	0	92	83	92	1	0	176	0	0	0	0	0	365
Total	0	189	108	0	297	132	0	267	0	399	387	321	7	0	715	0	0	1	0	1	1412
09:00 AM	0	44	22	0	66	33	0	63	1	97	88	80	1	0	169	0	0	0	0	0	332
09:15 AM	0	49	25	0	74	24	0	74	0	98	63	84	0	0	147	1	0	0	0	1	320
09:30 AM	0	51	33	0	84	29	1	60	0	90	56	76	2	0	134	0	0	0	0	0	308
09:45 AM	0	47	32	0	79	39	0	66	0	105	69	91	0	0	160	0	1	0	0	1	345
Total	0	191	112	0	303	125	1	263	1	390	276	331	3	0	610	1	1	0	0	2	1305
10:00 AM	0	62	16	0	78	29	0	67	0	96	70	76	1	0	147	1	0	0	0	1	322
10:15 AM	0	57	28	0	85	31	2	60	0	93	66	63	3	0	132	0	0	1	0	1	311
10:30 AM	0	52	23	0	75	29	1	57	2	89	82	64	1	0	147	0	1	1	0	2	313
10:45 AM	0	61	35	0	96	29	1	55	0	85	70	80	1	0	151	1	0	0	0	1	333
Total	0	232	102	0	334	118	4	239	2	363	288	283	6	0	577	2	1	2	0	5	1279
11:00 AM	1	59	41	0	101	39	0	81	0	120	88	73	0	0	161	1	1	1	0	3	385
11:15 AM	0	70	40	0	110	32	0	78	0	110	80	93	1	0	174	1	0	0	0	1	395
11:30 AM	0	61	39	0	100	33	0	79	1	113	92	79	1	0	172	1	0	0	0	1	386
11:45 AM	0	59	54	0	113	50	0	86	0	136	109	84	1	1	195	3	0	0	0	3	447
Total	1	249	174	0	424	154	0	324	1	479	369	329	3	1	702	6	1	1	0	8	1613
Grand Total	2	1145	670	0	1817	665	7	1485	8	2165	1923	1633	23	1	3580	11	3	4	0	18	7580
Apprch %	0.1	63	36.9	0		30.7	0.3	68.6	0.4		53.7	45.6	0.6	0		61.1	16.7	22.2	0		
Total %	0	15.1	8.8	0	24	8.8	0.1	19.6	0.1	28.6	25.4	21.5	0.3	0	47.2	0.1	0	0.1	0	0.2	
Auto	1	1042	639	0	1682	636	5	1329	7	1977	1784	1466	18	1	3269	8	1	2	0	11	6939
% Auto	50	91	95.4	0	92.6	95.6	71.4	89.5	87.5	91.3	92.8	89.8	78.3	100	91.3	72.7	33.3	50	0	61.1	91.5
Medium	1	82	29	0	112	26	2	124	1	153	111	139	3	0	253	1	2	1	0	4	522
% Medium	50	7.2	4.3	0	6.2	3.9	28.6	8.4	12.5	7.1	5.8	8.5	13	0	7.1	9.1	66.7	25	0	22.2	6.9
Heavy	0	21	2	0	23	3	0	32	0	35	28	28	2	0	58	2	0	1	0	3	119
% Heavy	0	1.8	0.3	0	1.3	0.5	0	2.2	0	1.6	1.5	1.7	8.7	0	1.6	18.2	0	25	0	16.7	1.6

NOTE:
ASSUME RIGHT FROM EAST APPROACH AT SYKES MTN AVE
PLUS
THRU FROM US5
EQUALS THE NORTHBOUND US5 APPROACH

Vermont Agency of Transportation

Traffic Research/Highway Division
Turning Movement Report

Counted By: M Carr
Weather: Sunny
Town: 5-19.9 Hartford

File Name : 5-19_9pm18
Site Code : 31408750
Start Date : 7/19/2018
Page No : 1

Groups Printed- Auto - Medium - Heavy

	US 5 from US 4 From North					Sykes Mtn Ave from South Main St From East					US 5 from Exit 11 Ramps From South					Ryder Truck Parking Lot From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
12:00 PM	0	96	48	0	144	37	0	90	1	128	100	92	0	0	192	0	0	0	0	0	464
12:15 PM	0	60	39	0	99	52	0	88	0	140	77	84	2	0	163	1	0	0	0	1	403
12:30 PM	0	77	37	0	114	39	0	76	1	116	75	79	5	0	159	2	1	1	0	4	393
12:45 PM	0	77	41	0	118	39	0	79	1	119	92	69	3	0	164	1	0	0	0	1	402
Total	0	310	165	0	475	167	0	333	3	503	344	324	10	0	678	4	1	1	0	6	1662
01:00 PM	2	58	33	0	93	43	3	75	0	121	72	58	1	0	131	1	1	2	0	4	349
01:15 PM	0	70	35	0	105	32	1	69	0	102	66	67	4	0	137	1	0	0	0	1	345
01:30 PM	1	76	32	0	109	28	0	76	1	105	75	88	1	0	164	1	0	0	0	1	379
01:45 PM	0	65	39	0	104	39	0	66	0	105	87	75	0	0	162	1	1	1	0	3	374
Total	3	269	139	0	411	142	4	286	1	433	300	288	6	0	594	4	2	3	0	9	1447
02:00 PM	0	55	33	0	88	41	2	76	0	119	86	63	0	0	149	0	1	0	0	1	357
02:15 PM	0	54	27	0	81	42	1	65	0	108	69	67	1	0	137	0	1	1	0	2	328
02:30 PM	1	59	25	0	85	26	5	76	0	107	85	76	1	0	162	1	0	0	0	1	355
02:45 PM	0	59	32	0	91	36	1	77	0	114	87	85	1	3	176	0	0	0	0	0	381
Total	1	227	117	0	345	145	9	294	0	448	327	291	3	3	624	1	2	1	0	4	1421
03:00 PM	2	63	32	0	97	33	0	70	0	103	70	73	2	0	145	2	0	1	0	3	348
03:15 PM	0	59	24	0	83	45	0	70	0	115	80	80	2	0	162	0	0	0	0	0	360
03:30 PM	2	62	16	0	80	33	0	83	1	117	73	84	1	0	158	0	0	1	0	1	356
03:45 PM	2	75	30	0	107	21	1	85	0	107	84	78	3	0	165	2	0	1	0	3	382
Total	6	259	102	0	367	132	1	308	1	442	307	315	8	0	630	4	0	3	0	7	1446
04:00 PM	1	79	33	0	113	48	1	90	0	139	94	84	0	0	178	2	0	1	0	3	433
04:15 PM	1	76	32	0	109	40	0	91	0	131	71	100	1	0	172	1	0	2	0	3	415
04:30 PM	1	99	32	0	132	56	0	99	0	155	93	95	0	0	188	3	1	0	0	4	479
04:45 PM	1	65	25	0	91	35	0	96	0	131	89	89	1	0	179	2	0	0	0	2	403
Total	4	319	122	0	445	179	1	376	0	556	347	368	2	0	717	8	1	3	0	12	1730
05:00 PM	0	90	36	0	126	55	6	112	4	177	80	92	0	0	172	2	0	0	0	2	477
05:15 PM	0	71	36	0	107	48	1	113	0	162	76	91	2	0	169	0	0	0	0	0	438
05:30 PM	0	67	16	0	83	49	0	88	0	137	80	59	1	0	140	0	0	0	0	0	360
05:45 PM	0	59	20	0	79	23	0	65	0	88	47	58	1	0	106	1	0	0	0	1	274
Total	0	287	108	0	395	175	7	378	4	564	283	300	4	0	587	3	0	0	0	3	1549
Grand Total	14	1671	753	0	2438	940	22	1975	9	2946	1908	1886	33	3	3830	24	6	11	0	41	9255
Apprch %	0.6	68.5	30.9	0		31.9	0.7	67	0.3		49.8	49.2	0.9	0.1		58.5	14.6	26.8	0		
Total %	0.2	18.1	8.1	0	26.3	10.2	0.2	21.3	0.1	31.8	20.6	20.4	0.4	0	41.4	0.3	0.1	0.1	0	0.4	
Auto	2	1576	727	0	2305	898	18	1807	9	2732	1748	1723	26	3	3500	21	4	8	0	33	8570
% Auto	14.3	94.3	96.5	0	94.5	95.5	81.8	91.5	100	92.7	91.6	91.4	78.8	100	91.4	87.5	66.7	72.7	0	80.5	92.6
Medium	11	80	22	0	113	36	4	131	0	171	126	139	4	0	269	3	2	2	0	7	560
% Medium	78.6	4.8	2.9	0	4.6	3.8	18.2	6.6	0	5.8	6.6	7.4	12.1	0	7	12.5	33.3	18.2	0	17.1	6.1
Heavy	1	15	4	0	20	6	0	37	0	43	34	24	3	0	61	0	0	1	0	1	125
% Heavy	7.1	0.9	0.5	0	0.8	0.6	0	1.9	0	1.5	1.8	1.3	9.1	0	1.6	0	0	9.1	0	2.4	1.4

VERMONT
AGENCY OF TRANSPORTATION

MS2
Transportation Data Management System

Volume Count Report

LOCATION INFO	
Location ID	Y469
Type	SPOT
Fnct'l Class	7
Located On	AIRPORT RD
Loc On Alias	TH101
BETWEEN	BEECH ST AND FAIRVIEW TER
Direction	2-WAY
County	WINDSOR
Community	HARTFORD
MPO ID	
HPMS ID	
Agency	Vermont AOT

COUNT DATA INFO	
Count Status	Accepted
Start Date	Wed 5/23/2018
End Date	Thu 5/24/2018
Start Time	12:00:00 AM
End Time	12:00:00 AM
Direction	
Notes	vtrans
Station	0000Y4690000
Study	
Speed Limit	
Description	
Sensor Type	Axle/Tube
Source	
Latitude,Longitude	

INTERVAL:60-MIN

Time	Hourly Count
0:00-1:00	1
1:00-2:00	2
2:00-3:00	0
3:00-4:00	6
4:00-5:00	1
5:00-6:00	15
6:00-7:00	58
7:00-8:00	108
8:00-9:00	79
9:00-10:00	62
10:00-11:00	55
11:00-12:00	71
12:00-13:00	71
13:00-14:00	83
14:00-15:00	78
15:00-16:00	111
16:00-17:00	100 ← 50
17:00-18:00	99
18:00-19:00	56
19:00-20:00	48
20:00-21:00	46
21:00-22:00	13
22:00-23:00	20
23:00-24:00	6
Total	1,189
AADT	1,026
AM Peak	07:00-08:00 108
PM Peak	15:00-16:00 111

NOTE:

ASSUME 50% CONTRIBUTES TO AIRPORT ROAD MINOR APPROACH TO U.S.I.

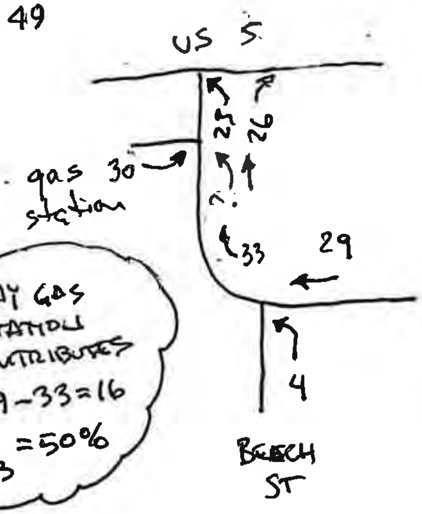
US 5 at Airport Road (and Beech Street)

					3:49-4:00 PM	4:00-4:15 PM	4:19-4:34 PM	Four X Pea	Prorated (1 H	Total (41 mins)	
Location	1										
				LT	1	4	7	12	18	28	28
US 5	South Leg	NB		TH	62	84	89	235	344	356	356
				RT	5	3	7	15	22	28	28
				LT	8	12	13	33	48	52	52
US 5	North Leg	SB		TH	55	70	102	227	332	408	408
				RT	1	1	2	4	6	8	8
				LT	1	1	2	4	6	8	8
Plaza Drive	West Leg	EB		TH	0	0	0	0	0	0	0
				RT	2	5	2	9	13	8	8
				LT	3	9	11	23	34	44	44
Airport Drive	East Leg	WB		TH	0	0	0	0	0	0	0
				RT	8	7	11	26	38	44	44
*********************					146	196	246	588	860	984	984
Location	2										
				LT	8	6	16	30	44	64	64
Gas Station Drive	South Leg	NB		TH	0	0	0	0	0	0	0
				RT	0	2	3	5	7	12	12
				LT	0	0	0	0	0	0	0
Gift Shop Drive	North Leg	SB		TH	0	0	0	0	0	0	0
				RT	0	1	0	1	1	0	0
				LT	1	0	0	1	1	0	0
Airport Drive	West Leg	EB		TH				0	0	0	0
				RT	2	6	9	17	25	36	36
				LT	0	0	0	0	0	0	0
Airport Drive	East Leg	WB		TH				0	0	0	0
				RT	0	0	0	0	0	0	0
*********************					11	15	28	54	79	112	112
Location	3										
				LT				0	0	0	0
Airport Drive	South Leg	NB		TH	7	10	12	29	42	48	48
				RT	1	0	1	2	3	4	4
				LT	0	0	0	0	0	0	0
Airport Drive	North Leg	SB		TH	2	6	8	16	23	32	32
				RT				0	0	0	0
				LT				0	0	0	0
	West Leg	EB		TH				0	0	0	0
				RT				0	0	0	0
				LT	3	1	0	4	6	0	0
Beech Street	East Leg	WB		TH				0	0	0	0
				RT	0	0	0	0	0	0	0
*********************					13	17	21	51	75	84	84

23
26 => 49

32

29
+ => 33
4



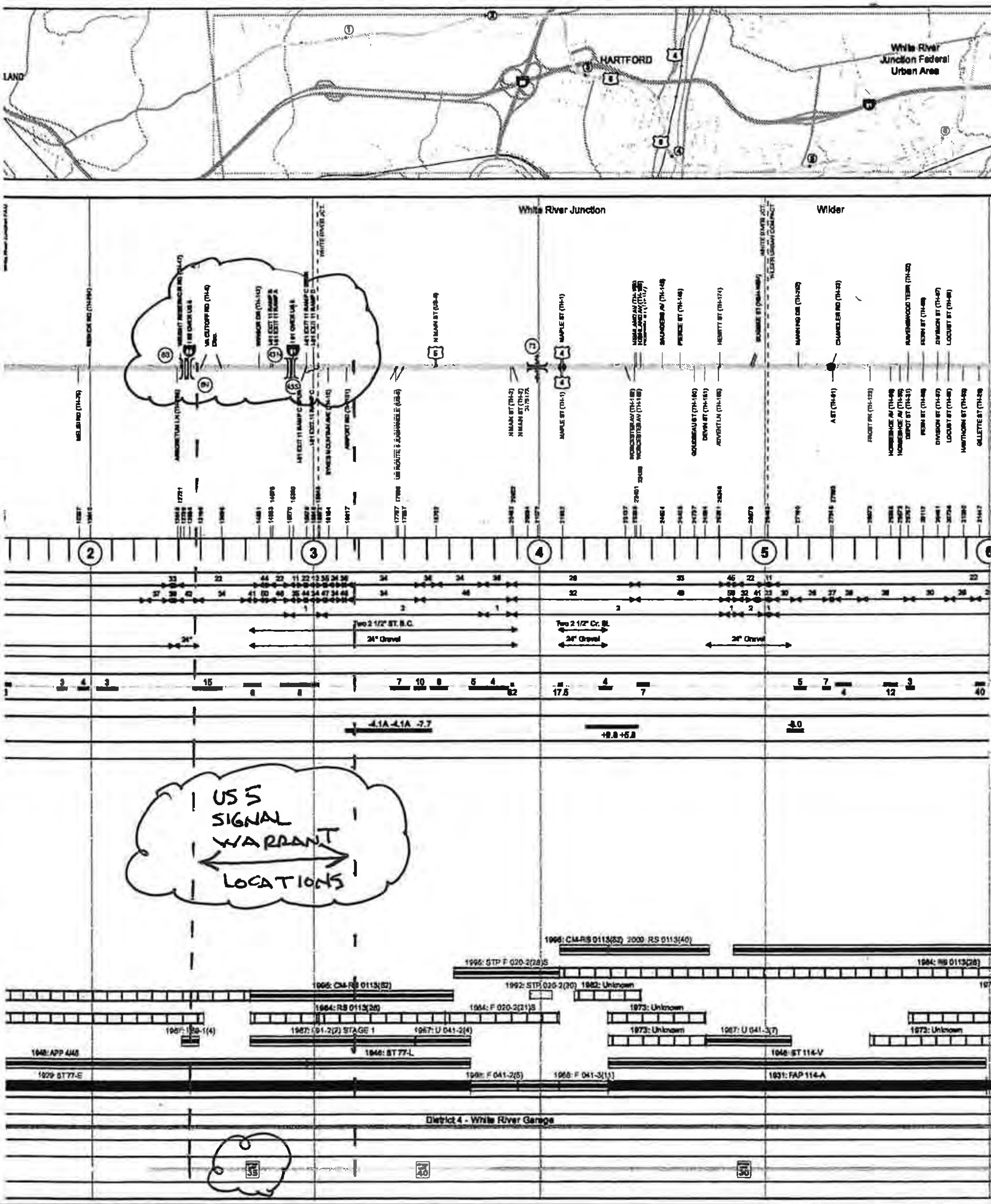
SAY GAS STATION CONTRIBUTES
49 − 33 = 16
16/33 = 50%

Stantec

Route Log and Progress Chart

US 5 - HARTFORD EXTRACTION

Please Note: Errors a
Contact the VTrans Mapping Section wi



HARTFORD VT US 5

Designed by: 1953 11561

Checked by:

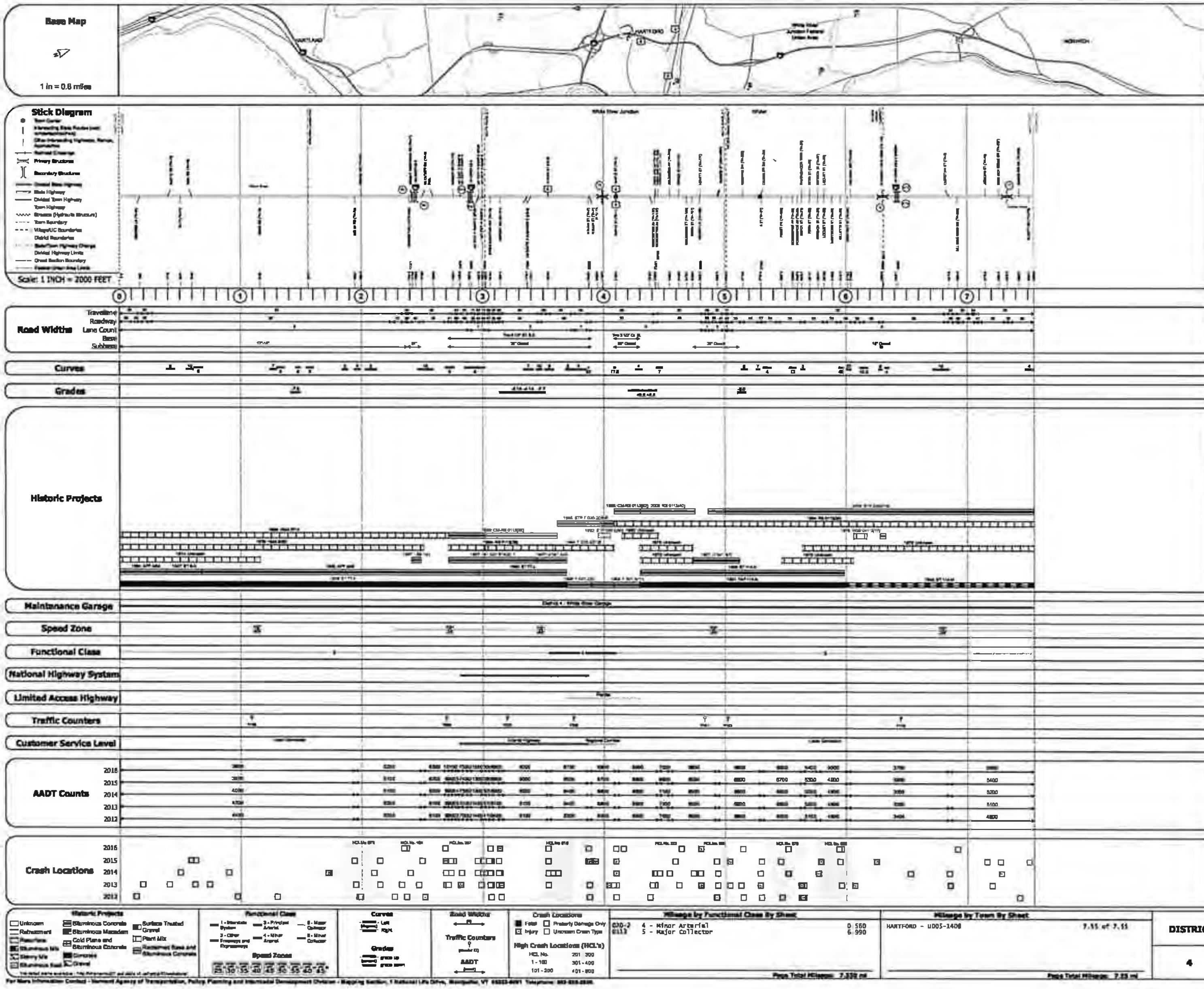
VTrans Working to Get You There

Route Log and Progress Chart

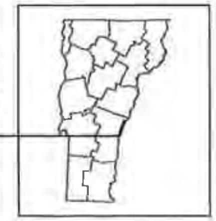
DRAFT

Please Note: Errors and Omissions May Exist.
Contact the VTrans Mapping Section with questions or concerns.

DISTRICT	TOWN	ROUTE
4	HARTFORD	US-5



5



STRUCTURE DESCRIPTIONS

Bridge 6S:
Stringer/multi-beam or girder - 1968
Structure No. 200089006S14082
Length: 187'
Width: 38.0'
Under Clearance: 15.92'
Facility Carried: I 89089 ML
Bridge Type: 3 SP ROLLED BEAM
Features Intersected: I 89 OVER US 5
Surface: Bituminous
Maintenance/Ownership: State

Bridge 6N:
Stringer/multi-beam or girder - 1968
Structure No. 200089006N14082
Length: 187'
Width: 38.0'
Under Clearance: 14.25'
Facility Carried: I 89089 ML
Bridge Type: 3 SP ROLLED BEAM
Features Intersected: I 89 OVER US 5
Surface: Bituminous
Maintenance/Ownership: State

Bridge 43S:
Stringer/multi-beam or girder - 2016
Structure No. 200091043S14082
Length: 136'
Width: 48.0'
Under Clearance: 17.58'
Facility Carried: I 09091 ML
Bridge Type: WELDED GIRDER
Features Intersected: I 91 OVER US 5
Surface: Concrete
Maintenance/Ownership: State

Bridge 43N:
Stringer/multi-beam or girder - 2016
Structure No. 200091043N14082
Length: 136'
Width: 44.0'
Under Clearance: 15.42'
Facility Carried: I 09091 ML
Bridge Type: WELDED GIRDER
Features Intersected: I 91 OVER US 5
Surface: Concrete
Maintenance/Ownership: State

Bridge 73:
Stringer/multi-beam or girder - 1966
Structure No. 200113007314082
Length: 976'
Width: 87.0'
Under Clearance: 23.08'
Facility Carried: US 00005 ML
Bridge Type: 6 SP CONT WELDED GRD
Features Intersected: US 5 OVER WH R + RR
Surface: Bituminous
Maintenance/Ownership: State

Bridge 75:
Slab - 1977
Structure No. 300113007514081
Length: 22'
Width: 33.5'
Under Clearance: 4.0'
Facility Carried: US5
Bridge Type: CONCRETE SLAB
Features Intersected: DOTHAN BROOK
Surface: Bituminous
Maintenance: State

Bridge 47N:
Stringer/multi-beam or girder - 1987
Structure No. 200091047N14082
Length: 197'
Width: 37.3'
Under Clearance: 17.25'
Facility Carried: I 09091 ML
Bridge Type: 3 SP CONT PLATE GIR
Features Intersected: I 91 OVER US 5 + BROOK
Surface: Bituminous
Maintenance/Ownership: State

Bridge 47S:
Stringer/multi-beam or girder - 1987
Structure No. 200091047S14082
Length: 197'
Width: 37.3'
Under Clearance: 14.08'
Facility Carried: I 09091 ML
Bridge Type: 3 SP CONT PLATE GIR
Features Intersected: I 91 OVER US 5 + BROOK
Surface: Bituminous
Maintenance/Ownership: State

Culvert 77:
Culvert - 1961
Structure No. 300113007714081
Length: 8'
Under Clearance: 6.0'
Facility Carried: US5
Bridge Type: R. C. BOX CULVERT
Features Intersected: BROOK
Maintenance: State

Mileage by Functional Class By Sheet

020-2	4 - Minor Arterial	0.560
0113	5 - Major Collector	6.990

Page Total Mileage: 7.550 mi

Mileage by Town By Sheet

HARTFORD - U005-1408	7.55 of 7.55

Page Total Mileage: 7.55 mi

DISTRICT	TOWN	Date: 10/24/17	ROUTE
4	HARTFORD	1 of 1 TWN mileage: 0.0 to 7.55	US-5 ETE mileage: 70.84 to 78.39