VT 2A Scoping Study – Industrial Avenue / Mountain View Road to River Cove Road

Williston, Vermont

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Final Report

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This study is the result of the support and strong interest of the Project Committee Members. Much of the background, history, local input, existing conditions, and consensus documented in the study are attributed to the Committee member's involvement. The study's quality and success is due to their contributions.

Executive Summary

The *VT 2A Scoping Study – Industrial Avenue/Mountain View Road to River Cove Road* was prepared at the request of the Town of Williston and the Chittenden County Regional Planning Commission (CCRPC) to evaluate alternative strategies to address existing and expected future travel demands at the VT 2A/Industrial Avenue/Mountain View Road intersection and along VT 2A north of this intersection. The operational and safety benefits associated with multiple improvement strategies were determined in the context of projected future peak hour traffic flows in the corridor. Alternatives were also evaluated with respect to their expected impacts on parcels abutting the roadways. Implementation costs for the various improvements were also considered. At the conclusion of an extensive public review process in which the findings of this evaluation were presented and reviewed, the Williston Selectboard chose a preferred alternative for implementation. The preferred plan includes the addition of left-turn lanes to the Industrial Avenue and Mountain View Road approaches to their intersection with VT 2A and the addition of a second northbound through lane on VT 2A at this location. North of the intersection to River Cove Road a widening of VT 2A to provide a two-way, left-turn lane consistent with a treatment planned for VT 2A north of River Cove Road is supported.

Existing Conditions

VT 2A is a state highway and is the principal roadway link between Tafts Corner in Williston and Essex Junction. It generally functions as a two-lane, two-way roadway with paved shoulders that are generally suitable for bicycle traffic. Sidewalks or multi-use paths parallel the roadway in some sections. In the project study area a multiuse path follows the west side of the roadway. Bus transit services are provided along VT 2A by the Chittenden County Transportation Authority. Traffic operations are generally controlled by the signalized intersections in the corridor. The VT 2A/Industrial Avenue/Mountain View Road intersection is a high-volume, signalized intersection which contributes to peak hour traffic congestion. The existing lane configuration of the VT 2A/Industrial Avenue/Mountain View Road intersection consists of the following by approach:

- Southbound VT 2A – One 125-foot long left-turn lane, one through lane and one 250 foot long right-turn lane;
- Northbound VT 2A – One 75-foot long left-turn lane and one shared through/right-turn lane;
- Eastbound Industrial Ave – One 200-foot long left-turn lane and one shared through/ right-turn lane;
- Westbound Mountain View Road – One 150-foot long right-turn lane and one shared through/left-turn lane.

Pedestrian crosswalks are present on the west side of the intersection across Industrial Avenue and across VT 2A on the south side of the intersection. There is an existing sidewalk along the west side of VT 2A to the north and on the east side south of the intersection. Land use in the vicinity of the intersection is primarily residential although significant truck traffic uses the intersection generated in part by land uses further west along Industrial Avenue.

Existing Traffic Demands and Traffic Operations

VT 2A carries 12,600 vehicles per day (vpd) south of Industrial Avenue and 18,100 vpd north of Industrial Avenue. The higher volumes north of the intersection reflect the fact that most of the traffic using Industrial Avenue also uses VT 2A north of the intersection. Industrial Avenue carries 8400 vpd. Mountain View Road carries 5600 vpd. Approximately 11 percent of the daily traffic on VT 2A passes through the Industrial Avenue/Mountain View Road intersection during the evening commuter peak hour. Volumes are lighter during the morning commuter peak hour with hourly volumes during this hour accounting for only nine percent of the daily total.

The higher volumes during the PM peak traffic hour combined with a heavy left-turn demand from Industrial Avenue eastbound to VT 2A northbound causes some traffic congestion during this time period. The VT 2A/Industrial Avenue/ Mountain View Road intersection presently operates at 98 percent of its capacity during the PM peak hour. During the afternoon peak hour vehicle queues on Industrial Avenue can extend as far west as Avenue C, a distance of approximately one-half mile from VT 2A. Morning peak hour conditions are less severe with the intersection operating at only 79 percent of its capacity during this hour.

Future Conditions

Projections of future traffic conditions in the study area were made by considering planned area roadway improvements and potential future traffic growth. Area-wide land use and traffic forecasting models employed the CCRPC were used to define an expected traffic growth rate for the area. A growth rate of approximately one percent per year was used to project traffic flows over a 20-year time horizon to 2033. This growth rate will be supported by planned improvements to VT 2A and Industrial Avenue. North of River Cove Road VTrans is proposing to widen VT 2A from its existing two-lane cross section to a three-lane cross section with a two-way center left-turn lane. At the west end of Industrial Avenue where it meets Route 2 plans are being developed to construct a second left-turn lane from Route 2 eastbound to Industrial Avenue eastbound. A section of industrial Avenue near the intersection will be widened to accept the additional traffic flows that the proposed double left-turn lanes will be able to deliver.

Analyses of the projected year 2033 peak hour traffic flows at the VT 2A/Industrial Avenue/Mountain View Road intersection indicate a significant worsening of traffic operations relative to existing conditions. PM peak hour traffic demands will exceed the theoretical intersection capacity by 19 percent. During the AM peak traffic hour conditions will match existing PM peak hour conditions. For the AM peak hour the intersection is expected to operate at 98 percent of capacity in 2033, the same "volume-to-capacity ratio" experienced during the PM peak hour today.

Alternatives

Various alternative improvement plans were developed for the Route 2A/Mountain View Road/Industrial Avenue intersection with the objective of providing sufficient vehicular carrying capacity to accommodate the projected 2033 peak hour traffic demands while maintaining a high level of pedestrian and bicycle accommodations. In this regard, two strategies were pursued. The first considered building upon the existing signalized intersection configuration by adding lanes and/or changing lane use conditions incrementally to achieve the desired level of operations. The second strategy examined a whole new intersection configuration, a modern roundabout. Here again, lanes were added incrementally until the desired operating condition could be achieved. At the same time, alternative plans were developed for the widening of VT 2A north of the Industrial Avenue intersection with the goal of improving traffic flow, safety and pedestrian accommodations. These alternatives included the addition of a sidewalk on the east side of the road and/or a center two-way, left-turn lane as currently proposed for VT 2A north of River Cove Road.

Findings

A detailed evaluation of all of the intersection improvement alternatives indicated that only two alternatives would enable the intersection to operate comfortably below capacity under the projected 2033 peak hour traffic flow conditions. These included the most aggressive signalized intersection expansion plan, Option 3, which allowed the intersection operate at only 89 percent of capacity under 2033 PM peak hour conditions. Option 3 would add to the intersection a westbound left-turn lane; a second eastbound left-turn lane; and a second northbound through lane.

The other “viable” alternative was a two-lane, modern roundabout which could operate at only 85 percent of capacity under 2033 PM peak hour traffic conditions. The signalized intersection alternative was found to have greater land area impacts as it involves roadway widening along all four of the intersection approaches. Roadway widenings to implement the roundabout alternative were mostly concentrated at just the location of the intersection itself. Plans to widen VT 2A north of the intersection to include both a two-way, left-turn lane and a new sidewalk on the east side of the roadway were found to have land area impacts well beyond the existing roadway right-of-way. Consequently, viable alternatives for this roadway segment were limited to just adding a two-way, left-turn lane or a sidewalk.

Recommended Alternative

The alternative improvement plans for the study area were presented to Town officials and residents at a series of public meetings. At the conclusion of the public review process the Williston Selectboard voted to advance intersection Option 3, the expanded signalized intersection alternative shown below. In selecting intersection Option 3 over the multilane roundabout alternative, the Selectboard noted concerns regarding limited public acceptance of roundabouts in Williston. The addition of a two-way, left-turn lane as shown below was supported for the roadway segment treatment as it would facilitate safer left-turn movements to and from VT 2A and allow for enhanced pedestrian crossings. The proposed cross section is also consistent with the treatment proposed for VT 2A just north of River Cove Road. The

Selectboard recommendations were accepted by the CIRC Alternatives Task Force allowing the CCRPC and the Town of Williston to now pursue funding for the permitting and design of the recommended improvement plans.

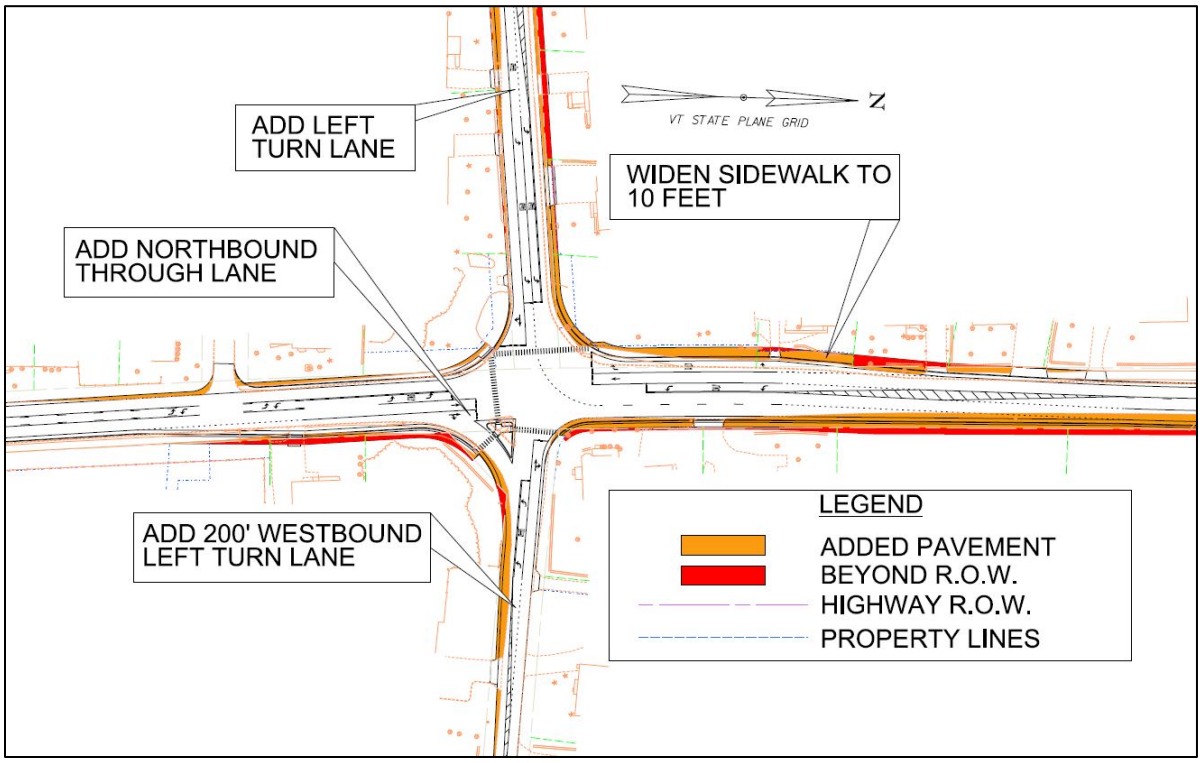

Figure ES-1 Proposed VT 2A/Industrial Avenue/Mountain View Road Intersection Plan

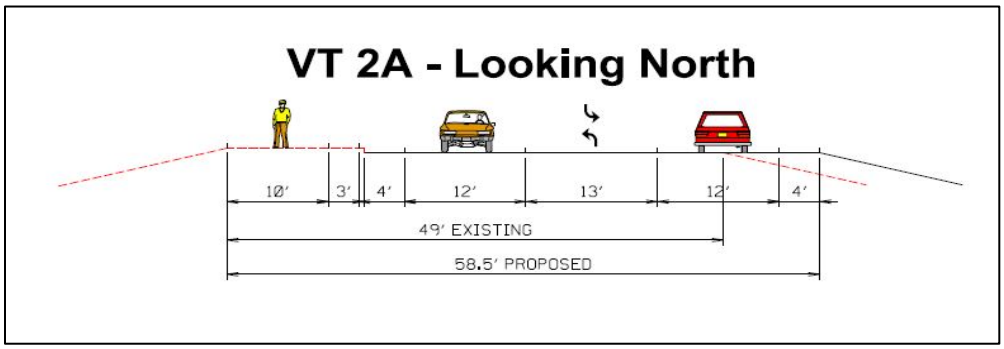

Figure ES-2 Proposed VT 2A Cross Section Treatment North of Industrial Avenue

Contents

Figure List

Table List

1.0 Introduction

The *VT 2A Scoping Study – Industrial Avenue/Mountain View Road to River Cove Road* was prepared at the request of the Town of Williston and the Chittenden County Regional Planning Commission (CCRPC) to evaluate alternative strategies to address existing and expected future travel demands at the VT 2A/Industrial Avenue/Mountain View Road intersection and along VT 2A north of this intersection. The operational and safety benefits associated with multiple improvement strategies were determined in the context of projected future peak hour traffic flows in the corridor. Alternatives were also evaluated with respect to their expected impacts on parcels abutting the roadways. Implementation costs for the various improvements were also considered. At the conclusion of an extensive public review process in which the findings of this evaluation were presented and reviewed, the Williston Selectboard chose a preferred alternative for implementation. The preferred plan includes the addition of left-turn lanes to the Industrial Avenue and Mountain View Road approaches to their intersection with VT 2A and the addition of a second northbound through lane on VT 2A at this location. North of the intersection to River Cove Road a widening of VT 2A to provide a two-way, left-turn lane consistent with a treatment planned for VT 2A north of River Cove Road is supported. This study documents the analyses leading to this recommendation.

1.1 Project Background

The Chittenden County Regional Planning Commission (CCRPC) has been working with numerous communities in Chittenden County to address area transportation issues now that plans for further development of the Circumferential Highway (The CIRC) have been cancelled by the State of Vermont. A CIRC Alternatives Task Force was formed comprised of representatives of each of the communities affected by cancellation of the CIRC and other key stakeholders. Likewise, the CCRPC commissioned various studies to develop alternative transportation system improvement plans. The Williston-Essex Network Transportation Study (WENTS) is one such study recently completed that outlined broad strategies to address congestion and mobility issues in Williston. The WENTS study flagged the VT 2A/Industrial Avenue/Mountain View Road intersection as an existing bottleneck where conditions will worsen over time with future traffic growth. Accordingly, the WENTS recommended that a more detailed scoping study be prepared to define a preferred improvement plan for this location.

The WENTS also recommended bicycle and pedestrian facility improvements in the project area. These included:

- A shared path facility on Mountain View Road (south side) from Old Stage Road to VT 2A.
- A sidewalk on the east side of VT 2A from Mountain View Road to River Cove Road. (A sidewalk is also proposed on the east side of VT 2A from Morgan Parkway north to Eastview Circle as part of the ongoing VT 2A/James Brown Drive project.))

Based on these recommendations, the Town of Williston and the CCRPC commissioned this study to define a preferred improvement plan for VT 2A between Industrial Avenue/Mountain View Road and River Cove Road inclusive of the VT 2A/Industrial Avenue/Mountain View Road intersection.

1.2 Project Area

The project study area includes the VT 2A/Industrial Avenue/Mountain View Road intersection and extends northerly along VT 2A to River Cove Road. The segment of VT 2A north of Industrial Avenue includes intersections with Hillside Drive and Sharon Drive entering from the west and Bittersweet Circle entering from the east. Figure 1 shows the location of the project area within the Town of Williston.

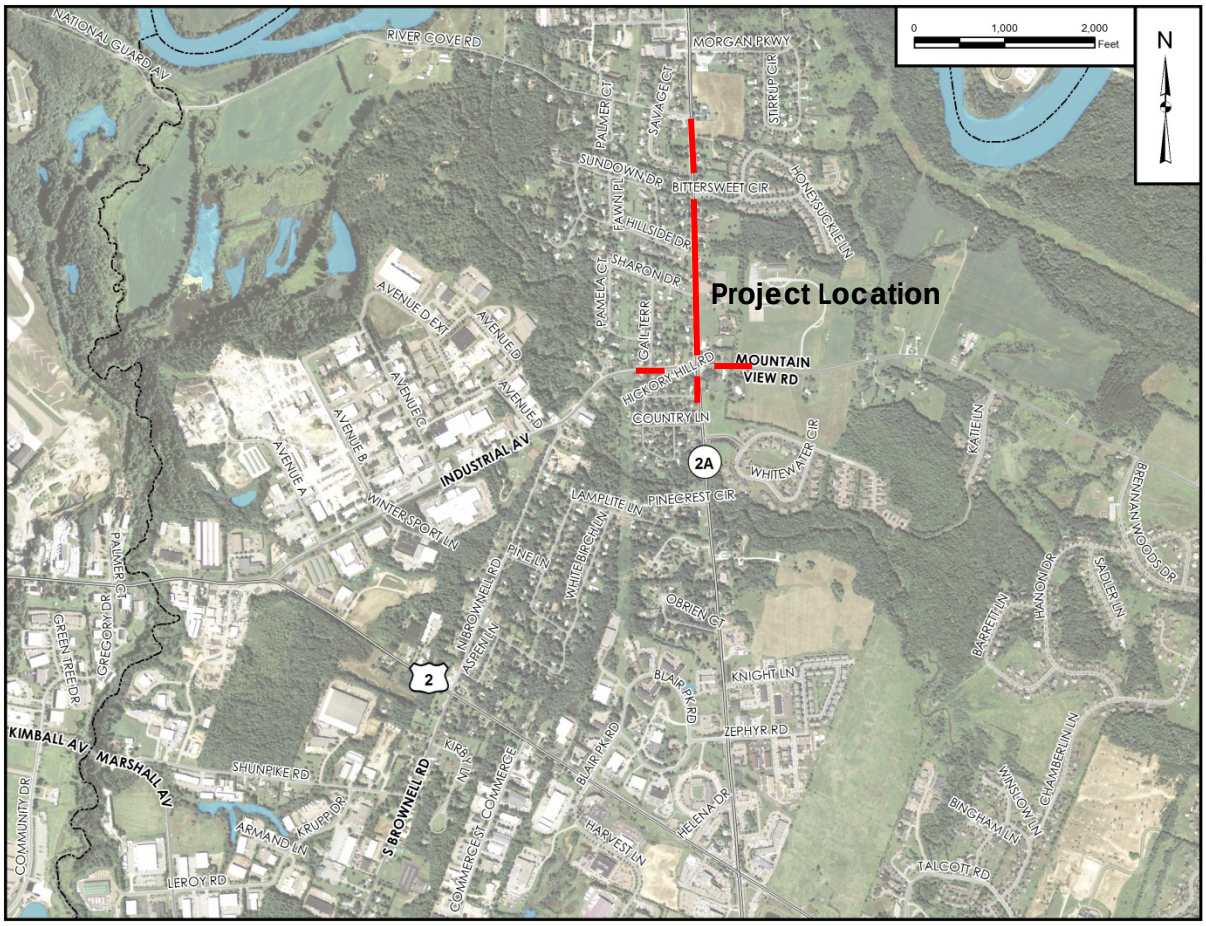

Figure 1: Project Location Plan

1.3 Study Process

A multi-step planning process was completed that included the following major steps listed below.

- Project Initiation
- Data Collection and Quantification of Existing Conditions
- Future Traffic Forecasts and Analysis
- Local Concerns Meeting
- Development and Evaluation of Alternatives
- Public Hearings
- Selection of Preferred Alternative
- Documentation

During the project initiation phase the study team was assembled and a work plan was developed. Data were then collected including a topographic survey of the study area, a natural resources review, and an historic/archeological survey to define existing roadway, traffic and environmental conditions. Traffic forecasts were then developed and used to evaluate expected roadway operations during peak traffic hours under future conditions for a 2035 design year. The findings of this investigation and existing conditions plans were presented to area residents at a Local Concerns Meeting where residents were asked to comment on their priorities and concerns for the study area. Alternative plans were then developed by the project team to address the concerns raised in the meeting. A project Purpose and Need Statement was also drafted at this time to provide guidance in evaluating the alternatives. The alternative plans were then presented to area residents and Town officials in a series of public meetings. At these meetings the expected performance of each alternative in terms of traffic operations, safety and multi-modal accommodations were weighed against the impacts of each alternative measured in terms of construction cost, potential land takings and loss of mature trees. (Environmental, historical and archeological impacts are not expected to be significantly different among the alternatives considered based on the existing conditions analysis.) Based on the public comments received and its own evaluation of the alternatives presented, the Williston Selectboard selected a preferred alternative. This report was completed subsequent to the Selectboard decision to document the study findings and process.

2.0 Existing Conditions

Existing land, roadway and traffic conditions for the study area were developed through the assemblage of existing data and through the collection of new data. Compiled information includes:

- Roadway conditions including roadway cross sections, right-of-way, sidewalks, bike lanes or shoulders, driveways, and traffic controls. (A topographic survey conducted by VSE as part of this study was used to compile roadway base plans for the study area.)
- Existing potential environmental constraints. (A field inspection and resource/map review was conducted by an environmental scientist as part of this study.)
- Existing potential historical and archeological constraints. (Field visits and file research were conducted by Hartgen Archeological Associates, Inc. for this study.)
- Travel demands including AM and PM commuter peak hour vehicular traffic volumes, daily traffic volumes, and pedestrian and bicycle volumes. (Recent traffic counts conducted by VTrans were used to define existing volumes for the Industrial Avenue/VT 2A intersection and new counts were conducted for the Sharon Drive and Hillside Drive intersections with VT 2A.)
- Public transit facilities, services and usage. (These were defined by published route information and field observations.)
- Recent crash experience. (Crash data were compiled from VTrans' database.)
- Peak hour roadway performance based on capacity analyses for intersections.

The existing conditions data collection efforts and findings are presented below.

2.1 Existing Roadway Conditions

The project study area includes approximately one half mile of VT 2A from its intersection with Industrial Avenue and Mountain View Road and extending north to River Cove Road. North of Industrial Avenue, Hillside Drive and Sharon Drive enter VT 2A from the west and Bittersweet Circle enters from the east. These side streets are two-lane Town roads used for local access to residential properties. Existing roadway conditions in the corridor are described below.

2.1.1 VT 2A

Route 2A is classified as an urban, minor arterial. Its orientation through the project study area is north-south. To the south VT 2A intersects with US Route 2 at Tafts Corner approximately one mile south of Industrial Avenue. Still farther south (approximately 1.5 miles south of Industrial Avenue) VT 2A has an interchange with Interstate Route 89. To the north VT 2A passes through Essex Junction at Five

Corners. Primarily residential land uses abut the roadway in the study area although commercial uses are present along the west side of the roadway north of River Cove Road and on both sides of the roadway in the Tafts Corner area. Throughout the study area VT 2A is a two-lane, two-way roadway with turning lanes added at the Industrial Avenue/Mountain View Road intersection. The typical section includes 12-foot wide travel lanes and paved four-foot wide shoulders. An eight to ten-foot wide multi-use path is provided on the west side of the roadway separated from the roadway by a greenbelt of varying width. At the intersection with Industrial Avenue/Mountain View Road the multi-use path meets a five-foot sidewalk running along the north side of Industrial Avenue. South of Industrial Avenue, a five-foot sidewalk continues on the west side of VT 2A for about 250 feet while the multi-use path continues on the east side of VT 2A for about 750 feet to the Meadow Run neighborhood.

2.1.2 Intersections

The intersection of VT 2A/Industrial Avenue/Mountain View Road is state-owned and controlled by a traffic signal under the authority of the Vermont Agency of Transportation (VTrans). The existing lane configurations of the VT 2A/Industrial Avenue/Mountain View Road intersection approaches consist of the following:

- Southbound VT 2A – One 125-foot long left turn lane, one through lane and one 250-foot long right turn lane.
- Northbound VT 2A – One 75-foot long left turn lane and one shared thru/right turn lane. A raised island provides channelization for the right-turn movement.
- Eastbound Industrial Ave – One 200-foot long left turn lane and one shared thru/ right turn lane.
- Westbound Mountain View Road – One shared approach lane.

Pedestrian crosswalks are present on the west side of the intersection across Industrial Avenue and on the south side of the intersection across VT 2A. There is a multi-use path along the west side of VT 2A to the north and on the east side to the south of the intersection as well as a sidewalk on the west side of VT 2A to the south. A sidewalk is also present along the north side of Industrial Avenue at the intersection. There are no bike lanes designated at the intersection however, the existing paved shoulders on VT 2A accommodate bike traffic. The surveyed plan for this intersection is provided in Appendix A.

The VT 2A/Industrial Avenue/Mountain View Road intersection is under traffic signal control. The traffic signal provides an advanced protected left-turn phase for the eastbound Industrial Avenue approach. South bound right-turns from VT 2A to Industrial Avenue receive a green signal indication during this phase. The traffic signal is not coordinated with other signalized intersections along VT 2A. An “all walk” pedestrian signal phase can be activated via pushbuttons.

Sharon Drive intersects VT 2A from the west approximately 500 feet north of Industrial Avenue, and Hillside Drive intersects VT 2A from the west approximately 900 feet north of Industrial Avenue. Bittersweet Circle meets VT 2A from the east approximately 1400 feet north of Industrial Avenue. Each of these two-lane, two-way side streets join VT 2A at a T-type intersection with STOP-sign control on the side street. No turn lanes are provide on VT 2A at these intersections. As noted above, the multi-use path continues along the west side of VT 2A at these

intersections. A sidewalk is provided on the south side of Bittersweet Circle leading out to VT 2A. There are no sidewalks on Sharon Drive or Hillside Drive. The surveyed plan for VT 2A north of Industrial Avenue is provided in Appendix A.

2.2 Traffic Volumes

Traffic volume data for the study area were collected from various sources. Twelve hour turning movement counts were available from VTrans and the CCRPC for the VT 2A / Industrial Avenue / Mountain View Road intersection for 2012. These counts were recorded during the first two weeks of June. Vehicle turning movement and classification counts were taken by Stantec at the VT 2A intersections with Sharon Drive and Hillside Drive during April 2013. The commuter period volumes generally peaked from 7:45 to 8:45 AM and from 4:45 to 5:45 PM.

The collected traffic data were used to create "Design Hour Volume" (DHV) traffic flow networks. The DHV networks are meant to represent the 30th highest hourly volumes that would occur on the roadway over the course of a year. Since volumes are not counted continuously for a year at this location, VTrans provides formulas to estimated DHV's based on continuous traffic count data for nearby and/or similar roadways. The observed VT 2A / Industrial Avenue / Mountain View Road intersection volumes were increased to 2013 DHV levels per VTrans standards. Then the Hillside Drive and Sharon Drive volumes were balanced with the VT 2A / Industrial Avenue / Mountain View Road DHV's to create the existing traffic flow networks for AM and PM commuter peak hours shown in Figures 2 and 3. The collected traffic data and DHV calculations are included in Appendix B

Daily traffic volumes for the study area roadways were obtained from CCRPC and VTrans records as well. As noted in Table 2, VT 2A carries 12,600 vehicles per day (vpd) south of Industrial Avenue and 18,100 vpd north of Industrial Avenue. Volumes are much lower on Industrial Avenue and Mountain View Road with Industrial Avenue carrying approximately 8,400 vpd and Mountain View Road carrying 5,600 vpd. Based on the peak period turning movement counts estimated volumes on Sharon Drive and Hillside Drive are fewer than 500 vehicles per day. Similarly, based on the number of residences on Bittersweet Circle, Bittersweet Circle carries approximately 500 vehicles per day.

Location	Daily Traffic Volume	Count Date
VT 2A-South of Industrial Avenue	12,600	2010
VT 2A-North of Industrial Avenue	18,100	2012
Industrial Ave – West of VT 2A	8,400	2009
Mountain View Road - East of VT 2A	5,600	2011

Table 1: Existing Daily Traffic Volumes

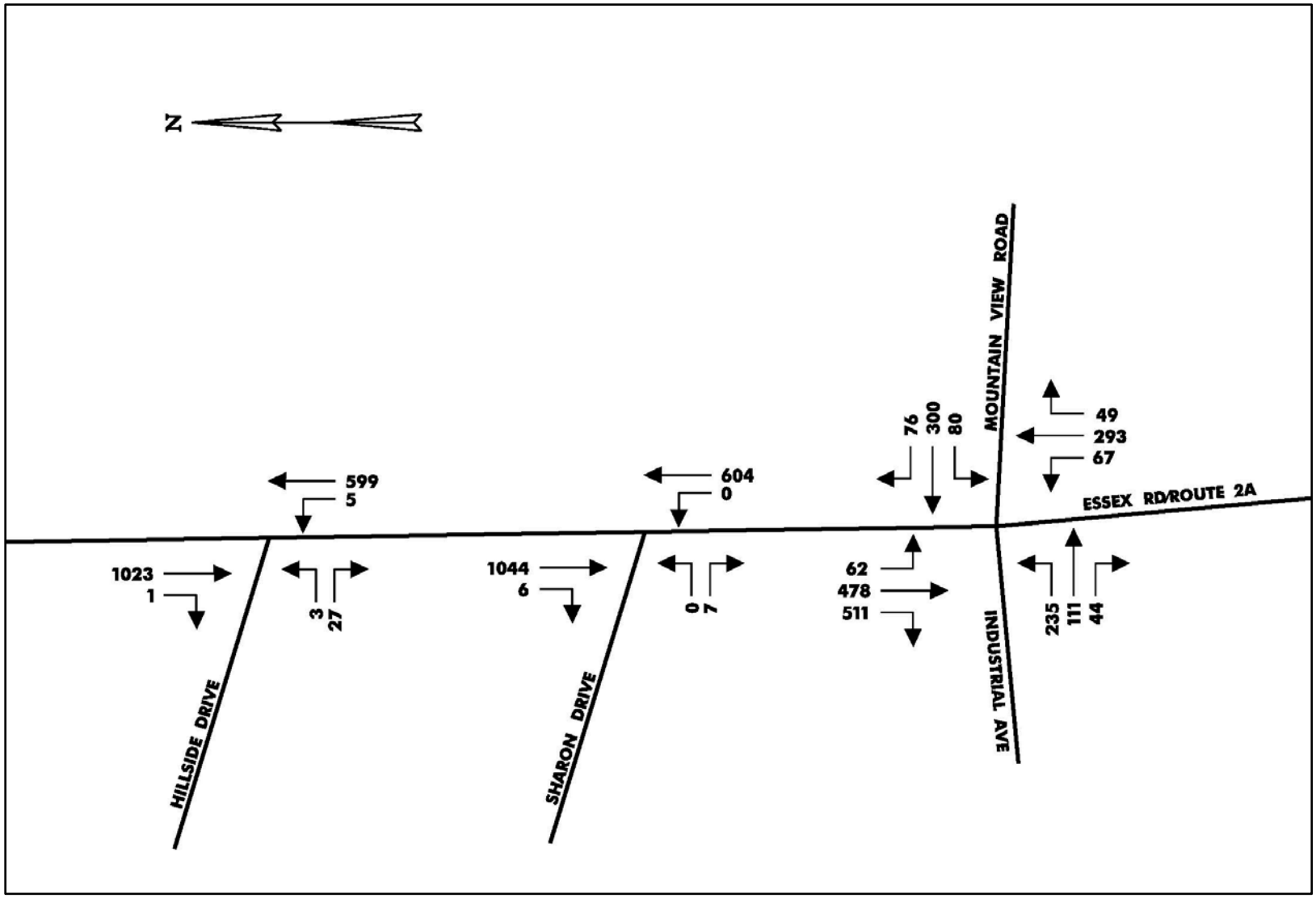

Figure 2: 2013 AM Peak Hour Volumes

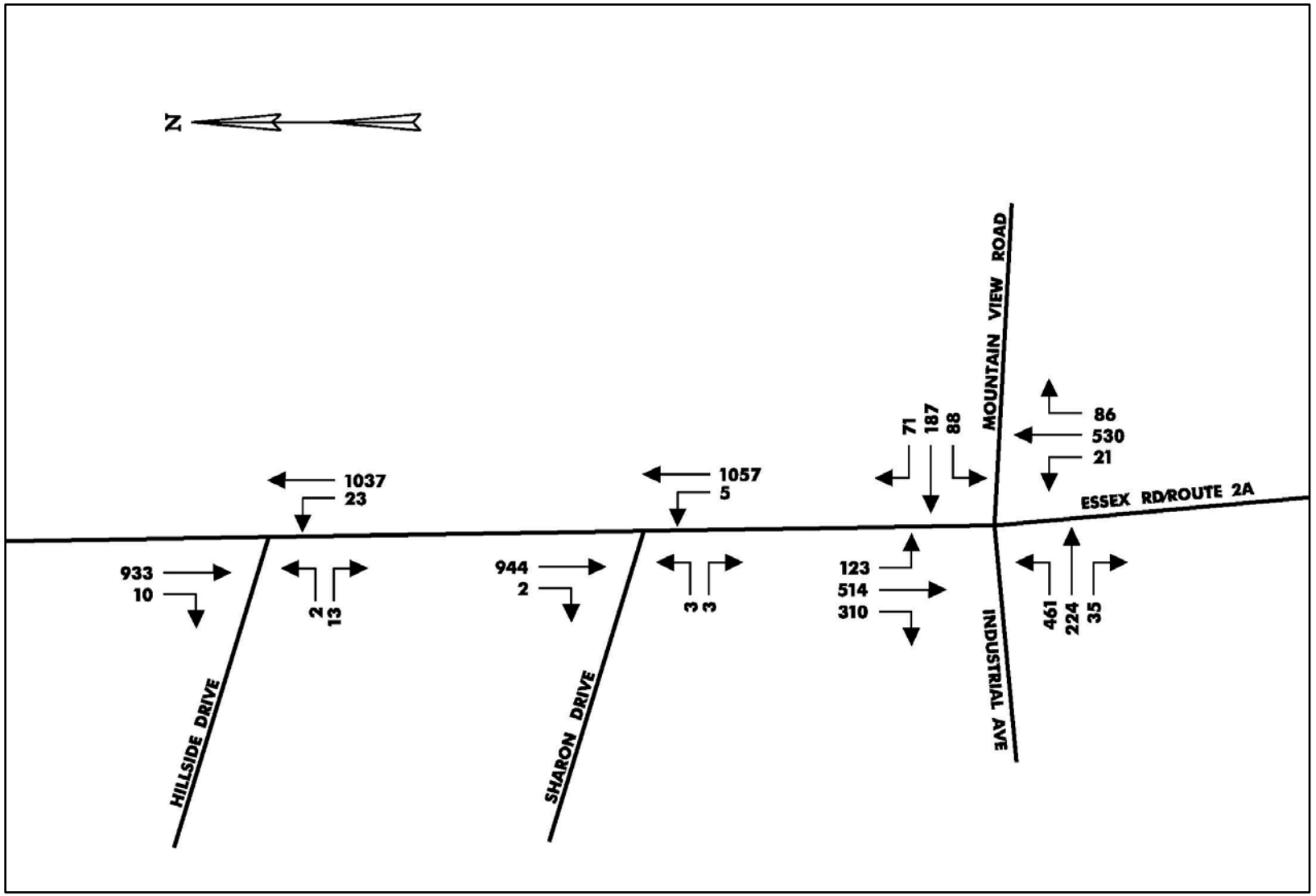

Figure 3: 2013 PM Peak Hour Volumes

2.3 Traffic Operations

Intersection and roadway operating levels of service (LOS) are calculated for the study area intersections based on the traffic volume, geometry and traffic control data provided above.

2.3.1 Level of Service Criteria

Level of service 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 following 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 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 *2000 Highway Capacity Manual* to determine operating levels of service are summarized in Table 2.

	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

Table 2: Intersection Level of Service Criteria

[1]Level of Service F is also assigned if the volume-to-capacity ratio exceeds 1.0.

Source: *HCM 2010 Highway Capacity Manual*, Transportation Research Board, National Academy of Sciences, Washington, DC, 2010.

For unsignalized intersections, it is assumed that through movements on the main street have the right-of-way and are not delayed by side street traffic. Main street traffic may be exposed to delays from traffic turning left from the main street. Generally, and in the case of this study, the longest delays at unsignalized

intersections are experienced on the side streets by traffic waiting to enter or cross the main street (VT 2A).

2.3.2 Calculated Operating Levels of Service

Capacity analysis results for the study area intersections were calculated using the software Synchro and are presented in Table 3 below. Capacity analysis worksheets are included in Appendix C. It was found that the AM peak hour level of service was at LOS D or better at both the side streets analyzed (Hillside Drive and Sharon Drive) as well as at the VT 2A/Mountain View Road/Industrial Avenue intersection. Afternoon peak hour conditions are worse. Calculated side street delays are greater than 100 seconds per vehicle. However, the side street volumes are relatively low and the side street volume-to-capacity ratios are well below 1.0. PM peak hour conditions at the signalized intersection are at LOS E with the intersection virtually operating at capacity (volume-to-capacity ratio is 0.98). This is consistent with field observations that noted very long queues on Industrial Avenue eastbound during the PM peak hour as noted below.

		Existing (2013)		
	Peak Hour	**LOS[1]**	**Delay[2]**	**V/C[3]**
Unsignalized Intersections				
VT 2A / Hillside Drive				
	AM	*D*	*26.0*	*0.16*
	PM	*F*	*>100*	*0.31*
VT 2A / Sharon Drive				
	AM	*C*	*20.2*	*0.03*
	PM	*F*	*>100*	*0.41*
Signalized Intersections				
VT 2A/Mountain View Road /Industrial Avenue				
	AM	D	37.1	0.79
	PM	E	58.8	0.98

Notes: Results shown are for the worst operating minor street approach for unsignalized conditions.

[1] LOS= Level of Service

[2] Delay = Average delay expressed in seconds per vehicle

[3] V/C = Volume-to-capacity ratio for critical movements

Table 3: Existing Intersection Capacity Analysis Results

2.3.3 Field Observations

During field visits observations were made of existing traffic operations. These observations help to validate and/or qualify findings based on the analytical methods presented above. In fact, field observations confirm the above capacity analysis results for the VT 2A/Industrial Avenue/Mountain View Road intersection. During peak hours long queues can be observed on any of the intersection approaches. During the evening peak hour long queues are regularly observed on the eastbound Industrial Avenue approach often spilling back up to one half-mile. At the intersection the eastbound left-turn vehicle queue exceeds the capacity of the left-turn lane and blocks the through lane. When this occurs queues build quite rapidly in the single approach lane extending west of the intersection.

2.4 Safety

The crash history for the study area was investigated using the VTrans crash database. VTrans keeps records of crashes by roadway link or segment and VTrans reports for 2008 through 2012 were reviewed for this scoping study. Over this five year period, VTrans reported 87 crashes along VT 2A from approximately 300 feet south of the Industrial Avenue/Mountain View Road intersection to approximately one-half mile north of the intersection including the intersections with Sharon Drive and Hillside Drive. In the immediate area of the Route VT2A/Industrial Avenue/Mountain Road intersection there were 42 crashes plus: another six within the 300 feet south of the intersection; eight within the 500 feet north of the intersection; and, another 31 crashes along the next 2000 feet north of the intersection.

Table 5 provides a summary of the number of crashes by type, time of day, weather and location. The original crash data, provided by VTrans, is included in Appendix D. As noted, none of the crashes involved fatalities. A great majority (76) of the crashes involved property damage only. The most frequent crashes were rear end crashes (67 percent) which is typical of signalized intersections. There were 11 angle type crashes (13%) and three head-on crashes.

VTrans also maintains a High Crash Location (HCL) list for intersections statewide. This list was most recently updated to include crash experience from 2008 through 2012. The VT 2A/Industrial Avenue/Mountain View Road intersection was listed as Number 71 on the HCL list with 45 crashes reported over this five year period. Again, no fatalities were reported at this intersection and only seven of the crashes involved injuries.

	Segment	Industrial Ave / Mountain View Road	Segment	Sharon Drive	Segment	Hillside Drive	Segment	Total
Mile marker	**4.72-4.78**	**4.79 -4.81**	**4.82-4.92**	**4.93-4.95**	**4.97**	**5.02-5.04**	**5.07-5.32**	
Year								
2008	2	10	3	4			4	23
2009	1	5	1	1		1	3	12
2010		10				1	4	15
2011		9	1	2	1	1	2	16
2012	3	8	3	3		2	2	21
Total	**6**	**42**	**8**	**10**	**1**	**5**	**15**	**87**
Type								
Angle		10					1	11
Rear-end	4	24	7	9	1	4	9	58
Head-on		2					1	3
Unknown-other	2	6	1	1		1	4	15
Total	**6**	**42**	**8**	**10**	**1**	**5**	**15**	**87**
Severity								
Property Damage	6	37	8	8	1	4	12	76
Personal Injury		5		2		1	3	11
Fatality								
Other								

	Segment	Industrial Ave / Mountain View Road	Segment	Sharon Drive	Segment	Hillside Drive	Segment	Total
Total	**6**	**42**	**8**	**10**	**1**	**5**	**15**	**87**
Weather								
Clear	4	19	7	6	1	5	15	**57**
Cloudy		11	1	1				13
Rain	1	5		2				8
Snow/Ice		3		1				4
Fog								
Unknown	1	4						5
Total	**6**	**42**	**8**	**10**	**1**	**5**	**15**	**87**
Time								
7:00AM to 9:00AM		6	1	1	1	1	1	11
9:00AM to 4:00PM	2	13	6	7		2	9	39
4:00PM to 6:00PM	2	11	1	1		2	4	21
6:00PM to 7:00AM	2	12		1			1	16
Total	**6**	**42**	**8**	**10**	**1**	**5**	**15**	**87**

Table 4 VT 2A Reported Crashes (2008-2012)

2.5 Transit Services

The Chittenden County Transit Authority provides regularly scheduled bus service to the project area by way of Route 1, the "Williston" route. There are several variations of Route 1, however all buses pass through the Route 2/Industrial Avenue intersection offering service at approximately 30-minute intervals at this location during commuter peak periods. The Williston-Essex variation of the route has buses on VT 2A passing through the Industrial Avenue intersection on one-hour headways. Buses on the Williston Village variation travel the length of Industrial Avenue and continue on to Mountain View Road. Two buses make this trip during the AM commuter peak period and again during the PM commuter peak period. Route maps are shown in Figures 4 and 5 below. There are no bus shelters provided on VT 2A within the project area but some are present at other points along VT 2A.

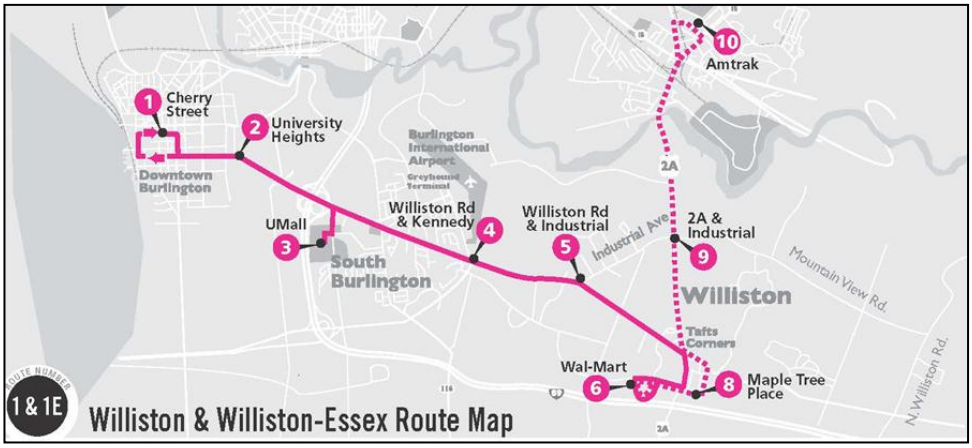

Figure 4: CCTA Williston Route

Figure 5: CCTA Williston Village Route

2.6 Natural Resources

Stantec evaluated the natural resources present within the VT 2A/Industrial Avenue/Mountain View Road to River Cove Road project area as of May 7, 2013 (see Appendix E). Specifically, Stantec identified and characterized wetlands, streams, observable rare, threatened or endangered (RTE) species, wildlife habitat, agricultural land, and public conservation lands. Approximate wetland boundaries under state and federal jurisdiction were based on the technical criteria described in the *2012 Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region (Version 2.0)*. Only reconnaissance-level investigations were carried out, and formal wetland delineations were not conducted. Natural resources were reviewed within 50 feet of roadway edges in order to assess potential wetland buffer impacts. Locations were sketched on the project base map. Following is a summary of the findings.

2.6.1 Review of Existing Materials

Stantec used the Vermont Agency of Natural Resources (ANR) Natural Resources Atlas mapping program to assess the likelihood of the presence of mapped Vermont Significant Wetland Inventory (VSWI) wetlands. According to this program,[1] there are no Class 2 VSWI wetlands mapped within the project area, nor are there any known RTE species (see ANR Map in Appendix E).

According to the Natural Resource Conservation Service (NRCS) Web Soil Survey[2] for Chittenden County, Vermont, the soils within the project corridor are mapped as Belgrade and Eldridge soils, 0-3% slopes, 3-8% slopes, and 8-15% slopes; Munson and Raynham silt loams, 3-8% slopes; and Peru stony loam, 5-12% slopes. The Belgrade and Eldridge soils, 0-3% slopes are considered Prime Farmland soils, while the remaining soil types are considered Farmland Soils of Statewide Importance.

[1] http://anrmaps.vermont.gov/websites/anra/
[2] Natural Resource Conservation Service Web Soil Survey: http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx. Refer to map for Chittenden County, Vermont. Accessed on May 13, 2013.

2.6.2 Wetlands and Streams

There are no mapped wetlands or streams within the project area. However, three small wetland areas were identified during the May 7, 2013 site investigation. These are all located near the northern limits of the project area, adjacent to VT 2A (see Wetland Sketch in Appendix E). All three are small palustrine emergent wetlands. The wetland located on the west side of VT 2A, just south of River Cove Road, appears to be an overgrown stormwater detention pond dominated by common reed (*Phragmites australis*). The other two small wetland areas are dominated by cattail (*Typha latifolia*).

2.6.3 RTE Species

Stantec identified no RTE species during the May 7, 2013 site visit. The project corridor has been disturbed to some degree by mowing, clearing, fill, or previous development. As a result, it is unlikely that any RTE plant or animal species occur within the project corridor.

2.6.4 Wildlife and Wildlife Habitat

The project area provides habitat for various wildlife species common to Vermont's urbanizing areas such as blue jay (*Cyanocitta cristata*), raccoon (*Procyon lotor*), skunk (*Mephitis mephitis*), gray squirrel (*Sciurus carolinensis*), as well as other species that may travel through the area. The Town of Williston was studied as part of the PLACE (Place-based Landscape Analysis and Community Education) Program[3]. Part of the evaluation included identifying core forest, edge forest, and wildlife habitat corridors. The project corridor does not include any of these identified features, and does not provide significant wildlife habitat.

2.6.5 Agricultural Land

According to the NRCS Web Soil Survey for Chittenden County, Vermont, the project corridor includes soils rated as Farmland of Statewide Importance as well as Prime Farmland soils. However, the project corridor is not currently in active agriculture, and any proposed improvements would be constructed within a narrow strip alongside the existing pavement. Any proposed work in these areas will require authorization from the NRCS via form CPA-106, the Farmland Conversion Impact Rating form for corridor projects.

2.6.6 Conservation Zones

No designated state or town conservation zones are present within the narrow project corridor. Therefore, the project area does not include public recreation lands (a Section 4(f) resource) or public lands developed with Land and Water Conservation Funds (a Section 6(f) resource).

2.6.7 Federal and State Wetland Regulations

The US Army Corps of Engineers (Corps) regulates wetland and streams under the provisions of Section 404 of the Clean Water Act. The Corps has issued a Programmatic General Permit for the State of Vermont. Typically, wetland and

[3] http://www.uvm.edu/place/towns/williston/index.php

stream impacts of less than one acre may be covered by a Programmatic General Permit, with impacts of less than 3,000 s.f. often eligible for approval via a one-page Self-Verification Form.

The three small wetland areas identified near VT 2A near the northern limits of the project would likely be considered Vermont Class 3 wetlands, and any impacts to these wetlands would likely not require authorization from ANR under the Vermont Wetland Permit or Vermont General Permit. However, any impacts to the wetlands would require authorization from the Corps.

2.6.8 Summary

In summary, the project area includes three small Vermont Class 3 wetlands. Any impacts to these resources may require authorization from the Corps. In addition, the project corridor includes Prime Farmland soils and Farmland Soils of Statewide Significance. Any impacts to these soils will require coordination with the NRCS via form CPA-106, the Farmland Conversion Impact Rating form for corridor projects.

2.7 Archeological Resources and Historic Preservation Assessment

Hartgen Archeological Associates, Inc. (Hartgen) was contracted by Stantec to conduct an Archeological Resource and Historic Preservation Assessment for this study (see Appendix F). This review is required according to Section 16 of the National Historic Preservation Act of 1966, as amended.

Hartgen identified the project area of potential effects (APE), which extends along both sides of VT 2A from River Cove Road in the north to Meadowrun Road in the south, a distance of approximately 3,637 feet (1.1 km). The APE also extends west from VT 2A along Industrial Avenue approximately 699 feet (213 m) and east from VT 2A along Mountain View Road approximately 547 feet (167 m). The width of the APE is estimated at 170 feet (51.8 m). Given these dimensions, the APE encompasses approximately 19.05 acres (7.71 ha).

Hartgen conducted a site visit to the project area on June 12, 2013 and identified areas of disturbance along much of the APE related to the installation of several utilities and existing sidewalks. Outside of this disturbance there is some disturbance from grading and filling around house lots, but the archeological sensitivity remains high in undisturbed areas. A large number of archeological sites have been documented for the project vicinity, indicating a high potential for unknown archeological sites to be present in undisturbed portions of the APE. If these undisturbed areas cannot be avoided in project design, Phase IB archeological reconnaissance survey is recommended.

Historic preservation concerns are focused on mature trees that are located along the APE. Such large trees should be avoided in the project design. Any draft plans for roadway changes, once developed, should be reviewed for historic preservation issues.

3.0 Purpose and Need

As noted earlier, the purpose of this study is to define improvements for the VT 2A corridor as an alternative to construction of the CIRC Highway. The CIRC would have provided an alternative north-south travel corridor through Williston providing some relief to travel demands on VT 2A. In the absence of the CIRC, travel demands on VT 2A are expected to grow with future new land development in Williston and surrounding communities. Consequently, this study seeks to define capacity improvements for the corridor allowing it to more safely handle future vehicular travel demands with reduced congestion. Recognizing that the use of alternative travel modes might help to reduce future vehicular travel demands, the study also looks to enhance accommodations for pedestrians, bicyclists and transit riders. In consideration of the above, a Purpose and Need Statement for the project has been defined as follows:

To address existing and future traffic congestion; enhance safety for all users; and, improve bike-pedestrian travel along VT 2A in Williston between Industrial Avenue/Mountain View Road and River Cove Road.

The need for improvements is indicated by the evaluation of existing and future traffic operations included in this study. The VT 2A/Industrial Avenue/Mountain View Road intersection presently operates at or near capacity during commuter peak hours with significant congestion experienced particularly on the Industrial Avenue approach during the PM peak hours. Vehicle queues on this leg of the intersection regularly extend more than one-half mile to the west during peak times. Regional traffic and land use models suggest that travel demands will grow at this location by nearly one percent per year worsening traffic congestion conditions over time. The WENTS indicated that the overall intersection peak hour operating level of service would degrade from LOS D to LOS F for the design year 2033.

From a multi-modal perspective, the study area is now served by public transit; however, there are limited sidewalk facilities to support users of the existing bus services. Bike lanes are absent from Industrial Avenue and Mountain View Road. Bicyclists are presently accommodated along VT 2A where a multi-use path parallels the west side of the road for a short distance and shoulders are provided on VT 2A. However, the multi-use path narrows to a substandard width near Industrial Avenue as do the shoulders on VT 2A.

4.0 Future Conditions

Traffic conditions in the project study area were projected to a 2033 design-year. These forecasts consider anticipated future traffic growth and planned roadway improvements in the project area. Each of these factors are described below.

4.1 Future Traffic Growth

Historic traffic volumes for the project area roadways were first examined in considering potential future traffic growth patterns. Data published by VTrans and the CCRPC for area roadways were combined in Figure 6. Daily traffic volumes are provided from 1977 to present for Industrial Avenue, Route 2 and VT 2A. As shown, there was a period of significant traffic growth on Route 2 from 1977 to 1996 when traffic volumes peaked. Volumes have generally been in decline since then except for a slight "uptick" in 2012. A similar, albeit somewhat delayed, growth pattern occurred on VT 2A and Industrial Avenue. Volumes on these roads grew until approximately 2005 when daily volumes began to show some decline. Again, 2012 data indicates a slight uptick and may indicate the start of a new growth trend.

In the absence of a clearly defined traffic growth pattern from the historic data, the CCRPC's regional land use and traffic model was used to develop an assumed future traffic growth rate. The model when applied to 2033 conditions indicated a regional traffic growth of approximately one percent per year. Accordingly, existing Design Hour Volumes were increased by an annual growth factor of approximately one-percent per year to represent 2033 traffic conditions. The resulting 2033 AM and PM peak hour traffic flow networks are presented in Figures 7 and 8, respectively.

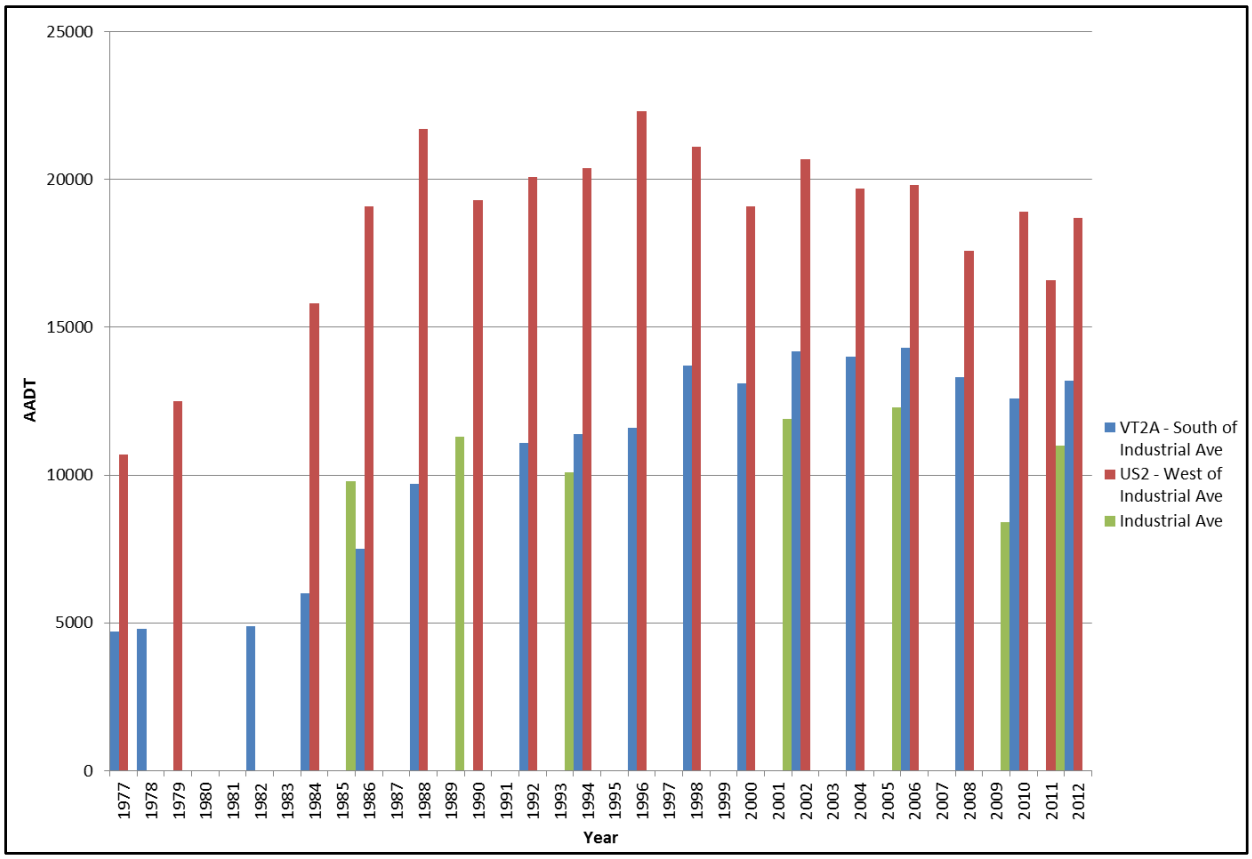

Figure 6: Historic Traffic Volumes

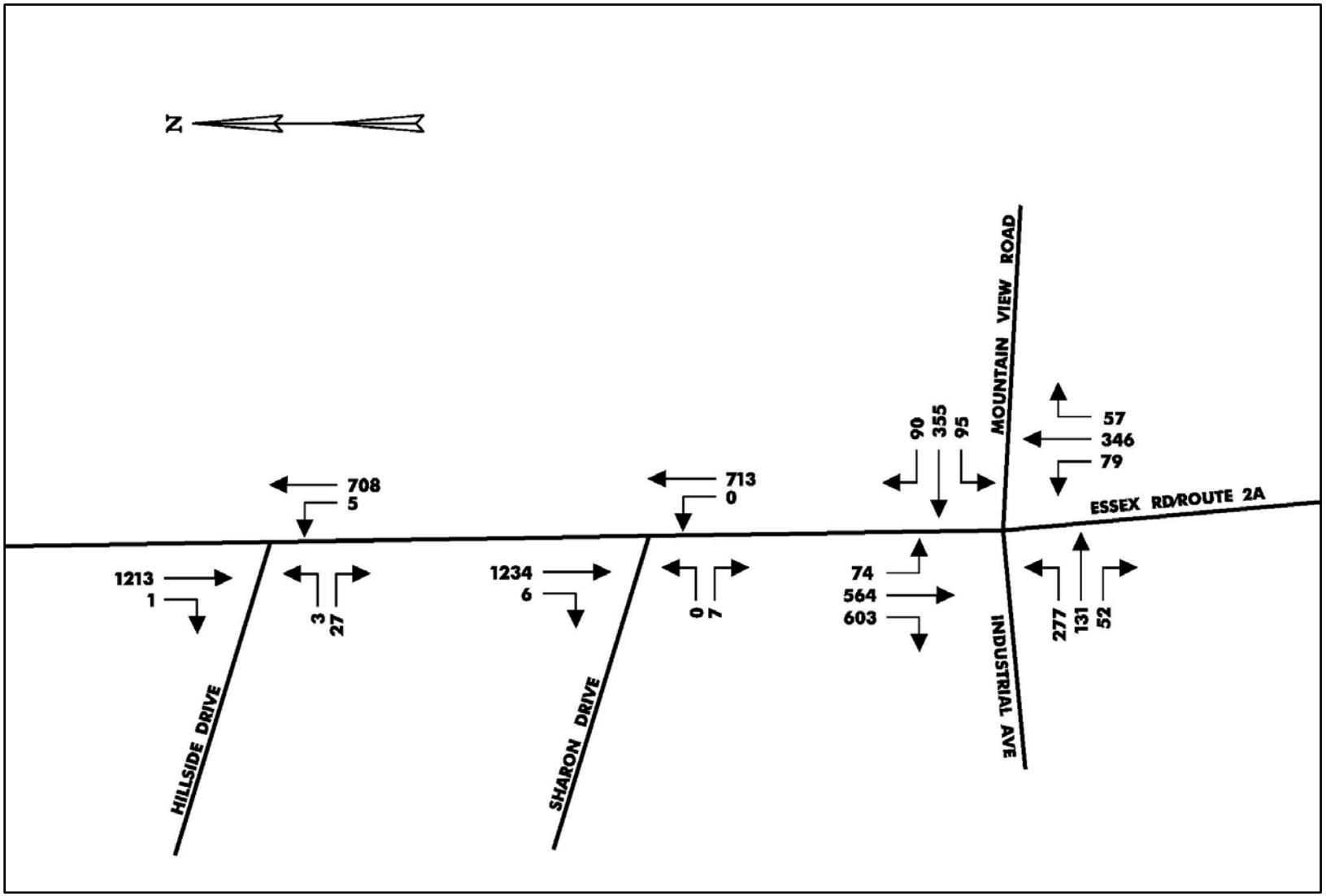

Figure 7: 2033 AM Peak Hour Traffic Volumes

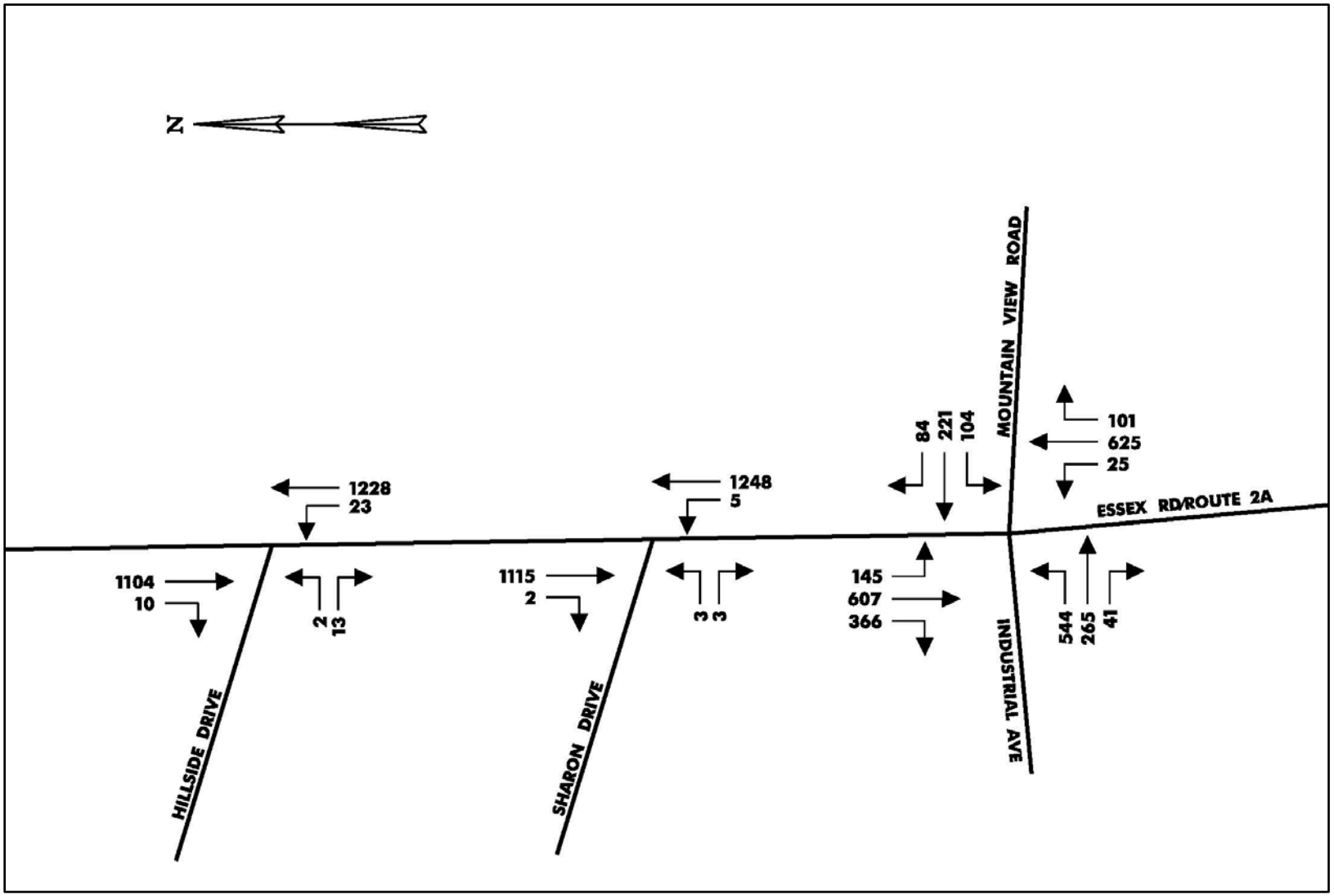

Figure 8: 2033 PM Peak Hour Traffic Volumes

4.2 Proposed Transportation System Improvements

Three transportation system improvements are proposed in vicinity of the study area which should be constructed well in advance of the 2033 design year used in this study. First, VTrans is developing plans to reconstruct the Industrial Avenue/Route 2 intersection. The current conceptual plans include the addition of a second eastbound left-turn lane on Route 2 to Industrial Avenue. This added lane would support potential future growth in peak hour volumes on Industrial Avenue eastbound at VT 2A. Second, just north of the study area VTrans is developing plans to reconstruct VT 2A between River Cove Road and James Brown Drive. A traffic signal will be installed at the James Brown Drive intersection. VT 2A will be widened to provide a three-lane cross section with a center two-way, left-turn lane (TWLTL). The widened VT 2A cross section at River Cove Road is illustrated in Figure 9. Implementation of this improvement will help support the assumed future traffic growth on VT 2A. Finally, the Town of Williston and the CCRPC recently completed a corridor study for Industrial Avenue. This planning study recommended a minor widening of Industrial Avenue at VT 2A to the south in order to provide on-street bike lanes in both directions along Industrial Avenue. Detailed plans for this improvement have not been developed.

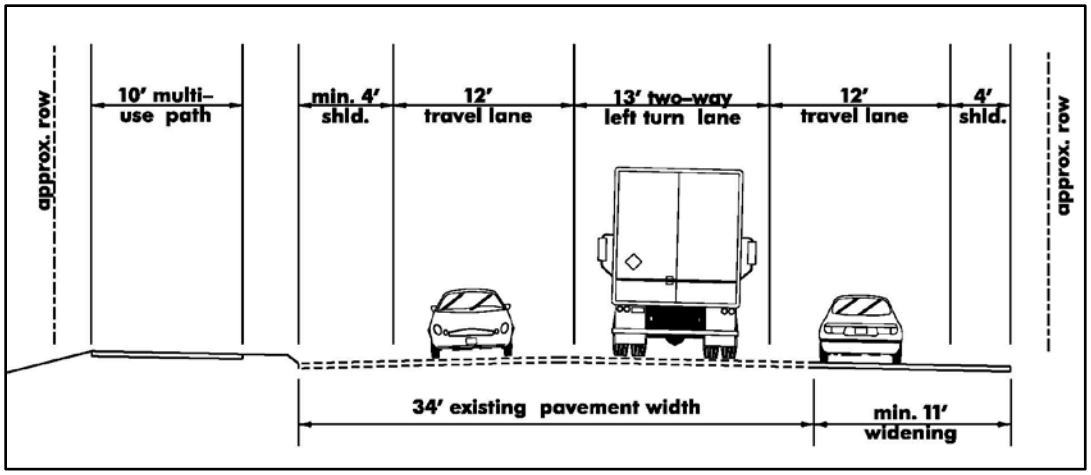

Figure 9: Proposed VT 2A Cross-section Just South of River Cove Road

4.3 Future Traffic Operations

Future traffic operations analyses were completed for the study area intersections following the procedures used to assess existing operating conditions. Capacity analysis results for the study area intersections are compared in Table 5 for Existing and 2033 Future conditions. As shown, little change is anticipated at the level of service ratings for the unsignalized intersections studied. Calculated volume-to-capacity ratios for eastbound traffic on the two side streets do exceed 1.0 under future PM peak hour conditions suggesting long delays for traffic turning left from the side streets. Conditions will worse measurably for the AM peak hour at the VT 2A/Industrial Avenue/Mountain View Road intersection with the assumed traffic growth. The peak hour volume-to-capacity will reach 0.92 (92 percent of capacity). Traffic demands at this location during the PM peak hour will exceed capacity with delays in the Level of Service F range (almost 100 seconds per vehicle). Existing vehicle queues will grow dramatically with the higher travel demands.

Peak Hour	Existing (2013)				Future (2033)			
	LOS[1]	Delay[2]	V/C[3]	Queue[4]	LOS	Delay	V/C	Queue
Unsignalized Intersections								
Hillside Drive/VT 2A								
AM								
Northbound	A	0.2	0.01	1	A	0.3	0.01	1
Eastbound	D	26.0	0.16	14	E	41.3	0.25	23
PM								
Northbound	A	1.4	0.04	3	A	2.5	0.04	3
Eastbound	F	>100	0.31	27	F	>100	2.75	80
Sharon Drive/VT 2A								
AM								
Northbound	A	0.0	-	0	A	0.0	-	0
Eastbound	C	20.2	0.03	2	D	25.2	0.04	3
PM								
Northbound	A	0.3	0.01	1	A	0.6	0.01	1
Eastbound	F	>100	0.41	27	F	>100	4.28	-
Signalized Intersections								
Industrial Ave/Mountain View Dr/Essex Rd (VT 2A)								
AM								
Northbound Left	C	27.0	0.39	68	C	32.9	0.55	82
Northbound Through/Right	C	33.2	0.62	356	D	35.2	0.67	447
Southbound Left	C	24.4	0.23	64	C	25.4	0.28	76
Southbound Through	D	45.4	0.84	#594	D	51.6	0.89	#757
Southbound Right	C	29.6	0.40	143	C	33.5	0.58	298
Eastbound Left	C	31.0	0.72	#270	E	76.5	0.96	#411
Eastbound Through/Right	B	19.0	0.21	132	C	22.3	0.25	166
Westbound	D	52.3	0.89	#617	F	>100	1.07	#810
Overall	**D**	**37.1**	**0.79**	**-**	**D**	**54.2**	**0.92**	**-**
PM								
Northbound Left	C	26.1	0.13	30	C	28.9	0.23	34
Northbound Through/Right	D	51.0	0.90	#829	F	95.2	1.08	#1043
Southbound Left	E	56.5	0.81	#188	F	89.3	0.95	#233
Southbound Through	D	35.6	0.72	#655	D	48.9	0.89	#834
Southbound Right	C	26.2	0.28	126	C	28.5	0.39	191
Eastbound Left	F	81.6	1.03	#580	F	>100	1.26	#768
Eastbound Through/Right	C	25.0	0.34	240	C	25.4	0.4	289
Westbound	F	>100	1.11	#570	F	>100	1.28	#692
Overall	**E**	**58.8**	**0.98**	**-**	**F**	**96.5**	**1.19**	**-**

[1] LOS= Level of Service [2] Delay = Average delay expressed in seconds per vehicle
[3] V/C = Volume-to-Capacity ratio [4] 95th Percentile Vehicle Queue (feet) # Queue volume exceeds capacity

Table 5: Future Capacity Analysis Results

5.0 Alternatives

Alternative improvement plans were developed and analyzed for the study area. For this analysis options to improve intersection operations were considered separately from options to improve travel accommodations along VT 2A recognizing that all intersection options can be made compatible with all roadway segment options. The range of options considered for each element of the study area are described below.

5.1 Intersection Alternatives

Various alternative improvement plans were developed for the Route 2A/Mountain View Road/Industrial Avenue intersection with the objective of providing sufficient vehicular carrying capacity to accommodate the projected 2033 peak hour traffic demands while maintaining a high level of pedestrian and bicycle accommodations. In this regard, two strategies were pursued. The first considered building upon the existing signalized intersection configuration by adding lanes and/or changing lane use conditions incrementally to achieve the desired level of operations. The second strategy examined a whole new intersection configuration, a modern roundabout. Here again, lanes were added incrementally until the desired operating condition could be achieved.

For each of the alternatives described, information is provided relative to their expected performance and their associated environmental consequences. From a performance perspective, the overall intersection PM peak hour volume-to-capacity ratio is provided as a quantitative measure of the improvement's ability to satisfy the Purpose and Need Statement. The volume-to-capacity ratio is also used to estimate the "life expectancy" of the improvement. Specifically, the life expectancy reflects the number of years that the intersection will operate below capacity assuming that existing traffic demands grow at one percent per year. For all calculations involving signalized intersection operations it is assumed that signal timings include a 24-second pedestrian phase and ten pedestrian calls per hour. This assumption addresses the multi-modal aspect of the Purpose and Need Statement. From an environmental consequences perspective, principal attention is given to land and right-of-way impacts. The impacts of added pavement and/or land takings will be directly felt by abutters to the roadway. Quantified land area impacts generally indicate the magnitude of impacts in other areas such as wetlands, prime agricultural soils, archeological and historic preservation. Related to the land area impacts is documentation of the number of mature trees expected to be impacted by each alternative.

5.1.1 Option 1 - Add Westbound Left-turn Lane

The lowest level of improvement considered is the addition of a westbound left-turn lane on Mountain View Road at the VT 2A/Mountain View Road/Industrial Avenue intersection. (This improvement was recommended as an "early action" item in a ten-year old study of the intersection.) A conceptual plan of this improvement is shown in Appendix G. As shown, the addition of a 200 foot long left-turn lane adds approximately 10,000 square feet of pavement to the east leg of the intersection. This

is indicated by the orange shaded area in the figure. Most of this pavement can be provided within the existing public roadway layout. However, some land takings in the southeast corner of the intersection, approximately 500 square feet as indicated by the red shading, are anticipated. The takings would impact two landowners. This change would improve operations relative to the existing geometric conditions but would result in the intersection still experiencing travel demands well in excess of capacity under the 2033 traffic conditions. The projected 2033 PM peak hour volume-to-capacity ratio is 1.17 indicating that peak hour traffic demands would exceed the intersection capacity by 17 percent. These findings are summarized in Appendix I, which documents the impacts and benefits of this alternative relative to the "Do Nothing" condition and relative to other alternatives described below.

5.1.2 Option 2 - Add Westbound Left-turn Lane and Eastbound Left-turn Lane (Add eastbound left-turn lane to Option 1)

Given the shortcomings of Option 1 from an operations perspective, a higher level of improvement was considered for Option 2. As shown in Appendix G, Option 2 adds an eastbound left-turn lane to Option 1. In effect, double left-turn lanes would be provided for traffic on Industrial Avenue entering VT 2A northbound providing at least 500 feet of queuing space for left-turning vehicles. In addition, the five-foot wide sidewalk on the west side of VT 2A is widened to 10 feet matching the width of the multi-use path that exists north of the intersection. In order to accommodate the double left-turn movement VT 2A northbound would also need to be widened to include two "receiving" lanes for a short distance before tapering back to a single lane. The required widening can be concentrated on the west or east side of 2A as shown in Options 2A and 2B, respectively. This plan provides more significant improvements to traffic operations with the future PM peak hour volume-to-capacity ratio dropping from 1.19 under the Do Nothing condition to 0.99 with the Option 2 improvements. The added benefit however, comes with additional impacts. Option 2 has the same right-of-way impacts on the east leg of the intersection as Option 1 but also has new impacts on the west and north legs of the intersection. The required widening impacts up to 13 different parcels and up to 3,800 square feet of property from a right-of-way perspective. It adds up to 20,000 square feet of pavement. The roadway edge moves close to several mature trees on the east side of the road and one mature tree on the west side. (One tree on the east side of the road suffered extreme storm damage and was removed during the conduct of this study. The remaining trees appear to be of similar age and health as the tree that was just removed.)

5.1.3 Option 3 - Add Westbound Left-turn Lane, Eastbound Left-turn Lane and Northbound Through Lane (Add northbound through lane to Option 2)

Whereas Option 2 yields a 2033 PM peak hour intersection volume-to-capacity ratio that is close to 1.0 for the VT 2A/Mountain View Road/Industrial Avenue intersection an even higher level of improvement was considered. As shown in Appendix G, Option 3 builds upon Option 2 by also adding a northbound through lane on VT 2A at the intersection. This lane addition takes advantage of the pavement that would be added under Option 2 on the north leg of the intersection to accommodate two northbound receiving lanes to accept traffic from the two lanes turning left from Industrial Avenue. This plan provides significant improvements to traffic operations with the future PM peak hour volume-to-capacity ratio dropping

from 1.19 under the Do Nothing condition to 0.89 with the Option 3 improvements. In fact, Option 3 results in traffic operations that are better than existing conditions. (The calculated 2013 PM peak hour volume-to-capacity ratio is higher at 0.98.) The additional operational benefits however, can be realized with only nominal additional impacts. Relative to Option 2, Option 3 only adds pavement and new right-of-way impacts to the south leg of the intersection. In total, Option 3 adds 25,000 square feet of pavement at the intersection and has right-of-way impacts of 5,200 square feet on 15 different parcels. The drawing in Appendix G shows both a two-way-left-turn and a sidewalk being added to VT 2A north of the intersection as discussed in Option N2 below. Any of the three options to the north of the intersection (N1, N2, or N3) are compatible with this option, and impacts stated here are irrespective of which northern option is chosen.

Impacts to mature trees are similar to those anticipated for Option 2 with up to seven trees impacted.

5.1.4 Option 4 - Add Westbound Left-turn Lane, Add Northbound Through Lane and Change Lane Use on Industrial Avenue (Delete eastbound left-turn lane addition from Option 3)

Since Option 3 yields a 2033 PM peak hour intersection performance level that is much better than existing conditions, another alternative was considered to determine if the below capacity performance could be achieved with lesser right-of-way impacts. Option 4 is consistent with Option 3 except that there is no eastbound left-turn lane added to Industrial Avenue. Instead, the existing through/right-turn lane would be converted to an all-purpose lane. (Left turns would be allowed from this lane.) Split signal phasing would also be implemented to allow traffic to safely turn left-from both eastbound lanes. With split phasing the eastbound Industrial Avenue approach would operate during its own dedicated signal phase separate from the westbound phase for Mountain View Road. As with Option 3 the addition of a westbound left-turn lane and a northbound through lane are part of this plan. VT 2A northbound north of the intersection would also be widened to accept traffic from the two northbound lanes provided on the south leg of the intersection. This improvement option is illustrated in Appendix G. As shown, the principal benefit of this plan is that pavement widening and right-of-way impacts on the Industrial Avenue leg of the intersection are relatively minor. As summarized in Appendix I, new pavement added under Option 4 is only 14,000 square feet compared with 25,000 square feet under Option 3. Similarly, only seven parcels would be impacted by land takings under Option 4 compared to 15 parcels under Option 3. However, from an operations perspective, Option 4 results in a 2033 PM peak hour intersection volume-to-capacity ratio of 0.98. This volume-to-capacity ratio matches the existing PM peak hour volume-to-capacity ratio. Consequently, implementation of this plan would generate significant improvements in traffic operations when first implemented but operations would deteriorate to existing levels at or around 2033 should the traffic growth forecasts considered in this study be realized.

5.1.5 Option 5 - Reconstruct Intersection as a Single-lane Roundabout

VTrans policy requires that roundabouts be considered as an alternative for all intersection improvement projects that may be eligible for federal funding. Roundabouts must be considered as they offer certain benefits relative to conventional, signal-controlled intersections. These benefits generally include:

- Lesser roadway widenings on intersection approaches. (Roadway networks comprised of roundabout intersections consist of “narrow roads and wide nodes”.)
- No traffic signal operations (electricity) and maintenance costs.
- Fewer crashes and less severe crashes due to low traffic speeds and one-directional flow.
- Less delay during off-peak hours when traffic demands do not warrant signal control.
- Suitable as a gateway treatment and traffic calming device.

Common concerns with roundabouts include:

- Higher maintenance costs with respect to snow removal.
- Wide diameters required to accommodate large trucks.
- Challenging for blind pedestrians.
- Less effective when traffic flows are heavily unbalanced.

Option 5, illustrated in Appendix G, defines a single-lane roundabout plan for the VT 2A/Industrial Avenue/Mountain View Road intersection. The inscribed diameter of the roundabout is approximately 150 feet. All four approaches to the roundabout provide deflection to slow entering traffic. Traffic entering the roundabout on all approaches will be required to yield to circulating traffic. Splitter islands are shown on the south and west legs providing refuge areas for pedestrians following the existing travel paths through the intersection.

Roundabout operations were considered following procedures defined in the 2010 Highway Capacity Manual. These procedures can be used to determine volume-to-capacity ratios for each of the four individual merge areas within the roundabout where an entering approach flow meets a circulating flow. Calculation sheets for roundabout operations are provided in the report appendix indicating volume-to-capacity ratios for all merge areas. For presentation purposes, only the worst performing merge operations are shown in Appendix I. As shown, the single-lane roundabout fails to improve operations relative to the existing intersection conditions with a PM peak hour volume-to-capacity ratio of 1.37 in 2033 during the PM peak hour. However, it does have much more limited right-of way impacts relative to the signalized intersection alternatives. The roadway widenings for the roundabout occur in close proximity to the intersection on parcels that are presently owned by the Town or the State on the west side of VT 2A. Only 400 square feet of takings are associated with Option 5 impacting only two privately owned parcels.

5.1.6 Option 6 - Reconstruct Intersection as a Multi-lane Roundabout

Given the limited capacity of a single-lane roundabout conceptual plans were also prepared for a multi-lane roundabout offering much greater traffic carrying capacity. The multilane roundabout alternative, Option 6, is shown in Appendix G. Two-lane approaches are provided on all entries and two circulating lanes are provided in all but the northwest quadrant of the roundabout. As with the single-lane roundabout right-of way impacts are generally limited to the immediate vicinity of the roundabout. Two privately owned parcels along the Industrial Avenue leg of the intersection would be subject to takings. One parcel is impacted on the west side of VT 2A north of the intersection where expansion of the existing sidewalk to a multi-

use path is assumed, and one parcel on each of the remaining legs is impacted to accommodate the splitter islands on those legs.

Performance expectations for Option 6 are shown in Appendix I. As noted, this alternative yields the lowest 2035 PM peak hour volume-to-capacity ratio for all scenarios. At 0.85 this volume-to-capacity ratio is lower than the volume-to-capacity ratio, 0.89, associated with best performing signalized intersection alternative, Option 3. Based on the assumed traffic growth rate in this study, the "life expectancy" of the multilane roundabout alternative is about 35 years if the traffic growth forecasts considered in this study are realized. Implementation of this improvement would allow traffic to operate at levels that are better than existing conditions for the next 35 years.

5.1.7 Intersection Options Summary

The attributes of the intersection improvement options are compared side-by-side in Table 6. (An expanded evaluation matrix in the standard VTrans format is in Appendix M.) As shown, only improvement Option 3, which includes the most extensive intersection widening, and Option 6, the multilane roundabout, add sufficient roadway capacity (and low enough PM peak hour volume-to-capacity ratios) to be considered effective alternatives. For these two alternatives, construction cost estimates were developed and are provided in Appendix J. As shown, at $3.8 million the multilane roundabout is the most expensive but also performs the best with an expected 2033 PM peak hour volume-to-capacity ratio of 0.85. This is accomplished with 24,000 square feet of added pavement but only 1300 square feet of land takings affecting five parcels. The roundabout option is also expected to achieve a reduction in crash rates relative to existing conditions. Option 3 adds approximately the same amount of pavement as Option 6 but 5100 square feet of takings are anticipated impacting 15 different parcels. Operational benefits are not quite as good as those afforded by the multilane roundabout alternative but the expected construction cost is somewhat lower at $3.3 million.

Performance / Impacts	No Build	Option 1: Add WB Left Extend EB Left	Option 2A: Add EB Left to Opt. 1, Widen to West	Option 2B: Add EB Left to Opt. 1, Widen to East	Option 3: Add NB Through to Opt. 2	Option 4: Add NB Through to Opt. 1, Change EB Use	Option 5: Singe Lane Roundabout	Option 6: Dual Lane Roundabout
PM Volume to Capacity Ratio (2033)	1.19	1.17	0.99	0.99	0.89	0.98	1.37	0.85
Added Pavement	None	10,000 SF	20,000 SF	17,000 SF	25,000 SF	14,000 SF	13,000 SF	24,000 SF
ROW Takings								
East Leg (Mtn. View)	None	400 SF	400 SF	400 SF	400 SF	400 SF	400 SF	500 SF
West Leg (Industrial)	None	None	2,300 SF	2,300 SF	2,300 SF	None	None	600 SF
North Leg (VT 2A)	None	100 SF	1,100 SF	500 SF	1,100 SF	1,100 SF	None	None
South Leg (VT 2A)	None	None	None	None	1,300 SF	1,300 SF	None	200 SF
Total SF	None	500 SF	3,800 SF	3,200	5,100 SF	2,800 SF	400 SF	1,300 SF
Number of Parcels Impacted	None	2	12	13	15	7	2	5
Utility Poles to be Moved	None	7	12	13	14	11	7	12
Number of Mature Trees Removed	None	2	3	6	7	3	4	5
Typical Crash Reduction[1]	None	None	None	None	None	None	51%	29%
Total Cost	None	Not Calculated	Not Calculated	Not Calculated	$3.3 Million	Not Calculated	Not Calculated	$3.8 Million

Table 6: Intersection Options Summary

5.2 Segment Alternatives

Three alternative improvement plans were also developed for the VT 2A roadway segment between Mountain View Road and River Cove Road. The existing roadway cross section generally consists of a single travel lane and four-foot wide shoulder in each direction and a 10-foot wide multiuse path on the west side of the roadway. (The path narrows to a six-foot wide sidewalk just north of the intersection with Industrial Avenue.) The improvements first include widening the roadway to the east to provide a two-way center left-turn lane. The second alternative then widens further to the east to provide a sidewalk on the east side of the roadway. The third alternative only adds the east side sidewalk to existing conditions. Each of these plans are described in greater detail below.

The descriptions of the alternative segment treatments consider performance from a traffic flow and safety perspective and consequences from an added pavement and land takings perspective. Traffic operations benefits are more difficult to quantify here as there is very little interruption to traffic flow under existing conditions. As noted in Table 5, calculated delays to through northbound traffic due to left-turns into Sharon and Hillside Drives amount to less than one second per vehicle. Two of the options will reduce these delays but this reduction is not significant with regard to satisfying the overall project Purpose and Need Statement. Two options offered will make the roadway safer. Two options support the Purpose and Need Statement by adding pedestrian accommodations. “Consequences” are also considered by quantifying anticipated roadway construction costs.

5.2.1 Option N1 - Add Two-way Left-turn Lane

Improvements considered for VT 2A under Option N1 are illustrated in cross section view and in plan view in Appendix H. As shown, a third lane, two-way left-turn lane would be added to the roadway by widening the roadway to the east. A widening of approximately 10 feet is assumed. Existing shoulders would be maintained to accommodate bike traffic along the roadway. As shown in the figure the proposed improvements can fit within the available 66 foot roadway right-of-way. However, associated drainage improvements and relocation of drainage swales may extend beyond the public right-of-way requiring alterations on private property. Easements may be required to make necessary drainage improvements. The proposed widening would also impact all utility poles located along the east side of the roadway. In order to relocate the utility lines within the public right-of-way it may be necessary to install curbing along the roadway edge. (With curbing the utility poles can be located closer to the edge of the roadway. Without curbing greater separation is required to establish a clear zone for roadway safety.) The proposed two-way, left-turn lane addition should help smooth traffic flow on this roadway segment as left-turning vehicles will be removed from the VT 2A through traffic streams. Also, motorists making left-turns from intersecting side streets and driveways may experience less delay as the left-turn lane can be used to make a staged left-turn movement. Side Street traffic can first turn left into the left-turn lane and then merge with traffic in the adjacent through lane as the second phase of the left-turn procedure. The Traffic Engineering Handbook (Institute of Transportation Engineers, Washington, D.C. 2009) reports that “providing two-way left-turn lanes on streets without left-turn lanes can significantly reduce crashes”. This proposed treatment is consistent with

plans being developed for VT 2A north of River Cover Road. As such, implementation of this plan would provide a consistent cross section for an extended section of VT 2A. The consistency of the roadway treatment would likely provide further safety benefits.

Appendix I summarizes the impacts associated with construction of Option 1N. As shown, 27,000 square feet of pavement would be added all within the available public right-of-way. Six mature trees would be removed and 14 utility poles would be relocated on this segment. As noted above, utility pole relocation and drainage improvements could have impacts outside of the public right-of-way. A cost breakdown for this option is included in Appendix J. The $2.1 million total cost estimate assumes that curbing and a closed drainage system is installed on the east side of the roadway to minimize drainage and utility pole impacts.

5.2.2 Option N2 - Add Two-way Left-turn Lane and East Side Sidewalk

The second improvement plan considered for VT 2A north of Industrial Avenue included the above two-way, left-turn lane addition and provision of a five-foot wide sidewalk on the east side of the roadway. The sidewalk would be separated from the edge of the traveled way by a five-foot wide greenbelt. As shown in Appendix J, the additional widening would occur on the east side of the roadway so as to not disturb the existing multiuse path located on the west side of the roadway. The two-way left turn lane would provide the same operational and safety benefits noted above. The new sidewalk would serve residential properties located along the east side of the roadway.

Impacts from construction of Option N2 are also noted in Appendix I. As shown, 50,000 square feet of new pavement would be installed for the roadway widening and sidewalk. Since the roadway widening itself brings the edge of pavement very close to the limit of the public right-of-way, the sidewalk addition would occur mostly on private property. Hence, 15,000 square feet of sidewalk would be built on what is now private property impacting 17 parcels. On two of those parcels the outside edge of the sidewalk would shrink driveways to less than 25 feet in length. These driveways would need to be reconstructed, relocated or abandoned. Tree loss would include 11 mature trees, five more than anticipated with just the two-way, left-turn lane addition. Again, 14 utility poles would need to be relocated. In this case the poles would need to be relocated to what is now private property. Provision of the sidewalk adds approximately $0.4 million to the construction cost for Option N1 not including right-of-way costs. As noted for Option N1, the approach to managing roadway drainage can affect construction costs and utility relocations. Similarly, it can influence right-of-way impacts under Option N2. If curbing were installed along the east side of the roadway and a closed drainage system were installed then the sidewalk could be located directly adjacent to the roadway. The proposed five-foot wide green belt could be eliminated lessening the right-of-way and driveway impacts accordingly.

5.2.3 Option N3 - Add East Side Sidewalk

The third improvement plan considered for VT 2A north of Industrial Avenue is a scaled back version of Option N2. The proposed two-way, left-turn lane is removed from the plan and only the five feet wide sidewalk on the east side of the roadway is

added. The new sidewalk would serve residential properties located along the east side of the roadway.

This plan does not provide the traffic operations and safety benefits associated with the other alternatives but does provide pedestrian accommodations on the east side of the roadway. With this plan only 19,000 square feet of new pavement is added and the new sidewalk, with a five-foot wide greenbelt, can be located fully within the available roadway right-of-way. As noted in Appendix I, five mature trees would be lost and 14 utility poles would need to be relocated. If curbing were provided and the sidewalk were constructed immediately adjacent to the roadway some utility pole relocation may be avoided. The estimated construction cost for the sidewalk with the five-foot greenbelt and pole relocations is approximately $0.6 million.

5.2.3 Roadway Segment Options Summary

The attributes of the roadway segment improvement options are compared side-by-side in Table 7. (An expanded evaluation matrix in the standard VTrans format is in Appendix M.) As shown, Option N3, adding just and east side sidewalk to VT 2A is the least expensive alternative at $600,000. While this improvement benefits pedestrian mobility it offers no benefit to vehicular traffic flow and results in a roadway cross section that is inconsistent with the treatment proposed for VT 2A north of this roadway segment. Options N1 and N2 offer a consistent roadway cross section, both include a three-lane section, but Option N2 adds an east side sidewalk with significant added impacts in terms of right-of-way and new pavement. The estimated cost of Option N2 is $2.5 million compared to $2.1 million for Option N1.

The figures presented in Table 7 assume that a closed drainage system will be provided along VT 2A to convey and treat the additional stormwater runoff associated with the proposed improvements. This design assumption affects the construction cost estimate, provided in Appendix J, and estimate right-of-way impacts. If the “country drainage” system remains in place and is deemed adequate during the project permitting phase to treat runoff then, there could be substantial construction cost savings. However, the right-of-way impacts of moving the utility poles out of the clear zone without curbing provided along the roadway may be more costly to address than installing curbing and drainage treatment systems.

		Option N1	Option N2	Option N3
Performance / Impacts	**No Build**	**3-Lane Cross Section**	**3-Lane Cross Section + Sidewalk**	**Existing + Sidewalk**
"Bike Lanes"	On Street	On Street	On Street	On Street
Refuge Islands	No	Potential	Potential	No
New Pavement	None	27,000 SF	50,000 SF	19,000 SF
ROW Takings-Area	None	None	15,000 SF	None
ROW Takings-Parcels	None	None	17 Parcels	None
< 25 Feet of Driveway	None	None	2 Parcels	None
Tree Loss	None	6 Trees	11 Trees	5 Trees
Utility Poles	None	14	14	14
Construction Cost	None	$2.1 million	$2.5 million	$0.6 million

Table 7: Roadway Segment Options Summary

5.3 Pedestrian Crossings/Transit Access

As noted above, the CCTA operates bus service along VT 2A and several bus stops are located on VT 2A in the project study area. These locations are noted on the plans for Alternatives N1, N2, and N3 in Appendix H. Some transit riders accessing these bus stops must cross VT 2A. The proposed two-way, left-turn addition on VT 2A creates opportunities to better serve these transit riders and other pedestrians crossing VT 2A. Figure 10 illustrates how sections of the suggested two-way, left-turn lane could be treated as designated left-turn lanes at cross streets. Opposite the dedicated left-turn lanes, raised, center median islands can be installed with a pedestrian cut-through. The center median can function as a refuge island allowing pedestrians to make a staged crossing of the roadway. Also, pedestrian crossing signs would be installed at these locations. Figure 11 shows a similar treatment with the addition of pedestrian actuated rectangular rapid flashing beacons to accentuate the crossing location. These crossings can be installed with the flashing beacons for approximately $10,000 per location.

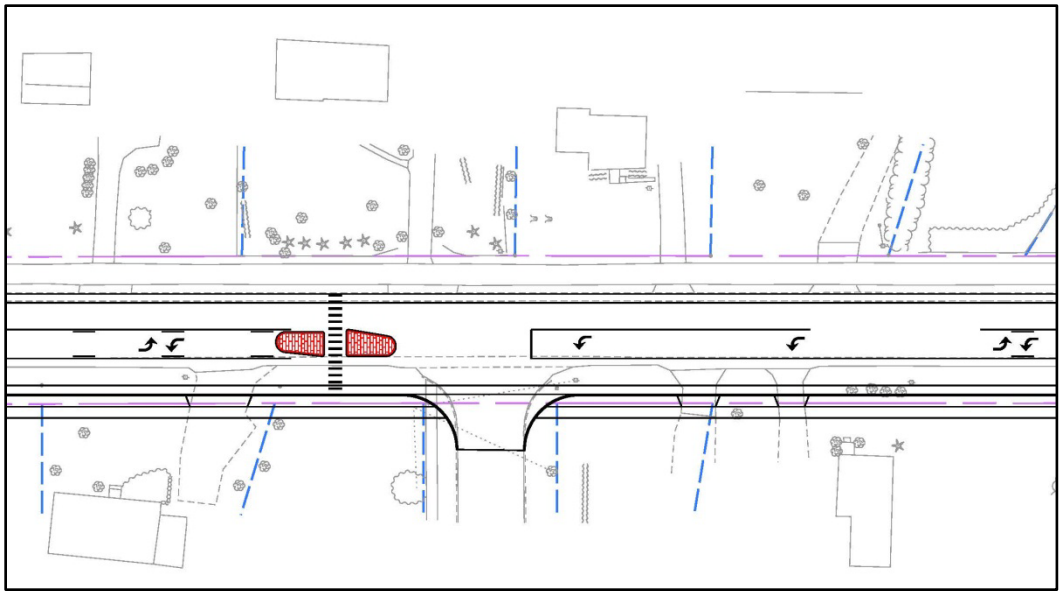

Figure 10: Two-Way, Left-Turn-Lane withPedestrian RefugeIisland

Figure 11: Example of Crosswalk Highlighted with Rapid Flashing Beacons and Signage

6.0 Recommendations

The alternative improvement plans for the study area were presented to Town officials and residents at a series of public meetings. Copies of meeting minutes and written comments received in response to presentations made at the meetings are included in Appendices K and L. At the conclusion of the public review process the Williston Selectboard voted to advance intersection *Option 3-Add Westbound Left-turn Lane, Eastbound Left-turn Lane and Northbound Through Lane* and segment *Option N1-Add Two-way Left-turn Lane*. In selecting intersection Option 3 over *Option 6-Mutlilane Roundabout*, the Selectboard noted concerns regarding limited public acceptance of roundabouts in Williston. Of the signalized intersection alternatives, Option 3 provides the most improvement in traffic operations and likewise has the greatest longevity. *Option N1-Add Two-way, Left-turn Lane* was supported for the roadway segment treatment as it would create a consistent and safer roadway cross section along VT 2A and avoid the significant right-of-way issues associated with the addition of a sidewalk to the plan as proposed in Option N2. The Selectboard recommendations were presented to and accepted by the CIRC Alternatives Task Force. The CCRPC and the Town of Williston will work with VTrans to secure funding for the design of the recommended improvement plan. Table 8 provides an overall description and implementation budget for the recommended alternatives.

Proposal:	Implement Intersection Option 3-*Add Westbound Left-turn Lane, Eastbound Left-turn Lane and Northbound Through Lane* and Segment Option N1-*Add Two-way Left-turn Lane*	
Operational Benefits	VT 2A/Industrial Avenue/Mountain View Road Intersection Operations Improve from Level of Service F to Level of Service D for 2033 PM Peak Hour Conditions	
Environmental Impacts	9 Mature Trees Removed	
Construction Impacts	50,000 square feet of Additional Pavement 28 Utility Poles Relocated	
Right of Way Impacts	Permanent Land takings from 15 Parcels 5,200 square feet of takings to edge of pavement (Additional takings would be warranted to accommodate utilities, snow storage, etc, in the public right-of-way.)	
Permits	Wetlands: Self Verification Form Class III wetlands are present on site, impacts likely less than 3,000 square feet Stormwater: Treatment: Permit Likely required Allen Brook watershed: impaired waters Historical: Section 106 Historical properties and mature trees present Archaeological: Highly sensitive in undisturbed areas Phase IB required if work is performed outside of previously disturbed areas NEPA Documents: Categorical Exclusion	
Cost		
	Construction	$4,000,000
	Preliminary Engineering (15%)	$600,000
	Construction Engineering (10%)	$400,000
	Municipal Project Manager (7%)	$280,000
	Legal Fees (estimate)	$30,000
	ROW Fees	Unknown
Total		**$5,310,000**

Table 8: Summary of Recommended Alternatives