RSG INC.
TRANSPORTATION

North Williston Road and Mountain View Road Intersection Study

Williston, VT

FINAL
July 2012

DATA ■ ANALYSIS ■ SOLUTIONS

Prepared for:

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Introduction

This study has been commissioned by the Chittenden County Regional Planning Commission (CCRPC) for the Town of Williston. The intersection of North Williston Road and Mountain View Road has been identified by the Town of Williston in their 2011-2016 Comprehensive Plan (Draft) as a high priority for improvement to address congestion at peak travel times. In addition, recent vehicle crash records reflect a high occurrence of crashes compared to other similar intersections in Vermont.

A few notable factors contribute to traffic at this intersection:

- The IBM campus to the northwest is a significant trip generator with some 5,300 employees[1], as well as recent leasing of 112,000 square feet of office space on the Williston sub-campus to General Dynamics.
- The North Williston Road bridge over the Winooski River provides access to Essex, Jericho and points to the northeast, connecting these bedroom communities with places of employment and shopping in Williston and South Burlington. Accordingly, this section of North Williston Road is sometimes referred to as the "de facto" Circ Highway.
- The Fontaine sand pit in North Williston generates dump truck traffic with varying intensities depending on the season and degree of economic activity.
- Events at the Catamount Family Outdoor Center on Governor Chittenden Road also influence vehicle, bicycle and pedestrian traffic at this intersection, particularly Wednesday evening bike races which overlap with the evening commuter hour.

Accordingly, this study is intended to investigate potential deficiencies and alternatives for improvement, as well as the costs, impacts, safety, performance and benefits of each. The following tasks outline the necessary steps to complete this study, and include appropriate public participation, notification and confirmation from the Selectboard.

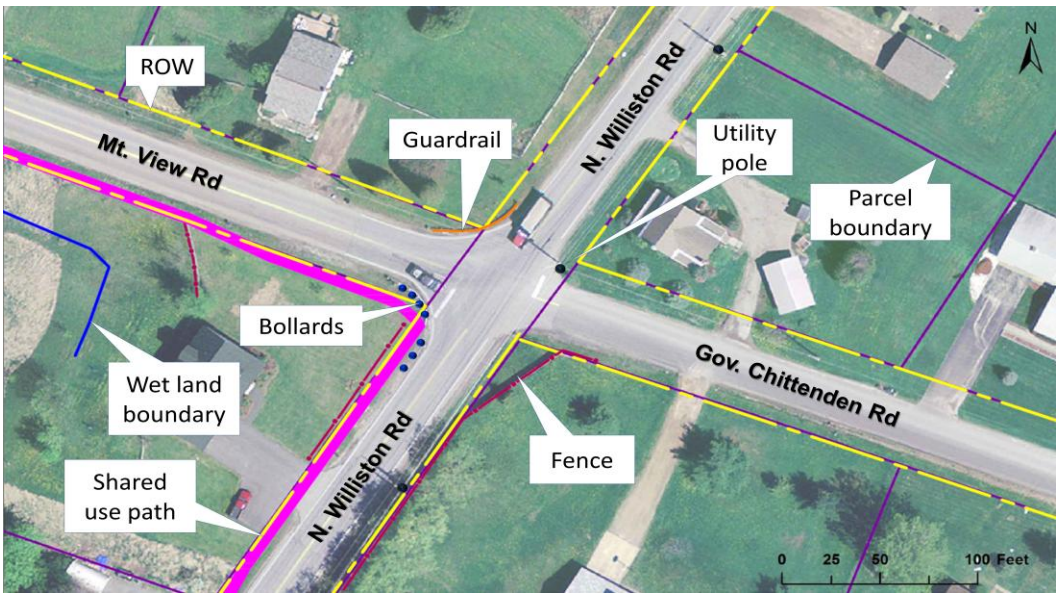
1. Compile existing conditions and background information,
2. Analyze existing conditions,
3. Solicit local concerns,
4. Analyze and develop alternatives, and
5. Determine a preferred alternative.

Existing Conditions

The North Williston Road and Mountain View Road intersection is currently a two-way stop-controlled intersection with stop signs on Mountain View Road and Governor Chittenden Road (see Figure 1). It has one lane in each direction. The speed limit is 35 mph on North Williston Road and 40 mph on Mountain View Road.

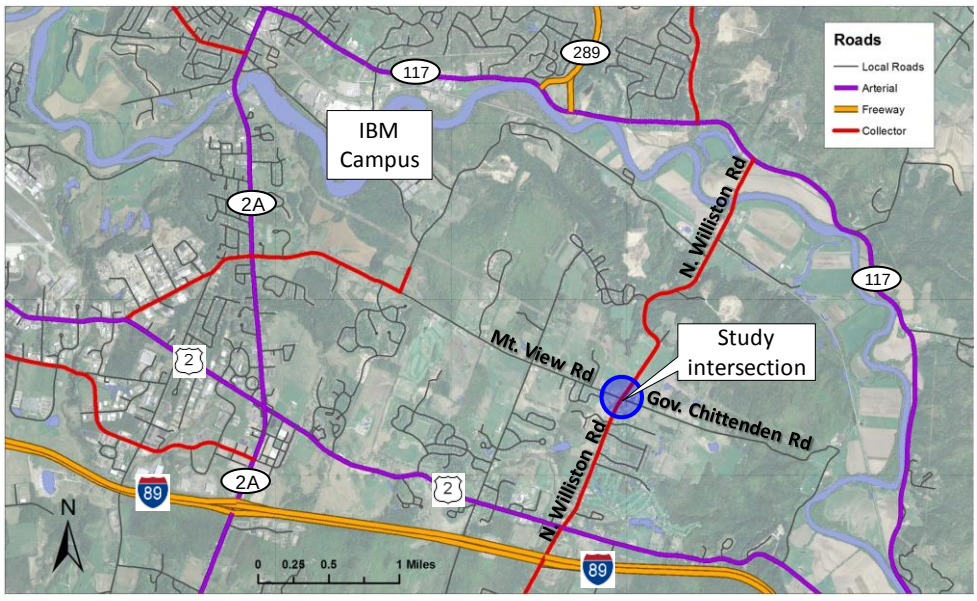
[1] VT Department of Labor, 1st quarter 2009. IBM employed as many as 8,000 employees in the past

Figure 1: Study Intersection



North Williston Road is defined by VTrans (2009) as a Federal Aid Urban Route (FAU) and is classified as an urban collector road; while Mountain View Road and Governor Chittenden Road are local roads (see Figure 2).

Figure 2: Project Area Road Network



Bicycle and Pedestrian Considerations

New shared use paths have been built on the southern and western quadrants of the study intersection to accommodate bicyclists and pedestrians (see Figure 3). The Old Stage Road path connection to the

Williston Bike Path is scheduled for construction in 2012. Existing road shoulders in this area are narrower than the state standard (minimum recommended is 3 feet)[2].

Figure 3: Shared Use Paths and Wetlands in the Study Area

Crash History

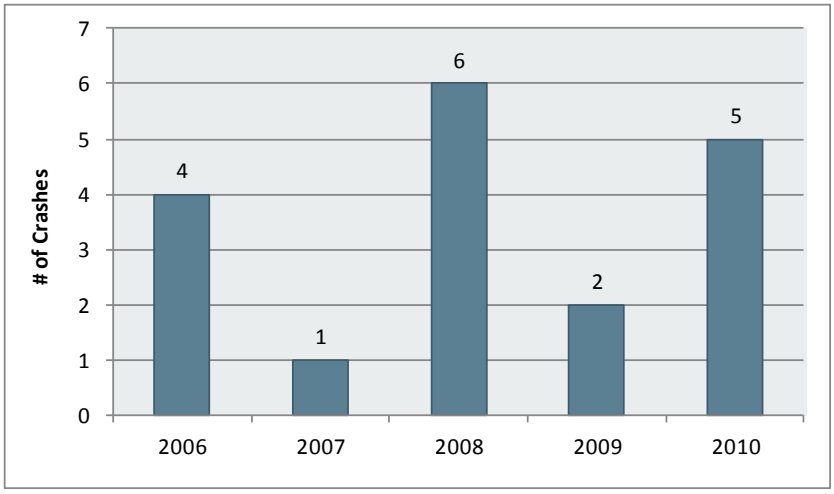
Crash histories were collected from VTrans (2006-2010) for the study intersection. VTrans maintains a statewide database of all reported crashes along all state highways and federal aid road segments.

A reportable crash is a collision with at least one of the following results caused by the event:

- property damage exceeding $1,000
- personal injury
- fatality
-
- Figure 4 shows the total number of reported crashes that occurred on North Williston Road (between mile markers 0.94 and 1.06) and on the Mountain View Road portion of the study intersection, for each year from 2006 to 2010.

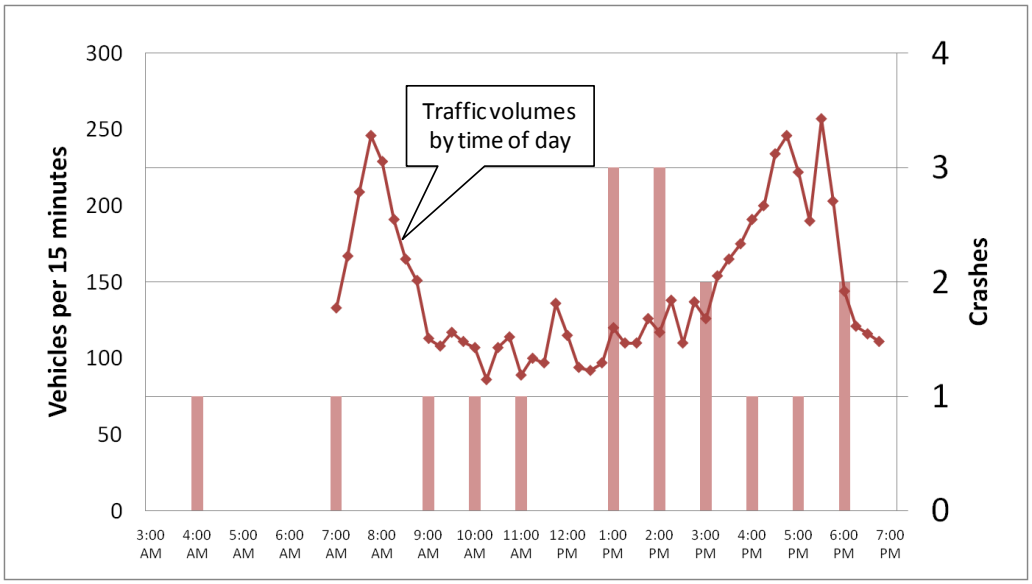
Figure 4: Crash History by Year

[2] VT State Standards 10/97, local or collector roads, AADT >2000 vehicles per day



The total number of crashes varies from 1 to 6 crashes per year. Figure 5 shows the time of day crashes and the corresponding traffic conditions, with the highest concentration of crashes at the study intersection occurring during off peak hours.

Figure 5: Crashes by Time of Day



High Crash Locations

In order to be classified as a High Crash Location (HCL), an intersection or road section (0.3 mile section) must meet the following two conditions:

1. It must have at least 5 crashes over a 5-year period
2. The Actual Crash Rate must exceed the Critical Crash Rate for a similar facility.

Resource Systems Group conducted an HCL analysis using the latest available data and concluded the study intersection is a HCL Intersection, as shown in Table 1 below. It shows that the average rate of observed crashes at the study intersection is much higher than the statewide average crash rate for similar intersections of major collectors and non-federal aid collectors. The actual to critical ratio for establishing HCLs is more than 1 indicating the intersection qualifies as a HCL Intersection.

Table 1: High Crash Location Intersection Analysis

INTERSECTION NAME	**N. Williston Rd. & Mt. View Rd.**
Number of Years	5
Total Crashes	18
ADT - EB Approach	4600
ADT - WB Approach	540
ADT - NB Approach	4800
ADT - SB Approach	6000
Statewide Average Crash Rate for Similar Intersections	0.498
Actual Observed Crash Rate (crashes per million vehicles)	1.238
Statewide Critical Rate for similar intersections	0.941
Actual/Critical Ratio	**1.315**
High Crash Location	**Yes**

Inclement weather does not appear to be a significant factor in crashes at the study intersection since over 80% of the crashes occurred when it was clear or cloudy. There were no fatal crashes reported, and only 1 crash resulted in personal injuries (see Table 2).

Table 2: Severity and Weather Related Crashes

	# of crashes	% of crashes
Inclement weather	3	17%
Injury crash	1	6%
Fatalities	0	0%

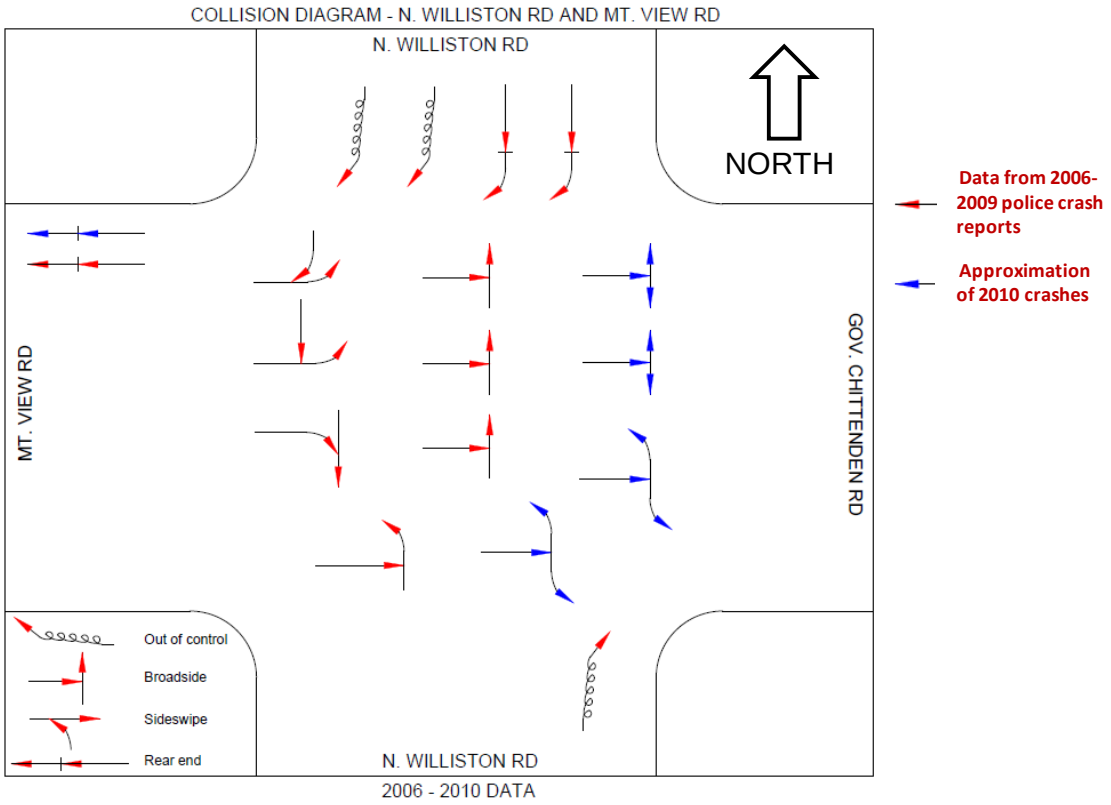
Half of the crashes at the study intersection were broadside collisions, while rear end, single vehicle out of control and sideswipe collisions composited another half of total crashes (see Table 3).

Table 3: Type of Crashes

	# of crashes	% of crashes
Broadside	9	50%
Rear end	4	22%
Single vehicle Out of Control	3	17%
Sideswipe	2	11%
Total	18	100%

Detailed crash reports were obtained from VTrans Traffic Highway Research unit in order to gain more understanding of the nature and trends of crashes. Figure 6 below illustrates details of all the crashes occurred at the study intersection from 2006 to 2010. Of particular note is that the crossing traffic resulted in the greatest number of crashes, and 11 of 18 crashes involved the Mountain View Road eastbound traffic.

Figure 6: Collision Diagram for Crashes from 2006 to 2010



While several factors contribute to the crashes, failure to yield right of way and inattention account for almost 70% of crashes at the study intersection (see Table 4).

Table 4: Contributing Factors of Crashes

	# of crashes	% of crashes
Failed to yield right of way	7	39%
Inattention	5	28%
Followed too closely	2	11%
Failure to keep in proper lane	2	11%
Distracted	2	11%
Visibility obstructed	2	11%
Other improper action	1	6%
Fatigued/asleep	1	6%
Unknown	1	6%

Note: some crashes have more than one contributing factor.

In summary, there are a higher number of crashes at this location than would be expected at similar intersections. The frequency of broadside crash types is significant, and failure to yield and inattention are common contributing factors.

Traffic Volumes and Adjustments

The traffic turning movement counts were provided by the CCRPC for the intersection of North Williston Road and Mountain View Road. The analysis was done for both AM and PM peak hours in 2011 and 2021. The AM and PM peak hour traffic volumes from these counts were adjusted to represent the design hour volume (DHV) in 2011 using the following adjustment factors:

1. A design hour adjustment factor is based on VTrans Design Hourly Volume (DHV) Policy for urban streets. The DHV adjustments used Average Annual Daily Traffic counts (AADTs) from two CCRPC short-term counters in Williston in order to obtain the seasonal adjustment:
    a. WILL03 located on North Williston Road just north of Golf Course Road, and
    b. WILL54 located on Mountain View Road between Jensen Road and Pleasant Acres Drive.

The Urban Area "k" factor of 10.6% was applied to the AADTs to determine the design hour volume. The DHV design hour adjustment calculation resulted in a decrease of the turning movement volumes at the study intersection by 9% and 4%, respectively (see Figure 7 and appendix).

2. The future growth factor is typically based on the expected growth rate from the *VTrans Continuous Traffic Counter Grouping Study and Regression Analysis*[3] which expects little or no growth between 2011 and 2021 in urban areas. To be conservative, we used the 20 year growth rate expected in the area of counter P6D061 on US2, just east of Industrial Avenue in Williston, which increases volumes by 3% between 2011 and 2021.

The AM peak hour is from 7:30 AM to 8:30 AM and the PM peak hour is from 4:45 PM to 5:45 PM.

[3] VTrans - http://www.aot.state.vt.us/Planning/Documents/TrafResearch/Publications/Redbook2010.pdf

Figure 7: Adjusted 2011 AM and PM Traffic Turning Movements

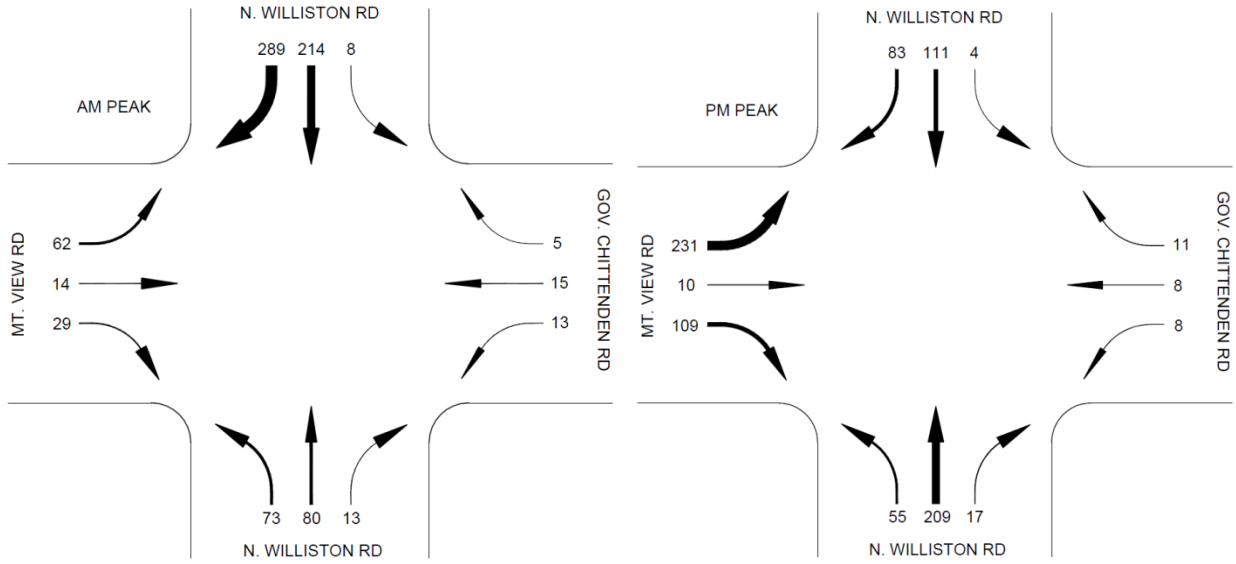
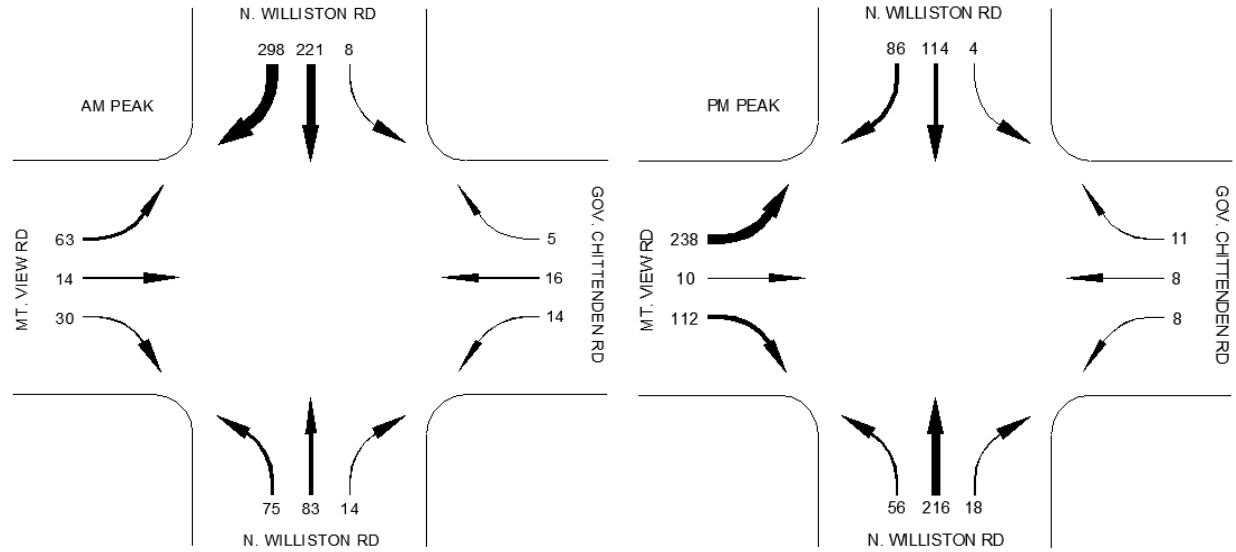


Figure 8: Adjusted 2021 AM and PM Traffic Turning Movements



The turning movement counts show that the heaviest traffic movements in the AM peak hour are southbound right and through traffic. In the PM peak hour, the dominant flow of traffic is from the Mountain View Road (primarily left turns) and the North Williston Road northbound through movements.

Traffic Performance Analysis

Level-of-Service (LOS) is a qualitative measure describing the operating conditions as perceived by motorists driving in a traffic stream. The 2000 Highway Capacity Manual (HCM) defines six grades to

describe the level of service at an intersection. Level-of-service is based on the average delay per vehicle. Table 5 shows the various level-of-service grades, qualitative descriptions, and quantitative definitions for unsignalized intersections.

Table 5: LOS Criteria for Intersections

Unsignalized Intersection LOS Criteria		
LOS	Characteristics	Average Delay (sec)
A	Little or no delay	≤ 10.0
B	Short delays	10.1-15.0
C	Average delays	15.1-25.0
D	Long delays	25.1-35.0
E	Very long delays	35.1-50.0
F	Extreme delays	> 50.0

According to HCM procedures, an overall LOS cannot be calculated for two-way stop-controlled intersections because not all movements experience delay. In signalized and all-way stop-controlled intersections, all movements experience delay and an overall LOS can be calculated.

The VTrans policy on LOS[4] states that:

> "It is the Agency's policy to design its highways and to require others accessing its facilities to effect improvements that will maintain a LOS "C" for the prescribed design period. In interpreting this policy, LOS refers to the overall LOS for the particular facility as defined in the latest HCM."

The level of service policy provides further guidance for minor stop-controlled intersections:

> "For two-way stop-controlled intersections, the HCM does not define a procedure for obtaining an overall LOS or a LOS for major street approaches. Therefore, VTrans LOS Policy for two-way stop-controlled intersections is to maintain a LOS "D," or better, for side roads with volumes exceeding 100 vehicles/hour for a single lane approach, or 150 vehicles/hour for a two lane approach. No LOS criteria are in effect for volumes less than these.
>
> VTrans' main objective at unsignalized two-way stop-controlled intersections is to minimize potential consequences when vehicle operators exit stop-controlled side streets by accepting unsafe gaps in the major street through traffic."

The 2000 Highway Capacity Manual congestion reports within Synchro (v7), a traffic analysis software package from Trafficware, were used to assess congestion at the study intersection.

[4] Vermont Agency of Transportation (VTrans) Highway Design "Level of Service" Policy, 31 May 2007.

Unsignalized intersections experience delay only for vehicle movements that conflict with other movements. Side street stops and left turns are often the only movements that experience delay at unsignalized intersections.

Table 6 presents the LOS results during the weekday AM and PM peak hours, respectively. Note that these results reflect the use of a peak hour factor (PHF), which takes into account the highest 15 minutes of traffic volumes, a somewhat conservative approach that would not be necessary for a typical traffic study, but which more closely reproduces the public's perception of congestion at this location.

In addition to LOS and delay, VTrans has recommended using Volume to Capacity (V/C) ratios when analyzing capacity at stop-controlled intersections. A V/C ratio less than 1.0 indicates that adequate capacity is available on a specific approach, even if the LOS is F. A ratio of 1.0 (or higher) indicates the facility is at (or over) capacity for the study period. 95th percentile queue lengths (given in feet) are also shown for each movement at the study intersection.

Table 6: Existing Condition - AM Peak Hour LOS Results

N. Williston Dr/Mt. View Rd	2011 AM Peak Hour				2021 AM Peak Hour			
	LOS	Delay (s)	Q. Length (ft)	v/c	LOS	Delay (s)	Q. Length (ft)	v/c
Overall	A	4	-	-	A	4	-	-
EB LT/Thru/RT, Mt. View Rd	C	20	34	0.32	C	21	37	0.34
WB LT/Thru/RT, Gov. Chittenden Rd	C	18	10	0.12	C	19	11	0.13
NB LT/Thru/RT, N. Williston Rd	A	4	7	0.08	A	4	7	0.09
SB LT/Thru/RT, N. Williston Rd	A	0	0	0.01	A	0	0	0.01

Table 7: Existing Condition - PM Peak Hour LOS Results

N. Williston Dr/Mt. View Rd	2011 PM Peak Hour				2021 PM Peak Hour			
	LOS	Delay (s)	Q. Length (ft)	v/c	LOS	Delay (s)	Q. Length (ft)	v/c
Overall	C	15	-	-	C	17	-	-
EB LT/Thru/RT, Mt. View Rd	E	35	185	0.80	E	40	208	0.84
WB LT/Thru/RT, Gov. Chittenden Rd	B	13	5	0.07	B	14	5	0.07
NB LT/Thru/RT, N. Williston Rd	A	2	4	0.05	A	2	4	0.05
SB LT/Thru/RT, N. Williston Rd	A	0	0	0.00	A	0	0	0.00

The results show all approaches at the study intersection are operating under acceptable conditions in the AM peak hour. However, the Mountain View Road approach is operating under LOS of E in the PM peak hour.

Warrant Analysis

RSG analyzed the MUTCD warrant for adding a second lane on Mountain View Road, converting the study intersection to all-way stop control, and a traffic signal that may improve the traffic performance at the North Williston Road and Mountain View Road intersection. In order to perform the warrant analysis for these alternatives, traffic volumes need to be adjusted to the average conditions. Through

communicating with Maureen Carr at VTrans, we used the following factors to adjust the 12-hour turning movement count from July 9th, 2009 to the 2011 average conditions:

1. The Monthly Average Weekday Daily Traffic (MAWDT) to the Annual Average Weekday Daily Traffic (AAWDT) adjustment factor (0.95) for the VTrans continuous traffic counter of P6D129, located on VT2A just north of Marshall Avenue, was used to adjust the July 2009 condition to the average annual 2009 condition.
2. The growth factor from 2009 to 2011 was calculated as 2011 AADT/2009 AADT. The 2011 AADT was published by the CCRPC for the station WILL03, located on North Williston Road just north of Golf Course Road. The 2009 AADT was from VTrans short-term counter S6D345, located on North Williston Road 0.5 mile south of Mountain View Road. The 2009 to 2011 annual growth factor increases the volumes of the study intersection by 7%. Please note the 2011 AADT from the CCRPC is based on 2010 adjustment factors, so the value could change a bit if the 2011 monthly factors are different from 2010. But they don't tend to vary too much from year to year.

In summary, adding a second lane on Mountain View Road is warranted. All-way stop and a traffic signal are not warranted. The analysis details are in the appendix.

Local Concerns

During initial stages of the project, input was gathered from the public and the project Steering Committee. Some suggestions for potential alternatives that had come about at that time included a roundabout, flashing beacon, all-way stop, a second lane on Mountain View Road or a traffic signal.

On Sept 7, 2011 a meeting was held to review existing conditions and gain public input at to the perceived problems and potential solutions. See meeting notes in appendix. A modified list of potential alternatives was subsequently developed for analysis and review by the public and Selectboard.

Based on public and Steering Committee input, six alternatives were selected for further, detailed investigation:

1. No Build
2. Switch Stop Sign Orientation
3. All-Way Stop
4. Second Lane on Mountain View Road approach
5. Single Lane Roundabout
6. Traffic Calming and Safety Measures
    a. Transverse rumble strips
    b. Pavement marking and sign upgrades
    c. Speed table / Raised intersection
    d. Radar Speed feedback signs
7. Flashing Warning Beacons

The specific issues to address were clearly identified as follow:

- Speeding – the speed limit on North Williston Road is 35 mph, but the measured 85th percentile speed is 42-43 mph
- Safety – there have been 18 crashes in 5 years, significantly exceeding the statewide crash rate for similar facilities, with 61% involve multi-vehicle / turning traffic
- Sight lines – are technically adequate, but cluttered with various items like fence posts, power poles, and bollards, particularly when speeds exceed the speed limit.
- Bike and Pedestrian accommodations:
    - New paths on south and west quadrant have created and attracted demand
    - Old Stage Rodd path connection is soon to be completed, further enticing use
    - Catamount Family Center events are significant at many times of the year
- Narrow Shoulders provide little to no room for walkers or bikers, which feel further vulnerable at the busy intersection. State standards suggest 3 feet minimum shoulder width.
- Property impacts & Cost
- Congestion – is considered moderate, and for short periods (15-30 minutes), this is secondary to the preceding issues.

Alternative Investigation

Description of Alternatives

Alternative 1: No Build

The no build scenario assumes that no changes would be made to the study intersection. None of the identified issues would be addressed in this case. Any future increase in traffic would likely exacerbate these issues. The existing condition is shown in Figure 1.

Alternative 2: Rearrange Stop Sign Orientation

This alternative considers switching the existing stop signs on Mountain View Road and Governor Chittenden Road to the North Williston Road northbound and southbound approaches.

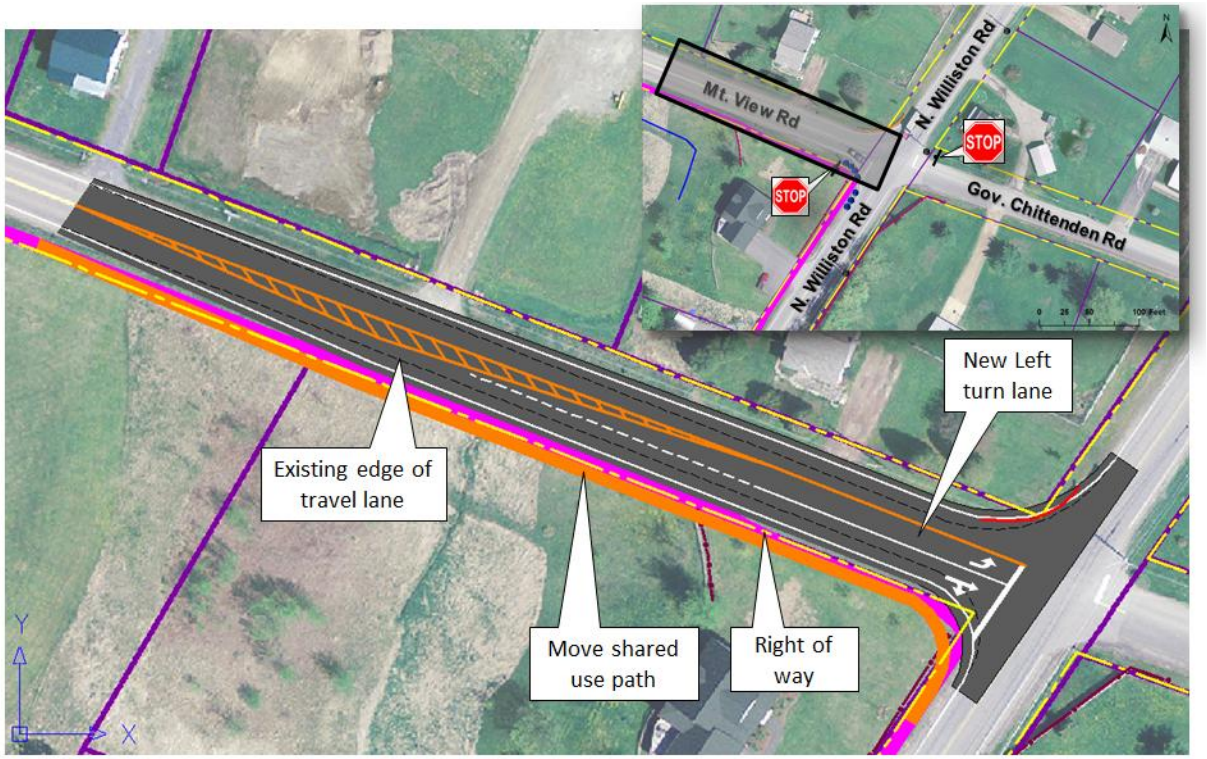
Alternative 3: All-Way Stop

This alternative seeks to convert the existing two-way stop-controlled intersection to an all-way stop-controlled intersection, adding stop signs to the North Williston Road approaches.

Alternative 4: Second Lane on Mountain View Road

This alternative widens Mountain View Road to a 2-lane approach, to include an exclusive left-turn lane, and a through-right turn lane. The intersection would remain stop-controlled on Mountain View Road and Governor Chittenden Road only. This new intersection configuration is shown in Figure 9.

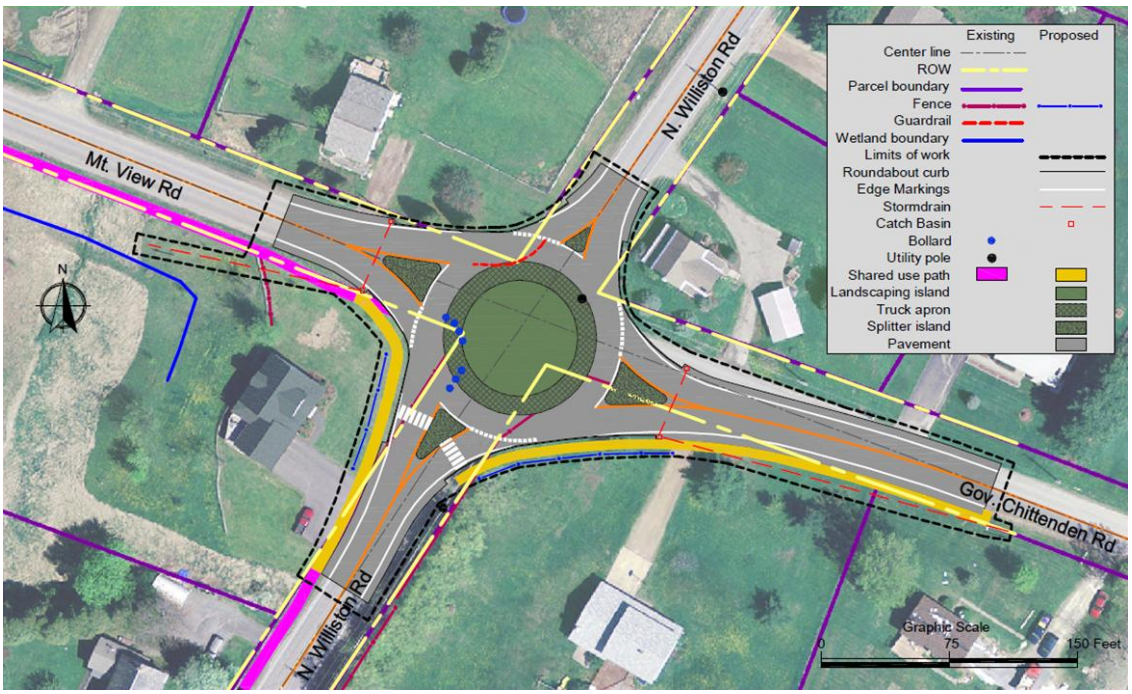
Figure 9: Additional Lane on Mountain View Road



Alternative 5: Single Lane Roundabout

A modern roundabout is a circular roadway, requiring a yield condition on all approaches, giving circulating traffic the right of way (Figure 15). Roundabouts are proven to provide better safety while maximizing traffic performance and efficiency, compared to other 4-way intersection control types, including 2-way stop control such as the project intersection. Figure 10 provides an approximate layout for a potential roundabout.

Figure 10: Potential Roundabout Layout



Alternative 6: Traffic Calming and Safety Measures

This alternative proposes a series of traffic calming measures to improve traffic operation and safety at the study intersection, including;

a. Transverse Rumble Strips

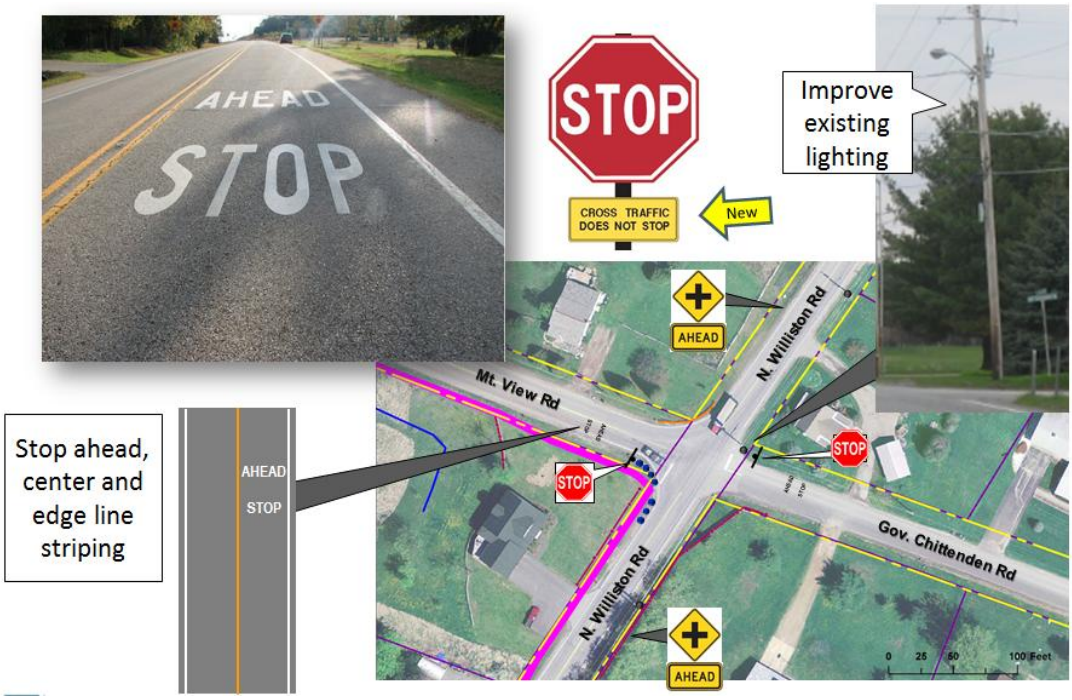
Transverse rumble strips have been shown in certain situations to have a slowing effect on vehicles, and provide a physical warning of an approaching hazard. An example installation is shown below.

Figure 11: Example of Transverse Rumble Strips

b. *Upgrade Signs, Pavement Markings and Lighting*

Better "signs and lines" are often the first form of treatment considered for increasing safety at certain locations as they are cost effective and can be implemented relatively quickly. Relevant examples are shown below. Along with lighting, these provide better visibility of critical features.

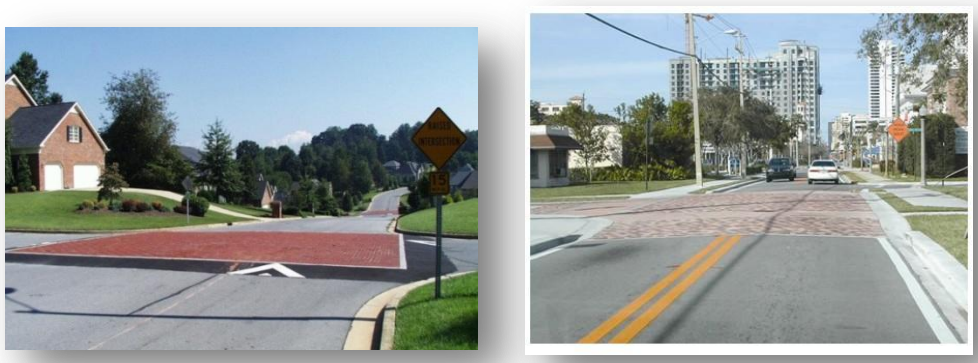
Figure 12: Examples of New Signs, Pavement Markings and Lighting



c. *Raised Intersection or Speed Table*

A raised intersection which refers to a roadway intersection entirely elevated to the sidewalk level. It is designed with ramps on all approaches and often includes decorative surface materials on the flat raised section (Figure 13). A raised intersection provides increased visibility of the critical turning and crossing area.

Figure 13: Examples of Raised Intersections



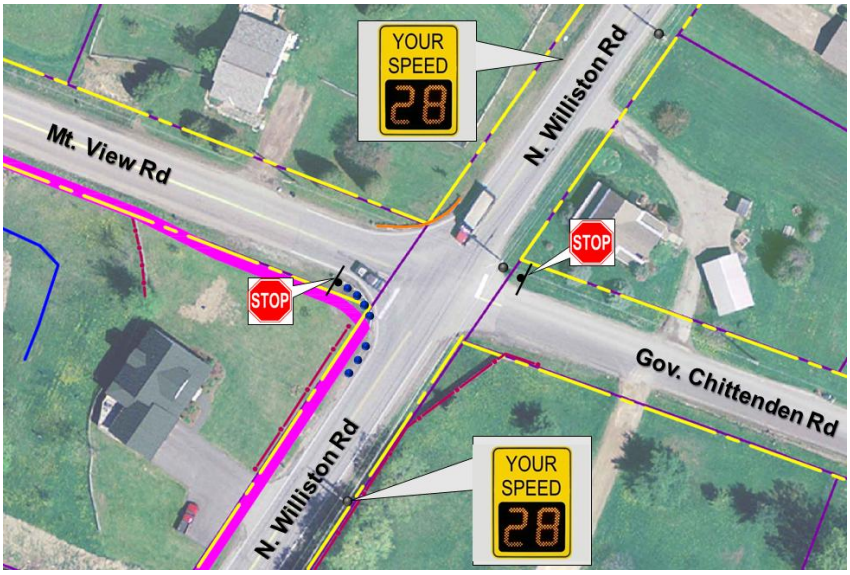
Speed tables on the North Williston Road northbound and southbound approaches would provide a reason for all cars to slow on approach to the intersection. A typical speed table is 3 inches high and 22 feet along the direction of travel, including 6 feet ramps at both ends (Figure 14).

Figure 14: Potential Speed Table Location and Example

d. Radar Speed Feedback Signs

Radar Speed feedback signs detect approaching vehicles speeds and display this for the driver, alerting them when the speed limit or some upper threshold is exceeded. Potential locations are shown in Figure 15.

Figure 15: Possible Placement of Radar Speed Feedback Signs



e. *Raised Median Islands*

Median islands provide guidance to traffic, keeping cars in or along a desired path. They provide a visual queue to the intersection, and can provide a refuge for crossing pedestrians (if wide enough and accompanied by vertical curbs). Examples of median islands at intersections are shown in Figure 16 below.

Figure 16: Examples of Raised Medians

Alternative 7: Warning Beacons

Warning beacons has several potential applications: overhead flashing, advance warning, and stop sign beacons. Several examples are depicted in Figure 17.

Figure 17: Examples of Warning Beacons

Evaluation of Alternatives[5]

Several alternatives have negative effects that

Rearrange Stop Sign Orientation

The perceived benefit would be to stop traffic on North Williston Road, thereby impacting vehicle speed. A significant and likely unacceptable secondary impact would be that many drivers, particularly at first would be confused by this situation as the less busy sideline street is the typical place for the stop condition. Therefore this alternative is not recommended as unexpected or confusing situations are often times hazardous as well.

All-Way Stop

By converting the study intersection to an all-way stop condition; all approaches can share the capacity more evenly. It may reduce right angle crashes, but may increase rear end collisions. It can reduce

[5] Traffic performance for alternatives 1, 5, and 6 were analyzed in Synchro 8. Alternative 2a (Roundabout) was analyzed in SIDRA (v5, by Akcelik & Associates).

delays at the eastbound and westbound approaches, but could also add delays to the northbound and southbound approaches (see Tables 9 & 10).

Adding a Turn Lane on Mountain View

This alternative can slightly reduce congestion on Mountain View Road due to the increased capacity (see Tables 9 & 10).

Single Lane Roundabout

Converting the study intersection to a roundabout can reduce eastbound and westbound approach delays and increase northbound and southbound approach delays (see Tables 9 & 10). It would likely reduce crashes and crash severity significantly.

Traffic Calming and Safety Measures

Transverse Rumble Strips

Transverse rumble strips have been shown to have an effect on speed reduction, but not safety[6]. In addition they have impacts to bicyclists, which are frequent users to this area. Other considerations include driver "surprise" and noise effects.

Upgrade Signs, Pavement Markings and Lighting

These features are intended to increase prominence and visibility to the intersection, control devices (stop signs) and lanes. This is often the first line of defense for high crash locations due to affordability and ability to be done quickly.

Raised Intersection or Speed Table

These features have been shown to effect speed and safety in a positive manner.[7] Much of the safety effect is attributable to reducing traffic volume through diversion effects. They are not recommended on heavily traveled routes such as North Williston Road, or routes with significant truck traffic.

Radar Speed Feedback Signs

Radar speed feedback signs (a subset of *dynamic* signs) are shown to have a significant effect on speed when installed. The effect however is much diminished over time, if they are not reinforced regularly with enforcement.[8]

Raised Median Islands (& Reduced Lane Width)

Reduced lane width and median splitter islands, in combination, are shown to reduce speeds and increase safety. Vertical curbs require a lane setback and warning signs at either ends. Low sloped edging to the islands are more plow friendly and can have much the same effect.

[6] Guidelines for Selection of Speed Reduction Treatments at High Speed Intersections, NCHRP 613
[7] Ibid.
[8] Evaluation of Gateway and Low-Cost Traffic-Calming Treatments for Major Routes in Small, Rural Communities, IHRB TR523

Flashing Beacon

Beacons have been shown to improve safety in general[9]. MUTCD guidance notes they are appropriate at known hazards, noting that it does not directly address the hazard or deficiency. Beacons on stop signs are effective for addressing noncompliance of the stop sign, but don't address the uncontrolled approach (North Williston Road). An advance warning beacon on the uncontrolled approach would be directed at the approach(es) shown to have excessive speeds.

The expected impacts to speed and safety from each alternative have been summarized in Table 8 below. A summary of all impacts and cost are presented in Table 11.

Table 8: Summary of Expected Speed and Safety Effects

Alternative		Volume or Crash Warranted?	Speed Effects	Safety Effects
1	No Build	-	N	18 crashes in the last five years
2	Rearrange 2-way Stop	**Not Recommended on (unexpected) Major Approaches**		
3	All-way Stop	N	N	1. Encourage **disobedience** to the stop sign. 2. **Decreased** pedectrian safety. 3. Particularly **dangerous** where vehicle speeds through the stop sign are greater than 10 mph.
4	2nd Lane on Mt. View Rd.	Y	N	No safety benefit reported.
5	h. Single-Lane Roundabout	-	Reduced **30 mph**	**78%** reduction of fatal/injury, **39%** reduction of total crashes.
6. Traffic Calming & Safety Measures	a. Transverse Rumble Strips	-	No reduction for cars Reduce 3-5 mph for truck Encourage full stop at the stop sign.	Likely to reduce crashes of all severities. Possible hazardous to cyclists.
	b. Speed Feedback Sign	-	Reduced by 1-9 mph	Not reported.
	c. Speed Table	-	Reduced 20 mph	An average of **45%** reduction of total crashes at particular test sites.
	d. Raised Intersection	-	Minor reduction of travel speeds	Similar to speed table.
	e. Raised Median Islands	-	Reduce up to 5 mph	**39%** reduction of fatal/injury crashes.
	f. Upgrade Signs, Markings, Lighting	-	N	Small individual effects, potentially significant in aggregate.
7	g. Intersection Beacon	Y	N	Considered a cost effective way to reduce crashes.

[9] Safety Evaluation of Flashing Beacons at Stop-Controlled Intersections, FHWA-HRT-08-048

Table 9. Improvement Alternative AM Peak Hour LOS Results

N. Williston Rd/Mt. View Rd	No Build				All-Way Stop				2nd Lane on Mt. View Rd				Roundabout			
2011 AM Peak Hour	LOS	Delay (s)	Q. Length (ft)	v/c	LOS	Delay (s)	Q. Length (ft)	v/c	LOS	Delay (s)	Q. Length (ft)	v/c	LOS	Delay (s)	Q. Length (ft)	v/c
Overall	A	4	-	-	B	14	-	-	A	4	-	-	A	7	-	-
EB LT/Thru/RT, Mt. View Rd	C	20	34	0.32	B	10	18	0.19	C	17	-	-	B	11	28	0.15
EB LT, Mt. View Rd	-	-	-	-	-	-	-	-	C	20	21	0.23	-	-	-	-
EB Thru/RT, Mt. View Rd	-	-	-	-	-	-	-	-	B	13	8	0.10	-	-	-	-
WB LT/Thru/RT, Gov. Chittenden Rd	C	18	10	0.12	A	9	5	0.06	C	18	10	0.12	A	8	7	0.04
NB LT/Thru/RT, N. Williston Rd	A	4	7	0.08	A	10	28	0.27	A	4	7	0.08	A	8	34	0.18
SB LT/Thru/RT, N. Williston Rd	A	0	0	0.01	C	16	158	0.68	A	0	0	0.01	A	6	130	0.51
2021 AM Peak Hour	LOS	Delay (s)	Q. Length (ft)	v/c	LOS	Delay (s)	Q. Length (ft)	v/c	LOS	Delay (s)	Q. Length (ft)	v/c	LOS	Delay (s)	Q. Length (ft)	v/c
Overall	A	4	-	-	B	14	-	-	A	4	-	-	A	7	-	-
EB LT/Thru/RT, Mt. View Rd	C	21	37	0.34	B	10	18	0.20	C	18	-	-	B	11	29	0.16
EB LT, Mt. View Rd	-	-	-	-	-	-	-	-	C	21	23	0.24	-	-	-	-
EB Thru/RT, Mt. View Rd	-	-	-	-	-	-	-	-	B	13	9	0.10	-	-	-	-
WB LT/Thru/RT, Gov. Chittenden Rd	C	19	11	0.13	A	9	5	0.06	C	19	11	0.13	A	8	7	0.05
NB LT/Thru/RT, N. Williston Rd	A	4	7	0.09	B	10	28	0.28	A	4	7	0.09	A	8	36	0.19
SB LT/Thru/RT, N. Williston Rd	A	0	0	0.01	C	17	178	0.70	A	0	0	0.01	A	6	137	0.53

Table 10. Improvement Alternative PM Peak Hour LOS Results

N. Williston Rd/Mt. View Rd	No Build				All-Way Stop				2nd Lane on Mt. View Rd				Roundabout			
2011 PM Peak Hour	LOS	Delay (s)	Q. Length (ft)	v/c	LOS	Delay (s)	Q. Length (ft)	v/c	LOS	Delay (s)	Q. Length (ft)	v/c	LOS	Delay (s)	Q. Length (ft)	v/c
Overall	C	15	-	-	B	14	-	-	A	10	-	-	A	8	-	-
EB LT/Thru/RT, Mt. View Rd	E	35	185	0.80	C	16	105	0.59	C	22	-	-	A	10	79	0.37
EB LT, Mt. View Rd	-	-	-	-	-	-	-	-	D	27	104	0.63	-	-	-	-
EB Thru/RT, Mt. View Rd	-	-	-	-	-	-	-	-	B	10	15	0.17	-	-	-	-
WB LT/Thru/RT, Gov. Chittenden Rd	B	13	5	0.07	A	9	5	0.05	B	13	5	0.07	B	10	8	0.05
NB LT/Thru/RT, N. Williston Rd	A	2	4	0.05	B	14	70	0.48	A	2	4	0.05	A	8	78	0.38
SB LT/Thru/RT, N. Williston Rd	A	0	0	0.00	B	11	38	0.34	A	0	0	0.00	A	5	39	0.2
2021 PM Peak Hour	LOS	Delay (s)	Q. Length (ft)	v/c	LOS	Delay (s)	Q. Length (ft)	v/c	LOS	Delay (s)	Q. Length (ft)	v/c	LOS	Delay (s)	Q. Length (ft)	v/c
Overall	C	17	-	-	B	14	-	-	B	11	-	-	A	8	-	-
EB LT/Thru/RT, Mt. View Rd	E	40	208	0.84	C	17	115	0.61	C	23	-	-	A	10	83	0.38
EB LT, Mt. View Rd	-	-	-	-	-	-	-	-	D	30	116	0.66	-	-	-	-
EB Thru/RT, Mt. View Rd	-	-	-	-	-	-	-	-	B	10	15	0.17	-	-	-	-
WB LT/Thru/RT, Gov. Chittenden Rd	B	14	5	0.07	A	9	5	0.05	B	14	5	0.07	B	11	8	0.05
NB LT/Thru/RT, N. Williston Rd	A	2	4	0.05	B	14	75	0.50	A	2	4	0.05	A	8	82	0.39
SB LT/Thru/RT, N. Williston Rd	A	0	0	0.00	B	11	40	0.35	A	0	0	0.00	A	5	41	0.21

Table 11: Summary of Impacts and Cost

	Alternative	Volume or Crash Warranted	Cost	Effect on Congestion	ROW Impacts	Other Impacts	Speed Effects	Safety Effects	Other Limitations	Overall
1	No Build	-	-	N	N	N	N	N	Significant	negative
2	Rearrange 2-way Stop	N	$	Worse	N	N	N	Worse	Not Reccomended	negative
3	All-way Stop	N	$	Worse AM Better PM	N	N	N	Worse	Significant	negative
4	2nd Lane on Mt. View Rd.	Y	$$$	Good	Moderate	Moderate	N	N		positive
5	h. Single-Lane Roundabout	-	$$$$	Very Good	High	High	Very Good	Very Good	Significant	neutral
6. Traffic Calming Measures	a. Transverse Rumble Strips	-	$	N	N	N	Minor	N		neutral
	b. Speed Feedback Sign	-	$$	N	N	N	Minor	Not reported	Moderate	neutral
	c. Speed Table	-	$$	N	N	N	Good	Good	Not Reccomended	negative
	d. Raised Intersection	-	$$$	N	N	N	Minor	Good	Not Reccomended	negative
	e. Raised Median Islands	-	$$	N	Moderate	Moderate	Minor	Good	***	positive
	f. Signs, Pavement Markings and Lighting	-	$	N	N	N	Minor	Minor		positve
7	Intersection Beacon	Y	$$	N	N	N	N	Minor		positive

Vertical features such as median islands, raised intersections or speed tables **may be undesirable on such heavily traveled roads

$ under $3,500
$$ $5,000 to $25,000
$$$ $25,000 to $100,000
$$$$ $100,000 to $500,000

Preferred Alternative

In summary several alternatives were rejected, as follows:

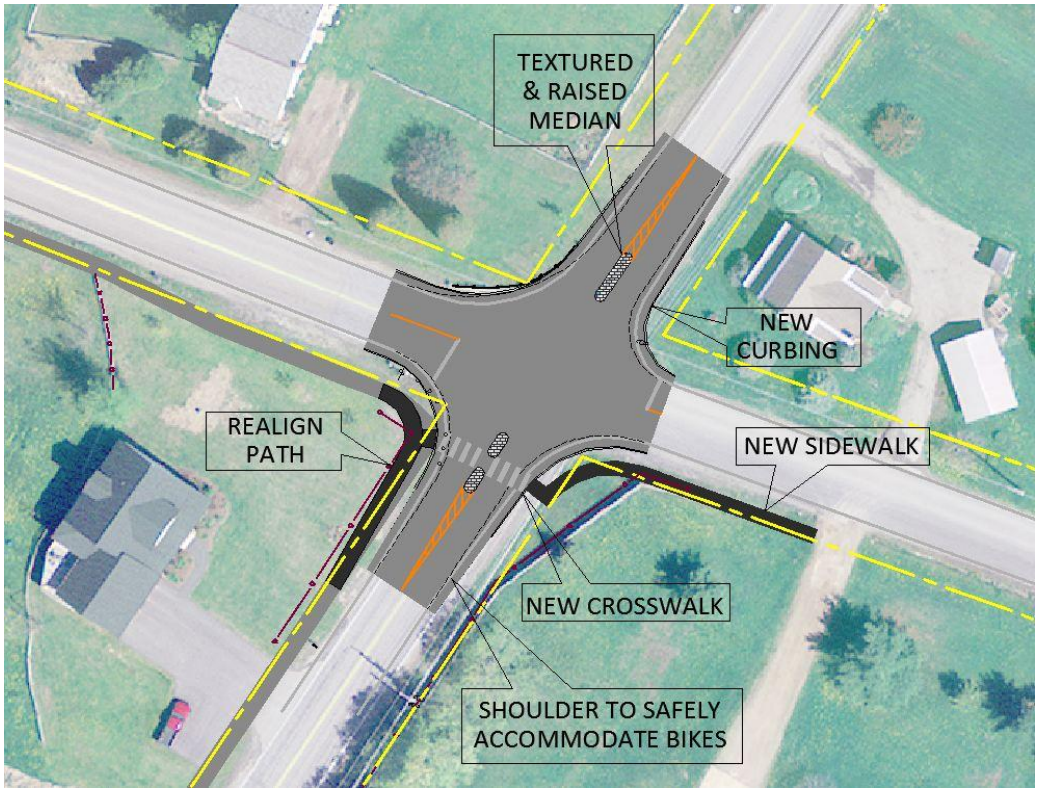
- 4-way stop – volumes do not meet MUTCD warrant. A 4-way stop could be considered as a potential medium term measure if warrants are met in the future.
- Roundabout – is very expensive and has high property impacts. Modest measures should be taken first. A roundabout should be considered as a potential long term solution if more modest measures do not improve safety.
- Left turn lane on Mountain View – This alternative provides some performance improvement, but neutral safety benefits, thus does not address the primary need. This should be considered as medium term measure.

The preferred alternative was selected based on public and Selectboard input following the presentation of the various alternatives, and was determined to be a combination of safety and traffic calming measures, as described below:

A. **Roadway features**.

1. Install curbing to provided visual definition to lanes, define corner radii, and allow the removal of the guardrail and bollards.
2. median islands, either raised or textured
3. Improved striping to define edge of travel lane and approach to median islands

Figure 18: Preferred Features - Curb, Sidewalk, Shoulders

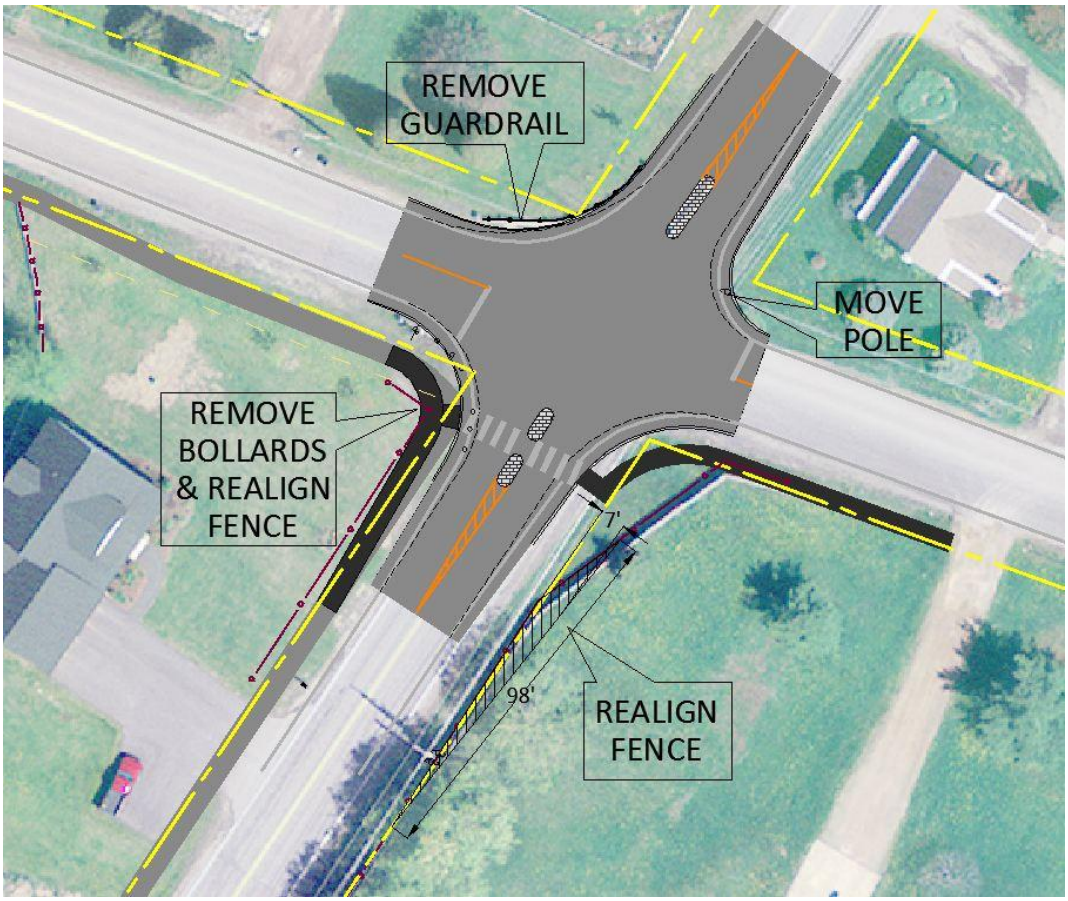


B. Improved **pedestrian and bicycle features** (note measures 1-3 above help by slowing vehicles and call attention to intersection):

4. Sidewalk on Governor Chittenden to the extent of the intersections area of influence (general queuing area)
5. Pedestrian crossing area sign on North Williston Road
6. A marked crosswalk. Note that a crosswalk by itself would not be expected to increase pedestrian safety, according to recent studies, but is recommended in combination with the other features noted here.
7. Provide at least a minimal shoulder area (3 feet per the Vermont State Standards) for bicycles and pedestrians.

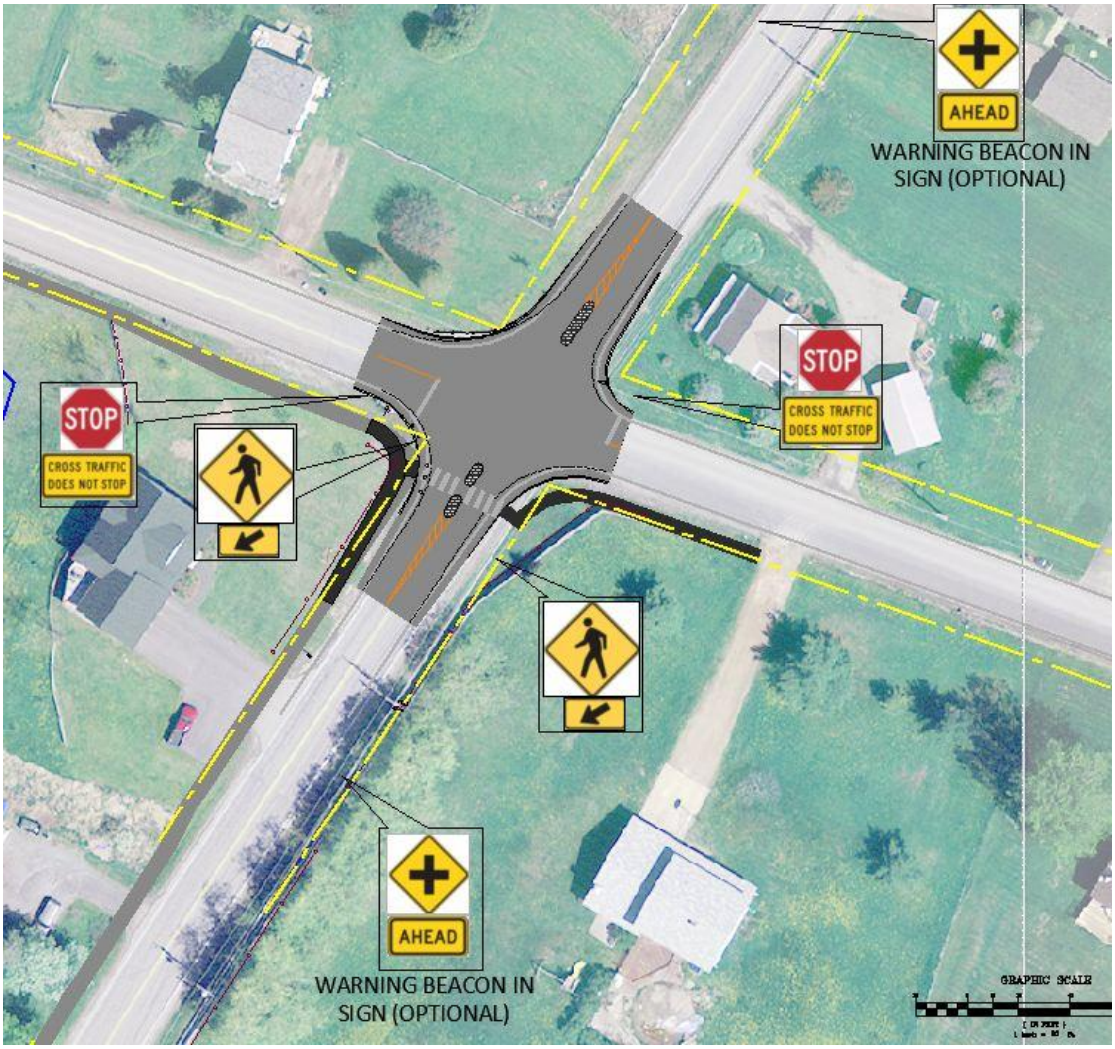
C. **Remove sight line obstacles** (guardrail, bollards, fencing) and Install better lighting. The current street light is weak. New lighting should be near sidewalk and crossing area.

Figure 19: Sight Obstacles to Address



D. Install **improved signage** (see Figure 20),
   a. replace existing signs with better reflective signs that meet current MUTCD standards
   b. crosswalk warning signs
   c. crossing traffic does not stop
   d. Install flashing **warning beacons** on new signs (intersection ahead) on the North Williston Road approaches.

Figure 20: New Signage



The cost of the various features of the preferred alternative has been estimated, as follows:

Road, curbing & islands	$25,000
Sidewalks	$25,000
Signs	$2,000
Remove obstacles	$8,000
	$60,000

A full size plan, cross section, and a more detailed cost estimate of the preferred alternative are provided in the appendix.

&&end