

Office of Highway Safety

Road Safety Audit Review

Town:	Alburgh	Date Reviewed:	November 2, 2015
Route:	US 2 and VT 78 Intersection	Mile points:	US 2: 6.23, VT 78: 0.0

Location Map



RSAR Process

A **Road Safety Audit Review** (RSAR) is a formal examination of an existing road in which an independent, multi-discipline team (the Audit Team) reports on potential safety issues.

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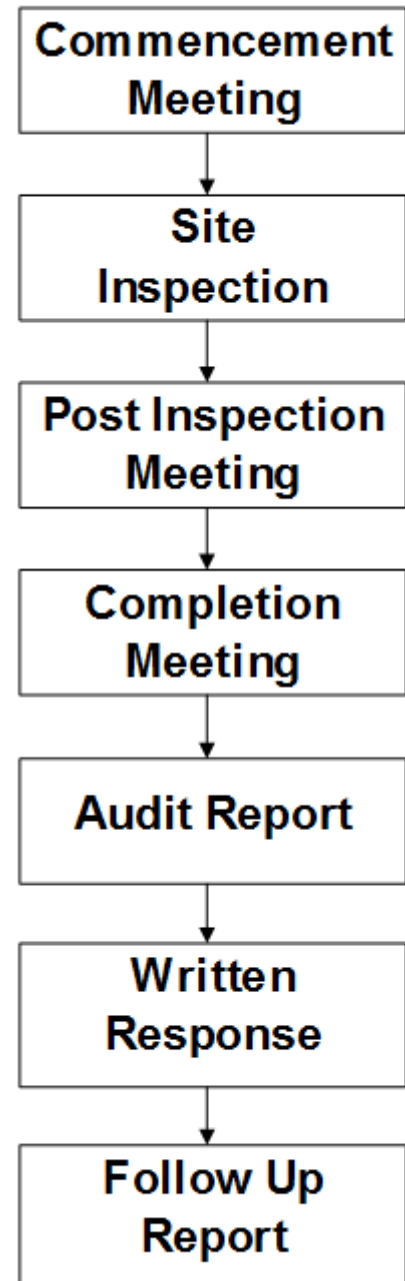
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According to the Federal Highway Administration (FHWA), the purpose of a RSAR is to determine which elements of the road may present a safety concern, to what extent and under what circumstances as well as to identify opportunities to mitigate the identified safety concerns.

The RSAR process is composed of several steps as shown in Figure 1. The process starts with a **Commencement Meeting** during which the Audit Team reviews data and gathers community concerns. A **Site Inspection** is then performed by the Audit Team. The site visit involves the identification of safety deficiencies as seen in the field. The Audit Team will usually drive through the location of interest to “get a feel” for the area, traveling through each approach in the case of intersections. The team is to then drive at a slower speed to make observations. If needed, the team will also walk the location. Following the site inspection, the Audit Team holds a **Post Inspection Meeting**. It is during this meeting that the team members discuss their observations and identify safety issues. The team is to reach a consensus on the importance of each safety issue mentioned. Only those issues for which a consensus is reached are included in the RSAR findings. A RSAR report (Written Report) is prepared.

The **Written Report** identifies safety concerns and proposes guidance. These issues and solutions are presented in a tabular format associated to each Responsible Entity for ease of reporting. The **Responsible Entities** are any groups who own a roadway feature or who are responsible for making an improvement or for initiating further studies. These could include for example, the VTrans design section, the local town, the local police or the local RPC.

Figure 1 - Road Safety Audit Process



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Location

The location of this RSAR is the intersection of US 2, VT 78 and Truck Route Road in Alburgh.

Purpose of the RSAR

This RSAR was conducted at the request of Bruce Nyquist, Director of the Office of Highway Safety at the Agency of Transportation in response to recent citizens' complaints.

The RSAR herein has sought to identify potential safety hazards and physical features which may affect road user safety. However, it is possible that not every deficiency has been identified. It should further be recognized that the implementation of the guidance in this report may contribute to improve the level of safety of the facility reviewed but not necessarily remove all the risks.

RSAR Participants

Mario Dupigny-Giroux from the Office of Highway Safety, VAOT, was the RSAR coordinator.

The other participants were:

Jim Cota,	District 8, VAOT
Tom Fields,	Office of Highway Safety, VAOT
Michael LaCroix,	Traffic Safety, VAOT
Pat McManamon,	DMV Enforcement, VAOT
Peter Pochop,	Permitting Services, VAOT
Laura Stone,	Assets Management, VAOT
Bethany Remmers,	Northwest Regional Planning Commission
Alton Brusio	Town of Alburgh
Bing Pero,	Town of Alburgh
Ray Allen,	Franklin County Sheriff
Blake Allen,	Franklin County Sheriff

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Information Reviewed

Geometry

Both US 2 and VT 78 are considered “west to east” roads by VTrans’ routing convention. However, in this area, US 2 is mostly running south to north. As such, the eastbound approach of US 2 is located on the north side of the intersection while the westbound approach of US 2 is located on the south side of the intersection. The east approach of the intersection is VT 78 and the west approach of the intersection is Truck Route Road.

According to recent project plans, the typical on US 2 at this location is 3-foot shoulders and 11-foot lanes.

Speed Limit

The posted speed limit is 40 mph on US 2. The speed limit is 50 mph on VT 78 and it is 45 mph on Truck Route Road.

Traffic Volumes

The latest 12-hour turning movement count was done in March 2015. This raw count indicated that 1673 vehicles entered the intersection from the north (US 2 approach from downtown Alburgh), compared to 689 vehicles from the Grand Isle direction along US 2. The count further showed that 1885 vehicles entered the intersection from the VT 78 approach and that 600 vehicles entered from Truck Route Road.

The raw count confirmed that the main flow of travel is to and from the north and the east approaches of the intersection, that is, to and from US 2 (from Alburgh) and VT 78. At this intersection, 78% of the traffic that is coming from the north is turning left onto VT 78. Similarly, 71% of the traffic that is coming from VT 78 is turning right onto US 2.

With this large proportion of traffic making a left turn from the north side of the intersection, only 17% of the traffic is continuing through and only 5% is making a right turn from this approach. For the same reason, 17% of the traffic from VT 78 is continuing across to Truck Route Road and 11% is turning left.

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Coming from the south of the intersection (from US 2), 41% of the traffic is continuing north, while 35% of the traffic is turning right onto VT 78 and 17% left onto Truck Route Road.

On the Truck Route Road approach, 60% of the traffic is continuing across the intersection to VT 78, 23% of the motorists are making a right turn and 17% a left turn.

The raw count showed that there were 216 heavy trucks that entered the intersection from VT 78, or 11.4% of all the traffic from this approach. Of these, 202 heavy trucks turned right (10.7% of all the traffic on this approach). Similarly, from the north approach, 166 heavy trucks entered the intersection (9.9% of all traffic from this approach), with 151 making the left turn onto VT 78 (9% of all traffic on this approach).

The 2015 Turning Movement Report is provided at the end of this report.

Signs and Markings

There is an overhead beacon at this intersection. The signal indications are facing yellow for US 2 traffic and red for both VT 78 traffic and Truck Route Road as this is a two-way stop controlled intersection.

Approaching the intersection from the north on US 2, there is a 40 mph speed limit sign at mile point 5.99 with a do not pass sign. Then, there is an intersection sign with a 1000 ft distance plaque at mile point 6.02, followed by a VT 78 junction sign. OBDS signs are located at mile point 6.09, then destination boards at about mile point 6.16 and route markers at mile point 6.17.

From the south on US 2, there is a 40 mph speed limit sign at mile point 6.55. The intersection sign on this approach is at mile point 6.41 with an 800 ft plaque underneath it. This is followed by a VT 78 junction sign at 6.37 and a do not pass sign at 6..34. Destination boards are located at mile point 6.29 and route markers at mile point 6.25.

Approaching the intersection on VT 78, there are gate posted stop ahead signs located at mile point 0.23. The stop ahead sign on the right hand side is supplemented with dual flashing beacons. At about mile point 0.20, there is a US 2 junction sign followed at mile point 0.17 by

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OBDS signs. Directional signs are then located at mile point 0.14, followed by a no passing zone sign at mile point 0.11 and route markers for US 2 at mile point 0.06.

The approach of VT 78 is controlled by gate posted stop signs.

Along Truck Route Road Towards the intersection, there is a 45 mph speed limit sign. The approach of Truck Route Road is controlled with a stop sign.

Markings consist of double yellow centerline markings on all approaches along with white edgeline markings. The approaches of VT 78 and Truck Route Road have a stop bar and STOP word markings. The stop ahead signs on VT 78 and supplemented with STOP AHEAD word markings.

Pavement Conditions

Pavement conditions on VT 78 are rated as fair by VTrans. Similarly, pavement conditions on the north approach of the intersection (US 2) are also rated as fair, while the conditions on the south approach (US 2) of the intersection are rated as good. These ratings are based on 2014 data.

Past Projects

Project STP HES 028-1(6) was for the construction of a raised island in front of the gas station along with slight adjustment to the overhead beacons (completed in July 1994)

South of the intersection, US 2 was last paved in 2014, while north of the intersection, US 2 was recently paved in 2013 (NH SURF(35) & STP SURF(36)). VT 78 was last paved in 2000 but there was a crack fill project in 2005 (STP CRAK(22)).

The traffic signs on US 2 were installed in 2014 via project STPG SIGN(45). The traffic signs along VT 78 were installed in 2013 as part of project STPG SIGN(42).

Future Projects

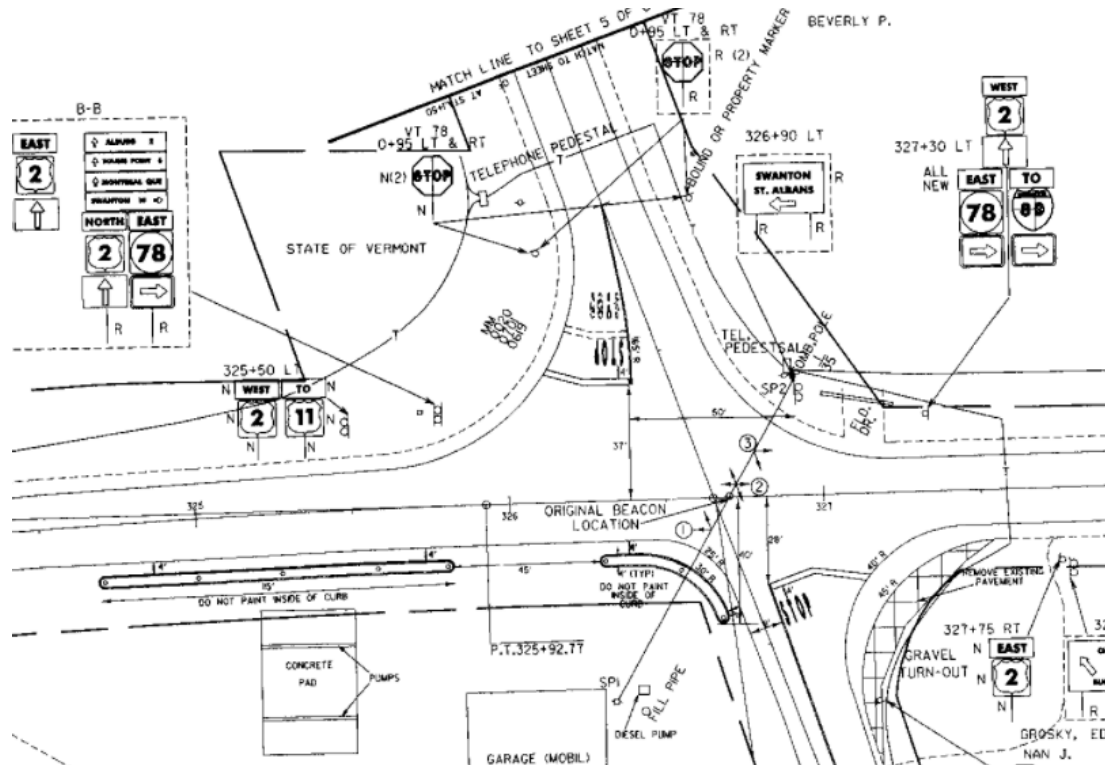
There are no planned projects in this area.

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Right-of-Way

The figure below shows the right-of-way information at this intersection. The right-of-way plans were from project HES 028-1(6).



Traffic Studies

The Traffic Research Unit of VTrans conducted a traffic signal warrant analysis in April 2015 to determine if a traffic signal could be justified at this location. The warrant analysis was completed using a turning movement count that was collected in April 2015. It was found that none of the signal warrants were met.

Traffic Research also performed an all-way stop warrant analysis. It was found that the warrant was met and that as per the Manual on Uniform Traffic Control Devices, all-way stop control at this intersection was justifiable.

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The Traffic Design Unit of VTrans made a model of the intersection under an all-way stop control scenario. This analysis showed that the intersection delay would be 9.1 seconds with a level of service A on all legs.

There was also a study, completed by the VTrans Policy, Planning and Research Bureau in 2013, that conducted a broad look at the potential traffic pattern changes as a result of connecting I-89 in Highgate to the future A-35 highway in Quebec. This study did look at the potential for diverted traffic from the Lacolle-Champlain crossing, which would likely be travelled currently coming into Vermont via VT 78. This study determined that there would be a reduction of 113 daily vehicles at the Lacolle-Champlain crossing under a 2012 scenario in both directions (i.e., from and to the US) and that there would be a reduction of 184 daily vehicles under a 2025 scenario.

Crash History

The crash history was reviewed in the area of the intersection for the five-year period covering the years 2010 to 2014. Crashes that took place during 2015 up to the time of this review were also examined to provide additional insight.

This intersection is currently defined as a high crash location (the latest report covers the period 2008 to 2012). The intersection ranks 38 out of 132 high crash intersections.

A collision diagram and the crash narratives for each of the crashes are provided at the end of this report.

There are eleven crashes listed on the 2010-2014 general yearly crash summary report near this intersection. However, one of the crashes took place at the gas station due to road rage and should not be considered in the discussion. This thus leaves ten crashes at this intersection for further analysis.

In addition to the ten crashes that took place between 2010 and 2014, there were a total of three known crashes at this intersection in 2015 (with not all of the data being up to date).

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Therefore, in five years and six months, there were thirteen crashes at this intersection. Of these, ten (77%) involved some form of right angle crash (either broadside or left turn) with eight of these ten right angle crashes involving motorists that departed from the side roads.

Of these eight crashes that involved a side road vehicle, four crashes involved a vehicle that came from VT 78 (50%) and four crashes involved a vehicle that came from Truck Route Road (50%).

Furthermore for these eight crashes, five implicated a vehicle that was traveling from the south on US 2 (63%) and three, a vehicle that was traveling from the north (37%).

Motorists mentioned in six of these eight crashes (75%) that they had not seen any vehicles coming, while in the other two crashes (25%), the motorists did not stop for the stop sign and just continued through the intersection.

Other common factors related to these eight right angle crashes are that they happened mostly during the summer months, during daylight and during clear weather. There is no common element concerning the day of the week and the time of day.

Current Local Concerns

VTrans received two specific comments within the last year from motorists who regularly use this intersection. In both cases, the motorists reported almost getting hit. Both of them also pointed to the fact that they thought there was too much traffic for the current type of traffic control at the intersection. One specifically said that “there is too much traffic on this route for it not to be a working light. The new dollar general there now has caused more traffic”. The other one stated “I would like to see at least someone come and observe traffic on a Saturday morning; perhaps there might be a change in attitude about how dangerous that intersection really is”.

Furthermore, one of these motorists also described how confusing maneuvering through the intersection was in his opinion by mentioning “nobody knows where to go just wait until you think it is your turn then step on it”.

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In addition to these emails from local citizens, a couple of comments were collected via emails from people working at VTrans who were also familiar with the intersection.

The first individual mentioned observing congestion at times at this intersection and indicated that the parking situation at the gas station sometimes added to the poor visibility coming off the town road on the west side of the intersection. Although there is an island in the mobile station to prevent parking along US2, if the parking lot is full, this person reported that then, this parking extended close to the town highway and added to the distractions.

This first individual also suggested that, 'if a tractor trailer unit was parked just north of the intersection (in a paved shoulder) on the right side, this could give poor visibility to traffic coming off VT78 headed north or south'.

The other person from whom we received comments mentioned driving through this intersection numerous times and wondered if the sun could be a factor as to why sometimes drivers just do not see the other motorists crossing their path. This person reported that, "especially this time of year, the sun was low and depending on time of day, can be quite blinding headed WB on VT 78".

The following comments were also obtained during the commencement meeting.

The district reported that parking at the gas station was causing issues for people entering the intersection from Truck Route Road. The district also reported that there was an individual that was selling potatoes in the pull off area in the northeast corner of the intersection and that this was also an issue with corner sight distance on VT 78.

The district also suggested that there might be sign clutter in the area and that the stop ahead signs on VT 78 were maybe too far.

Town representatives mentioned that the gas station was very busy during the summer and that they did not know if traffic volumes were heavier on a Saturday than during the week.

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The sheriff office does enforcement at this intersection every other day. They do not perceive high speeds as being a problem. They did report that, when the intersection was busy, motorists seemed confused and that the intersection “shut down”.

A member of the group also talked with the store clerk at the gas station. The store clerk reported that they frequently hear tires screeching like a car braking trying to stop and that they expect to hear a crash but that somehow the cars avoided a collision. The clerk also mentioned that, from time to time, people come in after a close call and ask them if they saw what happened.

Identified Safety Concerns

This section lists the areas of safety concern identified by the audit team during the site inspection and from the analysis of available data. This section also reports the potential safety enhancement suggested by the audit team. The concerns are not listed in order of importance.

Concern: Corner Sight Distance Issue, Northwest Quadrant

The corner sight distance when stopped on Truck Route Road and looking north, towards US 2 (i.e., when looking to the left) is sometime poor. This is due when vehicles at the gas station are parked between the gas pumps and the raised island. Signage and banners inside of the grass island can also contribute to the visibility issue. These situations are illustrated in the next few pictures.



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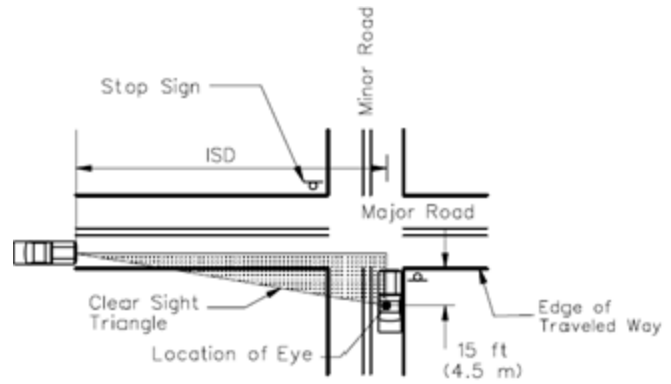
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Safety Enhancements:

The district should enforce any signage obstruction located in the right-of-way and especially in the grass island.

Eliminate the possibility of parking vehicles in the sight triangle by enlarging the grass island.

Note, Intersection Sight Distance (ISD) on the diagram to the right, for 40 mph, is 445 feet as per AAHSTO.



Clear Sight Triangle Concept
(for two-way stop)

Concern: Potential Corner Sight Distance Issue, Northeast Quadrant

Trucks have been reported to park across the gas station on US 2 in the shoulder. There is also an individual who regularly sells potatoes in the pull off area.

(The picture to the right does not show this as being a problem).



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Concern: Potential Corner Sight Distance Issue, Southeast Quadrant

Tall grass during the summer months in this quadrant is reported to reduce the corner sight distance for motorists who are stopped on VT 78 and who are looking to the south (i.e. left towards US 2).

Safety Enhancement:

Mow twice a year in this area.
District and Town to work together and coordinate.



Concern: Potential Corner Sight Distance Issue, VT 78 Approach (Side-by-Side Vehicles)

The VT 78 approach is wide and while it is not marked as such, there is enough room for motorists to form two lines, one for left and through traffic and one for making a right turn. When vehicles are side-by-side, this potentially prevents motorists from being able to see oncoming traffic on US 2.



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Safety Enhancement:

Reduce the width of the approach with cross hatched pavement markings to create only one lane. This would still permits trucks to use part of the pavement to make right turns.

A longer term solution could be to construct a truck apron.

Concern: Left Turning Truck Conflicts, VT 78 Approach

Trucks that are coming from the north and making a left turn onto VT 78 from US 2 are often conflicting with approaching traffic on VT 78 as they complete their maneuver. As they make their turns, trucks are sometimes off tracking outside the paved surface.

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Safety Enhancement:

Shift the centerline to the right on VT 78 to give more space for US 2 trucks to make a left turn. The disadvantage would be that crossing traffic would be crossing more at an angle and be exposed longer.

Construct a wider paved shoulder on the south side of VT 78.

A long term solution could be to construct a roundabout.

Concern: Right Angle and Turning Crashes

Right angle crashes including left turning crashes is the common crash pattern at this intersection. The crash reports indicated that motorists had stopped and looked for traffic but had not seen any vehicles. The reports did not specifically mention that obstructions were in the way.

Safety Enhancement:

Convert the traffic control at this intersection from two-way stop to all-way stop. The crash reduction factor to go from two-way stop to all-way stop control is 48% (cmf id 315) for intersections at which the MUTCD warrant is met. As previously mentioned, the MUTCD warrant for all-way stop control is met at this intersection.

A long term solutions would be to construct a roundabout. The crash reduction factor to go from two-way stop control to a roundabout is 71% (cmf id 229). From a safety perspective and using crash reduction as the only benefit, a benefits-to-costs ratio of 1 would be obtained when the costs (of constructing a roundabout at this intersection) are not greater than \$1,330,000 for converting from two-way stop to a roundabout.

Concern: Different Speed Limits on the Approaches to the Intersection

The law enforcement representatives present at the site meeting noted that the speed limits on all four approaches were different and that from a law enforcement perspective, this was making the enforcement of speed at this intersection difficult. The speed limit is 40 mph on US2, 45 mph on Truck Route Road and 50 on VT 78.

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Safety Enhancement:

The speed limit on Truck Route Road should be reviewed and possibly lowered to 40 mph.
The speed limit on VT 78 approaching US 2 should be reviewed and possibly lowered to 40 mph.

Summary of Safety Enhancements

The safety concerns and potential actions that were identified in the previous sections are further summarized in the next table. These potential enhancements will be presented to the Director of the Office of Highway Safety for further consideration.

Potential Safety Enhancements Summary Table

Safety Concern	Safety Enhancement	Responsibility	Safety Payoff	Time Frame	Cost
Corner Sight Distance Issue, Northwest Quadrant (gas station side)	The district should enforce any signage that is in the right-of-way, especially in the grass island	VTrans (District 8)	Low	On-Going	Low
	Enlarge the grass island to prevent vehicle from parking in the ROW	VTrans (District 8 & Utilities)	Med	Short	Med
Potential Corner Sight Distance Issue, Southeast Quadrant (field side)	Mow twice a year in this area. District and Town to work together and coordinate	Town & VTrans (District 8)	Low	On-Going	Low
Potential Corner Sight Distance Issue, VT 78 Approach (Side-by-Side Vehicles)	Reduce the width of the approach with cross hatched pavement markings	VTrans (TSMO)	Low	Short	Low
	A longer term solution could be to construct a truck apron	VTrans (AMP)	Low	Med/Long	Med
Left Turning Truck Conflicts, VT 78 Approach	Shift the centerline to the right on VT 78	VTrans (TSMO)	Low	Short	Low
	Construct a wider paved shoulder on the south side of VT 78.	VTrans (District 8)	Low	Short/Med	Med
	A longer term solution could be to construct a roundabout	VTrans (TSMO)	High(71% reduction)	Long	High (\$1,330,000 for B/C>=1)
Right Angle and Turning Crashes	Convert to All-Way Stop (stop signs on all approaches)	VTrans (TSMO)	High(48% reduction)	Short	Low
	A longer term solution could be to construct a roundabout	VTrans (AMP)	High(71% reduction)	Long	High (\$1,330,000 for B/C>=1)
Speed limits on all four approaches are different, makes it harder to enforce according to LE.	Evaluate the speed limit on Truck Route Road	Town	Low	Short	Low
	Evaluate the speed limit on VT 78	VTrans (TSMO)	Low	Short	Low

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