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Old Hollow Road Traffic Calming Study

Town of Ferrisburgh, Vermont

September 27, 2013

Submitted by
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Prepared for:

The Town of Ferrisburgh, VT

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

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1.0 INTRODUCTION

The Old Hollow Road Traffic Calming Feasibility Study was commissioned by the Transportation Advisory Committee (TAC) of the Addison County Regional Planning Commission (ACRPC) and the Town of Ferrisburgh, Vermont to identify and evaluate appropriate traffic calming treatments in the neighborhood along Old Hollow Road. The project area within the State of Vermont is shown in Figure 1.

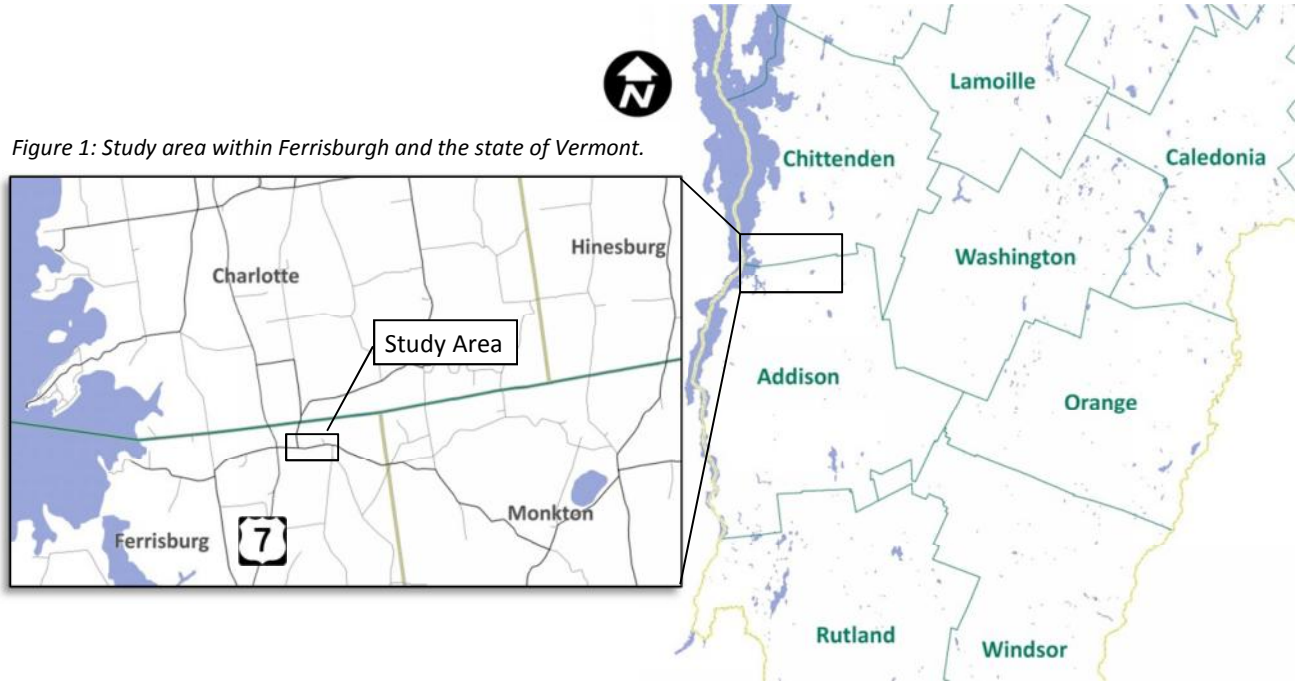


Figure 1: Study area within Ferrisburgh and the state of Vermont.

This feasibility study includes the following items:

- The project description and study scope;
- An introduction to common traffic calming measures;
- An evaluation of the Old Hollow Road neighborhood, including applicable traffic calming measures; and
- Recommendations and conclusions.

This study relies upon design guidance and analysis procedures documented by the Institute of Traffic Engineers (ITE) Traffic Calming Library[1] and *Traffic Calming: State of the Practice*,[2] the *Manual on Uniform Traffic Control Devices* (MUTCD),[3] National Cooperative Highway Research Program (NCHRP) Report 737 *Design Guidance for High-Speed to Low-Speed Transitions Zones for Rural Highways*,[4] and Federal Highway Administration (FHWA) *Traffic Calming on Main Roads Through Rural Communities*.[5]

[1] ITE Traffic Calming Library: http://www.ite.org/traffic/

[2] ITE Traffic Calming State of the Practice, 1999. http://www.ite.org/traffic/tcstate.asp

[3] American Traffic Safety Services Association (ATSSA), ITE, and AASHTO, *Manual on Uniform Traffic Control Devices*, 2009 Edition (Washington DC: FHWA, 2009).

[4] NCHRP Report 737 - Design Guidance for High-Speed to Low-Speed Transitions Zones for Rural Highways :http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_737.pdf

[5] FHWA Traffic Calming on Main Roads Through Rural Communities: http://www.fhwa.dot.gov/publications/research/safety/08067/08067.pdf

1.1 Introduction to Traffic Calming

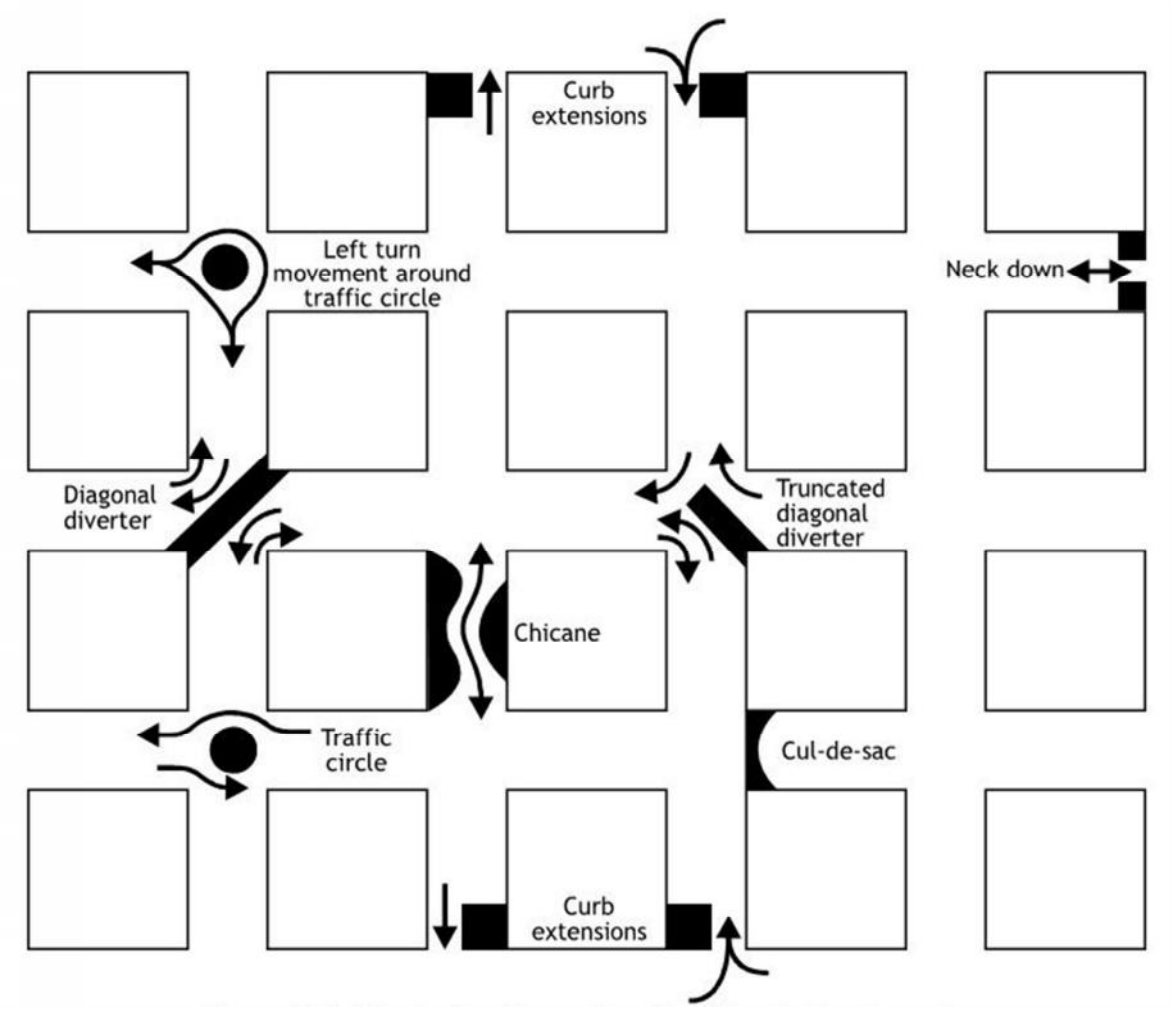
The ITE Traffic Calming State of the Practice guideline defines traffic calming as "the combination of mainly physical measures that reduce the negative effects of motor vehicle use, alter driver behavior and improve conditions for nonmotorized street users."

In general, education programs, increased enforcement, and regulatory devices such as stop signs and speed limits are not considered as traffic calming measures. Regulatory devices are placed based on warrant analysis and engineering procedures documented in the MUTCD and other guiding documents. While not considered in this report for traffic calming, stop signs and a reduced speed limit may be warranted pending further evaluation. Additional discussion on setting speed limits can be found in Attachment C.

Traffic calming devices can generally be grouped into three categories: horizontal deflection, vertical deflection, and visual cues.

Horizontal deflection involves a change in the horizontal alignment in the roadway that forces the driver to adjust their direction and speed to safely navigate. Typically, horizontal deflections require the use of curbs, bollards, or other non-traversable barriers to force the driver to comply and accomplish the traffic calming effects. Typical horizontal deflection traffic calming techniques are illustrated in Figure 2.

Figure 2: Typical horizontal deflection traffic calming techniques (FHWA University Course on Bicycle and Pedestrian Transportation, Lesson 20: Traffic Calming).



Vertical deflection devices are traffic calming measures placed above the surface of the pavement, intended to be traversed by vehicles, resulting in a change in the roadway profile. Typical vertical deflection includes speed bumps, humps, and tables, rumble strips, raised crosswalks, and raised intersections.

Visual cues are traffic calming measures that affect the driver's interpretation of the environment. Visual cues may be communicated through active feedback, such as a LED speed feedback sign, or through passive experiences that modify the driver's perception of the roadway through signs, striping, gateways, and streetscaping enhancements that increase the *perceived risk* without increasing the *actual risk*.

As with any change in roadway geometry or the roadside environment, the application of traffic calming measures needs to be designed with sensitivity to the context of the neighborhood and applied judiciously with input from local and regional stakeholders. The design decisions related to traffic calming may impact many stakeholders' daily lives, economic well-being, and the neighborhood livability. Typical issues that need to be investigated prior to the application of traffic calming measures include:

1. Emergency Vehicle Access. All traffic calming measures, particularly horizontal and vertical deflections, should be evaluated with their impact to emergency vehicle response times. Any proposed enhancements should be reviewed with local police, fire, and ambulance services.
2. Noise. Vertical deflections, rumble strips, and some striping applications may cause unintended noise increases. These devices should be placed appropriately to limit disturbances to neighboring homes.
3. Relocated Traffic: Some traffic calming measures may discourage traffic in the calmed neighborhood or street. This traffic may relocate to adjacent streets or neighborhoods, resulting in the need for more traffic calming measures in other neighborhoods.
4. Traffic as a Symptom of a Larger Issue: In some situations, traffic may be routing through a neighborhood to avoid a network bottleneck or congested area. In these cases, traffic calming may not be necessary if the network congestion can be relieved.

Additional details on the history, background, application, effectiveness, and legal and liability issues of traffic calming measures can be found in the literature cited on Page 1.

1.2 Purpose and Need

The purpose of the Old Hollow Road Traffic Calming Feasibility Study is to identify and evaluate a set of immediately implementable short-term traffic calming measures coupled with long-term strategies that can be developed to improve the non-motorized transportation environment in the Old Hollow Road neighborhood of North Ferrisburgh, Vermont. The appropriate measures will encourage a reduction in vehicle operating speed to be consistent with the speed limit, and may discourage use of Old Hollow Road as a regional through route.

Traffic speeds have been measured at various points of the neighborhood at levels above the speed limit. The neighborhood consists of a variety of land uses, including residential and commercial properties. With no bicycle or pedestrian infrastructure within the neighborhood, traffic calming measures are needed to improve the non-motorized transportation environment along Old Hollow Road.

1.3 Local Concerns Comments

In an effort to condense the project schedule, neighborhood residents were contacted via email and internet based community forums to solicit feedback regarding traffic calming in lieu of a traditional Local Concerns Meeting. Twenty written email responses were received, with 18 in favor of further study and evaluation of traffic calming measures, two against physical measures that may impact vehicle travel through the neighborhood. The comments received are compiled in Attachment B.

2.0 OLD HOLLOW ROAD NEIGHBORHOOD CHARACTERISTICS

Old Hollow Road is an east-west Major Rural Collector designated as a Class II town highway. Old Hollow Road connects US Route 7 (US-7) on the west to Monkton Ridge and Monkton Boro neighborhoods to the east. The Old Hollow Road neighborhood in Ferrisburgh is located near the crossing of Lewis Creek, approximately 4,000-feet west of US-7. The neighborhood consists of approximately 50 households and small businesses. The study area is shown in Figure 3.

Figure 3: Old Hollow Road Traffic Calming Feasibility Study project area in North Ferrisburgh, VT.

2.1 Existing Conditions

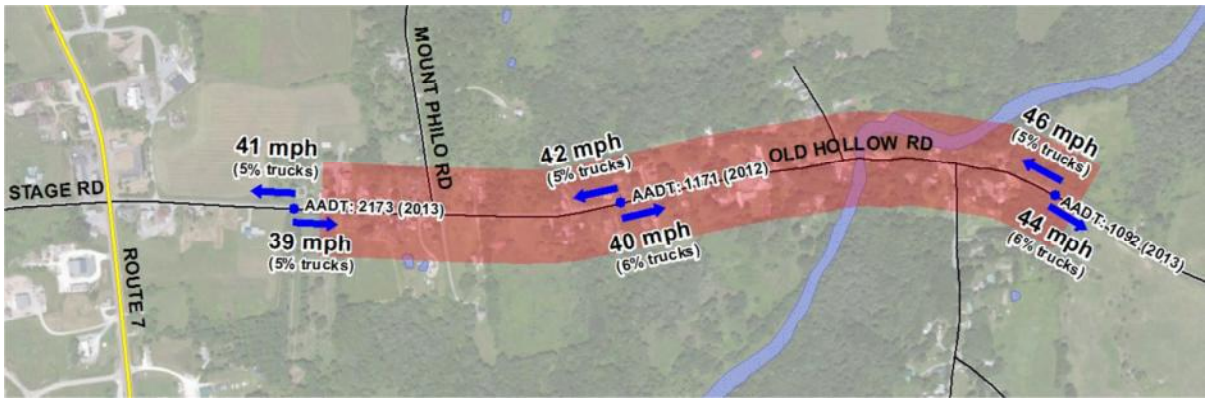
2.1.1 Roadway Characteristics

The existing roadway through the study area generally consists of one 11-foot-wide travel lane in each direction and no shoulders. The pavement is generally in acceptable condition with longitudinal and transverse cracking evident. The bridge over Lewis Creek was recently reconstructed. Following reconstruction, the bridge was restriped for a widened shoulder on the eastbound lane to accommodate pedestrian traffic. In the eastbound direction the lanes are 11-feet wide with a 3-foot shoulder. The westbound lane is 10-feet wide with no shoulder. The Vermont Agency of Transportation minimum lane width for this roadway classification is 11-feet.

There is a limited segment of narrow sidewalk on the south side of Old Hollow Road. A painted crosswalk connects Champlain Hill Road and the 3-foot shoulder on the Lewis Creek Bridge to the south side of Old Hollow Road. There are no other bicycle or pedestrian facilities in the project area.

The speed limit west of and through the study area is 35 mph. East of the study area, the speed limit increases to 40 mph. Several traffic speed and volume counts have been conducted recently along the study corridor. The results of these spot traffic and speed studies are shown in Figure 4. 85th percentile speeds represent the speed that most (85%) of motorists are traveling at or below. The 85th percentile speed is commonly referred to when performing engineering studies to set speed limits.

Figure 4: Recent traffic volume and 85th percentile speed results



2.1.2 Topography

As the name of the roadway suggests, the study area includes a river valley formed by Lewis Creek. The eastern and western boundaries of the Old Hollow neighborhood rise steeply from the river. At the western boundary near US-7, the elevation is approximately 240 feet. Moving east into the study area, the road descends for approximately 1200 feet at a 4-6% slope to an elevation of 160 feet. Most of the Old Hollow neighborhood is relatively flat near this elevation until the road crosses Lewis Creek and begins to ascend at a 6-8% slope for 1500 feet to an elevation near 280 feet at the eastern boundary of the project area. These slopes leading into the neighborhood contribute to the speed issues noted above. Additionally, the slopes create crest vertical curves and limit the sight distance near the intersections at Mount Philo Road and at Four Winds Road. The approximate slopes and profile of Old Hollow Road through the project area are illustrated in Figure 6.

2.1.3 Stormwater and Drainage

The roadside development is typical of a compact neighborhood in Vermont. The neighborhood, recognized as a historic district by the Vermont Division of Historic Preservation, contains many mature trees along the corridor with 40 historic structures, many built as near as 10 feet from the edge of pavement. The roadway is uncurbed with few drainage structures. In the steeper sections of Old Hollow Road noted above, ditches have been constructed to channelize storm water flow. Within the flat section of the Old Hollow neighborhood, storm water sheet flows unchannelized through landscaped yards.

2.1.4 Utilities

Utility poles are located primarily along the south side of Old Hollow Road, with some utility poles on the north side of the road due to the presence of structures and landscaping. Utility poles are located approximately 8 feet from the edge of pavement. There were no underground utilities identified during the site visits.

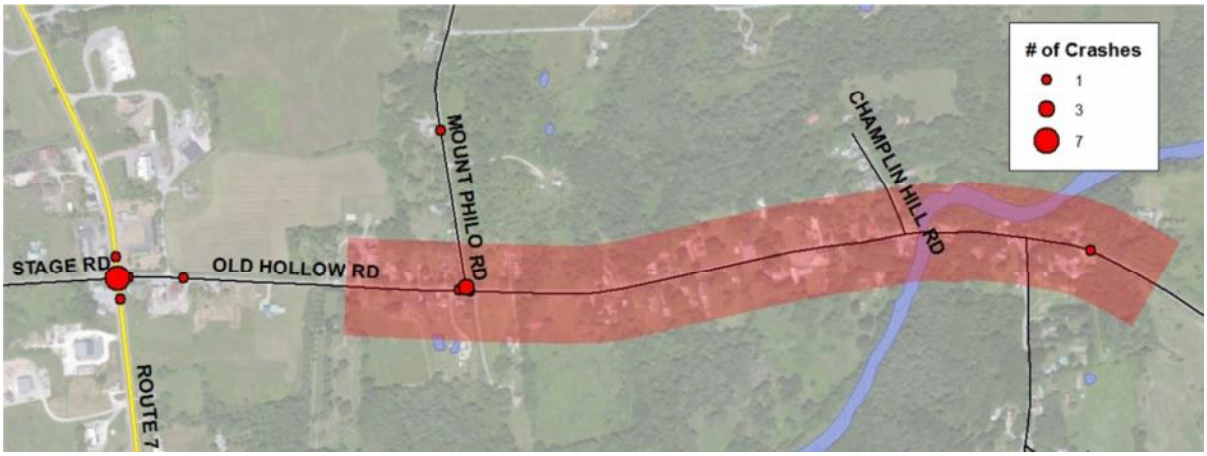
2.1.5 Natural Resources

The Vermont Agency of Natural Resources (ANR) Natural Resources Atlas (NRA) was consulted to locate existing natural resources and communities near the study area. No natural resources were identified immediately adjacent to the project area. One uncommon animal species (unspecified in the record) was identified at Lewis Creek. Hydric soils, an indicator of wetland conditions, are present on the eastern and western boundaries of the project area, but no mapped wetlands are immediately adjacent to the project area. The NRA mapping results are included in Attachment D.

2.1.6 Safety

From 2007 – 2011, there were six reported vehicle crashes along the study corridor. Five of these crashes occurred near the Old Hollow Road / Mount Philo Road intersection, and the remaining crash occurred near the eastern gateway of the project area. In three of the crashes, "Driving too fast for conditions" is listed as a contributing circumstance in the crash report. In addition, the limited sight distance due to the crest vertical curve identified earlier may contribute to the number of crashes at the Mount Philo Road intersection. The crashes in the study area (shown in transparent red) are illustrated in Figure 5.

Figure 5: Reported crashes from 2007 - 2011 near the Old Hollow Road study area



2.2 Identification of Appropriate Traffic Calming Strategy

The goal of the traffic calming strategy shall be to encourage vehicles to maintain a reasonable speed through the linear neighborhood along Old Hollow Road. US-7 to the west is a higher-speed, principal arterial carrying local and regional through traffic. Traffic entering from the west must either turn from US-7, or cross US-7 to enter the Old Hollow neighborhood. In either case, vehicles will be traveling slowly near this intersection and the goal should be to keep vehicles moving slowly as they travel down the hill into the Hollow and enter the neighborhood.

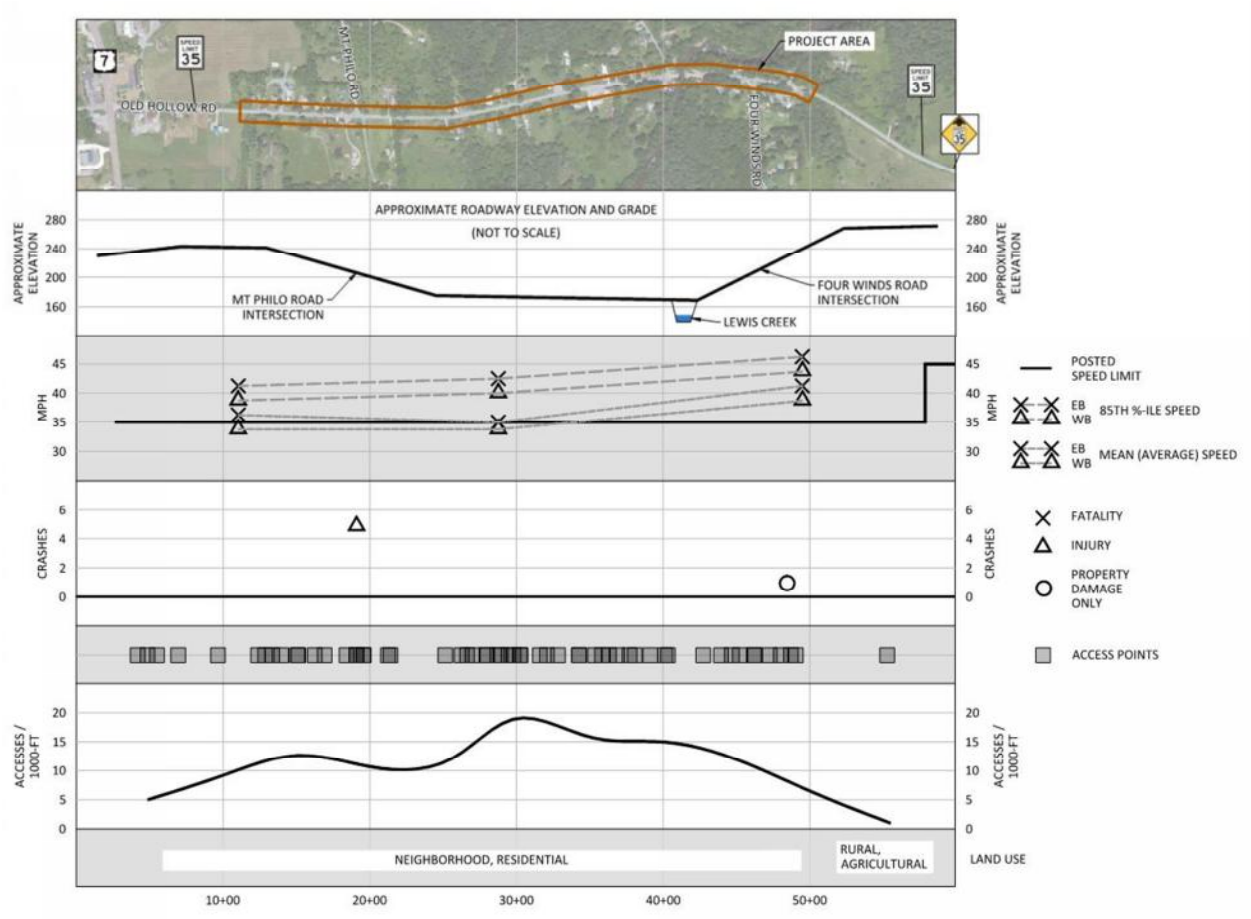
From the east, vehicles are traveling on higher-speed (40 mph) rural town highways. The traffic calming measures should encourage vehicles to slow down at the entrance to the neighborhood in a "transition zone". Through the village, traffic calming measures should encourage vehicles to maintain this reasonable speed at or near the speed limit of 35 mph.

In general, appropriate traffic calming measures will not restrict through traffic, such as diagonal diverters, cul-de-sacs, and curb extensions. Furthermore, appropriate traffic calming techniques would not likely include new curbing requiring storm water measures or lane width restrictions below 15-feet for plowing considerations.

2.3 Straight Line Diagram Tool

A straight line diagram was prepared to illustrate the opportunities and constraints along the corridor. The Straight line diagram illustrates the project area topography, posted and observed speeds, crash locations, and driveway access density along the Old Hollow Road corridor.

Figure 6: Straight line diagram



The diagram illustrates the following key points along the corridor:

- Eastbound speeds from US-7 are generally lower than westbound speeds.
- Vehicle speeds in both directions increase from west to east.
- The highest number of crashes occurs at the Old Hollow Road / Mt. Philo Road intersection where corridor speeds are generally lower.
- Mean (average, or 50th percentile) speeds are very near the existing speed limit.
- The existing westbound transition zone from the rural east into the Old Hollow Road appears to be set too far east based on operating speeds and land use.

3.0 PROPOSED TRAFFIC CALMING MEASURES

Several short- and long-term traffic calming measures have been developed to address the issue of excessive speed. The short term measures include relatively low cost (less than $10,000) and easily implementable physical measures. The long-term strategies focus more on programmatic changes in land use and policy making to emphasize the neighborhood character.

3.1 Short-Term Measures

The proposed short-term traffic calming measures are described below. Estimated costs and effectiveness statistics are from similar applications documented in the references in the Introduction.

3.1.1 Gateways

Gateways placed at the eastern and western entrances to the neighborhood, specifically before the road descends into the Hollow, will provide motorists with a visual cue that they are entering a neighborhood environment. With placement on the crest of the hill, vehicles may be more likely to recognize the neighborhood before accelerating down the hill.

Estimated cost: $7,000 each, plus annual maintenance for plantings

Estimated effectiveness: -5% to -7% in 85th percentile speed

Figure 7: Gateway treatments in Jericho, VT (left) and Vergennes, VT (right).

3.1.2 Optical Speed Bars / Dragon's Teeth

Optical Speed Bars are 12-inch by 18-inch rectangles placed on the left and right sides of the lane. The rectangles are spaced at decreasing intervals to give the motorist a sense of speeding up. The speed bars should be placed on the downslope section of the hill to further discourage excessive speed.

Similarly Dragon's Teeth are triangles placed in a similar pattern. Dragon's teeth have not been approved by the MUTCD.

Estimated cost: $2,500, plus restriping costs

Estimated effectiveness: -2% to -7% in 85th percentile speed

Figure 8: Optical speed bars (left) and Dragon's Teeth (right) application. (NCHRP Report 737)

3.1.3 Radar Speed Feedback Sign

Figure 9: Radar speed feedback sign. (radarsign.com)

Radar speed feedback signs (RSFS) are LED signs that display the speed of the approaching vehicle on the sign. The speed flashes when it exceeds a certain limit. Many studies have shown that RSFS are effective in encouraging speed limit compliance. A radar feedback sign would be most effective in the flat, most dense section of the Hollow where the sign would be visible for the greatest distance. An RSFS could be placed for both directions of travel, but a westbound installation would likely yield the greatest benefit.

A recent study conducted by the ACRPC evaluated the effectiveness of radar speed feedback signs. The study was conducted on Harbor Road in Shelburne, which is a similar neighborhood road setting with a speed limit of 25 mph. The study, available from the ACRPC[1] and included as Attachment F, measured a reduction in the 85th percentile speed of -3 to -8 mph, or -9% to -20%.

Estimated cost: $5,000 each

Estimated effectiveness: -9% to -20% in 85th percentile speed

3.1.4 Speed Tables

Speed tables are vertical deflection devices that are traversed by vehicles. A speed table is longer than both speed bumps and humps. A properly designed speed table will allow vehicles to comfortably travel across it at the intended speed. Along Old Hollow Road, a speed table that is 3-inches high and 22-feet long including two 6-foot transition approaches should be easily traversed at 30 mph by passenger vehicles, emergency responders, commercial vehicles, and farm equipment. The tables should be placed at the base of the Hollow hill to encourage slow speeds entering the neighborhood and discourage significant acceleration between tables. Speed tables are most effective when placed at approximately 500-foot intervals.

As an alternative to asphalt paving, several pre-manufactured rubber speed tables are available. These rubber mats may be installed during the warm weather months and removed for cold weather periods. Speed tables should be accompanied by appropriate warning signs.

[1] "Effectiveness of Radar Speed Feedback Signs & Other Traffic Calming Techniques: A Test Case in Shelburne, Vermont", 2013, Addison County Regional Planning Commission, http://acrpc.org/transportation/

An increase in noise due to the vertical movement of vehicles crossing the table would be expected. Winter plowing operations may be impacted.

Estimated cost: $4,000 each

Estimated effectiveness: -14% to -24% in 85th percentile speed

Figure 10: Similar speed table application. (FHWA HRT-08-067)

3.1.5 Lane Reduction at the Lewis Creek Bridge

The bridge over Lewis Creek creates a natural bottleneck between the east and west sides of the Old Hollow Road neighborhood. Recently reconstructed, the 24-foot-wide bridge easily accommodates two lanes of traffic. One effective traffic calming measure would be placing concrete barriers 4 feet from the northern and southern bridge rails, reducing the width of the bridge from two lanes to one lane. This measure would require advance warning signs, particularly in the westbound direction where there is limited sight distance on a downgrade.

Figure 11: One-lane bridge across the Otter Creek in New Haven.

One-lane bridges are not uncommon in Vermont, and the shared lane requires drivers to slow and yield to traffic already on the bridge before proceeding. Additionally, the space between the bridge rail and concrete barriers would be available for pedestrians and bicyclists. The 16-foot shared lane should be large enough for town plows to maintain.

Estimated cost: $5,000

Estimated effectiveness: -3% to -8% in 85th percentile speed

3.1.6 Increased Enforcement

Lastly, increased enforcement will provide greater visibility to law enforcement in the neighborhood. While the neighborhood may risk becoming known as a "speed trap", the traffic data show that the median vehicle speed is at or near the speed limit. Ticketing offenders traveling at excessive speeds through the neighborhood, some noted as high as 76 mph, is a necessary component of speed limit compliance.

Estimated cost: Varies based on commitment

Estimated effectiveness: Varies based on commitment

3.2 Long-Term Measures

The following measures were identified as longer-term strategies to help encourage traffic calming from a more programmatic and policy approach.

3.2.1 Enhanced streetscape environment

The streetscape environment influences the motorist's perception of the roadway. A developed streetscape, including sidewalks, landscaping, street lighting, and other features increases the perception of uncertainty resulting from the increased likelihood of activity from pedestrians, bicyclists, and on-street parking. This uncertainty may lead to more defensive driving and slower operating speeds.

The existing neighborhood maintains many historic features, including mature landscaping and on-street parking, which promotes these characteristics. Continued attention to the streetscape will further enhance the positive traffic calming effects.

3.2.2 Encourage higher-density, mixed-use development as appropriate

Likely to occur in combination with enhancements to the streetscape environment, higher-density, mixed-use development will increase the feeling of activity and uncertainty to passing motorists, which may lead to more defensive driving and slower operating speeds. Town land use zoning and planning policies that encourage this type of development have the opportunity to positively impact the traffic environment through the neighborhood.

3.2.3 Secure long-term funding for regular enforcement

Long-term funding for law enforcement of the existing speed limit will help maintain regular enforcement of the speed limit, which is necessary for compliance.

3.3 Summary

The following short-term traffic calming measures are proposed:

Short Term Measure:	Cost:	Effectiveness (change in 85th %-ile):
Gateways	$7,000 each	-5% to -7%
Optical Speed Bars	$2,500 each	-2% to -7%
Radar Speed Feedback Signs	$5,000 each	-9% to -20%
Speed Tables	$4,000 each	-14% to -24%
Lane Reduction at Lewis Creek	$5,000	-3% to -8%
Increased Enforcement	Varies	Varies

4.0 RECOMMENDATIONS

In response to the results of the August 20, 2013 Alternatives Presentation Meeting (APM), the following recommendations have been developed. The APM was held in conjunction with the Selectboard Meeting and was well attended by over 20 nieghborhood residents. In general, most neighborhood residents were in favor of the traffic calming measures, with some in opposition.

An overall plan of the improvements as presented at the APM are illustrated in Attachment E.

Neighborhood Gateway
A neighborhood gateway feature should be installed on the eastern and western entrances to the neighborhood. Typical gateways include a sign identifying the community with attractive landscape plantings. The location of the of the gateways has been tentatively identified, however the features may need to be located outside the highway clear zone. The most appropriate location will likely be agreed upon with a willing landowner. Long term maintenance of the plantings could be provided by a neighborhood volunteer group.

It is recommended that the neighborhood gateway is designed by a landscape architect to select appropriate plantings and design an attractive sign or features within the context of the neighborhood. Municipal planning grants or other funding sources may be available to assist the town in designing an appropriate gateway.

Optical Speed Bars
Optical speed bars are recommended to be placed in the travel lanes going down the hill as vehicles enter the neighborhood. On the western entrance, the optical speed bars are recommended from Mount Philo Road to the bottom of the hill; on the eastern entrance, the optical speed bars are recommended from the bridge up the hill through the Four Winds Road intersection.

The speed bars would likely be required to be restriped on an annual basis to maintain maximum visibility and retroreflectivity. This cost should be included within the annual town highway maintenance budget.

Radar Speed Feedback Sign (optional)
A solar-powered radar speed feedback sign is recommended through the flat section of Old Hollow Road through the intersection, facing westbound vehicles. The sign should display the speed of the oncoming vehicle. Above 42 mph (7 mph over the speed limit) the sign should read "SLOW DOWN" to discourage motorists from recording a high vehicle speed. If the westbound sign is acceptable to the neighborhood, an eastbound sign may be added also. The sign(s) should be sited to avoid glare into residences and avoid the appearance of sign clutter.

The signs generally represent a one-time capital expense. Small construction grants may be available to assist the town in installing, wiring, and operating the signs. The signs may also be used in gathering data to measure the effectiveness of the feature.

The remaining two alternatives, including the proposed speed tables and lane reduction at the bridge are more impactive physical features. If the three recommendations above do not yield acceptable traffic calming results, these two alternatives may be implemented. It is anticipated that these recommendations will have a greater impact to drivers in compliance with the speed limit and should be implemented as other alternatives are exhausted.

These recommendations represent short-term, easily implementable physical traffic calming features. The three longer term recommendations, including streetscape enhancements, higher-density, mixed-use development policies, and enforcement funding are all applicable strategies for enhancing the neighborhood characteristic and encouraging slower operating speeds. All alternatives may be funded through grant opportunities, and the Town and neighborhood is encouraged to discuss the available options with ACRPC staff.