Capital District Transportation Committee (CDTC)/ Capital District Regional Planning Commission (CDRPC) Technical Assistance Program

TECHNICAL MEMORANDUM

Town of Glenville – Hoffman Hill Road

Hoffman Hill Road Safety Analysis FINAL 4/9/2021

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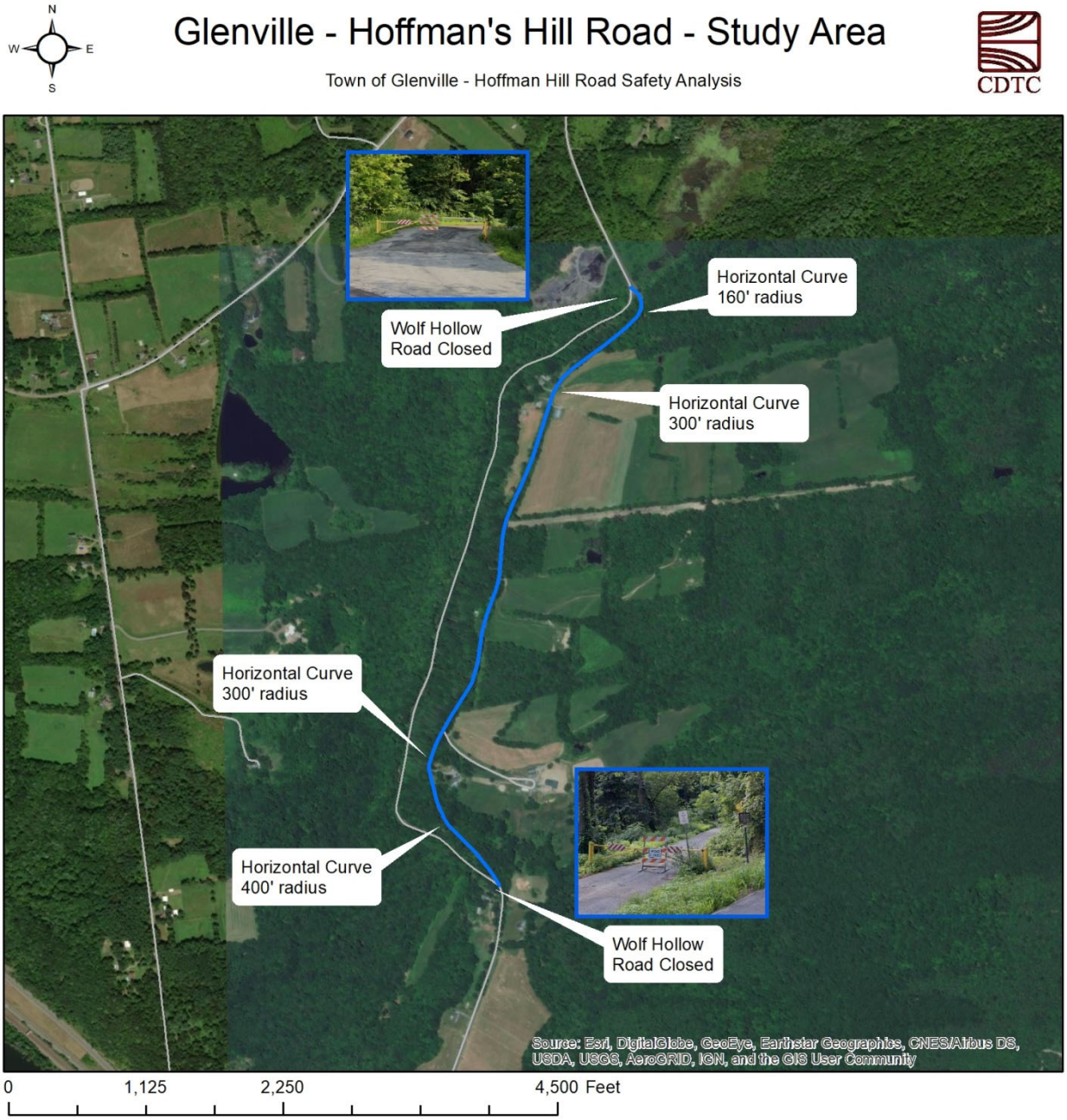
Background

The Town of Glenville has requested technical assistance through the CDTC/CDRPC Community Planning Technical Assistance Program to provide a safety assessment of a 1.1-mile portion of Hoffman Hill Road. The scope of work includes compiling an existing conditions assessment, meeting with town officials, and completing a safety analysis with recommendations for improving safety on Hoffman Hill Road. Recommendations for safety improvements are drawn from a number of sources that provide guidance on improving rural road safety and reducing lane departure crashes. The results of the assessment have been compiled into a technical memo for Town Official review.

Study Area

The study area is the 1.1-mile portion of Hoffman Hill Road between the gated ends of County Route 59: Wolf Hollow Road. This portion of Wolf Hollow Road runs parallel to Hoffman Hill Road and is closed to vehicle traffic. Hoffman Hill Road provides the only connection on County Route 59. Hoffman Hill Road is a town-owned road. The map below shows the study area.



Prior Planning Efforts

CDTC Local Road Safety Action Plan (2019)

Local Road Safety Plans have been identified by the Federal Highway Administration (FHWA) as a Proven Safety Countermeasure. For the CDTC Local Road Safety Action Plan, an analysis of local road safety data was conducted to determine emphasis areas based on predominant crash types to help guide safety investments. One of the emphasis areas identified - lane departure crashes - is relevant to Hoffman Hill Road, as the majority of crashes that have occurred on Hoffman Hill Road involve collisions with roadside fixed objects. Lane departure crashes account for 67% of all fatal & serious injury crashes on rural roadways in the CDTC Region. The Local Road Safety Action Plan identifies 13 actions that may be considered for implementation to reduce lane departure crashes. These 13 actions are grouped into four strategy categories as follows:

Program: *Create a program to identify* ***lane departure*** *crash contributing factors and higher risk locations on the local roadway system.*

Program Action	Lead Agency / *Partners*	Focus
Identify locations with high-risk roadway features that are correlated with lane departure crashes	**County, Municipal /** *CDTC*	Roadway
Develop a systemic lane departure safety program	**County, Municipal /** *CDTC, NYSDOT*	Roadway
Develop a methodology to review horizontal curves	**CDTC**	Roadway

Engineering: *Implement safety countermeasures at locations based on lane departure crash experience.*

Engineering Action	Lead Agency / *Partners*	Focus
Install/maintain retro-reflective shoulder striping	**County, Municipal**	Roadway
Install high friction surface treatments on horizontal curves	**County, Municipal**	Roadway
Install or upgrade curve warning and alignment signs to current MUTCD requirements	**County, Municipal**	Roadway
Install Safety Edge	**County, Municipal**	Roadway
Construct shoulder rumble strips (audible delineators)	**County, Municipal**	Roadway
Improve roadside clear zones	**County, Municipal**	Roadway
Install roadway lighting	**County, Municipal**	Roadway

Education: *Develop education and training materials related to lane departure crashes.*

Education Action	Lead Agency / *Partners*	Focus
Disseminate outreach materials, and training to educate the public on the major causes of lane departure crashes	**Department of Health /** *Municipal*	Behavioral
Conduct outreach to the public	**GTSC /** *CDTC, Municipal*	Behavioral

Enforcement: *Continue enforcement of traffic laws that reduce lane departure crashes.*

Enforcement Action	Lead Agency / *Partners*	Focus
Increase speed enforcement	**Local, County, State law enforcement**	Behavioral

The actions above shall be considered for implementation specifically on Hoffman Hill Road. The Local Road Safety Action Plan provides further guidance on the relative cost and timeframe of implementing each action and strategies for implementation.

Town of Glenville Traffic Safety Committee

Existing conditions data was compiled by Thomas Melander and provided to the Town of Glenville Traffic Safety Committee. Data provided included crash data, traffic volumes, traffic speeds, vehicle classification, existing signage, and more. A memo detailing the history of traffic safety concerns on Hoffman Hill and Wolf Hollow roads was also provided. The memo states that the portion of Wolf Hollow Road that runs parallel to Hoffman Hill Road has been closed since 2011 due to inclement weather erosion and has remained closed since. Traffic on that portion of Wolf Hollow has been rerouted onto Hoffman Hill Road. Concerns regarding vehicle safety and truck travel were documented in the memo. In response to concerns about truck traffic on Hoffman Hill Road, the Town of Glenville restricted heavy vehicles in excess of four tons in 2013.

All data provided has been summarized in the Existing Conditions portion of this report.

MUTCD Horizontal Curve Guidance

Chapter 2C of the Manual of Uniform Traffic Control Devices (MUTCD) provides regulatory guidance on the use of warning signs and object markers on roadways with horizontal curves. The study area has several horizontal curves that may benefit from improved signage. MUTCD guidance shall be reviewed for applicability to the study area.

FHWA Every Day Counts: Reducing Rural Roadway Departures

The FHWA Every Day Counts (EDC) program identifies proven innovations and develops State-based models for deployment. One of the innovation programs identified as part of the fifth round of EDC was 'Reducing Rural Roadway Departures'. According to FHWA, 12,000 fatalities occur each year in the United States when car leave their travel lanes on rural roads, which accounts for one-third of all fatalities. As part of the EDC initiative, FHWA identified proven safety countermeasures to deploy on all public rural roads. Planners are encouraged to develop systemic approaches to rural roadway safety that identify hazardous conditions and apply the appropriate countermeasures to treat them. FHWA also encourages the development of Safety Action Plans, such as the CDTC Local Road Safety Action Plan.

FHWA has identified the following treatments for reducing rural roadway departures. These treatments shall be considered for Hoffman Hill Road:

- Signage and markings that delineate lane edges and alignment changes and help drivers navigate.
- Rumble strips that alert drowsy and distracted drivers drifting from their lane.
- Friction treatments at curves or other important locations to reduce loss of control.
- Shoulders, SafetyEdge, and clear zones to provide opportunities for a safe recovery when drivers leave the roadway.
- Roadside hardware that can reduce the severity of roadway departure crashes.

Source: FHWA Roadway Departure Crash Emphasis Areas

More information on the EDC initiative 'Reducing Rural Roadway Departures' may be found here: https://www.fhwa.dot.gov/innovation/everydaycounts/edc_5/roadway_departures.cfm

General guidance from FHWA on rural roadway safety may be found here: https://safety.fhwa.dot.gov/roadway_dept/

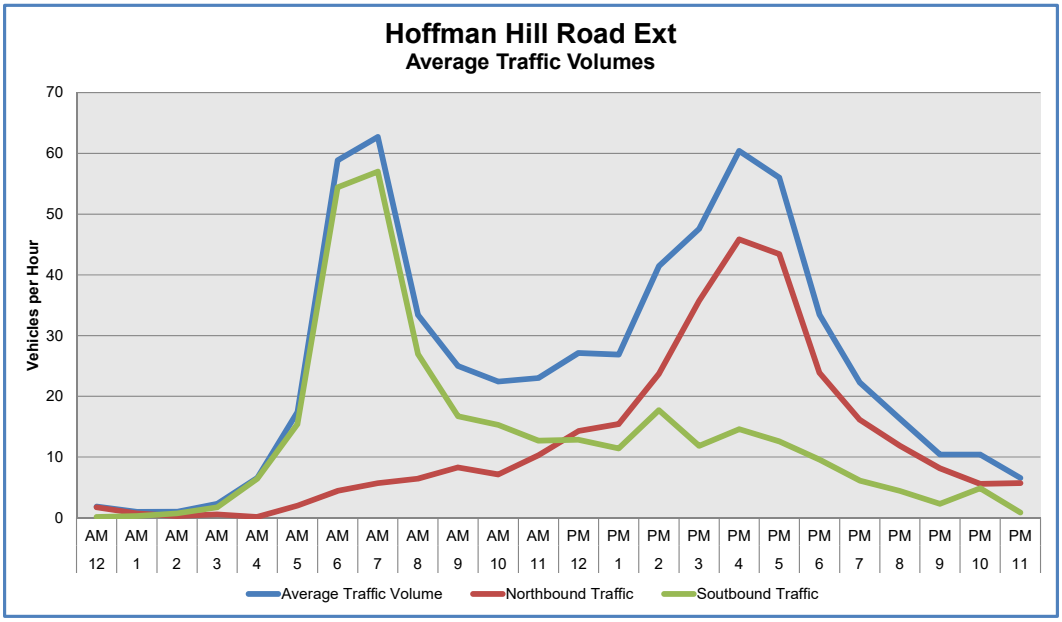
Existing Conditions

Traffic Volume

A 7-day vehicle speed and classification count was conducted on Hoffman Hill Road from October 19th through October 25th, 2019. Data from the count was prepared by Thomas Melander and provided to the Town of Glenville Traffic Safety Committee.

The observed two-way average daily traffic (ADT) was 614 vehicles/day. Peak hour traffic volume was 94 vehicles, observed on Tuesday from 7 to 8 AM. The average weekday traffic volume was 686 vehicles/day.

Strong directionality of traffic was observed by time-of-day, with greater southbound volume in the AM peak period and greater northbound volume in the PM peak period:

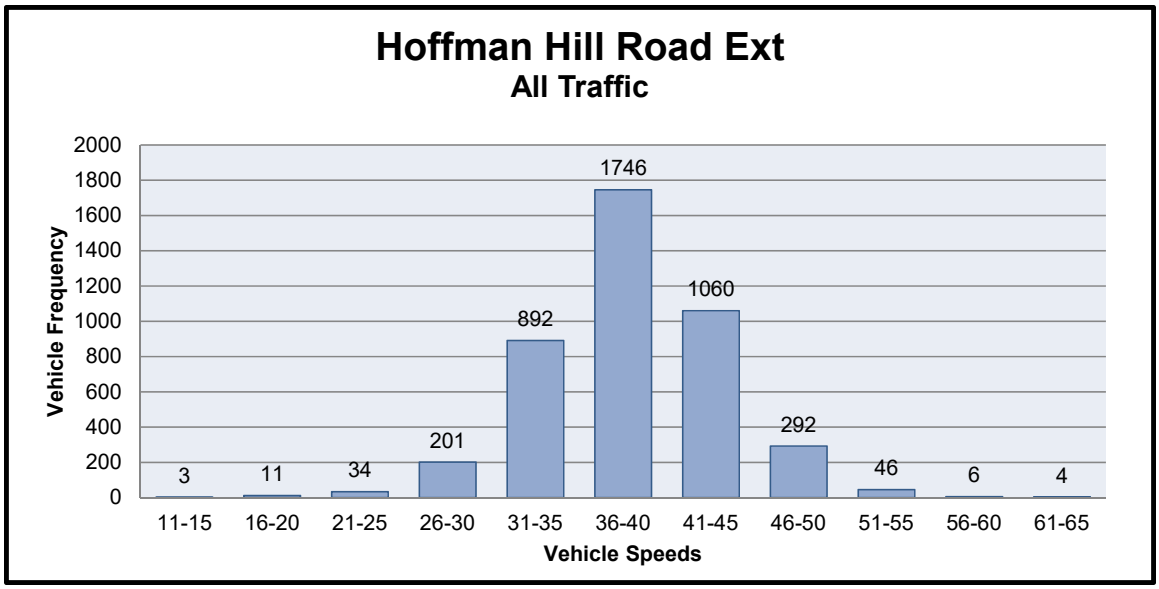


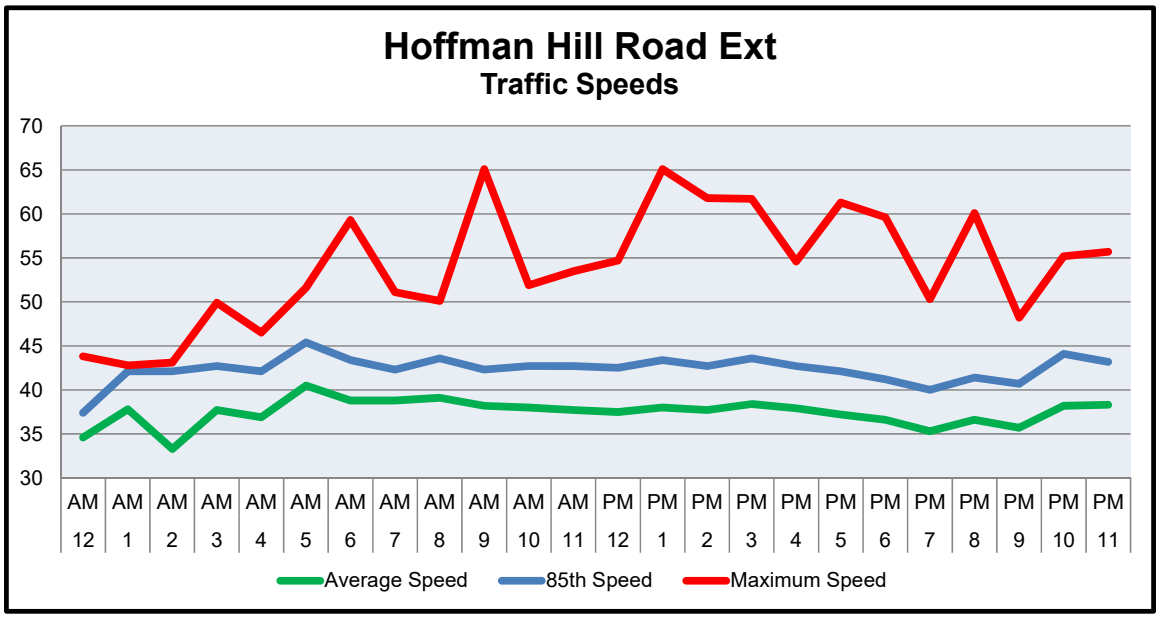
Source: Memo, G-2019-020 – Hoffman Hill Road Ext Vehicle Speed Statistics.

Vehicle Speed

The posted speed limit on Hoffman Hill Road is 30 mph. During the 7-day count conducted from October 19th through October 25th, the average speed observed was 38 mph. The 85th percentile speed was 43 mph for both northbound and southbound traffic. 71% of vehicles were observed to be travelling between 32 and 42 mph.

The diagrams below summarize observed vehicle speed by speed and by time-of-day.





Source: Memo, G-2019-020 – Hoffman Hill Road Ext Vehicle Speed Statistics.

Vehicle Classification

During the 7-day count conducted from October 19th through October 25th, 4,301 total vehicles were observed and classified. Almost all vehicles observed were passenger vehicles, SUVs, Vans, or Pickups due to the posted weight limit of four tons. The table below summarizes vehicle types:

Vehicle Type	Count	Percent	Notes
Passenger Vehicles	2,790	65%	
Motorcycles	42	1%	
SUVs/Vans/Pickups	1,443	34%	
Buses	5	0%	
Trucks – 2 Axles	12	0%	UPS, Fed Express Trucks
Trucks – 3+ Axles	7	1%	Garbage Trucks
Tractor-Trailers – 3 Axles	1	0%	Lawn Service Truck and trailer
Tractor-trailers -5+ Axles	1	0%	Large Tractor Trailers

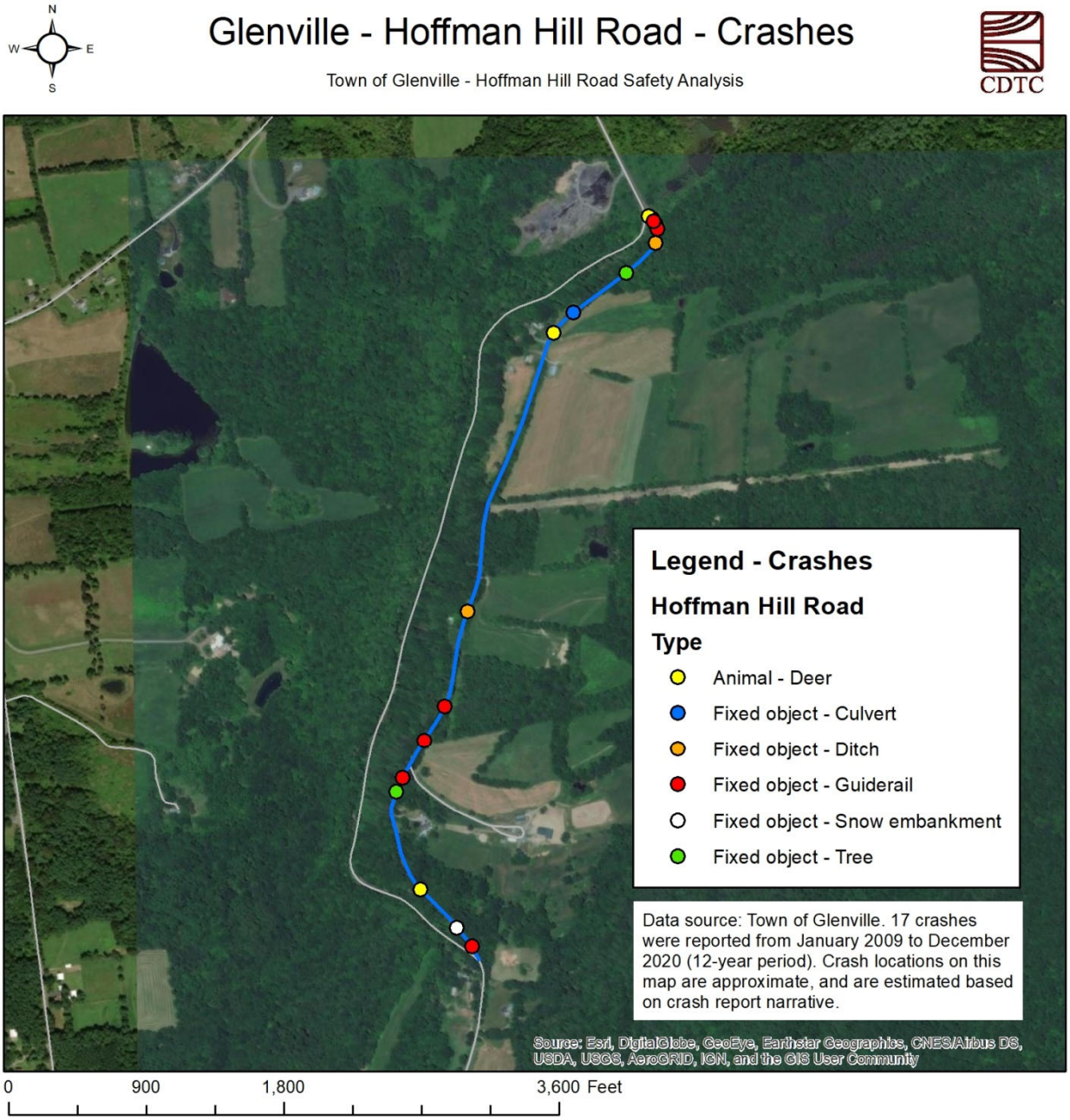
Safety Analysis

A crash history summary for Hoffman Hill Road was prepared by Thomas Melander. Crash reports were pulled for a 12-year period beginning January, 2009 and ending December, 2020. During this period, 17 crashes were reported. All crashes were reported to be property damage only – no injuries were reported.

Of the 17 crashes that occurred, 14 were fixed object collisions and three were animal collisions. None of the reported crashes involved two or more vehicles. Of the 14 fixed object collisions, 7 were collisions with guide rail, 3 with ditches, two with trees, one with culvert, and one with snow bank.

Eleven of the 17 crashes occurred in daylight, and six occurred in dark conditions. Six crashes were reported to occur in snow/ice conditions, while the remaining 11 occurred in dry conditions.

The diagram on the following page shows the approximate locations of the 17 reported crashes. Locations are approximate, and are estimated based on crash report narrative. There is a cluster of six crashes at the north end of the study area, at the northern intersection with Wolf Hollow Road. Of the six crashes at this cluster, three were collisions with guiderail, two with ditches, and one with a deer.



The crash rate on Hoffman Hill Road is estimated to be 5.75 crashes per million vehicle miles travelled (ACC/MVM). This rate exceeds the average for rural state highways. According to average accident rates published by NYSDOT, the average rate for undivided two-lane rural state highways 2.11 ACC/MVM. The disparity in crash rate is likely due to the high proportion of fixed object collisions reported on Hoffman Hill Road.

Right-of-way

Hoffman Hill Road is maintained by the Town of Glenville. Most of the parcels adjacent to the roadway are privately owned. At the north end of the study area, the first 230 feet of Hoffman Hill Road is flanked by parcels owned by Scotia Sand & Stone Co., according to the Schenectady County tax parcel map. The rest of the roadway is adjacent to private parcels.

Pavement width

For the entire length of the study area, the pavement width is approximately 20 feet, with two 10-foot travel lanes. Shoulders are not present in the study area. There are no sidewalks or trails in the study area.

Above: Typical roadway section with 20' pavement width and no shoulders

Pavement condition

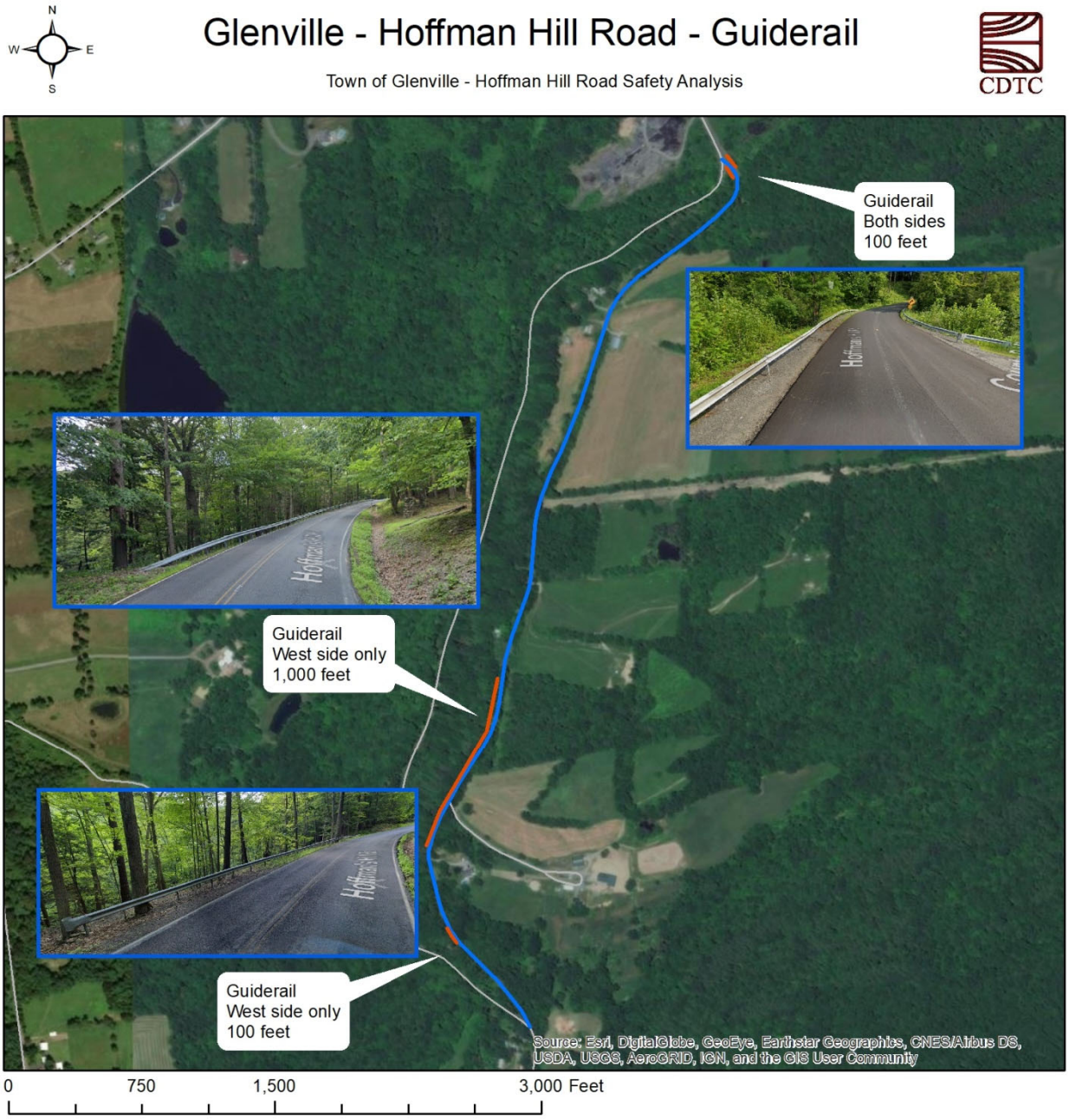
During a March 2021 field visit, pavement was observed to be in poor-to-moderate condition. In some sections, centerline joint cracking was visible. There was considerable erosion of the pavement edge in many places. Centerline and edge line pavement markings are faded, and in some places no longer visible.

Above: erosion of the pavement edge can be seen in many places

Above: centerline joint cracking at the south end of the study area

Guiderail

Three segments of Hoffman Hill Road have guiderail. At the south end of the study area, there is a short section of guiderail on the west side of the roadway at the southernmost curve. There is approximately 1,000 feet of guiderail on the west side just north of the curves. At the north end of the study area, there are short sections of guiderail on both sides of the road.



Vertical alignment

Steep gradients at both the north end and south end of Hoffman Hill Road present additional hazards. Gradients can limit visibility and impede braking, especially in wet or icy conditions. The gradients present on Hoffman Hill Road overlap with horizontal curves.

South gradient – from the beginning of Hoffman Hill Road to approximately 1600 feet north, there is a vertical elevation change from 450 feet to 670 feet (+220 feet). This corresponds to a mean grade of approximately 13.8%.

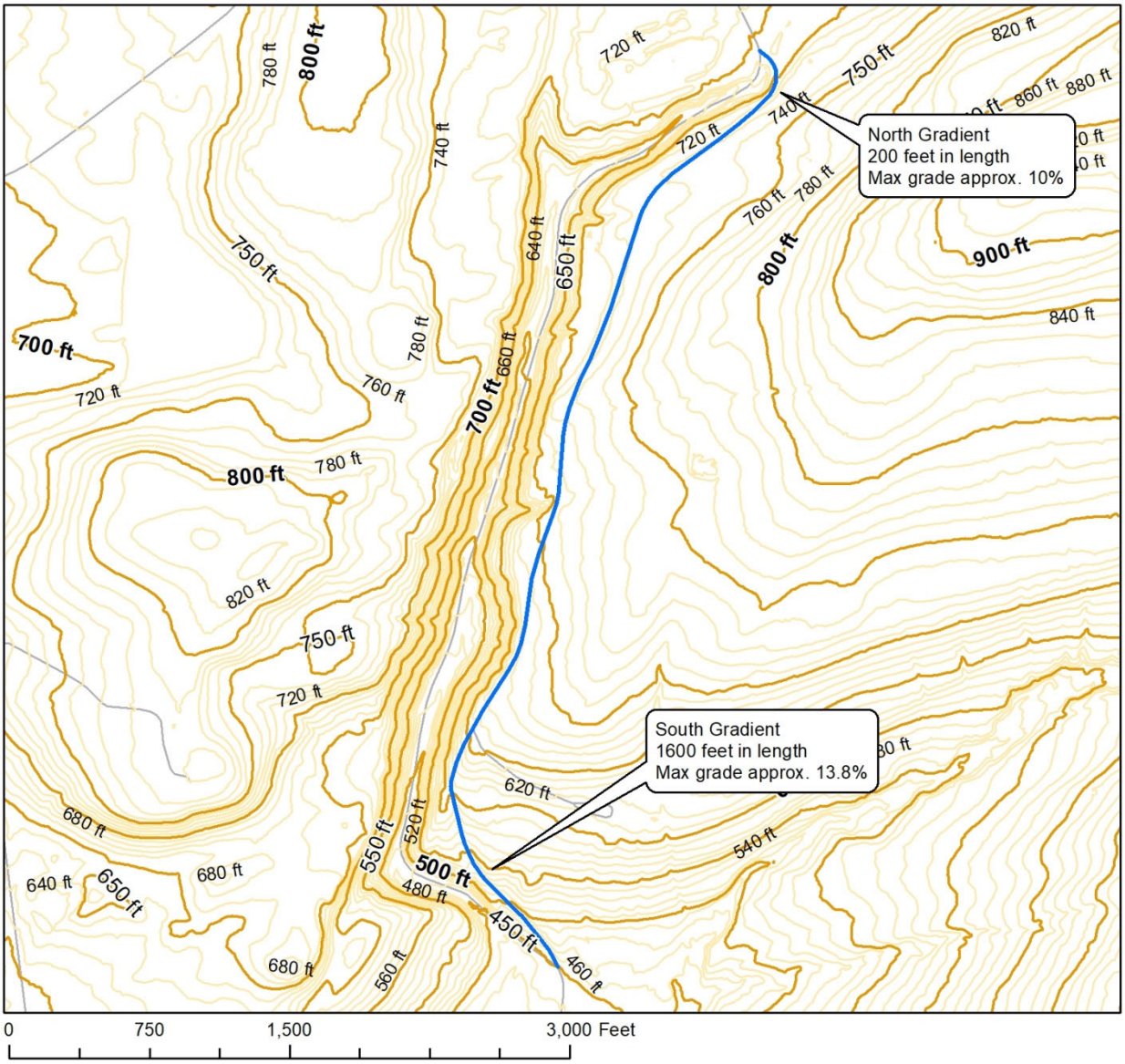
North gradient – from the northern end of the study area to approximately 200 feet south, there is a vertical elevation change from 700 feet to 720 feet (+20 feet). This corresponds to a mean grade of approximately 10%.

Per the NYSDOT Highway Design Manual, the maximum percent grade on a local rural road with a design speed of 30 mph is 11% in 'Rolling' terrain. Therefore, the south gradient may exceed the NYSDOT-recommended design grade for this type of roadway, and the north gradient is close to the maximum.

The map on the following page shows 10-foot contour lines in the study area.

Glenville - Hoffman Hill Road - Elevation

Town of Glenville - Hoffman Hill Road Safety Analysis



Roadside hazards

The pavement width throughout the study area is approximately 20 feet, with 10-foot travel lanes and no shoulders. In many locations on Hoffman Hill Road, roadside hazards are present:

Trees: throughout much of the study area, trees are present close to the edge of the road.

Above: trees close to pavement edge

Steep drop-offs: On the elevation map on the preceding page, a steep gradient can be seen on the west side of the roadway throughout much of the study area. This drop-off comes close to the roadway in several places. Such drop-offs make vehicles unable to recover from road departures. The steepest off-road gradient is present in the 1,000 foot section with guiderail.

Above: the steepest roadside drop-off, behind guiderail on west side of roadway

Above: another roadside drop-off without guiderail

Ditches: Drainage ditches are close to the pavement edge throughout much of the study area. Ditches make vehicles unable to recover from road departures.

Above: ditches on east side of roadway

As part of the FHWA Model Inventory of Roadway Elements (MIRE), roadways may be assigned a Roadside Hazard Rating from 1 (least hazard) to 7 (most hazard). FHWA has published MIRE guidance including the criteria used to assign a hazard score. The most suitable score for Hoffman Hill Road is 6:

6. **Rating = 6**
   - Clear zone less than or equal to 5 ft.
   - Sideslope about 1:2.
   - No guardrail.
   - Exposed rigid obstacles within 0 to 6.5 ft of the pavement edgeline.
   - Non-recoverable.

Above: criteria for Roadside Hazard Rating of 6. Source: FHWA MIRE Version 2.0

Typical Roadway with Roadside Hazard Rating Equal to 6.

Above: Photo example of Roadside Hazard Rating of 6. Source: FHWA MIRE Version 2.0

Recommendations

Potential roadway safety recommendations are drawn from the CDTC Local Road Safety Action Plan and FHWA 'Reducing Rural Roadway Departures' guidance. Specific recommendations relating to signage, striping, and other forms of traffic control are derived from the MUTCD.

The engineering actions reviewed below are considered for specific application to Hoffman Hill Road; however, many actions would benefit from a broader systemic application to all roadways maintained by Town of Glenville. For example, friction treatments on curves may help reduce roadway departure crashes on Hoffman Hill, but the Town may have many other curves that would benefit from friction treatment that could all be bundled into the same contract. Taking a systemic approach to safety involves identifying all areas that have hazardous conditions rather than focusing only on crash hotspots.

Per FHWA's Roadway Departure Safety guidance, safety countermeasures may be broadly grouped into three categories:

- ***Keeping vehicles on the roadway***, for actions such as signage, striping, rumble strips, and friction treatments that keep drivers on the road and in their lane;
- ***Providing for safe recovery***, for actions such as Safety Edge and clear zones that allow vehicles to safely steer back onto the roadway; and
- ***Reducing crash severity***, for actions such as guiderail and breakaway sign supports that reduce the severity of crashes for vehicle unable to recover.

Safety countermeasures in all three categories shall be considered for deployment on Hoffman Hill Road.

Countermeasures that keep vehicles in their lane

Retro-reflective edge line striping: Over time, the retroreflectivity of pavement markings fade and must be maintained for nighttime visibility. The white edge line striping on Hoffman Hill Road is faded throughout the study area. Because there is no shoulder, it is especially important to maintain edge line striping so that drivers can see changes in horizontal alignment at night.

Maintaining centerline retroreflectivity is also helpful, especially on horizontal curves. Although Hoffman Hill does not have a history of crashes caused by centerline crossing, it would still be beneficial to maintain centerline striping to mitigate this risk.

Above: photo from field visit showing edge line striping is no longer visible

Curve signage and delineation: Per MUTCD, advance warning signs should be present in advance of each horizontal curve. Curve warning signs and advisory speed signs are present on the north curve, but not the south curve. Additional W1-1 signage and advisory speed signs should be considered for the south curve.

Both the north and south curve would benefit from the installation of chevrons. Per FHWA, chevron signage has been shown to reduce nighttime crashes by 25%, and all fatal and injury crashes by 16%.

Per FHWA, delineators may also be used to indicate changes in horizontal alignment. Delineators are retroreflective devices mounted above the roadway surface and along the side of the road in a series. Delineators are white in color to match the edge line. Delineators should be placed 2 to 8 feet outside

the outer edge of the shoulder, or if appropriate, in line with the roadside barrier. The delineators should be placed at a constant offset, to appropriately reflect the alignment. An exception is made when there is a roadside obstruction, such as a tree. In this case, the line of delineators must be transitioned to be within the innermost edge of the obstruction. MUTCD Table 3F-1 contains more information on delineator placement and spacing.

Above: retroreflective delineators on a rural horizontal curve. Source: FHWA

Above: Retroreflective chevron signage, and guide rail linear delineators. Source: 3M.

Existing signage in the study area should be assessed for retroreflectivity. Per MUTCD, regulatory, warning, and guidance signs that do not meet retroreflectivity guidelines should be replaced.

Per MUTCD Section 2C.16, hill signs may be used in areas where the grade exceeds a certain length and steepness. On Hoffman Hill Road, the southern gradient is estimated to exceed 13%; therefore, a W7-1 Hill Sign may be warranted. Although trucks over 4 tons are not permitted on Hoffman Hill Road, the hill sign provides advance warning to all drivers and may help to reduce speeds.

Shoulder rumble strips: Rumble strips alert drivers who drift from their lane, and have been proven to greatly reduce lane departure crashes. However, no suitable shoulders are present on Hoffman Hill Road. If shoulders were installed as part of a future project, shoulder rumble strips should be considered due to the high roadside hazard and narrow travel lanes.

Friction treatments: Per FHWA, High friction surface treatment (HFST) is a highly cost-effective countermeasure. HFST compensates for the high friction demand at curves where the available pavement friction is not adequate to support operating speeds due to one or more of the following situations:

- Sharp curves.
- Inadequate cross-slope design.
- Wet conditions.
- Polished roadway surfaces.
- Driving speeds in excess of the curve advisory speed.

HFST installation involves the use of a thin layer polish- and abrasion-resistant aggregate (such as crushed bauxite) applied to the road with epoxy. HFST may extend the lifecycle of the pavement surface on which it is applied by reducing surface wear. FHWA estimates the expected lifecycle of HFST to be approximately 10 years.

Above: close-up of HFST application. Source: FHWA.

Per FHWA, high friction surface treatments have been shown to reduce wet road crashes by 52% and all curve crashes by 24%. HFST may be deployed as a hotspot treatment, or as part of a larger systemic application.

On Hoffman Hill Road, the horizontal curves at the north and south end of the study area would benefit from the installation of HFST. The north curve has a crash cluster that it likely caused by the combination of the steep grade and sharp curve; both conditions may be treated through HFST.

Roadway lighting: Overhead illumination can improve driver awareness of changes in horizontal alignment. Per FHWA, properly designed roadway lighting allows road users to quickly assess roadway conditions and creates a safer environment within the roadway vicinity.

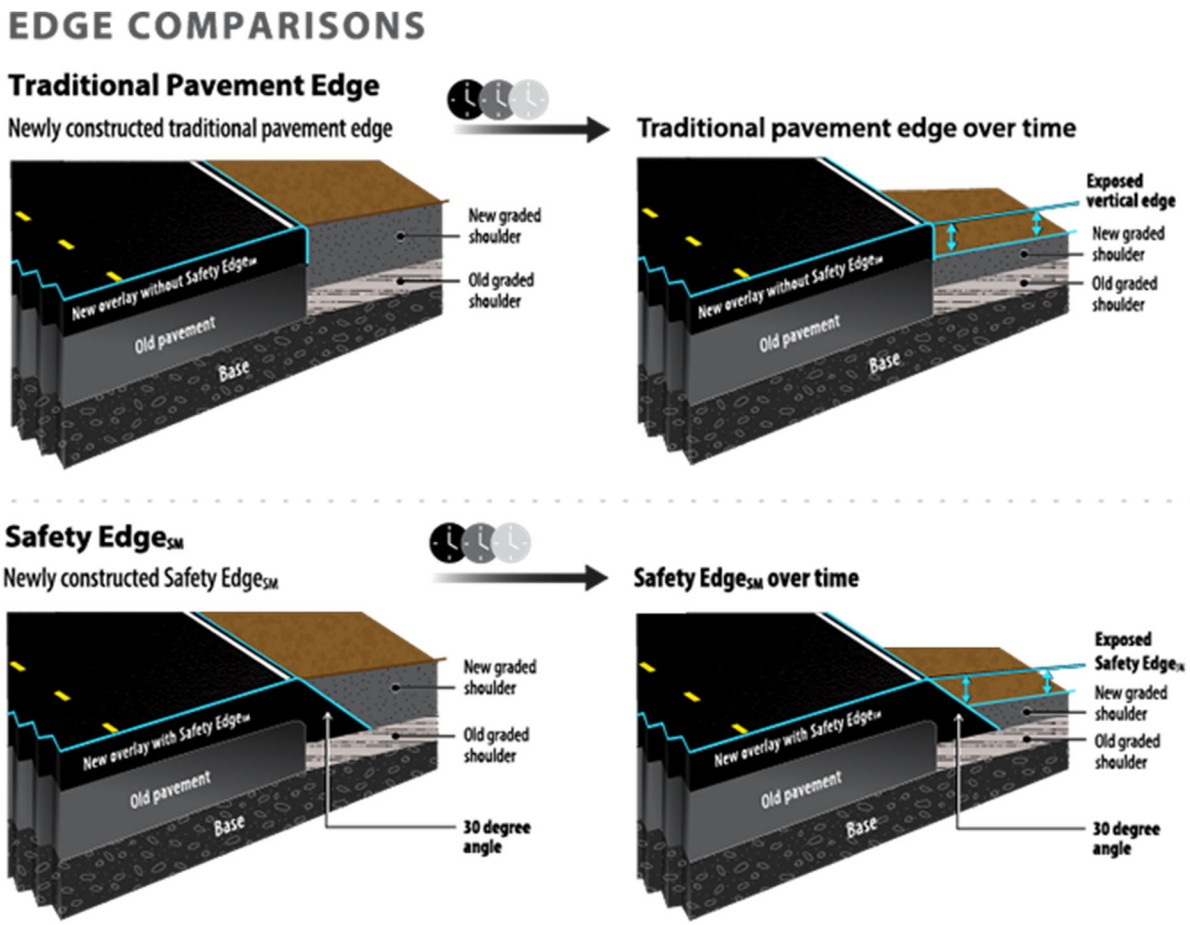
Most warrants for roadway lighting (high traffic volumes, presence of intersections, crosswalks, or raised medians) are not met by Hoffman Hill Road. However, FHWA notes that lighting systems may be warranted when there is a high Night-to-day crash ratio. On Hoffman Hill Road, 6 crashes occurred in dark conditions and 11 occurred in daylight. As traffic volumes are lower at night, the nighttime crash rate is likely higher than the daytime crash rate. The exact Night-to-day crash ratio cannot be calculated without traffic counts broken down by lighting condition. Further information on lighting warrants and implementation guidance can be found in the FHWA

As lighting systems are costly to implement, it may be best to focus on lower cost improvements such as signage, striping, and delineation first; once these improvements have been implemented, crash rates can be re-assessed to see if night crashes still warrant lighting systems.

Countermeasures that provide for safe recovery

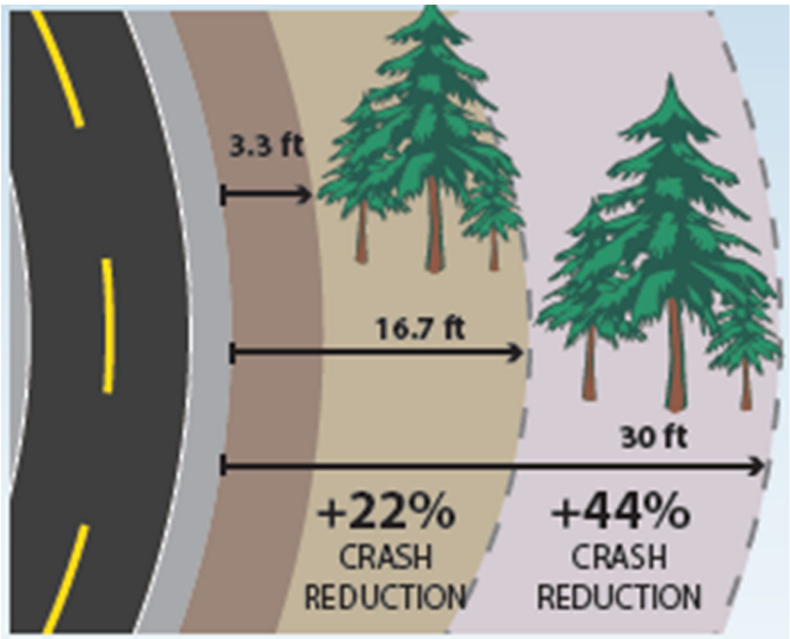
Safety Edge: Safety Edge is a 30-degree tapered pavement edge that aids in vehicle recovery back onto the roadway. Safety Edge is one of the FHWA Every Day Counts initiatives. FHWA recommends using a Safety Edge on all roadway resurfacing projects where there is a height difference between the paved road and the adjacent graded material. Shaping the pavement edge to a 30-degree taper reduces 'tire scrubbing' that occurs when vehicles attempt to steer back onto the roadway.

When resurfacing Hoffman Hill Road, the Town should consider incorporating Safety Edge to help vehicles safely recover. FHWA reports that Safety Edge is a low-cost safety countermeasure that may also help improve pavement edge durability.



Above: Safety Edge reduces drop-off when graded material has worn away. Source: FHWA

Roadside clear zones: Per FHWA, a roadside clear zone is an unobstructed, traversable area beyond the pavement edge for the recovery of errant vehicles. Clear zones are free of rigid fixed objects such as trees and utility cabinets or poles. Clear zones may be used in conjunction with adding or widening shoulders.



Above: crash reduction factors for 16.7-foot and 30-foot clear zones. Source: FHWA.

For much of the study area, clear zones may be difficult to implement due to the terrain. Data on ROW width is also needed to asses where clear zones may be implemented. In areas where clear zones cannot be established, FHWA recommends installing guide rail to shield roadside obstacles or embankments.

Countermeasures that reduce crash severity

Guiderail: There are three segments of Hoffman Hill Road that already have steel guiderail installed. Guiderail on these segments serves to shield vehicles from roadside hazards, such as steep slopes or trees. Additional guiderail should only be installed in areas where vehicles that leave the roadway cannot come to rest safety. The installation of additional segments of guiderail should be considered where roadside hazards are present.

FHWA publishes extensive device-specifc guidance and memoranda on guiderail. Manufacturers must have their guiderail assessed for crashworthiness before being issued an Eligibility Letter by FHWA. Guiderail should also have an appropriate 'End terminal' (or end treatment, crash plate) at each end. The end terminal should have a retroreflective surface for nighttime visibility.

Above: Guiderail end terminal

At the north end of the study area, there is a crash cluster of guiderail crashes at the bottom of the gradient. The guiderail shields vehicles from going over a steep drop-off and striking trees. This guiderail likely reduces the severity of crashes that occur. Portions of Hoffman Hill Road with similar roadside hazard should be considered for guiderail deployment.

References

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