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the routine presence of heavy-duty vehicles using the intersection.

**Suggestions:**

1. Narrow the White Schoolhouse approach with pavement markings. Narrowing the pavement width would discourage side by side stops and direct drivers to a safe stopping position. This could be implemented by visually narrowing the travel lanes on the east and west sides with hatching, and adjusting the configuration to be more of a 'T'. This would offer an opportunity to review a possible new stop line location, balancing truck turning needs and sight distance considerations for vehicles turning onto Slate Quarry Rd. The SA Team recognized that painted features require additional maintenance and there would be no physical feature to prevent incursions into the intersection shoulder areas and side-by-side vehicle queuing.
2. Physically narrow the existing pavement. This would involve removing excess pavement and narrowing the White Schoolhouse Rd approach (SA Team members pointed to Mulberry St in the Village of Rhinebeck as a useful model). The west leg of the Y could be eliminated, so that all drivers would use what is currently the east leg, making the intersection more of a 'T'. Design vehicle turning templates would need to be reviewed prior to making any physical changes. Narrowing the pavement could also offer an opportunity to address the regulatory sign issues identified above.

**Priority for Consideration:**

Suggestion 1: High

Suggestion 2: Moderate

**Issue #3: Sight Distance**

**Safety Concern:** Sight distance on Slate Quarry Rd is limited both eastbound and westbound near White Schoolhouse Rd. In particular, there is limited sight distance for eastbound traffic on Slate Quarry Rd turning left onto White Schoolhouse Rd, and limited stop line sight distance for traffic on White Schoolhouse Rd turning left onto Slate Quarry Rd.

**Observations:** Drivers on Slate Quarry Rd have difficulty seeing vehicles approaching from the opposite direction as they reach White Schoolhouse Rd. Though the intersection itself is visible from Slate Quarry Rd, approaching vehicles in the opposite lane are masked by an outcrop of trees and bushes on the south side of Slate Quarry Rd, directly opposite White Schoolhouse Rd. These trees may prevent drivers from recognizing vehicles that intend to turn onto White Schoolhouse Rd, and in turn, make them lose valuable reaction time. In particular, the SA Team noted that the sight line for Slate Quarry Rd could be improved by removing the large tree located on the inside of the curve. DCDPW previously discussed removal of this tree with the landowner (220 Slate Quarry Rd), but no changes have been made. The SA Team reported that residents at 209 Slate Quarry Rd had also complained of poor visibility from their driveway, particularly looking east. Sight lines from White

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Schoolhouse Rd looking east up the hill are also restricted by the general horizontal and vertical geometry of Slate Quarry Rd. See Figures 16-18.

**Risk Analysis:** The lack of adequate sight distance decreases driver reaction time, increasing the risk of a collision. Operating speeds on Slate Quarry Rd increase the probability of a severe collision, especially as westbound vehicles descend the hill on Slate Quarry Rd towards White Schoolhouse Rd.

**Suggestions:**

1. Trim and/or Remove Existing Vegetation. Pursue trimming or removal of the bushes and trees on the south side of Slate Quarry Rd across from and east of White Schoolhouse Rd.
2. Lower Vertical and Straighten Horizontal Curves on Slate Quarry Rd. This would improve sight distance for both eastbound Slate Quarry Rd drivers and those stopped at the intersection. The SA Team realized that this would require significant funding, so identified this as a low priority.
3. Trim the trees at the northeast corner of the Slate Quarry Rd/White Schoolhouse Rd intersection (on the north side of Slate Quarry Rd).
4. Remove rock and brush on both sides of the driveway to 209 Slate Quarry Rd, and consider installing a DRIVEWAY warning sign.

**Priority for Consideration:**

Suggestion 1: Moderate  
Suggestions 3-4: Low  
Suggestion 4: Moderate

**Issue #4: SCHOOL BUS STOP AHEAD Sign**

**Safety Concern:** Warning signs that rely on text rather than images require more driver attention and may become a distraction.

**Observations:** The SCHOOL BUS STOP AHEAD warning sign on the north side of Slate Quarry Rd, east of the White Schoolhouse Rd intersection uses the older, text-based style.



S3-1

**Risk Analysis:** Approaching drivers might become distracted by the text-based warning sign and lose reaction time as they approach the White Schoolhouse Rd intersection.

**Suggestion:** Install the current graphic-based SCHOOL BUS STOP AHEAD SIGN (S3-1) in advance of White Schoolhouse Rd.

**Priority for Consideration:** Low

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*Figure 17. Looking towards White Schoolhouse Rd from eastbound Slate Quarry Rd. Note the change in horizontal geometry towards the curve.*



*Figure 18. Looking towards White Schoolhouse Rd from westbound Slate Quarry Rd. The trees located to the left, inside the curve, obscure approaching vehicles.*

## **CR19 (Slate Quarry Rd) from White Schoolhouse Rd to Wurtemberg Rd**

### **Issue #1: Sight Distances**

**Safety Concern:** Limited visibility at two major curves on Slate Quarry Rd and from approaching driveways may lead to crashes. The horizontal and vertical changes on Slate Quarry Rd restrict sight distances from driveways, the White Schoolhouse Rd intersection, and on Slate Quarry Rd itself.

**Observations:** The horizontal and vertical geometry of Slate Quarry Rd changes throughout the eastern half of the study area. This challenging geometry is complicated by the presence of earthen embankments and vegetation that restrict visibility and reduce driver reaction time. This is especially noticeable at the curve on Slate Quarry Rd in the middle of the study area (91 Slate Quarry Rd), where the inside curve is framed by a rock embankment that includes trees and bushes. These obstructions prevent drivers from seeing down the road and recognizing potential hazards. The crash data does not indicate a safety issue related to poor visibility from driveways, but the road's geometry creates limited sight distances of east and westbound vehicles from driveways. See Figures 19-20.

**Risk Analysis:** Inadequate sight distance increases the risk of a crash by reducing the driver's ability to accurately judge upcoming roadway features and approaching vehicles. For vehicles turning from driveways, a lack of adequate sight distance increases the risk of a collision by affecting the driver's ability to accurately judge and accept gaps in approaching traffic. Operating speeds on Slate Quarry Rd increase the probability of a severe collision.

### **Suggestions:**

1. As part of normal tree maintenance, DCDPW should ensure that the County right-of-way is free and clear of obstructions and that the clear zone is sufficient for this type of facility. If vegetation is located on private property and is determined to compromise safety, DCDPW should notify the applicable property owner of the situation and suggest that they remove the obstruction(s).
2. Remove the rock embankment and trees located on the inside of the major curve located near 91 Slate Quarry Rd. DCDPW should investigate the ownership of this particular feature, since Dutchess County Parcel Access indicates that the rock embankment sits within the County's right-of-way and may not require taking property from local owners. It should be noted that the embankment is also bordered by a parcel that belongs to the mining operation at 410 White Schoolhouse Rd.
3. Reduce the horizontal and vertical curves at the two major curve sections on Slate Quarry Rd. This would improve sight distance for drivers exiting driveways along the road, while allowing drivers on Slate Quarry Rd to recognize oncoming vehicles earlier, increasing reaction times. Due to the cost and time needed for such improvements, the SA team identified this as a long-range suggestion.



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Figure 19. Looking west on Slate Quarry Rd, towards one of two major curves. The outcrop of trees and rocks to the right obscures oncoming vehicles.



Figure 20. Looking east on Slate Quarry Rd towards the rock embankment located on the inside of the curve shown above.

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**Priority for Consideration:**

Suggestion 1: Moderate

Suggestion 2: Low

Suggestion 3: Low

**Issue #2: Advisory Speeds**

**Safety Concern:** The range of posted advisory speeds along Slate Quarry Rd may lead to driver confusion and non-compliance.

**Observation:** The SA Team noted that there are four different advisory speeds along Slate Quarry Rd, ranging from a high of 40 mph at gradual curves, 35 mph at moderate curves, and 30 and 25 mph at sharper curves. In light of the speed limit reduction to 45 mph, the 40 mph advisory speed seems possibly too high; the same holds true for the 30 mph advisory speed when compared to subsequent 25 mph advisory speeds along the road.

**Risk Analysis:** Drivers may become confused by the inconsistent advisory speeds and ignore them, increasing the likelihood of a collision or road departure.

**Suggestion:** Re-evaluate the posted advisory speeds and consider using only two advisory speeds (e.g. 25 and 35 mph) on Slate Quarry Rd.

**Priority for Consideration:** High



*Figure 21. A variety of advisory speeds are used along Slate Quarry Rd.*

**Issue #3: Guiderails (Existing & New)**

**Safety Concern:** Portions of existing guiderails are in poor condition and use the older “W-beam” style of rail, while some roadside areas with steep drop-offs and water features may warrant the installation of additional guiderails.

**Observations:** Recurring vehicle impacts and general wear and tear have damaged sections of guiderail, some of which are missing structural members and many of which are missing delineators. The guiderails use the older “W-beam” design that includes gradually tapered end features. These guiderail ends can sometimes act as a ramp for vehicles that depart the roadway, vaulting them over the guiderail if hit at high speeds. Instead, it is recommended that the box-beam design be used for existing and new guiderails. The SA

team also noted that new guiderails might be needed on both sides of Slate Quarry Rd between the major curves on the eastern half of the study area: several locations have steep drop-offs and/or standing water, which could magnify the impact of road departures. However, some SA Team members noted that additional guiderails could potentially redirect errant vehicles back into the roadway and the path of oncoming vehicles. See Figures 22-27.

**Risk Analysis:** Lack of adequate guiderails can result in an errant vehicle traversing down a steep, non-recoverable slope. This is of special concern if the area at the toe of the slope contains fixed objects or other hazards such as deep water. Askew guiderail systems and turned down end sections can also increase the risk of vehicle launching.

**Suggestions:**

1. Repair exiting guiderails.
2. Install metal reflectors and/or add a reflective strip along the side of the guiderails to increase visibility at night.
3. Replace existing guiderails with a box-beam design. The SA Team noted that the County standard for new installations is box beam guiderail and that DCDPW has a program to identify and replace deficient systems.
4. Evaluate the need for installation of one more new guiderails along Slate Quarry Rd, especially in the section between the two major curves in the eastern half of the study area. DCDPW should weigh the benefit of a new guiderail with the potential of increasing possible head-on crashes if errant vehicles bounce back into traffic. As an alternative and where appropriate, DCDPW could consider raising shoulder and clear zone elevations to reduce drop-off distances.
5. As an interim measure, consider object markers at significant drop-off areas until guiderail can be installed.

**Priority for Consideration:**

Suggestions 1-2: High

Suggestions 3-5: Moderate

**Issue #4: Passing Zones**

**Safety Concern:** The horizontal and vertical geometry of Slate Quarry Rd, along with the reduced speed limit, do not support the need for passing zones.

**Observations:** Prior to its repaving, Slate Quarry Rd contained a short westbound passing zone near Wurtemberg Rd. However, its location near the stop-controlled Route 9G intersection makes the passing zone unnecessary.

**Risk Analysis:** A passing zone may encourage aggressive driving on Slate Quarry Rd and increase the risk of a collision.

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Figure 22. Some of the guidrails along Slate Quarry Rd are in need of repair (left), while delineators should be checked for retro-reflectivity (right).



Figure 23. The guidrails along Slate Quarry Rd use the older “W-beam” design, which should be replaced with a “box-beam” design (as shown above on CR16 ). A significant issue with the “W-beam” design involves the end treatment, which can act as a ramp for vehicles that depart the road.

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*Figure 24. Sections of Slate Quarry Rd may warrant guiderails to prevent vehicles from travelling down steep embankments such as the one shown above.*



*Figure 25. Some of the major culverts on Slate Quarry Rd remain unprotected by barriers, which could prevent vehicles from entering areas of standing water.*

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*Figure 26. This area of Slate Quarry Rd may warrant guiderails to prevent vehicles from travelling into the adjacent swamp/marsh, as evidenced by the tire tracks in the shoulder.*



*Figure 27. A close-up of the above photo, showing the tire tracks entering the swamp/marsh.*

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**Suggestion:** Install a double-yellow centerline (no passing zone) for the length of Slate Quarry Rd within the study area. [Note: DCDPW subsequently removed the passing zone when it added new lane markings to Slate Quarry Rd].

**Priority for Consideration:** High

**Issue #5: Clear Zones**

**Safety Concern:** Slate Quarry Rd does not contain a consistent clear zone – defined as an unobstructed, relatively flat area beyond the edge of the travel lane that allows a driver to stop safely or regain control of a vehicle that departs the road.

**Observations:** Insufficient clear zones are present along Slate Quarry Rd.

**Risk Analysis:** The lack of a clear zone may increase the severity of a crash by limiting the ability of a driver to recover from a road departure.

**Suggestion:** Ensure that road shoulders and adjacent areas are maintained so that they can effectively accommodate potential road departures or breakdowns.

**Priority for Consideration:** Moderate

**Issue #6: Culverts**

**Safety Concern:** Some culverts on Slate Quarry Rd do not have protective barriers, which prevent errant vehicles from entering water features.

**Observations:** A number of culverts along Slate Quarry Rd do not have barriers to prevent vehicles from entering nearby water and possibly becoming submerged. See Figure 25.

**Risk Analysis:** A vehicle that departs the road at or near a culvert could become submerged in standing water, thus increasing the risk of injury or death.

**Suggestion:** Conduct an engineering evaluation of existing culverts to determine if they warrant barriers.

**Priority for Consideration:** Moderate

**Issue #7: Superelevation**

**Safety Concern:** Given the recently approved change in speed limit, the superelevation along Slate Quarry Road may need to be re-evaluated.

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**Observations:** The SA Team noted that the road's current superelevations may not be consistent with the design standards associated with a 45 mph facility.

**Risk Analysis:** Improper superelevations may reduce driver safety, since they may not be appropriate for posted speed limits.

**Suggestion:** Evaluate the superelevation along Slate Quarry Rd to determine if it needs to be changed.

**Priority for Consideration:** Moderate

**CR19 (Slate Quarry Rd)/Wurtemberg Rd intersection**

**Issue #1: Visibility of Wurtemberg Rd STOP Sign**

**Safety Concern:** The STOP sign on northbound Wurtemberg Rd is partially obstructed by a large tree.

**Observations:** A large tree partially obscures the STOP sign on northbound Wurtemberg Rd as it approaches Slate Quarry Rd. The SA Team also noted that the stop lines on both approaches to Slate Quarry Rd were faded. Stop lines help motorists recognize the need to stop and designate proper positioning for optimal sight distance prior to entering the intersection. See Figure 28.

**Risk Analysis:** Inadequate STOP sign visibility can result in a high-speed, severe right-angle crash.

**Suggestions:**

1. Move the STOP (R1-1) sign post away from the large tree at the southeast corner of the intersection.
2. Consider the use of a vertical retro-reflective strip on the STOP (R1-1) sign support to enhance visibility.
3. Install a new pictorial STOP AHEAD warning sign (W3-1) on Wurtemberg Rd to warn drivers of the upcoming STOP sign. [Note: this was subsequently installed].
4. Consider restriping the stop lines on both Wurtemberg Rd approaches to Slate Quarry Rd, using the NYSDOT recommended standard width of 18 inches or the wider 24 inches, which would provide an additional cue to drivers.



**Priority for Consideration:**

Suggestions 1-2: High

Suggestions 3-4: Moderate





*Figure 28. A large tree obscures the STOP sign on the southern approach of Wurtemberg Rd, as it intersects Slate Quarry Rd.*

## **6. Next Steps**

The PDCTC, through the work of the SA Team, has prepared this report to assist DCDPW and the Town of Rhinebeck with prioritizing opportunities to improve safety within the study area. A draft was circulated to the SA Team for review in November, and comments were incorporated into the final draft. The suggestions are for consideration only and are in no way intended to serve as design or operational recommendations. DPW documented its responses to the issues and suggestions in a formal response, which is attached to the final report. The SA Team believes it has been thorough and diligent in its work, given the information available and its field reviews. This report does not preclude the identification of additional issues pertaining to safety by the owners or the emergence of new issues over time. It is recommended that DCDPW track progress towards the implementation of safety improvements prompted by this assessment.

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Table 3. Suggested Actions and Priority by Location

<b>Issue</b>	<b>Suggested Action</b>	<b>Priority</b>
<b>Overall Safety</b>		
1-1	Install new 45 mph (R2-1) signs with NEW (W16-10P) placards.	High
1-2	Install 45 mph REDUCED SPEED LIMIT AHEAD sign (W3-5).	High
1-3	Increase speed enforcement/employ DC Sheriff's VMS trailer.	High
1-4	Employ VMS/radar feedback trailer to alert drivers of their speed.	High
1-5	Contact local media to publicize new speed limit.	High
1-6	Consider narrowing travel lanes from 11 to 10 feet.	Dismissed
2-1	Install temporary NO CENTER LINE (W8-12) plaques.	Moderate
2-2	Stripe edge lines with epoxy paint and high-visibility beads.	High
2-3	Review retro-reflectivity of new pavement markings.	Low
2-4	Develop a County-wide sign reflectivity monitoring program.	Low
3-1	Reduce shoulder drop-offs by installing back-up material.	High
3-2	Consider adding safety wedges as per FHWA best practice.	Low
4-1	Install one or more flashing beacons on Slate Quarry Rd.	Low
5-1	Determine if number of deer strikes warrant DEER signs (W11-3).	Low
6-1	Upgrade street name signs to meet 2009 MUTCD standards.	Moderate
7-1	Ensure road shoulders can accommodate heavy duty vehicles.	Low
<b>CR19 (Slate Quarry Rd)/White Schoolhouse Rd Intersection</b>		
1-1	Remove YIELD sign on northwest corner.	High
1-2	Install STOP (R1-1) sign on northwest corner of White Schoolhouse Rd.	High
1-3	Increase size of STOP signs to 36x36 inches.	High
1-4	Consider a STOP AHEAD (W3-1) sign on White Schoolhouse Rd.	Moderate
1-5	Consider a stop line for southbound White Schoolhouse Rd.	Moderate
2-1	Narrow the White Schoolhouse Rd approach with pavement markings.	High
2-2	Physically narrow the White Schoolhouse Rd intersection.	Moderate
3-1	Trim or remove trees across from intersection.	Moderate
3-2	Lower vertical/straighten horizontal curves on Slate Quarry Rd.	Low
3-3	Trim trees at the northwest corner of intersection.	Low
3-4	Remove rock and brush near driveway at 209 Slate Quarry Rd.	Moderate
4-1	Install recommended SCHOOL BUS STOP AHEAD (S3-1) sign.	Low

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**CR19 (Slate Quarry Rd) from White Schoolhouse Rd to Wurtemberg Rd**

1-1	Remove vegetation/obstructions within right of way.	Moderate
1-2	Remove rock embankment near 91 Slate Quarry Rd.	Low
1-3	Reduce variation in horizontal and vertical geometry at major curves.	Low
2-1	Re-evaluate advisory speeds on Slate Quarry Rd.	High
3-1	Repair existing guiderails.	High
3-2	Consider upgrading reflective delineators on existing guiderails.	High
3-3	Replace "W-beam" guiderails with box-beam design.	Moderate
3-4	Consider installation of one or more new guiderails.	Moderate
3-5	Consider object markers for steep drop-off areas.	Moderate
4-1	Install double-yellow centerline (no passing zone) on Slate Quarry Rd.	High
5-1	Maintain road shoulders to accommodate vehicle road departures.	Moderate
6-1	Evaluate barrier warrants for culverts on Slate Quarry Rd.	Moderate
7-1	Evaluate the superelevation of Slate Quarry Rd.	Moderate

**CR19 (Slate Quarry Rd/Wurtemberg Rd intersection)**

1-1	Move STOP (R1-1) sign away from large tree on southeast corner.	High
1-2	Restripe worn stop lines on both approaches of Wurtemberg Rd.	High
1-3	Install new pictorial STOP AHEAD (W3-1) sign on Wurtemberg Rd.	Moderate
1-4	Consider the use of a vertical reflective strip on the STOP sign post.	Moderate