

**Road Safety Assessment (SA) Report
FINAL**



**BEEKMAN ROAD (CR 9) SAFETY ASSESSMENT
BEEKMAN-POUGHQUAG ROAD (CR 7) TO NYS ROUTE 55
TOWN OF BEEKMAN, NEW YORK**



**POUGHKEEPSIE-DUTCHESS COUNTY TRANSPORTATION COUNCIL
27 HIGH STREET, 2ND FLOOR
POUGHKEEPSIE, NY 12601**

**FINAL REPORT DATE: MARCH 2013
ASSESSMENT DATE: OCTOBER 24 - 26, 2012**



Table of Contents

1.0	BACKGROUND	4
1.1	SA Team	7
1.2	SA Process	8
1.3	SA Report	8
1.4	Study Area Characteristics, Operations, and Safety Performance	9
2.0	ASSESSMENT FINDINGS AND SUGGESTIONS	17
2.1	Beekman Road (CR 9)	17
2.1.1	Operating Speeds	17
2.1.2	Unforgiving Roadside Features	18
2.1.3	Shoulder Drop-Off	19
2.1.4	Non-Traversable Roadside Drainage Element	19
2.1.5	Guide Rail Condition	20
2.1.6	Hazardous Trees and Vegetation	21
2.1.7	Sign Consistency, Clutter, Legibility, and Spacing	21
2.1.8	Street Name Signing	22
2.1.9	Barton Orchard Sign	23
2.1.10	Breakaway Post Bases	23
2.1.11	Abandoned Sign Posts	24
2.1.12	Stop Lines	24
2.1.13	Bicycle and Pedestrian Accommodation	25
2.2	Intersection of Beekman Road (CR 9) with Beekman-Poughquag Road (CR 7)	26
2.2.1	Intersection Sight Distance - North	26
2.2.2	Intersection Sight Distance - South	26

2.2.3	Stopping Sight Distance - Southbound	29
2.2.4	STOP Sign Visibility	30
2.2.5	Guide Sign Placement	31
2.2.6	Excessively Wide Approach Pavement	32
2.3	Intersection of Beekman Road (CR 9) with Baker Road	33
2.3.1	Intersection Sight Distance - North	33
2.3.2	Intersection Sight Distance - South	35
2.3.3	Advance Warning Signs - Northbound	36
2.3.4	Advance Warning Signs - Southbound	37
2.3.5	Stop Line	38
2.3.6	Reflective Strips on STOP Sign Posts	38
2.4	Intersection of Beekman Road (CR 9) with Walker Road	39
2.4.1	Intersection Sight Distance - North	39
2.4.2	Advance Warning Sign	39
2.4.3	Gravel Within Intersection	41
2.5	Intersection of Beekman Road (CR 9) with Limbach Road	42
2.5.1	Warning Sign Location	42
2.6	Intersection of Beekman Road (CR 9) with Recreation Road	43
2.6.1	Rear End Crashes	43
2.6.2	Guide Sign Location	46
2.7	Beekman Road (CR 9) - Reverse Curves between Walker and Limbach Roads	47
2.7.1	Horizontal Geometry and Operating Speeds	47
3.0	CONCLUSIONS & SUMMARY OF SUGGESTED ACTIONS	56

1.0 Background

The Poughkeepsie-Dutchess County Transportation Council (PDCTC) commissioned this Safety Assessment (SA) of Beekman Road (CR 9) from Beekman-Poughquag Road (CR 7) to NYS Route 55 in support of their goal to improve transportation safety and mobility throughout Dutchess County. The site was chosen given the magnitude of crashes, its similarity with other County roads, and because it is recognized as a high profile location. This Safety Assessment provides the County with a list of opportunities for low-cost, short-range safety improvements and some more expensive, long-range transformations.

Beekman Road (County Road (CR) 9) begins at NYS Route 82 in the Town of East Fishkill and extends east-northeast to the intersection of NYS Route 55 and Clove Valley Road (CR 9) in the Town of Beekman (**Exhibit 1**). Within the study limits, Beekman Road is a two-way, two-lane, asphalt surfaced, urban collector with narrow asphalt shoulders and a posted speed limit of 45 miles per hour. Generally, lane widths are 10 to 11 feet with shoulders up to 2 feet in width. It is owned and maintained by the Dutchess County Department of Public Works (DPW).

Beekman Road intersects several other roadways from Beekman-Poughquag Road to NYS Route 55. These include Baker Road, Walker Road, Limbach Road, Coon Den Road, and Recreation Road (**Exhibit 2**).

- Beekman-Poughquag Road (CR 7) extends east-west through the Town of Beekman, beginning at Beekman Road (CR 9) and ending at the intersection of Church Street and Main Street (CR 7). Beekman-Poughquag Road is a two-way, two-lane, asphalt surfaced, urban collector with asphalt shoulders and a posted speed limit of 40 miles per hour. It is owned and maintained by the Dutchess County DPW.
- Baker Road begins at Beekman Road and extends north-northwest to its intersection with Clapp Hill Road. Baker Road is a two-way, two-lane, asphalt surfaced, urban local road with a speed limit of 40 miles per hour. It is owned and maintained by the Town of Beekman.

Road Safety Assessment (SA) Report (FINAL)
Beekman Road (CR 9) - Beekman-Poughquag Road (CR 7) to NYS Route 55
Poughkeepsie-Dutchess County Transportation Council
March 2013

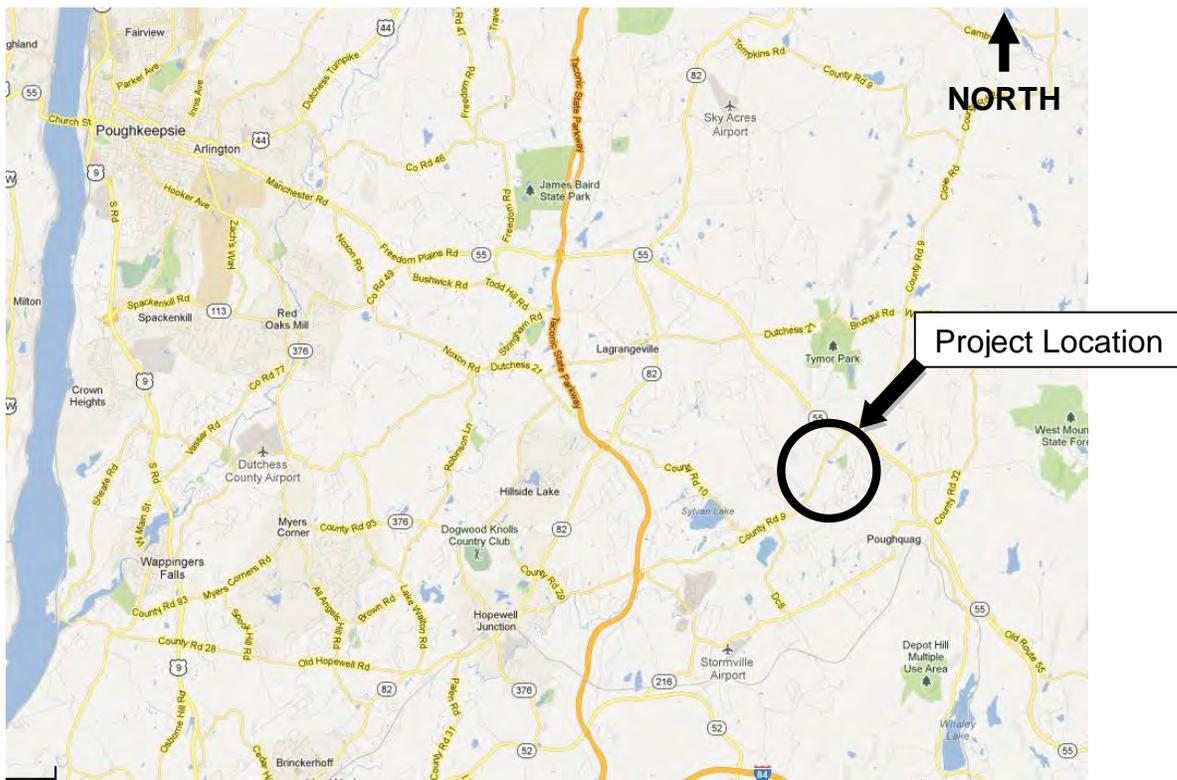


Exhibit 1 - Project Location Map

- Walker Road begins at Beekman Road and continues north to its intersection with NYS Route 55. It is a narrow two-way, two-lane, asphalt surfaced, urban local roadway and has a speed limit of 30 miles per hour. It is owned and maintained by the Town of Beekman.
- Limbach Road and Coon Den Road both begin at Beekman Road, extending east and west, respectively, to a dead end. Both roadways are narrow two-way, two-lane, asphalt surfaced, urban local roadways, and do not have posted speed limits. Both are owned and maintained by the Town of Beekman.
- Recreation Road starts at Beekman-Poughquag Road and continues north to its intersection with Beekman Road. Recreation Road is a two-way, two-lane, asphalt surfaced, urban local roadway and has a speed limit of 30 miles per hour. It is owned and maintained by the Town of Beekman.
- NYS Route 55 is one of the main east-west thoroughfares in and out of the City of Poughkeepsie. Adjacent to Beekman Road, NYS Route 55 is a two-way, two-lane, asphalt surfaced, urban principal arterial with asphalt

shoulders and a posted speed limit of 45 miles per hour. It is owned and maintained by the New York State Department of Transportation (NYSDOT).

All roadways within the project limits intersect at approximately 90-degrees. All roadways approaching Beekman Road are STOP sign controlled. Several approaching roadways, including Beekman-Poughquag Road and Baker Road, have stop lines.

The overall geometry of Beekman Road is classified as rolling with vertical and horizontal curvature that occasionally restricts sight distance. Adjacent land uses within the area are primarily residential with other uses including minor commercial, recreational, and seasonal orchards mixed in. **Appendix A** contains an aerial view of the corridor.

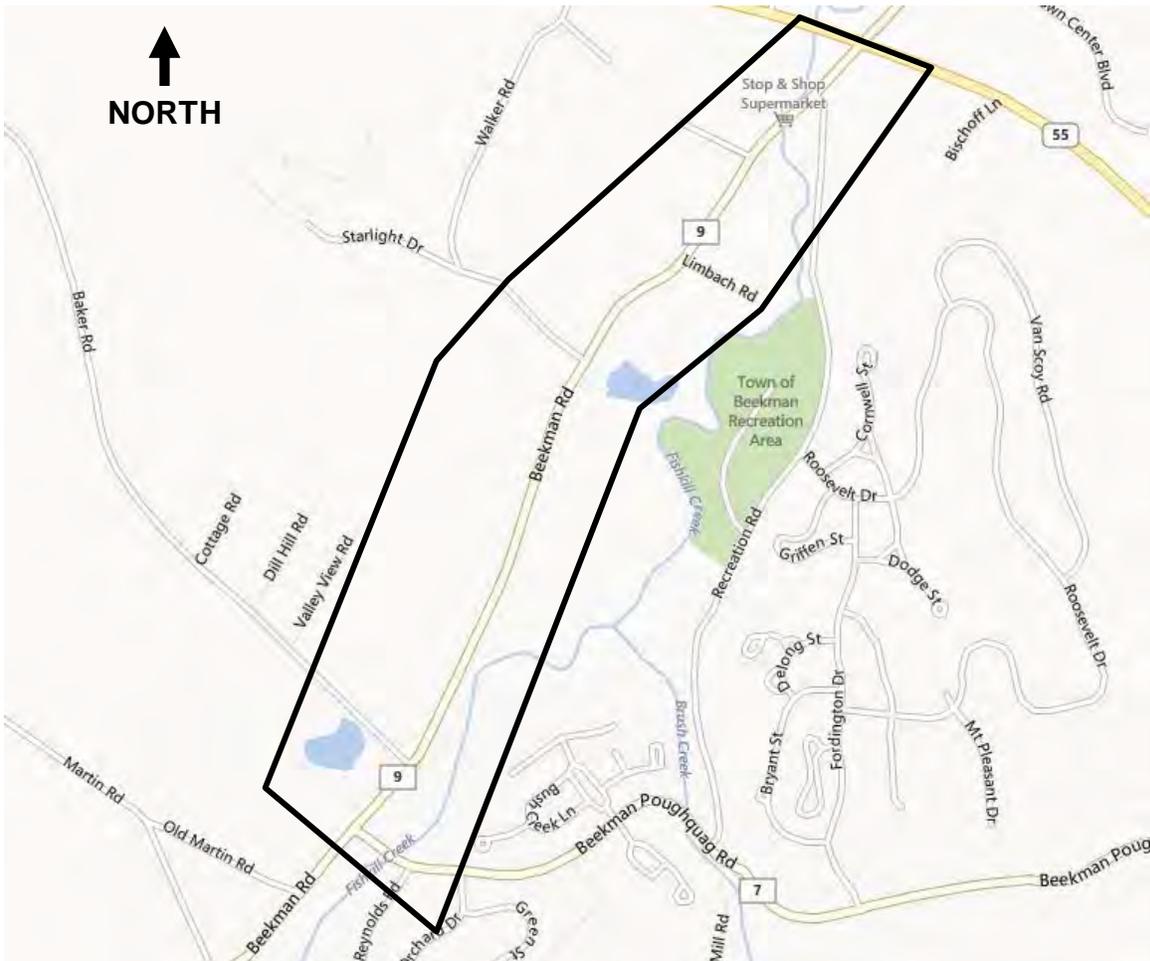


Exhibit 2 - Project Area Map

1.1 SA Team

This was the first formal application of the SA process within Dutchess County. Therefore, an introductory training session was provided to all team members on October 24, 2012. Additional staff from Dutchess County and the Town of Beekman also participated in this one-day training session.

The following agencies were represented on the SA Team:

- Poughkeepsie-Dutchess County Transportation Council (PDCTC);
- Dutchess County Department of Public Works (DPW);
- Dutchess County Sheriff's Office;
- Town of Beekman Highway Department; and
- New York State Department of Transportation (NYSDOT).

The SA was led by members of the consultant team. The SA Team included the following individuals:

- **Mark Debald** - Transportation Program Administrator, PDCTC;
- **Emily Dozier** - Senior Planner, PDCTC;
- **Mohd Azher-Uddin** - Dutchess County DPW;
- **William Trifilo** - Dutchess County DPW;
- **Mike Rahilly** - Dutchess County Sheriff's Office;
- **Tony Coviello** - Superintendent, Town of Beekman Highway Department;
- **Rich Dillmann** - Regional Traffic and Safety, NYSDOT;
- **Mike Croce** – Assessment Team Leader, Bergmann Associates; and
- **Tom Detrie** – Project Engineer, Bergmann Associates.

Although not part of the SA Team, the following individuals also participated in the SA process:

- **Barbara Zulauf** - Town Board Member, Town of Beekman (training session);
- **Michael Gadjos** - Dutchess County DPW (field visits); and
- **Kurt Twaddell** - Dutchess County Sheriff's Office (training session and field visit)

1.2 SA Process

The SA was conducted in a manner consistent with the Safety Assessment Guidelines (October 2008), published by the New York State Association of Metropolitan Planning Associations (NYSAMPOs). The assessment took place on October 24 (office review), October 25 (daytime and nighttime field visits), and October 26 (in-house discussion), 2012.

Information utilized by the SA Team during the course of the assessment included the following:

- Aerial photographs;
- Traffic data;
- Collision information;
- Adjacent land uses; and
- Existing safety concerns.

These items were reviewed by the SA Team on the afternoon of October 24 in the office. The next day, the SA Team went into the field to conduct a daytime site visit. Weather conditions were cool and overcast. The site visit was documented with digital images supplemented by notes and sketches. That same evening, the SA Team conducted a review of the site under darkness, making additional notes relevant to their nighttime observations.

The SA Team reconvened to complete the process on October 26. Preliminary findings and suggestions for safety improvements were discussed and documented using the Federal Highway Administration (FHWA) Road Safety Audit (RSA) Software. General safety improvement goals include creating an environment that is “*caring*” (providing information supportive of appropriate decisions and actions) and “*forgiving*”, (anticipating the inevitable errors that users will make) and mitigating the severity of those outcomes. This report was subsequently prepared by the consultant team and circulated among all assessment team members for review prior to being finalized.

1.3 SA Report

This report provides information on issues identified by the SA Team as opportunities to improve overall safety along the corridor and on all approaching roadways.

Where appropriate, an assessment of road user safety risk and suggestions for improvement are included. These suggestions should not be viewed as design or operational recommendations. They are intended to be illustrative of potential solutions to the safety issues identified and are presented for consideration only.

1.4 Study Area Characteristics, Operations, and Safety Performance

Beekman Road (CR 9) covers rolling terrain with horizontal and vertical curvature. Intersection and stopping sight distances are occasionally restricted by geometry. One notable feature along the corridor is a set of reverse curves on Beekman Road between Walker Road and Limbach Road. **Appendix B** contains a summary of the existing conditions as provided to the SA Team.

The SA Team noted that traffic on Beekman Road typically consists of either localized trips between nearby housing developments and minor commercial areas along NYS Route 55 or motorists accessing Taconic State Parkway, NYS Route 55, and other major routes. Volumes collected in 2012 indicate an annual average daily traffic volume of 5,440 vehicles per day (vpd), with peak hour volumes of approximately 380 vehicles per hour (vph) during the a.m. (8 to 9 a.m.) and 520 vph during the p.m. (5 to 6 p.m.). From the same 2012 traffic count, a heavy vehicle percentage of 4% was observed. The SA Team noted that significant seasonal traffic fluctuations (fall months) occur along Beekman Road due to Barton Orchards, which is located off Beekman-Poughquag Road. For the segment between Beekman-Poughquag Road and Walker Road, speeds averaged 46 miles per hour (mph) with an 85th percentile speed of 52 mph. For the segment between Walker Road and NYS Route 55, speeds averaged 42 mph and had an 85th percentile speed of 48 mph outside the influence of the reverse curves. All speed measurements were taken in 2012 by the PDCTC.

Beekman-Poughquag Road (CR 7) also covers rolling terrain with horizontal and vertical curvature. Based upon traffic counts on Beekman Road, annual average daily traffic is estimated at 2,240 vpd. While in the field, the SA Team noted that a majority of vehicles going to and coming from Beekman-Poughquag Road were headed south on Beekman Road, toward the Taconic State Parkway.

The terrain covered by the other intersecting roads including Baker Road, Walker Road, Limbach Road, Coon Den Road, and Recreation Road is similar. Volumes are typically low as they feed residential communities. One exception is Recreation Road. The SA Team noted that it is used as a cut-through for

vehicles from NYS Route 55 (and the nearby Stop & Shop) to the residential communities off Beekman-Poughquag Road.

Traffic growth has been approximately 1% per year over the last 12 years. The road historically functioned as a farm-to-market route when the Town of Beekman harbored primarily agricultural land uses. In the 1980s and 1990s the town experienced significant growth with an influx of housing development. Traffic growth spiked at that time. Since then, the Town of Beekman has remained one of the fastest growing towns in Dutchess County.

Vehicle types throughout the project corridor include passenger vehicles, commercial truck traffic, and school buses. The lack of wide shoulders or separate facilities discourages bicycle and pedestrian traffic from using the road. Bicycle traffic is limited to experienced riders. Pedestrian traffic is limited to those without vehicular transportation or, as noted by the SA Team, those headed from Recreation Park along Recreation Road to the commercial facilities at the intersection of Beekman Road and NYS Route 55, primarily during the summer months.

Overall, the pavement along Beekman Road was in good condition. According to available records, the last resurfacing occurred in 2006 and consisted of a single course overlay. Approaching Town roadways were in fair to good condition. Surface imperfections generally include minor potholes and transverse and longitudinal cracking. Additionally, the SA Team noted a buildup of gravel in the intersection of Walker Road due to poor drainage.

Exhibits 3 through 10 below are representative photos of the project corridor and key locations discussed in this report.



**Exhibit 3 - Looking North Along Beekman Road,
South of Beekman-Poughquag Road**



Exhibit 4 - Looking North Along Beekman Road at Baker Road



Exhibit 5 - Looking South Along Beekman Road at Baker Road



**Exhibit 6 - Looking North Along Beekman Road Between
Limbach Road and Walker Road**



**Exhibit 7 - Looking North Along Beekman Road,
Approaching the Reverse Curves**



Exhibit 8 - Looking South Along Beekman Road at the Reverse Curves



Exhibit 9 - Looking North Along Beekman Road towards Recreation Drive



Exhibit 10 - Looking South Along Beekman Road towards Recreation Drive

None of the roadways or intersections within the project corridor has lighting. On-street parking is prohibited as enforced by signage from Beekman-Poughquag Road to Baker Road. The SA Team noted that the roadway was originally posted at 55 mph until 1982, when it was reduced to 45 mph.

All roadways approaching Beekman Road are STOP sign controlled. Reflective strips were recently installed on several of the posts. Stop bars exist on two roadway approaches: Beekman-Poughquag Road and Baker Road. Beekman Road and Beekman-Poughquag Road are striped with a double yellow full barrier line and white edge lines. Approaching town roadways are typically not striped with the exception of Baker Road, which recently had a short length of double yellow full barrier line installed on its approach to Beekman Road.

Throughout the project corridor, there are intersection warning signs, curve warning signs, speed advisory plaques, DRIVEWAY supplementary plaques, and SCHOOL BUS STOP AHEAD warning signs. Additionally, there is a LIMITED SIGHT DISTANCE warning sign on the southbound approach to Baker Road. The reverse curves between Walker Road and Limbach Road have chevrons on the first curve in the northbound and southbound directions.

By inspection, sight distance is restricted at various locations throughout the project corridor. In particular, the following locations were noted by the SA Team:

Factors Observed to Limit Sight Distance

Type	Location	Contributing Factor(s)
Intersection Sight Distance	Beekman-Poughquag Road at Beekman Road looking south	Trees and vegetation in the southeast corner. Vertical and horizontal geometry of Beekman Road to the south.
	Baker Road at Beekman Road looking north and south	Roadway bank and vegetation in the northwest corner. Horizontal curve on Beekman Road to the north. Vegetation in the southwest corner and a sag curve on Beekman Road to the south.
Stopping Sight Distance	Beekman Road at Beekman-Poughquag Road looking south	Sag vertical curve on Beekman Road
	Beekman Road between Walker Road and Limbach Road northbound and southbound	Reverse curves

Crash data for the period from January 2008 to December 2011 indicate a total of 67 intersection and midblock collisions occurred along the project corridor. A summary of the crash history, including various summary tables, is provided in **Appendix B**. Collision diagrams are provided in **Appendix C**.

A summary of collision attributes indicates the following:

- There were no fatal collisions. A total of 48% involved injury, 46% involved property damage, and 6% were non-reportable.
- There were no pedestrian or bicycle collisions during the data review period, though one bicycle collision was reported in July 2012.
- 67% (45) were midblock collisions along Beekman Road.
- 16% (11) occurred at the intersection with Beekman-Poughquag Road.
- A high percentage of collisions occurred at horizontal curves, 65% (43).
- 63% (42) occurred under wet/snow/ice road surface conditions.
- 49% of the collisions occurred on the reverse curves between Walker Road and Limbach Road. They took place primarily under wet/snow/ice road surface conditions (94%); many were attributed to unsafe speeds and slippery pavement, and almost half resulted in injury (49%) after the vehicle departed the road and struck a fixed object such as a tree or rock.

The existing right-of-way is determined by prescription, based on the historic width used by the traveling public and existing roadway features. Maintenance on Beekman Road (CR 9) and Beekman-Poughquag Road (CR 7) is conducted by the Dutchess County DPW. All other approaching roadways are maintained by the Town of Beekman. Winter snow removal operations are completed by the maintaining agency.

2.0 Assessment Findings and Suggestions

2.1 Beekman Road (CR 9)

2.1.1 Operating Speeds

Safety Concern: Roadway operating speeds are considered high.

Observations: The 85th percentile operating speeds on Beekman Road exceed 50 miles per hour. There are several geometric features along this segment of road with posted advisory speeds. Stopping sight distance is limited by vertical and horizontal curves, including several near intersections.

The SA Team noted the difficulty in enforcing speed limits, given the lack of adequate shoulder space or pull-off areas to observe traffic and safely stop vehicles.

Risk Analysis: Elevated operating speeds increase the probability that a collision will have a severe result. The existing geometry does not afford adequate sight distance to support safe motor vehicular operation well above the posted speed limit. This substantially increases the risk of a collision.

Suggestions:

1. **Petition for a Speed Limit Reduction.** *The Dutchess County DPW could approach NYSDOT for a speed limit reduction study. Approval often requires data showing that operating speeds are lower than the current posted speed limit. The posted speed limit on this roadway was already decreased to 45 mph from 55 mph in 1982. Given the lack of supportive speed evidence and the current posted speed limit conforming to prevailing roadway conditions, the SA Team eliminated this suggestion from further consideration.*
2. **Increase Sight Distance.** *Increase available stopping sight distance by eliminating sight restrictions including trees, rock outcroppings, and improving the horizontal and vertical geometry. Eliminating these features or reconstructing the roadway would require property acquisitions, involve environmental impacts, and involve relatively high overall project costs given the limited existing right-of-way. Given the potential impacts to*

adjacent properties, the SA Team eliminated this suggestion from further consideration.

- 3. Increase Speed Enforcement.** *This suggestion would implement various means to reinforce the posted speed limit. That might involve increased police presence, setting up speed display devices, and increasing speed limit enforcement (writing more tickets). This would require the installation of police pull-off locations for safer enforcement operations.*

Priority for Consideration:

Suggestions 1-2: Dismissed
Suggestion 3: Moderate

2.1.2 Unforgiving Roadside Features

Safety Concern: Roadside environment includes many unforgiving features.

Observations: The existing roadside environment includes mature trees, rock outcroppings, steep side slopes, and drainage ditches. Shoulders are narrow. Overall, this package of elements presents an unforgiving environment for all roadway users. The trees, rocks, and steep side slopes are of particular concern for errant vehicles. The basic recovery area beyond the pavement is limited and there is little if any refuge available for disabled vehicles.

Risk Analysis: Lack of adequate clear area and refuge for disabled vehicles increases the risk for a roadside collision. The high operating speeds along Beekman Road increase the chances of severe crashes.

Suggestions: *Remove roadside objects, install wider shoulders, and establish a wider clear area. Eliminating unforgiving roadside features would impact the visual character of the corridor, impact adjacent properties, and possibly involve significant costs given right-of-way limitations. SA Team deemed this suggestion as infeasible and eliminated it from further consideration.*

Priority for Consideration: Suggestions dismissed.

2.1.3 Shoulder Drop-Off

Safety Concern: Shoulder (pavement edge) drop-off.

Observations: Roadway runoff is cutting a path along the edge of the pavement, resulting in an edge drop-off condition at the shoulder / backup interface. Shoulder (pavement edge) drop-offs were observed at several locations, primarily on steeper grades. There was a location along southbound Beekman Road, at the reverse curves, where vehicles leaving the pavement have also pushed away the shoulder backup resulting in a drop-off condition. Some drop-offs were measured as deep as 12 inches. Lack of proper shoulder backup was also observed to be contributing to pavement failures.



Exhibit 11: Example of shoulder drop-off, just north of Limbach Road.

Risk Analysis: Edge drop-off can cause loss-of-control when a vehicle drifts toward and off the shoulder. If a driver attempts a sudden correction to regain the roadway, the vehicle can become destabilized resulting in a loss of control. The lack of adequate clear area and high operating speeds along the road elevate the chances of a severe crash.

Suggestions: *Install shoulder backup material. Material should be compacted and designed to limit future erosion. Compacted subbase material treated with a lignosulfonate (natural wood polymer acting as a binder) is one possibility.*

Priority for Consideration: High

2.1.4 Non-Traversable Roadside Drainage Element

Safety Concern: There is a non-traversable drainage feature in the northwest corner of the intersection of Beekman Road and Beekman-Poughquag Road.

Observations: A drainage ditch of significant size crosses Beekman Road, just north of Beekman-Poughquag Road. Approaching the road crossing, the west side ditch and pipe end section are located several feet below the traveled way. Roadway runoff enters the open ditch via a short swale. The swale steeply

slopes towards the ditch, resulting in a variable, non-traversable shoulder section.

Risk Analysis: If an errant vehicle enters the non-traversable section, it could become lodged in the ditch, roll over, or become airborne. This could result in a personal injury.

Suggestions: *Remove the ditch and redirect roadway drainage to other adjacent drainage facilities. Replace the ditch with a shallower asphalt swale or concrete gutter. Install a roadside or field drainage inlet (drop structure) with a direct outlet (pipe and end section) to the watercourse below.*

Priority for Consideration: Low

2.1.5 Guide Rail Condition

Safety Concern: Portions of guide rail along Beekman Road are in poor condition.

Observations: Several segments of guide rail are in poor condition and leaning outward, away from the roadway. They may have either been struck or suffer from a lack of suitable support for the backup posts. Existing guide rail consists of turned down end sections, poor posts and supports, and some wooden posts. The SA Team also noted several steep side slopes where guide rail should be considered for installation. One included a drainage culvert, over 5 feet deep, located within 4 feet of the traveled way.



Exhibit 12: Example of damaged and leaning guide rail.

Risk Analysis: Lack of adequate guide rail 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 slope contains fixed objects or other non-bypassable hazards. Low guide rail systems and turned down end sections can increase the risk of vehicle launching.

Suggestions: *Replace and/or install new guide rail. Existing guide rail that is damaged or leaning should be replaced. New guide rail should be installed in*

locations where steep side slopes or drop-offs exist as determined by the Dutchess County DPW. The SA Team noted that the County DPW standard for new installations is box beam guiderail and the DPW has a program to identify and replace deficient systems.

Priority for Consideration: High

2.1.6 Hazardous Trees and Vegetation

Safety Concern: Some trees and vegetation are in danger of falling on the roadway. Additionally, trees and vegetation block several traffic control devices.

Observations: Throughout the project limits, there are several locations where dead or hazardous trees and vegetation are located along the roadside. One such tree was observed near the Coon Den Road intersection. These could fall in the road and cause an incident. Additionally, there are locations where trees and vegetation block warning and other signs. This makes it difficult for drivers to be properly informed of upcoming conditions.

Risk Analysis: Trees and vegetation falling on the roadway surface or blocking traffic signs could lead to head-on, roadway departure, or loss-of-control type collisions. Additionally, the operating speeds of Beekman Road increase the risk for a severe crash.

Suggestions: *Remove dead or hazardous trees and vegetation near the road. Trim and/or remove existing vegetation away from sight lines to traffic control devices. Though allowable by the Highway Law, talk to adjacent property owners in advance to explain why the operation as necessary.*

Priority for Consideration: High

2.1.7 Sign Consistency, Clutter, Legibility, and Spacing

Safety Concern: Existing signs clutter the project limits and detract from clear and positive guidance to drivers.

Observations: There are numerous signs throughout the project limits. This includes a mix of regulatory, street name, and warning signs. Some are inconsistent with those on other segments of Beekman Road and adjacent roads.

There are older guide, regulatory (parking), and warning signs that may no longer be applicable. Additionally, existing signs may be installed too far in advance – a condition left over from the previous 55 mph posted speed limit. Overall, there is a lack of uniformity and clarity. This makes it difficult for drivers to determine the most important message.

Risk Analysis: Sign clutter and inconsistency increase the risk of a collision. Possible results are differential speed or driver confusion resulting in rear end or roadway departure collisions.

Suggestions: Review the need for, condition of, and placement of signing throughout the study limits. This includes replacing existing sign panels with their National Manual on Uniform Traffic Control Devices and New York State Supplement (MUTCD) compliant, retroreflective equivalent; removing unnecessary or outdated signs; improving legibility; and consolidating sign installations where feasible.

Priority for Consideration: High

2.1.8 Street Name Signing

Safety Concern: Street name signs are difficult to see and read on approach.

Observations: Street name signs are of an older style (all capital letters and no borders) and lack clear legibility and conspicuity on approach. The SA Team observed several different styles throughout the project limits.

Risk Analysis: Lack of clear navigational information increases the risk of last minute decision making and maneuvers, which in turn may increase the risk of a collision. This condition would affect unfamiliar motorists to a greater extent than local motorists.

Suggestions: Upgrade existing street name signs. Street name signs should be larger and in accordance with the MUTCD. Larger panels would assist with intersection conspicuity, especially at night.



Exhibit 13: Example of existing (top) and proposed (bottom) street name signs.

Priority for Consideration: Low

2.1.9 Barton Orchard Sign

Safety Concern: Barton Orchard directional service sign blocks the southbound winding road warning sign (W1-5).

Observations: The existing Barton Orchard directional service sign, just north of Beekman-Poughquag Road in the southbound direction, blocks the winding road warning sign (W1-5) (see note 1).

Risk Analysis: In general, warning signs should have higher priority over driver information signs. Leaving the warning sign obscured increases the risk of a driver not recognizing and properly adjusting their driving to accommodate the downstream condition. This increases the risk of a roadway departure incident. A high-speed, head-on collision with a northbound vehicle could also result.

Suggestions: *Relocate the Barton Orchard directional service sign to a location where it does not obscure the winding road warning sign.*



Exhibit 14: Illustration of Barton Orchards sign for relocation.

Priority for Consideration: Moderate

2.1.10 Breakaway Post Bases

Safety Concern: The embedded portion of breakaway sign posts is too high above the ground.

Observations: There are several breakaway sign posts throughout the study area where the segment driven into the ground is excessively long, sticking up too high above the neighboring ground. If a sign were to be hit by an errant vehicle, the embedded post could snag the vehicle's undercarriage. This constitutes an unforgiving roadside feature.



Exhibit 15: Example of high breakaway post base.

Note 1: Sign panel reference to National Manual on Uniform Traffic Control Devices and New York State Supplement (MUTCD) sign designation number.

Risk Analysis: High breakaway posts within the clear zone could result in vehicular damage in the event of a roadway departure incident.

Suggestions: *Reset or cut off the embedded sections of breakaway posts to a safer, standard height (4-inch maximum).*

Priority for Consideration: Low

2.1.11 Abandoned Sign Posts

Safety Concern: Abandoned sign posts were observed in several places throughout the corridor.

Observations: There are abandoned sign posts (without signs) throughout the project limits. Some do not feature breakaway bases. If these posts were to be hit by an errant vehicle, they could snag the vehicle's undercarriage. These are unforgiving roadside elements.

Risk Analysis: Old posts within the clear zone could damage a vehicle undercarriage in the event of a roadway departure incident or spear the occupant compartment resulting in a severe crash.

Suggestions: *Remove old, unused sign posts from the project limits.*

Priority for Consideration: Moderate

2.1.12 Stop Lines

Safety Concern: Stop lines are not present on several side street approaches.

Observations: Stop line pavement markings are missing where Walker Road, Limbach Road, Coon Den Road, and Recreation Road intersect Beekman Road.

Risk Analysis: Stop lines are a tool to help motorists recognize the need to stop and designate proper positioning for optimal sight distance prior to entering an



Exhibit 16: Example of an abandoned sign post.

intersection. Lack of these markings increases the risk of non-compliance and a severe right angle collision.

Suggestions: *Install stop lines on all approaches to Beekman Road. The NYSDOT recommended standard width is 18 inches.*

Priority for Consideration: Moderate

2.1.13 Bicycle and Pedestrian Accommodation

Safety Concern: There is a lack of bicycle and pedestrian accommodation along Beekman Road.

Observations: In general, the corridor does not accommodate bicycling or walking. The existing shoulder provides little room for bicyclists or pedestrians. This results in bicyclists sharing the travel lanes with vehicles and pedestrians walking either in the travel lane or along the roadside.

Risk Analysis: A lack of bicycle and pedestrian accommodation significantly increases the risk of pedestrians or bicyclists becoming involved in a collision. Given the road's high operating speeds, the chance of a severe collision is high.

Suggestions:

1. **Construct Sidewalks.** *Construction of a separate sidewalk for pedestrians would provide a safer place for walking. However, due to the close proximity of roadside features, including residential structures, as well as the narrow prescriptive right-of-way, the costs associated with this suggestion would likely be prohibitive. Therefore, this suggestion was eliminated from further consideration.*
2. **Widen the Existing Shoulder.** *Widening the existing shoulders to a four (4) foot minimum would provide additional space outside the travel lanes for pedestrians and bicyclists, thus incrementally improving safety. However, the SA Team also noted that widening the pavement could encourage higher vehicular speeds, which would detract from overall safety. Due to the close proximity of roadside features, including residential structures, and narrow prescriptive right-of-way, wider shoulders could be difficult and costly to construct. The SA Team noted that the benefits of constructing wider shoulders for pedestrians and*

bicyclists should be carefully weighed against the potential impacts to overall safety and adjacent features.

Priority for Consideration:

Suggestion 1: Dismissed.
Suggestion 2: Low

2.2 Intersection of Beekman Road (CR 9) with Beekman-Poughquag Road (CR 7)

2.2.1 Intersection Sight Distance - North

Safety Concern: Intersection sight distance from Beekman-Poughquag Road is limited when looking north.

Observations: Westbound vehicles stopped on Beekman-Poughquag Road have difficulty seeing vehicles approaching from the north due to brush along the ditch and overhanging branches. These obstructions also prevent vehicles southbound on Beekman Road from seeing vehicles stopped at the intersection. The SA Team noted that this condition is more prevalent during the late spring, summer, and early fall when the trees are bearing leaves.

Risk Analysis: A lack of adequate sight distance increases the risk of a collision by affecting a driver's ability to accurately judge and accept gaps in approaching traffic. Elevated operating speeds on Beekman Road increase the probability of a severe result should a collision occur.

Suggestions: *Trim and/or remove existing vegetation in the northeast corner. Discuss with adjacent property owners.*

Priority for Consideration: High

2.2.2 Intersection Sight Distance - South

Safety Concern: Intersection sight distance from Beekman-Poughquag Road is limited when looking south.

Observations: Westbound vehicles stopped on Beekman-Poughquag Road have difficulty seeing vehicles approaching from the south because of trees and bushes paralleling a private fence line. Additionally, sight lines are restricted by the horizontal and vertical geometry of Beekman Road to the south. Drivers were observed to pause at the stop line and slowly edge out until sight lines were maximized, approximately 5 to 8 feet in front of the stop line. These obstructions also limited drivers northbound on Beekman Road from seeing vehicles stopped at the intersection.

The SA Team noted the private fence in the southeast corner of the intersection does not appear to significantly restrict sight lines given the horizontal and vertical curvature on Beekman Road to the south. One large tree and the bushes in front of the fence actually present a more significant barrier. Anecdotal evidence suggests the County discussed the current placement of the fence with the landowner when recent renovations were made to the property. The SA Team also noted that the stop line on Beekman-Poughquag Road was previously moved closer to Beekman Road.

Risk Analysis: A lack of adequate sight distance for turning maneuvers increases the risk of a collision by affecting the driver's ability to accurately judge and accept gaps in approaching traffic. Operating speeds on Beekman Road increase the probability of a severe incident.



Exhibit 17: Sight line to the south as viewed from westbound Beekman-Poughquag Road at stop line.

Suggestions:

1. **Trim and/or Remove Existing Vegetation.** Discuss the trimming or removal of the bushes and trees in the southeast corner with the adjacent property owner. The SA Team noted that if the sight obstructions were removed, particularly the large tree adjacent to the fence, the existing stop line would be located in the optimal position for sight distance.
2. **Petition for a Reduction in the Posted Speed Limit.** Refer to the suggestions in Section 2.1.1. The SA Team eliminated this suggestion from further consideration.
3. **Lower Vertical / Straighten Horizontal Curves on Northbound Beekman Road.** This would improve sight distance for both northbound Beekman Road motorists and those stopped at the intersection. The roadway would be lowered through the hamlet of Beekman, significantly impacting adjacent properties. Many of those properties have minimal setback. The SA Team felt the property and cost implications involved would generate a low safety benefit-to-cost ratio, and therefore eliminated this from further consideration.
4. **Install Overhead Intersection Lighting.** This suggestion would involve installing overhead lighting at the intersection. This would help identify the intersection for northbound drivers. The SA Team noted that a majority of the collisions occurred during the day and the local driver population is generally aware of the presence of the intersection. Since nighttime conspicuity is not the central issue, this suggestion was eliminated from further consideration.
5. **Install Overhead Flashing Beacon or Traffic Signal.** This suggestion would install an overhead two color flashing beacon or three-color traffic signal. A flashing beacon would identify the presence of the intersection but not address the identified safety concerns. While a three-color traffic signal would assist with turning movements, the SA Team felt it could also increase the number of rear-end collisions associated with available stopping sight distance. Additionally, the signal would require vehicles to stop on the downhill Beekman Road approaches. Flashing or changing signals could negatively impact nearby homes. Therefore, the SA Team eliminated this suggestion from further consideration.

Priority for Consideration:

Suggestion 1: High
Suggestions 2 -5: Dismissed

2.2.3 Stopping Sight Distance - Southbound

Safety Concern: Stopping sight distance for southbound motorists is restricted by overhanging branches on approach to the intersection.

Observations: Stopping sight distance is limited by overhanging branches on the southbound approach to the intersection. The crash history and anecdotal evidence suggests this condition may be contributing to rear-end collisions. The downward slope on this approach increases the distance needed to complete a stop. The SA Team noted that this condition is more obtrusive in the late spring, summer, and early fall when the trees have their leaves.

Risk Analysis: A lack of adequate stopping sight distance could result in high-speed, rear-end collisions with a severe outcome given prevailing operating speeds on Beekman Road.



Exhibit 18: View of southbound Beekman Road from Baker Road.

Suggestions:

1. **Trim Overhanging Branches.** This would improve stopping sight distance on the southbound Beekman Road approach to Beekman-Poughquag Road.
2. **Petition for a Reduction in the Posted Speed Limit.** Refer to the suggestions in Section 2.1.1. The SA Team eliminated this suggestion from further consideration.
3. **Lower the Crest Vertical Curve on the Southbound Approach.** This would improve sight distance for motorists traveling southbound on Beekman Road. The entire approach and intersection with Baker Road would be lowered, significantly impacting adjacent properties. The SA Team felt the property and cost implications would result in a low safety benefit-to-cost ratio, and therefore, eliminated this suggestion from further consideration.
4. **Install Intersection Warning Sign.** This suggestion involves installing an intersection warning sign (W2-2) on the southbound Beekman Road approach to the intersection. The SA Team felt this might result in sign overload for southbound motorists given the upstream warning signs for the Baker Road. This suggestion was eliminated from further consideration.

Priority for Consideration:

Suggestion 1: High
Suggestions 2 - 4: Dismissed

2.2.4 STOP Sign Visibility

Safety Concern: STOP signs (R1-1) are blocked by vegetation and difficult to see given their wide spacing.

Observations: STOP signs on the westbound Beekman-Poughquag Road approach are



Exhibit 19: Illustration of poor stop sign visibility and width of westbound approach.

difficult to see. Existing vegetation blocks the STOP sign on the right side of the road; however the STOP sign on the left side is highly visible. Both STOP signs appear widely spread given the size of the intersection throat (29 feet).

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

Suggestions:

1. **Trim and/or Remove Existing Vegetation.** *Trim or remove bushes and trees on the north side of Beekman-Poughquag Road after discussion with the adjacent property owners.*
2. **Relocate the Existing STOP Signs.** *The STOP signs could be relocated slightly farther from Beekman Road, which would bring them to a narrower portion of the intersection's throat and thus, closer together. Proper placement per MUTCD guidelines should be maintained.*
3. **Install Larger STOP Signs with Retroreflective Strips.** *The STOP signs could be increased in size with red retroreflective strips added to the posts to improve conspicuity.*

Priority for Consideration:

Suggestion 1:	High
Suggestion 2:	Moderate
Suggestion 3:	Low

2.2.5 Guide Sign Placement

Safety Concern: Guide signs are located across Beekman Road from Beekman-Poughquag Road.

Observations: Guide signs for Beekman Road (CR 9) are located across the intersection. Generally guide signs are placed on the right side of an intersection approach, in advance of the cross road, such that motorists can plan their movements in advance. While the existing placement does provide an additional visual cue that Beekman-Poughquag Road does not go through, the existing target arrow is there for that purpose.

Risk Analysis: A lack of clear navigational information can elevate the risk of last minute decision making and maneuvers, which in turn increases the risk of a collision. This condition would affect unfamiliar motorists to a greater extent than local motorists.

Suggestions: *Relocate the Beekman Road (CR 9) guide signs to the right side of the westbound intersection approach and install new street name signs at the intersection in accordance with MUTCD guidelines. The SA Team identified a suitable location for the Beekman Road signs, but it would coincide with an existing hamlet of Beekman sign. The hamlet sign could be relocated or removed in coordination with the Town of Beekman. The Dutchess County DPW could also consider increasing the size of the target arrow sign across the intersection at the same time.*

Priority for Consideration: Low

2.2.6 Excessively Wide Approach Pavement

Safety Concern: The westbound Beekman-Poughquag Road pavement on approach to Beekman Road appears excessively wide, measuring approximately 29 feet at the stop bar.

Observations: The wide intersection approach on Beekman-Poughquag Road allows left and right turning vehicles to pull up side by side at the stop line. This can result in poor sight lines for one of the turning vehicles, especially when one is a large SUV and the other is a passenger car. This is also of concern for the occasional bicyclist. The SA Team did recognize that the existing pavement width may be necessary to accommodate turning trucks.

Risk Analysis: A lack of adequate sight distance can result in vehicles pulling out in front of on-coming traffic, resulting in right angle collisions. Operating speeds on Beekman Road increase the probability of a severe crash.

Suggestions:

1. ***Narrow the Westbound Approach with Pavement Markings.*** *Narrowing the pavement width at the stop line would discourage side by side stops. This could be implemented by visually narrowing the travel lane on the right side by hatching out the shoulder or installing a striped median on the left side. Either case would offer an opportunity to review the stop line*

location, balancing the truck turning needs and sight distance considerations for vehicles stopped on Beekman Road. The SA Team recognized that painted features require additional maintenance and there would be no physical feature to prevent the recurrence of side by side stops.

- 2. Physically Narrow the Existing Pavement.** *This suggestion would involve removing existing excess pavement and narrowing the westbound approach. Design vehicle turning templates would need to be reviewed prior to making any physical changes. Narrowing the pavement width could also offer an opportunity to address the distance between the left and right side STOP signs identified in Section 2.2.4.*

Priority for Consideration:

Suggestion 1: Moderate
Suggestion 2: Low

2.3 Intersection of Beekman Road (CR 9) with Baker Road

2.3.1 Intersection Sight Distance - North

Safety Concern: Eastbound vehicles on Baker Road have obstructed sight lines to the north.

Observations: Eastbound vehicles stopped on Baker Road cannot see vehicles approaching from the north due to shrubs along a private fence line, a tree adjacent to a private shed, and overhanging branches. Sight lines are further restricted by the horizontal and vertical geometry of Beekman Road and the roadside embankment. Motorists were observed pausing at the stop line and slowly edging their vehicles onto Beekman Road while verifying the existence of an adequate gap. These conditions also make it difficult for southbound motorists on Beekman Road to see vehicles stopped on Baker Road.

The SA Team noted a private, temporary sign, placed on the roadside embankment, further restricted sight distance.



Exhibit 20: Sight line to the north from eastbound Baker Road at stop line.

Risk Analysis: A lack of adequate intersection 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 Beekman Road increase the probability of a severe collision.

Suggestions:

1. **Trim and/or Remove Existing Vegetation.** Trim existing shrubs and remove the aforementioned tree upon discussion with the property owner.
2. **Regrade the Side Slope.** The roadway embankment could be steepened (lowered) to improve inter-visibility between southbound and eastbound motorists. This would improve the ability of drivers to assess and select gaps when entering the intersection. Depending on the steepness needed to obtain improved sight lines, this could make the embankment more difficult to properly maintain.

3. **Monitor Intersection Corners for Extraneous Signs.** Town and County personnel should observe conditions at intersections and report the existence of any advertising or other unpermitted signage that significantly restricts sight lines such that follow-up efforts can be made to work with adjacent property owners or businesses for its relocation or removal. Applicable zoning requirements or local law should be reviewed prior to discussing this with property owners or businesses.

Priority for Consideration:

Suggestion 1: High
Suggestions 2-3: Low

2.3.2 Intersection Sight Distance - South

Safety Concern: Eastbound motorists on Baker Road have obstructed sight lines to the south.

Observations: Eastbound motorists stopped on Baker Road have their sight lines blocked by a row of shrubs in the southwest quadrant. Vehicles must pull out beyond the stop line in order to see traffic approaching from the south.



Exhibit 21: Sight line to the south from eastbound Baker Road at stop line.

Risk Analysis: A lack of adequate intersection 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 Beekman Road increase the probability of a severe collision.

Suggestions: *Trim and/or remove shrubs after discussion with the property owner.*

Priority for Consideration: High

2.3.3 Advance Warning Signs - Northbound

Safety Concern: A series of three closely spaced warning signs on the northbound Beekman Road approach to Baker Road makes it difficult to discern which condition motorists should be most aware of.

Observations: The northbound approach to Baker Road includes three closely spaced warning signs in series. This includes an intersection warning (W2-2), curve warning (W1-2) with advisory speed plaque (W13-1P), and intersection warning (W2-2) with DRIVEWAY supplementary panel. The placement and proximity of the signs may cause a driver to miss or ignore an important message. Additionally, the SA Team noted that the curve warning sign is bent.

Risk Analysis: Sign overload can distract and confuse, resulting in drivers being unaware of important downstream conditions. In this case, the result could be a severe right-angle collision or a roadway departure incident.

Suggestions: *Replace and condense warning signage for northbound drivers. Replace the existing curve and intersection warning signs with a combination alignment and intersection warning sign (W1-10) with advisory speed plaque (W13-1P) posted at the appropriate distance in advance of Baker Road. This would effectively warn motorists of the Baker Road intersection and downstream curve. The need for and placement of the DRIVEWAY sign should also be reviewed. Adding the driveway to the combination alignment and intersection warning sign using a thinner line could also be considered. However, adding it*



Exhibit 22: Example of proposed combination alignment and intersection warning sign (W1-10).

to the combination sign elevates it to a prominence that the driveway does not merit, given its low volume.

Priority for Consideration: Moderate

2.3.4 Advance Warning Signs - Southbound

Safety Concern: A series of three closely spaced warning signs on the southbound Beekman Road approach to Baker Road makes it difficult to discern which condition motorists should be most aware of.

Observations: The southbound approach to the Baker Road intersection has three warning signs in series. They include a curve warning (W1-2) with supplementary speed panel (W13-1P), intersection warning (W2-2), and a LIMITED SIGHT DISTANCE warning sign. These three signs can overload drivers on Beekman Road. Given the proximity of these three signs, the most important message for approaching drivers may be lost.



Exhibit 23: Illustration of existing warning signs on southbound approach.

Several of these signs were blocked by adjacent vegetation. In addition, the LIMITED SIGHT DISTANCE warning sign is no longer an acceptable message by MUTCD standards.

Risk Analysis: Sign overload can distract and confuse, resulting in drivers being unaware of important downstream conditions. In this case, the result could be a severe right-angle collision or a roadway departure incident.

Suggestions: Remove the existing signs and install a combination curve and intersection warning sign (W1-10) with advisory speed plaque (W13-1P) at the appropriate posting distance in advance of the Baker Road intersection per MUTCD guidance. The LIMITED SIGHT DISTANCE sign would not be replaced. The SA Team briefly discussed installing a slippery when wet sign. However, due to the lack of a crash history indicating this as an issue and in an attempt to prevent sign overload, the SA Team did not recommend adding this sign.

Priority for Consideration: Moderate

2.3.5 Stop Line

Safety Concern: The existing stop line on Baker Road is narrower than expected.

Observations: The existing stop line on Baker Road appeared to be narrower than normally expected by motorists and pavement marking standards. The SA Team noted that the existing location of the stop line appears to optimize sight lines at the intersection.

Risk Analysis: Drivers might miss an undersized stop line. At best, it does not provide as strong a visual cue as it should regarding stopping position. If a driver were to miss or ignore the stop control, a high speed, severe right-angle collision could result.

Suggestions: *Restripe the stop line with a wider, standard size. The NYSDOT recommended standard width is 18 inches.*

Priority for Consideration: Low

2.3.6 Reflective Strips on STOP Sign Posts

Safety Concern: Retroreflective strips on the STOP sign posts at Baker Road are of the incorrect color.

Observations: Retroreflective strips are used on sign supports to increase conspicuity of the sign and draw driver attention. Yellow strips are used with warning signs and red strips with STOP signs.

Risk Analysis: Retroreflective strips with an incorrect color do not send a consistent message to drivers and thus reduce their overall effectiveness. The SA Team also



Exhibit 24: Existing retroreflective strip and example of correct retroreflective strip on STOP sign.

noted that the proliferation of these devices could cause them to lose their effectiveness.

Suggestions: *Replace the white retroreflective strips with red strips according to the MUTCD. The width should be a minimum of 2 inches based on applicable standards.*

Priority for Consideration: Low

2.4 Intersection of Beekman Road (CR 9) with Walker Road

2.4.1 Intersection Sight Distance - North

Safety Concern: Eastbound vehicles on Walker Road have obstructed sight lines to the north.

Observations: Eastbound vehicles stopped on Walker Road cannot see vehicles approaching from the north on Beekman Road due to vegetation on the bank and overhanging branches. The SA Team noted that the bank itself does not restrict sight lines.

Risk Analysis: Inadequate intersection 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 Beekman Road increase the probability of a severe incident.

Suggestions: *Trim vegetation and overhanging branches in the northwest quadrant to mitigate the existing sight distance obstruction.*

Priority for Consideration: Moderate

2.4.2 Advance Warning Sign

Safety Concern: The existing intersection warning sign for southbound drivers on Beekman Road is located within the reverse curves and seems distant from the intersection.

Observations: An intersection warning sign for southbound drivers is located within the reverse curves along Beekman Road. This location demands additional attention from drivers while they are also concentrating on negotiating the reverse curves.

The SA Team noted that the intersection is well marked by its street name signs, particularly under darkness. Though not measured, the existing sign appears to be located in too far in advance of the intersection, which may be due to the previously posted 55 mph speed limit.

Risk Analysis: The position of the existing warning sign may take a driver's attention away from the more pertinent task of negotiating the reverse curves, leading to a roadway departure incident. As previously noted, the consequences of a roadway departure could be serious given the generally unforgiving roadside environment. Alternatively, the sign might be missed or forgotten by the time a driver reaches Walker Road. In the latter case, the sign does not provide useful, timely information. In the former, missing the sign elevates the probability of a rear-end or right-angle collision at the intersection.



Exhibit 25: Illustration of intersection warning sign within reverse curves.

Suggestions: *Remove and/or relocate intersection warning sign. The warning sign could be removed if a study indicates there is sufficient visibility and sight distance available upon approach (in accordance with Section 2C.05 and 2C.46 of the National MUTCD as amended by the New York State Supplement) after exiting the reverse curves. If the warning sign is warranted, it should be repositioned, balancing the recommended advance placement distance for the posted speed limit with its relationship to the reverse curves.*

Priority for Consideration: Moderate

2.4.3 Gravel Within Intersection

Safety Concern: A buildup of gravel was observed on the Walker Road intersection approach to Beekman Road.

Observations: There is an accumulation of loose gravel and stone on the approach to Beekman Road. The location corresponds to where vehicles stop and start on Walker Road as they enter Beekman Road. It appears that runoff from Walker Road is eroding the shoulders and ditches, depositing gravel on the pavement just before Beekman Road.



Exhibit 26: Illustration of gravel within intersection.

Risk Analysis: Loose stone and gravel may cause low traction when entering and exiting an intersection. Vehicles could slide into Beekman Road. Additionally, startup time could be increased, consuming valuable gap time as a driver tries to complete a left or right turn. This result could be a high speed, severe collision. However, the overall exposure is low due to relatively low volumes on Walker Road.

Suggestions:

1. ***Remove Loose Gravel Within Intersection.***

2. **Resolve Drainage Issues on Walker Road Approach.** Review the existing drainage patterns and clear any blocked drainage facilities. Consider installing a paved ditch or concrete gutter to resolve shoulder/ditch erosion issues. Also, consider relocating the existing drainage basin to a location where it can better intercept runoff prior to Beekman Road. Fill in any locations where water could pond.

Priority for Consideration:

Suggestion 1: High
Suggestion 2: Moderate

2.5 Intersection of Beekman Road (CR 9) with Limbach Road

2.5.1 Warning Sign Location

Safety Concern: The NO OUTLET warning sign is very close to the intersection with Beekman Road.

Observations: The NO OUTLET warning sign for Limbach Road is located immediately adjacent to the intersection with Beekman Road. Drivers entering Limbach Road quickly pass the message. It may also distract drivers along Beekman Road by drawing their attention away from the reverse curves.

Risk Analysis: Inadequate messages can result in vehicles having to back up on Limbach Road. This can result in rear-end collisions with other vehicles while entering back onto Beekman Road. Sign overload can distract or confuse drivers, especially those navigating the reverse curves. Given the proximity to the reverse curves and lack of available sight distance, it could cause high-speed, severe collisions. However, this is a relatively low risk due to the likely low frequency of occurrence.

Suggestions: Relocate the NO OUTLET warning sign further away from the intersection. The optimal location would place the warning sign away from the signs on Beekman Road, but still close enough to warn entering vehicles.

Priority for Consideration: Moderate

2.6 Intersection of Beekman Road (CR 9) with Recreation Road

2.6.1 Rear End Crashes

Safety Concern: There is a pattern of southbound rear-end collisions on Beekman Road at this intersection.

Observations: There are several driveways and intersections in close proximity to each other along the east side of Beekman Road between Recreation Road and NYS Route 55. These include Recreation Road, the Beekman Auto Body driveway, and the Stop & Shop driveway. Collision data reveal a pattern of southbound rear-end collisions at the same location.

The SA Team observed southbound through vehicles using the 6 ft wide shoulder to bypass left turning vehicles at the Stop & Shop driveway and Recreation Road. The wider shoulder ends abruptly just south of Recreation Road, where some vehicles were observed to barely make it back into the travel lane before the 1 to 2 ft shoulder begins. It is important to note that it is illegal in the State of New York to cross the white edge line and pass a vehicle on the right using a designated shoulder.

The SA Team also observed that Beekman Road motorists coming from NYS Route 55 tend to speed up prior to reaching these intersections. In some cases, these drivers did not appear to anticipate slowing and maneuvering vehicles ahead. The wide shoulder is indicative of higher speeds and provides space for impatient drivers to bypass turning vehicles. With the three closely spaced intersections, southbound through motorists might find it difficult to discern where a left turning vehicle is going unless it is already stopped.

Lastly, the SA Team observed a number of vehicles traveling between Recreation Road and the Stop & Shop during the evening peak. Many vehicles entered Beekman Road from Stop & Shop and then quickly turned left onto Recreation Road.



Exhibit 27: Illustration of vehicles using the existing shoulder to bypass left turning vehicles.

The frequency of these movements likely contributes to the rear-end collision pattern as drivers on Beekman Road, coming from NYS Route 55, are surprised by the starts and stops.

Risk Analysis: Differential speeds, along with quick stops and starts can lead to rear end collisions. The 6 ft wide shoulder, as opposed to the 1 to 2 ft shoulder found elsewhere along the Beekman Road corridor, facilitates higher speeds and makes it more comfortable for motorists to utilize it for passing. Confusion arising from quick starts and stops can also contribute to a rear-end collision pattern. If a moderate to high-speed vehicle were to miss the shoulder transition, it could lose control, leave the roadway, strike a tree, strike the downstream bridge wall, or end up in Fishkill Creek.

Suggestions:

1. **Narrow the Shoulder by Installing Curb.** *Installing curb along this segment of Beekman Road would develop an urbanized feel, more in tune with the developed area. This would prevent vehicles from bypassing stopped cars, however it would not reduce the potential for rear-end collisions. Additionally, curb would be inconsistent with the rest of the Beekman Road corridor and could potentially vault a fast moving, errant vehicle. This suggestion was eliminated from further consideration by the SA Team.*
2. **Extend the 6 ft Wide Shoulder Further South.** *Extending the 6 ft wide shoulder toward the Fishkill Creek bridge would provide more room for a passing vehicle to transition to the travel lane. Additionally, the extended shoulder would have a smoother transition back to the narrower width. However, this would also make the illegal passing movement more attractive. Although this action would not reduce the potential for rear-end collisions, the SA Team felt it would foster a more forgiving roadway environment.*
3. **Widen the Existing Shoulder.** *Widening the existing shoulder to an 8 ft width would allow more room to bypass stopped vehicles. The SA Team noted that passing vehicles currently shy away from the edge of shoulder due to a curve warning sign near the Recreation Road intersection. However, a wider shoulder would not reduce the potential for rear-end collisions and would facilitate an illegal traffic maneuver. Therefore, this suggestion was eliminated from further consideration.*

4. **Install a Safety Widening.** A safety widening is a short, striped bypass lane made available to avoid turning vehicles. No exclusive turn lane markings are used, allowing through traffic to stay to the left when turning traffic is not present. The SA Team felt this feature might encourage high speeds and not necessarily reduce the potential for rear-end collisions. Pavement widening to the west could impact Fishkill Creek, therefore the SA Team suggested using the existing pavement width to accomplish the lane addition if possible. This would reduce the 6 ft shoulder to a width more consistent with the rest of the corridor.

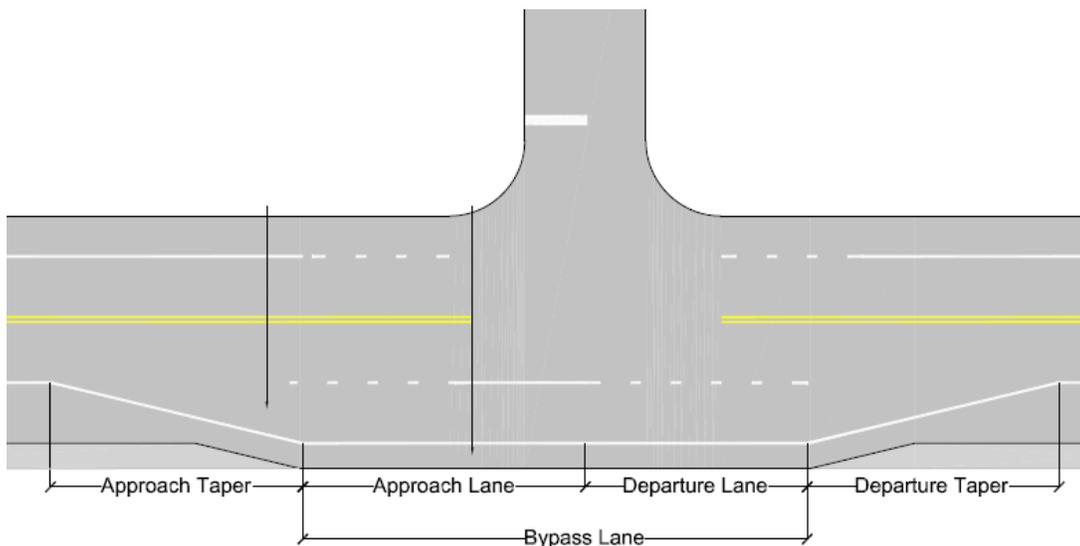


Exhibit 28: Illustration of safety widening.

5. **Install a Left Turn Pocket for Recreation Road.** A separate left turn only lane could be installed, providing a refuge for left turning vehicles and eliminating the illegal bypass movement. The SA Team made note of some design issues that would need to be resolved prior to implementation, including: maintain existing shoulder widths that are occasionally used as pedestrian facilities, install a sidewalk if shoulder widths cannot be maintained, and fit the turn lane in with the adjacent intersections. The SA Team suggested using the existing pavement width to create this facility given the potential impacts to Fishkill Creek. This suggestion should be considered in conjunction with a proposed future intersection improvement and bridge replacement project at Beekman Road and NYS Route 55. Refer to **Appendix D** for a conceptual sketch of the left turn pocket.

Priority for Consideration:

- Suggestion 1: Dismissed
- Suggestion 2: Moderate
- Suggestion 3: Dismissed
- Suggestion 4: Low
- Suggestion 5: Moderate

2.6.2 Guide Sign Location

Safety Concern: A guide sign for Recreation Park is stacked above the street name sign.

Observations: The street name sign for Recreation Road is supplemented with a guide sign for Recreation Park with an arrow. This does not provide positive guidance to drivers looking for Recreation Road or Recreation Park.

Risk Analysis: A lack of clear navigational information increases the risk of last minute decision making and maneuvers, which in turn can increase the risk of a collision. This condition would affect unfamiliar motorists to a greater extent than local motorists.

Suggestions: *Install general information park signs (NYM8-10) with supplementary text panels and directional arrows on Beekman Road both north and south of the intersection. These would provide advanced notice of the park entrance to drivers.*

Priority for Consideration: Low



Exhibit 29: Existing Recreation Park Guide Sign.



Exhibit 30: Example of proposed general information sign.

2.7 Beekman Road (CR 9) - Reverse Curves between Walker and Limbach Roads

2.7.1 Horizontal Geometry and Operating Speeds

Safety Concern: A significant number of roadway departure incidents (33/67 within the study period) have occurred on the reverse curves between Walker Road and Limbach Road. The roadside environment in this area is characterized as unforgiving.

Observations: The reverse curves between Walker Road and Limbach Road have posted advisory speeds of 30 mph and 35 mph in the northbound and southbound directions, respectively. Speed measurements taken in this area suggest that motorists routinely exceed those speeds, with the 85th percentile speed being 45 mph. Sight lines are restricted by the roadside environment. That environment includes numerous unforgiving features including mature trees, utility poles, and a rock outcropping. Shoulders are relatively narrow, measuring between 1 and 2 ft wide. Shoulder drop-off is also an issue in several locations. On multiple occasions, the SA Team observed vehicles crossing the center and edge lines while traversing the curves. Furthermore, the SA Team noticed a small crest in the southbound direction, just upstream of the first curve and near Limbach Road, which may be contributing to vehicle instability at relatively high speeds.

Warning signs in the northbound direction include a reverse curve sign (W1-4) with advisory speed plaque (30 mph) (W13-1P), oversized fluorescent yellow-green SCHOOL BUS STOP AHEAD sign (S3-1), intersection warning sign (W2-2) with supplementary DRIVEWAY plaque (NYW5-16P), and 2 chevron alignment (W1-8) signs. Warning signs in the southbound direction include a reverse curve sign (W1-4) with advisory speed plaque (35 mph) (W13-1P), intersection warning sign (W2-2) with supplementary DRIVEWAY plaque (NYW5-16P), 3 chevron alignment signs (W1-8), and an intersection warning sign (W2-2).

While there are numerous crashes related to geometry and speed, the alignment signs generally appear less noticeable than the other signs. This is due to differences in panel size and retroreflectivity. In the southbound direction under darkness, the intersection warning sign shows up far better than the reverse curve warning sign. The SCHOOL BUS STOP AHEAD sign in the northbound direction is more noticeable than any other sign in daylight or darkness.

A majority of crashes (94%) experienced on the curves occurred under wet pavement conditions and typically resulted in a roadway departure.

Risk Analysis: The combination of tight horizontal curvature, narrow shoulders, relatively high approach speeds, propensity of vehicles to cross the center and edge lines, and proliferation of unforgiving roadside elements can be characterized as both uncaring and unforgiving. The potential for a roadway departure event or head-on collision increases with approach speed and when the pavement is slippery. This is evidenced by a collision history where approximately 50% of incidents have resulted in at least one personal injury. The observed shoulder drop off condition makes it difficult for a driver to regain control once their wheel has gone off the relatively narrow shoulder pavement. Once off the pavement, there is a high probability of a collision with a fixed object.

Lack of sufficient warning and/or sign overload can distract and confuse unfamiliar drivers. Even familiar drivers may not get adequate information to assist in navigating the reverse curve geometry under adverse weather conditions and darkness if the most important warnings are not prominent.

The SA Team felt that the risk of a severe crash was greatest within this segment of the corridor as compared to any other location. It was agreed to be the portion of Beekman Road most deserving of attention. The SA Team recommends that the Dutchess County DPW strive to implement suggested improvements incrementally, installing those it believes have the best potential to improve safety and reduce the frequency of crashes, and then adding other improvements if/as needed. This would allow for an understanding of which changes are most effective and would divide the overall treatment into manageable packages. This approach would also reserve options for future treatment should the first package of changes not be as effective as initially hoped.



Exhibit 31: Illustration of warning sign dominance in the northbound direction.



Exhibit 32: Illustration of evidence from a recent roadway departure collision.



Exhibit 33: Illustration of southbound chevron signing, tight geometry, and numerous roadside elements.

Suggestions:

1. **Northbound Reverse Curve Signing Modifications.** This suggestion involves the review of existing warning signage, further study to ensure proper placement of all signs including the existing chevron alignment signs (W1-8), installation of additional chevron alignment signs (W1-8) to mark the second curve, and a general effort to improve consistency, message primacy, and positive guidance.

The revised signing plan should present a clear message to drivers approaching the curves. The suggested sequence would include:

- A. An enlarged combination reverse curve and intersection warning sign (W1-10e) with advisory speed plaque (W13-1P) installed at the proper advanced posting distance in accordance with the MUTCD. Consideration should be given to making the advisory speed consistent in both the



Exhibit 34: Examples of proposed warning signs.

northbound and southbound directions after appropriate review. If the recommended advisory speed is determined to be 30 mph or less the curve/reverse curve signing should be replaced with turn/reverse turn signs

- B. A symbolic, appropriately sized, school bus stop ahead sign (S3-1) should be installed in advance of the stopping location.
- C. If these measures prove unsuccessful at lowering the crash rate, additional warning could be provided by installing a combination curve/advisory speed (W1-2a) sign at the beginning of the first curve.

In addition to the above sequence, chevron alignment signs (W1-8) should be installed to help guide motorists through the second portion of the reverse curve. Vegetation should be trimmed around all signs to ensure visibility during all seasons.

- 2. **Southbound Reverse Curve Signing Modifications.** This suggestion involves the review of existing warning signage, further study to ensure proper placement of all signs including the existing chevron alignment signs (W1-8), installation of additional chevron alignment signs (W1-8) to mark the second curve, and a general effort to improve consistency, message primacy, and positive guidance.

The suggestions for the southbound direction are the same as described above for the northbound direction. Please also refer to Section 2.4.2 for suggestions regarding the Walker Road intersection warning sign.

- 3. **Install Slippery When Wet Signing.** This suggestion would install a slippery when wet sign (W8-5) on each approach to the curve. This would respond to the number of incidents occurring under wet pavement conditions. While the SA Team agreed that these signs are applicable, the group also felt adding more signs at or before the

curves could detract from the primary message about geometry. If installed, the placement of these signs should be carefully



Exhibit 35: Slippery When Wet (W8-5) Sign.

considered as part of the overall signing package for Beekman Road. They could be used as an alternative to the combination alignment and advisory speed signs described under suggestions 1 and 2.

4. **Install Warning Sign Enhancements.** Installing systems to enhance key warning signs, such as flashing beacons or light emitting diode (LED) borders was considered by the SA Team. This would catch a driver's attention, drawing focus to the warning about the upcoming curves. Such a system could be powered via solar panels or hardwired and metered. The SA Team also discussed placing these on the chevron alignment signs, however, due to the high potential for getting knocked down by an errant vehicle, this treatment was not recommended.



Exhibit 36: Example of warning sign LED enhancement.

5. **Install Actuated Warning Sign Enhancements.** This would build upon suggestion 4 by using sensors to actuate the beacons or LED borders based on speed or weather condition. For example, the beacons might only be activated when a vehicle is traveling over the posted advisory speed, when the pavement is wet, or when the pavement is icy. These systems would catch the driver's attention, drawing focus to the appropriate warning at the most critical times. The SA Team discussed some limitations of this approach. For example, if roadway conditions were very poor, travel at or below the posted advisory speed may still be too fast for conditions. After deliberation, the SA Team eliminated this suggestion from further consideration.

6. **Install Roadside Delineators.** This suggestion would involve installing delineators along the curves to provide additional guidance. The SA Team noted that delineators may become a maintenance burden if continually knocked over by plows or errant vehicles. The use of flexible delineator supports is suggested as one possible way to avoid this issue.



Exhibit 37: Example of a flexible roadside delineator.



Exhibit 38: Illustration of speed reduction markings.

7. **Install Speed Reduction Markings.** *Install speed reduction markings on the approaches to the reverse curves to give drivers the impression that their speed is increasing. The goal of this treatment would be to realize a reduction in speed and increase driver vigilance when approaching the curves. The SA Team noted that this treatment could potentially draw attention away from the warning signs.*
 8. **Install Shoulder Backup Material.** *The addition of stable, compacted shoulder backup would eliminate the drop-off condition and make it easier for vehicles that have departed the roadway to regain the traveled way. The Dutchess County DPW might also consider installing a shoulder safety wedge along the edge of the pavement when repaving to make it easier for vehicles to regain the roadway in the event that backup material wears away. This practice is recommended by the Federal Highway Administration (FHWA). These are examples of forgiving roadside features.*
- 
9. **Install High Friction Pavement Treatment.** *This would involve the installation of a higher friction pavement treatment through the reverse curves to increase the horizontal friction factor, especially during periods of rain. A higher friction factor would help keep some vehicles from leaving the roadway. The SA Team discussed alternative treatments including a rough asphalt top course, microsurfacing, and epoxy overlays often seen on bridge decks. Further study and evaluation would be required determine which would be the best treatment for Beekman Road.*
 10. **Install Rumble Strips.** *This suggestion would involve the installation of rumble strips across the travel lanes approaching the reverse curves from the north and south. Vehicles approaching the curve would run over the strips, notifying them physically and audibly to reduce speed. Given the*

Exhibit 39: Illustration of shoulder drop-off condition.

residential nature of the area and the potential for noise to be regarded as a nuisance, the SA Team eliminated this suggestion from further consideration.

11. ***Install Centerline Pavement Markers.*** *Permanent, reflective pavement markers would be installed along the centerline to enhance positive guidance under darkness and wet conditions. The reflectors would be embedded in the pavement surface. The SA Team noted future pavement maintenance as a concern as well as durability under snow plowing operations. This suggestion was eliminated from further consideration by the SA Team.*
12. ***Install Audible Roadway Delineators.*** *This suggestion involves the installation of centerline and shoulder audible roadway delineators to warn drivers when they are encroaching on the opposing travel lane or shoulder. Though vehicles were observed crossing the centerline, the crash history did not indicate a pattern of opposing sideswipe or head-on collisions. This suggestion was eliminated from further consideration by the SA Team due to future maintenance concerns and the lack of available shoulder width.*
13. ***Widen the Existing Pavement.*** *This could be accomplished in one of two ways: widening the shoulders or widening the traveled way. The SA Team felt that it would be difficult to widen shoulders throughout the reverse curves given the close proximity of residential structures and the value of roadside features that screen them visually from the road. Acquisition of right-of-way would also be a concern. Widening the existing traveled way could be done as a spot treatment at select locations, lessening the impact. However, one of the preferred locations near Limbach Road is very close to an existing home with limited frontage. After further discussion, the SA Team felt that widening the pavement could encourage higher speeds, which in turn would increase the severity of roadway departure incidents. This suggestion was eliminated from further consideration.*
14. ***Remove Roadside Objects.*** *Fixed objects along the roadside could be removed to provide a clear zone beyond the traveled way. This would include vegetation, rocks, trees, and utility poles. However, the existence of these roadside elements is consistent with adjacent roadway segments, helps encourage appropriate driver behavior, and does provide some traffic calming effect. Additionally, the relocation or removal of these*

elements would be an expensive endeavor given the narrow prescriptive right-of-way. The SA Team eliminated this suggestion from further consideration as it anticipated a low benefit-to-cost ratio.

15. *Install Guide Rail.* *Installing guide rail along these curves would shield motorists from fixed roadside objects, however it would also prevent vehicles from leaving the roadway. This could result in out-of-control vehicles rebounding back into the travel lanes, precipitating a severe, head-on collision. This suggestion was eliminated from further consideration by the SA Team.*

16. *Straighten Roadway Alignment.* *This suggestion would involve realigning Beekman Road to eliminate or flatten the reverse curves. Construction of a new roadway would require property acquisitions and have high costs. Given its potential impacts to the community, the SA Team eliminated this suggestion from further consideration.*

Priority for Consideration:

Suggestions 1 - 2:	High
Suggestions 3 - 4:	Low
Suggestion 5:	Dismissed
Suggestion 6:	Moderate
Suggestion 7:	Low
Suggestion 8:	High
Suggestion 9:	Low
Suggestions 10 - 16:	Dismissed

3.0 Conclusions & Summary of Suggested Actions

This assessment has been prepared to assist the roadway owners in the identification and actualization of opportunities to improve safety within the study area. The suggestions it contains are for consideration only and are in no way intended to serve as design or operational recommendations.

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 owner or the emergence of new issues over time.

It is recommended that the Dutchess County DPW review this report, document its responses to the issues identified in a formal response, and track progress toward the implementation of safety improvements prompted by this assessment.

The locations are listed below in order of their importance to the overall safety of the corridor and suggested actions for each location are listed in order of priority.

Section	Suggested Action	Suggested Priority	Estimated Construction Cost ¹
Beekman (CR 9) - Reverse Curves between Walker and Limbach Roads			
2.7.1	Northbound reverse curve signing modifications	High	\$3,000
2.7.1	Southbound reverse curve signing modifications	High	\$3,000
2.7.1	Install shoulder backup material	High	\$2,000
2.7.1	Install roadside delineators	Moderate	\$2,500
2.7.1	Install slippery when wet signing	Low	\$500
2.7.1	Install warning sign enhancements	Low	\$20,000
2.7.1	Install speed reduction markings	Low	\$1,000
2.7.1	Install high friction pavement treatment	Low	\$45,000

Section	Suggested Action	Suggested Priority	Estimated Construction Cost ¹
Intersection of Beekman Road (CR 9) with Beekman-Poughquag Road (CR 7)			
2.2.2	Trim and/or remove existing vegetation - southeast corner	High	\$3,500
2.2.1	Trim and/or remove existing vegetation - northeast corner	High	\$1,500
2.2.3	Trim overhanging branches - north side	High	\$1,500
2.2.4	Trim and/or remove existing vegetation - westbound approach	High	\$500
2.2.4	Relocate the existing STOP signs	Moderate	\$500
2.2.6	Narrow the westbound approach with pavement markings	Moderate	\$2,500
2.2.4	Install larger STOP signs with retroreflective strips	Low	\$500
2.2.5	Relocate the Beekman Road (CR 9) guide signs	Low	\$500
2.2.6	Physically narrow the existing pavement	Low	\$5,000

Section	Suggested Action	Suggested Priority	Estimated Construction Cost ¹
Intersection of Beekman Road (CR 9) with Recreation Road			
2.6.1	Extend the 6 ft shoulder further south	Moderate	\$3,000
2.6.1	Install a left turn pocket for Recreation Road	Moderate	\$20,000
2.6.2	Install general information park signs on Beekman Road	Low	\$500
2.6.1	Install a safety widening	Low	\$10,000

Section	Suggested Action	Suggested Priority	Estimated Construction Cost ¹
Beekman Road (CR 9)			
2.1.3	Install shoulder backup material	High	\$25,000
2.1.5	Replace and/or install new guide rail	High	\$30,000
2.1.6	Remove dead or hazardous trees and vegetation	High	\$8,000
2.1.6	Trim and/or remove vegetation away from traffic signs	High	\$4,000
2.1.7	Review the need for, condition of, and placement of signing throughout	High	\$6,000
2.1.12	Install stop lines on all approaches to Beekman Road	Moderate	\$2,000
2.1.9	Relocate Barton Orchard directional service sign to north	Moderate	\$500
2.1.11	Remove old, unused sign posts	Moderate	\$1,000
2.1.1	Increase speed enforcement	Moderate	\$5,000 See Note 2
2.1.8	Upgrade existing street name signs	Low	\$3,000
2.1.10	Reset or cut off embedded section of breakaway posts	Low	\$4,000
2.1.4	Remove ditch and redirect roadway drainage to other adjacent drainage facilities	Low	\$5,000
2.1.13	Widen the existing shoulder	Low	\$300,000

Section	Suggested Action	Suggested Priority	Estimated Construction Cost ¹
Intersection of Beekman Road (CR 9) with Baker Road			
2.3.2	Trim and/or remove shrubs - southwest corner	High	\$3,000
2.3.1	Trim and/or remove existing vegetation - northwest corner	High	\$3,000
2.3.3	Replace and condense warning signage - northbound	Moderate	\$3,000
2.3.4	Replace and condense warning signage - southbound	Moderate	\$1,500
2.3.5	Restripe the stop line with a wider, standard size	Low	\$500
2.3.6	Replace the white retroreflective strips with red strips	Low	\$500
2.3.1	Regrade side slope to improve sight distance - northwest corner	Low	\$6,000
2.3.1	Monitor intersection corners for extraneous signs - northwest corner	Low	See Note 3

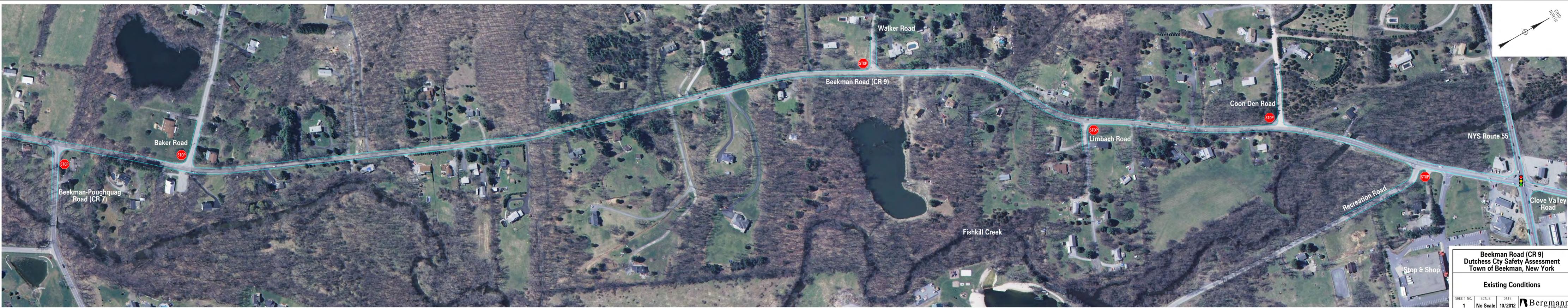
Section	Suggested Action	Suggested Priority	Estimated Construction Cost ¹
Intersection of Beekman Road (CR 9) with Walker Road			
2.4.3	Remove loose gravel within intersection	High	\$500
2.4.1	Trim vegetation and overhanging branches - northwest corner	Moderate	\$1,500
2.4.3	Resolve drainage issues on Walker Road approach	Moderate	\$5,000
2.4.2	Remove and/or relocate intersection warning sign	Moderate	\$500

Section	Suggested Action	Suggested Priority	Estimated Construction Cost ¹
Intersection of Beekman Road (CR 9) with Limbach Road			
2.5.1	Relocate NO OUTLET warning sign	Moderate	\$500

Notes:

1. Estimates of probable construction cost are presented for planning and comparison purposes only. Costs such as engineering, construction inspection, property acquisition, environmental mitigation, utility relocation, etc. are not included. Costs are based upon engineering judgment and recent experience with similar actions. They may differ from the actual construction costs experienced by the Dutchess County DPW.
2. Construction cost accounts for installation of pull-off locations. Additional engineering and/or administrative costs would apply in order to increase police presence and set up speed display devices.
3. Assume no construction cost associated with these actions. Engineering and/or administrative costs would apply.

Appendix A - Aerial View Graphic



Beekman Road (CR 9)
Dutchess Cty Safety Assessment
Town of Beekman, New York

Existing Conditions

SHEET NO.	SCALE	DATE	
1	No Scale	10/2012	

Appendix B - Existing Conditions Summary

Poughkeepsie-Dutchess County Transportation Council

Beekman Road (CR 9) Safety Assessment Beekman-Poughquag Road (CR 7) to NYS Route 55 Town of Beekman, New York

October 24 - 26, 2012

Existing Conditions Information:

1. Location and Character:

a. Beekman Road (CR 9)

- i. Generally north-south through the project limits
- ii. Owned and maintained by Dutchess County DPW
- iii. Functional Classification - Urban Collector
- iv. Posted Speed Limit - 45 mph
- v. Travel lane width - 10 to 11 feet
- vi. Shoulder width - 2 foot maximum
- vii. Length - 1.45 miles (within study limits)
- viii. Intersecting Roadways
 1. Beekman-Poughquag Road (CR 7)
 2. Baker Road
 3. Walker Road
 4. Limbach Road
 5. Coon Den Road
 6. Recreation Road
 7. NYS Route 55 (outside project limits)

b. Beekman-Poughquag Road (CR 7)

- i. Generally east-west through the project limits
- ii. Owned and maintained by Dutchess County DPW
- iii. Functional Classification - Urban Collector
- iv. Posted Speed Limit - 40 mph

c. Terrain - Rolling



2. Traffic Control / Signage

a. Intersection Control

i. STOP Signs

1. All intersecting roadways

ii. Stop Lines

1. Beekman-Poughquag Road (CR 7)
2. Baker Road

b. Warning Signs

i. Curve Warning

1. Installed prior to reverse curve located just north of Walker Road
 - a. Advisory speed postings - 30 mph NB, 35 mph SB

ii. Others installed where applicable

3. Pavement History

- a. 2006 – Asphalt (HMA type 6F3 top course) overlay

4. Traffic Volumes, Speeds, and Composition (2012)

a. Beekman Road (CR 9) - Beekman-Poughquag Road to Walker Road Data Location - (0.3 miles south of Walker)

i. AADT - 5440

1. 50/50 split NB/SB

ii. Peak Hour Volumes - 380 AM, 520 PM

1. Marginally higher SB during AM and NB during PM

iii. Average Speed - 46 mph

iv. 85% Speed - 52 mph

v. Heavy Vehicle % - 3%



- b. Beekman Road (CR 9) - Walker Road to NYS Route 55
 Data Location (900 ft north of Walker – in curve)
 - i. AADT - 5380
 - 1. 50/50 split NB/SB
 - ii. Peak Hour Volumes - 370 AM, 530 PM
 - 1. Marginally higher SB during AM and NB during PM
 - iii. Average Speed - 42 mph
 - iv. 85% Speed - 48 mph
 - v. Heavy Vehicle % - 4%
- c. Beekman Road (CR 9) - South of Beekman-Poughquag Road
 - i. AADT - 7680
 - ii. Peak Hour Volumes - 580 AM, 750 PM
 - iii. Average Speed - 40 mph
 - iv. 85% Speed - 48 mph
 - v. Heavy Vehicle % - 2%
- d. Beekman-Poughquag Road (CR 7)
 - i. AADT - 2240 (estimated)
- e. Historic Traffic Growth -
 - i. Minimal growth since 2007

5. Crash History

- a. Time Period - 2008 to 2011 (4 years)
- b. No pedestrian or bicycle crashes in review period. One bicycle collision reported in July 2012.
- c. No Fatalities.

Location by Type	No. of Accidents	% of Total
Midblock	39	58%
Intersection	22	33%
Driveway	6	9%
Total	67	100%

33 of 39 midblock accidents occurred at reverse curve.



By Location	No. of Accidents	% of Total
Beekman Road (CR 9)	45	67%
Beekman-Poughquag Road (CR 7)	11	16%
Baker Road	3	5%
Coon Den Road	1	2%
Recreation Road	7	10%
Total	67	100%

50% of intersection accidents occurring at Beekman-Poughquag Road.

Accident Severity	No. of Accidents	% of Total	Intersection	Midblock	Driveway
Injury	32	48%	10	21	1
Property Damage	31	46%	10	17	4
Non-Reportable	4	6%	2	1	1
Total	67	100%	22	39	6

48% of accidents result in injury.

Light Conditions	No. of Accidents	% of Total
1 Daylight	49	73%
2 Dawn	2	3%
3 Dusk	2	3%
4 Dark-Road Lighted	0	0%
5 Dark-Road Unlighted	14	21%
Total	67	100%

Most accidents occur during daylight hours.

Roadway Character	No. of Accidents	% of Total
1 Straight and Level	15	22%
2 Straight and Grade	9	13%
3 Straight and Hill Crest	0	0%
4 Curve and Level	36	54%
5 Curve and Grade	7	11%
Total	67	100%

High percentage of accidents at the horizontal curves.



Roadway Surface Conditions	No. of Accidents	% of Total
1 Dry	25	37%
2 Wet	36	54%
4 Snow/Ice	6	9%
Total	67	100%

High percentage of accidents occurring during wet/slippy surface conditions.

Weather	No. of Accidents	% of Total
1 Clear	25	37%
2 Cloudy	20	30%
3 Rain	16	24%
4 Snow	3	4%
5 Sleet/Hail/Freezing Rain	2	3%
6 Fog/Smog/Smoke	1	2%
Total	67	100%

Accident Type	No. of Accidents	% of Total
Rear End	13	19%
Left Turn	4	6%
Out of Control	1	2%
Sideswipe	2	3%
Right Angle	5	7%
Right Turn	1	2%
Head On	3	4%
Object	38	57%
Total	67	100%

30/38 object hits are due to run-off-the-road at reverse curve.

Factors Listed	No. of Accidents
Unsafe Speed	41
Failure to Yield the Right of Way	9
Following Too Closely	9
Pavement Slippery	31
DWI	2
Deer Incidents	13*

*Reports Removed from Summary

59% of accidents reported are due to reported unsafe operating speeds.



Accident Cluster Location - Walker Road to Limbach Road Reverse Curves	
Total Number of Accidents	33
Factor - Unsafe Speed	29
Factor - Pavement Slippery	26
Roadway Surface Conditions - Wet / Snow	31
Light Conditions - Dark	9
Accident Severity - Injury	16

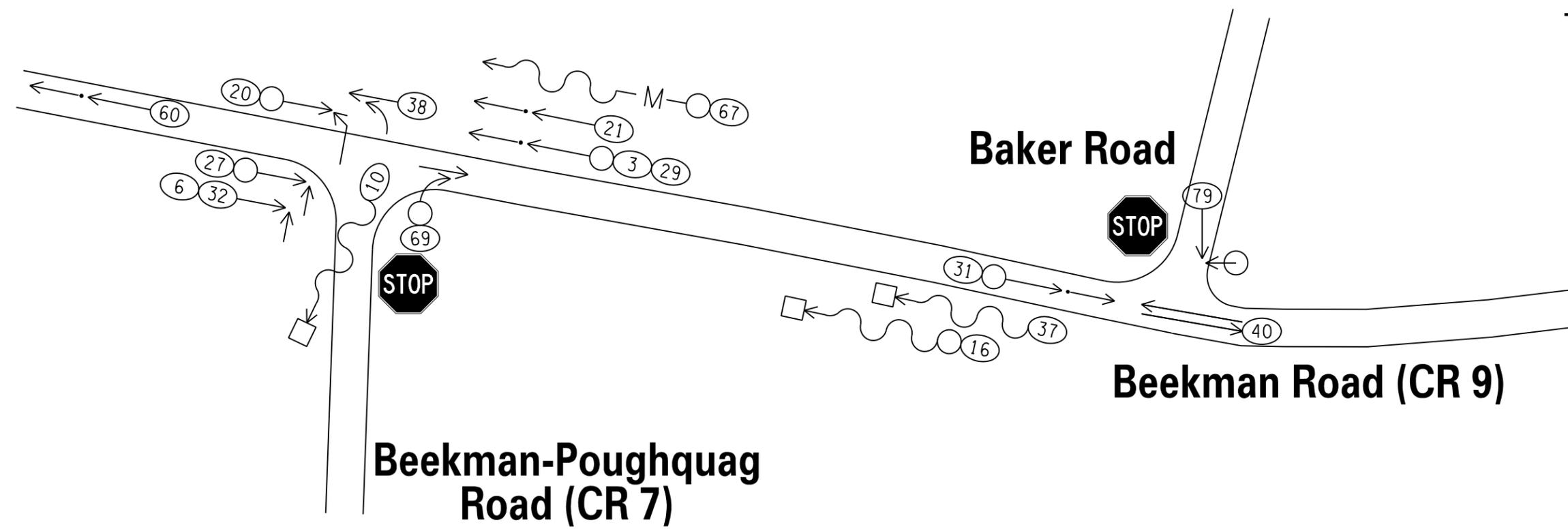
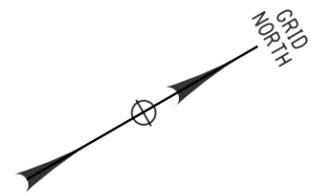
Accidents at reverse curves occur under wet / snow pavement conditions (94%) with 49% resulting in injury due to collision with trees. Factors primarily include unsafe speed and slippery pavement. 73% occurred during daylight conditions (not at night). Reviewing accident reports, generally those involved in these accidents are inexperienced or elderly drivers and reside within 15 miles of the project area.



Sorted by Numbers

Number	ID Number	Date	Location if Intersection	Intersection	Severity	Light	Character	Surf Cond.	Weather	Impact	Factors Listed	Comments
1	32538888	1/29/2008	Beekman Road	N	1 Injury	5 Dark-Road Unlighted	4 Curve and Level	2 Wet	3 Rain	Object	Pavement Slippery, Unsafe Speed	NB V1 lost control and struck tree - Walker Curve S
2	32538984	2/22/2008	Beekman Road	N	0 Property Damage Only	5 Dark-Road Unlighted	4 Curve and Level	4 Snow/Ice	4 Snow	Object	Pavement Slippery, Unsafe Speed	NB V1 lost control and struck tree - Walker Curve N
3	32605884	5/17/2008	Beekman Road at Beekman-Poughquag Road	Y	1 Injury	1 Daylight	1 Straight and Level	2 Wet	1 Clear	Rear End	Following Too Closely	SB V2 struck stopped SB V1
5	32676781	7/24/2008	Beekman Road	N	-1 Non-Reportable	1 Daylight	4 Curve and Level	2 Wet	3 Rain	Object	Pavement Slippery	SB V1 lost control and struck guide rail - Walker Curve N
6	32739693	8/19/2008	Beekman Road at Beekman-Poughquag Road	Y	0 Property Damage Only	1 Daylight	5 Curve and Grade	2 Wet	3 Rain	Right Angle	Pavement Slippery	WB V2 failed to stop and struck NB V1
7	32766798	10/17/2008	Beekman Road	D	0 Property Damage Only	1 Daylight	2 Straight and Grade	1 Dry	1 Clear	Head On	Failure to Keep Right	SB V1 failed to turn into driveway and struck stopped WB V2
9	32797843	11/13/2008	Beekman Road	N	0 Property Damage Only	3 Dusk	4 Curve and Level	2 Wet	3 Rain	Object	Pavement Slippery	SB V1 lost control and struck tree - Walker Curve S
10	32797861	11/11/2008	Beekman Road at Beekman-Poughquag Road	Y	-1 Non-Reportable	1 Daylight	1 Straight and Level	1 Dry	2 Cloudy	Object	Unsafe Speed	SB V1 lost control during turn and struck hedgerow
11	32801081	11/6/2008	Beekman Road at Recreation Road	Y	1 Injury	1 Daylight	1 Straight and Level	2 Wet	3 Rain	Rear End	Following Too Closely	SB V2 struck stopped SB V1
13	32822101	12/1/2008	Beekman Road	N	1 Injury	1 Daylight	4 Curve and Level	2 Wet	1 Clear	Object	Pavement Slippery, Unsafe Speed	SB V1 lost control and struck tree - Walker Curve N
15	32834500	11/7/2008	Beekman Road	N	1 Injury	1 Daylight	5 Curve and Grade	2 Wet	2 Cloudy	Object	Pavement Slippery, Unsafe Speed	SB V1 lost control and struck tree - Walker Curve N
16	32921094	2/22/2009	Beekman Road	N	1 Injury	5 Dark-Road Unlighted	5 Curve and Grade	1 Dry	1 Clear	Object	Unsafe Speed	SB V1 lost control and struck tree
17	32938519	1/22/2009	Beekman Road at Recreation Road	Y	0 Property Damage Only	1 Daylight	1 Straight and Level	1 Dry	1 Clear	Rear End	Unsafe Speed, Sun Glare	SB V2 struck stopped SB V1
18	32967983	2/10/2009	Beekman Road	N	0 Property Damage Only	2 Dawn	4 Curve and Level	4 Snow/Ice	1 Clear	Object	Pavement Slippery, Unsafe Speed	SB V1 lost control and struck utility pole - Walker Curve N
19	33041425	5/7/2009	Beekman Road at Recreation Road	Y	0 Property Damage Only	1 Daylight	1 Straight and Level	1 Dry	1 Clear	Rear End	Following Too Closely	SB V2 struck stopped SB V1
20	33068510	7/1/2009	Beekman Road at Beekman-Poughquag Road	Y	1 Injury	1 Daylight	2 Straight and Grade	2 Wet	3 Rain	Left Turn	Failure to Yield	WB V2 failed to yield and struck NB V1
21	33071689	7/10/2009	Beekman Road at Beekman-Poughquag Road	Y	0 Property Damage Only	1 Daylight	2 Straight and Grade	1 Dry	1 Clear	Rear End	Following Too Closely	SB V2 struck stopped SB V1
22	33084187	6/5/2009	Beekman Road	N	0 Property Damage Only	5 Dark-Road Unlighted	4 Curve and Level	2 Wet	2 Cloudy	Object	Unsafe Speed	NB V1 lost control and struck tree - Walker Curve S
23	32473541	1/5/2008	Beekman Road at Recreation Road	Y	0 Property Damage Only	5 Dark-Road Unlighted	4 Curve and Level	4 Snow/Ice	5 Sleet/Hail/Freezing Rain	Object	Pavement Slippery, Unsafe Speed	SB V1 lost control during turn and struck tree
24	32499951	1/29/2008	Beekman Road	N	1 Injury	5 Dark-Road Unlighted	4 Curve and Level	2 Wet	3 Rain	Rear End	Reaction to Other Collision	NB V2 struck stopped NB V1
25	33101478	6/28/2009	Beekman Road at Coon Den Road	Y	1 Injury	1 Daylight	1 Straight and Level	1 Dry	1 Clear	Object	Unsafe Speed	SB V1 struck drainage culvert
26	33110634	6/18/2009	Beekman Road	N	1 Injury	5 Dark-Road Unlighted	4 Curve and Level	2 Wet	3 Rain	Object	Pavement Slippery, Unsafe Speed	SB V1 lost control and struck tree - Walker Curve S
27	33132730	9/4/2009	Beekman Road at Beekman-Poughquag Road	Y	1 Injury	1 Daylight	1 Straight and Level	1 Dry	1 Clear	Right Angle	Failure to Yield	WB V2 failed to yield and struck NB V1
28	33149996	9/17/2009	Beekman Road	N	1 Injury	1 Daylight	1 Straight and Level	1 Dry	2 Cloudy	Object	Improper Passing, Unsafe Speed	SB V1 avoid collision with stopped SB V2 and struck tree
29	33163242	9/19/2009	Beekman Road at Beekman-Poughquag Road	Y	1 Injury	1 Daylight	2 Straight and Grade	1 Dry	1 Clear	Rear End	Following Too Closely	SB V2 failed to stop and struck SB V1
30	33165261	8/18/2009	Beekman Road at Recreation Road	Y	0 Property Damage Only	1 Daylight	1 Straight and Level	1 Dry	1 Clear	Rear End	Following Too Closely	SB V3 failed to stop and struck SB V2 and SB V1
31	33167034	10/2/2009	Beekman Road at Baker Road	Y	1 Injury	1 Daylight	1 Straight and Level	1 Dry	1 Clear	Rear End	Unsafe Speed	NB V1 failed to stop and struck NB V2 and SB V3
32	33173901	10/4/2009	Beekman Road at Beekman-Poughquag Road	Y	0 Property Damage Only	1 Daylight	1 Straight and Level	1 Dry	1 Clear	Right Angle	Failure to Yield	WB V1 failed to yield and struck NB V2
33	33181683	10/19/2009	Beekman Road	N	0 Property Damage Only	5 Dark-Road Unlighted	4 Curve and Level	2 Wet	6 Fog/Smog/Smoke	Object	Pavement Slippery, Unsafe Speed	SB V1 lost control and struck tree - Walker Curve S
34	33206693	11/15/2009	Beekman Road	N	1 Injury	1 Daylight	4 Curve and Level	2 Wet	1 Clear	Head On	Pavement Slippery, Unsafe Speed	SB V1 lost control and struck NB V2 and NB V3 - Walker Curve N
35	33208369	10/28/2009	Beekman Road	N	1 Injury	2 Dawn	4 Curve and Level	2 Wet	2 Cloudy	Object	Pavement Slippery, Unsafe Speed	NB V1 lost control and struck tree - Walker Curve S
37	33218582	11/14/2009	Beekman Road	N	0 Property Damage Only	5 Dark-Road Unlighted	4 Curve and Level	2 Wet	3 Rain	Object	DWI, Unsafe Speed	NB V1 lost control and struck guide rail
38	33225851	11/21/2009	Beekman Road at Beekman-Poughquag Road	Y	-1 Non-Reportable	1 Daylight	2 Straight and Grade	1 Dry	2 Cloudy	Left Turn	Failure to Yield	WB V1 failed to yield and struck SB V2
39	33271501	11/15/2009	Beekman Road	N	1 Injury	1 Daylight	4 Curve and Level	2 Wet	1 Clear	Object	Pavement Slippery, Unsafe Speed	SB V1 lost control and struck tree - Walker Curve N
40	33288953	12/13/2009	Beekman Road at Baker Road	Y	0 Property Damage Only	1 Daylight	5 Curve and Grade	4 Snow/Ice	5 Sleet/Hail/Freezing Rain	Sideswipe	Pavement Slippery, Unsafe Speed	NB V1 lost control and struck stopped SB V2
41	33297230	12/11/2009	Beekman Road	N	1 Injury	5 Dark-Road Unlighted	4 Curve and Level	1 Dry	1 Clear	Object	DWI, Unsafe Speed	SB V1 lost control and struck utility pole
43	33327307	12/31/2009	Beekman Road	N	1 Injury	1 Daylight	5 Curve and Grade	4 Snow/Ice	4 Snow	Object	Pavement Slippery, Unsafe Speed	NB V1 lost control and struck tree
44	33329200	1/28/2010	Beekman Road	N	1 Injury	1 Daylight	4 Curve and Level	2 Wet	2 Cloudy	Object	Pavement Slippery, Unsafe Speed	SB V1 lost control and struck tree - Walker Curve S
45	33330495	1/30/2010	Beekman Road	D	0 Property Damage Only	1 Daylight	2 Straight and Grade	1 Dry	2 Cloudy	Rear End	Following Too Closely	SB V1 failed to stop and struck SB V2 stopped for driveway entrance
46	33421160	4/17/2010	Beekman Road	D	0 Property Damage Only	1 Daylight	4 Curve and Level	2 Wet	2 Cloudy	Left Turn	Failure to Yield, Sight Distance	EB V1 failed to yield from driveway and struck SB V2
47	33499796	6/15/2010	Beekman Road at Recreation Road	Y	0 Property Damage Only	1 Daylight	1 Straight and Level	1 Dry	1 Clear	Rear End	Following Too Closely	SB V2 failed to stop and struck SB V1
48	33505604	7/9/2010	Beekman Road	D	0 Property Damage Only	1 Daylight	1 Straight and Level	1 Dry	1 Clear	Left Turn	Failure to Yield	WB V1 failed to yield from driveway and struck SB V2
49	33548929	8/10/2010	Beekman Road	N	0 Property Damage Only	1 Daylight	4 Curve and Level	2 Wet	3 Rain	Object	Pavement Slippery, Unsafe Speed	SB V1 lost control and struck tree - Walker Curve N
50	33553867	8/23/2010	Beekman Road	N	1 Injury	1 Daylight	5 Curve and Grade	2 Wet	2 Cloudy	Head On	Pavement Slippery, Unsafe Speed	NB V1 lost control and struck SB V2 - Walker Curve S
52	33587258	9/27/2010	Beekman Road	N	0 Property Damage Only	1 Daylight	4 Curve and Level	2 Wet	3 Rain	Object	Pavement Slippery, Unsafe Speed	SB V1 lost control and struck tree - Walker Road Curve N
53	33588696	9/8/2010	Beekman Road	N	0 Property Damage Only	1 Daylight	4 Curve and Level	2 Wet	3 Rain	Object	Pavement Slippery, Unsafe Speed	SB V1 lost control and struck tree - Walker Road Curve N
54	33625398	10/12/2010	Beekman Road	N	0 Property Damage Only	1 Daylight	4 Curve and Level	2 Wet	3 Rain	Object	Pavement Slippery, Unsafe Speed	NB V1 lost control and struck tree - Walker Road Curve S
55	33644131	11/4/2010	Beekman Road	N	1 Injury	1 Daylight	4 Curve and Level	2 Wet	3 Rain	Object	Pavement Slippery, Unsafe Speed	SB V1 lost control and struck tree - Walker Road Curve N
57	33658595	11/16/2010	Beekman Road	N	0 Property Damage Only	1 Daylight	4 Curve and Level	2 Wet	2 Cloudy	Sideswipe	Unsafe Speed, Failure to Keep Right	NB V1 lost control and struck SB V2 - Walker Curve S
58	33666497	11/26/2010	Beekman Road	N	1 Injury	1 Daylight	4 Curve and Level	2 Wet	2 Cloudy	Object	Unsafe Speed	NB V1 lost control and struck tree - Walker Curve S
59	33709543	12/28/2010	Beekman Road	N	0 Property Damage Only	1 Daylight	4 Curve and Level	2 Wet	2 Cloudy	Object	Pavement Slippery, Unsafe Speed	NB V1 lost control and struck tree - Walker Curve S
60	33709544	12/28/2010	Beekman Road	D	-1 Non-Reportable	1 Daylight	2 Straight and Grade	2 Wet	2 Cloudy	Rear End	Pavement Slippery, Unsafe Speed	SB V1 failed to stop and struck SB V2 stopped for driveway entrance
61	33750676	1/22/2011	Beekman Road at Recreation Road	Y	0 Property Damage Only	1 Daylight	1 Straight and Level	1 Dry	1 Clear	Rear End	Following Too Closely	SB V1 failed to stop and struck SB V2 and SB V3
64	33845319	1/19/2011	Beekman Road	N	0 Property Damage Only	1 Daylight	4 Curve and Level	4 Snow/Ice	4 Snow	Object	Pavement Slippery	NB V1 lost control and struck tree - Walker Road Curve S
65	33847509	4/19/2011	Beekman Road	N	1 Injury	5 Dark-Road Unlighted	4 Curve and Level	2 Wet	2 Cloudy	Object	Pavement Slippery, Unsafe Speed	NB V1 lost control and struck tree - Walker Road Curve S
66	33878013	4/23/2011	Beekman Road	N	0 Property Damage Only	1 Daylight	4 Curve and Level	2 Wet	2 Cloudy	Object	Unsafe Speed	NB V1 lost control and struck tree - Walker Road Curve S
67	33918683	6/19/2011	Beekman Road at Beekman-Poughquag Road	Y	1 Injury	1 Daylight	2 Straight and Grade	1 Dry	2 Cloudy	Out of Control	Steering Failure	SB M1 lost control
69	33947955	6/3/2011	Beekman Road at Beekman-Poughquag Road	Y	1 Injury	3 Dusk	2 Straight and Grade	1 Dry	1 Clear	Right Angle	Failure to Yield	WB V1 failed to yield and struck NB V2
70	34000658	8/18/2011	Beekman Road	N	0 Property Damage Only	5 Dark-Road Unlighted	4 Curve and Level	1 Dry	1 Clear	Object	Driver Distraction	SB V1 lost control and struck tree - Walker Road Curve N
71	34001878	8/14/2011	Beekman Road	N	1 Injury	5 Dark-Road Unlighted	4 Curve and Level	2 Wet	3 Rain	Object	Unsafe Speed	SB V1 lost control and struck guide rail - Walker Curve N
72	34019067	9/5/2011	Beekman Road	N	0 Property Damage Only	1 Daylight	4 Curve and Level	2 Wet	2 Cloudy	Object	Pavement Slippery, Unsafe Speed	SB V1 lost control and struck utility pole - Walker Curve N
73	34041392	10/1/2011	Beekman Road	N	1 Injury	1 Daylight	4 Curve and Level	2 Wet	2 Cloudy	Object	Pavement Slippery, Unsafe Speed	SB V1 lost control and struck tree - Walker Curve N
74	34067090	10/27/2011	Beekman Road	N	0 Property Damage Only	1 Daylight	4 Curve and Level	2 Wet	3 Rain	Object	Pavement Slippery, Unsafe Speed	NB V1 lost control and struck tree - Walker Curve S
75	34086309	11/7/2011	Beekman Road	N	1 Injury	1 Daylight	4 Curve and Level	1 Dry	1 Clear	Object	Unsafe Speed	NB V1 lost control and struck tree - Walker Curve S
76	34105648	10/22/2011	Beekman Road	D	1 Injury	1 Daylight	1 Straight and Level	1 Dry	1 Clear	Right Angle	Failure to Yield	WB V1 failed to yield and struck NB V2
78	34140340	12/16/2011	Beekman Road	N	1 Injury	5 Dark-Road Unlighted	4 Curve and Level	2 Wet	2 Cloudy	Object	Pavement Slippery, Unsafe Speed	NB V1 lost control and struck tree - Walker Curve S
79	34152597	12/24/2011	Beekman Road at Baker Road	Y	1 Injury	1 Daylight	5 Curve and Grade	1 Dry	1 Clear	Right Turn	Failure to Yield	EB V1 failed to yield and struck SB V2

Appendix C - Collision Diagrams



LEGEND

- ⊙ COLLISION NUMBER
- FATALITY
- INJURY
- OBJECT
- ↔ BACKING
- ← B — BICYCLE
- ← HEAD ON
- ↙ LEFT TURN (SAME DIRECTION)
- ↘ LEFT TURN (OPPOSITE DIRECTION)
- ← M — MOTORCYCLE
- MOVING
- ⊖ OUT OF CONTROL
- ⊖ OVERTURNED
- PEDESTRIAN
- ▭ PARKED
- ← · ← REAR END
- ↘ RIGHT ANGLE
- ↗ RIGHT TURN (SAME DIRECTION)
- ↘ RIGHT TURN (OPPOSITE DIRECTION)
- ← ← SIDESWIPE (SAME DIRECTION)
- ↔ SIDESWIPE (OPPOSITE DIRECTION)

**Beekman Road (CR 9)
Dutchess Cty Safety Assessment
Town of Beekman, New York**

**Collision Diagram
2008-2011**

SHEET NO. 1 of 4	SCALE 1:100	DATE 10/2012	Bergmann associates
----------------------------	-----------------------	------------------------	-------------------------------

LEGEND

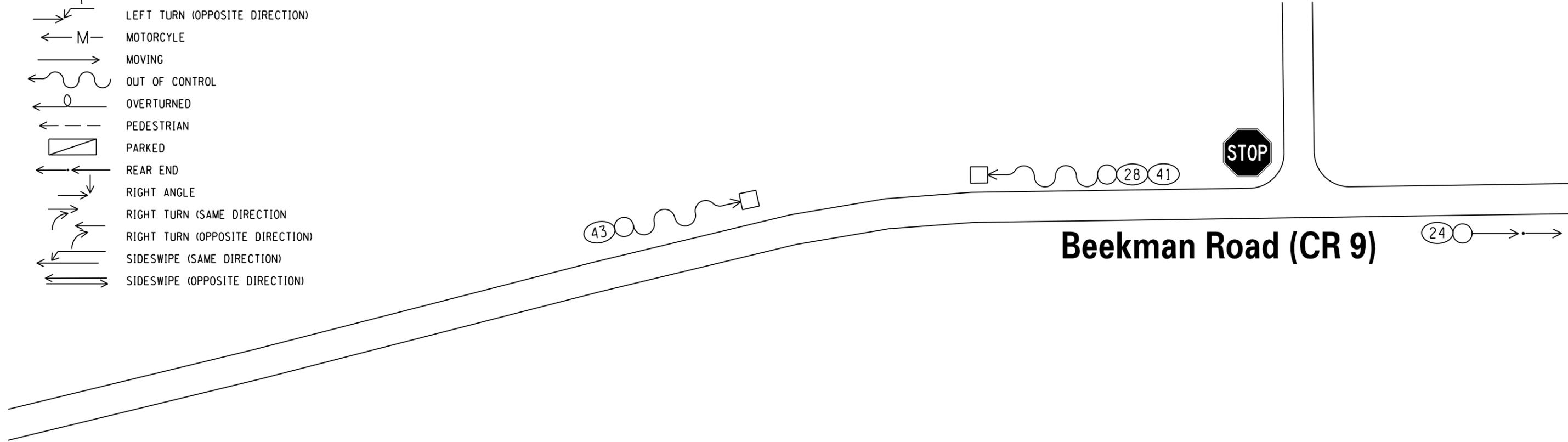
- ①①① COLLISION NUMBER
- FATALITY
- INJURY
- OBJECT
- ↔↔↔↔ BACKING
- ← B — BICYCLE
- ← HEAD ON
- ↙ LEFT TURN (SAME DIRECTION)
- ↘ LEFT TURN (OPPOSITE DIRECTION)
- ← M — MOTORCYCLE
- MOVING
- ⚡ OUT OF CONTROL
- ⊖ OVERTURNED
- ⋯ PEDESTRIAN
- ▭ PARKED
- ← · ← REAR END
- ↘ ↘ RIGHT ANGLE
- ↘ ↙ RIGHT TURN (SAME DIRECTION)
- ↘ ↙ RIGHT TURN (OPPOSITE DIRECTION)
- ← ← SIDESWIPE (SAME DIRECTION)
- ↔ ↔ SIDESWIPE (OPPOSITE DIRECTION)



Walker Road



Beekman Road (CR 9)

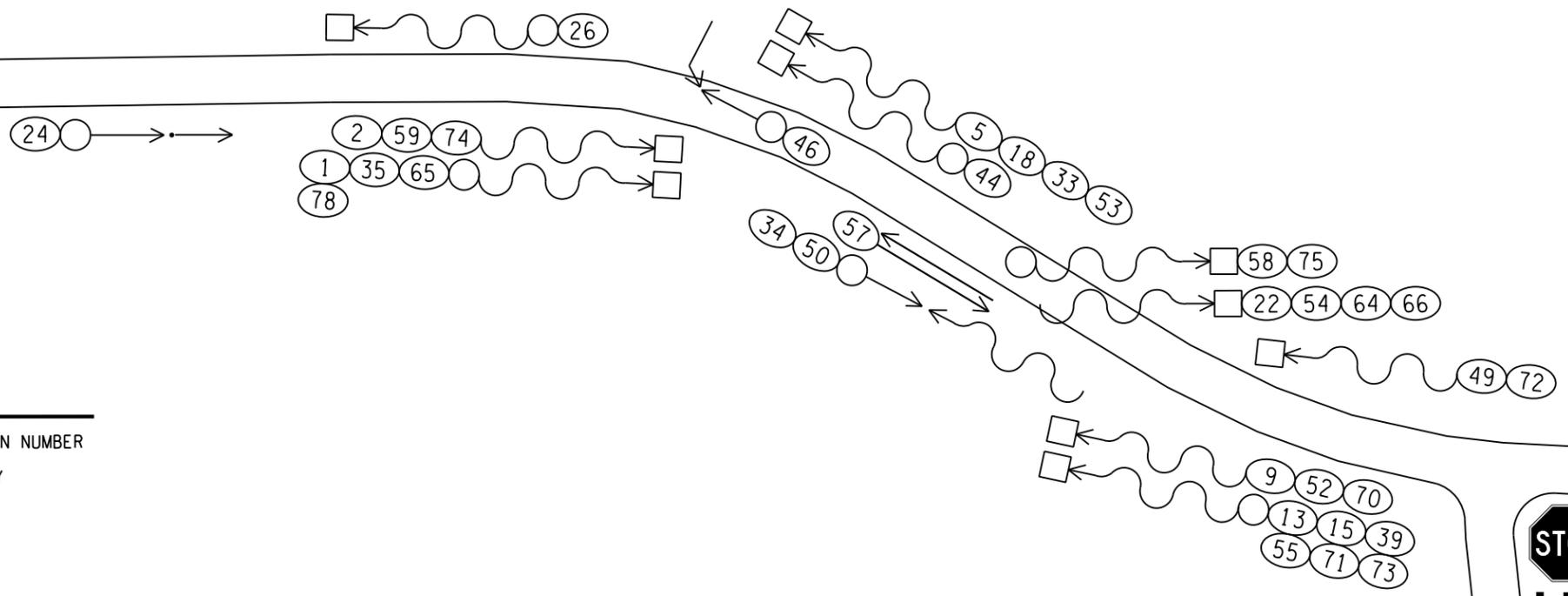
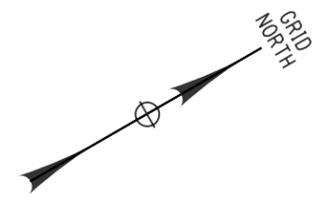


**Beekman Road (CR 9)
Dutchess Cty Safety Assessment
Town of Beekman, New York**

**Collision Diagram
2008-2011**

SHEET NO. 2 of 4	SCALE 1:100	DATE 10/2012	Bergmann associates
----------------------------	-----------------------	------------------------	-------------------------------

Walker Road



LEGEND

- 000 COLLISION NUMBER
- FATALITY
- INJURY
- OBJECT
- ↔ BACKING
- ← B — BICYCLE
- ↔ HEAD ON
- ↙ LEFT TURN (SAME DIRECTION)
- ↘ LEFT TURN (OPPOSITE DIRECTION)
- ← M — MOTORCYCLE
- MOVING
- ⤿ OUT OF CONTROL
- ⤿ OVERTURNED
- PEDESTRIAN
- ▭ PARKED
- ↔ REAR END
- ↘ RIGHT ANGLE
- ↙ RIGHT TURN (SAME DIRECTION)
- ↘ RIGHT TURN (OPPOSITE DIRECTION)
- ↔ SIDESWIPE (SAME DIRECTION)
- ↔ SIDESWIPE (OPPOSITE DIRECTION)



Limbach Road

Beekman Road (CR 9)

**Beekman Road (CR 9)
Dutchess Cty Safety Assessment
Town of Beekman, New York**

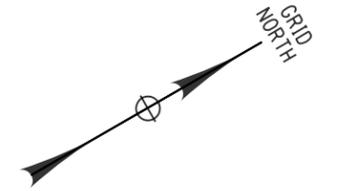
**Collision Diagram
2008-2011**

SHEET NO.	SCALE	DATE	
3 of 4	1:100	10/2012	

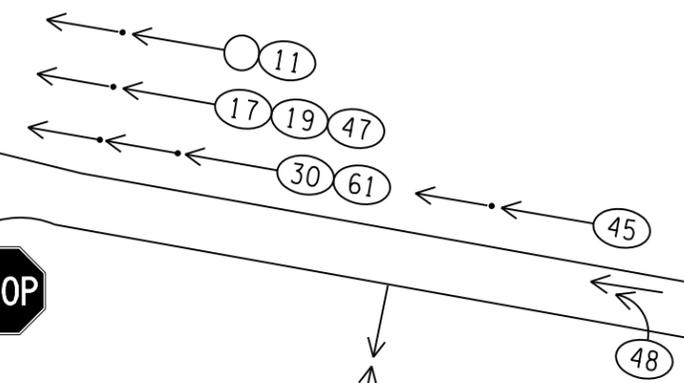
Coon Den Road



NYS Route 55



Beekman Road (CR 9)



Recreation Road



Clove Valley Road

LEGEND

- ①①① COLLISION NUMBER
- FATALITY
- INJURY
- OBJECT
- ↔↔↔ BACKING
- ← B — BICYCLE
- ← HEAD ON
- ↙ LEFT TURN (SAME DIRECTION)
- ↘ LEFT TURN (OPPOSITE DIRECTION)
- ← M — MOTORCYCLE
- MOVING
- ↪ OUT OF CONTROL
- ↻ OVERTURNED
- PEDESTRIAN
- ▭ PARKED
- ← · ← REAR END
- ↘ RIGHT ANGLE
- ↗ RIGHT TURN (SAME DIRECTION)
- ↘ RIGHT TURN (OPPOSITE DIRECTION)
- ← ← SIDESWIPE (SAME DIRECTION)
- ↔↔ SIDESWIPE (OPPOSITE DIRECTION)

**Beekman Road (CR 9)
Dutchess Cty Safety Assessment
Town of Beekman, New York**

**Collision Diagram
2008-2011**

SHEET NO. 4 of 4	SCALE 1:100	DATE 10/2012	Bergmann associates
----------------------------	-----------------------	------------------------	-------------------------------

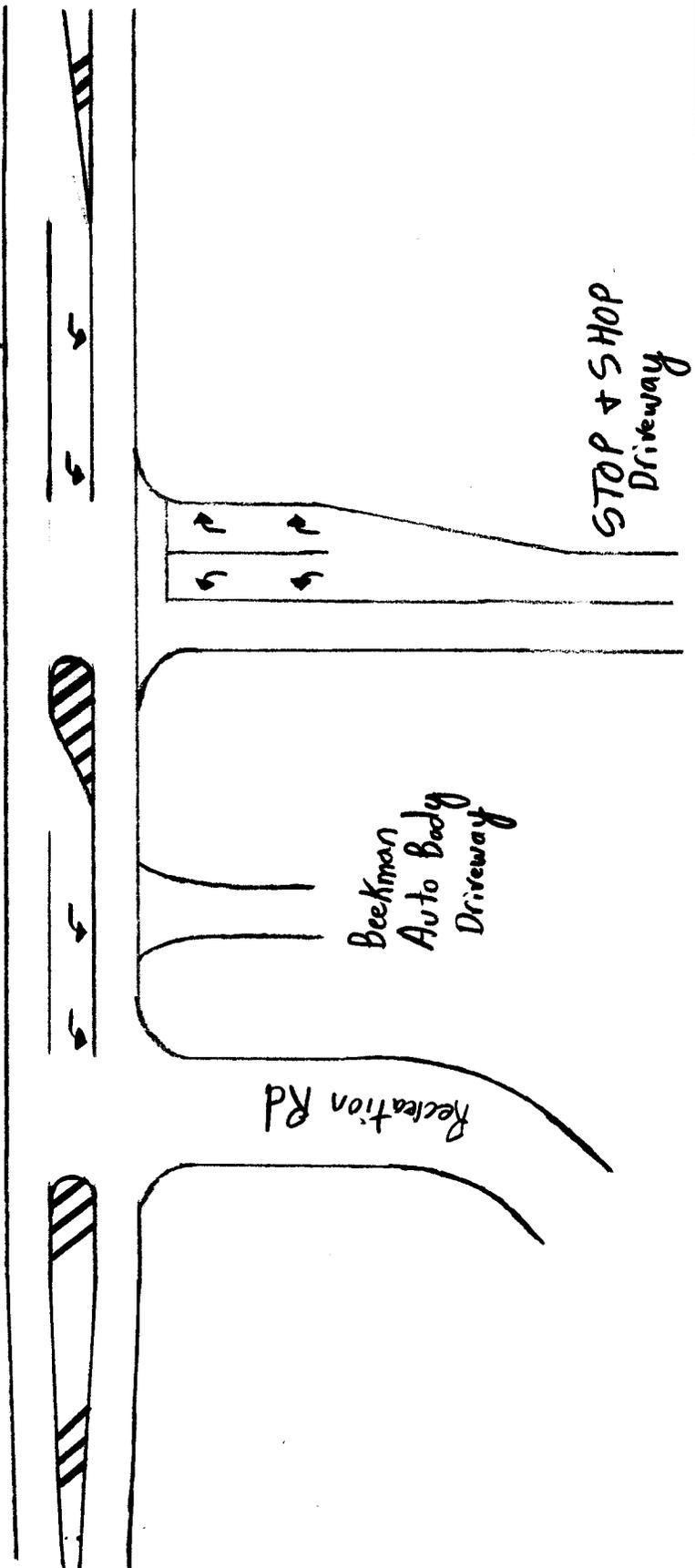
Appendix D - Conceptual Sketch for Left Turn Pocket at Recreation Road

Conceptual Sketch For Left Turn Pocket at Recreation
Road / STOP + SHOP Driveway

NOT TO SCALE



BeeKman Rd (CR9)



Beekman Road (CR 9) Safety Assessment

Owner's Response:
Dutchess County Department of Public Works

Background:

The Poughkeepsie-Dutchess County Transportation Council (PDCTC) commissioned this Safety Assessment (SA) of Beekman Road (CR 9) from Beekman-Poughquag Road (CR 7) to NYS Route 55 in support of their goal to improve transportation safety and mobility throughout Dutchess County. The site was chosen given the magnitude of crashes, its similarity with other County roads, and because it is recognized as a high profile location.

Traffic growth on Beekman Road has been approximately one percent per year over the last 12 years. The road historically functioned as a farm-to-market route when the Town of Beekman harbored primarily agricultural land uses. In the 1980s and 1990s the town experienced significant growth with an influx of new housing developments. Traffic growth spiked at that time. Since then, the Town of Beekman has remained one of the fastest growing towns in Dutchess County.

This Safety Assessment provides the County with a list of opportunities for low-cost, short-range safety improvements and some more expensive, long-range transformations.

Introduction:

This was the first formal application of the SA process within Dutchess County. Therefore, an introductory training session was provided to all team members on October 24, 2012. Additional staff from Dutchess County and the Town of Beekman also participated in this one-day training session.

The following agencies were represented on the SA Team:

- Poughkeepsie-Dutchess County Transportation Council (PDCTC);
- Dutchess County Department of Public Works (DCDPW);
- Dutchess County Sheriff's Office;
- Town of Beekman Highway Department; and
- New York State Department of Transportation (NYSDOT)

The SA was led by members of the consultant team. The SA Team included the following individuals:

Mark Debald – Transportation Program Administrator, PDCTC;
Emily Dozier – Senior Planner, PDCTC;
Mohd Azher-Uddin – Assistant Civil Engineer I, DCDPW;
William Trifilo – Junior Civil Engineer, DCDPW;
Mike Rahilly – Dutchess County Sheriff's Office;
Tony Coviello – Superintendent, Town of Beekman Highway Department;
Rich Dillmann – Regional Traffic and Safety, NYSDOT;
Mike Croce – Assessment Team Leader, Bergmann Associates; and
Tom Detrie – Project Engineer, Bergmann Associates.

Although not part of the SA Team, the following individuals also participated in the SA process:

Barbara Zulauf – Town Board Member, Town of Beekman (training session);

Michael Gadjos – Dutchess County Department of Public Works (field visits); and
Kurt Twaddell – Dutchess County Sheriff's Office (training session and field visit)

SA Process:

The SA was conducted in a manner consistent with the Safety Assessment Guidelines (October 2008), published by the New York State Association of Metropolitan Planning Associations (NYSAMPOs). The assessment took place on October 24 (office review), October 25 (daytime and nighttime field visits), and October 26 (in-house discussion), 2012.

Owner's Response:

In this Owner's Response, suggestions from SA Team have been repeated in *italics* with the Owner's response in normal "Calibri" font.

2.1 Beekman Road (CR 9)

2.1.1 Operating Speeds

Safety Concern: Roadway operating speeds are considered high.

Suggestions:

- 3. Increase Speed Enforcement. This suggestion would implement various means to reinforce the posted speed limit. That might involve increased police presence, setting up speed display devices, and increasing speed limit enforcement (writing more tickets). This would require the installation of police pull-off locations for safer enforcement operations.*

Suggestion number 3 is noted here as 1 and 2 were dismissed by the SA Team. DCDPW will contact the County Sheriff's office to discuss this safety suggestion. DCDPW will also consider options to install police pull-off locations for safer enforcement operations as future capital improvements in the corridor are developed.

2.1.2 Unforgiving Roadside Features

Safety Concern: Roadside environment includes many unforgiving features.

Suggestions: Remove roadside objects, install wider shoulders, and establish a wider clear area. Eliminating unforgiving roadside features would impact the visual character of the corridor, impact adjacent properties, and possibly involve significant costs given right-of-way limitations. SA Team deemed this suggestion as infeasible and eliminated it from further consideration.

SA Team dismissed this suggestion from consideration. DCDPW concurs with the SA Team, but will continue its ongoing practice of increasing roadside safety whenever possible through capital and permitted capital improvements on private development projects.

2.1.3 Shoulder Drop-Off

Safety Concern: Shoulder (pavement edge) drop-off.

Suggestions: Install shoulder backup material. Material should be compacted and designed to limit future erosion. Compacted sub-base material treated with a lignosulfonate (natural wood polymer acting as a binder) is one possibility.

DCDPW will consult with its Highway Division and shoulder back-up material will be installed by DCDPW maintenance personnel as soon as resources permit.

2.1.4 Non-Traversable Roadside Drainage Element

Safety Concern: There is a non-traversable drainage feature in the northwest corner of the intersection of Beekman Road and Beekman-Poughquag Road.

Suggestions: Remove the ditch and redirect roadway drainage to other adjacent drainage facilities. Replace the ditch with a shallower asphalt swale or concrete gutter. Install a roadside or field drainage inlet (drop structure) with a direct outlet (pipe and end section) to the watercourse below.

DCDPW will complete survey & mapping and preliminary plan development to determine if suggested drainage improvements would create a more forgiving roadside without severe impacts to drainage patterns or adjacent property owner(s). Consultation with adjacent property owner(s) for possible improvement would be completed during preliminary plan development. This construction would be completed by DCDPW or contractor as soon as administratively and financially practical.

2.1.5 Guide Rail Condition

Safety Concern: Portions of guide rail along Beekman Road are in poor condition.

Suggestions: Replace and/or install new guide rail. Existing guide rail that is damaged or leaning should be replaced. New guide rail should be installed in locations where steep side slopes or drop-offs exist as determined by the Dutchess County DPW. The SA Team noted that the County DPW standard for new installations is box beam guiderail and the DPW has a program to identify and replace deficient systems.

DCDPW will continue plans for upgrading guiderail in the corridor as part of our annual guiderail improvement plan. This construction would be completed either by DCDPW forces or a contractor as soon as administratively and financially practical.

2.1.6 Hazardous Trees and Vegetation

Safety Concern: Some trees and vegetation are in danger of falling on the roadway. Additionally, trees and vegetation block several traffic control devices.

Suggestions: Remove dead or hazardous trees and vegetation near the road. Trim and/or remove existing vegetation away from sight lines to traffic control devices. Though allowable by the Highway Law, talk to adjacent property owners in advance to explain why the operation is necessary.

DCDPW will complete a field survey, preliminary trimming plan development, and consultation with adjacent property owners as soon as administratively possible. Anticipated work would be completed by DCDPW maintenance personnel as soon as administratively and financially practical.

2.1.7 Sign Consistency, Clutter, Legibility, and Spacing

Safety Concern: Existing signs clutter the project limits and detract from clear and positive guidance to drivers.

Suggestions: Review the need for, condition of, and placement of signing throughout the study limits. This includes replacing existing sign panels with their National Manual on Uniform Traffic Control Devices (MUTCD) and New York State Supplement compliant, retroreflective equivalent; removing unnecessary or outdated signs; improving legibility; and consolidating sign installations where feasible.

DCDPW will complete survey & mapping and preliminary plan development to determine the suggested signage replacement or removal locations within the study corridor. Suggested improvements would be completed by DCDPW forces or contractor as soon as administratively and financially practical.

2.1.8 Street Name Signing

Safety Concern: Street name signs are difficult to see and read on approach.

Suggestions: Upgrade existing street name signs. Street name signs should be larger and in accordance with the MUTCD. Larger panels would assist with intersection conspicuity, especially at night.

Walker Road is owned and maintained by the Town of Beekman. Copy of this owner's response will be forwarded to the Town to consider implementing the SA report suggestions. Street name signage not meeting current MUTCD standards within the study corridor belonging to the County will be replaced by DCDPW forces or contractor as ongoing maintenance occurs and capital improvements are performed.

2.1.9 Barton Orchard Sign

Safety Concern: Barton Orchard directional service sign blocks the southbound winding road warning sign (W1-5).

Suggestions: Relocate the Barton Orchard directional service sign to a location where it does not obscure the winding road warning sign.

DCDPW will coordinate with Barton Orchards owners toward improving sign visibility. Anticipated work would be completed either by the business or DCDPW maintenance personnel as soon as administratively and financially practical.

2.1.10 Breakaway Post Bases

Safety Concern: The embedded portion of breakaway sign posts is too high above the ground.

Suggestions: Reset or cut off the embedded sections of breakaway posts to a safer, standard height (4-inch maximum).

DCDPW will implement the suggestions above as soon as resources permit.

2.1.12 Stop Lines

Safety Concern: Stop lines are not present on several side street approaches.

Suggestions: Install stop lines on all approaches to Beekman Road. The NYSDOT recommended standard width is 18 inches.

Existing stop lines will continue to be maintained. DCDPW does not maintain stop bars at all existing intersections due to fiscal constraints. DCDPW will examine all intersections in the project segment to determine if additional stop bars are warranted as soon as administratively and financially practical.

2.1.13 Bicycle and Pedestrian Accommodation

Safety Concern: There is a lack of bicycle and pedestrian accommodation along Beekman Road.

Suggestions:

- 1. Construct Sidewalks. Construction of a separate sidewalk for pedestrians would provide a safer place for travel. However, due to the close proximity of roadside features, including residential structures, as well as the narrow prescriptive right-of-way, the costs associated with this suggestion would be prohibitive. Therefore, this suggestion was eliminated from further consideration.*
- 2. Widen the Existing Shoulder. Widening the existing shoulders to a four (4) foot minimum would provide additional space outside the travel lanes for pedestrians and bicyclists, thus incrementally improving safety. However, the SA Team also noted that widening the pavement could encourage higher*

vehicular speeds, which would detract from overall safety. Due to the close proximity of roadside features, including residential structures, and narrow prescriptive right-of-way, wider shoulders could be difficult and costly to construct. The SA Team noted that the benefits of constructing wider shoulders for pedestrians and bicyclists should be carefully weighed against the potential impacts to overall safety and adjacent features.

During the 1980s and 1990s, the Town of Beekman experienced significant growth. Beekman Road also serves as a commuter route and serves traffic traveling northeast and southwest between Route 55 and the Taconic State Parkway in southern Dutchess County. Beekman Road's western terminus is proximate to the southeastern end of the Dutchess Rail Trail. DCDPW does not agree that "...widening the pavement could encourage higher vehicular speeds, which would detract from overall safety." Our experience indicates that the provision of minimum four feet wide paved shoulders on roads of this type would improve overall vehicular, bicyclist, and pedestrian safety. Limiting the striped width of the travel lanes will offset any driver tendency toward higher speed due to increased pavement width.

Provision of widened shoulders is warranted, but will be difficult to provide due to the constrained right-of-way and many adjacent roadside features. Widening of shoulders is not currently achievable. DCDPW will implement shoulder improvements throughout the length of Beekman Road if major capital improvements for this route are proposed in the future.

2.2 Intersection of Beekman Road (CR 9) with Beekman- Poughquag Road (CR 7)

2.2.1 Intersection Sight Distance – North

Safety Concern: Intersection sight distance from Beekman-Poughquag Road is limited when looking north.

Suggestions: Trim and/or remove existing vegetation in the northeast corner. Discuss with adjacent property owners.

DCDPW will review the subject location and complete survey & mapping, preliminary plan development and consultation with adjacent property owners for subject improvement as soon as administratively possible. Anticipated work would be completed by DCDPW maintenance personnel as soon as resources permit.

2.2.2 Intersection Sight Distance – South

Safety Concern: Intersection sight distance from Beekman-Poughquag Road is limited when looking south.

Suggestions:

1. *Trim and/or Remove Existing Vegetation. Discuss the trimming or removal of the bushes and trees in the southeast corner with the adjacent property owner. The SA Team noted that if the sight obstructions were removed, particularly the large tree adjacent to the fence, the existing stop line would be located in the optimal position for sight distance.*

Suggestion 1 of the 5 is noted here since others were dismissed by the SA Team. DCDPW will complete survey & mapping, preliminary plan development and consultation with adjacent property owners for subject improvement as soon as administratively possible. If vegetation removal is performed, it would be completed by DCDPW maintenance personnel as soon as resources permit.

2.2.3 Stopping Sight Distance – Southbound

Safety Concern: Stopping sight distance for southbound motorists is restricted by overhanging branches on approach to the intersection.

Suggestions:

1. *Trim Overhanging Branches. This would improve stopping sight distance on the southbound Beekman Road approach to Beekman-Poughquag Road.*

Suggestion 1 of the 4 is noted here since others were dismissed by the SA Team. DCDPW will complete review of the subject location and anticipated work would be completed by DCDPW maintenance personnel as soon as administratively and financially practical.

2.2.4 STOP Sign Visibility

Safety Concern: STOP signs (R1-1) are blocked by vegetation and difficult to see given their wide spacing.

Suggestions:

1. *Trim and/or Remove Existing Vegetation. Trim or remove bushes and trees on the north side of Beekman-Poughquag Road after discussion with the adjacent property owners.*
2. *Relocate the Existing STOP Signs. The STOP signs could be relocated slightly farther from Beekman Road, which would bring them to a narrower portion of the intersection's throat and thus, closer together. Proper placement per MUTCD guidelines should be maintained.*
3. *Install Larger STOP Signs with Retroreflective Strips. The STOP signs could be increased in size with red retroreflective strips added to the posts to improve conspicuity.*

DCDPW will complete a review of the subject location as soon as administratively practical, consider the suggestions as noted by the SA Team and determine appropriate improvements, if any, to implement. Work would be completed by DCDPW maintenance personnel as soon as resources permit.

2.2.5 Guide Sign Placement

Safety Concern: Guide signs are located across Beekman Road from Beekman-Poughquag Road.

Suggestions: Relocate the Beekman Road (CR 9) guide signs to the right side of the westbound intersection approach and install new street name signs at the intersection in accordance with MUTCD guidelines. The SA Team identified a suitable location for the Beekman Road signs, but it would coincide with an existing hamlet of Beekman sign. The hamlet sign could be relocated or removed in coordination with the Town of Beekman. The Dutchess County DPW could also consider increasing the size of the target arrow sign across the intersection at the same time.

DCDPW will complete a review of the subject location, consider the suggestions as noted by the SA Team and determine appropriate improvements, if any, to implement. Work would be completed by DCDPW maintenance personnel as soon as resources permit. Relocation or removal of an existing hamlet of Beekman sign would be by the Town of Beekman which will be coordinated by DCDPW personnel as soon as administratively and financially practical. As noted earlier, copy of the owner's response will be forwarded to the Town.

2.2.6 Excessively Wide Approach Pavement

Safety Concern: The westbound Beekman-Poughquag Road pavement on approach to Beekman Road appears excessively wide, measuring approximately 29 feet at the stop bar.

Suggestions:

- 1. Narrow the Westbound Approach with Pavement Markings. Narrowing the pavement width at the stop line would discourage side by side stops. This could be implemented by visually narrowing the travel lane on the right side by hatching out the shoulder or installing a striped median on the left side. Either case would offer an opportunity to review the stop line.*
- 2. Physically Narrow the Existing Pavement. This suggestion would involve removing existing excess pavement and narrowing the westbound approach. Design vehicle turning templates would need to be reviewed prior to making any physical changes. Narrowing the pavement width could also offer an opportunity to address the distance between the left and right side STOP signs identified in Section 2.2.4.*

DCDPW will review the subject location and determine an appropriate improvement at this location. Removal of pavement may not be implemented due to needed turning radius for larger vehicles. We anticipate that work would be completed by DCDPW forces or contractor as resources permit.

2.3 Intersection of Beekman Road (CR 9) with Baker Road

2.3.1 Intersection Sight Distance – North

Safety Concern: Eastbound vehicles on Baker Road have obstructed sight lines to the north.

Suggestions:

- 1. Trim and/or Remove Existing Vegetation. Trim existing shrubs and remove the aforementioned tree upon discussion with the property owner.*
- 2. Regrade the Side Slope. The roadway embankment could be steepened (lowered) to improve inter-visibility between southbound and eastbound motorists. This would improve the ability of drivers to assess and select gaps when entering the intersection. Depending on the steepness needed to obtain improved sight lines, this could make the embankment more difficult to properly maintain.*
- 3. Monitor Intersection Corners for Extraneous Signs. Town and County personnel should observe conditions at intersections and report the existence of any advertising or other unpermitted signage that significantly restricts sight lines such that follow-up efforts can be made to work with adjacent property owners or businesses for its relocation or removal. Applicable zoning requirements or local law should be reviewed prior to discussing this with property owners or businesses.*

DCDPW will complete review of the subject location, including right-of-way; prioritize consideration of the suggestions as noted by the SA Team and consult with adjacent property owners for subject improvement as soon as administratively possible. Anticipated work would be completed by DCDPW maintenance personnel as soon as administratively and financially practical.

2.3.2 Intersection Sight Distance – South

Safety Concern: Eastbound motorists on Baker Road have obstructed sight lines to the south.

Suggestions: Trim and/or remove shrubs after discussion with the property owner.

DCDPW will complete review of the subject location, including right-of-way, for possible shrub removal. We anticipate work would be completed by DCDPW maintenance personnel as soon as administratively and financially practical.

2.3.3 Advance Warning Signs - Northbound

Safety Concern: A series of three closely spaced warning signs on the northbound Beekman Road approach to Baker Road makes it difficult to discern which condition motorists should be most aware of.

Suggestions: Replace and condense warning signage for northbound drivers. Replace the existing curve and intersection warning signs with a combination alignment and intersection warning sign (W1-10) with advisory speed plaque (W13-1P) posted at the appropriate distance in advance of Baker Road. This would effectively warn motorists of the Baker Road intersection and downstream curve. The need for and placement of the DRIVEWAY sign should also be reviewed. Adding the driveway to the combination alignment and intersection warning sign using a thinner line could also be considered. However, adding it to the combination sign elevates it to a prominence that the driveway does not merit, given its low volume.

DCDPW will complete review of the subject location and prepare any appropriate sign revisions. We anticipate work would be completed by DCDPW maintenance personnel as soon as administratively and financially practical.

2.3.4 Advance Warning Signs - Southbound

Safety Concern: A series of three closely spaced warning signs on the southbound Beekman Road approach to Baker Road makes it difficult to discern which condition motorists should be most aware of.

Suggestions: Remove the existing signs and install a combination curve and intersection warning sign (W1-10) with advisory speed plaque (W13-1P) at the appropriate posting distance in advance of the Baker Road intersection per MUTCD guidance. The LIMITED SIGHT DISTANCE sign would not be replaced. The SA Team briefly discussed installing a slippery when wet sign. However, due to the lack of a crash history indicating this as an issue and in an attempt to prevent sign overload, the SA Team did not recommend adding this sign.

DCDPW will complete review of the subject location and prepare any appropriate sign revisions. We anticipate work would be completed by DCDPW maintenance personnel as soon as resources permit.

2.3.5 Stop Line

Safety Concern: The existing stop line on Baker Road is narrower than expected.

Suggestions: Restripe the stop line with a wider, standard size. The NYSDOT recommended standard width is 18 inches.

DCDPW will upgrade to an 18 inch stop bar when resources permit.

2.3.6 Reflective Strips on STOP Sign Posts

Safety Concern: Retroreflective strips on the STOP sign posts at Baker Road are of the incorrect color.

Suggestions: Replace the white retroreflective strips with red strips according to the MUTCD. The width should be a minimum of 2 inches based on applicable standards.

DCDPW will replace the Town-installed reflective strip with strips of the appropriate color as soon as resources permit.

2.4 Intersection of Beekman Road (CR 9) with Walker Road

2.4.1 Intersection Sight Distance - North

Safety Concern: Eastbound vehicles on Walker Road have obstructed sight lines to the north.

Suggestions: Trim vegetation and overhanging branches in the northwest quadrant to mitigate the existing sight distance obstruction.

DCDPW will complete review of the subject location and anticipated work would be completed by DCDPW maintenance personnel as soon as resources permit.

2.4.2 Advance Warning Sign

Safety Concern: The existing intersection warning sign for southbound drivers on Beekman Road is located within the reverse curves and seems distant from the intersection.

Suggestions: Remove and/or relocate intersection warning sign. The warning sign could be removed if a study indicates there is sufficient visibility and sight distance available upon approach (in accordance with Section 2C.05 and 2C.46 of the National MUTCD as amended by the New York State Supplement) after exiting the reverse curves. If the warning sign is warranted, it should be repositioned, balancing the recommended advance placement distance for the posted speed limit with its relationship to the reverse curves.

DCDPW will review the sign location and relocate in accordance with current MUTCD. Work would be completed by DCDPW forces as soon as resources permit.

2.4.3 Gravel Within Intersection

Safety Concern: A buildup of gravel was observed on the Walker Road intersection approach to Beekman Road.

Suggestions:

- 1. Remove Loose Gravel Within Intersection.*
- 2. Resolve Drainage Issues on Walker Road Approach. Review the existing drainage patterns and clear any blocked drainage facilities. Consider installing a paved ditch or concrete gutter to resolve shoulder/ditch erosion issues. Also, consider relocating the existing drainage basin to a location where it can better intercept runoff prior to Beekman Road. Fill in any locations where water could pond.*

DCDPW will remove gravel within the intersection in summer of 2013. DCDPW will examine the existing drainage system and determine any appropriate drainage improvements to be constructed or maintained as resources permit. DCDPW will coordinate with the Town toward improvement of the Town-installed drainage system.

2.5 Intersection of Beekman Road (CR 9) with Limbach Road

2.5.1 Warning Sign Location

Safety Concern: The NO OUTLET warning sign is very close to the intersection with Beekman Road.

Suggestions: Relocate the NO OUTLET warning sign further away from the intersection. The optimal location would place the warning sign away from the signs on Beekman Road, but still close enough to warn entering vehicles.

It is our understanding that the existing NO OUTLET warning sign installation is by the Town of Beekman. DCDPW will coordinate with the Town toward implementation of the suggested sign relocation as soon as administratively practical.

2.6 Intersection of Beekman Road (CR 9) with Recreation Road

2.6.1 Rear End Crashes

Safety Concern: There is a pattern of southbound rear-end collisions on Beekman Road at this intersection.

Suggestions:

2. *Extend the 6 ft Wide Shoulder Further South. Extending the 6 ft wide shoulder toward the Fishkill Creek bridge would provide more room for a passing vehicle to transition to the travel lane. Additionally, the extended shoulder would have a smoother transition back to the narrower width. However, this would also make the illegal passing movement more attractive. Although this action would not reduce the potential for rear-end collisions, the SA Team felt it would foster a more forgiving roadway environment.*

4. *Install a Safety Widening. A safety widening is a short, striped bypass lane made available to avoid turning vehicles. No exclusive turn lane markings are used, allowing through traffic to stay to the left when turning traffic is not present. The SA Team felt this feature might encourage high speeds and not necessarily reduce the potential for rear-end collisions. Pavement widening to the west could impact Fishkill Creek, therefore the SA Team suggested using the existing pavement width to accomplish the lane addition if possible. This would reduce the 6 ft shoulder to a width more consistent with the rest of the corridor.*

5. *Install a Left Turn Pocket for Recreation Road. A separate left turn only lane could be installed, providing a refuge for left turning vehicles and eliminating the illegal bypass movement. The SA Team made note of some design issues that would need to be resolved prior to implementation, including: maintain existing shoulder widths that are occasionally used as pedestrian facilities, install a sidewalk if shoulder widths cannot be maintained, and fit the turn lane in with the adjacent intersections. The SA Team suggested using the existing pavement width to create this facility given the potential impacts to Fishkill Creek. This suggestion should be considered in conjunction with a proposed future intersection improvement and bridge replacement project at Beekman Road and NYS Route 55.*

Suggestions 2, 4, and 5 are noted here since others were dismissed by the SA Team. DCDPW concurs with the suggestions of the SA Team. DCDPW will review the suggestions in coordination with the proposed intersection improvement and bridge replacement project at Beekman Road and NYS Route 55. In the interim, DCDPW will consult with its Highway Division and shoulder back-up material will be installed by DCDPW maintenance personnel as soon as resources permit.

2.6.2 Guide Sign Location

Safety Concern: A guide sign for Recreation Park is stacked above the street name sign.

Suggestions: Install general information park signs (NYM8-10) with supplementary text panels and directional arrows on Beekman Road both north and south of the intersection. These would provide advanced notice of the park entrance to drivers.

It is our understanding that the existing Guide Sign installation is by the Town of Beekman. Copy of this owner's response will be forwarded to the Town for it to consider implementation of the SA report suggestion.

2.7 Beekman Road (CR 9) - Reverse Curves between Walker and Limbach Roads

2.7.1 Horizontal Geometry and Operating Speeds

Safety Concern: A significant number of roadway departure incidents (33/67 within the study period) have occurred on the reverse curves between Walker Road and Limbach Road. The roadside environment in this area is characterized as unforgiving.

The SA report provided 16 suggestions. Those that were dismissed by the SA Team are not noted here.

Suggestions:

1. **Northbound Reverse Curve Signing Modifications.** *This suggestion involves the review of existing warning signage, further study to ensure proper placement of all signs including the existing chevron alignment signs (W1-8), installation of additional chevron alignment signs (W1-8) to mark the second curve, and a general effort to improve consistency, message primacy, and positive guidance.*

The revised signing plan should present a clear message to drivers approaching the curves. The suggested sequence would include:

- A. *An enlarged combination reverse curve and intersection warning sign (W1-10e) with advisory speed plaque (W13-1P) installed at the proper advanced posting distance in accordance with the MUTCD. Consideration should be given to making the advisory speed consistent in both the northbound and southbound directions after appropriate review. If the recommended advisory speed is determined to be 30 mph or less the curve/reverse curve signing should be replaced with turn/reverse turn signs*
- B. *A symbolic, appropriately sized, school bus stop ahead sign (S3-1) should be installed in advance of the stopping location.*
- C. *If these measures prove unsuccessful at lowering the crash rate, additional warning could be provided by installing a combination*

curve/advisory speed (W1-2a) sign at the beginning of the first curve.

In addition to the above sequence, chevron alignment signs (W1-8) should be installed to help guide motorists through the second portion of the reverse curve. Vegetation should be trimmed around all signs to ensure visibility during all seasons.

- 2. Southbound Reverse Curve Signing Modifications.** *This suggestion involves the review of existing warning signage, further study to ensure proper placement of all signs including the existing chevron alignment signs (W1-8), installation of additional chevron alignment signs (W1-8) to mark the second curve, and a general effort to improve consistency, message primacy, and positive guidance.*

The suggestions for the southbound direction are the same as described above for the northbound direction. Please also refer to Section 2.4.2 for suggestions regarding the Walker Road intersection warning sign.

- 3. Install Slippery When Wet Signing.** *This suggestion would install a slippery when wet sign (W8-5) on each approach to the curve. This would respond to the number of incidents occurring under wet pavement conditions. While the SA Team agreed that these signs are applicable, the group also felt adding more signs at or before the curves could detract from the primary message about geometry. If installed, the placement of these signs should be carefully considered as part of the overall signing package for Beekman Road. They could be used as an alternative to the combination alignment and advisory speed signs described under suggestions 1 and 2.*
- 4. Install Warning Sign Enhancements.** *Installing systems to enhance key warning signs, such as flashing beacons or light emitting diode (LED) borders was considered by the SA Team. This would catch a driver's attention, drawing focus to the warning about the upcoming curves. Such a system could be powered via solar panels or hardwired and metered. The SA Team also discussed placing these on the chevron alignment signs, however, due to the high potential for getting knocked down by an errant vehicle, this treatment was not recommended.*
- 6. Install Roadside Delineators.** *This suggestion would involve installing delineators along the curves to provide additional guidance. The SA Team noted that delineators may become a maintenance burden if continually knocked over by plows or errant vehicles. The use of flexible delineator supports is suggested as one possible way to avoid this issue.*
- 7. Install Speed Reduction Markings.** *Install speed reduction markings on the approaches to the reverse curves to give drivers the impression that their*

speed is increasing. The goal of this treatment would be to realize a reduction in speed and increase driver vigilance when approaching the curves. The SA Team noted that this treatment could potentially draw attention away from the warning signs.

8. ***Install Shoulder Backup Material.*** *The addition of stable, compacted shoulder backup would eliminate the drop-off condition and make it easier for vehicles that have departed the roadway to regain the traveled way. The Dutchess County DPW might also consider installing a shoulder safety wedge along the edge of the pavement when repaving to make it easier for vehicles to regain the roadway in the event that backup material wears away. This practice is recommended by the Federal Highway Administration (FHWA). These are examples of forgiving roadside features.*

9. ***Install High Friction Pavement Treatment.*** *This would involve the installation of a higher friction pavement treatment through the reverse curves to increase the horizontal friction factor, especially during periods of rain. A higher friction factor would help keep some vehicles from leaving the roadway. The SA Team discussed alternative treatments including a rough asphalt top course, microsurfacing, and epoxy overlays often seen on bridge decks. Further study and evaluation would be required determine which would be the best treatment for Beekman Road.*

DCDPW will examine and implement the report recommendations as follows:

Northbound reverse curve signing modifications – DCDPW will complete this task in 2013 as resources permit.

Southbound reverse curve signing modifications – DCDPW will complete this task in 2013 as resources permit.

Install slippery when wet signing – if found appropriate, DCDPW will complete this task in 2013 as resources permit.

Install warning sign enhancements – if found appropriate, DCDPW will complete this task in 2013 as resources permit.

Install roadside delineators – if found appropriate, DCDPW will complete this task in 2013 as resources permit.

Install speed reduction markings – DCDPW will consider this option as resources permit.

Install shoulder backup material – DCDPW will complete this task in summer of 2013 as resources permit.

Install high friction pavement treatment – DCDPW will consider pavement improvements as resources permit.