Chapter 3

Safety Assessment

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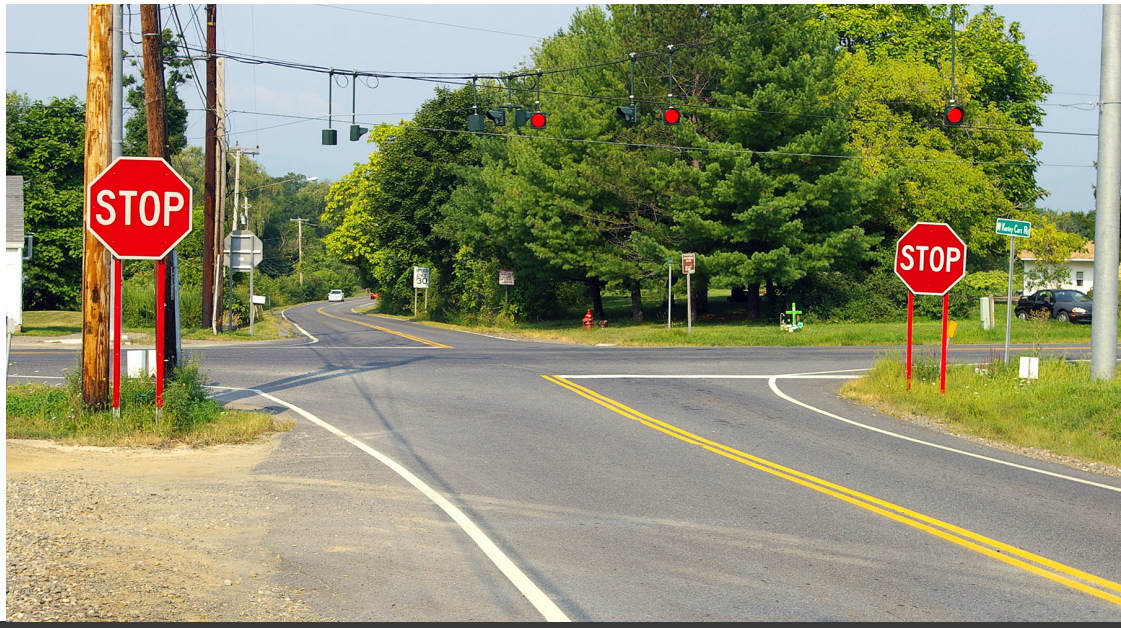

Upper Route 9G Corridor Management Plan

Technical Memorandum No.3
Safety Assessment

PDCTC
Poughkeepsie-Dutchess County Transportation Council

vhb

JANUARY 2016

Technical Memorandum No. 3 – Safety Assessment

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SAFETY ASSESSMENT

3

3.0 Executive Summary

As part of the Upper Route 9G Corridor Management Plan, a Safety Assessment was conducted following the Road Safety Audit (RSA) process detailed in the Federal Highway Administration's (FHWA's) *Roadway Safety Audit Guidelines* (FHWA, 2006). The Safety Assessment was performed on Wednesday, September 2 and Thursday, September 3 of 2015. The purpose of this Safety Assessment was to identify safety issues that may be contributing to crashes, and develop potential measures to improve safety.

The Safety Assessment (SA) Team discussed the crash history and patterns that were found to have occurred within the study area since 2009, with a particular focus on six fatal crashes that occurred. Four of these crashes involved vehicles running off the road and striking fixed objects (three occurred along NYS Route 9G and one occurred along CR 78 (West Kerley Corners Rd)). One crash involved a motorist making a left turn from westbound CR 78 (West Kerley Corners Rd) to southbound Route 9G that collided with a box truck. One crash involved two pedestrians that were struck and killed while walking along NYS Route 9G near W. Kerley Corners Road.

The SA Team also discussed the ongoing, positive benefits resulting from relatively recent changes in roadway and traffic control features, as well as by existing practices of involved agencies, as described below:

- Positive attitude among stakeholders and multi-agency collaboration.
- Bard College's well-established system for communicating safety concerns with new and existing students.
- NYSDOT shoulder widening project along NYS Route 9G within the project limits.
- Installation of a flashing signal at the intersection of Route 9G and CR 78 (W. Kerley Corners Rd) where the northbound and southbound approaches are controlled by a flashing yellow light and the eastbound and westbound approaches are controlled by a flashing red light operation supplemented with oversized stop signs.
- Reduced posted speed limit from 55 MPH to 45 MPH along NYS Route 9G within study area.

- Reduced posted speed limit from 35 MPH to 25 MPH along CR 103 (Annandale Rd) within study area.
- Installation of pedestrian/bicyclist warning signs with flashing beacons on CR 103 (Annandale Rd).

Despite the existing measures to improve road safety within the study area, five general issues were identified by the SA Team. The issues are:

1) Driver/Pedestrian Behavior and Expectancy
2) Signing, Pavement Marking, Wayfinding and Visibility Conditions
3) Geometry
4) Pavement Surface Conditions
5) Guiderail Conditions

These issues, along with mitigation strategies, are discussed in further detail in Section 3.2 and in Appendix B. For the purposes of coordinating the implementation of these mitigation strategies, the strategies are listed by location on the following pages. These strategies are also discussed by issue in the chapter and by implementation time frame in the appendix.

1. NYS Route 9G

1) Near-term strategies (within 1-year)

Corridor-wide:

a) Make more frequent use of portable driver speed feedback devices.
b) Install additional Deer Crossing warning signs at appropriate locations.
c) Evaluate the location of existing driveway warning signs.
d) Replace attraction sign along the northbound NYS Route 9G approach to River Road/Kelly Road to improve sign retro-reflectivity.
e) Perform a review of existing street name signing and upgrade with new signs with standard font size and type.
f) Review existing signing along NYS Route 9G to determine if some can be consolidated or removed or relocated further away from intersections to reduce sign clutter.
g) Remove existing "No Stopping Any Time" and pedestrian crossing warning signs along NYS Route 9G in the vicinity of the Bard College Maintenance Entrance Road (opposite Two Boots).
h) Trim vegetation and/or relocate signs to avoid sign obstructions.
i) Continue vegetation trimming operations to maintain a clear roadside, clear visibility of signs and maximize sight distance conditions.
j) Install roadside delineators where none exist along curved roadway sections to better delineate roadway alignment.
k) Replace all damaged guiderail along NYS Route 9G within the study area.
l) Perform a linear speed zone evaluation to assess existing posted speed limits.
m) Evaluate the operation of the existing signals along NYS Route 9G to determine if there is an opportunity to reprogram them to help enforce the posted speed limit.

Intersection:

a) Supplement intersection warning sign located along the **northbound NYS Route 9G approach to CR 78 (West Kerley Corners Rd)** with a flashing beacon assembly.
b) Install a stop ahead warning sign along the **eastbound CR 78 (Broadway) approach to NYS Route 9G.**
c) Install route marker signs at the **westbound CR 78 (West Kerley Corners Rd) approach to NYS Route 9G.**
d) Install "No Turn on Red" signs at the **eastbound River Road and westbound Kelly Road approaches to NYS Route 9G.**
e) Evaluate the location of the existing intersection warning signs along the **northbound and southbound NYS Route 9G approaches to Kidd Lane.**
f) Perform a traffic signal warrant study to evaluate the appropriateness of installing a traffic signal at the **intersection of NYS Route 9G and Old Whalesback Road/ CR 103 (Annandale Rd)**.

2) Intermediate-term strategies (1 to 3 years)

Corridor-wide:

a) After a three year period, assess the effectiveness of the reduced speed limit to determine if this action has helped to reduce the overall number of crashes and the frequency of crashes citing "Unsafe Speed" as a contributing factor. Supplement the existing speed limit signs with permanent driver-feedback speed limit signs as necessary.
b) Evaluate the need for upgrading existing guiderail and end treatments for conformance to the latest applicable standards, and evaluate the need for additional guiderail along the study roadways.

Intersection:

a) After a three year period, assess the effectiveness the flashing signal and larger stop signs at the **intersection of NYS Route 9G and CR 78 (West Kerley Corners Rd)** to determine if this helped to reduce the frequency and severity of crashes at this location.
b) Evaluate the skid resistance characteristics of the pavement surface along the **northbound NYS Route 9G approach to River Road/Kelly Road** and, if warranted, program an improvement project to address this potential condition.

3) Long-term strategies (3 years +)

Corridor-wide:

a) Incorporate traffic calming elements to encourage motorists to reduce their speed as they approach and travel through the study area. These improvements could involve gateway elements such as a narrower curbed pavement section and/or roundabouts with the objective of modifying driver behavior and mindset and helping to reduce driver speed.

Intersection:

a) Reconstruct the **intersection of Budds Corner Road and NYS Route 9G** to be more perpendicular so it better controls, channelizes and facilitates efficient movements at the intersection. [See Exhibit A.2 in Appendix A for a conceptual improvement plan for this intersection]

2. CR 103 (Annandale Rd)

1) Near-term strategies

Corridor-wide:

a) Make more frequent use of portable driver speed feedback devices.
b) Consider reducing the posted speed limits along the section of CR 103 (Annandale Rd) between Barrytown Road and a point south of the Montgomery Place Historic Estate driveway from 40 MPH to 35 MPH.
c) Restripe the pavement markings along CR 103 (Annandale Rd) and side street approaches to NYS Route 9G. Compare the life-cycle cost of high-visibility / high-durability marking materials (such as thermoplastic or epoxy) to standard paint marking materials and consider using high-visibility / high-durability marking materials in the future. If paint is used (i.e., existing practice), then coordinate the maintenance schedule to restripe twice per year.
d) In general, all pavement markings, including pedestrian crosswalks, double yellow centerlines, edge lines and stop lines along CR 103 (Annandale Rd) between south and north Campus Road should be restriped using high visibility, durable pavement marking materials (such as thermoplastic or epoxy) to better delineate proper paths for pedestrians and motorists and provide an increased awareness of pedestrians by motorists.
e) The existing pedestrian crosswalk warning signs should be reviewed and, if necessary, upgraded by installing new signs using Type XI prismatic fluorescent yellow-green sheeting material. All proposed and existing use of in-road pedestrian crosswalk warning signing should conform to the requirements of the most current Manual of Uniform Traffic Control Devices. Exhibit A.1 in Appendix A presents a typical layout for pedestrian crosswalk warning signing and striping.
f) Check mounting height of signs and adjust as appropriate. The Safety Assessment Team noted a stop sign on the westbound River Road approach of CR 103 (Annandale Rd) that appeared high.
g) Trim vegetation and/or relocate signs to avoid sign obstructions.
h) Continue vegetation trimming operations to maintain a clear roadside, clear visibility of signs and maximize sight distance conditions.
i) Relocate 25 MPH speed limit sign along CR 103 (Annandale Rd) just west of NYS Route 9G further to the west.
j) Install roadside delineators were none exist along curved roadway sections to better delineate roadway alignment.

2) Intermediate-term strategies

Corridor-wide:

a) After a three year period, assess the effectiveness of the previously implemented reduced 25 MPH speed limit to determine if this action has helped to reduce the overall number of crashes and the frequency of crashes citing "Unsafe Speed" as a contributing factor.
b) Supplement the existing speed limit signs with permanent driver-feedback speed limit signs as necessary.
c) Study the existing wayfinding and other signing relating to accessing Bard College and all of the points of interest that exist on the Campus. Develop an improved wayfinding signing plan that helps visitors (often new and unfamiliar with the area) to efficiently access the campus, as well as the other points of interest.
d) Conduct a pedestrian origin-destination study to assess pedestrian crosswalk locations along CR 103 (Annandale Rd) between south and north Campus Road to determine if there is an opportunity to better locate them and/or consolidate them.
e) Consider installing rectangular rapid flashing beacons (RRFBs) at pedestrian crossings along CR 103 (Annandale Rd) between south and north Campus Road. Studies have shown that these devices can increase driver yielding rates.

3) Long-term strategies

Corridor-wide:

a) Incorporate traffic calming elements along CR 103 (Annandale Rd) to encourage lower vehicle speeds through the campus. These improvements could involve a raised or textured pavement surface, curb bump-outs or a narrower pavement section with the objective of better informing motorists that they are about to enter and drive through a section of roadway that has frequent pedestrian activity. Gateway elements should also be considered near the limits of the campus as they are also effective at modifying driver behavior and mindset.
b) Work with the Town of Red Hook, the Village of Tivoli, and the New York State Department of Environmental Conservation to develop an off-road, multi-use path, such as the Tivoli Bays connection recommended in Walk Bike Dutchess, which would accommodate pedestrians and bicyclists travelling between the Bard College area and the Village of Tivoli.

Intersection:

a) Reconstruct the **intersection of Cruger Island Road and CR 103 (Annandale Rd)** to be more perpendicular so it better controls, channelizes and facilitates efficient movements at the intersection. [See Exhibit A.3 in Appendix A for a conceptual improvement plan for this intersection]

3. CR 78 (Broadway/West Kerley Corners Rd)

1) Near-term strategies

Corridor-wide:

a) Make more frequent use of portable driver speed feedback devices.
b) Add pavement markings to delineate on-street parking spaces along both sides of CR 78 (Broadway) east and west of Montgomery Street/North Road.
c) Trim vegetation and/or relocate signs to avoid sign obstructions.
d) Continue vegetation trimming operations to maintain a clear roadside, clear visibility of signs and maximize sight distance conditions.

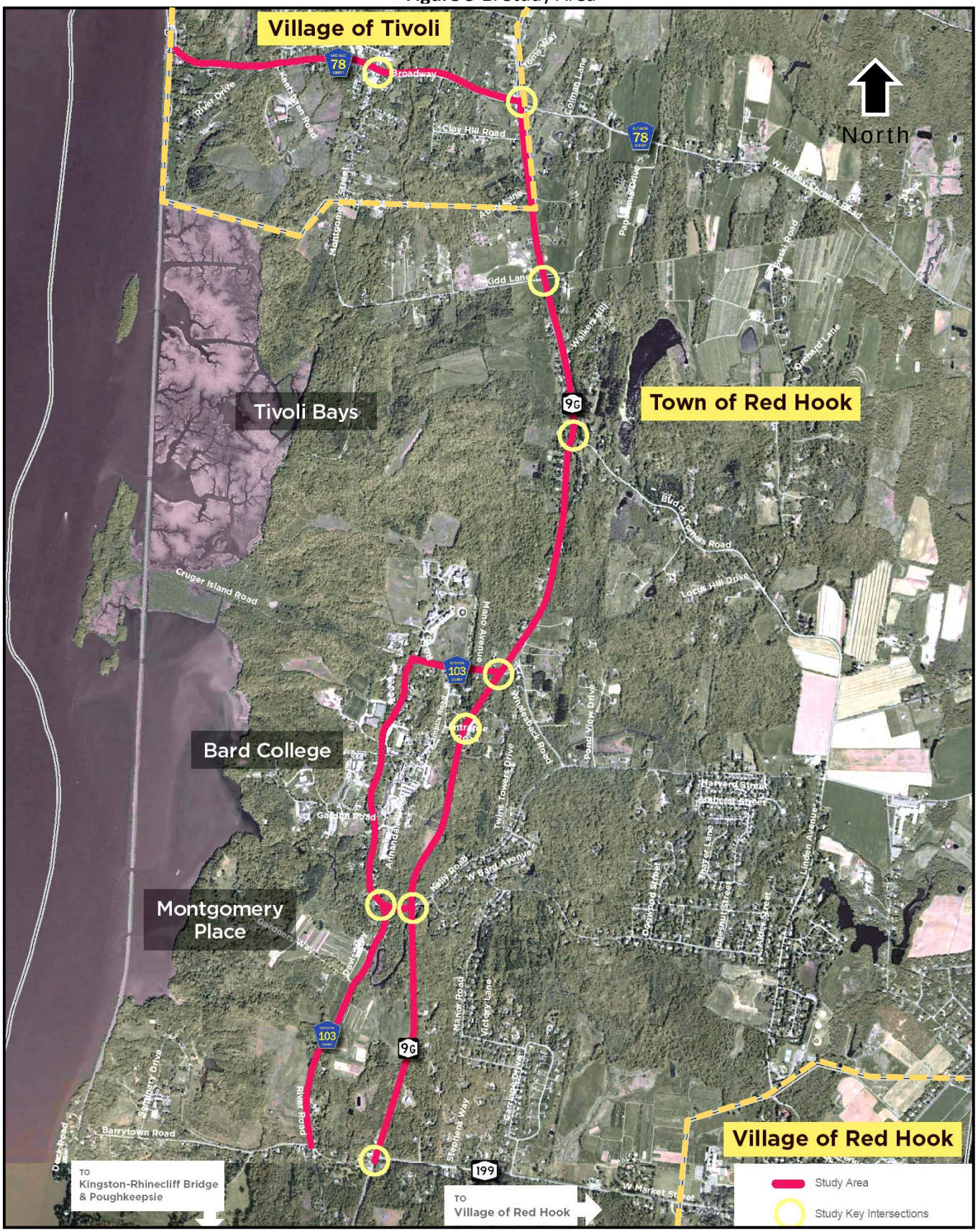
3.1 Introduction

1. Safety Assessment Process

As part of the Upper Route 9G Corridor Management Plan (CMP), a Safety Assessment was conducted following the Road Safety Audit (RSA) process detailed in the Federal Highway Administration's (FHWA's) *Roadway Safety Audit Guidelines* (FHWA, 2006). The Safety Assessment was performed on Wednesday, September 2 and Thursday, September 3 of 2015.

The study area covers a four-mile segment of NYS Route 9G from the intersection of CR 78 (Broadway/West Kerley Corners Rd) (reference marker 9G 8201 3236) south to the intersection of NYS Route 199 (reference marker 9G 8201 3203). In addition, this CMP will also evaluate overall safety and operations on two secondary corridors in the area: the section of CR 78 (Broadway/West Kerley Corners Rd) from the Hudson River to NYS Route 9G in Tivoli and CR 103 (Annandale Road) from NYS Route 9G to CR 82 (Barrytown Road) in Red Hook, as shown in Figure 3-1.

Figure 3-1: Study Area



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As part of the Safety Assessment, crash data for the corridor were provided and reviewed for the five year period of January 1, 2009 through December 31, 2013.

A review of the crash reports revealed that 249 crashes occurred within the study area over the five year period. The predominant crash types are:

- Collisions with animals (88 crashes, 35.3%)
- Rear end (36 crashes, 14.5%)
- Right angle (25 crashes, 10.0%)
- Fixed object (23 crashes, 9.2%)
- Run off the road (21 crashes, 8.4%)
- Parked vehicle (17 accidents, 6.8%)

Both NYS Route 9G and CR 103 (Annandale Rd) experienced significant patterns of collisions with animals, fixed object crashes, and run off the road crashes. CR 78 (Broadway) experienced a significant pattern of parked vehicle crashes. It was also found that a significant number of crashes occurred at night (95 accidents, 38.2%).

The Safety Assessment (SA) Team also discussed the six fatal crashes that occurred within the study area since 2009. Three of these crashes occurred during the crash study period, and the other three occurred afterward. Four of the crashes involved vehicles running off the road and striking fixed objects (three occurred along NYS Route 9G and one occurred along CR 78 (West Kerley Corners Rd)). One crash involved a motorist making a left turn from westbound CR 78 (West Kerley Corners Rd) to southbound Route 9G that collided with a box truck. One crash involved two pedestrians that were struck and killed while walking along NYS Route 9G near CR 78 (West Kerley Corners Rd). More information about the crash analysis can be found in technical memo #2 that was prepared under this project.

The purpose of this Safety Assessment was to identify existing and potential safety issues that may be contributing to the reported crashes, and develop potential measures to improve safety. The SA Team was assembled with members who have expertise in traffic engineering, planning, design, operations, and safety. The SA Team consisted of the following members:

Name	Organization
Mark Debald	PDCTC
Shelby Tompkins	PDCTC
Edward Goff	NYSDOT – Region 8 Traffic & Safety
Sandra Jobson	NYSDOT – Region 8 Landscape Architect
Rob Zahorsky	Dutchess County DPW
Theresa Burke	Town of Red Hook Highway
Ken Cooper	Bard College Security
Sgt. Patrick Hildenbrand	Red Hook Police
Trooper Brian Engel	NY State Police
Andrea Connell	VHB (Project Consultant)
Christopher Liberti	VHB (Project Consultant)
Scott Spittal	VHB (Project Consultant)

2. RSA Framework

The eight-step RSA process, listed below, is detailed in the Federal Highway Administration's (FHWA's) *Roadway Safety Audit Guidelines* (FHWA, 2006) and was utilized for this Safety Assessment.

1. Identify project or road in-service to be audited.
2. Select SA Team.
3. Conduct a pre-audit meeting to review project information.
4. Perform field observations under various conditions.
5. Conduct audit analysis and prepare report of findings.
6. Present audit findings to Project Owner/Design Team.
7. Project Owner/Design Team prepares formal response.
8. Incorporate findings into the project when appropriate.

A kickoff meeting was held with the SA Team to review existing information and identify concerns, followed by a field review to verify concerns and identify other potential safety issues. Members of the SA Team performed both daytime and nighttime field reviews. Based on the field review and crash analysis, the SA Team has recommended improvements to address the identified safety issues. The recommendations have been categorized as near-term (targeted for implementation within 1 year), intermediate (targeted for implementation within 3 years) and long-term (targeted for implementation within 5 years) improvements. Near-term improvements can typically be

implemented through maintenance forces, while intermediate and long-term improvements often require additional planning, study, design, and funding.

On the first morning of the Safety Assessment, the SA Team was provided a packet with existing conditions and crash data. Available aerial imagery was utilized to develop base maps depicting existing pavement markings and geometric conditions. Existing signing information, as well as information pertaining to the crashes in the study area was added to the plans and distributed to the SA Team. Statistical summaries of the crash data along with existing traffic volume data were also distributed. The crash and volume data can be found in technical memo #2 that was prepared under this project.

3.2 Assessment Findings

1. Safety Benefits of Existing Roadway Features

There are ongoing benefits resulting from relatively recent changes in roadway and traffic control features, as well by existing practices of involved agencies, as described below:

- **Positive attitude among stakeholders and multi-agency collaboration** – Throughout the course of the RSA process, the SA Team provided input and support, and were open to suggestions to enhance safety and improve communication and collaboration. This attitude will help to maintain a long-term commitment to improving safety for motorized and non-motorized road users travelling in the study area.
- **Bard College has a well-established system in place for communicating safety concerns with new and existing students.** – This includes Bard College Security, which is currently focused on pedestrian and motorist safety, and actively communicates issues concerning walking at night along roadways, drinking and driving (DWI check points), etc.
- **NYSDOT shoulder widening project along NYS Route 9G within the project limits.** – In the summer of 2014, NYSDOT stabilized the shoulder and restriped NYS Route 9G within the study limits. This changed the cross section of the roadway from consisting of two 12 foot travel lanes with 2 foot shoulders to consisting of two 11 foot travel lanes with 3 foot shoulders.
- **Installation of a flashing signal and upgraded stop signs at the intersection of NYS Route 9G and CR 78 (Broadway/West Kerley Corners Rd)** – In the summer of 2014, NYSDOT installed a flashing signal (flashing yellow indications for NYS Route 9G and flashing red indications for CR 78/W. Kerley Corners Road) supplemented with oversized size stop signs along the eastbound Broadway approach and westbound W. Kerley Corners Road approach at this intersection to improve awareness of the side street stop control.

- **Reduced posted speed limit along NYS Route 9G within study area –** In 2013, NYSDOT posted a lower speed limit along NYS Route 9G between Kelly Road and Peachtree Court reducing it from 55 MPH to 45 MPH. The PDCTC plans to collect data to assess the effect of this speed limit reduction.
- **Reduced posted speed limit along CR 103 (Annandale Rd) within study area –** In the spring of 2015, the County posted a lower speed limit along CR 103 (Annandale Rd) reducing it from 35 MPH to 25 MPH.
- **Installation of pedestrian/bicyclist warning signs with flashing beacons on CR 103 (Annandale Rd)** – In the fall of 2015, the County installed pedestrian/bicyclist warning signs with supplementary "share the road" plaques and flashing beacons on CR 103 (Annandale Rd) at the approaches to Bard College. One beacon assembly is located on southbound CR 103 (Annandale Rd), just south of Manor Avenue. The other is located on northbound CR 103 (Annandale Rd), just south of Campus Road.

Figure 3-2 (Left): Flashing signal at the intersection of NYS Route 9G and CR 78 (West Kerley Corners Rd).
Figure 3-3 (Right): Pedestrian/bicyclist warning sign with flashing beacon on CR 103 (Annandale Road) at Campus Road.

Other notable features which contribute to a safer driving environment are:

- **Pavement Markings -** pavement markings along NYS Route 9G were found to be generally in good condition.
- **Curb extensions and textured crosswalks at the intersection of CR 78 (Broadway) and Montgomery Street / North Road** – this intersection has curb extensions that shorten the distance pedestrians have to cross and help make motorists more aware of their presence.
- **No significant vegetation / overgrowth was observed along NYS Route 9G –** NYSDOT is doing a good job maintaining and controlling vegetation growth along the roadside area of NYS Route 9G.

2. Identified Safety Issues and Suggestions for Improvement

Despite the existing measures to improve road safety within the study area, five general issues were identified by the SA Team. The issues are:

1) Driver/Pedestrian Behavior and Expectancy
2) Signing, Pavement Marking, Wayfinding and Visibility Conditions
3) Geometry
4) Pavement Surface Conditions
5) Guiderail Conditions

The remainder of this section provides a detailed discussion of the identified issues along with the Safety Assessment Team's recommendations to correct or mitigate the identified issues. Conceptual drawings are provided in Appendix A. Appendix B contains a summary of the recommended improvements and serves as a framework for implementing the strategies.

3. ISSUE 1 – Driver/Pedestrian Behavior and Expectancy

The SA Team identified the following driver and pedestrian behavior and expectancy issues:

1. Driver Speeds -

   As noted earlier, actions have been taken to reduce the posted speed limit along segments of NYS Route 9G and CR 103 (Annandale Rd) in an attempt to help reduce driver speeding. The effect of these reduced speed limits should be assessed after an appropriate period of time to determine if these actions have helped to reduce crashes and the frequency of crashes citing "Unsafe Speed" as a contributing factor.

   Nonetheless, it was observed during the safety assessment field reviews that driver speeding is still an ongoing issue. The Safety Assessment Team identified the following characteristics along NYS Route 9G, CR 103 (Annandale Rd) and CR 78 (West Kerley Corners Rd), respectively, that relate to driver speeds and that may contribute to frequency of crashes:

   Driver Speeds along NYS Route 9G -

   The geometric characteristics of NYS Route 9G are such that many motorists are comfortable travelling at speeds higher than the posted limit. This is especially the case with those that are travelling along NYS Route 9G from and to points outside the area. There are no geometric features along this segment of NYS Route 9G that introduce a visual cue to motorists driving through the corridor and that might help to modify driver behavior and possibly reduce traveling speeds. There are also long distances between signalized intersections along NYS Route 9G which may promote vehicle speeding.

   In addition, the SA Team discussed that there is a mix of driver types travelling along the roadways within the project area. A portion of the drivers are local and the local population is aging – older drivers, it was recognized, tend to drive with a greater degree of caution, often at lower speeds. Another portion of the driver population are students attending Bard College, many of whom are relatively new and unfamiliar to the area. Combine these with residents and others who are travelling along NYS Route 9G through the area, and you often have a spectrum of driver behavior and range of vehicle speeds. It was also recognized that speeding may be contributing to the frequency of crashes involving deer along NYS Route 9G.

Driver Speeds along CR 103 (Annandale Rd) -

Vehicle speeding along CR 103 (Annandale Rd) had been a concern prior to the Safety Assessment. In the spring of 2015, Dutchess County posted a lower speed limit along CR 103 (Annandale Rd) reducing it from 35 MPH to 25 MPH between River Road and NYS Route 9G. The effect of this reduced speed limit should be assessed after an appropriate period of time to determine if this action has helped to reduce crashes and the frequency of crashes citing "Unsafe Speed" as a contributing factor.

The posted speed limit along the section of CR 103 (Annandale Rd) between Barrytown Road and a point south of the Montgomery Place Historic Estate driveway is 40 MPH. Although the roadway geometry might support this speed, during field safety assessment reviews it was recognized that it may not be appropriate to transition from 40 MPH to the existing 25 MPH posted speed limit located to the north. Furthermore, there is no roadway lighting within this area and, as a result, travelling at 40 MPH may not be comfortable for someone unfamiliar with the area.

The mix of frequent pedestrian activity crossing CR 103 (Annandale Rd) in the heart of Bard College campus (from Campus Road south to Campus Road north) and vehicular traffic, particularly as it relates to the speed of vehicles, was also noted as an issue by the Safety Assessment Team.

2. Driver Expectancy Issues

The FHWA describes driver expectancy as the driver's ability to respond to new situations, events, and information in predictable and successful ways. It influences the speed and accuracy of information handling, and affects all aspects of highway design and operations, and information presentation. Aspects of the highway situation that are in accordance with prevalent expectancies aid in the driving task, while expectancies that are violated lead to longer reaction time, confusion, and driver error. The issues regarding driver expectancy within the study area are as follows:

- Lack of driver expectation relating to location and frequency of pedestrian crossings along CR 103 (Annandale Rd) between south and north Campus Road. Due to the nature of the improvements to mitigate this issue, this will be discussed further under Issue 2.
- Lack of driver expectation relating to deer crossing the road along both Route 9G and CR 103 (Annandale Rd).
- Lack of driver expectation relating to intersecting side streets and driveways. The intersections of Route 9G with the Bard College Entrance Road and Walkers Hill Road both lack advance warning signs. Additionally, a number of residential

driveways serving multiple dwellings along the east side of NYS Route 9G south of Kidd Lane may warrant the use of driveway warning signs due to limited sight distance conditions.

- Driver confusion regarding the recently installed flashing signal at NYS Route 9G and CR 78 (Broadway/West Kerley Corners Rd). Some appear to think that it operates as an all-way stop control.

The following is a list of potential mitigation measures related to these issues:

Near-Term Strategies

1.1 Make more frequent use of portable driver speed feedback devices along CR 78 (West Kerley Corners Rd), CR 103 (Annandale Rd) and NYS Route 9G.

1.2 Consider reducing the posted speed limits along the section of CR 103 (Annandale Rd) between CR 199 (Barrytown Road) and a point south of the Montgomery Place Historic Estate driveway from 40 MPH to 35 MPH.

1.3 Install additional Deer Crossing warning signs with high-visibility fluorescent yellow sheeting material along NYS Route 9G to better inform motorists of this potential condition.

1.4 Supplement the intersection warning sign located along the northbound NYS Route 9G approach to CR 78 (Broadway/West Kerley Corners Rd) with a flashing beacon assembly.

1.5 Install a stop ahead warning sign along the eastbound CR 78 (Broadway) approach to NYS Route 9G.

1.6 Evaluate the location of the existing and need for additional driveway warning signs along the northbound and southbound NYS Route 9G.

1.7 Evaluate the location of the existing intersection warning signs along the northbound and southbound NYS Route 9G approaches to Kidd Lane.

1.8 Perform a linear speed zone evaluation along NYS Route 9G to further assess existing posted speed limits. This type of evaluation provides a means for determining whether or not a particular speed limit is warranted by examining both highway development and geometric values and comparing them with statistically obtained State standards.

1.9 Perform a traffic signal warrant study to evaluate the appropriateness of installing a new signal at the intersection of NYS Route 9G and Old Whalesback Road/ CR 103 (Annandale Rd).

1.10 Evaluate the operation of the existing signals along NYS Route 9G to determine if there is an opportunity to reprogram them to better control vehicle speeds during selected off-peak periods.

Intermediate-Term Strategies

1.11 After a three year period, assess the effectiveness of the reduced speed limit along CR 103 (Annandale Rd) and NY 9G to determine if this action has helped to reduce the overall number of crashes and the frequency of crashes citing "Unsafe Speed" as a contributing factor. Supplement the existing speed limit signs with permanent driver-feedback speed limit signs as necessary.

1.12 After a three year period, assess the effectiveness the flashing signal and larger stop signs at the intersection of NYS Route 9G and CR 78 (West Kerley Corners Rd) to determine if this helped to reduce the frequency and severity of crashes at this location.

Long-Term Strategies

1.13 Incorporate traffic calming improvements along CR 103 (Annandale Rd) to alert motorists as they approach and travel through the college campus area and encourage lower vehicle speeds. These improvements could involve incorporating a raised or textured pavement surface, curb bump-outs or a narrower pavement section with the objective of better informing motorists that they are about to enter and drive through a section of roadway that has frequent pedestrian activity. Gateway elements should also be considered as they are also effective at modifying driver behavior and mindset and can also be considered at locations along CR 103 (Annandale Rd) near the limits of the campus.

1.14 Incorporate traffic calming improvements along NYS Route 9G that would encourage motorists to reduce their speed as they approach and travel through the study area. These improvements could involve gateway elements such as a narrower curbed pavement section and/or roundabouts with the objective of modifying driver behavior and mindset and helping to reduce driver speed.

1.15 Work with the Town of Red Hook, the Village of Tivoli, and the New York State Department of Environmental Conservation to develop an off-road, multi-use path, such as the Tivoli Bays connection recommended in Walk Bike Dutchess, which would accommodate pedestrians and bicyclists travelling between the Bard College area and the Village of Tivoli.

4. ISSUE 2 - Signing, Pavement Marking, Wayfinding and Visibility Conditions

The SA Team identified the following issues related to signing and pavement markings in the study area:

1. Poor pavement markings:
    a. Pavement markings along CR 103 (Annandale Rd) throughout the study area are faded and in poor condition.
    b. Pavement markings along a number of side street approaches to NYS Route 9G are faded and in poor condition.
    c. The frequency and condition of pedestrian crossings along CR 103 (Annandale Rd) between south and north Campus Road are not ideal and do not conform to the MUTCD. There are crosswalks that are skewed, causing pedestrians to be in the path of a motorist longer than what is necessary. Additionally, having multiple midblock crosswalks short distances from one another can cause motorists to become frustrated and increases the likelihood of a crash. Figure 3-4, on the next page, shows an example of midblock crosswalk markings from the MUTCD.

Figure 3-4: *Example of midblock crosswalk markings (Figure 3B-17 from the 2009 MUTCD).*

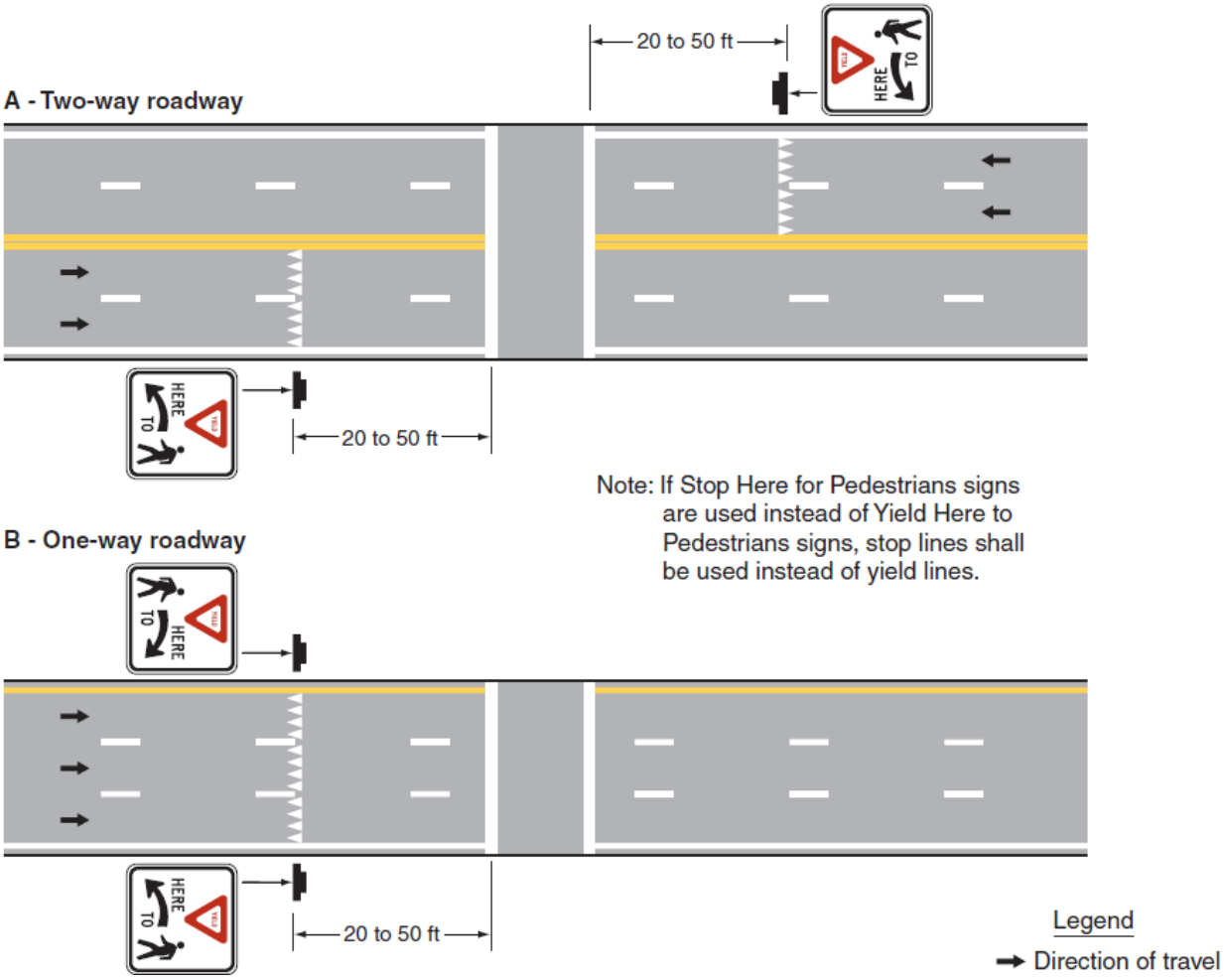
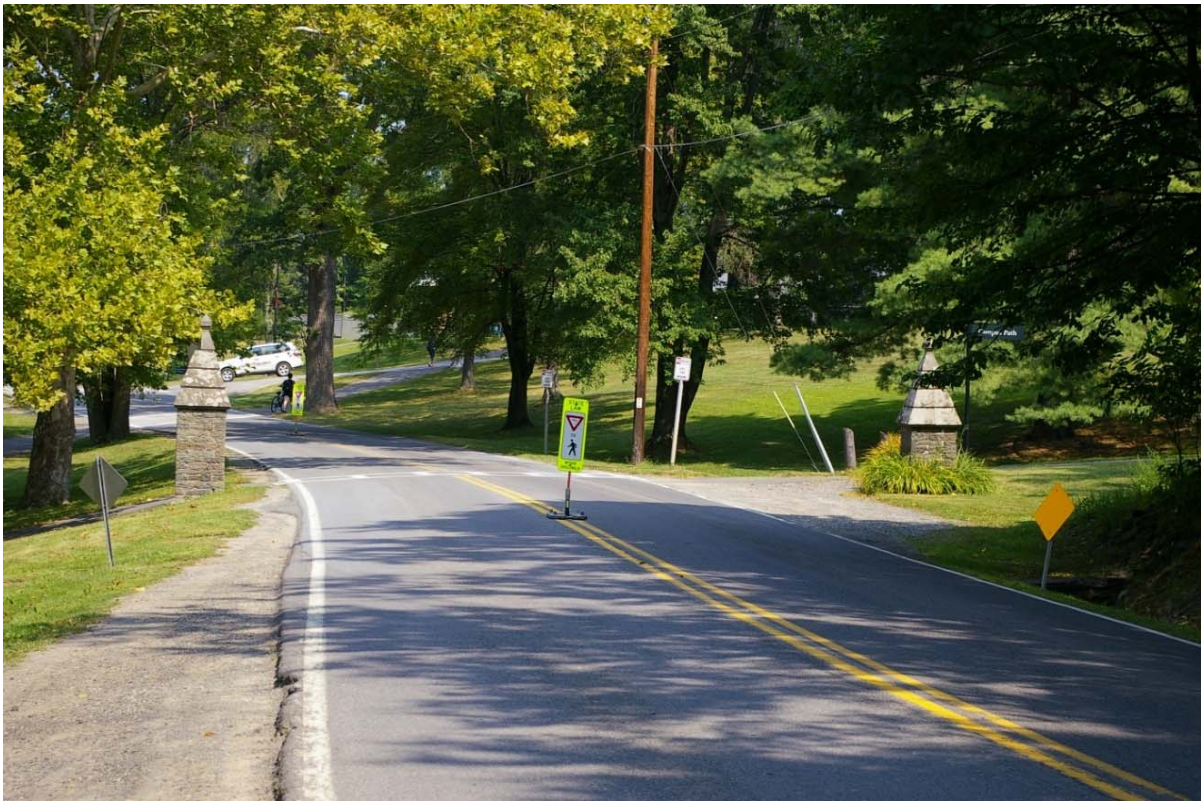


Figure 3-5: *Example of two existing pedestrian crosswalks along CR 103 (Annandale Rd) with an improperly used in-street pedestrian crossing sign. These crosswalks should be reviewed to determine if they can be consolidated and properly signed.*

Figure 3-6: *Example of diagonal crosswalk – not ideal as it creates a longer crossing distance for pedestrians.*

2. Improper use of In-Street Pedestrian Crossing signs: These signs are currently being used in advance of pedestrian crosswalks along CR 103 (Annandale Rd). Section 2B-12 of the MUTCD states "An In-Street or Overhead Pedestrian Crossing sign shall not be placed in advance of the crosswalk to educate road users about the State law prior to reaching the crosswalk, nor shall it be installed as an educational display that is not near any crosswalk." Therefore, an In-Street or Overhead Pedestrian Crossing sign shall be placed in the roadway at the crosswalk location on the center line, on a lane line, or on a median island.

Figure 3-7: *Example of improperly used In-Street Pedestrian Crossing sign along CR 103 (Annandale Rd).*



3. Poor sign retro-reflectivity: There was one attraction sign along the northbound NYS Route 9G approach to River Road/Kelly Road that was observed to have poor retro-reflective characteristics during the nighttime field review.

Figure 3-8: *Attraction sign along northbound Route 9G to River Road/Kelly Road that was observed to have poor retro-reflective characteristics.*

4. Non-standard street name signing: The MUTCD has provisions for font, size, and letter capitalization of street name signing for consistency and uniformity. It was observed that the street name signs in the study area do not match the MUTCD and vary from one to another.

Figure 3-9: *Example of existing street name sign that does not meet current font type/size standards.*

Figure 3-10: *Example of standard street name sign (D3-1) from the MUTCD.*

5. Sign clutter/wayfinding: There are a number of locations with sign clutter, and there is an opportunity to relocate and/or consolidate existing signs. Numerous signs along NYS Route 9G relating to points of interest on the Bard College campus also contribute to sign overload.
6. Poor wayfinding signing:
    a. Signage directing motorists to Bard College is hard to see with all the other signs.
    b. Lack of route marker signing along select side street approaches. Since the study area roadways are numbered state or county roads, there should be signage on each side street approach that help motorists recognize the upcoming roadway and its directions more clearly.

Figure 3-11: Example of route marker signage for an eastbound side street approach to NYS Route 9G.

   c. Lack of advance intersection warning signs.
7. Inconsistent messages relating to signing and markings at the following locations:
   a. There are pedestrian crossing warning signs along NYS Route 9G in the vicinity of the Bard College Entrance Road (opposite Two Boots) without any existing marked crosswalk.
   b. There are "No Stopping Anytime" signs along NYS Route 9G in the vicinity of the Bard College Entrance Road (opposite Two Boots) which might give the impression that stopping or parking is permitted outside of these limits.
   c. No markings delineate the existing on-street parking that is permitted along both sides of CR 78 (Broadway) east and west of Montgomery Street/North Road.
8. Sign mounting height: The mounting height of signs in the study area should be verified. The SA Team noted a stop sign on the westbound River Road approach of CR 103 (Annandale Rd) that appeared high.
9. Visibility/Obstructions:
   a. There were a few locations along CR 103 (Annandale Rd) where vegetation obstructs signs. Efforts to regularly trim vegetation along NYS Route 9G should be maintained, especially along the east side of NYS Route 9G, south of Whalesback Road where it was recognized that vegetation growth could create a potential sight distance issue.

Figure 3-12: *Example of vegetation partially obstructing the view of a warning sign.*

b. There is an existing utility pole at the southeast corner of NYS Route 9G and CR 78 (Broadway/West Kerley Corners Rd) that appeared to be having overhead utilities transferred onto a newly installed and adjacent pole. This pole adds an unnecessary obstruction and adds to the clutter at the intersection.
c. It was agreed by the SA Team that rights on red should be restricted, due to sight distance issues, at the eastbound River Road and westbound Kelly Road approaches to NYS Route 9G
d. The location of the 25 MPH speed limit sign along CR 103 (Annandale Rd) just west of NYS Route 9G is too close to the intersection to effectively inform motorists.

The following is a list of potential mitigation measures related to these issues:

Near-Term Strategies

2.1 Restripe the pavement markings along CR 103 (Annandale Rd) and side street approaches to NYS Route 9G. Compare the life-cycle cost of high-visibility / high-durability markings with standard painted markings and consider using high-visibility / high-durability markings in the future. If paint is used (i.e., existing practice), then coordinate the maintenance schedule to restripe more frequently (twice per year). A better option would be to use epoxy, which has high retroreflective characteristics and is more durable than paint.

2.2 In general, all pavement markings, including pedestrian crosswalks, double yellow centerlines, edge lines and stop lines along CR 103 (Annandale Rd) between south and north Campus Road should be restriped using high visibility, durable pavement markings to better delineate proper paths for pedestrians and motorists and provide an increased awareness of pedestrians by motorists.

2.3 In conjunction with strategy 2.2, the existing pedestrian crosswalk warning signs should be reviewed and, if necessary, upgraded by installing new signs using Type XI prismatic fluorescent yellow-green sheeting material. All proposed and existing use of in-road pedestrian crosswalk warning signing should conform to the requirements of the most current Manual of Uniform Traffic Control Devices. Exhibit A.1 in Appendix A presents a typical layout for pedestrian crosswalk warning signing and striping.

2.4 Replace attraction sign along the northbound NYS Route 9G approach to River Road/Kelly Road to improve sign retro-reflectivity.

2.5 Perform a review of existing street name signing and upgrade with new signs with standard font size and type.

2.6 Review existing signs along NYS Route 9G to determine if some can be consolidated, removed or relocated further away from intersections to reduce sign clutter.

Figure 3-13: *Attraction signs along NYS Route 9G that should be reviewed to determine if all are necessary and if they could be relocated to reduce sign clutter.*

Figure 3-14: *Two signs along northbound NYS Route 9G south of CR 78 that can be mounted together to help reduce sign clutter.*

Figure 3-15: *View looking north along NYS Route 9G south of River Road/Kelly Road showing the numerous attraction signs within close proximity to each other.*

2.7 Install route marker signs at the westbound CR 78 (West Kerley Corners Rd) approach to NYS Route 9G.

2.8 Remove existing “No Stopping Anytime” and pedestrian crossing warning signs along NYS Route 9G in the vicinity of the Bard College Entrance Road (opposite Two Boots).

2.9 Add pavement markings to delineate on-street parking spaces along both sides of CR 78 (Broadway) east and west of Montgomery Street/North Road.

Figure 3-16: *View looking west along CR 78 (Broadway) east of Montgomery Street/North Road – No markings are present to delineate the on-street parking that is permitted along both sides of the street.*

2.10 Check mounting height of signs and adjust as appropriate. The Safety Assessment Team noted a stop sign on the westbound River Road approach of CR 103 (Annandale Rd) that appeared high.

2.11 Trim vegetation and/or relocate signs to avoid sign obstructions.

2.12 Continue vegetation trimming operations along CR 103 (Annandale Rd), CR 78 (West Kerley Corners Rd) and NYS Route 9G to maintain a clear roadside, improve visibility of signs and maximize sight distance.

2.13 Install “No Turn on Red” signs at the eastbound River Road and westbound Kelly Road approaches to NYS Route 9G.

2.14 Relocate 25 MPH speed limit sign along CR 103 (Annandale Rd) just west of NYS Route 9G further to the west.

Figure 3-17: *View looking west across NYS Route 9G at CR 103 (Annandale Rd) – Note location of 25MPH speed limit sign is too close to the intersection to effectively inform motorists.*

Intermediate-Term Strategies

2.15 Study the existing wayfinding and other signage relating to accessing Bard College and points of interest on the Campus. Develop an improved wayfinding plan that better informs visitors (often new and unfamiliar with the area) how to efficiently access the campus, as well as the other points of interest.

2.16 In addition to the pedestrian origin-destination study that was conducted along Route 9G as part of this project, conduct a pedestrian origin-destination study to assess pedestrian crosswalk locations along CR 103 (Annandale Rd) between south and north Campus Road to determine if there is an opportunity to better locate them and/or consolidate the number of them.

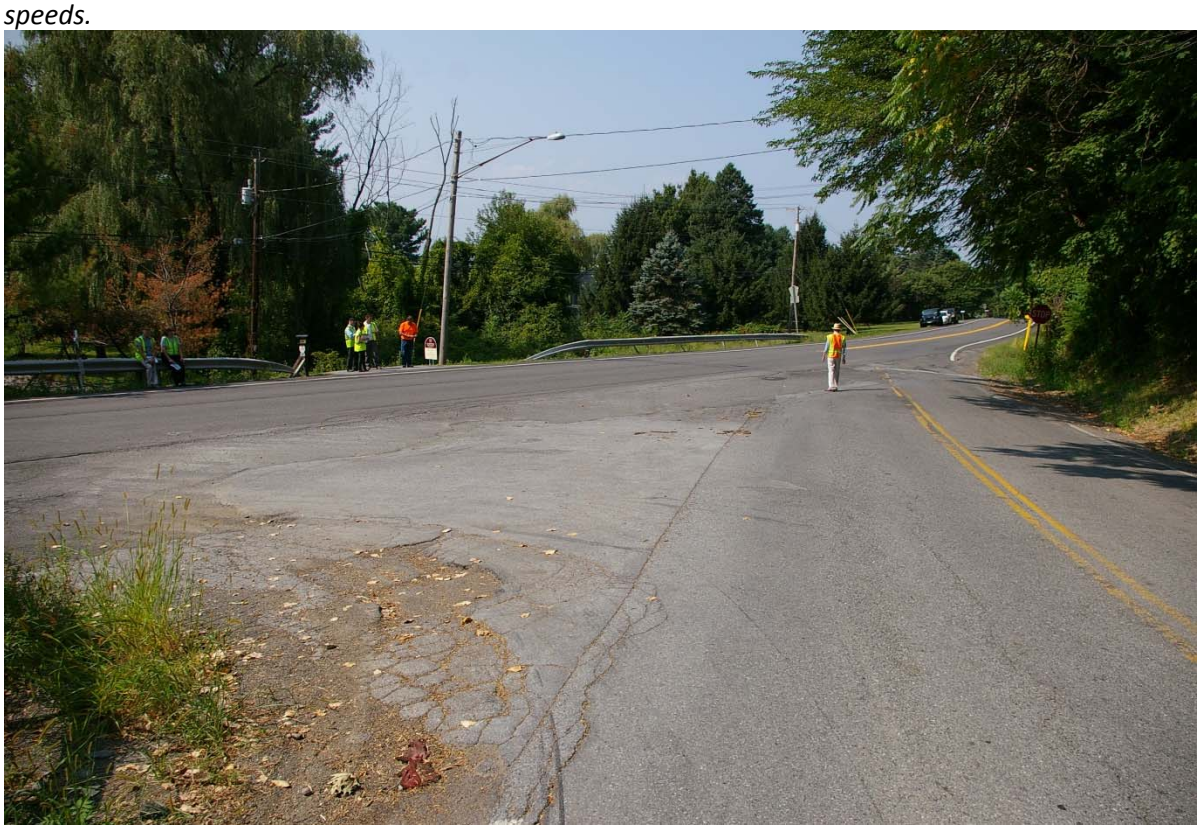
2.17 Consider installing rectangular rapid flashing beacons (RRFBs) at pedestrian crossings along CR 103 (Annandale Rd) between south and north Campus Road. Studies have shown that these devices can increase driver yielding rates.

5. ISSUE 3 - Geometry

The SA Team identified the following geometric issues that may contribute to crashes.

1. Lack of roadside features to better delineate roadway alignment.
2. Poor (skewed) intersection alignment at Budds Corners Road and NYS Route 9G.
3. Poor (skewed) intersection alignment at Cruger Island Road and CR 103 (Annandale Rd).
4. Poor sight distance due to a vertical curve on the northbound NYS Route 9G approach to CR 78 (Broadway/West Kerley Corners Rd).

Figure 3-18: *View of Budds Corners Road approach to NYS Route 9G – skewed intersection geometry and large, expansive pavement condition are not ideal due to poor sight distance and high vehicle speeds.*



The following is a list of potential mitigation measures related to these issues:

Near-Term Strategies

3.1 Install roadside delineators where none exist along curved sections of CR 103 (Annandale Rd) and NYS Route 9G to better delineate roadway alignment.

Figure 3-19: *Example of roadside delineators on a horizontal curve during nighttime conditions.*

Long-Term Strategies

3.2 Construct roadway improvements at the intersection of Budds Corners Road and NYS Route 9G to better control, channelize and facilitate efficient movements at the intersection. This will involve reducing the pavement area at the intersection and re-aligning the Budd's Corners Road approach so it is more perpendicular to NYS Route 9G [See Exhibit A.2 in Appendix A for conceptual improvement plan for this intersection].

3.3 Construct roadway improvements at the intersection of Cruger Island Road and CR 103 (Annandale Rd) to better control, channelize and facilitate efficient movements at the intersection. This will involve reducing the pavement area at the intersection and re-aligning the Cruger Island Road approach so it is more perpendicular to CR 103 (Annandale Rd) [See Exhibit A.3 in Appendix A for conceptual improvement plan for this intersection].

6. ISSUE 4 - Pavement Surface Conditions

The Safety Assessment Team identified a pattern of ten rear end crashes along the northbound NYS Route 9G approach to River Road/Kelly Road. With five of these crashes occurring on a wet road surface, the SA Team thought that there could be a pavement surface condition along this approach that may be contributing to this pattern of crashes. Note that there is a section of the NYS Route 9G pavement surface that is concrete where there is a structure carrying traffic over a stream in the vicinity of this approach.

The following is a potential mitigation measure related to this issues:

Near-Term Strategies

4.1 Evaluate the skid resistance characteristics of the pavement surface along the northbound NYS Route 9G approach to River Road/Kelly Road and, if warranted, program an improvement project to address this potential condition.

Figure 3-20: *View along NYS Route 9G looking north towards River Road/Kelly Road showing the concrete pavement surface.*

7. ISSUE 5 – Guiderail Conditions

During field reviews, the Safety Assessment Team recognized that there are sections of existing guiderail along NYS Route 9G that are in poor condition. There were also locations where there was no guiderail, but it appeared that it could be needed.

Figure 3-21: *View of damaged guiderail at southeast corner of NYS Route 9G and Budds Corner Road*

The following is a list of potential mitigation measures related to these issues:

Near-Term Strategies

5.1 Replace all damaged guiderail along NYS Route 9G within the study area.

Intermediate-Term Strategies

5.2 Evaluate the need for upgrading existing guiderail and end treatments along NYS Route 9G for conformance to the latest applicable standards, and evaluate the need for additional guiderail along the study roadways.

3.3 Conclusions

There were five significant safety issues identified during the RSA, including:

1) Driver/Pedestrian Behavior and Expectancy
2) Signing, Pavement Marking, Wayfinding and Visibility Conditions
3) Geometry
4) Pavement Surface Conditions
5) Guiderail Conditions

Suggestions for improvements have been identified and are described in the report. The suggestions have been categorized as near-term, intermediate, and long-term strategies. Concept drawings are provided in Appendix A to illustrate long-term concepts. Appendix B provides a complete summary of suggested improvements, which provides a basis for the formal response letter.

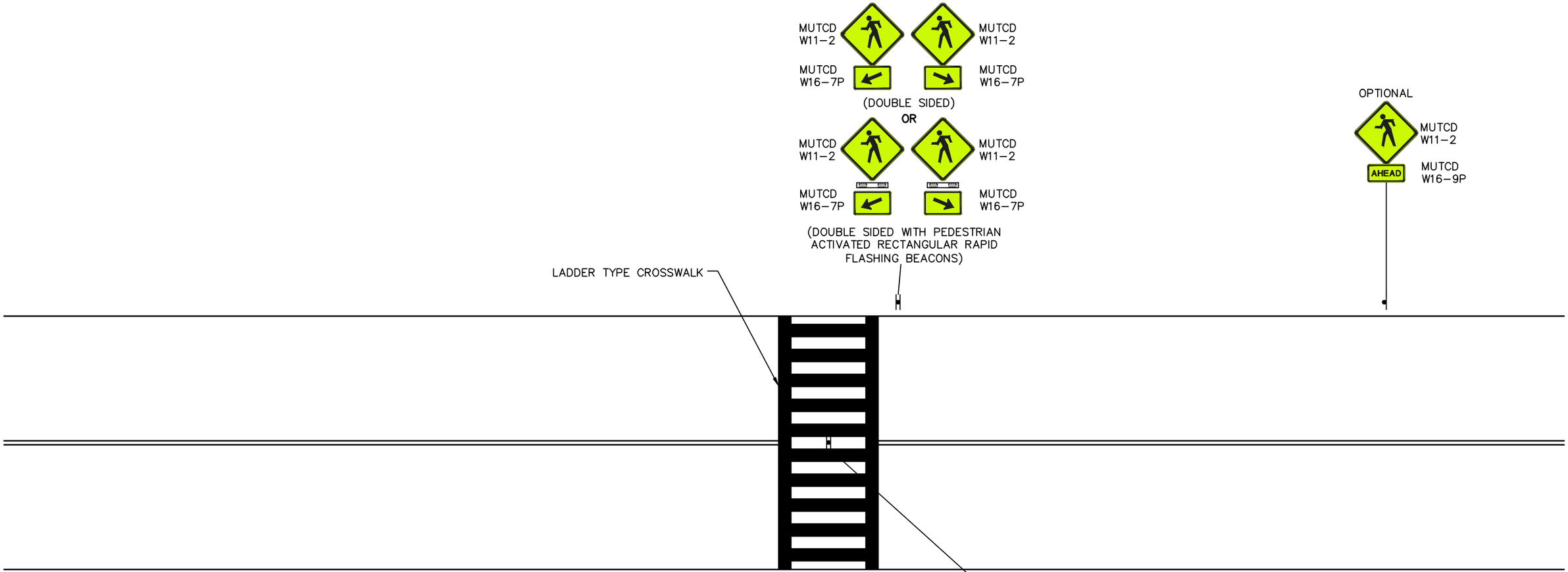
3.4 References

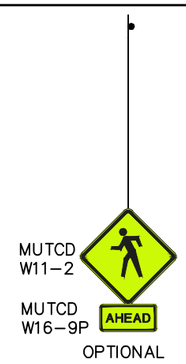
1. American Association of State Highway and Transportation Officials (AASHTO). *Highway Safety Manual, 1st* Edition, Washington, DC, 2010.
2. United States Department of Transportation Federal Highway Administration. *Manual on Uniform Traffic Control Devices* (MUTCD), 2009 Edition.

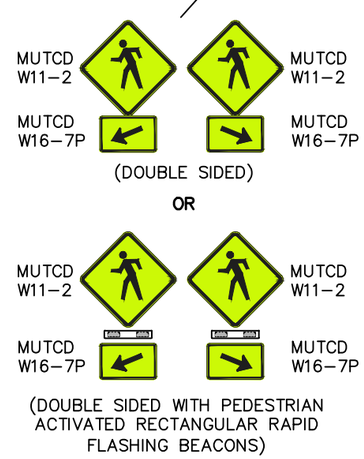
APPENDIX A
Upper Route 9G Conceptual Drawings

Conceptual Designs and Considerations

As noted above, the alternatives provided are conceptual representations of mitigation strategies highlighted in Section 3.2. The concepts are two-dimensional sketches overlaid on aerial photography without horizontal and vertical alignments; therefore, the actual footprint could be different as design continues. The primary focus of the concepts is to address the history of vehicular and pedestrian crashes within the study area. The three concepts are presented below in Figures A.1 – A.3.







MUTCD R1–6
(DOUBLE SIDED)

IF IN–STREET PEDESTRIAN CROSSING SIGNS ARE TO BE USED, THEY SHOULD BE PLACED IN THE ROADWAY AT THE CROSSWALK LOCATED ON THE CENTERLINE, ON A LANE LINE, OR IN A MEDIAN ISLAND.

AN IN–STREET PEDESTRIAN CROSSING SIGN SHALL NOT BE PLACED IN ADVANCE OF THE CROSSWALK

NOTES:

1. IT IS RECOMMENDED THAT NEW PEDESTRIAN CROSSWALK SIGNS USE TYPE XI PRISMATIC FLUORESCENT YELLOW–GREEN SHEETING MATERIAL.
2. IT IS RECOMMENDED THAT NEW PEDESTRIAN CROSSWALK MARKINGS USE HIGH VISIBILITY, DURABLE PAVEMENT MARKING MATERIAL.

MUTCD – MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES

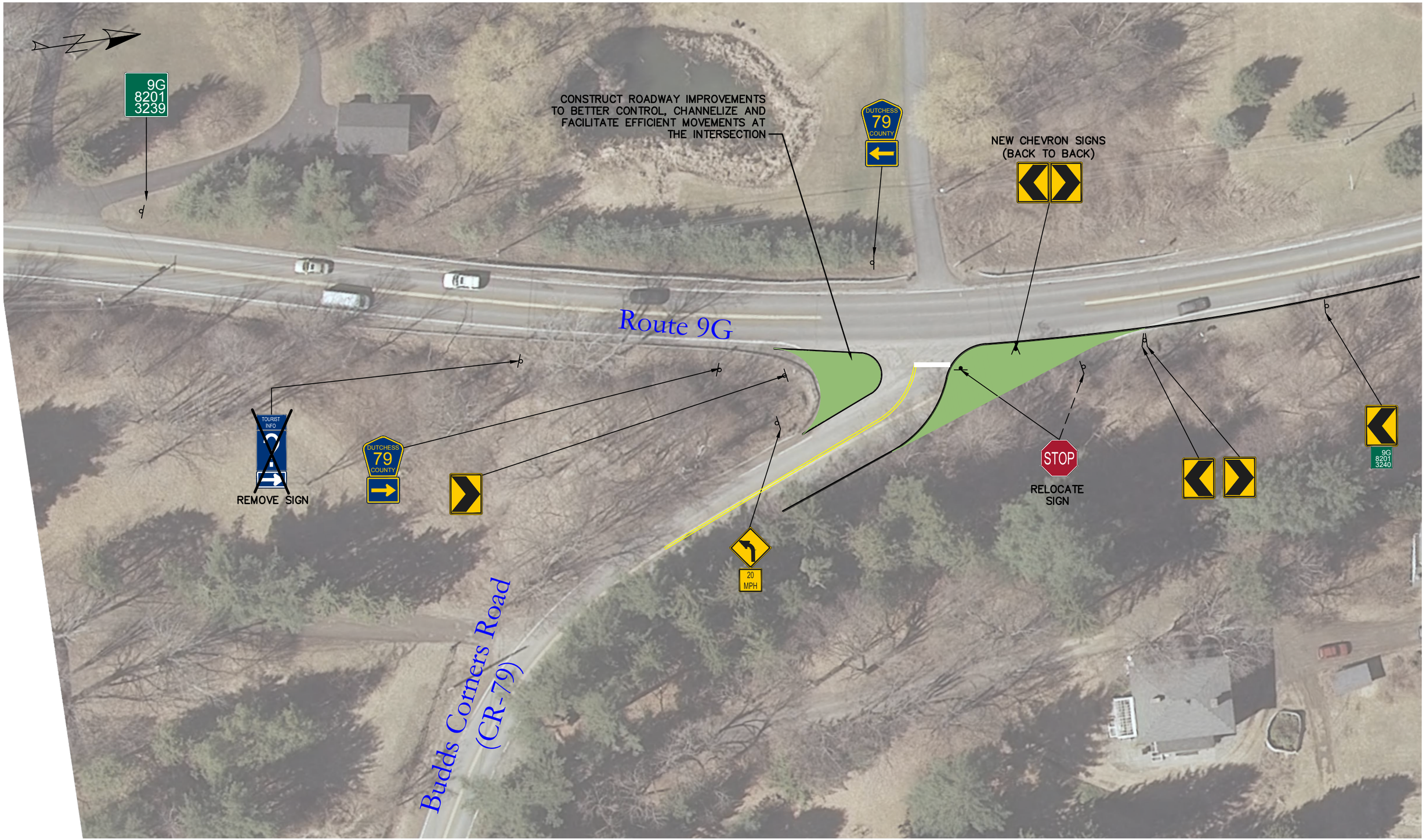
vhb

PDCTC
Poughkeepsie-Dutchess County Transportation Council

UPPER ROUTE 9G CORRIDOR MANAGEMENT PLAN
Typical Layout for Pedestrian Crosswalk Warning Signing and Striping

MUNICIPALITY: Town of Red Hook COUNTY: Dutchess FILE: 29418.00
LOCATION: VARIOUS LOCATIONS
BY: AG
SCALE: NONE DATE: 9/2015

EXIHIBIT A.1



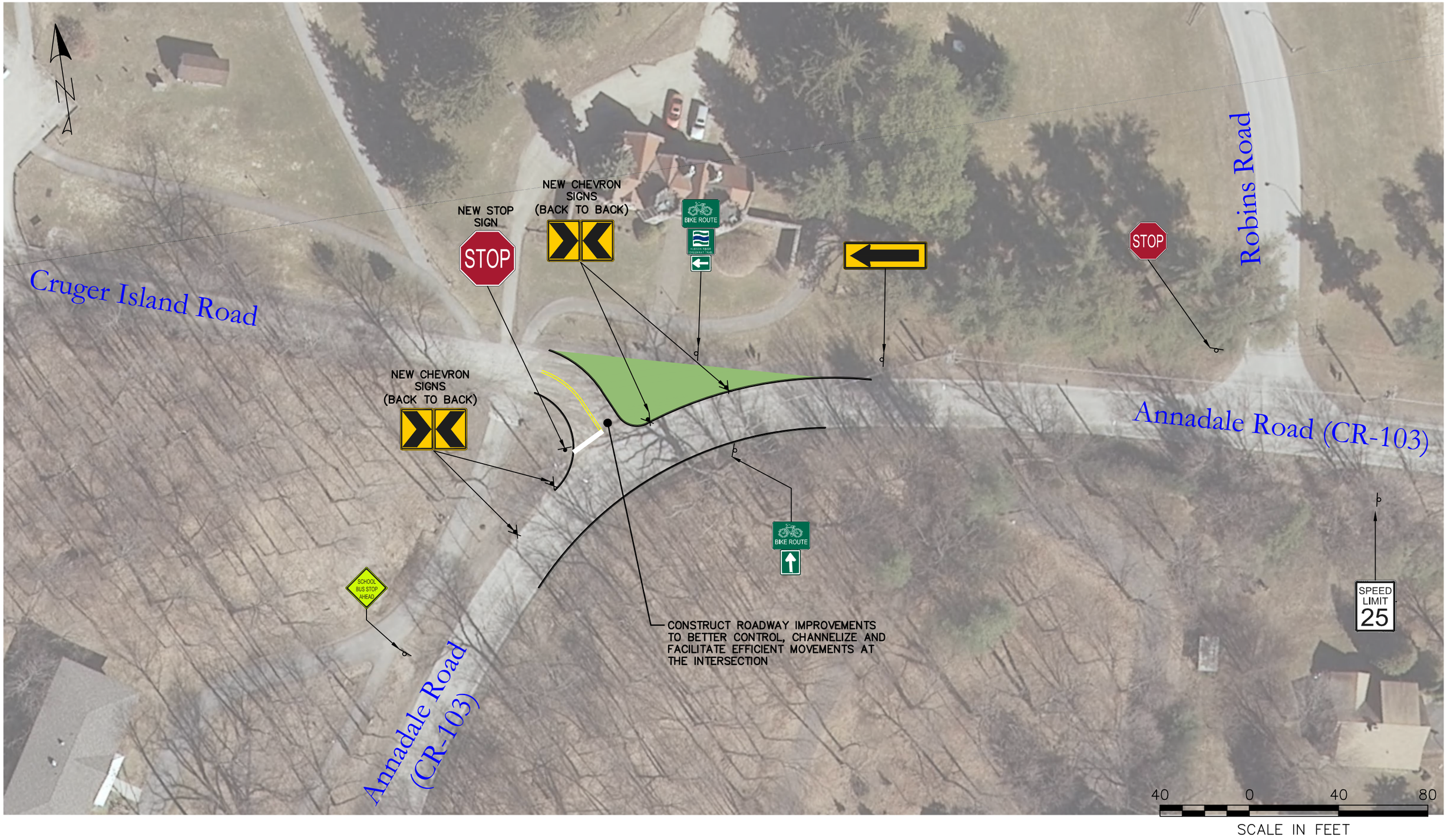
ALL SIGNS ARE EXISTING UNLESS OTHERWISE SHOWN

PDCTC
Poughkeepsie-Dutchess County Transportation Council

UPPER ROUTE 9G CORRIDOR MANAGEMENT PLAN
Conceptual Improvement Plan

MUNICIPALITY: Town of Red Hook COUNTY: Dutchess FILE: 29418.00
LOCATION: NYS Route 9G at Budds Corners Road (CR-79)
BY: AG
SCALE: 1"=40' DATE: 9/2015

EXHIBIT A.2



vhb

ALL SIGNS ARE EXISTING UNLESS OTHERWISE SHOWN

PDCTC
Poughkeepsie-Dutchess County Transportation Council

UPPER ROUTE 9G CORRIDOR MANAGEMENT PLAN
Conceptual Improvement Plan

MUNICIPALITY: Town of Red Hook COUNTY: Dutchess FILE: 29418.00
LOCATION: Annadale Road (CR-103) at Cruger Island Road
BY: AG
SCALE: 1"=40' DATE: 9/2015

EXIHIBIT A.3

APPENDIX B
Upper Route 9G Safety Assessment Summary of Strategies

Appendix B provides a summary of suggested strategies. This can form the basis of the formal response letter, which is Step 7 of the FHWA RSA Process. The objective is to document the decisions made by the project owner/design team with respect to the RSA findings. The response identifies those strategies that can be implemented and lists the responsible party(s) that would be involved. The response should also note any strategies that will not be implemented and why. The following are examples of why a strategy may not be selected:

- The strategy is not within the scope of a project initiated to meet other objectives.
- The strategy would lead to mobility, environmental, or other non-safety related issues.
- The strategy is not cost-effective and other alternatives will be explored.

In addition, the Village of Red Hook, Town of Red Hook , Dutchess County and NYSDOT should document and share strategies for maintaining conditions of pavement markings, signing, lighting, tree and vegetation trimming, etc. that are necessary to ensure a commitment to improving safety in the study area.

Near-Term Strategies (to be implemented within 1-year)

Issue(s)	Strategy	Responsible Stakeholder		Status / Comments
		Implementation	Maintenance	
1	1.1 Make more frequent use of portable driver speed feedback devices along CR 78 (Broadway/West Kerley Corners Rd), CR 103 (Annandale Rd) and NYS Route 9G.	Red Hook Police, NYS Police, NYSDOT & Dutchess County Sherriff's Office	Red Hook Police, NYS Police, NYSDOT & Dutchess County Sherriff's Office	
1	1.2 Consider reducing the posted speed limits along the section of CR 103 (Annandale Rd) between Barrytown Road and a point south of the Montgomery Place Historic Estate driveway from 40 MPH to 35 MPH.	NYSDOT & Dutchess County DPW	NYSDOT & Dutchess County DPW	
1	1.3 Install additional Deer Crossing warning signs with high-visibility fluorescent yellow sheeting material along NYS Route 9G to better inform motorist of this potential condition.	NYSDOT	NYSDOT	
1	1.4 Supplement intersection warning sign located along the northbound NYS Route 9G approach to CR 78 (Broadway/West Kerley Corners Rd) with a flashing beacon assembly.	NYSDOT	NYSDOT	
1	1.5 Install a stop ahead warning sign along the eastbound CR 78 (Broadway) approach to NYS Route 9G.	Dutchess County DPW	Dutchess County DPW	
1	1.6 Evaluate the location of the existing driveway warning signs along northbound and southbound NYS Route 9G.	NYSDOT	NYSDOT	
1	1.7 Evaluate the location of the existing intersection warning signs along the northbound and southbound NYS Route 9G approaches to Kidd Lane.	NYSDOT	NYSDOT	
1	1.8 After a three year period, assess the effectiveness the flashing signal and larger stop signs at the intersection of NYS Route 9G and CR 78 (Broadway/West Kerley Corners Rd) to determine if this helped to reduce the frequency and severity of crashes at this location.	NYSDOT	NYSDOT	

Issue(s)	Strategy	Responsible Stakeholder		Status / Comments
		Implementation	Maintenance	
1	1.9 Perform a linear speed zone evaluation along NYS Route 9G to assess existing posted speed limits.	NYSDOT	NYSDOT	
1	1.10 Perform a traffic signal warrant study to evaluate the appropriateness of installing a new signal at the intersection of NYS Route 9G and Old Whalesback Road/ CR 103 (Annandale Rd). In conjunction with this, evaluate the operation of the existing signals along NYS Route 9G to determine if there is an opportunity to reprogram them to better control vehicle speeds during selected off-peak periods.	Dutchess County DPW (DCDPW) & NYSDOT	DCDPW & NYSDOT	
2	2.1 Restripe the pavement markings along CR 103 (Annandale Rd) and side street approaches to NYS Route 9G. Compare the life-cycle cost of high-visibility / high-durability markings with standard painted markings and consider using high-visibility / high-durability markings in the future. If paint is used (i.e., existing practice), then coordinate the maintenance schedule to restripe more frequently (twice per year). A better option would be to use epoxy, which has high retroreflective characteristics and is more durable than paint.	Town of Red Hook, Village of Red Hook, DCDPW & Bard College	Town of Red Hook, Village of Red Hook, Dutchess County & Bard College	
2	2.2 In general, all pavement markings, including pedestrian crosswalks, double yellow centerlines, edge lines and stop lines along CR 103 (Annandale Rd) between south and north Campus Road should be restriped using high visibility, durable pavement markings to better delineate proper paths for pedestrians and motorists and provide an increased awareness of pedestrians by motorists.	DCDPW & Bard College	DCDPW & Bard College	

Issue(s)	Strategy	Responsible Stakeholder		Status / Comments
		Implementation	Maintenance	
2	2.3 In conjunction with Strategy 2.2, the existing pedestrian crosswalk warning signs should be reviewed and, if necessary, upgraded by installing new signs using Type XI prismatic fluorescent yellow-green sheeting material. All proposed and existing use of in-road pedestrian crosswalk warning signing should conform to the requirements of the most current Manual of Uniform Traffic Control Devices. Exhibit A.1 in Appendix A presents a typical layout for pedestrian crosswalk warning signing and striping.	DCDPW & Bard College	DCDPW & Bard College	
2	2.4 Replace attraction sign along the northbound NYS Route 9G approach to River Road/Kelly Road to improve sign retro-reflectivity.	NYSDOT, DCDPW, Town of Red Hook, Village of Tivoli	NYSDOT, DCDPW, Town of Red Hook, Village of Tivoli	
2	2.5 Perform a review of existing street name signing and upgrade with new signs with standard font size and type.	NYSDOT	NYSDOT	
2	2.6 Review existing signing along NYS Route 9G to determine if some can be consolidated or removed or relocated further away from intersections to reduce sign clutter.	NYSDOT	NYSDOT	
2	2.7 Install route marker signs at the westbound CR 78 (West Kerley Corners Rd) approach to NYS Route 9G	NYSDOT	NYSDOT	
2	2.8 Remove existing “No Stopping Anytime” and pedestrian crossing warning signs along NYS Route 9G in the vicinity of the Bard College Entrance Road (opposite Two Boots).	NYSDOT	NYSDOT	
2	2.9 Add pavement markings to delineate on-street parking spaces along both sides of CR 78 (Broadway) east and west of Montgomery Street/North Road.	Village of Tivoli	Village of Tivoli	
2	2.10 Check mounting height of signs and adjust as appropriate. The Safety Assessment Team noted a stop sign on the westbound River Road approach of CR 103 (Annandale Rd) that appeared high.	NYSDOT, DCDPW, Town of Red Hook, Village of Tivoli	NYSDOT, DCDPW, Town of Red Hook, Village of Tivoli	

Issue(s)	Strategy	Responsible Stakeholder		Status / Comments
		Implementation	Maintenance	
2	2.11 Trim vegetation and/or relocate signs to avoid sign obstructions.	NYSDOT, DCDPW, Town of Red Hook, Village of Tivoli	NYSDOT, DCDPW, Town of Red Hook, Village of Tivoli	
2	2.12 Continue vegetation trimming operations along CR 103 (Annandale Rd), CR 78 (West Kerley Corners Rd) and NYS Route 9G to maintain a clear roadside, clear visibility of signs and maximize sight distance conditions.	NYSDOT, DCDPW, Town of Red Hook, Village of Tivoli	NYSDOT, DCDPW, Town of Red Hook, Village of Tivoli	
2	2.13 Install “No Turn on Red” signs at the eastbound River Road and westbound Kelly Road approaches to NYS Route 9G.	NYSDOT	NYSDOT	
2	2.14 Relocate 25 MPH speed limit sign along CR 103 (Annandale Rd) just west of NYS Route 9G further to the west.	DCDPW	DCDPW	
3	3.1 Install roadside delineators were none exist along curved sections of CR 103 (Annandale Rd) and NYS Route 9G to better delineate roadway alignment.	DCDPW & NYSDOT	DCDPW & NYSDOT	
5	5.1 Replace all damaged guiderail along NYS Route 9G within the study area.	NYSDOT	NYSDOT	

Intermediate Term Strategies (to be implemented within 1 to 3 years)

Issue(s)	Strategy	Responsible Stakeholder		Status / Comments
		Implementation	Maintenance	
1	1.11 After a three year period, assess the effectiveness of the reduced speed limit along CR 103 (Annandale Rd) and NYS Route 9G to determine if this action has helped to reduce the overall number of crashes and the frequency of crashes citing "Unsafe Speed" as a contributing factor. Supplement the existing speed limit signs with permanent driver-feedback speed limit signs as necessary.	DCDPW & NYSDOT	DCDPW & NYSDOT	
1	1.12 After a three year period, assess the effectiveness the flashing signal and larger stop signs at the intersection of NYS Route 9G and CR 78 (Broadway/West Kerley Corners Rd) to determine if this helped to reduce the frequency and severity of crashes at this location.	NYSDOT	NYSDOT	
2	2.14 Develop an improved wayfinding signing plan that better informs visitors (often new and unfamiliar with the area) how to efficiency access the campus, as well as the other points of interest.	Bard College	Bard College	
2	2.15 Conduct a pedestrian origin-destination study to assess pedestrian crosswalk locations along CR 103 (Annandale Rd) (between south and north Campus Road to determine if there is an opportunity to better locate them and/or consolidate the number of them.	DCDPW & Bard College	DCDPW & Bard College	
2	2.16 Consider installing rectangular rapid flashing beacons (RRFBs) at pedestrian crossings along CR 103 (Annandale Rd) between south and north Campus Road.	DCDPW & Bard College	DCDPW & Bard College	

Issue(s)	Strategy	Responsible Stakeholder		Status / Comments
		Implementation	Maintenance	
4	4.1 Evaluate the skid resistance characteristics of the pavement surface along the northbound NYS Route 9G approach to River Road/Kelly Road and, if warranted, program an improvement project to address this potential condition.	NYSDOT	NYSDOT	
5	5.2 Evaluate the need for upgrading existing guiderail and end treatments for conformance to the latest applicable standards and to evaluate the need for additional guiderail along the study roadways.	NYSDOT	NYSDOT	

Long-Term Strategies (to be implemented 3 years +)

Issue(s)	Strategies	Responsible Stakeholder		Status / Comments
		Implementation	Maintenance	
1	1.13 Incorporate traffic calming improvements along CR 103 (Annandale Rd) to alert motorists as they approach and travel through the college campus area and encourage lower vehicle speeds. These improvements could involve incorporating a raised or textured pavement surface, curb bump-outs or a narrower pavement section with the objective of better informing motorists that they are about to enter and drive through a section of roadway that has frequent pedestrian activity. Gateway elements should also be considered as they are also effective at modifying driver behavior and mindset and can also be considered at locations along CR 103 (Annandale Rd) near the limits of the campus.	DCDPW & Bard College	DCDPW & Bard College	
1	1.14 Incorporate traffic calming improvements along NYS Route 9G that would encourage motorists to reduce their speed as they approach and travel through the study area. These improvements could involve gateway elements such as a narrower curbed pavement section and/or roundabouts with the objective of modifying driver behavior and mindset and helping to reduce driver speed.	NYSDOT	NYSDOT	
1	1.15 Develop an off-road, multi-use path, such as the Tivoli Bays connection recommended in Walk Bike Dutchess, which would accommodate pedestrians and bicyclists travelling between the Bard College area and the Village of Tivoli.	NYSDOT, DCDPW, Town of Red Hook, Village of Tivoli, Bard College, NYSDEC	NYSDOT, DCDPW, Town of Red Hook, Village of Tivoli, Bard College, NYSDEC	

Issue(s)	Strategies	Responsible Stakeholder		Status / Comments
		Implementation	Maintenance	
3	3.2 Construct roadway improvements at the intersection of Budds Corners Road and NYS Route 9G to better control, channelize and facilitate efficient movements at the intersection. This will involve reducing the pavement area at the intersection and re-aligning the Budd's Corners Road approach so it is more perpendicular to NYS Route 9G [See Exhibit A.2 in Appendix A for conceptual improvement plan for this intersection].	DCDPW & NYSDOT	DCDPW & NYSDOT	
3	3.3 Construct roadway improvements at the intersection of Cruger Island Road and CR 103 (Annandale Rd) to better control, channelize and facilitate efficient movements at the intersection. This will involve reducing the pavement area at the intersection and re-aligning the Cruger Island Road approach so it is more perpendicular to CR 103 (Annandale Rd) [See Exhibit A.3 in Appendix A for conceptual improvement plan for this intersection].	DCDPW & Bard College	DCDPW & Bard College	