

Highway 13 and Blueberry Road

Road Safety Audit/Assessment

Red Cliff, Wisconsin

May 20 – 21, 2009



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1. Introduction

1.1. Objectives of Study

The objective of this study was to complete a road safety audit/road safety assessment (RSA) for Highway 13 and Blueberry Rd. in Red Cliff, Wisconsin (see Figure 1). The study area is located on tribal lands of the Red Cliff Band of Lake Superior Chippewa. The study limits along Highway 13 include the area from Bresette Hill Rd. to the Buffalo Bay store, approximately 0.25 miles north of Blueberry Rd. The study also included Blueberry Rd. from Highway 13 to Daley Rd.

1.2. Background

Highway 13 is a two-lane, rural State trunk highway, providing a north-south connection between the communities of Wisconsin Dells, Wisconsin Rapids, Marshfield, and Ashland. Locally, this road serves as a commuter route between the communities of Bayfield and Red Cliff and also accommodates tourist traffic visiting local attractions such as the Isle Vista Casino, Town of Bayfield, and the Apostle Islands National Lakeshore (National Park). There are approximately 50,000 visitors annually to the National Parks alone. Pedestrian, bicycle, and ATV activity in the study area is generated by the Isle Vista Casino, school bus stops, commercial developments, and residential areas. Other attractions include the annual polo event, which creates traffic congestion issues at the intersection of Highway 13 and Pike Rd.

Blueberry Rd. is a two-lane, rural local road, primarily serving residents of the Red Cliff community. Blueberry Rd. is a north-south road, intersecting Highway 13 near Isle Vista Casino and continuing north to Lake Superior. Approximately 100 additional housing units are planned off of Blueberry Rd. (on Daley Rd.), which is expected to increase the population in Red Cliff to approximately 2,000 by 2015, nearly a 50 percent increase. Other planned redevelopments in the area include a new medical clinic on the west side of Highway 13 at Pike Rd. and a new Casino facility to be located on the west side of Highway 13 near the existing facility. Any new developments will increase traffic volumes within the study area and likely increase pedestrian activity. As such, it is necessary to anticipate the increased potential for conflicts between pedestrians and vehicles and develop short-, intermediate-, and long-term strategies to provide safe and efficient facilities for both pedestrians and vehicles.

In 2004, a separate safety evaluation was performed along Highway 13 in a joint effort between the Wisconsin Department of Transportation (WisDOT) and the Red Cliff community. The goal of the study was to improve safety for pedestrians and motorists on and along Highway 13 from Bresette Hill Rd. to Aiken Rd. from an uncomfortable level to a comfortable level by October 2005. Several safety issues were identified, including a lack of safety education for youths, speeding, lack of sidewalks, lack of signing, and a general lack of the 3 E's (engineering, enforcement, and education). Recommendations were developed as part of this effort and strides have been made to enhance signing and markings and provide education at the Early Childhood Center (ECC) and community meetings.

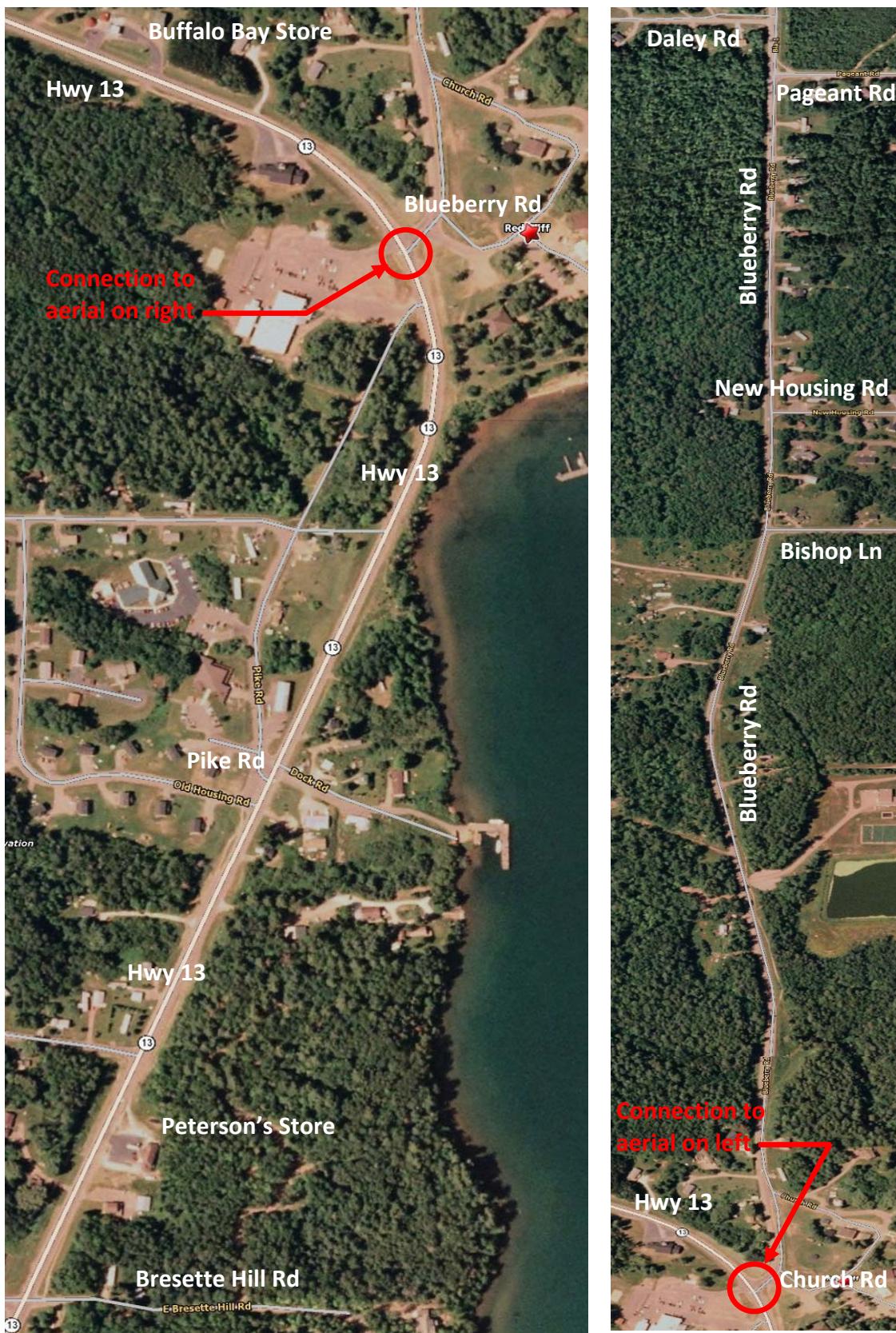


Figure 1. Study Area

There are also several planned improvements for Highway 13 at various stages in the planning and design process. WisDOT has developed preliminary design plans for a pavement replacement project, including the portion of Highway 13 through the Red Cliff reservation. Improvements identified on the preliminary plans included pavement replacement, a right-turn lane for northbound Highway 13 at Blueberry Rd., and the provision of a sidewalk or walkable shoulder along portions of Highway 13. The Red Cliff community has also signed a memorandum of understanding (MOU) with WisDOT to incorporate sidewalks and lighting along Highway 13 within the study area. Prior to the RSA, the Red Cliff community completed a Transportation Enhancement Application (TEA) to apply for American Recovery and Reinvestment Act (ARRA) funding. The TEA included conceptual drawings to incorporate additional safety improvements and enhance continuity and connectivity for pedestrians and bicyclists throughout the area. Specifically, the TEA illustrated a trail, pedestrian lighting, pedestrian plazas, and streetscaping along Highway 13. The concept drawings also illustrated median islands and designated pedestrian crossings at the intersections of Highway 13 with Blueberry Rd. and Pike Rd. The TEA has since been approved and will move forward to design. With the approval of the TEA, the WisDOT project will now focus on the pavement replacement, and the ARRA-funded project will focus on the intersection, median, lighting, and pedestrian enhancements.

Four vehicle and two ATV crashes were reported in the study area between January 1, 2006, and December 31, 2008. An additional 13 unreported crashes occurred within the study area, but generally resulted in minor property damage and, as such, no police report was filed. The purpose of this RSA was to identify safety issues that may be contributing to the reported crashes along the corridor and to identify potential measures to mitigate these issues. Another goal of the RSA was to review planned improvements for the area, incorporate the RSA findings with the planned improvements where applicable, and to help facilitate communication among the Red Cliff community, WisDOT, and the Bureau of Indian Affairs (BIA).

The RSA team consisted of members from the Red Cliff Tribe, WisDOT, Red Cliff Police Department, Michigan Tribal Assistance Program, Bureau of Indian Affairs, and VHB, Inc. The RSA was performed on May 19 - 20, 2009, during daytime and nighttime hours.

2. Existing Conditions

2.1. Site Characteristics and Pedestrian Accommodations

Highway 13 is a two-lane, rural road. There are paved shoulders throughout the study area, but the width varies from approximately 6 feet at the south end of the study area to 3 feet north of Blueberry Rd. Curb and gutter are located intermittently on both sides of the road along the southern end of the study area. There are centerlines and edge lines provided throughout the study area. The speed limit is posted at 35 mph through the study area, but is 55 mph to the north and 45 mph to the south. The RSA team also investigated the unsignalized intersections of Highway 13 with Pike Rd. and Blueberry Rd. There are pedestrian crossings at three locations along Highway 13: Peterson's Store, Pike Rd., and Blueberry Rd. This area is served by Bay Area Rural Transit (BART) as well as several school buses to provide transportation to/from Bayfield schools.

Blueberry Rd. is a two-lane rural road with 4-ft paved shoulders on the east side and no paved shoulders on the west side. At one point where there is a bridge, a pedestrian walkway has been recently added to separate pedestrians and vehicles. Blueberry Rd. has a painted centerline and edge lines within the study area. The speed limit is posted at 25 mph.

2.2. Traffic Data

The average daily traffic (ADT) along Highway 13 in the study corridor is approximately 1,000 vehicles per day, which increases to nearly 3,500 vehicles per day in Bayfield. The traffic volumes are, however, significantly greater during the late spring through the summer as tourist activity increases. Pedestrians and ATVs were observed along the shoulders of Highway 13 and Blueberry Rd. during both day and night. Bicyclists were also observed during the day along the shoulders of Highway 13 and Blueberry Rd.

2.3. Crash Analysis

The Red Cliff Police Department provided three years of crash data, including vehicle and ATV crashes along Highway 13 and Blueberry Rd. During that period there were 5 reported crashes on Blueberry Rd. and 1 crash on Highway 13 in the study area. There were 13 additional “unreported” crashes in the study area, resulting in minor or no injury or property damage (see Appendix A for crash details). There is no apparent pattern for the reported crashes in the study area. For those unreported crashes, nearly all were run-off the road during nighttime or wet/snowy road conditions.

3. Assessment Findings

3.1. Safety Benefits of Existing Roadway Features

Based on a review of existing site conditions, there are several notable roadway features that enhance pedestrian and bicycle safety in the study area, namely:

- **Positive Attitude and Cooperation from Red Cliff Community, WisDOT, and BIA –** Throughout the course of the RSA process, the Red Cliff community, WisDOT, and BIA provided support and were open to suggestions for improvements. This attitude will help to maintain a long-term commitment to improving safety for the Red Cliff community.
- **Paved Shoulder on Blueberry Rd. –** A paved 4-ft shoulder is provided on the east side of Blueberry Rd. from Church Rd. to Pageant Rd. This is used by both pedestrians and bicyclists traveling to and from residential areas along Blueberry Rd.

Designated Walkway along Bridge – A separate pedestrian/bicycle facility is provided at the bridge along Blueberry Rd. connecting to the paved shoulder (see photo, right). A w-beam barrier



provides positive separation between vehicles and the pedestrians/bicyclists. This is noteworthy because bridges on rural roadways often create choke points along the roadway, causing pedestrians and bicyclists to travel in the roadway with vehicles; in this case separation is maintained for pedestrians and bicyclists.

- **Education Efforts for Safe Pedestrian Behavior** – The Red Cliff Police Department has taken steps to educate the community on safe pedestrian and bicycle behavior. Specifically, the Red Cliff Police Department has provided educational campaigns at community meetings as well as the ECC daycare facility (ages 0-6).

3.2. Safety Benefits of Planned Roadway Improvements

There are also several planned and conceptual improvements for the area. Based on a review of design plans and concept drawings, there are several notable roadway features that enhance pedestrian and bicycle safety in the study area, namely:

- **Positive Separation and Buffer** – The proposed conceptual designs show positive separation through the use of a buffer strip between the travel lane and sidewalk along Highway 13, south of Blueberry Rd. This creates a safer and more comfortable environment for pedestrians by increasing the distance from vehicle traffic.
- **Installation of Right- and Left-Turn Lanes** – Currently, drivers are using the shoulder to decelerate and encroaching on the pedestrian waiting area on the southeast corner of Blueberry Rd. and Highway 13. The planned WisDOT pavement replacement project shows the addition of a northbound right-turn lane on Highway 13 at Blueberry Rd. A separate right-turn lane will provide separation for the slower turning vehicles and allow them to decelerate prior to the turn, without encroaching on the pedestrian waiting area. While turn-lane improvements were initially included as part of the WisDOT pavement replacement project, intersection improvements will now be included as part of the ARRA-funded improvements as discussed in Section 1.2.
- **Continuous Lighting** – There is currently lighting along the study corridor, but there are inconsistencies, including spacing, set-back, and maintenance of bulbs. The MOU between the Red Cliff community and WisDOT identifies the installation of lighting along Highway 13. This will provide an opportunity to create a more consistent lighting pattern along the segment and extend lighting north of Blueberry Rd. to the Buffalo Bay store.
- **Parallel Pedestrian Paths along Highway 13** – The Transportation Enhancement Application includes the concept of a continuous 10-ft sidewalk/shared use path along both sides of Highway 13, providing separation from traffic as well as continuity and connectivity from one end of the study area to the other.
- **Access Management at Pike Rd. and Casino Entrance** – The Transportation Enhancement Application identifies opportunities to consolidate access points at Pike Rd. and the entrance to the Casino. This will reduce conflicting movements among pedestrians and vehicles in these areas. This will also help to enhance sight distance at Pike Rd. by forcing drivers to the northern access point where sight distance is not obstructed by the crest curve to the north along Highway 13.

- **Installation of Medians** – The Transportation Enhancement Application includes concept drawings for a raised median along Highway 13 at the intersections of Pike Rd. and Blueberry Rd. There are currently pedestrian crossings located at or near these intersections. Raised medians will provide refuge for pedestrians crossing and may help with traffic calming (speed reduction).
- **Focused Crossing Locations** – The Transportation Enhancement Application includes concepts for pedestrian crossings at the intersections of Highway 13 and Blueberry Rd. (Figure 2) and Highway 13 and Pike Rd. (Figure 3). The proposed crossings provide better continuity and connectivity for pedestrians, but they also help to channelize pedestrian movements. This will hopefully result in less random crossing behaviors and establish locations where drivers can expect to see pedestrians crossing.



Figure 2. Conceptual Design for Highway 13 at Blueberry Rd.

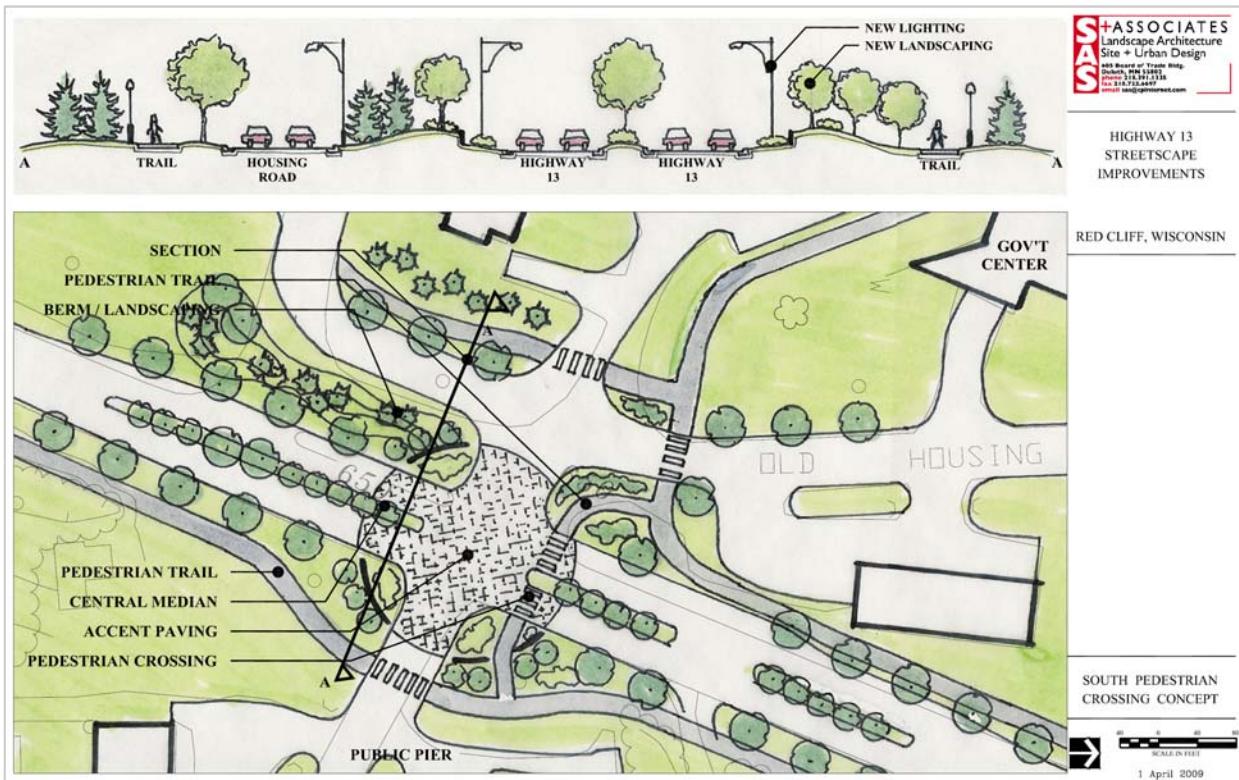


Figure 3. Conceptual Design for Highway 13 at Pike Rd.

3.3. Identified Safety Issues and Suggestions for Improvement

Despite the measures to improve safety throughout the study area, the RSA team identified 3 general issues. The RSA team members prioritized the issues based upon their perceived importance in the study area and developed suggestions to correct or mitigate the safety concerns. The RSA team also identified safety issues associated with specific locations, including two intersections and four segments. The two main intersections were 1) Highway 13 and Pike Rd., and 2) Highway 13 and Blueberry Rd. The segments included Highway 13 from Peterson's Store to Pike Rd., Highway 13 from Pike Rd. to Blueberry Rd., Highway 13 from Blueberry Rd. to Buffalo Bay Store, and Blueberry Rd. from Highway 13 to Daley Rd. The issues and suggestions are summarized in Table 3 with photos to illustrate the safety concerns.

TABLE 3. Summary of Safety Issues and Suggestions for Existing Facilities

1. Overarching Safety Issues		
Safety Issue	Suggested Improvements	Examples of Issues
<p>Pavement and pavement marking maintenance—the pavement on Highway 13 is deteriorating throughout the study area, creating several large cracks, pot holes, and unstable shoulders. These conditions present a hazard to all roadway users, but may especially present a serious hazard for motorcyclists and bicyclists who rely on smooth surfaces for stable travel. The pavement markings are also faded along Highway 13 and Blueberry Rd., which limits conspicuity during nighttime and wet weather conditions.</p>	<p><i>Intermediate</i> – Determine a schedule for the DOT pavement replacement project. If the project is scheduled in the short-term, the pavement surface will be upgraded as part of planned activities. If the pavement replacement project is not scheduled in the short-term, consider scheduling a mill and fill project to maintain the pavement surface. Coordinate restriping of the pavement markings on Highway 13 with the mill and fill or pavement replacement project. Pavement markings should also be enhanced along Blueberry Rd.</p>	 <p>Photo shows an example of pavement issues along Highway 13. The pavement is separating, creating a large crack across the entire section of Highway 13.</p>
<p>Faded crosswalk pavement markings—the crosswalk pavement markings are faded, most notably within the travel lanes. This reduces conspicuity during day and night and limits the effectiveness of the cue to drivers that pedestrians may be present.</p>	<p><i>Short-term</i> – Restripe crosswalk to increase conspicuity.</p>	 <p>Photo shows the faded crosswalk at the intersection of Highway 13 and Blueberry Rd.</p>

<p>Inconsistent cross-section—the cross-section is inconsistent through the study area. On the south end of Highway 13, there is curb-and-gutter with a 6-ft paved shoulder, but the curb and gutter are only present in certain locations. At the north end of Highway 13, there is no curb and gutter and the paved shoulder width is reduced to 3 feet. An inconsistent cross-section can lead to inconsistent driver behaviors due to the lack of expectancy. A more consistent cross-section will help to improve expectancy for drivers.</p> <p>Sample cross-sections are provided in Appendix B.</p>	<p><i>Intermediate</i> – Identify the desired cross-section for Highway 13 and coordinate this vision with the DOT pavement replacement project. Providing a consistent cross-section may help to bring about more uniform speeds and increase driver expectancy, particularly related to pedestrian activity.</p> <p>A cross-section with a median treatment may have a gateway effect and which would enhance the visual appeal through the community and help reduce traffic speeds.</p>	 <p>View of Highway 13, north of Blueberry Rd. Photo shows the inconsistent cross-section along Highway 13. The paved shoulder is approximately 3 ft in this section. To the south, the shoulder is approximately 6 ft and curb-and-gutter is installed in some locations.</p>
<p>Lack of continuity and connectivity for peds, bikes, and ATVs—there is lack of continuity and connectivity for peds, bikes, and ATVs. Pedestrians travel from residential areas along Highway 13 and Blueberry Rd. to several locations along Highway 13, including stores (Peterson's and Buffalo Bay), the Casino, the lake side, and the medical clinic without continuous, clearly defined paths. There is no paved shoulder along the west side of Blueberry Rd. and the shoulder width on Highway 13 is reduced from 6-ft south of Blueberry Rd. to 3 feet north of Blueberry Rd. This limits the separation between vehicles and pedestrians.</p> <p>There are several marked pedestrian crossings along Highway 13, but there are no designated facilities to provide safe connections to the crossings. For ATVs, there are trails along Highway 13, but the trail is discontinuous forcing riders to cross Highway 13 in several locations to stay on the trail.</p>	<p><i>Long-term</i> – Consider developing an overall ped/bike/ATV plan. An origin-destination study should be conducted to identify the major attractors and preferred routes. Facilities for pedestrians, bikes, and ATVs should be considered to provide continuity and connectivity between residential areas and the major attractors.</p> <p>There is also an opportunity to identify parking areas for ATVs prior to Peterson's Store. This may help to limit the number of ATVs crossing Highway 13 and reduce the amount of ATV traffic traveling along Highway 13 to Peterson's Store.</p>	 <p>Photo illustrates the lack of continuity and connectivity at the intersection of Highway 13 and Blueberry Rd. The marked crosswalk leads pedestrians across Highway 13, but there are no pedestrian facilities provided on either side.</p>

<p>Vehicles turning into/out of Isle Vista Casino</p> <p>Casino—there are multiple access points for the Isle Vista Casino, which create several safety issues.</p> <ul style="list-style-type: none"> When vehicles are exiting from both access points at the same time, they create sight obstructions for each other. The location of the access points along the inside of a horizontal curve creates additional sight distance issues to the north and south. Multiple access points within close proximity also create several conflicting movements and increases driver workload. 	<p><i>Intermediate</i> – Consider consolidating the access points at Isle Vista Casino to provide access at the intersection of Blueberry Rd.</p>	 <p>View of access points to Isle Vista Casino from Highway 13 looking southbound.</p>
<p>Multiple intersections in close proximity—the intersection of Blueberry Rd. and Highway 13 is in close proximity to the intersection of Blueberry Rd. and Church Rd. This creates a very wide pavement surface. To compound the issue, there are few pavement markings to channelize vehicles and pedestrians.</p>	<p><i>Short-term</i> – Provide better channelization through the intersections of 1) Blueberry Rd. and Church Rd. and 2) Highway 13 and Blueberry Rd. through the use of pavement markings.</p>	 <p>View from the east side of the intersection of Blueberry Rd. and Church Rd. looking west toward Highway 13. Photo shows the close proximity of the intersections and lack of pavement markings.</p>

<p>Drivers using shoulder as turn lane—drivers traveling northbound on Highway 13 are using the shoulder as a deceleration/turn lane to Blueberry Rd. This creates a safety issue because a crosswalk is located on the southern leg of the intersection and pedestrians stand in this area while waiting for a gap in traffic.</p>	<p><i>Short-term</i> – Provide better delineation of the edge of roadway by installing pavement markings and designate refuge areas for pedestrians at waiting areas. The shoulder should be designated as a continuous walkable shoulder with connection to the north along Blueberry Rd.</p> <p><i>Intermediate</i> – As discussed previously, there is an opportunity to create a consistent cross-section through the community. Consider installing curb and gutter as part of the community cross-section. A curb will help to separate pedestrians from vehicular traffic. Curb ramps would also need to be installed at crossing locations as part of this option.</p>	 <p>View of intersection of Highway 13 and Blueberry Rd. Photo shows a driver using the shoulder as a right-turn lane. There is a crosswalk at this location and pedestrians are often waiting on the corner.</p>
<p>Run-off/washout—the slope of the driveway and lack of drainage control in the Isle Vista Casino parking lot creates drainage issues, including run-off into the roadway and washout from the parking lot into the ditch.</p>	<p><i>Intermediate</i> – There is an opportunity to mitigate run-off issues if the access points at Isle Vista Casino are consolidated and the southern access point is closed.</p>	 <p>View of the southern access point at the Isle Vista Casino. Photo shows where debris from the parking lot has washed out into the ditch.</p>

2. Intersection: Highway 13 and Pike Rd.

Safety Issue	Suggested Improvements	Examples of Issues
<p>Location and condition of crosswalk—the crosswalk is located in a passing zone, which creates a major safety issue for pedestrians. With this configuration, drivers slowing for a crossing pedestrian may be passed by a driver who is unaware of the pedestrian. To compound the issue, the pavement markings are faded, most notably within the travel lanes. This reduces conspicuity during day and night and limits the effectiveness of the cue to drivers that pedestrians may be present.</p>	<p><i>Short-term</i> – Restripe the centerline, changing the markings from a passing zone to a no passing zone. Also, restripe the crosswalk to increase the conspicuity of the pavement markings.</p> <p>Consider installing an advance pedestrian warning sign along Highway 13 to warn southbound drivers of the upcoming crosswalk.</p> <p><i>Intermediate</i> – As discussed in the Overarching Issues (<i>Inconsistent cross-section</i>), there is an opportunity to install a median along Highway 13. If it is not desirable to install a raised median throughout the community, a painted two-way left-turn lane can be painted between the gateway locations with a raised median at critical pedestrian crossing locations, including the intersection at Pike Rd. Raised medians provide a pedestrian refuge and increase driver expectancy, particularly related to pedestrian activity. This is discussed further in Appendix B.</p>	 <p>Photo shows the location and condition of the crosswalk at the intersection of Highway 13 and Pike Rd.</p>

<p>Vehicles turning into/out of access points— there are multiple access points at this location as well as a bus stop and pedestrian crossing. This increases driver workload and creates several potential conflict points.</p> <ul style="list-style-type: none"> When vehicles are exiting from both roads at the same time, they create sight obstructions for each other. The access points are also located just south of a vertical curve, which creates additional sight distance issues, particularly for drivers on Community Rd. 	<p><i>Intermediate</i> – Consider consolidating the access points, closing the intersection of Highway 13 and Community Rd. This will direct drivers to the intersection at Pike Rd., which has better sight distance over the vertical curve to the north.</p>	 <p>View of Community Rd. and Highway 13 looking north toward the intersection of Pike Rd. and Highway 13. Photo shows where two vehicles are creating sight obstruction for each other.</p>
<p>Multiple intersections in close proximity— the intersection of Pike Rd. and Highway 13 is in close proximity to the intersection of Community Rd. and Highway 13. There is also a paved road parallel to Highway 13, connecting the two access points. This creates a very wide pavement surface and several conflicting movements. To compound the issue, there are few pavement markings to channelize vehicles and pedestrians.</p>	<p><i>Short-term</i> – Provide better channelization through the intersections of 1) Pike Rd. and Highway 13 and 2) Community Rd. and Highway 13 through the use of stop bars, centerlines, and edgelines. Appendix C illustrates one option for enhancing delineation.</p> <p><i>Intermediate</i> – Consider consolidating the access points as discussed previously.</p>	 <p>View the intersections of Community Rd. and Highway 13 and Pike Rd. and Highway 13, looking north along Highway 13. Photo shows the close proximity of the intersections and lack of pavement markings.</p>

<p>Traffic Control Issues—there are a lack of pavement markings through the intersections of Pike Rd. and Highway 13 and Community Rd. and Highway 13. The STOP sign at the intersection of Pike Rd. and Highway 13 is improperly located on the left side of the intersection.</p>	<p><i>Short-term</i> – Provide better channelization (STOP bars, centerlines, and edge lines) through the intersections of 1) Pike Rd. and Highway 13 and 2) Community Rd. and Highway 13. A schematic drawing is provided in Appendix C to illustrate the placement of pavement markings and STOP signs.</p> <p>Relocate the STOP sign to the right side of the intersection of Pike Rd. and Highway 13.</p>	 <p>View of the intersection of Highway 13 and Pike Rd., looking south on Pike Rd. Photo shows the lack of pavement markings, improper location of the STOP sign on the left side of the road, and the inconsistent school crossing sign.</p>
<p>Inconsistent bus activity—the team observed three buses stopping at the intersection of Pike Rd. and Highway 13 in the afternoon to drop-off students. The drivers were inconsistent when stopping:</p> <ul style="list-style-type: none"> • Bus 1: pulled into the access point and used the bus shelter as a stopping location. Students walked west into the community. • Bus 2: pulled into the access point and used the bus shelter as a stopping location. Students walked west into the community, but some students crossed Highway 13 and walked east toward the lake. This creates a safety issue because the bus is not stopping traffic on Highway 13 to provide a safe crossing for eastbound pedestrians. • Bus 3: stopped on Highway 13. The bus parked on the crosswalk, forcing the student to cross into the intersection of Pike Rd. 	<p><i>Short-term</i> – Work with the schools to better coordinate bus activity. A plan could be developed to minimize the number of children crossing Highway 13. For children heading west into the community, the buses should use the bus shelter as the drop-off point. For children traveling east, the bus should stop on Highway 13.</p> <p><i>Intermediate</i> – Consider the potential to install sidewalks or trails along Highway 13. This may enable bus stops to be consolidated and reduce delays for other vehicles.</p>	 <p>Photo shows a bus dropping a student off at Pike Rd. along Highway 13. The bus stopped in the crosswalk, forcing the student to cross the road into the center of the intersection.</p>

3. Segments: Blueberry Rd.

Safety Issue	Suggested Improvements	Examples of Issues
<p>Lack of paved shoulder—there is a paved shoulder along the east side of Blueberry Rd., but not along the west side. Pedestrians choosing to use the paved shoulder must travel with their back to traffic in the northbound direction, increasing the risk of a crash. Furthermore, bicyclists use this shoulder to travel northbound and southbound conflicting with pedestrian traffic on the shoulder. The risks of walking along the roadway in the same direction as traffic are far greater than the risks of walking against traffic. A 1995 statewide study of pedestrian fatalities in Florida found that pedestrian fatalities were four times more likely to occur when the pedestrian was walking with traffic as opposed to against traffic. Another study conducted in Australia showed that, in three states, walking with traffic crashes were between 1.5 and 3.5 times greater than walking against traffic crashes (Cairney).</p>	<p><i>Intermediate</i> – Consider installing a 4' paved shoulder along the west side of Blueberry Rd.</p> <p><i>Long-term</i> – Consider opportunities to provide a separate mixed-use trail parallel to Blueberry Rd.</p>	 <p>View of Blueberry Rd. looking northbound. Photo shows a pedestrian traveling with their back to traffic because they chose to use the 4-ft paved shoulder.</p>

<p>Clear zone issues—traveling southbound on Blueberry Rd., there is a horizontal curve to the left (south of Bishop Ln). There is a limited unpaved shoulder, steep embankment, and trees at the bottom of the slope, which create a safety issue.</p>	<p><i>Short-term</i> – Consider installing post-mounted delineators along the outside of the curve on Blueberry Rd.</p>	 <p>View of Blueberry Rd. looking southbound. Photo shows the horizontal curve to the left with a steep embankment on the right.</p>
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4. Segment: Highway 13 from Peterson's Store to Pike Rd.

Safety Issue	Suggested Improvements	Examples of Issues
<p>Location and condition of midblock crosswalk—there is a midblock pedestrian crossing just north of the entrance to Peterson's store. Drivers traveling northbound are just transitioning from a 45 mph section into the 35 mph zone and there is a general lack of expectancy for pedestrians in this area due to the rural cross-section. In addition, the pavement markings are faded, which reduces the visibility of the crosswalk.</p> <p>Aside from the lack of expectancy, the crossing is located in a passing zone. The crossing should not be located in a passing zone for reasons discussed previously in #3: <i>Highway 13 and Pike Rd. (location and condition of crosswalk)</i>.</p> <p>The crosswalk is also located to the north of Peterson's store. Pedestrians traveling from the south to Peterson's store are not likely to go out of their way to use the crossing. The RSA team observed such behaviors where pedestrians were crossing at the driveway to Peterson's store (not at the crosswalk) when walking from the south.</p>	<p><i>Short-term</i> – Consider relocating the crosswalk further south to better align with Peterson's store and provide a more convenient crossing location for pedestrians walking northbound.</p> <p>Consider upgrading the signs to fluorescent yellow green and upgrade pavement markings (better retroreflectivity) to increase the visibility and conspicuity of the crossing.</p> <p>Restripe the centerline to make the area a no passing zone.</p> <p>Place post-mounted delineators on shoulders between shoulders and travel lanes at crossing to discourage vehicle encroachments of shoulder where pedestrians may wait to cross.</p> <p><i>Intermediate</i> - Consider installing lighting in coordination with the planned improvement projects to increase visibility of pedestrians at night. Consider installing a median refuge with the application of a median treatment as discussed in Issue 3 (<i>Location and condition of crosswalk</i>). This is discussed further in Appendix B.</p>	 <p>View of crosswalk along Highway 13 traveling northbound (near Peterson's store). Photo shows the condition of the crosswalk markings and the location in a passing zone.</p>  <p>View of Highway 13 looking southbound near Peterson's store. Photo shows the similar look and feel to the cross-section as drivers enter the 35 mph zone (traveling northbound) and the lack of expectancy for pedestrians.</p>

<p>ATVs riding along Highway 13—the team observed ATVs riding along the shoulders of Highway 13 (with and against traffic) during the day and night. ATVs are prohibited from riding on Highway 13, and this creates a specific issue at night; drivers can become confused when ATVs are riding against traffic (on the right side of the road) with their headlights on.</p>	<p><i>Short-term</i> – Increase enforcement to limit ATV traffic on Highway 13.</p> <p><i>Intermediate</i> – Consider opportunities for ATV parking lots where riders can park and then walk along Highway 13 to Peterson's store or other locations that are not accessible from existing trails.</p>	<p>The previous photo shows an ATV riding against traffic on Highway 13. A similar situation was observed at night.</p>
<p>Inconsistent cross-section—there is an inconsistent cross-section along Highway 13 near Peterson's store. The edge of roadway changes intermittently from curb-and-gutter to an open ditch. This creates a safety issue from a driver expectancy standpoint. Specifically, drivers cannot develop expectations and associate certain design features with the presence of pedestrians, a lower speed limit, and the entrance to a community.</p>	<p><i>Intermediate</i> – Develop a consistent cross-section for Highway 13 through the Red Cliff community and incorporate this concept with planned improvement projects. There are also opportunities to include design features to create a gateway to the community (e.g., a raised median at the community limits, curb and gutter through the section, a painted two-way left-turn lane or raised median through the community). These design features are also consistent with lower speed limits and may help to reduce speeds through the area. An example cross-section is provided in Appendix B.</p>	 <p>View of Highway 13 looking southbound near Peterson's store. Photo shows the inconsistent cross-section, where the edge of roadway transitions intermittently from curb-and-gutter to an open ditch.</p>

5. Segment: Highway 13 from Pike Rd. to Blueberry Rd.

Safety Issue	Suggested Improvements	Examples of Issues
<p>Inconsistent cross-section—the cross-section along Highway 13 is not consistent with the sections to the north and south. In this section there is an open ditch rather than curb-and-gutter. The shoulder width is also 6 feet, which is wider than the 3-ft shoulder to the north. The inconsistent cross-section prevents drivers from developing expectations and they may be less likely to expect pedestrians as discussed previously.</p>	<p><i>Intermediate</i> – Develop and construct a consistent cross-section as per previous discussion.</p>	 <p>View of Highway 13 between Pike Rd. and Blueberry Rd. Photo shows the relatively wide shoulders and open ditch. These design features are more consistent with a rural area that is not within a community.</p>
<p>ATVs crossing Highway 13—ATVs are not permitted to ride on Highway 13 and the existing trails are discontinuous along the road. As such, ATVs must cross Highway 13 in multiple locations to remain on the trail instead of riding along the road. These crossings increase the potential for conflict between vehicles and ATVs.</p>	<p><i>Intermediate</i> – Consider opportunities to create ATV parking areas so that riders may park and walk to destinations.</p> <p>As discussed previously, there is an opportunity to create a curbed cross-section through the community. This may help to deter midblock ATV crossings; the RSA team noted that midblock ATV crossings appear to occur in uncurbed sections.</p>	 <p>Photo shows an ATV crossing near the southern entrance to the Isle Vista Casino.</p>

6. Segment: Highway 13 from Blueberry Rd. to Buffalo Bay Store

Safety Issue	Suggested Improvements	Examples of Issues
<p>Location of access point to fire station—the access point at the fire station is relatively wide with limited sight distance to the north and to the access point for drivers traveling southbound on Highway 13 due to a crest curve. Vehicles parked along the north side of the fire station may create further sight obstructions for vehicles exiting the Casino/Blueberry Rd. due to the location of the parking on the inside of a horizontal curve.</p>	<p><i>Short-term</i> – Designate a parking area at the fire station so that vehicles do not park close to Highway 13 where they will obstruct sight distance.</p>	 <p>View of Highway 13 looking southbound near the fire station. Photo shows a crest curve to the north of the fire station, which limits sight distance to the driveway shown on the right.</p>
<p>Inconsistent cross-section—the shoulder width narrows from 6' (south of Blueberry Rd.) to 3' (north of Blueberry Rd.). This reduces the separation between vehicles and pedestrians traveling to the north of Blueberry Rd.</p> <p>Future plans identify a continuous sidewalk or shared use path along Highway 13. While there is a buffer shown to the south of Blueberry Rd., there is little or no buffer shown to the north (from Blueberry Rd. to Buffalo Bay store). A buffer helps separate pedestrians and vehicles. Providing a buffer to the north of Blueberry Rd. is particularly important because the path is along the outside of a horizontal curve, which increases the risk of run-off-road crashes.</p>	<p><i>Intermediate</i> – Consider opportunities to provide a consistent cross-section as per previous discussion.</p> <p>Plans for future sidewalks or shared-use paths should be updated to include a minimum 5-ft buffer between the roadway and the path.</p>	<p>The previous photo shows the limited shoulder width along Highway 13 to the north of Blueberry Rd.</p>

Opportunities Beyond Engineering

Public safety can be improved through education and enforcement measures as well as engineering. There are at least two opportunities to improve safety through these measures.

Public Outreach:

Education at Schools and Community Meetings: The Red Cliff Police Department has provided educational messages, including pedestrian safety, to the children at the ECC and to adults through community meetings. These educational efforts should be continued and other opportunities should be identified to include youth and teens. Future education campaigns should include information on ATV and bicycle safety in addition to pedestrian safety. Outreach should also provide information on designated areas to operate ATVs and appropriate bicycle routes.

Enforcement:

Red Cliff Police Department: The Red Cliff Police Department was represented on the RSA team and helped to identify opportunities for increased enforcement. Enforcement was not identified as a primary measure for any of the locations within the study area, but there may be an opportunity to provide spot enforcement along Highway 13 to mitigate ATVs riding on the shoulder.

While not identified during the RSA, a previous safety study identified speeding as an issue through the Red Cliff community. The RSA team identified opportunities to create a gateway and consistent cross-section through the area to provide a sense of community which should positively affect driver behavior. This is outlined in Appendix B. Another option for addressing vehicle speeds within the study area is to install electronic speed display signs on Highway 13 near the beginning of the 35 mph zones. WisDOT allows communities to install electronic speed display signs at the start of a speed zone entering a community; however, the local government is responsible for manufacture, liability, installation, and maintenance costs. For more information, refer to the State of Wisconsin Traffic Guidelines Manual, Chapter 2 (Signing), Section 1 (General), Subject 7 (Dynamic Speed Display Signs).

For more information related to education and enforcement, look at the education and enforcement measures included in the following publications:

How to Develop a Pedestrian Safety Action Plan (FHWA-SA-05-12)
<http://drusilla.hsrc.unc.edu/cms/downloads/howtoguide2006.pdf>

A Resident's Guide for Creating Safe and Walkable Communities (FHWA-SA-07-016)
http://safety.fhwa.dot.gov/PED_BIKE/ped/ped_walkguide/residentsguide.pdf

4. Conclusions

The objective of this study was to complete an RSA for the Red Cliff community, including Highway 13 from Peterson's store to Buffalo Bay store and Blueberry Rd. from Highway 13 to Daley Rd. The RSA team investigated existing safety issues, but also noted several positive safety

features throughout the study area. Safety issues were identified for the area in general as well as for two specific intersections and four roadway segments. Suggestions for mitigating issues have been identified and are described in this report.

Beyond engineering measures, road safety can be improved through education and enforcement. These measures are also discussed in the report.

The owners are invited to consider the suggested changes. To complete the RSA process, the owners may prepare a short written response to the issues and options outlined in this report. The response letter should identify the actions that will and will not be taken as well as the reason for those suggestions that are not implemented.

Appendix A: Crash Details

Road Name	Year	Severity	Time	Month	Notes
Blueberry	2006	PDO	1610	Jul	Single Vehicle (deer crash)
Blueberry (north of Church Rd.)	2006	PDO	720	May	Single Vehicle (spider in car)
Blueberry (near Bishop Rd.)	2006	A-injury	413	Apr	Single Vehicle (ATV)
Blueberry (north of Bradum Rd.)	2007	Fatal	440	May	Pedestrian (person laying in road)
Blueberry (south of Bishop)	2008	B-injury	1744	Apr	Multiple Vehicle (ATV)
STH 13	2008	PDO	1330	Jan	Multiple Vehicle

Appendix B: Sample Cross-Section

Aside from a reduced speed limit, drivers traveling on Highway 13 are not provided with any cues that they are entering the Red Cliff community. The cross-section along Highway 13 is inconsistent throughout the community and the design features are similar to those outside the community where speed limits are posted at 45 and 55 mph. As such, drivers are not recognizing the area as a rural community and speeds remain relatively high through the area.

There are several opportunities to improve the cross-section and create a “community feel”. For example, a gateway effect can be created by installing curb-and-gutter with a raised median at the entrances to the community along Highway 13. Figure B.1 shows an example of a community gateway created in an urban area. Note that plantings can be included in the median, but vegetation should be less than 24” so as not to create sight obstructions. If it is not desirable to install a raised median throughout the community, a painted two-way left-turn lane can be installed between the gateway locations. Raised medians provide a pedestrian refuge, so if a raised median is not installed through the entire community, it may be desirable to install raised medians at critical pedestrian crossing locations. The crossing locations should also include a marked crosswalk, advance pedestrian warning signs, and pedestrian crossing signs at the crosswalk.



Figure B.1. Example Gateway Effect in Urban Community

Many of these design features are identified in the conceptual plans submitted with the Transportation Enhancement Application. The conceptual plans provide illustrations of potential improvements for the intersections of Highway 13 with Blueberry Rd. and Pike Rd., but do not identify the cross-sectional design for the remainder of the corridor. Figure B.2 illustrates the existing cross-section along Highway 13 and Figure B.3 provides a sample cross-section for consideration. The roadway width can be reallocated to provide a median within the existing cross-section, but doing so eliminates the shoulders as travel lanes for pedestrians and bicyclists. As such, sidewalks would have to be provided on both sides of the road, which may be incorporated in the intermediate pavement rehabilitation project by WisDOT.

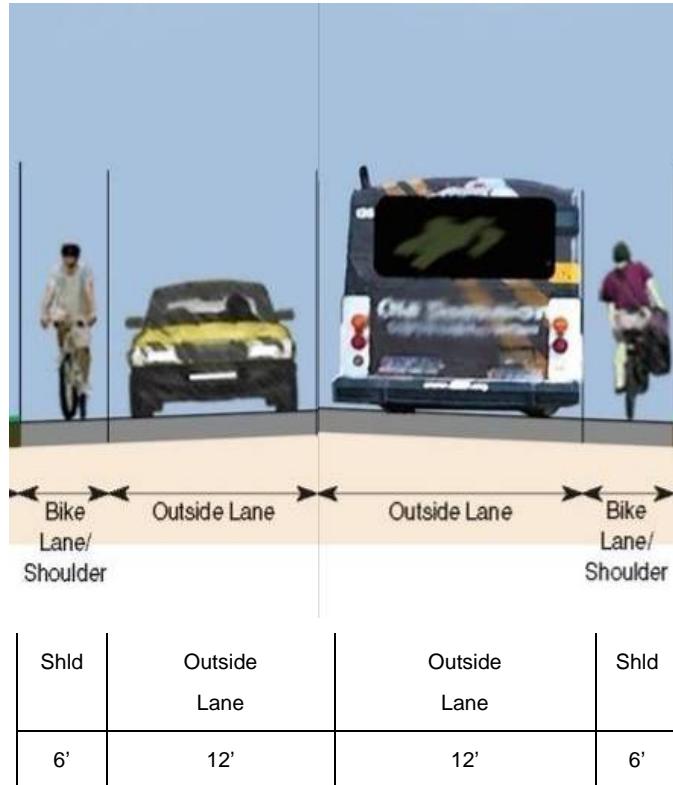
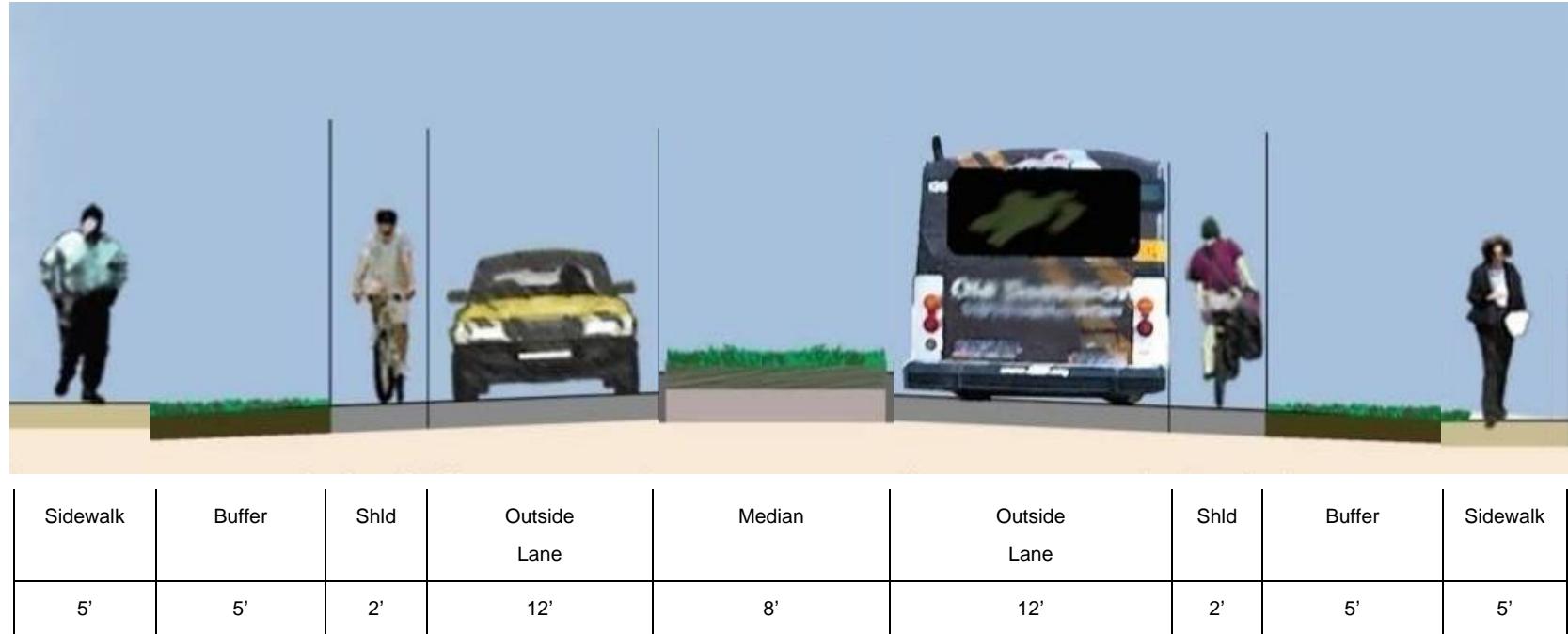


Figure B.2. Existing Cross-Section



Note: This option maintains the existing cross-section width of 36 ft as measured from the outside edge of the shoulders. While the median is labeled as 8 feet, this is the striped width and any raised portions would be 6 feet wide, maintaining the 8-ft striped width. The shoulder width (2 ft) is not sufficient for pedestrian and bicycle travel; therefore, the sample cross-section includes a buffer and sidewalks along Highway 13. The total width, including the buffer and sidewalk, is approximately 56 ft, which appears to be feasible given the information provided to the RSA team. Another variation of the sample cross-section could include curb-and-gutter rather than an open ditch. The total width would include an additional 2.5-ft standard curb on each side (between the shoulder and buffer) if the open ditch is replaced with curb-and-gutter.

Figure B.3. Sample Cross-Section with Open Ditch

Appendix C: Schematic Diagram of Highway 13 and Pike Rd/Community Rd

The following figure illustrates one option for enhancing delineation and guidance through the intersections of Community Rd and Pike Rd along Highway 13. Note the red octagons represent STOP signs and the red arrows point to the direction for which the sign is controlling. Also note that these are interim improvements until the southern access point (Community Rd) is closed as discussed in Table 3 (Issue 2).

