

**SOKAOGON CHIPPEWA BAND OF MOLE LAKE  
WISCONSIN DEPARTMENT OF TRANSPORTATION**

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FINAL REPORT

**MOLE LAKE**

**ROAD SAFETY AUDIT**





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SOKAOGON CHIPPEWA BAND OF MOLE LAKE

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FINAL REPORT

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ROAD SAFETY AUDIT

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## 1.0 INTRODUCTION

### 1.1 Background

The Sokaogon Chippewa Community in Mole Lake, Wisconsin is home to approximately 450 residents. This road safety audit (RSA) has focused on all roadways located within Mole Lake. STH 55 is the main artery through Mole Lake and is a two-lane minor arterial, posted at 35 mph through town and 55 mph north of Indian Settlement Road and south of CTH M. In 2006, STH 55 had an estimated annual average daily traffic (AADT) of 2,300 vehicles.

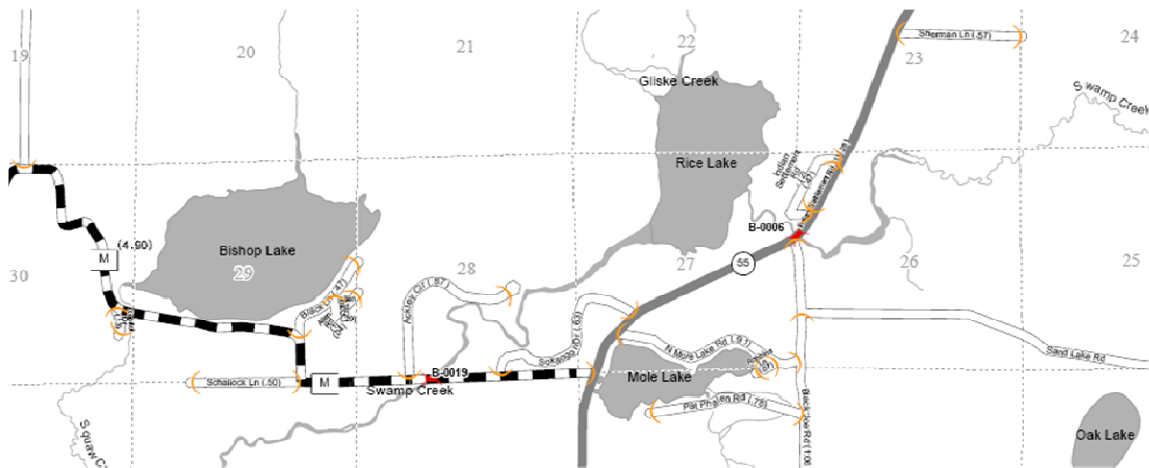


FIGURE 1.1 PROJECT LOCATION

### 1.2 Collision History

Using collision data provided by the Wisconsin Department of Transportation, over a period of five years (2003 through 2007), a total of 14 collisions were reported within Mole Lake, excluding animal crashes. As summarized in FIGURE 1.2, 42 percent of the collisions resulted in at least one injury. The remainder of the collisions involved property damage only. No fatalities were reported during the study period.

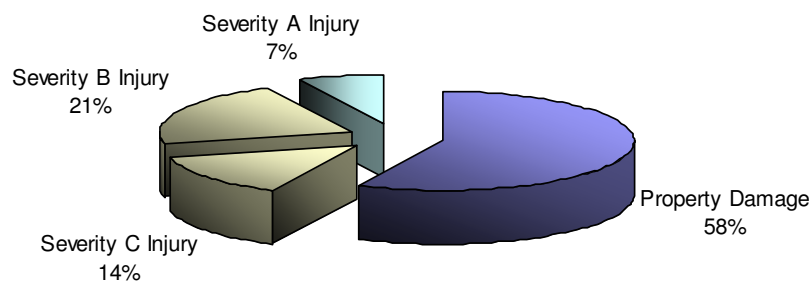
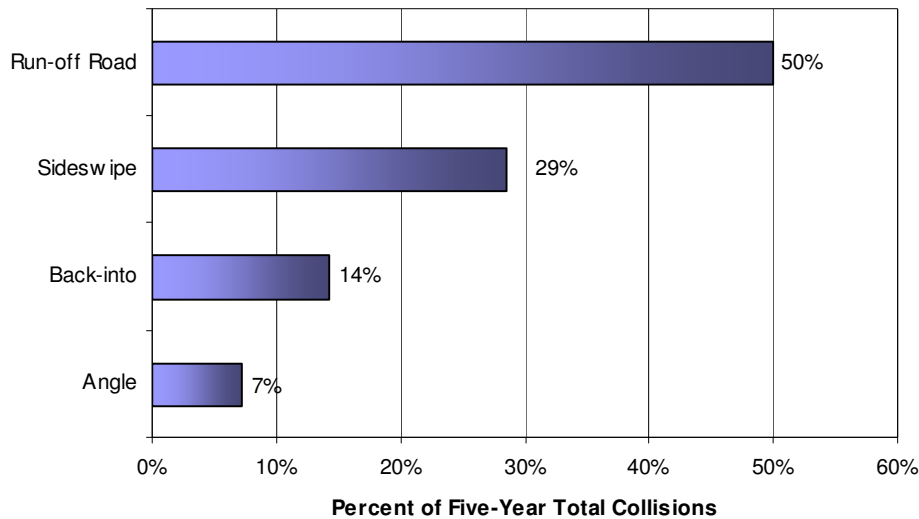


FIGURE 1.2 COLLISION SEVERITY DISTRIBUTION

Collision type distributions are summarized in FIGURE 1.3. A review of the collision types shows that run-off road collisions and sideswipe collisions are predominant, representing 50% and 29% of the collisions respectively.



**FIGURE 1.3 COLLISION TYPES**

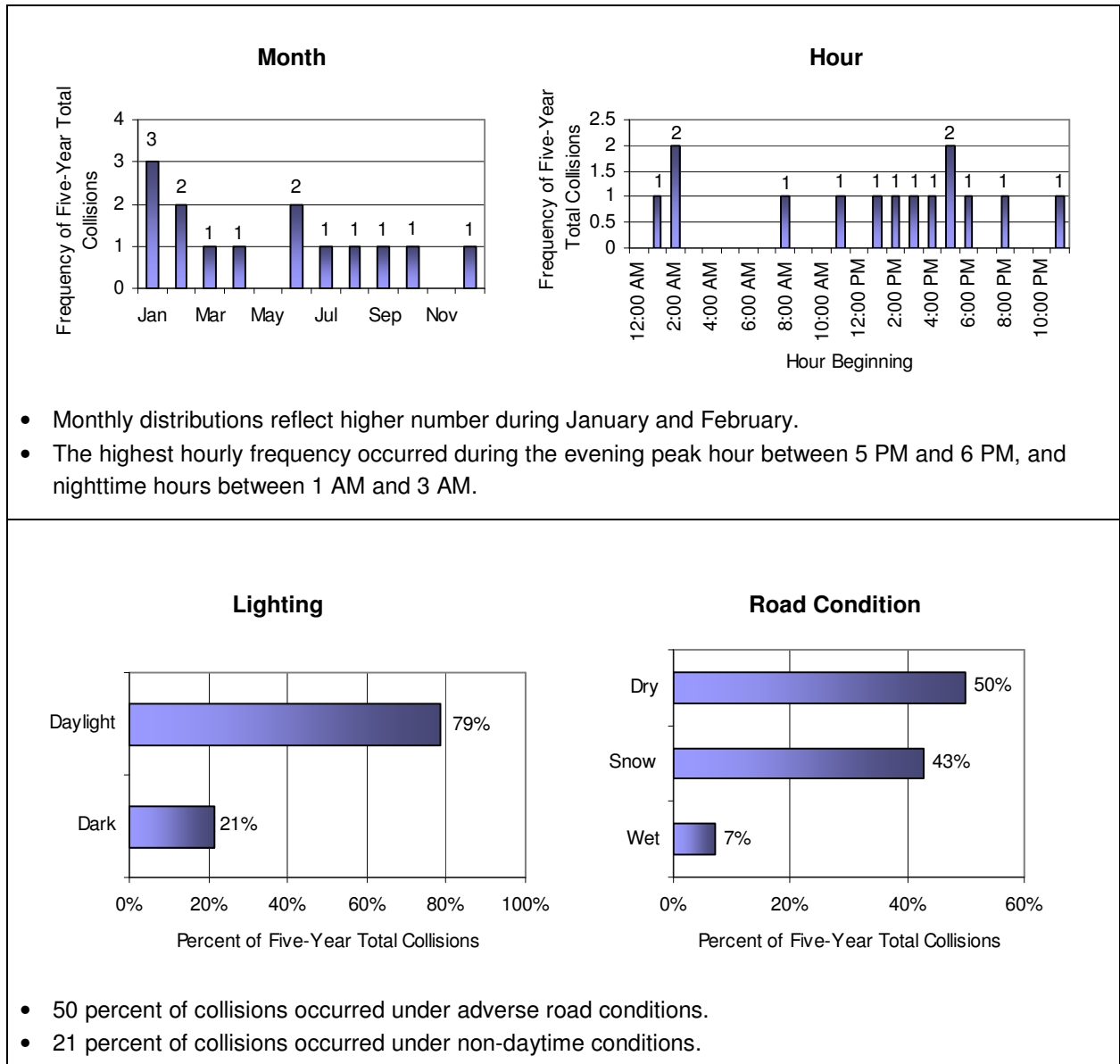
The following collision trends were observed:

- Majority of collisions occurred on STH 55 and were run-off the road including overturn, ditch, and fixed object crashes.
- Three collisions occurred on STH 55 near Indian Settlement Road.
- A cluster of collisions occurred on STH 55 near CTH M and Mole Lake Rd, including run-off road and sideswipe collisions.
- A sideswipe collision involving a right-turning vehicle and a motorcycle occurred on STH 55 south of Sand Lake Road.
- 21 percent (3 crashes) were alcohol related.

Temporal and environmental distributions are shown in TABLE 1.1. Temporal distributions suggest that commuter peaks were not a strong influence, and environmental distributions indicate that adverse weather conditions may contribute to half of the collisions.



**TABLE 1.1 TEMPORAL AND ENVIRONMENTAL COLLISION TRENDS**



### 1.3 Road Safety Audits

A RSA is a formal safety performance examination of an existing or future road or intersection by an independent audit team. RSAs help to promote road safety by identifying safety issues during the planning, design and implementation stages, promoting awareness of safe design practices, integrating multimodal safety concerns, and considering human factors.

## 1.4 Reminder

The RSA team has conducted this audit to the best of its professional abilities within the time available and by referring to available information. While every attempt has been made to identify significant safety issues, the project owner is reminded that responsibility for the design, construction, and performance of the roadway remains with the engineers of record.

## 1.5 Audit Team and Process

The RSA team and the project material on which the audit was based are described in *Section 1*.

Site visits were conducted in June 2008 to gain an understanding of the existing conditions and surroundings, observe road user behavior, and to identify existing safety concerns. Notes of the site visits are included in *Section 2*.

A road safety audit framework was applied in both the audit analysis and presentation of findings. The expected frequency and severity of crashes caused by each safety issue have been identified and rated according to the categories shown in TABLES 1.2 and 1.3. These two risk elements were then combined to obtain a risk assessment on the basis of the matrix shown in TABLE 1.4. Consequently, each safety issue is assessed on the basis of a ranking between F (highest risk and highest priority) and A (lowest risk and lowest priority).

For each safety issue identified, possible mitigation measures have been suggested. The suggestions have focused on measures that can be cost-effectively implemented at the current design stage, and consequently include few geometric changes.

**TABLE 1.2 FREQUENCY RATING**

ESTIMATED		EXPECTED CRASH FREQUENCY (per audit item)	FREQUENCY RATING
EXPOSURE	PROBABILITY		
high	high	10 or more crashes per year	<i>Frequent</i>
medium	high		
high	medium	1 to 9 crashes per year	<i>Occasional</i>
medium	medium		
low	high	less than 1 crash per year, but more than 1 crash every 5 years	<i>Infrequent</i>
high	low		
low	medium	less than 1 crash every 5 years	<i>Rare</i>
medium	low		
low	low		

**TABLE 1.3 SEVERITY RATING**

TYPICAL CRASHES EXPECTED (per audit item)	EXPECTED CRASH SEVERITY	SEVERITY RATING
crashes involving high speeds or heavy vehicles, pedestrians, or bicycles	probable fatality or incapacitating injury	<i>Extreme</i>
crashes involving medium to high speed; head-on, crossing, or off-road crashes	moderate to severe injury	<i>High</i>
crashes involving medium to low speeds; left-turn and right-turn crashes	minor to moderate injury	<i>Moderate</i>
crashes involving low to medium speeds; rear-end or sideswipe crashes	property damage only or minor injury	<i>Low</i>

**TABLE 1.4 CRASH RISK ASSESSMENT**

FREQUENCY RATING	SEVERITY RATING			
	<i>Low</i>	<i>Moderate</i>	<i>High</i>	<i>Extreme</i>
<i>Frequent</i>	<b>C</b>	<b>D</b>	<b>E</b>	<b>F</b>
<i>Occasional</i>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>
<i>Infrequent</i>	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>
<i>Rare</i>	<b>A</b>	<b>A</b>	<b>B</b>	<b>C</b>

Crash Risk Ratings:

A: minimal risk level

B: low risk level

C: moderate risk level

D: significant risk level

E: high risk level

F: extreme risk level

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## 2.0 RSA FINDINGS

### 2.1 Safety Benefits of the New Design

	<p><b>Sidewalks:</b> Sidewalks are provided along STH 55. Sidewalks provide a separation between non-motorized road users and motorized vehicles. This improves comfort and safety for pedestrians.</p>
	<p><b>Lighting:</b> Lighting is provided on STH 55, improving corridor conspicuity and visibility during nighttime hours. Lighting is particularly beneficial where pedestrians are present, by improving the visibility and driver awareness of pedestrians.</p>
	<p><b>Sand Lake Road Upgrades:</b> Sand Lake Road is a connector between STH 55 and CTH W. It also provides access to the Tribal offices and the future ATV park. The pavement was worn and cracked, in need of repair. Upgrades to Sand Lake Road are necessary and planned to be implemented next year to accommodate increased traffic due to the ATV park.</p>
	<p><b>Recognizing that ATVs are an Issue:</b> Signs prohibiting ATVs on the right-of-way were posted to enforce and warn ATV drivers of the law. The goal is to accommodate ATV users by providing separate facilities such as the ATV park and the proposed trail network.</p>

## 2.2 Summary of Audit Findings

Six main safety issues were identified, all of which have a moderate to significant risk rating. The six main issues and suggested alternatives are described in detail in *Section 5 (Issues and Suggestions)*, and are summarized in TABLE 2.1.

**TABLE 2.1 SUMMARY OF RSA SAFETY ISSUES AND SUGGESTIONS**

SAFETY ISSUE (Number and Description)		Risk Rating	Suggestions
1. All Terrain Vehicles and Dirt Bikes			
1a	Interactions of Modes	C	<ul style="list-style-type: none"> <li>▪ Multi-modal Transportation Plan</li> <li>▪ Provide alternative Barriers to Block ATVS</li> <li>▪ PI&amp;E Campaigns – BOTS Grants</li> </ul>
1b	Large Rocks	C	
2. Pedestrians			
Pedestrians walking along STH 55 have no continuous dedicated pedestrian facilities.		D	<ul style="list-style-type: none"> <li>▪ Multi-modal Transportation Plan</li> <li>▪ Establish and maintain a continuous sidewalk for pedestrians</li> <li>▪ Designated Pedestrian Crossings</li> </ul>
3. Speeds on STH 55			
Speeds above the posted speed limit increase the risk and potential severity of crashes.		C	<ul style="list-style-type: none"> <li>▪ Speed Enforcement</li> <li>▪ Narrow Lanes with Edgelines</li> <li>▪ Gateway Treatments</li> <li>▪ Permanent Speed Feedback Signs</li> </ul>
4. Signs			
4a	Sign Reflectivity	C	<ul style="list-style-type: none"> <li>▪ Minimum Retroreflectivity Standards</li> <li>▪ Upgrade Signs</li> <li>▪ MUTCD Standards</li> </ul>
4b	Sign Standards		
5. Bridge Over the Swamp Creek			
5a	Trail	C	<ul style="list-style-type: none"> <li>▪ Close Trail</li> <li>▪ Provide Pedestrian Facilities on Bridge</li> <li>▪ Separate ATV Crossing of the Swamp Creek</li> <li>▪ Lighting</li> <li>▪ Advance Intersection Signing</li> </ul>
5b	Interaction of Modes	C	
5c	Crossing STH 55	D	
5d	Intersection Visibility	D	
6. Sand Lake Reconstruction			
6a	Ten foot Lanes	B	<ul style="list-style-type: none"> <li>▪ Twelve foot Lanes</li> </ul>
6b	Intersection Control	C	<ul style="list-style-type: none"> <li>▪ Two-way Stop Control</li> </ul>

SAFETY ISSUE (Number and Description)		Risk Rating	Suggestions
6c	Turning Radius	B	<ul style="list-style-type: none"> <li>▪ Implement Right-turn Channelized Island</li> </ul>

Six safety issues have been identified in this operational stage road safety audit. Suggestions for improvements have been identified and are described in Section 5 of this 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.

## 2.3 Funding Sources

An important consideration in identifying and implementing road safety improvements is funding. The *Tribal Highway Safety Improvement Implementation Guide* (THSIP) ([http://www.fhwa.dot.gov/hep/tribaltrans/saf\\_guide.htm](http://www.fhwa.dot.gov/hep/tribaltrans/saf_guide.htm)) advises that the implementation plan for a THSIP or highway safety project will depend greatly on which funding sources the Tribe pursues, since each source has different program eligibility requirements. The website discusses several funding sources (briefly described below) that constitute some of the important government traffic safety-funding sources.

- *FHWA funds* administered by the state include the Highway Safety Improvement Program (HSIP). Funding can be used for a wide variety of improvements directed at eliminating or mitigating hazards affecting traffic safety, including safety planning and studies and safety construction. FHWA funds administered by the states also include Surface Transportation Program (STP), which provides flexible funding that can be used on rural minor collectors.
- *Transportation Enhancement Funds* assist in the funding of projects involving pedestrian facilities (including sidewalks) and scenic highways. This program typically has an 80/20 matching requirement (20 percent non-federal funds), but the tribal share may be “in kind”.
- *National Highway Traffic Safety Administration (NHTSA)* funds administered by the BIA Highway Safety Office include the *State and Community Highway Grant Program*. This program expends Section 402 funds for non-construction programs dealing with road safety, speed control, police enforcement, traffic records, and pedestrian and bicycle safety.

- The *IRR Program* jointly administered by BIADOT and the Federal Lands Highway Office and funded by FHWA, includes funds for projects to improve highway safety. Twenty-five percent of the IRR Program funds are now usable for maintenance. Examples of activities that are eligible for funding include sidewalks, installation/replacement of safety-related signs when designated as part of a highway safety project, guardrail, and pavement markings.
- The Indian Health Service *Injury Prevention Program* provides funding for basic and advanced injury prevention projects. Funding can be used to build tribal capacity for preventing any type of injury problem facing a tribal government.
- The *Public Lands Highways Discretionary Program* provides funding for improvements to roads that are open to public travel and serve federal property. This program is entirely discretionary in nature and there is no minimum level of funding for projects. Public Lands Discretionary funding requires no local match, but state and local financial support of a project is one of the factors considered when the FHWA decides which projects it will fund.



### 3.0 ROAD SAFETY AUDIT TEAM AND MATERIALS

**Location:** Mole Lake, Wisconsin

**RSA Team Members:** Jeffrey S. Bagdade, P.E. Opus International Consultants  
Nicole Thompson, EIT Opus International Consultants

**Project Owner:** Wisconsin Department of Transportation  
Sokaogon Chippewa Community

**Review Date:** June 9-11, 2008

**Review Stage:** Operational stage RSA of existing roads

**Start Up Meeting:** June 9, 2008

**Preliminary Findings Meeting:** June 11, 2008

**Attended by:** Opus International Consultants  
Wisconsin Department of Transportation  
Sokaogan Chippewa Band of Mole Lake

#### Documents Available for the RSA:

- WisDOT Town Plat Record
- Forest County AADT traffic volumes
- Collision data for 2003 through 2008
- STH 55 Plan and Profile sheets
- STH 55 Typical Section sheets
- STH 55 Cross-section sheets
- STH 55 Right-of-way Plat sheets
- Aerial photographs
- Proposed designs for Sand Lake Road

All documents were provided by WisDOT prior to or at the start-up meeting.

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## 4.0 SITE VISIT NOTES

**Project Name:** Mole Lake Road Safety Audit

**Site Visit Date:** Monday June 9 – Wednesday June 11, 2008 (dry and clear conditions)

**Network Connectivity:** STH 55 follows a north/south alignment through Mole Lake, and provides connections to the cities of Crandon, Argonne, and Nelma towards the north and Pickerel, Keshena, Shawano towards the south. CTH M ends at STH 55 and provides east/west connections to CTH Z and north/south connections to CTH B. Sand Lake Road provides access to the Tribal offices, and is a connection between STH 55 and CTH W.

**Land Uses:** The land use along STH 55 is a mix between rural, residential and commercial. The largest development along the study corridor is the Mole Lake Casino, Hotel and Conference Center.

**Road User Characteristics:** Moderate traffic volumes, consistent with the reported AADT of 2,300 vehicles, were observed.

A variety of travel modes were observed, listed below:

*Passenger cars*, reflecting use by:

- Residents of Sokaogon Chippewa Reservation for travel within Mole Lake, as well as travel to neighboring communities
- Visitors to Mole Lake and surrounding areas, including the casino, lakes, cottages, and future ATV park
- Through traffic on STH 55, including up-north traffic



*Trucks* traveling through Mole Lake consisted of primarily logging trucks. Logging trucks are extremely large and heavy, contributing to long stopping distances and reaction times. This may be a potential hazard for non-motorized road users crossing STH 55 where sight distance is limited.



*Recreational Vehicles (RVs)* have similar attributes to trucks, but drivers are less experienced.

*Buses* including tour buses and school buses. Tour buses are utilized to accommodate visitors at the Casino. School buses provide four stops for students on STH 55.



*All Terrain Vehicles (ATVs)/ Dirt Bikes*, reflecting use by:

- Traveling within Mole Lake
- Recreational use
- ATVs are prohibited on state and county highways but may be used on township roads only by ordinance and with DNR restrictions



*Snowmobiles* are present during the winter and have similar attributes as ATVs although are allowed within state right-of-way.

*Motorcycles* have similar attributes as passenger cars and may also be used as recreational vehicles.

*Bicycles* are primarily used for recreation among children.



*Pedestrians* were observed walking on sidewalks, trails and within the roadway along STH 55.

**Road and Roadside Physical Characteristics:**

- STH 55 is a two-lane rural road and curb and gutter is present north of Mole Lake Road.
- An incomplete network of sidewalks and trails are provided within Mole Lake.
- Intersections with local roads are STOP controlled on the minor approach, and access to adjacent private properties is direct and uncontrolled.
- Posted speed limits are 35 mph between CTH M and Indian Settlement Road and 55 mph north outside of town.



The RSA also included a review of the planned upgrades to Sand Lake Road. Sand Lake Road provides access to the Tribal offices and a proposed ATV park.

**Night-time Conditions:** Overhead lighting is provided along STH 55 in Mole Lake. Fair to poor sign reflectivity provided little or no guidance during night time hours.

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## 5.0 RSA ISSUES AND SUGGESTIONS

### 5.1 Safety Issue 1: All Terrain Vehicles and Dirt Bikes

#### Safety Issue 1(a): Interactions of Modes

##### Safety Issue 1(a) Description:

All terrain vehicles (ATVs) and dirt bikes have been a growing mode of travel and recreation within Mole Lake. It is an affordable method to travel short distances. ATVs do not have separate designated facilities to travel on; therefore, ATVs are forced to share the roadway with vehicles or interacting with non-motorized road users on the sidewalks and trails.



An ATV campground is proposed off of Sand Lake Road on the east of STH 55, however the ATV trails which are proposed are planned for the area west of STH 55. This will increase the volume of ATV traffic crossing STH 55.

ATVs are allowed to travel within the public right-of-way on township roads, but not on county roads and state trunk highways. During the RSA site visits, ATVs were observed traveling illegally on STH 55 (*above*).

Currently ATVs and dirt bikes utilize sidewalks and trails, which interact with pedestrians and recreational bike users. The sidewalks and trails are not wide enough to accommodate the different modes side-by-side. ATVs and dirt bikes are motorized vehicles which travel at a higher speed than pedestrians and bicyclists. This variance in speed between the modes increases the risk of a collision, resulting in severe injuries. The use of ATVs on trails can also lead to erosion, creating a hazardous walking facility for pedestrians and increasing the potential for damage to the shoulders and ditches.

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<b>Expected Crash Types:</b>	ATV crashes
<b>Expected Frequency:</b>	Infrequent
<b>Expected Severity:</b>	High
<b>Risk Rating:</b>	C (moderate risk level)

---

### Safety Issue 1(b): Large Rocks

#### Safety Issue 1(b) Description:

Large rocks have been distributed to residents in Mole Lake as a method to discourage ATVs from traveling on the front lawns of private homes. These large rocks may be considered to be potential fixed objects. The encroachment of the large rocks within the right-of-way and in some areas within the clear zone presents a hazard to vehicles that may have left the roadway, increasing the likelihood of severe fixed object collisions especially near driveways where there is a gap in the curb.



---

<b>Expected Crash Types:</b>	Fixed object crashes
<b>Expected Frequency:</b>	Infrequent
<b>Expected Severity:</b>	High
<b>Risk Rating:</b>	C (moderate risk level)

---



## **Suggestions:**

### *Multi-Modal Transportation Plan*

The tribe may consider developing a multi-modal transportation plan to identify specific facilities for pedestrians, bicycles, ATVs and dirt bikes. The ATV facilities should also take into consideration accommodating snowmobiles in the winter. Separate facilities for these different modes would reduce interactions between the different road user types and speed variations. This would lessen the likelihood of a severe injury crash occurring. Also, adequate facilities for ATVs with proper width and design would reduce the potential for erosion and increase service life of the transportation facilities.

### *Local ATV Ordinance*

A local ordinance to separate ATVs and dirt bikes from non-motorized road users (pedestrians and bicycles) may be considered to enforce the proper use of the transportation facilities. This ordinance could restrict the use of ATVs and dirt bikes from sidewalks and other non-motorized trails.

### *Provide Alternative Barriers to Block ATVs*

The tribe should consider promoting alternative barriers be used to prevent ATVs from riding on resident's lawns and sidewalks, other than large rocks. Break-away bollards may be strategically placed along lawns and sidewalks to prevent ATVs from traveling, however allowing pedestrians, strollers, and wheelchairs access. The break-away bollards will decrease the potential injury severity from a fixed object crash. An example photo is shown in SECTION 5.2.

### *Public Information and Education (PI&E) Campaigns*

A Public information and education (PI&E) campaign should accompany selective enforcement projects. PI&E campaigns maximize the impact of a safety message by raising the perceived risk in motorist's minds of being cited. The typical message for such a campaign revolves around the premise that high speeds and interaction of different modes may result in fatal and serious injury crashes. Included in this is the need to establish a suitable theme or message. Perhaps the campaign might include testimonials from residents who live on or near STH 55 about their concerns for safe travel along this roadway. PI&E campaigns should be sure to target the appropriate audience, in this case the ATV users. Keeping ATV users involved will maximize the effectiveness of the campaign.

## 5.2 Safety Issue 2: Pedestrians

**Safety Issue 2: Pedestrians walking along STH 55 have no continuous dedicated pedestrian facilities.**

### Safety Issue 2 Description:

STH 55 runs north/south through the Mole Lake, providing the major north/south links in the area. Mole Lake residents were frequently observed walking along the highway and crossing STH 55. In several cases where sidewalks existed, pedestrians prefer to walk on the road. This may be due to the lack of a continuous network of sidewalks and maintenance. Pedestrians at highest risk include:



- Unaccompanied children
- Elderly pedestrians
- Wheelchair users
- Pedestrians pushing strollers

The risk of collision is increased by:

- Limited lighting conditions
- An absence of marked and signed pedestrian crossing facilities where drivers might not be able to anticipate pedestrians
- Areas without shoulders, where pedestrians must walk on the roadway

---

**Expected Crash Types:** Pedestrian crashes

**Expected Frequency:** Infrequent

**Expected Severity:** Extreme

**Risk Rating:** D (significant risk level)

---

## Suggestions:

### *Multi-Modal Transportation Plan*

See Section 5.1.

### *Bollards and Gates*

The tribe may also consider utilizing a system which may include bollards and/or gates at key locations along the sidewalks and trails accommodating pedestrians and bicyclists. An example of a system of bollards and gates is shown on the right. The spacing between the bollards must be wide enough to accommodate bicyclists, strollers and wheelchairs but narrow enough to prevent ATVs from accessing the sidewalk or trail. This system would ensure vehicles and ATVs remain off the sidewalks and non-motorized trails.



### *Establish and Maintain a Continuous Sidewalk for Pedestrians*

To discourage pedestrians from walking along the highway shoulder, an alternative network of pedestrian routes should be considered. Using the existing (non-continuous) sidewalks already in place along STH 55 as the basis; this network of sidewalks should be continuous and well-maintained so it is usable in all seasons.

As the pedestrian network is expanded with improved continuity, measures to improve accessibility for disabled pedestrians need to be considered. Wheelchair accessibility assists not only wheelchair users, but also other pedestrians with limited mobility, such as persons using canes, walkers, and scooters. Compliance with the Americans with Disabilities Act (ADA)<sup>1</sup> is required for all new or altered non-motorized facilities including sidewalks. This includes specific curb ramp design guidelines and detectible warnings for blind pedestrians.

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<sup>1</sup> Draft Public Rights-of-Way Accessibility Guidelines (PROWAG), US Access Board (2002).

### *Designated Pedestrian Crossings*

Guidelines in the *Safety Effects of Marked vs. Unmarked Crosswalks at Uncontrolled Locations*<sup>2</sup> suggest that marked crosswalks at uncontrolled locations could be considered on two-lane roads where speed limit is 35 mph and AADT is less than 9,000 vehicles. Crosswalks should be installed carefully and selectively, with particular regard to selecting appropriate locations where sight distance requirements are met, and locating crosswalks along convenient routes that pedestrians are likely to use.

Potential locations for marked crosswalk are listed below:

- Adjacent to the Casino's hotel, near the historical marker and proposed museum
- Adjacent to the BP gas station
- At Sand Lake Road
- Adjacent to Indian Settlement Road

Marked crosswalks should include signing, crosswalks and ADA accessible sidewalks. Lighting to illuminate the proposed crosswalks would enhance safety by providing drivers on STH 55 with an indication that they are approaching a crosswalk. Lighting would also enhance visibility of approaching vehicles for pedestrians waiting at the crosswalk.

### **5.3 Safety Issue 3: Speeds on STH 55**

**Safety Issue 3: Speeds above the posted speed limit increase the risk and potential severity of crashes.**

#### **Safety Issue 3 Description:**

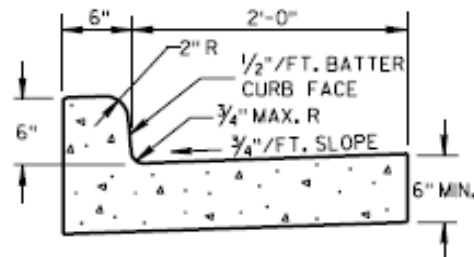
The speed limit increases from 35 mph to 55 mph north of Indian Settlement Road and south of CTH M. During the kick-off meeting it was reported that drivers were frequently observed traveling speeds of up to 55 mph through Mole Lake. During site visits, vehicles were observed traveling at higher speeds than the posted speed limit (35 mph) through Mole Lake.



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<sup>2</sup> Zegeer, C.V., J.R. Stewart, H.H. Huang, P.A. Lagerway, J. Feaganes, and B.J. Campbell, *FHWA Safety Effects of Marked vs. Unmarked Crosswalks at Uncontrolled Locations*, (Federal Highway Administration, 2002).

Between Sand Lake Road and Sokaogon Drive, the cross-section consists of 18 ft lanes including 30 in. Type D curb and gutter (*right*). North of Sand Lake Road and south of Sokaogon Drive, the cross-section consists of 15 ft lanes and 3 ft shoulders. The 18-foot wide lanes on STH 55 between Sand Lake Road and Sokaogon Drive are likely to contribute to speeding. The rural environment may also contribute to speeding. High operating speeds combined with the following factors increase the risk and the potential severity of collisions:



*Pedestrians:* A high volume of pedestrians were observed walking along and crossing STH 55. High Speeds:

- Limit the time available for drivers to see and react to pedestrians in the roadway, particularly at night;
- Increase the risk that a vehicle will lose control and enter the roadside area where pedestrians are present; and,
- Increase the potential severity of a collision. Studies indicate that speed affects the severity of pedestrian collisions<sup>3</sup>.

*Access points:* High speeds increase the risk of collisions when speeding drivers conflict with slower vehicles turning into or out of an access point along STH 55.

*School bus operations:* School buses stop along STH 55 to pick-up and drop-off students. High operating speeds increase the risk of collision with a school bus or younger pedestrians.

---

<b>Expected Crash Types:</b>	All crash types
<b>Expected Frequency:</b>	Occasional
<b>Expected Severity:</b>	Moderate
<b>Risk Rating:</b>	C (moderate risk level)

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<sup>3</sup> Transportation Research Board, *NCHRP Report 500 Volume 10: A Guide for Reducing Collisions Involving Pedestrians*, (National Cooperative Highway Research Program, 2004).

## Suggestions:

### *Speed enforcement*

Enforcement can be an effective measure to reduce speeding and other forms of aggressive driving. An enforcement plan should be considered for development in coordination between the tribe, Forest County Sheriffs Department and WisDOT. This plan should assign patrols to specific stretches of STH 55 during specific time periods correlating to both excessive speeding and associated crashes. In many cases, due to lack of resources or knowledge, agencies will simply concentrate their patrols on wherever the highest speeding is taking place. While this option is fallible in not connecting speed related crashes to speed enforcement, it will often still serve an objective in showing the public that speeding is not tolerated.

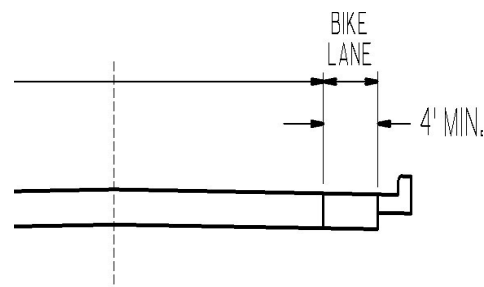
### *Narrow lanes with edgelines*

Consider narrowing the lane width on STH 55 from 18 feet to 12 feet within the section with the urban cross section. The new cross-section should be striped with 6 foot shoulders. Narrowing the roadway should help to reduce the speeds.

Bicycle lanes may be considered within the proposed 6 foot shoulder. The *Facilities Development Manual (FDM)*<sup>4</sup> criteria for the installation of bicycle lanes include:

1. The highway or street is on an officially designated bike plan; or
2. The two-way bicycle traffic volume is or is expected to be 25 AADT or more during the peak three months of the bicycling season where the current annual traffic volume on the highway or street exceeds 1000 AADT.

According to the FDM, the minimum width of a bicycle lane should be 4 feet measured between a gutter/pavement longitudinal joint and the motor vehicle traffic lane where curb and gutter. There is 4 feet available between the 12 foot lanes and the curb and gutter which is adequate for a bike lane.



<sup>4</sup> WisDOT, *Facilities Development Manual*, Procedure 11-45-10 (State of Wisconsin Department of Transportation, 2005).

### *Gateway Treatment*

A change in the road environment justifies a reduced speed limit. Drivers tend to travel based on the design speed of the roadway and not the posted speed limit. A gateway treatment may be implemented to inform drivers that they are transitioning from a rural environment into a more urban environment. A gateway treatment consists of measures that promote drivers' awareness that they are entering a more urban area where slower speeds are appropriate. Gateway treatments support, but do not replace, signing for a reduced speed limit.

Research indicated drivers travel at a reduced speed where the height of vertical features is greater than the width of the street<sup>5</sup>. Gateway treatments, which have been summarized from the New Zealand Land Transport Safety Authority, should consist of measures such as:

- Horizontal elements: Raised bump-outs to reinforce that the road is narrowing. Raised pavement markers, reflective paint and/or object markers should be used to delineate the raised bump-outs. The center median can either be raised or painted.
- Vertical elements: Oversized speed limit signs, roadside displays identifying entry to the Mole Lake community, trees and shrubs including decorative landscaping, artistic displays, or architectural displays should be placed adjacent to the bump outs. Trees or shrubs should not limit sight distance between oncoming vehicles and nearby access points.
- Other elements: Street lighting is desirable where raised bump outs are implemented. Daytime conspicuity can be improved by including bright flowers or shrubs in the landscaping, or colored or textured pavement within the gateway. Night-time conspicuity can be improved by using highly reflective pavement markings and lighting.

FIGURE 5.1 illustrates the gateway treatment concept.

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<sup>5</sup> Land Transport Safety Authority, *Guidelines for Urban-Rural Speed Thresholds RTS 15* (Wellington, 2002).

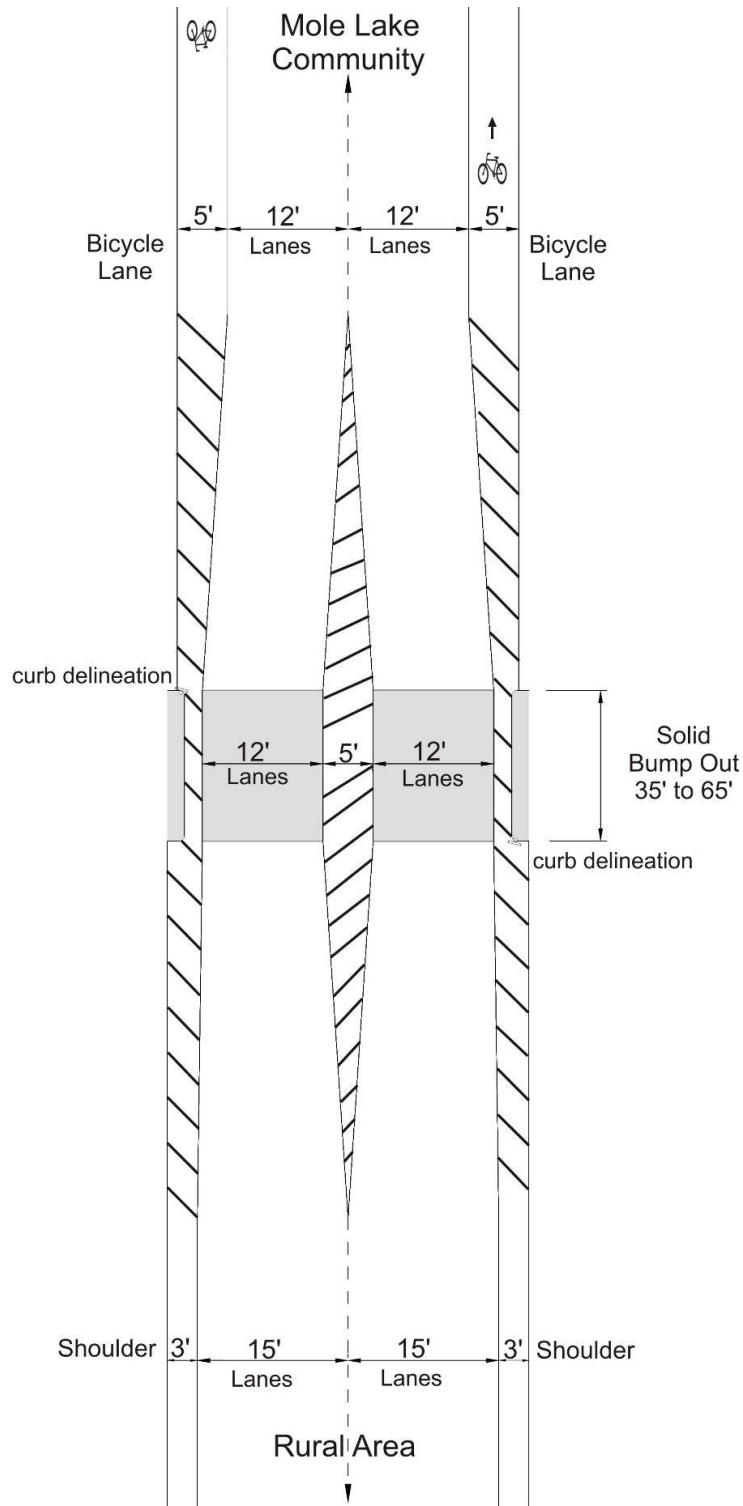


FIGURE 5.1 PROPOSED GATEWAY TREATMENT



Gateway treatments must be visible for approaching drivers to provide adequate stopping distance and must not limit sight distance from nearby access points. If sight distance permits, place the gateway treatment at a location where the urban land use is evident to drivers. Placing the speed reduction too far in advance of the community may reduce compliance (speed reduction is not justified to motorists), or motorists may slowly increase their speed by the time they reach the community.

#### *Permanent Speed Feedback Signs*

A permanent speed feedback sign informs drivers of the speed at which they are traveling, and helps mitigate high speeds. The results of a research study<sup>6</sup> indicated that the permanent speed feedback sign is more effective if a perceived level of enforcement exists, on a two-lane highway, where sight distance may be obstructed. Therefore, a speed feedback sign on STH 55 may effectively reduce speeds due to a vehicle slowing down which may influence vehicles following to slow down. The speed feedback sign may be more effective due to the sight distance restrictions caused by variations in horizontal alignment of the roadway. The use of flashers may be considered to make these signs more conspicuous. Speed display signs may be connected to a computer that records speeds along with the time of day and day of week, to help police identify peak violation times so they can more effectively target their enforcement efforts.

Speed feedback signs may be located near the area where the speed limit decreases from 55 mph to 35 mph. Signs may also be considered to reinforce the 35 mph speed zone midway between Sokaogon Drive and Sand Lake Road.

## **5.4 Safety Issue 4: Signs**

### **Safety Issue 4(a): Sign Reflectivity**

#### **Safety Issue 4(a) Description:**

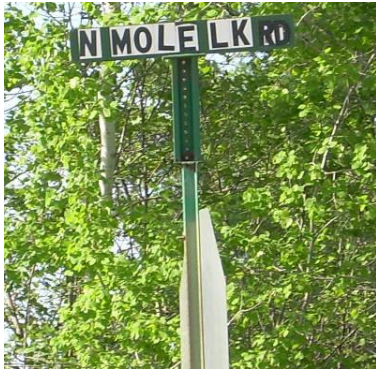
Signs provide warning and guidance to drivers concerning road alignment and conditions. During site visits, the RSA team observed signs that were worn or beyond its useful life, limiting retroreflectivity and conspicuity especially during nighttime hours. At these locations, driver guidance was limited by the following items:

- Inconspicuous street name signs may result in sudden braking and erratic maneuvers for unfamiliar drivers (*bottom left*),

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<sup>6</sup> Rose, E.R., and G.L. Ullman, *FHWA Evaluation of Dynamic Speed Display Signs (DSDS)*, (U.S. Department of Transportation Federal Highway Administration, 2003).

- Cracked regulatory signs may not be visible at night therefore reducing driver compliance (*bottom center*),
- Faded or damaged warning signs may not provide adequate delineation and guidance (*bottom right*).



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<b>Expected Crash Types:</b>	All crash types
<b>Expected Frequency:</b>	Occasional
<b>Expected Severity:</b>	Moderate
<b>Risk Rating:</b>	C (moderate risk level)

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#### Safety Issue 4(b): Sign Standards

##### Safety Issue 4(b) Description:

“Slow Children at Play” signs (*below left*) are posted in areas where pedestrians, particularly children, may be crossing the road. These signs are not consistent with current signs posted throughout the state and nation. This sign may also pose as a hazard for children by encouraging children to play in the road. It has been found in other areas that this sign message creates a false sense of security for children as they assume drivers know



that they are in the road may not find it necessary to clear oncoming traffic.

Yellow advisory speed plaques (*below right*) were posted throughout Mole Lake in lieu of standard speed limit signs. The MUTCD<sup>7</sup> states that supplemental plaques shall not be mounted alone or displayed alone, and shall be installed on the same post as a warning sign. Signs not in compliance with MUTCD standards may confuse or misinform drivers.



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<b>Expected Crash Types:</b>	All crash types
<b>Expected Frequency:</b>	Occasional
<b>Expected Severity:</b>	Moderate
<b>Risk Rating:</b>	C (moderate risk level)

---

### **Suggestions:**

#### *Minimum Retroreflective Standards*

To improve night-time conspicuousness and visibility, and reduce long-term maintenance requirements, the use of higher retroreflective sheeting is now required. In December 2007 the FHWA began requiring that all transportation agencies implement a system of maintaining minimum retroreflectivity for signs. Engineering-grade sheeting (ASTM Type 1) needs to be replaced with more reflective sheeting which meets these new standards, such as high intensity (ASTM Type 3 or 4) or prismatic (ASTM Type 9 or Type 11) sheeting.

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<sup>7</sup> MUTCD *Manual on Uniform Traffic Control Devices for Streets and Highways* 2003 Edition, (U.S. Department of Transportation Federal Highway Administration, 2007).

The minimum retroreflective standard stated in the MUTCD<sup>8</sup> is that regulatory, warning, and guide signs shall be retroreflective or illuminated to show the same shape and similar color by both day and night.

### *Upgrade signs*

A comprehensive signing review should be undertaken throughout Mole Lake as a result of the new standards. It is suggested that a process which identifies and documents sign maintenance issues involving damaged signs, signs with poor retroreflectivity, or obsolete signs that should be removed be considered.

The following timeline is stated in the MUTCD from the effective date December 2007 for the upgrade of signs:

- Four years for implementation and continued use of an assessment or management method that is designed to maintain traffic sign retroreflectivity at or above the established minimum levels;
- Seven years for replacement of regulatory, warning, and ground-mounted guide (except street name) signs that are identified using the assessment or management method as failing to meet the established minimum levels and repeated every seven years; and
- Ten years for replacement of street name signs that are identified using the assessment or management method as failing to meet the established minimum levels and repeated every ten years.

### *MUTCD Standards*

During the process of upgrading signs, MUTCD sign standards should be implemented. Below are a few examples of standard MUTCD signs that are suggested for implementation in Mole Lake.

Street Name signs (D3-1) with capitol lettering measured at least 6 in. high and have a white legend on a green background should be implemented. These signs would improve street name visibility, especially during night-time hours.



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<sup>8</sup> MUTCD *Manual on Uniform Traffic Control Devices for Streets and Highways* 2003 Edition, (U.S. Department of Transportation Federal Highway Administration, 2007).

Areas where high volumes of pedestrians are crossing the road, a pedestrian sign (R11-2) may be posted. Drivers would be more aware of pedestrians due to the proper signing and children would feel less encouraged to play in the road.



The advisory speed plaques should be replaced with standard regulatory speed limit signs (R2-1) to remain consistent with standards. The proper speed limit signs would effectively inform drivers of the speed limit.



## 5.5 Safety Issue 5: Bridge over Swamp Creek

### Safety Issue 5(a): Trail

#### Safety Issue 5(a) Description:

An unofficial trail adjacent to the bridge over Swamp Creek is extremely close to the box culvert. The box culvert is unshielded and is seen as a hazard for ATV's and pedestrians utilizing the trail. A risk is associated with pedestrians, bicyclists, ATVs or dirt bikes falling into the shallow creek, resulting in a severe injury.



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**Expected Crash Types:** ATV and pedestrian crashes

**Expected Frequency:** Rare

**Expected Severity:** Extreme

**Risk Rating:** C (moderate risk level)

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### Safety Issue 5(b): Interaction of Modes

#### Safety Issue 5(b) Description:

ATVs, pedestrians and bicyclists utilize the trail adjacent to the Bridge over Swamp Creek. The trail is not wide enough to comfortably accommodate the different modes. During the site visits, frequent interactions between ATVs and pedestrians were observed. This increases the risk of a collision between an ATV and a pedestrian or someone falling into the shallow creek. Also, ATVs utilizing the trail contributed to erosion, creating a hazardous walking facility for pedestrians and damage to the bridge structure.



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<b>Expected Crash Types:</b>	ATV and pedestrian crashes
<b>Expected Frequency:</b>	Infrequent
<b>Expected Severity:</b>	High
<b>Risk Rating:</b>	C (moderate risk level)

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### Safety Issue 5(c): Crossing STH 55

#### Safety Issue 5(c) Description:

Intersection conspicuity at Sand Lake Road is limited by the presence of a horizontal curve. A high volume of pedestrians and ATVs were observed crossing at the south end of the bridge over the Swamp Creek to get to Sand Lake Road and the sidewalk on the south side of the intersection. Visibility of crossing pedestrians is further limited by the guardrail and the slope approach to the unmarked crossing on the west



side of STH 55. No pedestrian warning signs are provided on the approaches. Drivers may not realize that a pedestrian, bicycle or ATV is within the roadway due to these sight distance restrictions, resulting in inadequate reaction time.

A bicycle fatality was reported when a bicyclist was struck by a southbound vehicle while crossing STH 55 at Sand Lake Road, approximately six years ago. The RSA team understands that this crash may have occurred as a result of limited sight distance due to the sloped trail which is obscured by the guardrail.

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<b>Expected Crash Types:</b>	ATV and pedestrian crashes
<b>Expected Frequency:</b>	Infrequent
<b>Expected Severity:</b>	Extreme
<b>Risk Rating:</b>	D (significant risk level)

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#### **Safety Issue 5(d): Intersection Visibility**

##### **Safety Issue 5(d) Description:**

Drivers approaching Sand Lake Road on STH 55 have a limited view of the intersection due to the horizontal curve. Sand Lake Road is expected to attract significant numbers of unfamiliar drivers in the future looking to access the proposed ATV campground which will result in higher traffic volumes. Unfamiliar drivers may not expect the Sand Lake Road in advance of the intersection due to the lack of advance signing, resulting in sudden braking or unsafe u-turns.



Restricted sight visibility may also be an issue for drivers who may not expect vehicles ahead to slow down to turn onto Sand Lake Road, or vehicles to turn off of Sand Lake Road in front of them.

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<b>Expected Crash Types:</b>	Rear-end, Sideswipe, and Angle collisions
<b>Expected Frequency:</b>	Occasional
<b>Expected Severity:</b>	High
<b>Risk Rating:</b>	D (significant risk level)

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**Suggestions:**

*Close Trail*

The existing trail should be considered for closure due to the hazards associated with the adjacent box culvert and erosion of the bridge. Separate facilities should be considered to accommodate pedestrians and ATVs. If trail remains open, a barrier should be implemented to protect anyone from falling into the shallow creek.

*Provide Pedestrian Facilities on Bridge*

Pedestrian facilities should be considered on the Swamp Creek Bridge, to accommodate pedestrians wanting to cross Swamp Creek. This would provide pedestrians a facility which will discourage them from walking in the road along this high speed horizontal curve.

*Separate ATV Crossing of the Swamp Creek*

As a result of the growing volume of ATVs, dirt bike and snowmobile traffic in Mole Lake a separate crossing facility over Swamp Creek should be considered. This facility should take into consideration the use of snowmobiles in the winter. An adequate facility for these motorized recreational vehicles will provide for separation of all of the transportation modes crossing the Swamp Creek.



### *Lighting and Pedestrian Signing*

Lighting during night-time hours should be implemented to improve pedestrian and vehicle visibility in areas where substantial pedestrian and vehicle volumes may conflict, such as the proposed crosswalk at Sand Lake Road. Lighting would also enhance the conspicuousness of the intersection, and may reduce all types of night-time collisions. A pedestrian crossing sign (W11-2) including a supplemental arrow plaque (W16-7p) and advanced pavement markings should also be considered to enhance the visibility of the crosswalk. Pedestrian-activated flashers or rectangular strobes may be considered to warn drivers when pedestrians are using the crosswalk. It is noted that marked crosswalks alone are not recommended in areas where sight distance requirements are not met.



### *Advance Intersection Signing*

Provide a sign on STH 55 (*similar to sign on right*) to warn drivers of the intersecting road, allowing drivers to navigate road cautiously. A supplemental plaque with the street name of the cross street may be implemented to inform drivers of the roadway, prior to the intersection, reducing sudden braking near the intersection. The supplemental street name sign would better inform unfamiliar drivers visiting the proposed ATV campground.



## **5.6 Safety Issue 6: Sand Lake Reconstruction**

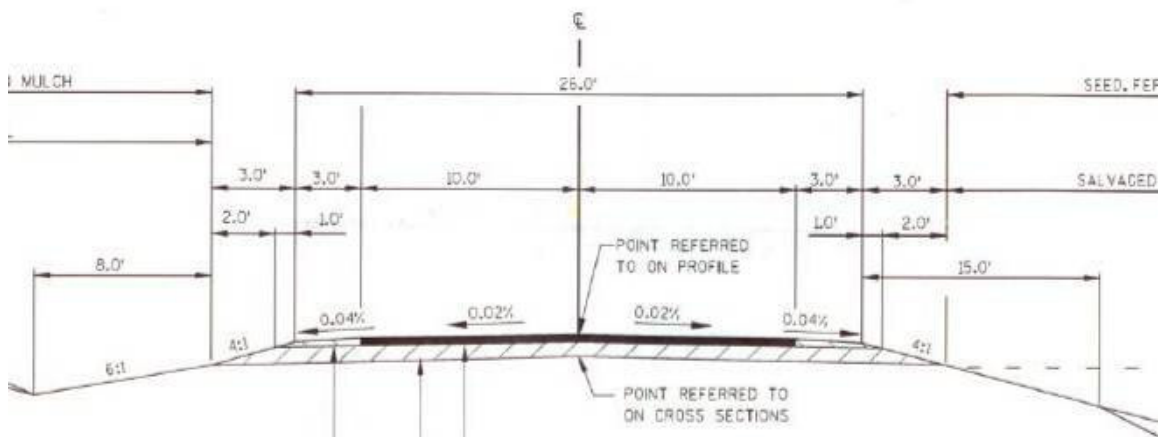
### **Safety Issue 6(a): 10 ft lanes**

#### **Safety Issue 6(a) Description:**

Sand Lake Road is a primary connection between STH 55 and CTH W. It is also the main access point for the tribal offices and the future ATV campground. During site visits a high volume of logging trucks and dump trucks were observed utilizing the roadway. The existing pavement condition is also deteriorating, affecting driver control and load stability.



The proposed ATV campground will attract significant amounts of large vehicles such as RVs. To accommodate these large vehicles and the future traffic growth, Sand Lake Road is scheduled to be reconstructed. The proposed design of the roadway incorporates 10 ft lanes, however it has been indicated that the design has been changed to 12 ft lanes. Ten foot lanes may not comfortably accommodate two large vehicles side-by-side.

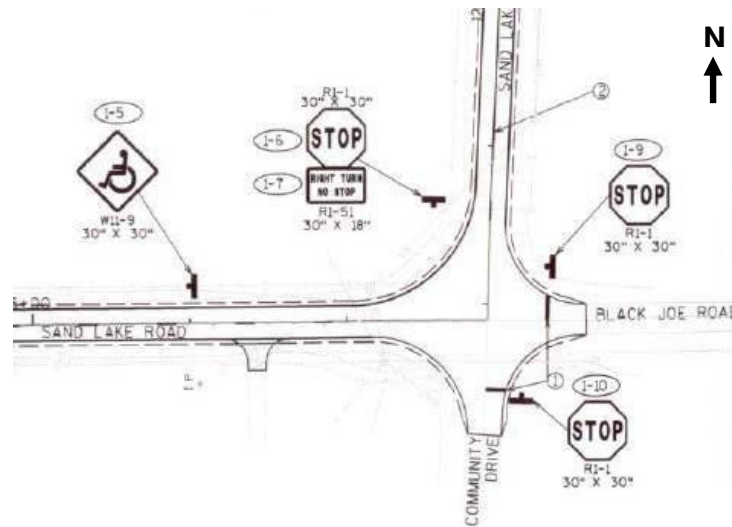


<b>Expected Crash Types:</b>	Sideswipe-opposite collisions
<b>Expected Frequency:</b>	Occasional
<b>Expected Severity:</b>	Low
<b>Risk Rating:</b>	B (low crash risk)

**Safety Issue 6(b): Intersection control**

**Safety Issue 6(b) Description:**

The intersection of Sand Lake Road/Black Joe Road/Community Drive is also included within the planned reconstruction. The intersection is proposed to accommodate traffic continuing on Sand Lake Road as a free-flow movement. Community Drive and Black Joe Road are STOP controlled. The westbound approach on Sand Lake Road is also STOP controlled except for the right-turn movements continuing on Sand Lake Road. A sign proposed underneath the STOP sign states, "Right Turn No Stop".



The proposed intersection control is not intuitive. Drivers waiting at the STOP control may not realize southbound Sand Lake Road is uncontrolled. Westbound right-turn movements from Sand Lake Road may also be an issue. Drivers may perceive that the right-turn vehicle is slowing down to Stop, where instead the vehicle is slowing down to turn right onto northbound Sand Lake Road. The proposed intersection control may increase the number of conflicts and the likelihood of a collision to occur.

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<b>Expected Crash Types:</b>	All crash types
<b>Expected Frequency:</b>	Occasional
<b>Expected Severity:</b>	Moderate
<b>Risk Rating:</b>	C (moderate crash risk)

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### Safety Issue 6(c): Turning Radius

#### Safety Issue 6(c) Description:

During site visits, vehicles were observed backing up to avoid being struck by a truck turning right onto Sand Lake Road. The proposed ATV campground will also increase the volume of large turning vehicles onto Sand Lake Road. Therefore, the turning radius on the southeast corner at Sand Lake Road may not be large enough to comfortably accommodate trucks and RVs.

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<b>Expected Crash Types:</b>	Truck related crash types
<b>Expected Frequency:</b>	Occasional
<b>Expected Severity:</b>	Low
<b>Risk Rating:</b>	B (low crash risk)

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### **Suggestions:**

#### *12 foot lanes*

Twelve foot lanes are recommended on Sand Lake Road to accommodate the future traffic growth of large vehicles. The *Geometric Design of Highway and Streets*<sup>9</sup> states that 12 foot wide lanes provide desirable clearance between large vehicles on two-lane two-way rural highways where large vehicles are expected. It is recommended that the tribe confirm that the lane widths in the designs have been updated to 12 foot lanes.

#### *Two-way Stop Control*

A two-way stop control at Sand Lake Road intersecting with Black Joe Road and Community Drive would reduce driver confusion and frustration. Drivers would be able to perceive whether a vehicle will continue through the intersection or STOP at the control. The two-way stop control would improve intersection operations and reduce the number of conflicts.

#### *Implement Right-turn Channelized Island*

A right-turn channelized island may be implemented on the northbound approach to Sand Lake Road. A right-turn channelized island would increase the radius on the southeast corner and comfortably accommodate trucks and RVs turning right onto Sand Lake Road.

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<sup>9</sup> AASHTO, *A Policy on Geometric Design of Highways and Streets*, (American Association of State Highway and Transportation Officials, 2004).

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- Road Safety Engineering
- Transportation Planning
- Traffic Operations
- Transit and Sustainability
- Community and School Safety
- Asset Management