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Regional Implementation of Tribal Transportation Safety Program: Standing Rock Sioux Tribe Roadway Safety Improvement Program

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Regional Implementation of Tribal Transportation Safety Program: Standing Rock Sioux Tribe Roadway Safety Improvement Program

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Disclaimer

ABSTRACT

Tribal communities recognize the need to improve roadway safety. A five-step methodology has been developed by the Wyoming Technology Transfer Center (WYT^2/LTAP) to improve roadway safety on Indian reservations. This methodology was initially implemented on the Wind River Indian Reservation (WRIR), which led to the Wyoming Department of Transportation funding of three system-wide, low-cost safety improvement projects. Due to the success of the program on the WRIR, tribes across the country have become interested in implementing the program. WYT^2/LTAP and the Northern Plains Tribal Technical Assistance Program (NPTTAP) are helping tribes implement this program on their reservations in the Great Plains region, and have developed criteria to identify tribes for participation.

Reservations in North Dakota and South Dakota applied to TTAP to participate and three tribes were accepted for implementation: the Standing Rock Sioux Tribe (SRST), the Sisseton Wahpeton Oyate Tribe, and the Yankton Sioux Tribe. This study describes the implementation on the SRST.

Many challenges and differences were identified through the analysis, demonstrating that a single procedure would not work for different reservations. Through extensive coordination and collaboration with the tribes and government agencies, WYT^2/LTAP, along with the TTAP centers, can provide the technical assistance the tribes need to develop their own road safety improvement program.

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1. INTRODUCTION

The Native American community has suffered greatly over the years with higher fatality rates on their reservation roadways than the general U.S. population (National Center for Statistics & Analysis, 2004). State and national tribal transportation safety summits have been held to identify problem areas and develop strategies to reduce fatal and serious injury crashes (Herbel & Kleiner, 2010). In order to address the high fatal and serious injury crashes on reservations, a methodology has been developed by the Wyoming Technology Transfer Center (WYT^2/LTAP) to improve roadway safety. This methodology provides tools for tribes to utilize in prioritizing safety improvements on their reservations. It was first implemented on the Wind River Indian Reservation (WRIR) in Wyoming, and three system-wide low-cost safety improvement projects were funded by the Wyoming Department of Transportation in 2013 (Shinstine & Ksaibati, 2013).

WYT^2/LTAP, along with the Northern Plains Tribal Technical Assistance Program (NPTTAP), is assisting tribes to implement this program on their reservations in the Great Plains region. Tribes interested in developing a safety improvement program for their reservation were notified and encouraged to participate in the spring of 2014. Standing Rock Sioux Tribe was accepted for implementation.

1.1 Background

A five-step methodology has been developed by WYT^2/LTAP to identify high-risk crash locations and provide low-cost safety improvements to address the hazards on reservations. This methodology was first implemented on the WRIR in Wyoming (Shinstine & Ksaibati, 2013).

A combination of data driven, field verification, and trend analysis is utilized. The five-step procedure is as follows:

1. Crash data analysis.
2. Level I field evaluation of roadway conditions.
3. Combined ranking to identify potential high risk locations based on steps 1 and 2.
4. Level II field evaluation to identify countermeasures.
5. Benefit-cost analysis.

Depending on available data, preference by the tribes, and other factors, this process can be altered to meet tribes' needs, and is intended for low-cost safety improvements. However, other improvements can be identified and presented to the tribes for other funding consideration. Part of this process includes looking at trends in crash data and developing a systemic approach.

Due to the success of the program on the WRIR, tribes across the country have become interested in implementing the program. The NPTTAP, along with WYT^2/LTAP, developed criteria to identify and help interested tribes participate. In order to qualify for the program, a tribe was required to provide at least three years of crash data and be willing to dedicate the resources to the project; the tribal leadership must also be committed to follow through on program implementation. The success of the programs on the WRIR was due to the cooperation and collaboration among the various stakeholders and WRIR members' commitment to improve safety on their roadways (Shinstine & Ksaibati, 2013).

As sovereign nations, tribes face different challenges than other communities to address their transportation and roadway safety needs (Martinez, Migliaccio, Albert, & Holt, 2009). Collaboration, communication, and cooperation are essential among the different jurisdictions responsible for the roadways on tribal lands. Federal, state, county, township, and tribal governments, and the Bureau of

Indian Affairs (BIA) are some of the many agencies involved in the decision-making process faced by the tribes.

Tribal communities recognize that crash reporting is inadequate among the many reservations (Herbel & Kleiner, 2010). Crash reports are either incomplete or non-existent. Many factors contribute to this issue. A South Dakota study of reservations in the state determined that approximately 64% of crashes on tribal lands are under-reported (Bailey & Huft, 2008). The study also indicated that the main problems were either the tribal law enforcement's inability to report the crashes or the relationships between tribes and the state.

The Indian Reservation Road Safety Improvement Program was developed with these challenges in mind. Through implementation, the tribes have the opportunity to address these issues to their satisfaction and gain an effective program for their reservation.

1.2 Objectives

The purpose of this report is to present the results of the implementation of a roadway safety improvement program on the Standing Rock Sioux Tribe Indian Reservation.

1.3 Report Organization

This report consists of five sections. Chapter 2 discusses the criteria developed for the regional implementation of the Indian Reservation Safety Improvement Program in the Northern Plains region. Chapter 3 lays out the methodology developed for the program. Chapter 4 is a discussion of crash trends identified on the Standing Rock Sioux Tribe (SRST) reservation. Chapter 5 discusses the results of the implementation of the program on the SRST. Chapter 6 provides conclusions and recommendations to the objectives laid out in this report.

2. REGIONAL IMPLEMENTATION

Due to the success of the safety improvement program implemented on the WRIR, tribes across the country became interested in implementing their own program. WYT^2/LTAP and the NPTTAP collaborated to develop a regional implementation for the Northern Plains. They developed criteria for the tribes in the region to apply for implementation of a roadway safety improvement program on their reservation.

2.1 Criteria

Coordination efforts between WYT^2/LTAP and NPTTAP resulted in the development of criteria to identify tribes willing and able to participate in the implementation of a road safety program. The following criteria were used to determine a tribe's eligibility to participate:

1. The tribe should be willing to invest the energy necessary to work with WYT^2/LTAP and NPTTAP throughout the process and commit the needed resources. The main resources needed are individuals willing to spend the time to meet with WYT^2/LTAP, provide personnel to assist with field reviews, and provide feedback.
2. Crash data are critical to addressing safety improvements. The interested reservation needs to have the ability to provide at least three years of crash data and provide WYT^2/LTAP and NPTTAP access to that data. WYT^2/LTAP can work with limited crash data, but needs enough to determine problem areas and trends.
3. Collaboration is key to the success of this program. The tribe needs to have the ability to work with the state DOT, law enforcement (state, county, and tribal), reservation road and transportation office or designated tribal member able to make decisions on behalf of the tribe concerning roadway matters.
4. The tribe would need to provide information about any existing strategic plan or initiatives in place to address roadway safety.
5. Most of all, the tribe must have a desire to improve roadway safety on their reservation.

A one-page application was sent to interested tribes addressing these criteria. The completed application, along with a commitment letter from the tribal leadership, was required for a tribe to be considered for implementation.

2.2 Selection

Reservations in North Dakota and South Dakota applied to TTAP to participate. Applications were received from three tribes: the SRST, the Sisseton Wahpeton Oyate Tribe, and the Yankton Sioux Tribe. Initial meetings were held between WYT^2/LTAP and the transportation contact from each to initiate communications and begin the process.

All three tribes are located in South Dakota. owever, SRST is located in both North Dakota and South Dakota. This presented an interesting challenge regarding crash data collection and coordination with the state agencies. WYT^2/LTAP met with the respective state offices to determine how their safety programs are managed and who is responsible for the crash data.

2.3 Standing Rock Sioux Tribe

Initial meetings established the contacts and processes involved in the transportation program on SRST. Their transportation department consists of a transportation director and a transportation safety officer, along with maintenance and administrative personnel. The transportation safety officer is the contact for

this project. The SRST reservation is approximately 2.3 million acres and lies along the border of North and South Dakota on the western end of the states. The North Dakota portion lies within Sioux County and the South Dakota portion lies within Corson County. The population is around 13,000, with more than 5,000 non-Indians living within the reservation boundaries. They maintain 128 miles of tribal roads and 232 miles of BIA roads, along with the respective state highways (NCHRP, 2007). The safety improvement program implementation on Standing Rock Reservation is discussed in detail in Chapter 5.

2.4 Chapter Summary

In this chapter, the regional implementation of the Indian Reservation Roadway Safety Improvement Program was discussed. WYT[2]/LTAP and NPTTAP collaborated to develop criteria for tribes to participate in the Northern Plains region. The main criteria require the tribe to have a desire to improve the safety of their roadways with the leadership's willingness to commit to supporting the implementation.

Three tribes, Standing Rock Sioux Tribe (SRST), Sisseton Wahpeton Oyate, and Yankton Sioux Tribe, were selected for participation. Standing Rock is a large reservation located in both North Dakota and South Dakota with a land area of about 2.3 million acres. They have identified their transportation safety officer as the contact for this project.

3. METHODOLOGY

The methodology developed and previously implemented on the WRIR was used for this project. The methodology allows for flexibility depending on available data, preference by the tribe, and other factors. Part of this process includes looking at trends in crash data and developing a systemic approach. A combination of data-driven field verification and trend analysis is utilized. The five-step procedure is as follows:

1. Crash data analysis.
2. Level I field evaluation.
3. Combined ranking to identify potential high-risk locations based on steps 1 and 2.
4. Level II field evaluation to identify countermeasures.
5. Benefit-cost analysis.

This procedure is shown graphically in Figure 3.1. Crash data are analyzed and a ranking is established based on the high-crash locations. From this ranking, a list of roadways is proposed for field evaluation. From the field evaluation, a ranking of roadway conditions is developed. The two rankings are combined to provide a list of proposed roadways considered for safety improvements. Another field evaluation is performed to identify safety improvements. Cost estimates are developed and a benefit-cost analysis is performed. The combination of historical crash data and field evaluations provides a substantive basis for identifying high-risk locations. The benefit-cost analysis gives the tribe a measure to prioritize the projects.

Other processes within the methodology are intended to give the tribe the ability to make changes and identify other factors involved in the high-risk locations, such as behavioral factors. These can then be included in their strategic highway safety plan and addressed in other funding requests. A final step in the process is the evaluation of the effectiveness of those improvements. Once projects have been established, funded, and implemented, an after study will need to be performed to determine actual crash reduction resulting from the safety improvement.

This program is intended for low-cost safety improvements, but other improvements can be identified and presented to the tribe to consider for other funding opportunities. The methodology provides flexibility for the tribe to utilize the results the way they consider best to address.

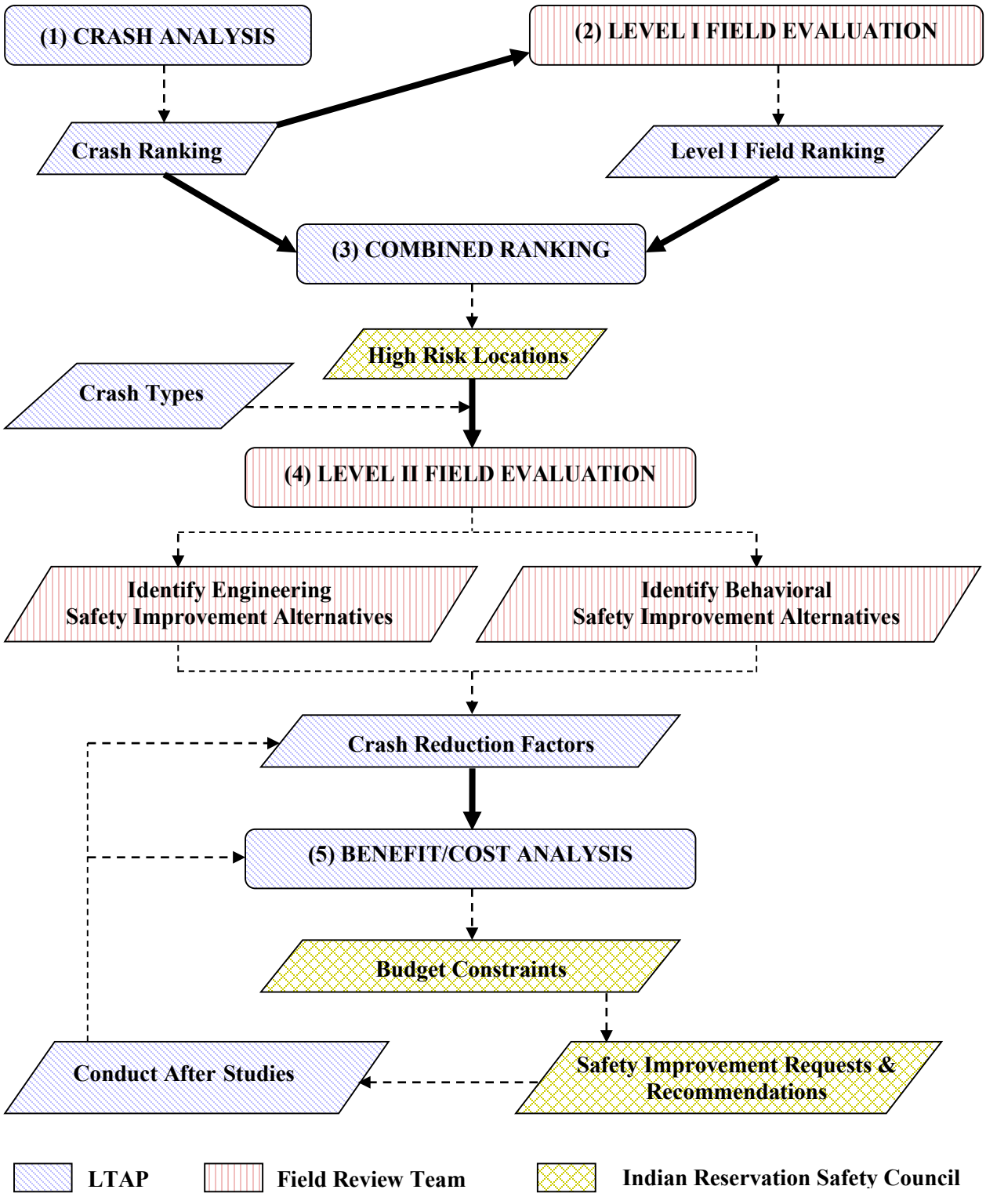

Figure 3.1 Five-Step Process for Indian Reservation Safety Improvement Program

3.1 Crash Data Analysis

The first step in determining high-risk crash locations is the analysis of crash data. All states have some form of crash data analysis capabilities. These data are maintained by either the state DOT, law enforcement, or possibly some other state agency or consultant. An analysis should be done for a recent period of time. Five to 10 years provides enough data to identify trends or hotspots depending on the state and volume of traffic experienced on the local tribal roads. However, as little as three years of data can be used. Typically, they are very low volume because of their rural nature. Crash rates are difficult to quantify because of the lack of traffic data and challenges in maintaining accurate and updated crash data. As discussed previously, tribes often lack complete and accurate crash data.

The crash history obtained will provide the basis for initial ranking of the sites. Based on the number of crashes for a given hotspot, the highest number would receive the highest rank. If traffic volume is available, these crashes can be converted to a crash rate, which provides for a more accurate assessment of high crash occurrence.

Besides the total number of crashes and crash rate, several other factors are analyzed to determine causal effects and severity to identify ways to reduce fatal and serious injury crashes. The following criteria are considered for this analysis:

- Total number of crashes
- Total number of crashes per mile
- Severity of crashes – fatal, injury, or property damage only (PDO)
- Road conditions
- Lighting conditions
- First harmful event
- Driver's gender
- Driver's age
- Alcohol-drug related crashes
- Safety device use
- Speed

The first six criteria above identify physical aspects of the crashes along with the severity. These will provide a basis for determining high-risk locations. Based on direction from the tribes, several factors being analyzed are behavioral in nature. The last five criteria are intended more for the behavioral analysis of the crash data. Behavioral improvements are reviewed along with physical improvements.

The crash analysis includes the number of crashes per one-mile segment, which are known as hotspots. Each segment is ranked from the largest number of crashes per hotspot to the least number of crashes. Based on this ranking, the top high-crash routes are selected and proposed for a Level I field evaluation as the tribes determine.

3.2 Level I Field Evaluation

With the high-crash locations identified, a Level I field evaluation is performed on the selected routes. A team of tribal members and transportation experts, such as LTAP, TTAP and/or the BIA, should perform this evaluation. This team should be selected by the tribes. Tribal personnel are essential in providing the site expertise because they have first-hand knowledge of the problem areas.

The roadways are reviewed at one-mile segments, and each segment is rated from 0 to 10, with 0 being the worst and 10 the best. All segments should begin with a 5 rating as the average. These ratings are applied to five categories as follows:

1. General:
   - Presence of sharp horizontal or vertical curve
   - Visibility
   - Pavement defects that could result in safety problems
   - Ponding or sheet flow areas that could result in safety problems
   - Presence of loose aggregate/gravel that could cause safety problems

2. Intersection and Railroad Crossings:
   - Intersections free of sight restrictions that could result in safety problems
   - Intersections free of abrupt changes in grade or conditions
   - Presence of advanced warning signs when intersection traffic control sight restrictions exist
   - Presence of railroad crossing signs at RR crossing approach
   - Presence of railroad advanced warning signs when crossing sight restrictions exist
   - Vegetation and other obstructions restricting sight distance at railroad crossing
   - Roadway approach grade at railroad crossing level enough to prevent snagging

3. Signage and Pavement Markings:
   - Signing present at needed locations to improve safety
   - Presence of unnecessary signage that may cause a safety problem
   - Effective signage for existing conditions
   - Presence of pavement markings
   - Presence of ineffective pavement markings for present conditions
   - Presence of old or faded pavement markings affecting the safety of the roadway
   - Presence of needed delineators
   - Presence of improper or unsuitable delineators

4. Fixed Objects and Clear Zones:
   - Clear zones free of hazards, non-traversable side slopes without safety barriers
   - Presence of narrow bridges or cattle guards
   - Presence of culverts with inadequate extensions

5. Shoulder and right-of-way:
   - Standard shoulder width
   - Slope greater than 3:1
   - Presence of hazards along shoulder
   - High rollover potential

For a team of evaluators, either discussion could be ensued to determine one score or each member could score independently. Then these scores would be averaged for each segment of each roadway. Maintaining the same team throughout the evaluation period would ensure consistency in results. Each segment receives a total score as the sum of the score for each category. All segments from all evaluated routes are then ranked from lowest to highest score. The lowest score value is considered to have the highest risk. Similar to the crash ranking, a Level I rank is assigned.

3.3 Combined Ranking

The third step in the process is to combine the crash ranking with the Level I ranking. Crash ranking and Level I ranking are tabulated and combined to develop a final ranking for the Level II field evaluation. These rankings are tabulated by road name and/or number, beginning and ending milepost, crash ranking, Level I ranking, and, finally, combined ranking. To combine the ranking, the crash ranking and Level I ranking are added.

The segments are then sorted by the combined rank value, smallest to largest. The segments with the smallest numbers are considered the most hazardous. From these segments, the roads with the smallest combined ranking value are considered for Level II field evaluation for determining countermeasures. Although other segments of the same road may have a much lower rank, each road is looked at in its entirety for safety improvements. Ten to 15 roads should be selected for the level II evaluation.

The rankings, along with the selected roads, are provided to the tribe for their review and approval to proceed with the Level II evaluation. The tribes have the option to include more sites or adjust the rankings based on their insights.

3.4 Level II Field Evaluation

Once the tribe has identified their priority sites, a Level II evaluation is performed on each of the routes selected. This should consist of a team determined by the tribe and should include tribal personnel and transportation experts. Additional data may need to be collected, such as traffic counts and review of behavioral factors, as well as other causal factors that would guide decisions on safety improvements. The team reviews each road and revisits the sites as needed to determine the proper countermeasures.

A list of countermeasures is developed for typical applications on rural roadways and crash reduction factors (CRFs) assigned. Information on proven safety countermeasures and CRFs can be obtained from the FHWA Safety website (FHWA, 2008). The FHWA Manual for Selecting Safety Improvements on High Risk Rural Roads (Atkinson, et al., 2014) was developed specifically for identifying appropriate countermeasures. The Crash Modification Factors Clearinghouse (FHWA) is a repository of CRFs that is regularly updated and provides extensive information on the proper applications. Individual states may have developed their own countermeasures and CRFs. Tribal lands in the states they are located typically have similar conditions unique to that area, thus they can utilize those informational resources. Included are behavioral countermeasures that the tribes can apply.

Typical countermeasures that are considered low-cost safety improvements include the installation of advanced warning signs, chevrons at curves, delineators, and pavement markings. Others that may require more design and resources would be culvert widening, installation of guardrails, and flashing warning beacons. Countermeasures should be applied based on the type of crashes. For run-off-the-road crashes, countermeasures, such as advanced curve warning signs, pavement markings, and chevrons, are effective and low cost.

Each route is evaluated and proposed countermeasures identified. Once all routes have been evaluated and improvements identified, a cost to implement is estimated. This information is used to perform the benefit-cost analysis.

3.5 BENEFIT-COST ANALYSIS

Based on the selected countermeasures and associated costs, a benefit-cost analysis is performed for each project. If the project is set up for each road, then all the improvements identified for that road are included in the estimate. This provides the tribe information on the most effective safety improvements. Construction costs are estimated for the safety improvements.

A benefit value associated with each improvement is calculated based on CRFs and societal costs of crashes. The CRF is an estimation of the percent reduction of crashes expected from the implementation of the associated countermeasure. The resources cited in the previous section for identifying countermeasures and crash modification factors should be used to identify the proper CRF for each countermeasure.

This is only an estimate and a general application. Other factors that apply specifically to the site must be considered. The benefit is calculated using the CRF assigned to the particular countermeasure and the cost of that type of crash being avoided. Values for fatal, injury, and PDO crashes are assigned and can be obtained from federal or state sources. When two or more countermeasures are applied to a site, then a weighted combined value is calculated.

The ratio of calculated benefit of the countermeasure to the estimated construction cost is then calculated. Any ratio less than 1.0 should not be considered because the benefit is actually decreased by the countermeasure. In other words, the countermeasure increases the hazard.

Once the benefit-cost analysis is completed for each site, a recommended prioritized list of improvements is provided to the tribe for their review and approval. When the tribe decides what improvements they desire, they can determine what resources they want to allocate to these projects. For the low-cost improvements, the state can provide HSIP funds under the HRRRP.

3.6 Chapter Summary

This chapter lays out the five-step methodology designed to assist tribal governments with developing a safety improvement program. Knowing that tribes have unique challenges and cultural differences, collaboration between their members, government agencies, and other safety stakeholders is vital to successfully implementing such programs. Starting with a review of crash data provides the trends attributed to the crashes, and identification of hotspots is necessary to know where to first look to improve their roadways. A priority ranking is determined based on the high-crash locations.

The top locations are considered for field evaluation, which provides a scoring of the locations based on the roadway conditions. These locations are then ranked from the worst condition to the best. Then the crash rank and the Level I field evaluation rank are combined, providing a new list of priority locations.

The entire road is considered for a Level II evaluation to determine countermeasures for the hotspot locations. Countermeasures are identified and tabulated for each road. Construction cost estimates are calculated for the safety improvement projects determined from the countermeasures. Low-cost improvements include pavement markings, signage, and delineators. Other improvements, such as culvert widening and guardrail installation, should be considered as well. The tribes can determine whether to pursue all or part of the proposed improvements.

The benefit of installing each countermeasure is calculated based on CRFs and crash costs. A benefit-cost ratio is then calculated. Projects with large benefit-to-cost ratios should be considered first for implementation. A high benefit-to-cost ratio indicates that for a small investment of funds, there is potential for a great reduction in fatal and injury crashes.

4. CRASH ANALYSIS AND TRENDS

In North Dakota, the Safety Division of the North Dakota Department of Transportation (NDDOT) manages crash data for the state; whereas in South Dakota, the Department of Public Safety (SD DPS) manages crash data. Both offices claimed they receive very little data from tribal and BIA law enforcement for the various tribes around the state. North Dakota is working with the tribes to allow their respective law enforcement offices to directly report crashes into their system. NDDOT will provide the software and training to the tribe. It will also develop a crash report form that would include information the tribes want. South Dakota publishes its crash data, which contain personal information on individuals involved in crashes. This presents a problem with many tribes who do not want such personal information publicized.

Initial analysis has been performed for SRST. Each state dataset was analyzed separately then combined. North Dakota provided WYT[2]/LTAP with a report containing crash data for 2005 through 2013. South Dakota provided access to the raw crash data for 2004 through 2013. Both datasets from North and South Dakota included information on injury severity, road conditions, lighting conditions, first harmful event (FHE), and FHE location. South Dakota included personal data, such as gender, age, alcohol and drug involvement, safety equipment use, as well as personal data about each individual such as name and address. Because the personal data include information on every person involved in the crash, some simplifications and assumptions needed to be made in order to link it to a specific crash. Typically, the first person listed in the personal data was the driver. If the crash involved more than one vehicle, only the first driver's information was used. The North Dakota data included whether alcohol was involved, but did not include any other personal data.

Because of the dissimilar information from the two states, several different analyses were performed. The first analysis considered crashes for the entire reservation for a nine-year period (2005-2013) for severity, road and lighting conditions, FHE and FHE location, and alcohol involvement. The next analysis compared Corson County in South Dakota with all state rural roads in the state for a 10-year period (2004-2013). This analysis compared severity, alcohol involvement, driver gender and age, safety equipment use, and FHE and FHE location. The final analysis compared Corson County with the WRIR for a ten-year period. The WRIR analysis was previously performed for 2002-2011.

4.1 Results

4.1.1 Corson and Sioux County 2005-2013

There were 276 crashes recorded for Corson County and 120 crashes recorded for Sioux County, yielding a total of 396 crashes for the entire reservation from 2005 through 2013. Although the North Dakota portion is much smaller than the South Dakota portion, the total number of crashes for the reservation from both counties appears to be quite low for a reservation of this size. It can also be observed in Figure 4.1 that the number of crashes has dropped since 2009. Initially, this was thought to be due to a change in reporting rather than actual reduction in crashes. A similar problem was encountered when crashes on the WRIR were first analyzed. Initially, only 245 crashes were reported for an 11-year period (2000-2010) in the state database, and crash numbers dropped significantly in 2006. Once the reporting issues were corrected for the tribal law enforcement crash records, the total crashes jumped to 673 for the same 10-year period. Discussions with the Corson County Sheriff revealed that enforcement was increased in 2009 and reductions were realized. However, the numbers are still low for a reservation of this size, and no crashes are identified on county or BIA roads. This indicates a discrepancy in crash reporting and warrants further study.

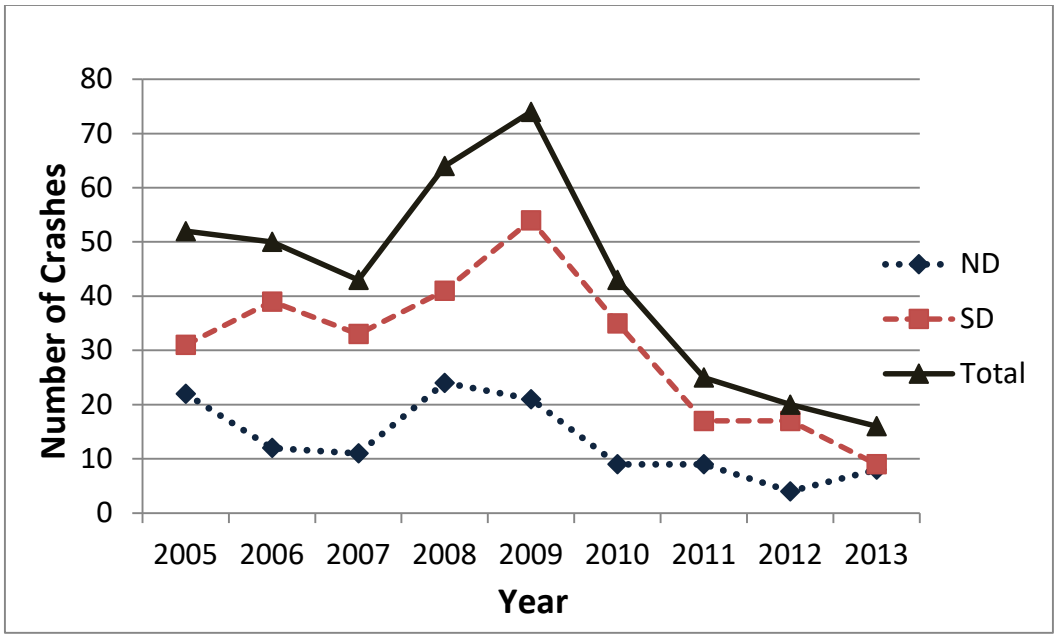

Figure 4.1 SRST Crashes 2005-2013

Crash severity was divided into fatal, injury, and property damage only (PDO). As seen in Figure 4.2, 11% of all crashes on SRST were fatal, although 22% of crashes in Sioux County were fatal and only 6% in Corson County were fatal. This could be due to how much non-fatal crashes are reported in North Dakota compared with South Dakota.

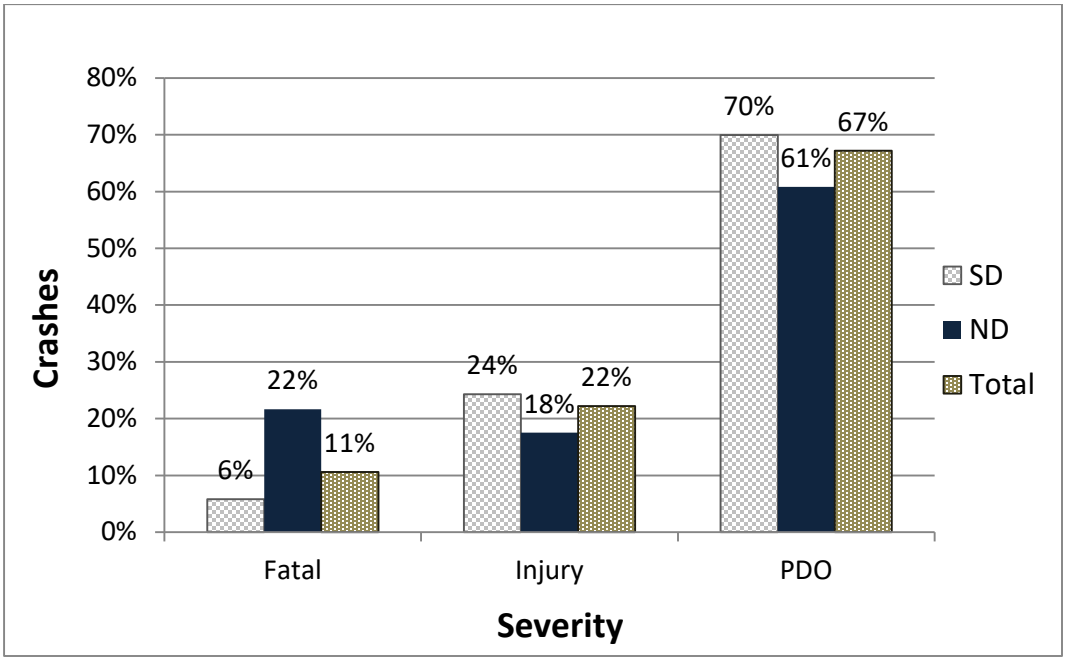

Figure 4.2 SRST Crash Severity 2005-2013

The first harmful event (FHE) revealed that 41% of crashes involved animals, followed by collisions with another vehicle at 22%. Of all animal crashes, 85% were wild animals such as deer, elk, and moose. Two percent of all crashes involved pedestrians, with 4% occurring in Sioux County and 0.4% occurring in Corson County. Most of the reservation is rural with long distances between communities. The Prairie Knights Casino and Ft. Yates are located in North Dakota along a major highway, which could account for higher pedestrian traffic in areas where limited pedestrian safe facilities exist. The FHE results are located in Figure 4.3.

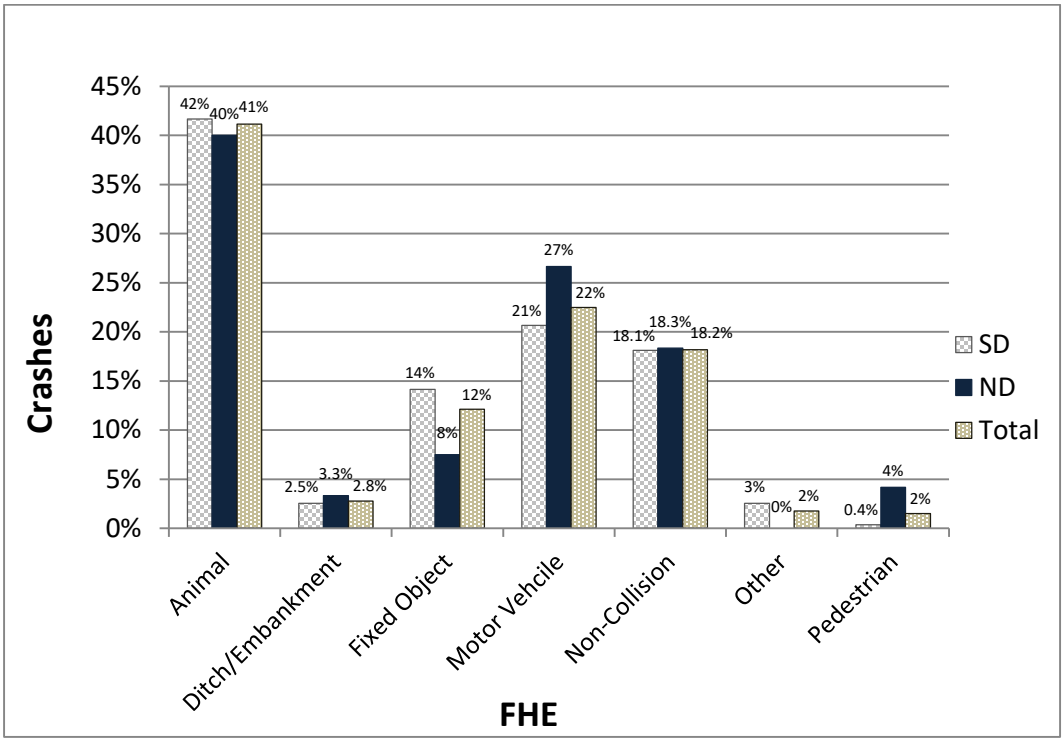

Figure 4.3 SRST First Harmful Event 2005-2013

Of crashes reported, 59% occurred on the roadway. However, only 1% of crashes were reported as occurring off the roadway in North Dakota. But North Dakota also reported that 22% of crashes occurred on the shoulder and 36% were unspecified. This is compared with South Dakota, where 32% were off the roadway, only 1% on the shoulder, and none were unspecified. This could also be due to different reporting procedures between the states. See Figure 4.4.

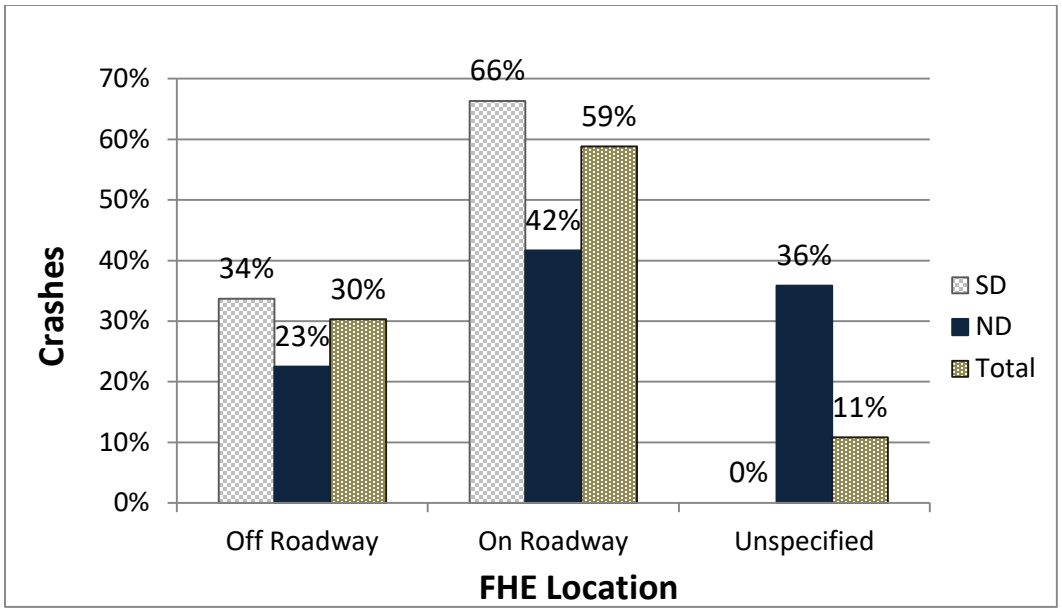

Figure 4.4 SRST First Harmful Event Location 2005-2013

Road conditions were reported as dry for 69% of the crashes, and as ice, snow, frost, or slush for 15% (Figure 4.5). When comparing the two counties, 78% of all crashes in Corson County and 51% in Sioux County were reported as dry conditions. In Sioux County, 36% of crashes had unspecified road conditions compared with Corson County, which had only 2% unspecified. This could be due to a difference in reporting procedures. Lighting conditions for the most part showed that crashes were evenly distributed between daylight and dark at 43% and 48%, respectively (Figure 4.6).

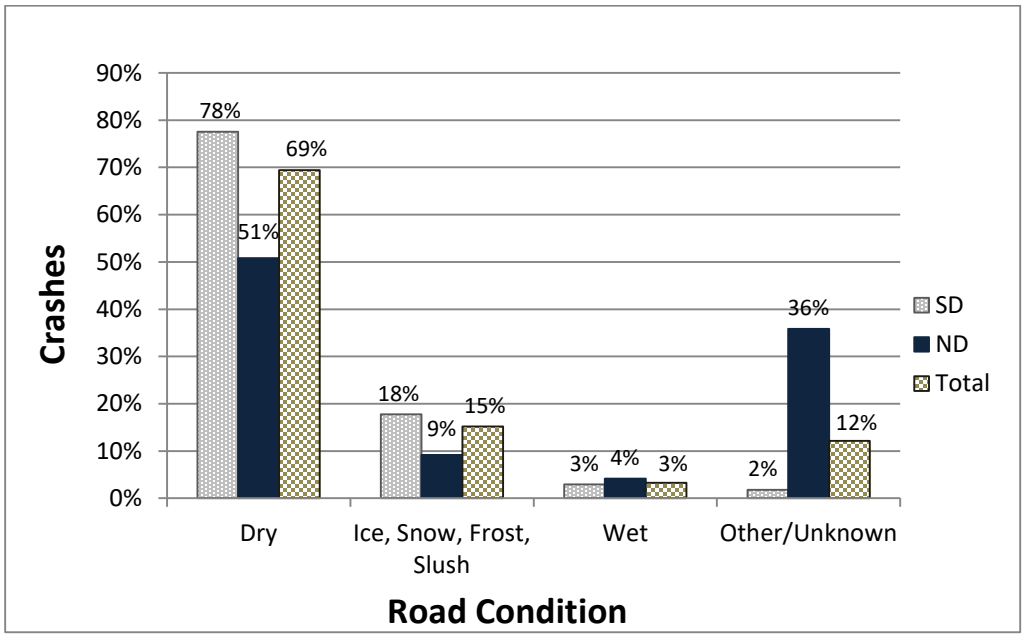

Figure 4.5 SRST Road Conditions 2005-2013

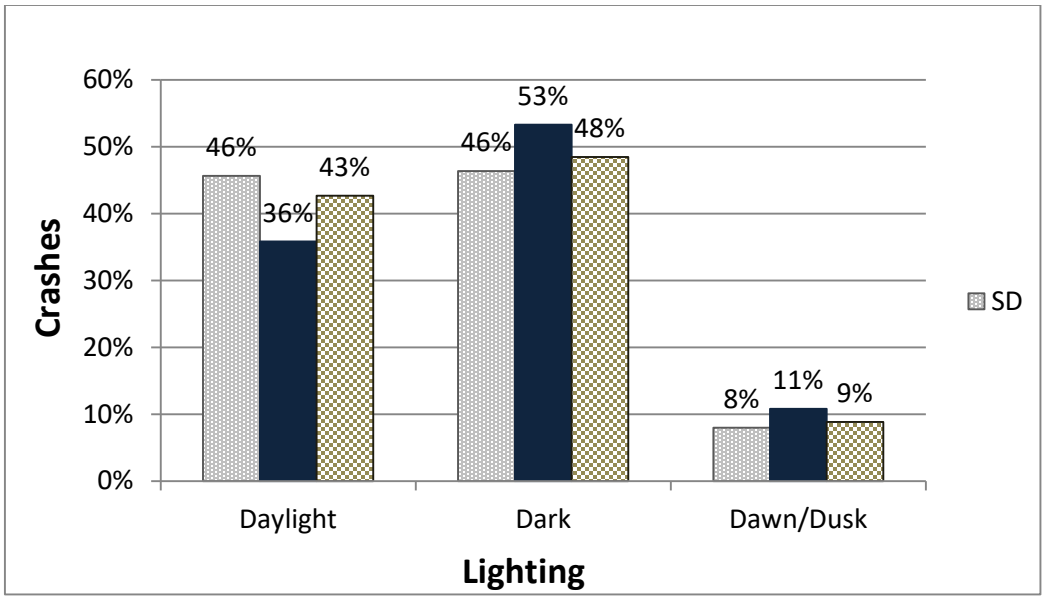

Figure 4.6 SRST Lighting Conditions 2005-2013

There is a large disparity between North Dakota and South Dakota regarding crashes involving alcohol. North Dakota has a much higher percentage of alcohol being involved in crashes at 26%, compared with 7% for South Dakota. It should be noted that both have a high percentage of unknown or unreported alcohol involvement. See Figure 4.7.

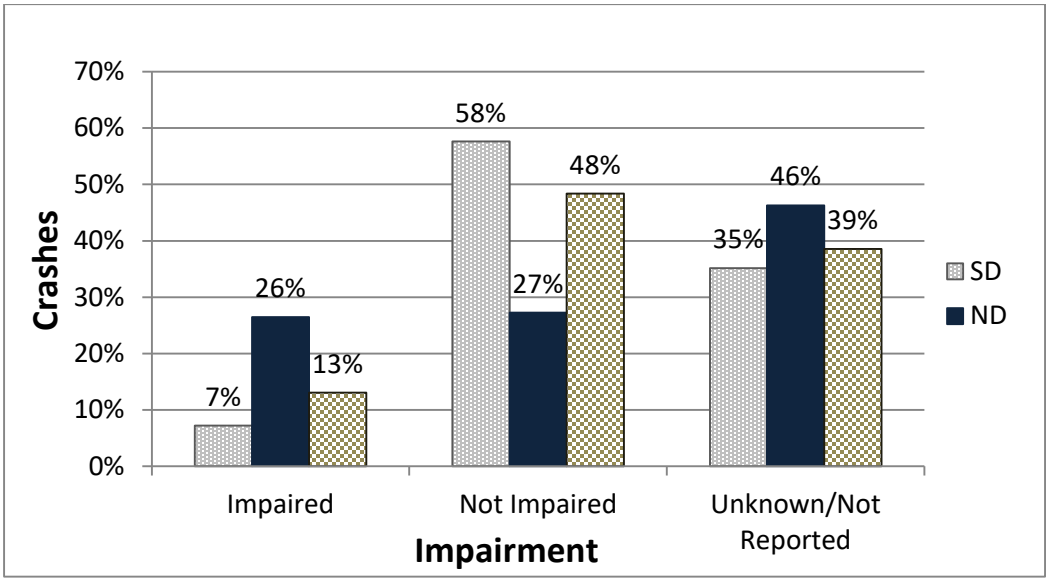

Figure 4.7 SRST Crashes Involving Alcohol 2005-2013

4.1.2 Corson County and South Dakota 2004-2013

The portion of the SRST reservation contained within Corson County, South Dakota, was compared with crashes throughout the state on rural roadways for a 10-year period between 2004 and 2013. At the time of this analysis, statewide information had not been obtained from North Dakota. When comparing crashes on the reservation in South Dakota, it was found that similar trends existed. In Figure 4.8, injury crashes were 12% and 23%, respectively. However, there were 6% fatal crashes on the reservation as compared with 1% across the state.

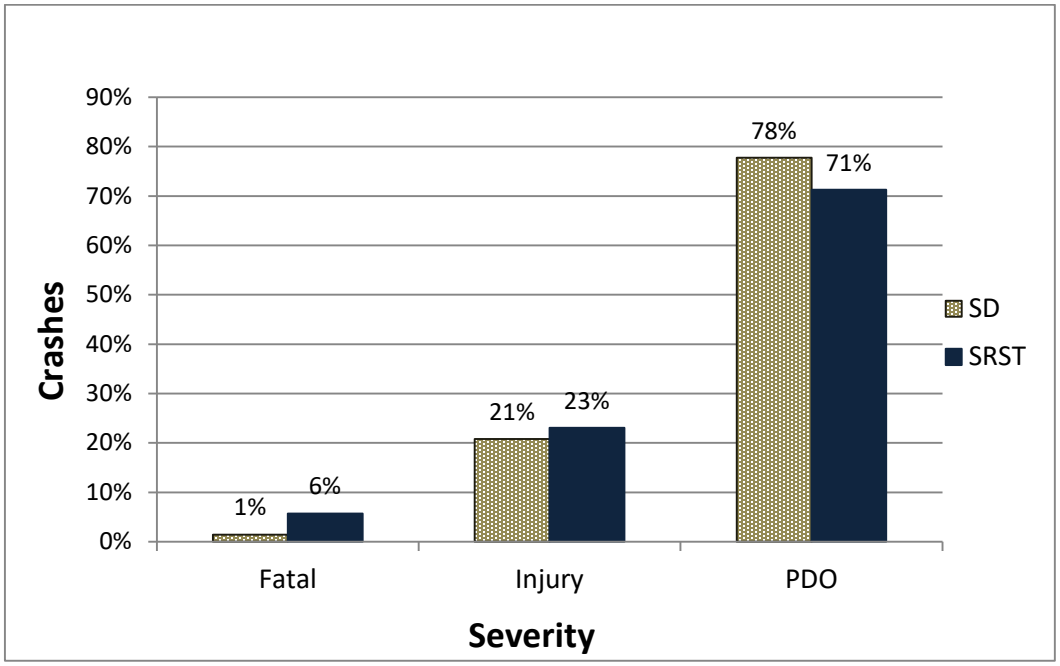

Figure 4.8 Crash Severity South Dakota and SRST 2004-2013

Crashes involving alcohol were higher on the reservation at 7%, compared with 4% in the state. Among all crashes on the reservation, 64% involved males, compared with 63% for the state. Figure 4.9 shows that a slightly higher percentage of drivers were between the ages of 15 and 24 for the state at 21% and 19% for the SRST. A slightly higher percent of drivers was between the ages of 45 and 54 on the reservation at 22%, compared with the state at 20%.

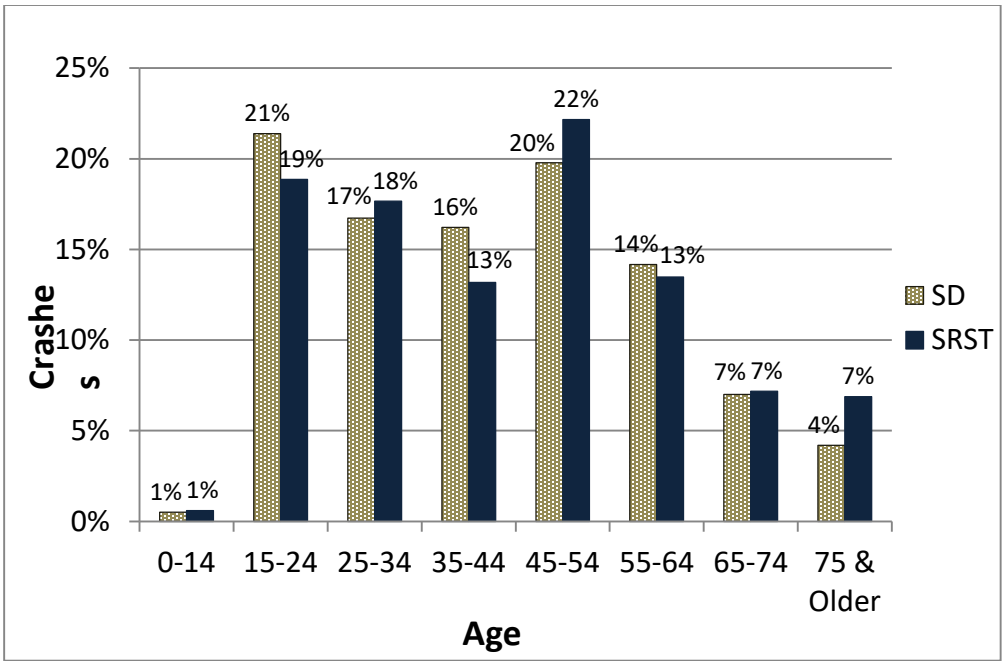

Figure 4.9 Driver Age South Dakota and SRST 2004-2013

FHE, FHE location, road conditions, and lighting conditions were all very similar. Animal crashes appear to be a major concern across the state. Of all crashes in South Dakota, 52% involved animals, and 95% of those crashes involved a wild animal. Safety equipment use is reported as higher on the reservation at 42%, compared with 37% across the state. On the reservation, 12% of crashes were reported as no safety equipment used, compared with 7% for the state (Figure 4.10). It might be more accurate to determine when safety equipment was not used rather than when it was.

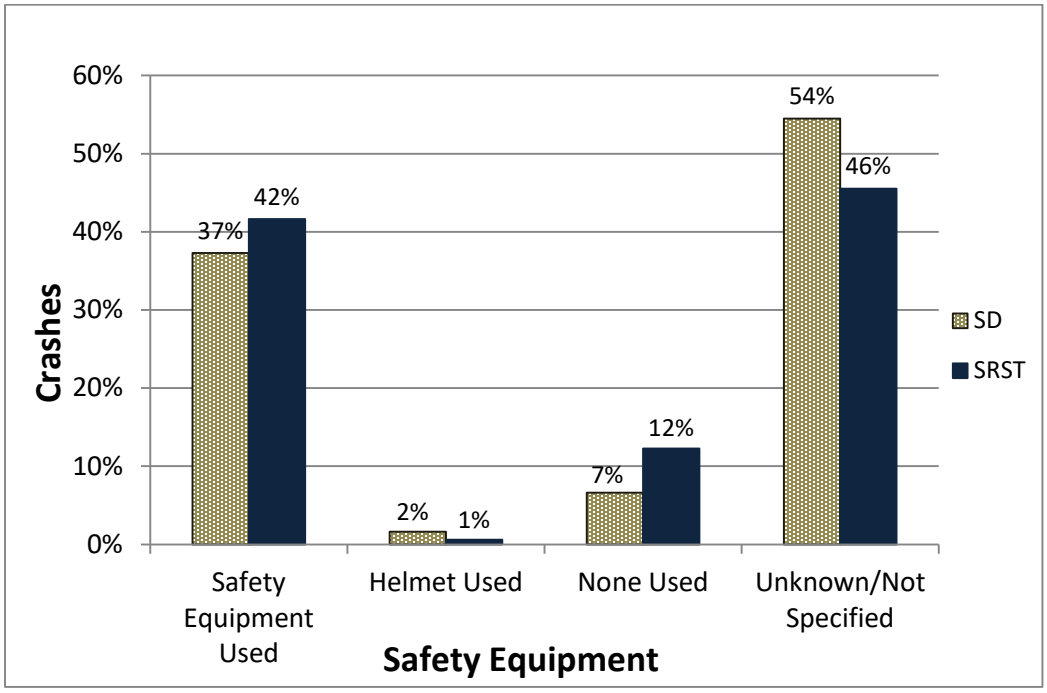

Figure 4.10 Safety Equipment Use in South Dakota and SRST 2004-2013

4.1.3 Standing Rock Sioux Tribe (Corson County) and Wind River Indian Reservation

SRST and the WRIR are similar in size at 2.3 million acres and 2.2 million acres, respectively, and they are both rural. A 10-year analysis was performed for both. Only Corson County had 10 years of data along with driver information. The WRIR was analyzed from 2002 through 2011 and Corson County was analyzed from 2004 to 2013. Several differences were noted between the two reservations. WRIR had a slightly lower number of fatal crashes at 4%, compared with SRST at 6%, but the number of injuries was higher at 32% compared with 23%. Alcohol involvement was much higher on the WRIR at 23%, with only 7% on the SRST. However, 38% of crashes on the SRST did not report, or reported as unknown, alcohol involvement; whereas, only 8% of crashes on the WRIR were unreported (Figure 4.11).

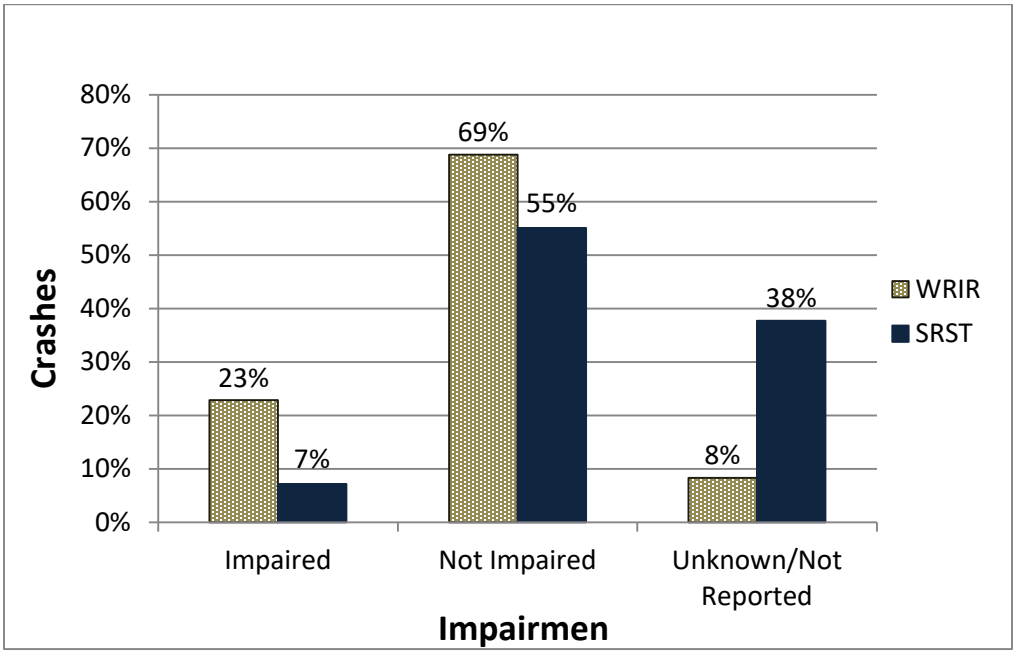

Figure 4.11 Alcohol Involvement on SRST and WRIR, 10-Year Analysis

The distribution of driver age was much different. More young drivers were involved in crashes on the WRIR as compared with SRST. In Figure 4.12, drivers between the ages of 15 and 34 accounted for 77% of all crashes on the WRIR. On the SRST, the highest number of crashes was among drivers between 45 and 54.

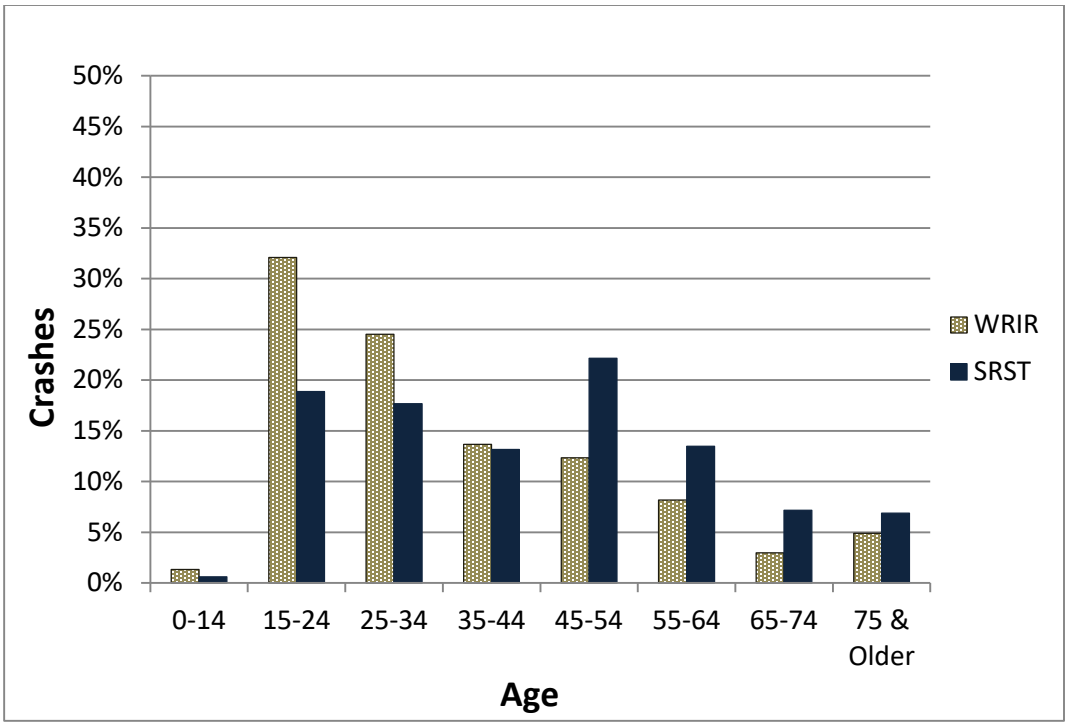

Figure 4.12 Driver Age SRST and WRIR, 10-Year Analysis

The lack of safety equipment use was more than two times higher on the WRIR than the SRST, where in 26% of crashes, safety equipment was not used on the WRIR, compared with 12% for SRST. (Figure 4.13)

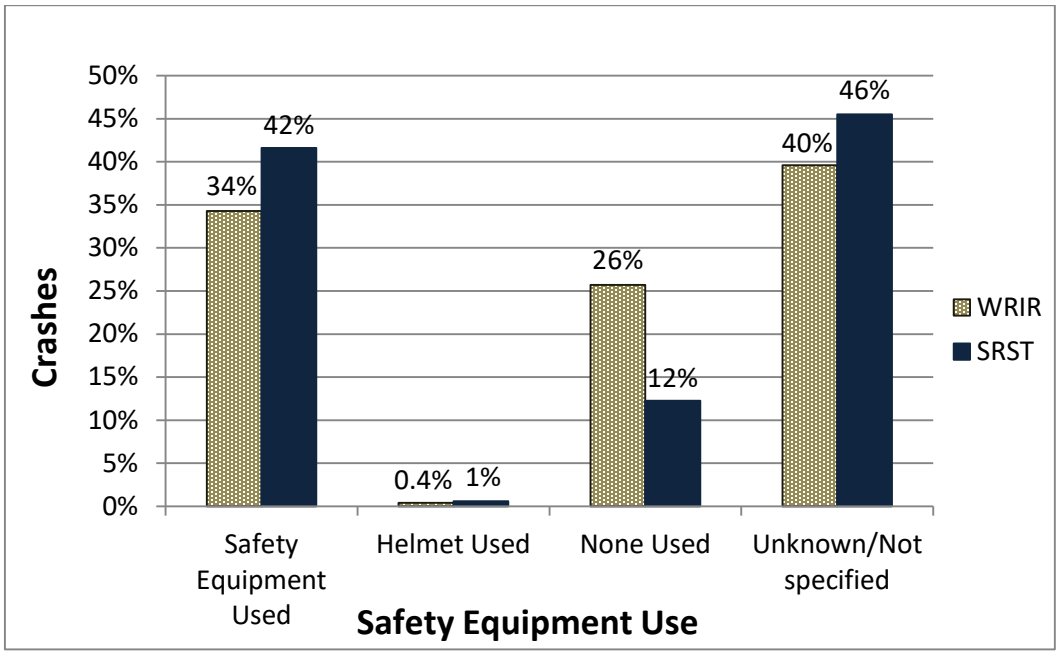

Figure 4.13 Safety Equipment Usage SRST and WRIR, 10-Year Analysis

The other major differences observed were the FHE and FHE location. Almost half as many crashes on the WRIR involved animals than on the SRST at 24% and 44%, respectively (Figure 4.14).

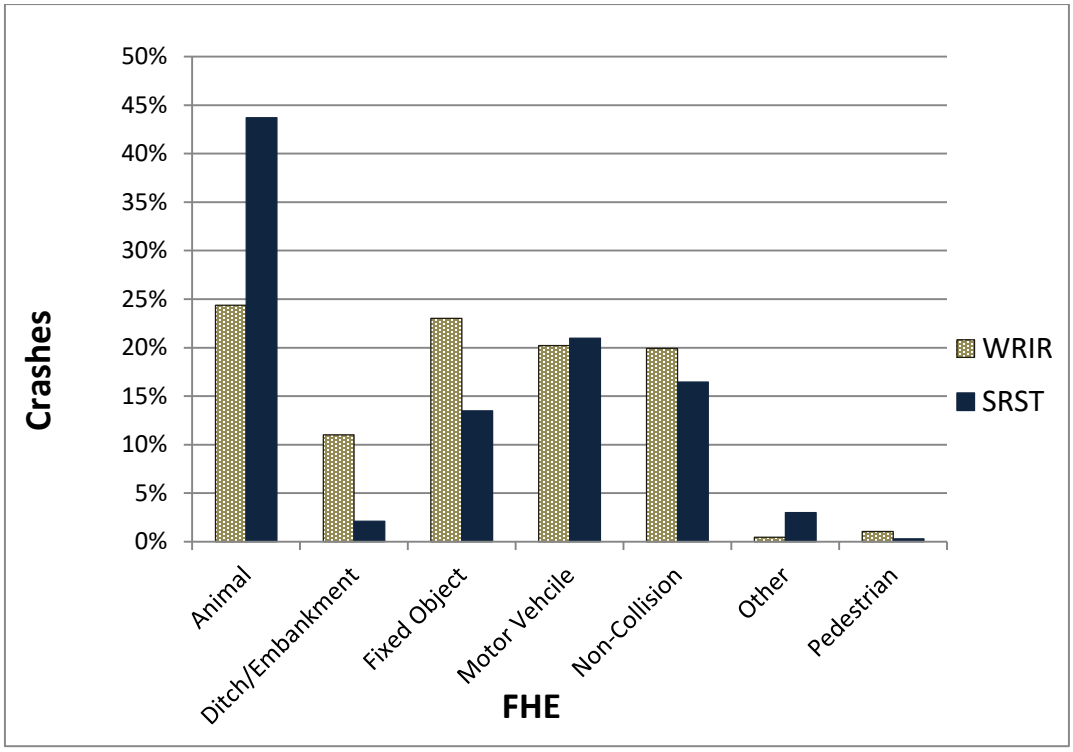

Figure 4.14 First Harmful Event SRST and WRIR, 10-Year Analysis

Of animal crashes, most of those on the WRIR involved domestic animals, such as horses and cows, at 59%; whereas 84% of animal crashes on the SRST involved wild animals (Table 4.1).

Table 4.1 Animal Crashes SRST and WRIR, 10-Year Analysis

Animal	**WRIR**	**SRST**
Wild	41%	84%
Domestic	59%	16%

Finally, more crashes occurred off the roadway on the WRIR at 47%; whereas 69% of crashes on the SRST occurred on the roadway (Figure 4.15).

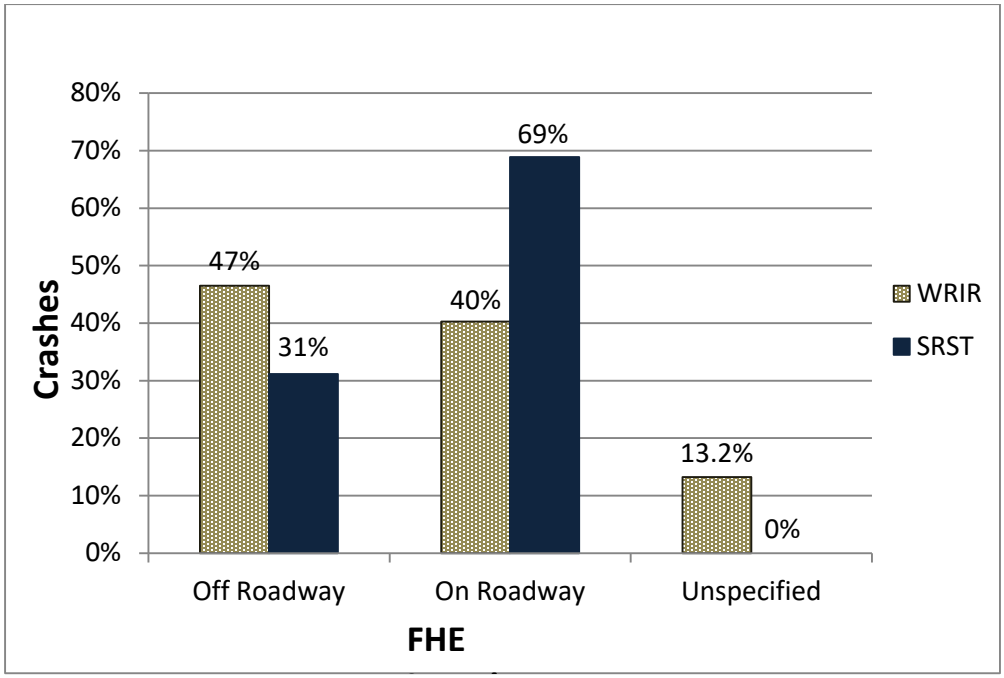

Figure 4.15 FHE Location SRST and WRIR, 10-Year Analysis

4.2 Chapter Summary

The crash data for Standing Rock were analyzed and trends were identified. Since SRST lies within two different states, crash data had to be obtained separately. NDDOT provided crash data for Sioux County from 2005 through 2013. South Dakota DPS provided crash data for Corson County from 2004 through 2013. There were a total of 396 crashes reported between 2005 and 2013, 120 in North Dakota and 276 in South Dakota. These numbers seem low for the size of the reservation and few crashes were reported on county and BIA roads. Crashes dropped considerably after 2009. This could be due to a combination of increased enforcement and changes in reporting.

Over 40% of crashes involved animals, mainly deer, and most crashes occurred on the roadway, as opposed to run-off-the-road. North Dakota has a much higher number of fatal crashes at 22% of all crashes, whereas South Dakota had 6% fatal crashes. There was also a much higher percentage of impaired driving in North Dakota with 26% of crashes involving an impaired driver, compared with only 6% percent in South Dakota.

When comparing SRST to the state of South Dakota, most trends between the two were similar. Crash severity was slightly higher on the reservation with 6% percent fatal crashes, compared with 1% fatal crashes across the state. Driver age and safety equipment use were comparable across the state.

SRST was compared with WRIR. These two reservations are similar in size with similar geographic features, such as the rural nature of the reservation with long stretches of rural highways connecting the pockets of residential and community centers. However, the crash trends varied substantially. WRIR had a much higher percentage of impaired driver crashes; more crashes occurred off the roadway on the WRIR; SRST had considerably more wild animal crashes; and WRIR had more young drivers involved in crashes. This comparison was made to determine if similarities existed between reservations across the region. The data indicate that every reservation is unique with unique challenges to addressing roadway safety.

5. STANDING ROCK SIOUX TRIBE IMPLEMENTATION

Standing Rock Reservation is located on the southern border of North Dakota on the western end of the state in Sioux County and continues into northern South Dakota contained in Corson County. It is approximately 2.3 million acres in size and is home to about 13,000 Native Americans and over 5,000 non-Native Americans. It maintains 128 miles of tribal roads and 232 miles of BIA roads, along with the respective state highways. It has a transportation department that consists of a director and a transportation safety officer, along with maintenance and administrative personnel.

5.1 Applied Methodology

Because Standing Rock Reservation lies within two states, the methodology was altered to rank the crashes and the Level I field evaluation separately for each state. A combined ranking and countermeasures were determined separately as well. In order to maximize resources, the Level I and Level II evaluations were performed simultaneously. See Figure 5.1.

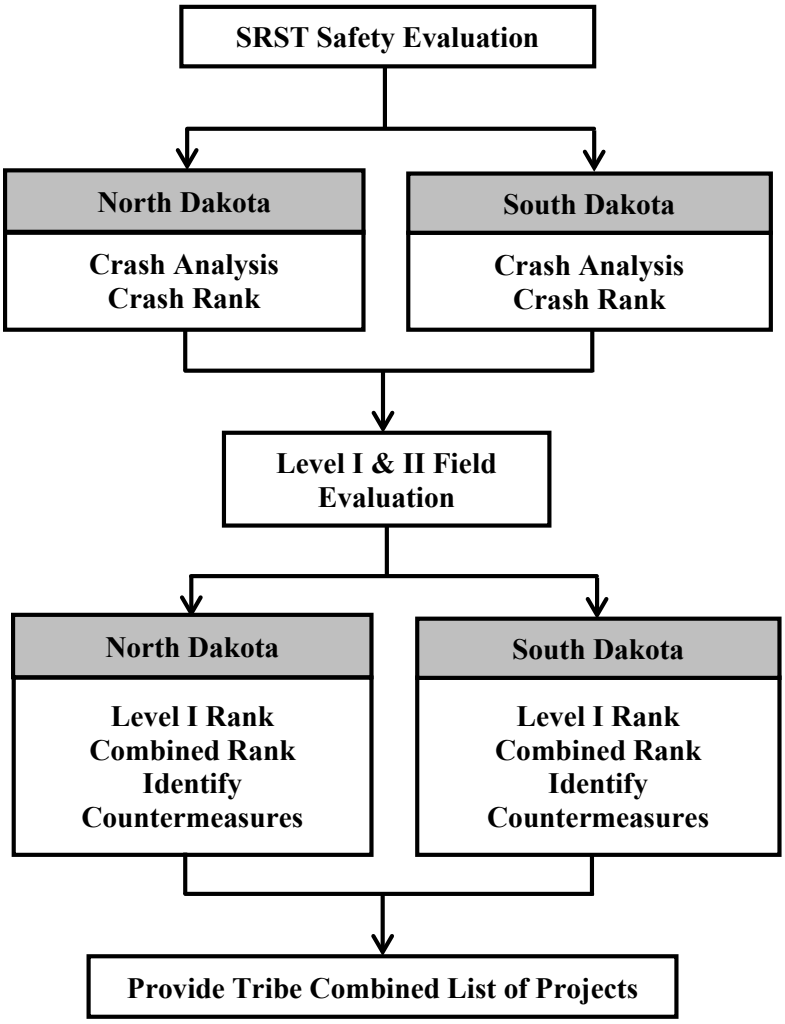

Figure 5.1 Applied Methodology

5.2 Crash Analysis

The analysis of crash data is the first step in the roadway safety program methodology. Safety goals and strategies are driven by data that document the safety problems. Many factors must be reviewed to determine appropriate safety measures considering the four E's of safety (engineering, enforcement, education, and emergency response).

The analysis and subsequent ranking proceeded using the crash analysis described in Chapter 3. An initial ranking was performed based on GIS maps with the crashes overlaid on the roadways (Appendix A). Initial data did not include all milepost locations. Once the Level I field evaluation was completed, the crash rankings mileposts were revised to match the Level I mileposts. Table 5.1 and Table 5.2 show the preliminary crash rankings for each state. The road segments were then sorted by the highest number of crashes per segment. Ranking was assigned starting at number one (1). Progressing through the list, equal scores received equal rank. Although this program is intended for local roadways, most of the crash data were contained on the state highways, so they were included and delivered to the tribe for their decision as to whether they wanted to be included in the program. The top nine roadway segments for North Dakota and the top 15 roadway segments for South Dakota were proposed to the tribe for Level I field evaluation.

Table 5.1 Sioux County, North Dakota, Crash Ranking (2005-2013)

Road Name	Functional Class	No. Crashes	Length (mi)	Crashes/mi	Rank
ND Hwy 1806	Rural Minor Arterial	9	3	3.0	1
ND Hwy 24	Rural Principal Arterial	4	2	2.0	2
ND Hwy 24	Rural Principal Arterial	10	5	2.0	2
ND Hwy 24	Rural Principal Arterial	23	15	1.5	4
ND Hwy 6	Rural Minor Arterial	8	6	1.3	5
ND Hwy 24	Rural Principal Arterial	6	5	1.2	6
Big Lake Road	Rural Local	3	3	1.0	7
ND Hwy 24	Rural Minor Arterial	4	5	0.8	8
ND Hwy 6	Rural Major Collector	5	7	0.7	9

Table 5.2 Corson County, South Dakota, Crash Ranking (2004-2013)

Road Name	Functional Class	No. Crashes	Length (mi)	Crashes/mi	Rank
107 St	Rural Local	4	1	4	1
SD Hwy 20	Rural Minor Arterial	100	29	3.4	2
249 Ave	Rural Minor Collector	3	1	3	3
SD Hwy 1806P	Rural Major Collector	3	1	3.0	3
US Hwy 12	Rural Principal Arterial	223	85	2.6	4
SD Hwy 65	Rural Minor Arterial	65	31	2.1	5
BIA Rd 44	Rural Major Collector	4	2	2	6
SD Hwy 63	Rural Minor Arterial	28	17	1.6	7
215 Ave	Rural Major Collector	4	3	1.3	8
SD Hwy 1806	Rural Major Collector	29	22	1.3	9
108 St	Rural Major Collector	7	13	0.5	11
BIA Rd 3	Rural Major Collector	4	10	0.4	12
SD Hwy 63	Rural Minor Arterial	12	33	0.4	12
BIA Rd 4	Rural Major Collector	10	30	0.3	14
113 St	Rural Local	4	13	0.3	14

5.3 Level I Field Evaluation

After consultation with the tribe, all nine roads in North Dakota were selected to be evaluated along with Sioux County Road 3 and Eagle Road. Although they had no crash data, the tribe requested they be reviewed. In South Dakota, eight of the 15 roads were selected by the tribe to be evaluated along with Honky Tonk Road. Again, this road had no crash data but was of concern to the tribe.

Five categories were evaluated: general roadway conditions, intersections, signage and pavement markings, fixed objects and clear zone, and shoulder and right-of-way, as described in Chapter 2. The same criterion used to score the segments for the initial implementation on the WRIR was used for the SRST. Each category was evaluated separately for each one-mile segment, assigning a score of 0 to 10 for each category. Zero (0) would be the worst condition and 10 would be the best. The starting level is five (5). For each segment, the score is totaled for all six categories providing a final score per segment.

The spreadsheets developed for each roadway for the Level I evaluation, which is a very subjective process can be observed in Appendix C. The evaluating team consisted of four individuals, SRST Transportation Safety Officer, WYT^2/LTAP, the county sheriff, and one BIA law enforcement officer. Each county was evaluated separately with its respective county sheriff. Segments of roadway were driven and conditions were discussed as a group and a score was given for each category.

This process was repeated for each segment of each roadway selected from the crash ranking. Each roadway ranged from one- to 20-miles long. SRST team members made field decisions to reduce the length evaluated based on knowledge of recent or upcoming construction and maintenance that would address safety issues. Looking at the hotspots in the context of the entire roadway is a practical approach to address roadway safety improvements. For example, if the field evaluation reveals that the roadway is in poor condition, pavement markings are missing, or shoulders are narrow, the improvement would not only be applied to the hotspot but to the entire portion of the roadway.

Once evaluation of all roads was complete, the segment scores were tabulated. The overall Level I score for each segment was assigned and the segments were sorted from lowest to highest score. From this, ranking was assigned starting at one (1). Progressing through the list, equal scores received equal rank. The next rank number would be the one associated with the total number of segments ranked so far. Table 5.3 summarizes the Level I ranking for Sioux County, ND, and Table 5.4 summarizes them for Corson County, SD.

Table 5.3 Sioux County, North Dakota Level I Rank

Highway	Beg MP	End MP	Level I Score	Level I Rank
Big Lake Rd	1	2	20	1
Big Lake Rd	2	3	21	2
Big Lake Rd	0	1	22	3
Big Lake Rd	3	4	22	3
ND 6	5	6	31	5
ND 24	14	15	32	6
ND 24	0	1	34	7
ND 24	5	6	34	7
ND 6	0	1	35	9
ND 6	3	4	35	9
ND 24	22	23	35	9
ND 6	1	2	36	12
ND 6	2	3	36	12
ND 6	4	5	36	12
ND 24	10	11	37	15
ND 24	11	12	37	15
ND 24	12	13	37	15
ND 24	13	14	37	15
ND 24	15	16	37	15
ND 24	16	17	37	15
ND 24	17	18	37	15
ND 24	18	19	37	15
ND 24	19	20	37	15
ND 24	20	21	37	15
ND 24	21	22	37	15
ND 24	23	24	37	15
ND 24	24	25	37	15
ND 24	25	26	37	15
ND 24	26	27	37	15
ND 24	27	28	37	15
ND 24	28	29	37	15
ND 24	29	30	37	15
ND 24	30	31	37	15
ND 24	31	32	37	15
ND 24	32	33	37	15
ND 24	33	34	37	15
ND 24	34	35	37	15
ND 24	35	36	37	15
ND 24	36	37	37	15
ND 24	37	38	37	15
ND 24	38	39	37	15
ND 24	39	40	37	15
ND 24	40	41	37	15
ND 24	41	42	37	15
ND 24	42	43	37	15
ND 1806	31	32	37	15
ND 1806	32	33	37	15
ND 1806	33	34	37	15
ND 24	3	4	38	49
ND 24	1	2	39	50
ND 24	2	3	39	50
ND 24	4	5	39	50
ND 24	6	7	39	50
ND 24	7	8	39	50
ND 24	8	9	39	50
ND 24	9	10	45	56

Table 5.4 Corson County, South Dakota, Level I Rank

Highway	Beg MP	End MP	Level I Score	Level I Rank
BIA 44	9	10	21	1
BIA 3	0	1	27	2
BIA 44	2	3	29	3
Honky Tonk	0	1	30	4
Honky Tonk	1	2	30	4
Honky Tonk	2	3	30	4
Honky Tonk	3	4	30	4
Honky Tonk	4	5	30	4
Honky Tonk	5	6	30	4
Honky Tonk	6	7	30	4
Honky Tonk	7	8	30	4
Honky Tonk	8	9	30	4
Honky Tonk	9	10	30	4
Honky Tonk	10	11	30	4
Honky Tonk	11	12	30	4
113 St	5	6	30	4
113 St	6	7	30	4
113 St	7	8	30	4
113 St	8	9	30	4
113 St	9	10	30	4
113 St	10	11	30	4
113 St	11	12	30	4
113 St	12	13	30	4
113 St	13	14	30	4
113 St	14	15	30	4
113 St	15	16	30	4
BIA 44	3	4	30	4
BIA 44	4	5	30	4
BIA 44	5	6	30	4
BIA 44	6	7	30	4
BIA 3	1	2	31	31
BIA 3	2	3	31	31
BIA 3	3	4	31	31
BIA 3	4	5	31	31
BIA 3	5	6	31	31
BIA 3	6	7	31	31
BIA 3	7	8	31	31
BIA 3	8	9	31	31
BIA 3	9	10	31	31
BIA 3	10	11	31	31
BIA 3	11	12	31	31
US 12	184	185	32	42
BIA 44	10	11	33	43
BIA 44	11	12	33	43
BIA 44	7	8	34	45
BIA 44	8	9	34	45
113 St	0	1	35	47
113 St	1	2	35	47
113 St	2	3	35	47
113 St	3	4	35	47
113 St	4	5	35	47
BIA 44	0	1	35	47
BIA 44	1	2	35	47
BIA 3	18	19	38	54
BIA 3	13	14	39	55
BIA 3	15	16	39	55
SD 63	244	245	39	55
SD 63	245	246	39	55
US 12	116	117	40	59
BIA 3	12	13	40	59
BIA 3	14	15	40	59
BIA 3	16	17	40	59
BIA 3	17	18	40	59
BIA 3	19	20	40	59
110 St	3	4	40	59
110 St	4	5	40	59
US 12	114	115	41	67
US 12	118	119	41	67
US 12	183	184	41	67
110 St	0	1	41	67
110 St	1	2	41	67
110 St	2	3	41	67
US 12	113	114	42	73
US 12	115	116	42	73
US 12	117	118	43	75
US 12	119	120	43	75
US 12	120	121	43	75
US 12	121	122	43	75
SD 63	246	247	44	79
SD 63	247	248	44	79
SD 63	248	249	44	79
SD 63	249	250	44	79
SD 63	250	251	44	79

5.4 Combining the Crash Ranking and the Level 1 Ranking

With a list of all segments ranked by highest number of crashes and lowest Level I score, the two rankings were combined. The crash rankings were first redone to match the one-mile segments to the Level I one-mile segments for each route. Refer to Appendix B for the revised crash rankings. Then the respective ranks for the respective segments were added. Appendix D provides the combined ranking for all roadway segments.

Once these were all totaled, the segments were sorted from smallest to largest combined rank value. The road segments with the lowest score were used to select the roads that would be evaluated for safety improvements. Table 5.5 is a list of the top four roads in Sioux County, ND, with their respective combined ranking. Table 5.6 is a list of the top roads for Corson County, SD, with their respective combined ranking.

Table 5.5 Combined Rank for Sioux County, North Dakota

Highway	From MP	To MP	Combined Rank
ND 24	9	10	59
	10	11	31
	11	12	21
	12	13	31
	13	14	31
	14	15	33
	15	16	16
	16	17	21
	17	18	65
	18	19	31
	19	20	42
	20	21	65
	21	22	65
	22	23	25
	23	24	21
	24	25	18
	25	26	21
	26	27	42
	27	28	65
	28	29	42
	29	30	20
ND 24	30	31	65
	31	32	42
	32	33	42
	33	34	42
	34	35	21
	35	36	65
	36	37	42
	37	38	65
	38	39	65
	39	40	65
ND 1806	31	32	16
	32	33	31
	33	34	21
Big Lake Rd	0	1	9

Table 5.6 Combined Rank for Corson County, South Dakota

Highway	From MP	To MP	Combined Rank
133 ST	3	4	56
	4	5	73
	5	6	30
	6	7	30
	7	8	30
	8	9	30
	9	10	30
	10	11	19
BIA 3	0	1	28
BIA 3	8	9	57
	9	10	46
	10	11	57
	11	12	57
	12	13	68
	13	14	81
	14	15	85
	15	16	70
	16	17	85
	17	18	85
	18	19	80
	19	20	85
BIA 44	6	7	13
	7	8	71
	8	9	71
	9	10	16
US 12	114	115	71
	115	116	82
	116	117	68
	117	118	78
	118	119	71
	119	120	90
	120	121	79
	121	122	101
US 12	183	184	68
	184	185	44

5.5 Level II Field Evaluation

As previously explained, Level II field evaluations were performed during the Level I field evaluations. The team discussed countermeasures with the understanding that further investigation would be needed. From the combined rankings, the hotspot locations were reviewed for most severe crashes at those locations, roadway geometrics, and other unique conditions to identify appropriate countermeasures.

5.5.1 Sioux County, North Dakota

Three roads were identified for recommended safety improvements with one road having multiple locations. The countermeasures are identified for the given roadway segment in Table 5.7.

Table 5.7 Level II Field Evaluation for Sioux County, North Dakota

Highway	From MP	To MP	Most Severe Crash	Road Geometry	Condition	Recommended Countermeasure
24	11	12	PDO	Straight	Deer	Deer Xing Signs**
24	15	16	Fatal	Curve	Curve at Bridge	Guard Rail north of bridge
24	16	17	Fatal*	Straight	Curve on Hill to North	Chevrons at curve
24	23	26	Fatal	Straight	Deer/ Rollover	Deer Xing Signs**/Speed Study
24	29	30	Injury	Straight	Intersection	Intersection Ahead Sign/Speed Study
24	34	35	Fatal	Curve	Good Sight Distance	Chevrons at curve/Speed Study
1806	31	34	Injury	Straight	Deer	Deer Xing Signs**
Big Lake Rd	0	1	Fatal	Straight	Narrow w/drop off	Widen

* One pedestrian fatality
** Determine best policy for animal crashes

There were two main stretches of ND 24 that had high combined rankings, the north-south section between Ft. Yates and ND 1806 (MP 9 to MP 28), and the east-west section from ND 1806 to Solen (MP 28 to MP 43). In three locations, the road was straight with wide shoulders and rumble strips. One location included the intersection of ND 24 and ND 1806. There were PDO crashes with deer and two fatal rollover crashes at two of the locations. Figure 5.2 presents the existing signage along ND Highway 24 with crash locations shown.

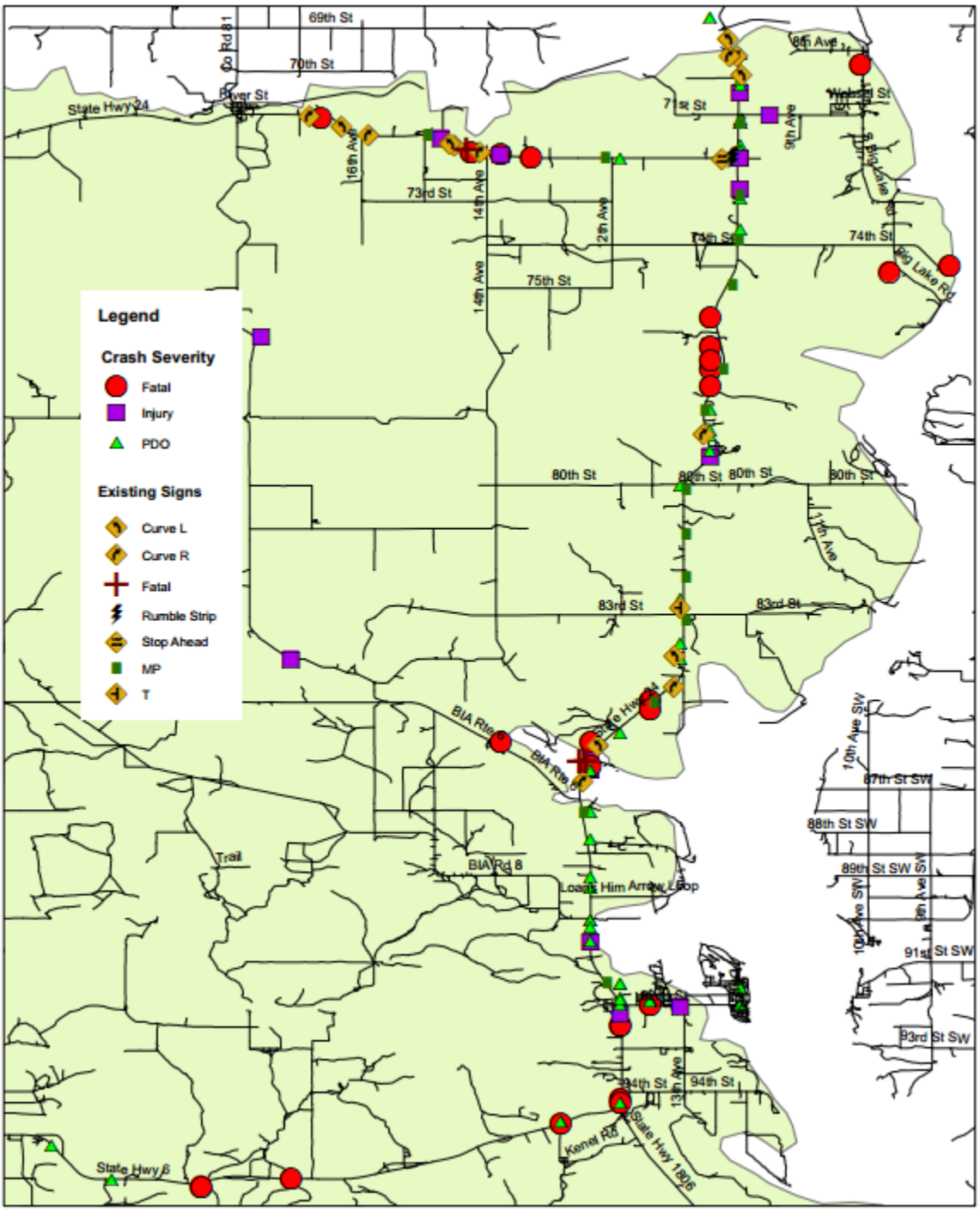

Figure 5.2 Existing Signage and Crashes along ND Highway 24

There were also deer crashes along ND 1806 (MP 31 to MP 34). Because 41% of all crashes in Sioux County are recorded as wild animal crashes, deer crossing signs should be carefully considered as to whether these locations have a higher deer concentration, or other factors are involved. Speeding could be a concern along these stretches, therefore a speed and safety study by NDDOT would be recommended.

There were two locations along ND 24 where fatalities occurred along a horizontal curve. One location in particular is also located near a bridge (MP 14 to MP 15). These locations contain curve warning signs with no advisory speeds. One of the curve locations (MP 34 to MP 35) appears to have good sight distance along a wide radius. This location could have some speeding issues, and a speed and safety study by NDDOT would be recommended. Near the bridge location, a guard rail is recommended (see Figure 5.3).

Figure 5.3 ND Highway 24 Curve at Bridge (MP 14 to MP 15)

Pedestrian safety is a concern on SRST. Pedestrian crashes resulting in fatalities were identified along ND 24. People will walk to work and to other services on the reservation. Some pathways have been constructed around Ft. Yates, but pedestrian travel extends across the reservation. Without adequate pedestrian facilities, individuals are forced to walk along the rural highways, which have narrow shoulders and high-speed traffic. Figure 5.4 shows how ND 24 is used by pedestrian.

Figure 5.4 ND Highway 24 North of Prairie Knights Casino (MP 24)

Big Lake Road was the only tribal road reviewed for safety improvements. This road is very narrow with no shoulders or recovery slopes. There are no pavement markings or lighting along this roadway. The slightest distraction or any reduction in visibility could lead to a serious incident. Three fatal crashes were recorded along this road. It is unknown how many other crashes of less severity have occurred there. The best solution for this roadway would be to widen it along the section that traverses a stream with a high drop-off (see Figure 5.5).

Figure 5.5 Big Lake Road

5.5.2 Corson County, South Dakota

From the combined ranking analysis, three roads were identified for recommended safety improvements. US Highway 12 was also identified for improvements due to the fatal crashes and concerns from the tribal and county enforcement agencies. The countermeasures are identified for the given roadway segment in Table 5.8.

Table 5.8 Level II Field Evaluation for Corson County, South Dakota

Highway	From MP	To MP	Most Severe Crash	Road Geometry	Condition	Recommended Countermeasure
113 ST	3	11	Fatal	Curves	ROR & Rollover Crashes	Speed study, rumble strip
BIA 44	6	10	Fatal	Curve	Gravel, RR Xing, Improper Signage	Curve warning signs with advisory speed, stop ahead/RR Xing ahead
BIA 3	0	1	Fatal	Intersection	Improper Speed Limit Sign	Replace speed limit sign
BIA 3	8	20	Fatal	Curves	Narrow, no shoulders, bumps	Curve warning signs, chevrons, realignment
US 12	114	122	Fatal	Curves	Reverse Superelevation	Speed study, advisory speed at curve
US 12	183	185	Fatal	Intersection	Collisions	Speed study and sight distance review, Advanced warning flashers

Honky Tonk Road was first evaluated as requested by the tribe. It is a gravel road that short cuts from McLaughlin to Bullhead. The roadway is in average condition for a gravel road and has good width and sight distance. Two sharp curves (MP 5.3 and 6.3) were properly signed. However, the T intersection with 257th Avenue did not have the sign in the proper location. This could be dangerous at night with no lighting. A double arrow sign (W1-7) and a T intersection ahead sign (W2-4) prior to the intersection should be posted.

Moving forward, 113th Street was evaluated starting at the end of Honky Tonk Road (257th Avenue). There are several curves between MP 3 and MP 11. The town of Bullhead is located around MP 5. The major curves have advanced warning signs with advisory speeds. Most crashes were run-off-the-road and rollovers. The road becomes narrower and the pavement degrades after the bridge at MP 5.3.

BIA 44 is a gravel road with varying conditions throughout. The evaluation started at 272nd Avenue and proceeded to Wakpala (MP 0 to 11). Areas along the segment have vegetation within the clear zone that could easily be removed. Several curves exist with curve warning signs in place. In two locations the road curved immediately after a railroad crossing, and neither location was signed properly for the curves (See Figure 5.6 and Figure 5.7). Advance warning signs for stop ahead and/or railroad crossing ahead should be added. An advanced curve warning sign should be added for the curve at MP 2.5. The curve warning signs should include the proper advisory speed plate.

Figure 5.6 BIA 44 at Railroad Crossing (MP 2.5)

Figure 5.7 BIA 44 at Railroad Crossing (MP 9.4)

BIA 3 begins in North Dakota at the intersection of ND 24 and ND 1806 and crosses the South Dakota border at MP 8. At the intersection with ND 24, the posted speed limit is 65 MPH. However, law enforcement noted that BIA is a 55-MPH speed limit. Intersection improvements have been made since the last fatality in 2005. Therefore, no other improvements are recommended at this location with the exception of posting the proper speed limit of 55 MPH.

BIA 3 has no shoulders with somewhat recoverable slopes. From MP 12 to MP 19 at Kenel, the road is newly constructed with wider shoulders and smooth pavement. However, at two culvert locations (MP 13.5 and 16.7), a noticeable bump exists in the roadway. Signs have been posted identifying these bumps. The tribe should consider repairing these sections when this pavement is scheduled for future maintenance.

No curve warning signs exist at the 90-degree curve at the state line (MP 8). At the curve, the pavement continues to extend to 100th Street. This allows drivers to continue at a high speed off the main roadway. Drivers entering as they head north are entering at a skew (see Figure 5.8). Advanced curve warning signs and possibly chevrons should be installed. he tribe should consider realigning the intersection at the curve to a 90 degree intersection, as illustrated in Figure 5.9. With the new construction starting at MP 12.4, it should be verified that curve warning signs were added.

Figure 5.8 BIA 3 at State Line (MP 8)

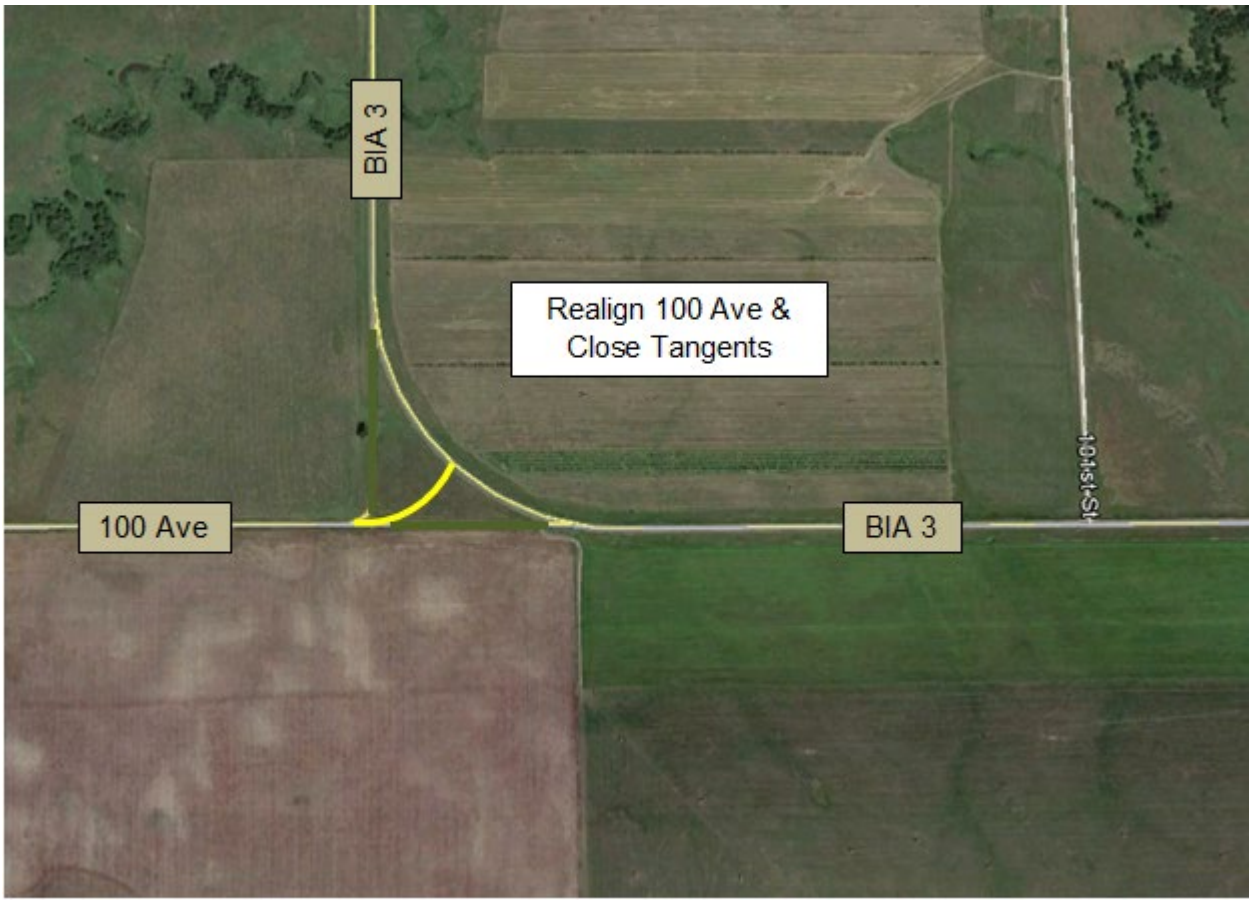

Figure 5.9 Proposed Realignment of 100 Avenue to BIA 3 at MP 8

US Highway 12 was not in the top combined rank mainly because the Level I evaluation showed the roadway is in good condition. However, it had the highest crash rank, so further investigation is warranted. Two separate segments were evaluated for safety improvements. The first segment is located between Morristown and Wantaga (MP 114 to 122).

Over a 10-year period, 22 crashes occurred along this segment (2004-2013). Most were either animal-related or rollover crashes. Curves exist with proper advanced warning signs in place along with no-passing zones. Although the shoulders are narrow, rumble strips are located the length of the segment. Speeding could be a concern, and a safety speed study by the DOT is recommended. Particular attention should be given to the curve located at MP 116.3. It appears that a reverse superelevation exists along this curve (see Figure 5.10). A study to determine a safe speed to maneuver this curve should be performed and advisory speed posted with the advanced curve warning sign.

Figure 5.10 Reverse Superelevation at Curve on US 12 (MP 116.3)

The next segment of concern on US 12 is at the Grand River Casino (MP 183 to 185). Many safety concerns have already been addressed at the casino entrance, which was identified in a previous study. A left-turn lane and a right-turn lane have been constructed. A 2,000-foot eastbound passing lane exists prior to the road leading to the casino. The right-hand lane becomes the right-turn lane 600 feet before the casino entrance. This is because of the long climbing grade starting at the bridge 3,300 feet east of the casino entrance. Signage for the lane merge and T intersection exist as well. See Figure 5.11 for locations.

With the improvements in place, safety is still a concern at the casino entrance. A fatal crash occurred in 2014 at the intersection of the entrance to US 12. Just east of the entrance is the crest of a vertical curve. Although the proper sight distance may exist, which should be verified, the perception is that eastbound oncoming traffic cannot be seen in time to enter the highway safely. The speed limit is 65 MPH eastbound and 55 MPH westbound. A speed safety study and sight distance determination should be performed by the DOT. Additional signage warning of the dangerous intersection or a flashing warning sign could be considered to get drivers to slow down and be more aware of the situation.

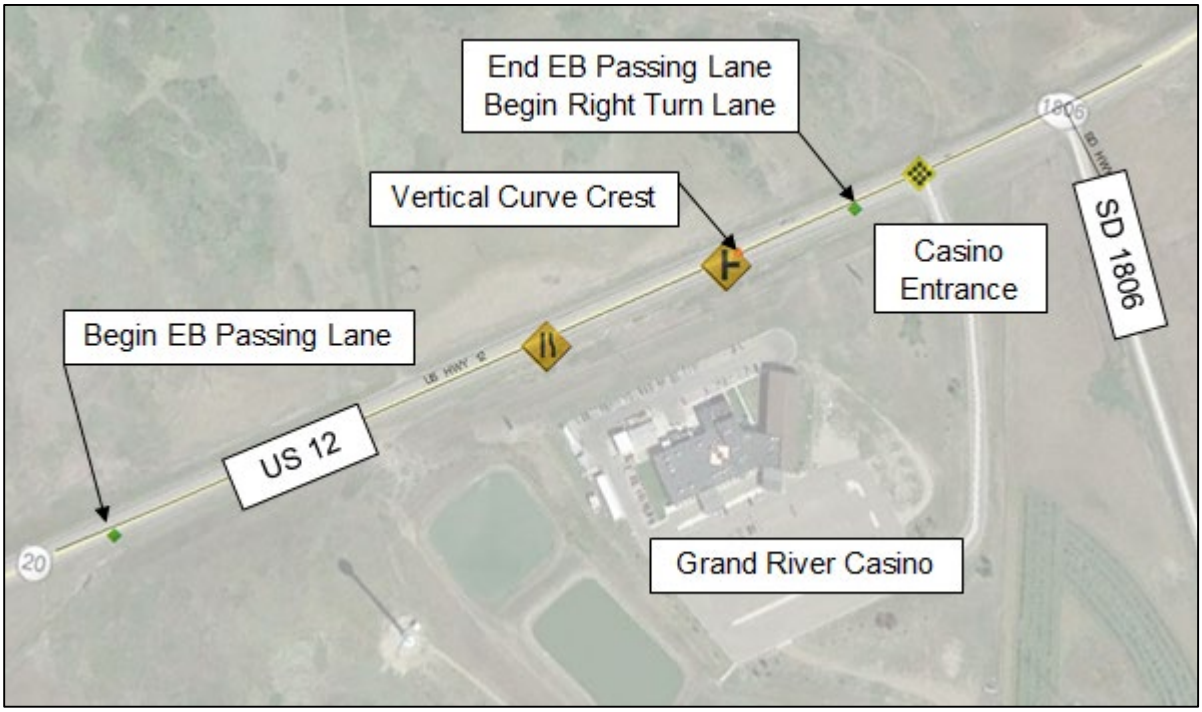

Figure 5.11 US 12 at Grand River Casino (MP 183 to 185)

5.6 Proposed Safety Improvements

The following projects in Table 5.9 are safety improvements proposed for SRST. The tribe should review these improvements and determine which projects they are interested in pursuing for funding and construction.

Table 5.9 Proposed Safety Improvements for SRST

Highway	Project
ND 24	Install Chevrons Install Intersection Ahead Signs Install Guardrail
ND 1806	Install Deer Xing Signs
Big Lake Road	Widen Roadway at Bridge
113 ST	Install Rumble Strip
BIA 44	Install Curve Warning Signs w/Advisory Speed Install Stop Ahead/RR Xing Ahead
BIA 3	Change Speed Limit Sign Install Curve Warning Signs Install Chevrons
BIA 3	Realign 100 Street
US 12	Install Advisory Speed Signs* Install Chevrons
US 12	Install Advanced Warning Flashers*
Honky Tonk Road	Install Intersection Ahead Sign Install Double Arrow Sign

*Dependent on DOT speed and safety study results

5.7 Benefit-Cost Analysis

Once the tribe determines which projects to pursue, a benefit-cost analysis should be performed. Based on countermeasures provided by FHWA in its Desktop Reference for Crash Reduction Factors (FHWA, 2008) and Manual for Selecting Safety Improvements on High Risk Rural Roads (Atkinson, et al., 2014), the improvements will be matched with the countermeasures and CRFs assigned. The countermeasures and their respective reduction factors are listed in Table 5.10.

Table 5.10 Countermeasures and Respective CRFs

Countermeasures	Crash Type	Crash Reduction Factors			Service Life
		Fatal	Injury	PDO	
Install guide signs (general)	All	15%	15%	15%	5
Install advance warning signs	All	40%	40%	40%	5
Install chevron signs on horizontal curves	All	35%	35%	35%	5
Install curve advance warning signs	All	30%	30%	30%	5
Install delineators (general)	All	11%	11%	11%	4
Install delineators (on bridges)	All	40%	40%	40%	4
Install edge lines, centerlines and delineators	All	0%	45%	0%	4
Install centerline markings	All	33%	33%	33%	2
Improve sight distance to intersection	All	56%	37%	0%	15
Flatten crest vertical curve	All	20%	20%	20%	15
Flatten horizontal curve	All	39%	39%	39%	15
Improve horizontal and vertical alignments	All	58%	58%	58%	15
Flatten side slopes	All	43%	43%	43%	15
Install guardrail (at bridge)	All	22%	22%	22%	10
Install guardrail (at embankment)	All	0%	42%	0%	10
Install guardrail (outside curves)	All	63%	63%	0%	10
Improve guardrail	All	9%	9%	9%	10
Improve superelevation	All	40%	40%	40%	15
Widen bridge	All	45%	45%	45%	15
Install shoulder	All	9%	9%	9%	5
Pave shoulder	All	15%	15%	15%	5
Install transverse rumble strips on approaches	All	35%	35%	35%	3
Improve pavement friction	All	13%	13%	13%	5
Install animal fencing	Animal	80%	80%	80%	10
Install snow fencing	Snow	53%	53%	53%	10

The cost of a countermeasure is calculated based on present construction costs. Since the crash analysis was performed for a 10-year period, if the service life of a countermeasure was different than 10 years, it was converted to a 10-year cost. For example, if a countermeasure had a service life of five years, the current construction cost would be two times the cost of one application. The total cost is calculated for each road and compared to an overall benefit in crash reduction for the entire roadway.

The benefit is calculated based on societal crash costs. It represents the cost savings of crashes reduced. A value is assigned to each type of crash severity (fatal, injury, or PDO). The values in Table 5.11 are suggested for use in the analysis. However, the others may be used as the tribe deems appropriate.

Table 5.11 Societal Crash Costs

	Crash Cost
Fatal	$2,500,000
Injury	$60,000
PDO	$6,000

The ratio of benefit to cost is then calculated. Values less than 1.0 would indicate there is no benefit in the improvement and the project should be eliminated. Based on the final analysis, the tribe can use the information for project funding requests.

5.8 Chapter Summary

The roadway safety improvement program has been implemented on the SRST reservation. North Dakota (Sioux County) and South Dakota (Corson County) were analyzed separately because the data varied between the states. A final list of projects is presented to the tribe to determine their priorities on the reservations.

5.8.1 Sioux County, ND, Safety Improvements

In Sioux County, the emphasis was on state highways based on feedback from the tribe. They have safety concerns for ND Highway 24 and ND Highway 1806. Based on the crash analysis and field evaluations, three roads were reviewed for safety improvements, ND 24, ND 1806, and Big Lake Road. Several fatalities are reported along ND 24. Signage will provide low-cost safety improvement. Just north of a bridge along a horizontal curve (MP 16), fatalities were reported along with known run-off-the-road crashes. Guardrails are recommended for this location.

ND 1806 has had several deer crashes. The placement of deer crossing signs between MP31 and MP34 is a recommended low-cost safety improvement. However, due to the high number of wild animal crashes, consideration should be given to other options or policies. This may be a safety concern for inclusion in the strategic highway safety plan.

Big Lake Road has known fatalities and an unknown number of other road departure crashes. This road is very narrow with no shoulder or pavement markings, and virtually no recovery. The only low-cost improvements that might be considered as a stop-gap measure are flexible delineators. This roadway should be widened to provide a shoulder and pavement markings.

Safe pedestrian access is a concern for the tribe. Fatal pedestrian crashes have been reported along ND 24. High-speed traffic and narrow shoulders are extremely hazardous conditions for pedestrians. However, tribal members walk across the reservation to get to work and other services. A long-range pedestrian access plan should be developed for the tribe to identify the high pedestrian traffic locations and needed improvement areas, which should then be included in the strategic plan.

Many locations appeared to have good geometrics and sight distance. However, several fatal and serious injury crashes have been reported. A speed safety study is recommended for ND 24 and ND 1806 to determine if safety is an issue. If this is the case, speeding should be included in the strategic plan as a safety concern.

5.8.2 Corson County, SD

Based on the crash analysis and field evaluations, four roads were reviewed for safety improvements, 113th Street, BIA 3, BIA 44, and US 12. In addition, Honky Tonk Road was reviewed based on feedback from the tribe. No crash data were available for this road. Fatal and run-off-the-road crashes were prevalent. Rumble strips or rumble stripe at the edge line is recommended for 113th Street. A speed study is recommended for 113th Street to determine compliance and if speeding is determined to be an issue. This should be included in the tribe's strategic highway safety plan.

BIA 44 is a gravel road in average condition. Some areas had vegetation in the clear zone and are recommended to be removed. Two railroad crossings exist along this roadway, with curves immediately after the crossings. Stop signs exist at the crossings, and one curve warning sign exists at the second crossing but with a regulatory speed limit sign. It is recommended that curve warning signs with advisory speed plates be posted for both curves. In addition, either stop ahead signs or railroad crossing ahead signs (or both) should be installed.

BIA 3 has narrow shoulders and is posted at 65 MPH. According to law enforcement, it should be posted at 55 MPH. Curve warning signs and chevrons should be installed at the curve located at the state line (MP 8). This location is also the intersection of 100th Street with tangent roadway access points. This intersection should be realigned and tangents removed.

US 12 between Morristown and Wantaga (MP 114 to 122) had 22 crashes over a 10-year period (2004-2013). Most were either animal or rollover crashes. A speed study is recommended for this location and, if it is an issue, it should be included in the tribe's strategic highway safety plan. One curve located at MP 116.3 appears to have a reverse superelevation. Advisory speed should be determined by the DOT and posted with the curve warning sign. Chevrons should also be added along this curve.

Collisions crashes were recorded for the intersection of US 12 and Grand River Casino. With a crest vertical curve east of the casino entrance, sight distance should be verified. A speed safety study should be performed and proper speed limits posted. It is recommended that an advanced warning flasher be installed east of the casino entrance.

6. CONCLUSIONS AND RECOMMENDATIONS

6.1 Summary

Tribal communities have suffered greatly with higher fatality rates on their roadways than the general U.S. population. As the country has been successful in decreasing fatal and injury crashes over the past several years, Native Americans have experienced an increase in these types of crashes.

This report presents a five-step methodology developed to help tribes improve their roadway safety through low-cost improvements. The methodology was successfully implemented on the WRIR with three low-cost projects funded by the Wyoming DOT and other safety measures implemented through identifying safety concerns in their strategic plan.

WYT^2/LTAP and NPTTAP developed criteria for other tribes in the Northern Plains region to participate in implementing the methodology on their reservations. The criteria required a commitment from the tribes to follow through in the program and provide support. Three reservations were selected for implementation; Standing Rock Sioux Tribe (SRST), Sisseton Wahpeton Oyate, and Yankton Sioux Tribe. This report covers the implementation on the SRST reservation.

6.2 Conclusions

Standing Rock Reservation is the second reservation where the five-step methodology has been implemented. Many differences were noted throughout the process, as well as similar challenges faced by tribal governments in implementing safety improvement programs. These included the following:

- Working with two separate states for one reservation required extensive coordination and communication among the entities to ensure a seamless program for the tribe.
- Crash data seemed incomplete due to the size of the reservation and the low number of reported crashes.
- Differences in trends across the state lines within the reservation could be due to differences in reporting for each state.
- The tribe has major concerns about safety along ND 24, which is corroborated by the crash data.
- North Dakota (Sioux County) has a higher percentage of fatal crashes and more impaired driver crashes than South Dakota (Corson County).
- SRST crash trends were similar compared with those in South Dakota.
- Although the SRST and WRIR reservations appear to be similar in size and geography, many differences exist with their roadway safety issues. Each reservation is unique with its own challenges in addressing roadway safety.
- Many locations in both North and South Dakota had good geometrics, but several crashes could be due to speeding.

6.3 Recommendations

Based on the analysis and the projects that have been identified for the SRST, the following recommendations are provided:

- The improvement projects identified in this report should be submitted to the respective state DOTs for funding.
- The strategic plan should be updated to include the safety concerns identified in this report that are not related to engineering improvements, including improved crash reporting, speeding, impaired driving, animal crashes, and pedestrian safety.
- A long-range pedestrian access plan should be developed for the SRST to identify needed pathways across the reservation.
- A speed safety study should be performed on ND 24, ND 1806, 113th Street, and US 12 by the respective state DOTs.
- Animal crashes should be investigated further to determine the best solution across the reservation to address the high number of animal crashes.

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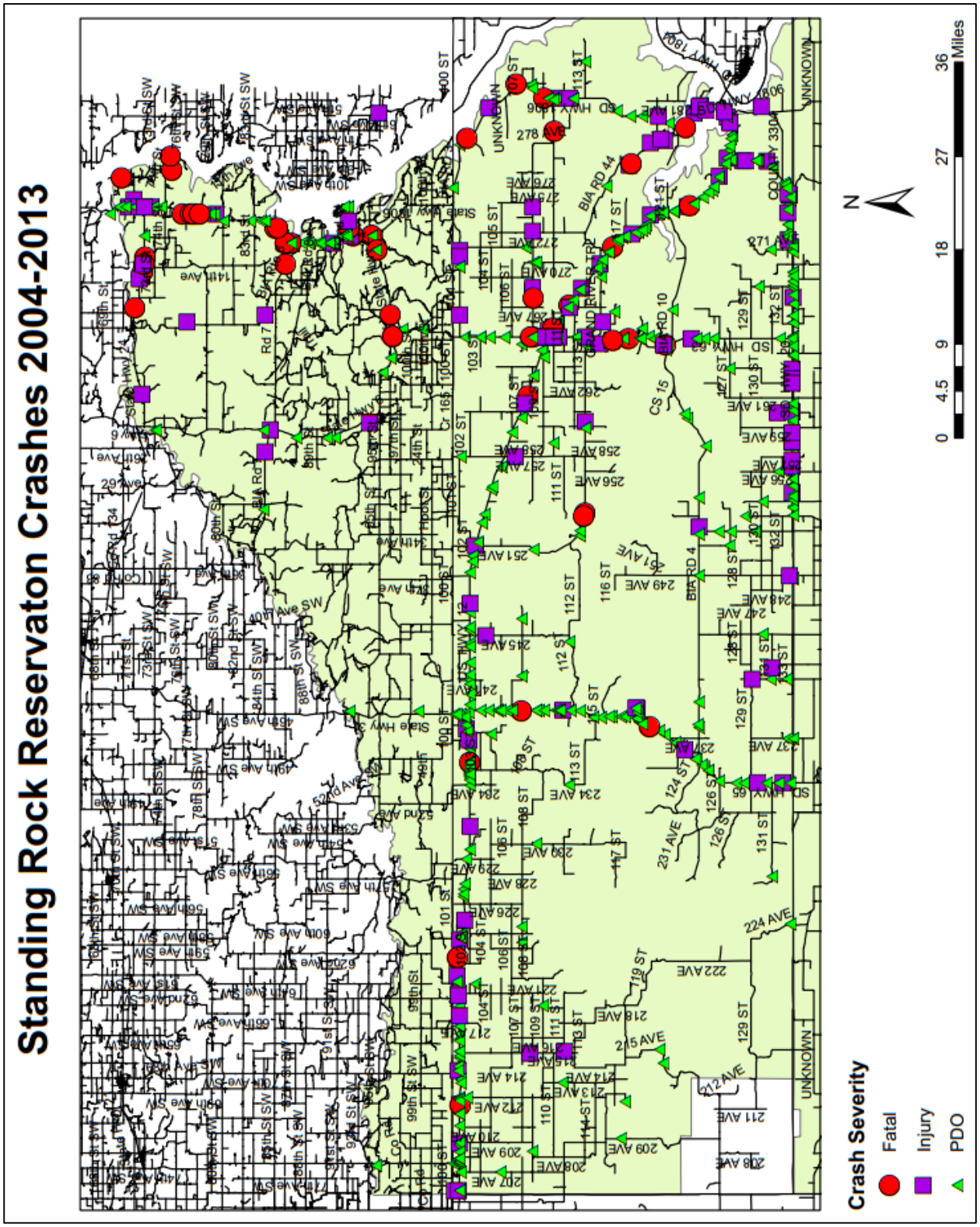
APPENDIX A: MAP OF SRST CRASHES



APPENDIX B: REVISED CRASH RANKINGS

Crash Ranking for Sioux County, ND

Highway	Beg MP	End MP	Total Crashes	Crash Rank
24	15	16	6	1
1806	31	32	6	1
24	9	10	5	3
24	24	25	5	3
24	29	30	4	5
24	6	7	3	6
24	7	8	3	6
24	8	9	3	6
24	11	12	3	6
24	16	17	3	6
24	23	24	3	6
24	25	26	3	6
24	34	35	3	6
1806	33	34	3	6
Big Lake Rd	0	1	3	6
6	2	3	2	16
6	6	7	2	16
6	16	17	2	16
6	33	34	2	16
24	10	11	2	16
24	12	13	2	16
24	13	14	2	16
24	18	19	2	16
24	22	23	2	16
24	42	43	2	16
1806	32	33	2	16
6	4	5	1	27
6	7	8	1	27
6	8	9	1	27
6	12	13	1	27
6	13	14	1	27
6	22	23	1	27
6	23	24	1	27
24	0	1	1	27
24	1	2	1	27
24	5	6	1	27
24	14	15	1	27
24	19	20	1	27

Highway	Beg MP	End MP	Total Crashes	Crash Rank
24	26	27	1	27
24	28	29	1	27
24	31	32	1	27
24	32	33	1	27
24	33	34	1	27
24	36	37	1	27
31	2	3	1	27
31	9	10	1	27
49	7	8	1	27
1804	9	10	1	27
1806	34	35	1	27
6	0	1	0	50
6	1	2	0	50
6	3	4	0	50
6	5	6	0	50
6	9	10	0	50
6	10	11	0	50
6	11	12	0	50
6	14	15	0	50
6	15	16	0	50
6	17	18	0	50
6	18	19	0	50
6	19	20	0	50
6	20	21	0	50
6	21	22	0	50
6	24	25	0	50
6	25	26	0	50
6	26	27	0	50
6	27	28	0	50
6	28	29	0	50
6	29	30	0	50
6	30	31	0	50
6	31	32	0	50
6	32	33	0	50
24	2	3	0	50
24	3	4	0	50
24	4	5	0	50
24	17	18	0	50
24	20	21	0	50
24	21	22	0	50
24	27	28	0	50
24	30	31	0	50

Highway	Beg MP	End MP	Total Crashes	Crash Rank
24	35	36	0	50
24	37	38	0	50
24	38	39	0	50
24	39	40	0	50
24	40	41	0	50
24	41	42	0	50
31	3	4	0	50
31	4	5	0	50
31	5	6	0	50
31	6	7	0	50
31	7	8	0	50
31	8	9	0	50

Crash Ranking for Corson County, SD

Highway	Beg MP	End MP	Total Crashes	Crash Rank
US 12	183	184	11	1
US 12	184	185	10	2
US 12	117	118	5	3
SD 63	245	246	3	4
US 12	113	114	3	4
US 12	114	115	3	4
US 12	118	119	3	4
US 12	120	121	3	4
113 St	3	4	2	9
BIA 3	12	13	2	9
BIA 44	6	7	2	9
SD 63	250	251	2	9
US 12	115	116	2	9
US 12	116	117	2	9
110 St	2	3	1	15
113 St	10	11	1	15
BIA 3	9	10	1	15
BIA 3	15	16	1	15
BIA 44	3	4	1	15
BIA 44	9	10	1	15
SD 63	244	245	1	15
SD 63	246	247	1	15
SD 63	247	248	1	15
SD 63	248	249	1	15
US 12	119	120	1	15
110 St	0	1	0	26
110 St	1	2	0	26
110 St	3	4	0	26
110 St	4	5	0	26
113 St	0	1	0	26
113 St	1	2	0	26
113 St	2	3	0	26
113 St	5	6	0	26
113 St	6	7	0	26
113 St	7	8	0	26
113 St	8	9	0	26
113 St	9	10	0	26
113 St	11	12	0	26
113 St	12	13	0	26
113 St	13	14	0	26
113 St	14	15	0	26

Highway	Beg MP	End MP	Total Crashes	Crash Rank
113 St	15	16	0	26
BIA 3	0	1	0	26
BIA 3	1	2	0	26
BIA 3	2	3	0	26
BIA 3	3	4	0	26
BIA 3	4	5	0	26
BIA 3	5	6	0	26
BIA 3	6	7	0	26
BIA 3	7	8	0	26
BIA 3	8	9	0	26
BIA 3	10	11	0	26
BIA 3	11	12	0	26
BIA 3	13	14	0	26
BIA 3	14	15	0	26
BIA 3	16	17	0	26
BIA 3	17	18	0	26
BIA 3	18	19	0	26
BIA 3	19	20	0	26
BIA 44	0	1	0	26
BIA 44	1	2	0	26
BIA 44	2	3	0	26
BIA 44	4	5	0	26
BIA 44	5	6	0	26
BIA 44	7	8	0	26
BIA 44	8	9	0	26
BIA 44	10	11	0	26
Honky Tonk Rd	0	1	0	26
Honky Tonk Rd	1	2	0	26
Honky Tonk Rd	2	3	0	26
Honky Tonk Rd	3	4	0	26
Honky Tonk Rd	4	5	0	26
Honky Tonk Rd	5	6	0	26
Honky Tonk Rd	6	7	0	26
Honky Tonk Rd	7	8	0	26
Honky Tonk Rd	8	9	0	26
Honky Tonk Rd	9	10	0	26
Honky Tonk Rd	10	11	0	26
Honky Tonk Rd	11	12	0	26
SD 63	249	250	0	26
US 12	121	122	0	26

APPENDIX C: LEVEL I FIELD EVALUATION WORKSHEETS

Level I Field Evaluation | Evaluator: DSS | Date: 9/9/14 | Page: of

Notes: Evaluation Team: SRST Traffic Safety officer, Chris Montclair; Sioux County Sheriff; BIA officer

Road Name: ND Hwy 24 (N/S) | Road Length:

Road No.: | Road Surface: Asphalt

Road Class: Rural Princ Arterial | Speed Limit: 65

Mile Post	General	Intersections / RR Crossings	Signage / Pavement Markings	Fixed Objects/ Clear Zones	Shoulder / ROW	Segment Score	Comments
0.0 - 1.0	9	9	9	9	9	45	Start at Ft. Yates heading north, first 1 mile under construction
1.1 - 2.0	5	9	7	9	7	37	
2.1 - 3.0	5	9	7	9	7	37	
3.1 - 4.0	5	9	7	9	7	37	
4.1 - 5.0	5	9	7	9	7	37	
5.1 - 6.0	4	9	6	9	4	32	Curve at Bridge and hill. Several fatalities. *Look at adding GR*
6.1 - 7.0	5	9	7	9	7	37	
7.1 - 8.0	5	9	7	9	7	37	
8.1 - 9.0	5	9	7	9	7	37	
9.1 - 10.0	5	9	7	9	7	37	
10.1 - 11.0	5	9	7	9	7	37	
11.1 - 12.0	5	9	7	9	7	37	
12.1 - 13.0	5	9	7	9	7	37	
13.1 - 14.0	5	7	7	9	7	35	Casino entrances 13.6 & 13.7
14.1 - 15.0	5	9	7	9	7	37	
15.1 - 16.0	5	9	7	9	7	37	15.2 (MM24-25) Hill to curve, missing curve signs. 15.8 curve
16.1 - 17.0	5	9	7	9	7	37	
17.1 - 18.0	5	9	7	9	7	37	
18.1 - 19.0	5	9	7	9	7	37	End at 18.5 (74th St)
19.1 - 20.0							
							18.6 Eagle Road and 24 intersection.
							Look at adding stop ahead sign at top of hill

Level I Field Evaluation	Evaluator: DSS	Date: 9/9/14	Page: of
Notes: Evaluation Team: SRST Traffic Safety officer, Chris Montclair; Sioux County Sheriff; BIA officer		Road Name: Eagle Road	Road Length:
		Road No.:	Road Surface: Gravel
		Road Class:	Speed Limit: 45

Mile Post	General	Intersections / RR Crossings	Signage / Pavement Markings	Fixed Objects/ Clear Zones	Shoulder / ROW	Segment Score	Comments
0.0 - 1.0	7	5	7	8	8	35	Begin at intersection with ND Hwy 24
1.1 - 2.0	7	7	8	8	8	38	*Look at adding stop ahead sign at top of hill*
2.1 - 3.0	7	6	7	8	8	36	End at 2.5 miles at Big Lake Road Intersection
3.1 - 4.0						0	
4.1 - 5.0						0	
5.1 - 6.0						0	
6.1 - 7.0						0	
7.1 - 8.0						0	
8.1 - 9.0						0	
9.1 - 10.0						0	
10.1 - 11.0						0	
11.1 - 12.0						0	
12.1 - 13.0							
13.1 - 14.0							
14.1 - 15.0							
15.1 - 16.0							
16.1 - 17.0							
17.1 - 18.0							
18.1 - 19.0							
19.1 - 20.0							

Level I Field Evaluation	Evaluator: DSS	Date: 9/9/14	Page: of
Notes: Evaluation Team: SRST Traffic Safety officer, Chris Montclair; Sioux County Sheriff; BIA officer		Road Name: Big Lake Road	Road Length:
		Road No.:	Road Surface: Asphalt
		Road Class: Rural Local	Speed Limit: ?

Mile Post	General	Intersections / RR Crossings	Signage / Pavement Markings	Fixed Objects/ Clear Zones	Shoulder / ROW	Segment Score	Comments
0.0 - 1.0	3	8	3	6	2	22	Pavement surface in poor condition
1.1 - 2.0	2	8	2	6	2	20	1. 7 Hill going into curve. Fatal crashes. *Look at adding GR*
2.1 - 3.0	3	8	2	6	2	21	2.1 no curve sign
3.1 - 4.0	3	8	3	6	2	22	End road at 3.3
4.1 - 5.0							
5.1 - 6.0							
6.1 - 7.0							
7.1 - 8.0							
8.1 - 9.0							
9.1 - 10.0							
10.1 - 11.0							
11.1 - 12.0							
12.1 - 13.0							
13.1 - 14.0							
14.1 - 15.0							
15.1 - 16.0							
16.1 - 17.0							
17.1 - 18.0							
18.1 - 19.0							
19.1 - 20.0							

Level I Field Evaluation	Evaluator: DSS	Date: 9/9/14	Page: of
Notes: Evaluation Team: SRST Traffic Safety officer, Chris Montclair; Sioux County Sheriff; BIA officer		Road Name: ND 24 (E/W)	Road Length:
		Road No.:	Road Surface: Asphalt
		Road Class:	Speed Limit: 65

Mile Post	General	Intersections / RR Crossings	Signage / Pavement Markings	Fixed Objects/ Clear Zones	Shoulder / ROW	Segment Score	Comments
0.0 - 1.0	5	9	7	9	7	37	West of Cannonball. Start at Eagle Road
1.1 - 2.0	5	9	7	9	7	37	
2.1 - 3.0	5	9	7	9	7	37	
3.1 - 4.0	5	9	7	9	7	37	
4.1 - 5.0	5	9	7	9	7	37	Fatalities 4 miles from intersection of 1806 and 24 NS.
5.1 - 6.0	5	9	7	9	7	37	
6.1 - 7.0	5	9	7	9	7	37	
7.1 - 8.0	5	9	7	9	7	37	Mile Mark 34
8.1 - 9.0	5	9	7	9	7	37	
9.1 - 10.0	5	9	7	9	7	37	
10.1 - 11.0	5	9	7	9	7	37	
11.1 - 12.0	5	9	7	9	7	37	
12.1 - 13.0	5	9	7	9	7	37	
13.1 - 14.0	5	9	7	9	7	37	
14.1 - 15.0	5	9	7	9	7	37	End at 14.2
15.1 - 16.0							
16.1 - 17.0							
17.1 - 18.0							
18.1 - 19.0							
19.1 - 20.0							

Level I Field Evaluation	Evaluator: DSS	Date: 9/9/14	Page: of
Notes: Evaluation Team: SRST Traffic Safety officer, Chris Montclair; Sioux County Sheriff; BIA officer		Road Name: Sioux Co Rd 3	Road Length:
		Road No.:	Road Surface: Gravel
		Road Class: Rural Local	Speed Limit: 45

Mile Post	General	Intersections / RR Crossings	Signage / Pavement Markings	Fixed Objects/ Clear Zones	Shoulder / ROW	Segment Score	Comments
0.0 - 1.0	5	5	5	5	1	21	
1.1 - 2.0	5	5	5	5	1	21	Curves well marked
2.1 - 3.0	5	5	5	5	1	21	
3.1 - 4.0	5	5	5	5	1	21	Questionable speed limit signs for curves
4.1 - 5.0	5	5	5	5	1	21	
5.1 - 6.0	5	5	5	5	1	21	
6.1 - 7.0	5	5	5	5	1	21	
7.1 - 8.0	5	5	5	5	1	21	
8.1 - 9.0	5	5	5	5	1	21	
9.1 - 10.0	5	5	5	5	1	21	
10.1 - 11.0	5	5	5	5	1	21	
11.1 - 12.0	5	5	5	5	1	21	
12.1 - 13.0	5	5	5	5	1	21	
13.1 - 14.0	5	5	5	5	1	21	
14.1 - 15.0	5	5	5	5	1	21	
15.1 - 16.0	5	5	5	5	1	21	
16.1 - 17.0	5	5	5	5	1	21	
17.1 - 18.0	5	5	5	5	1	21	
18.1 - 19.0	5	5	5	5	1	21	
19.1 - 20.0	5	5	5	5	1	21	End Road at 20.2

Level I Field Evaluation	Evaluator: DSS	Date: 9/9/14	Page: of
Notes: Evaluation Team: Remote by DSS		Road Name: ND Hwy 6	Road Length:
		Road No.:	Road Surface: Asphalt
		Road Class: Rural Princ Arterial	Speed Limit: 65

Mile Post	General	Intersections / RR Crossings	Signage / Pavement Markings	Fixed Objects/ Clear Zones	Shoulder / ROW	Segment Score	Comments
0.0 - 1.0	5	8	6	9	7	35	Start at SD State line. No signs at curves
1.1 - 2.0	5	9	6	9	7	36	
2.1 - 3.0	5	9	6	9	7	36	
3.1 - 4.0	5	9	6	9	6	35	Steeper Slopes and high drop off
4.1 - 5.0	5	9	6	9	7	36	
5.1 - 6.0	5	4	6	9	7	31	End at Hwy 24. No signs at curve. Fatality at intersection.

Level I Field Evaluation	Evaluator: DSS	Date: 9/9/14	Page: of
Notes: Evaluation Team: Remote by DSS		Road Name: ND Hwy 24 S	Road Length:
		Road No.:	Road Surface: Asphalt
		Road Class: Rural Princ Arterial	Speed Limit: 65

Mile Post	General	Intersections / RR Crossings	Signage / Pavement Markings	Fixed Objects/ Clear Zones	Shoulder / ROW	Segment Score	Comments: Edge and CL Rumble strip
0.0 - 1.0	6	4	8	9	7	34	Start at Intersection of Hwy 6. Fatality at int. GR at Creek crossing
1.1 - 2.0	6	9	8	9	7	39	
2.1 - 3.0	6	9	8	9	7	39	
3.1 - 4.0	6	9	8	9	6	38	Curves marked
4.1 - 5.0	6	9	8	9	7	39	
5.1 - 6.0	6	4	8	9	7	34	Fatality at intersection with 1806. Intersection on curve
6.1 - 7.0	6	9	8	9	7	39	
7.1 - 8.0	6	9	8	9	7	39	
8.1 - 9.0	6	8	8	9	8	39	

Level I Field Evaluation	Evaluator: DSS	Date: 9/9/14	Page: of
Notes: Evaluation Team: Remote by DSS		Road Name: ND Hwy 1806 (N)	Road Length:
		Road No.:	Road Surface: Asphalt
		Road Class: Rural Princ Arterial	Speed Limit: 65

Mile Post	General	Intersections / RR Crossings	Signage / Pavement Markings	Fixed Objects/ Clear Zones	Shoulder / ROW	Segment Score	Comments
0.0 - 1.0	5	9	7	9	7	37	Start at Intersection of Hwy 24.
1.1 - 2.0	5	9	7	9	7	37	
2.1 - 3.0	5	9	7	9	7	37	End at North County Line

Level I Field Evaluation	Evaluator: DSS	Date: 9/8/14	Page: of
Notes: Evaluation Team: SRST Traffic Safety officer, Chris Montclair; Corson County Sheriff; BIA officer		Road Name: Honky Tonk Road	Road Length: 11.3 miles
		Road No.:	Road Surface: Gravel
		Road Class: Rural Local	Speed Limit: 45 mph

Mile Post	General	Intersections / RR Crossings	Signage / Pavement Markings	Fixed Objects/ Clear Zones	Shoulder / ROW	Segment Score	Comments
0.0 - 1.0	5	8	7	5	5	30	Start at US 12 (109 St)
1.1 - 2.0	5	8	7	5	5	30	
2.1 - 3.0	5	8	7	5	5	30	
3.1 - 4.0	5	8	7	5	5	30	
4.1 - 5.0	5	8	7	5	5	30	
5.1 - 6.0	5	8	7	5	5	30	Proper curve signs in place (MP 5.3) (109 St to 259 Ave)
6.1 - 7.0	5	8	7	5	5	30	Proper curve signs in place (MP 6.3) (259 Ave to 110 St)
7.1 - 8.0	5	8	7	5	5	30	
8.1 - 9.0	5	8	7	5	5	30	T intersection at MP 8.3 sign in wrong location (110 St to 257 Ave)
9.1 - 10.0	5	8	7	5	5	30	
10.1 - 11.0	5	8	7	5	5	30	
11.1 - 12.0	5	8	7	5	5	30	11.3 miles end of road (at 113 St)

Level I Field Evaluation	Evaluator: DSS	Date: 9/8/14	Page: of
Notes: Evaluation Team: SRST Traffic Safety officer, Chris Montclair; Corson County Sheriff; BIA officer		Road Name: 113 Street & 251 Ave	
		Road No.:	Road Surface: Asphalt
		Road Class: Rural Local	Speed Limit: 65

Mile Post	General	Intersections / RR Crossings	Signage / Pavement Markings	Fixed Objects/ Clear Zones	Shoulder / ROW	Segment Score	**Comments:** Low volume. 4 crashes one fatal at curve . Turns into 251 Ave at Bullhead.
0.0 - 1.0	6	8	6	9	6	35	Begin at 257 Ave (Honky Tonk Road)
1.1 - 2.0	6	8	6	9	6	35	Narrow shoulders
2.1 - 3.0	6	8	6	9	6	35	
3.1 - 4.0	6	8	6	9	6	35	Curve to NW w/ advanced warning sign and delineator posts
4.1 - 5.0	6	8	6	9	6	35	No passing zone, 4.6 hill and curve
5.1 - 6.0	5	7	5	8	5	30	5.3 narrow bridge, 5.6 pavement degraded
6.1 - 7.0	5	7	5	8	5	30	
7.1 - 8.0	5	7	5	8	5	30	7.8 curve w/ warning
8.1 - 9.0	5	7	5	8	5	30	8.1 curve, no shoulder
9.1 - 10.0	5	7	5	8	5	30	9.6 curve
10.1 - 11.0	5	7	5	8	5	30	10.4 sign
11.1 - 12.0	5	7	5	8	5	30	
12.1 - 13.0	5	7	5	8	5	30	
13.1 - 14.0	5	7	5	8	5	30	
14.1 - 15.0	5	7	5	8	5	30	
15.1 - 16.0	5	7	5	8	5	30	15.6 end at Hwy 12
16.1 - 17.0							
17.1 - 18.0							
18.1 - 19.0							
19.1 - 20.0							

	Level I Field Evaluation	Evaluator: DSS	Date: 9/8/14	Page: of
	Notes: Evaluation Team: SRST Traffic Safety officer, Chris Montclair; Corson County Sheriff; BIA officer		Road Name: US Hwy 12	Road Length:
			Road No.:	Road Surface: Asphalt
			Road Class: Rural Princ Arterial	Speed Limit: 65

Actual MP	Mile Post	General	Intersections / RR Crossings	Signage / Pavement Markings	Fixed Objects/ Clear Zones	Shoulder / ROW	Segment Score	Comments: From Wantaga to Morristown (MP 122.1 to 113.2)
122 - 121	0.0 - 1.0	8	9	8	10	8	43	Narrow shoulder, rumble strip throughout
121 - 120	1.1 - 2.0	8	9	8	10	8	43	
120 - 119	2.1 - 3.0	8	9	8	10	8	43	
119 - 118	3.1 - 4.0	6	9	8	10	8	41	3.3 (MP 118.9) curve w/sign, visability ok, bad curve - crashes?
118 - 117	4.1 - 5.0	8	9	8	10	8	43	
117 - 116	5.1 - 6.0	5	9	8	10	8	40	5.1 (MP 117.1) drop off, 5.9 (116.3) curve w/ sign, reverse super
116 - 115	6.1 - 7.0	7	9	8	10	8	42	(Curve left sign at 116.2, Curve at 116.0)
115 - 114	7.1 - 8.0	6	9	8	10	8	41	7.6 (MP 114.6) bridge "bump"
114 - 113	8.1 - 9.0	7	9	8	10	8	42	8.5 curve, 8.9 end

Level I Field Evaluation	Evaluator: DSS	Date: 9/8/14	Page: of
Notes: Evaluation Team: SRST Traffic Safety officer, Chris Montclair; Corson County Sheriff; BIA officer		Road Name: BIA 3	Road Length:
		Road No.:	Road Surface: Asphalt
		Road Class: Rural Major Collector	Speed Limit: 55

Mile Post	General	Intersections / RR Crossings	Signage / Pavement Markings	Fixed Objects/ Clear Zones	Shoulder / ROW	Segment Score	Comments
0.0 - 1.0	4	3	7	9	4	27	Start at 24 (1806). Speed Limit 55 but posted at 65. *
1.1 - 2.0	4	7	7	9	4	31	No shoulders, good slopes
2.1 - 3.0	4	7	7	9	4	31	
3.1 - 4.0	4	7	7	9	4	31	
4.1 - 5.0	4	7	7	9	4	31	
5.1 - 6.0	4	7	7	9	4	31	
6.1 - 7.0	4	7	7	9	4	31	
7.1 - 8.0	4	7	7	9	4	31	
8.1 - 9.0	4	7	7	9	4	31	Curve at State line
9.1 - 10.0	4	7	7	9	4	31	
10.1 - 11.0	4	7	7	9	4	31	10.0 Hill w/sign
11.1 - 12.0	4	7	7	9	4	31	
12.1 - 13.0	8	7	8	9	8	40	12.4 New Construction
13.1 - 14.0	7	7	8	9	8	39	13.6 Bump w/sign (at culvert)
14.1 - 15.0	8	7	8	9	8	40	
15.1 - 16.0	7	7	8	9	8	39	
16.1 - 17.0	8	7	8	9	8	40	16.7 Bump w/sign (at culvert)
17.1 - 18.0	8	7	8	9	8	40	
18.1 - 19.0	6	7	8	9	8	38	18.4 Hill then curve
19.1 - 20.0	8	7	8	9	8	40	19.5 begin 1806, end BIA 3
							* At int w/1806 Intersection curve sign, is sight distance ok?
							Long curve, fatal crashes
							Improved since 2005 fatality

Level I Field Evaluation	Evaluator: DSS	Date: 9/8/14	Page: of
Notes: Evaluation Team: SRST Traffic Safety officer, Chris Montclair; Corson County Sheriff; BIA officer		Road Name: 110 Street	Road Length:
		Road No.:	Road Surface: Gravel
		Road Class: Rural Local	Speed Limit: 45

Mile Post	General	Intersections / RR Crossings	Signage / Pavement Markings	Fixed Objects/ Clear Zones	Shoulder / ROW	Segment Score	Comments
0.0 - 1.0	8	9	8	8	8	41	Begin at 1806 in Kennel
1.1 - 2.0	8	9	8	8	8	41	
2.1 - 3.0	8	9	8	8	8	41	2.5 Curve w/sign
3.1 - 4.0	7	9	8	8	8	40	
4.1 - 5.0	7	9	8	8	8	40	5.0 curve, drove at 50 mph. End of segment
							Hay bails in ROW

Level I Field Evaluation	Evaluator: DSS	Date: 9/8/14	Page: of
Notes: Evaluation Team: SRST Traffic Safety officer, Chris Montclair; Corson County Sheriff; BIA officer		Road Name: BIA 44	Road Length:
		Road No.:	Road Surface: Gravel/Asphalt
		Road Class: Rural Maj Collector	Speed Limit: 45

Mile Post	General	Intersections / RR Crossings	Signage / Pavement Markings	Fixed Objects/ Clear Zones	Shoulder / ROW	Segment Score	Comments
0.0 - 1.0	7	8	8	7	5	35	Begin at 272 east (CR 52). Narrow, Vegetation in ROW
1.1 - 2.0	7	8	8	7	5	35	MP 1.7 curve
2.1 - 3.0	7	5	5	7	5	29	MP 2.5 S curve, MP 2.8 RR Xing. MP 3.3 narrow bridge well marked
3.1 - 4.0	5	8	8	4	5	30	Increased vegetation in ROW. MP 4.1 narrow bridge well marked
4.1 - 5.0	5	8	8	4	5	30	MP 5.0 curve w/ sign
5.1 - 6.0	5	8	8	4	5	30	
6.1 - 7.0	5	8	8	4	5	30	MP 6.5 curve w/ sign
7.1 - 8.0	5	8	8	8	5	34	MP 8.0, 8.8, 9.1 curve w/ sign
8.1 - 9.0	5	8	8	8	5	34	
9.1 - 10.0	5	1	2	8	5	21	MP 9.4 RR Xing no advanced warning. Signed w/ stop.**
10.1 - 11.0	5	7	8	8	5	33	MP 10.2 begin apshalt pvmnt. 10.8 curve
11.1 - 12.0	5	7	8	8	5	33	MP 11.8 end
							** wrong speed limit sign w/ curve sign (white), curve after RR Xing
							*MP 5.4 1806

Level I Field Evaluation	Evaluator: DSS	Date: 9/8/14	Page: of
Notes: Evaluation Team: SRST Traffic Safety officer, Chris Montclair; Corson County Sheriff; BIA officer		Road Name: US Hwy 12	Road Length:
		Road No.:	Road Surface: Asphalt
		Road Class: Rural Princ Arterial	Speed Limit: 55/65

Mile Post	General	Intersections / RR Crossings	Signage / Pavement Markings	Fixed Objects/ Clear Zones	Shoulder / ROW	Segment Score	**Comments:** Intersection at Casino entrance, double fatality Aug 2014
183 - 184	8	8	8	9	8	41	Sight distance approx 500 ft. Intersection below crest of hill.
184 - 185	8	3	4	9	8	32	Truck lane before (EB) at 65 mph. 55 mph (WB)
							WB good sight distance

	Level I Field Evaluation	Evaluator: DSS	Date: 9/8/14	Page: of
	Notes: Evaluation Team: SRST Traffic Safety officer, Chris Montclair; Corson County Sheriff; BIA officer		Road Name: SD Hwy 63	Road Length:
			Road No.:	Road Surface:
			Road Class:	Speed Limit:

Actual MP	Mile Post	General	Intersections / RR Crossings	Signage / Pavement Markings	Fixed Objects/ Clear Zones	Shoulder / ROW	Segment Score	Comments
250 - 251	0.0 - 1.0	9	9	8	9	9	44	Begin south end of McClaughlin (MP251.2)
249 - 250	1.1 - 2.0	9	9	8	9	9	44	
248 - 249	2.1 - 3.0	9	9	8	9	9	44	
247 - 248	3.1 - 4.0	9	9	8	9	9	44	
246 - 247	4.1 - 5.0	9	9	8	9	9	44	
245 - 246	5.1 - 6.0	6	9	7	9	8	39	MP 5.7 hill before curve (MP245.5)
244 - 245	6.1 - 7.0	6	9	7	9	8	39	MP 6.5 pond at curve below hill, 6.8 end of curve area (MP 244.7, 244.4)

APPENDIX D: COMBINED RANKING

Sioux County, ND

Highway	Beg MP	End MP	Total Crashes	Crash Rank	Level I Score	Level I Rank	Combined Rank
6	0	1	0	50	35	9	59
6	1	2	0	50	36	12	62
6	2	3	2	16	36	12	28
6	3	4	0	50	35	9	59
6	4	5	1	27	36	12	39
6	5	6	0	50	31	5	55
24	0	1	1	27	34	7	34
24	1	2	1	27	39	50	77
24	2	3	0	50	39	50	100
24	3	4	0	50	38	49	99
24	4	5	0	50	39	50	100
24	5	6	1	27	34	7	34
24	6	7	3	6	39	50	56
24	7	8	3	6	39	50	56
24	8	9	3	6	39	50	56
24	9	10	5	3	45	56	59
24	10	11	2	16	37	15	31
24	11	12	3	6	37	15	21
24	12	13	2	16	37	15	31
24	13	14	2	16	37	15	31
24	14	15	1	27	32	6	33
24	15	16	6	1	37	15	16
24	16	17	3	6	37	15	21
24	17	18	0	50	37	15	65
24	18	19	2	16	37	15	31
24	19	20	1	27	37	15	42
24	20	21	0	50	37	15	65
24	21	22	0	50	37	15	65
24	22	23	2	16	35	9	25
24	23	24	3	6	37	15	21
24	24	25	5	3	37	15	18
24	25	26	3	6	37	15	21
24	26	27	1	27	37	15	42
24	27	28	0	50	37	15	65
24	28	29	1	27	37	15	42
24	29	30	4	5	37	15	20
24	30	31	0	50	37	15	65
24	31	32	1	27	37	15	42
24	32	33	1	27	37	15	42

Highway	Beg MP	End MP	Total Crashes	Crash Rank	Level I Score	Level I Rank	Combined Rank
24	33	34	1	27	37	15	42
24	34	35	3	6	37	15	21
24	35	36	0	50	37	15	65
24	36	37	1	27	37	15	42
24	37	38	0	50	37	15	65
24	38	39	0	50	37	15	65
24	39	40	0	50	37	15	65
24	40	41	0	50	37	15	65
24	41	42	0	50	37	15	65
24	42	43	2	16	37	15	31
1806	31	32	6	1	37	15	16
1806	32	33	2	16	37	15	31
1806	33	34	3	6	37	15	21
Big Lake Rd	0	1	3	6	22	3	9

Corson County, SD

Highway	Beg MP	End MP	Total Crashes	Crash Rank	Level I Score	Level I Rank	Combined Rank
110 St	0	1	0	26	41	67	93
110 St	1	2	0	26	41	67	93
110 St	2	3	1	15	41	67	82
110 St	3	4	0	26	40	59	85
110 St	4	5	0	26	40	59	85
113 St	0	1	0	26	35	47	73
113 St	1	2	0	26	35	47	73
113 St	2	3	0	26	35	47	73
113 St	3	4	2	9	35	47	56
113 St	4	5	0	26	35	47	73
113 St	5	6	0	26	30	4	30
113 St	6	7	0	26	30	4	30
113 St	7	8	0	26	30	4	30
113 St	8	9	0	26	30	4	30
113 St	9	10	0	26	30	4	30
113 St	10	11	1	15	30	4	19
113 St	11	12	0	26	30	4	30
113 St	12	13	0	26	30	4	30
113 St	13	14	0	26	30	4	30
113 St	14	15	0	26	30	4	30
113 St	15	16	0	26	30	4	30
BIA 3	0	1	0	26	27	2	28
BIA 3	1	2	0	26	31	31	57
BIA 3	2	3	0	26	31	31	57
BIA 3	3	4	0	26	31	31	57
BIA 3	4	5	0	26	31	31	57
BIA 3	5	6	0	26	31	31	57
BIA 3	6	7	0	26	31	31	57
BIA 3	7	8	0	26	31	31	57
BIA 3	8	9	0	26	31	31	57
BIA 3	9	10	1	15	31	31	46
BIA 3	10	11	0	26	31	31	57
BIA 3	11	12	0	26	31	31	57
BIA 3	12	13	2	9	40	59	68
BIA 3	13	14	0	26	39	55	81
BIA 3	14	15	0	26	40	59	85
BIA 3	15	16	1	15	39	55	70
BIA 3	16	17	0	26	40	59	85
BIA 3	17	18	0	26	40	59	85
BIA 3	18	19	0	26	38	54	80
BIA 3	19	20	0	26	40	59	85

Highway	Beg MP	End MP	Total Crashes	Crash Rank	Level I Score	Level I Rank	Combined Rank
BIA 44	0	1	0	26	35	47	73
BIA 44	1	2	0	26	35	47	73
BIA 44	2	3	0	26	29	3	29
BIA 44	3	4	1	15	30	4	19
BIA 44	4	5	0	26	30	4	30
BIA 44	5	6	0	26	30	4	30
BIA 44	6	7	2	9	30	4	13
BIA 44	7	8	0	26	34	45	71
BIA 44	8	9	0	26	34	45	71
BIA 44	9	10	1	15	21	1	16
BIA 44	10	11	0	26	33	43	69
BIA 44	11	12	0	26	33	43	69
Honky Tonk Rd	0	1	0	26	30	4	30
Honky Tonk Rd	1	2	0	26	30	4	30
Honky Tonk Rd	2	3	0	26	30	4	30
Honky Tonk Rd	3	4	0	26	30	4	30
Honky Tonk Rd	4	5	0	26	30	4	30
Honky Tonk Rd	5	6	0	26	30	4	30
Honky Tonk Rd	6	7	0	26	30	4	30
Honky Tonk Rd	7	8	0	26	30	4	30
Honky Tonk Rd	8	9	0	26	30	4	30
Honky Tonk Rd	9	10	0	26	30	4	30
Honky Tonk Rd	10	11	0	26	30	4	30
Honky Tonk Rd	11	12	0	26	30	4	30
SD 63	244	245	1	15	39	55	70
SD 63	245	246	3	4	39	55	59
SD 63	246	247	1	15	44	79	94
SD 63	247	248	1	15	44	79	94
SD 63	248	249	1	15	44	79	94
SD 63	249	250	0	26	44	79	105
SD 63	250	251	2	9	44	79	88
US 12	113	114	3	4	42	73	77
US 12	114	115	3	4	41	67	71
US 12	115	116	2	9	42	73	82
US 12	116	117	2	9	40	59	68
US 12	117	118	5	3	43	75	78
US 12	118	119	3	4	41	67	71
US 12	119	120	1	15	43	75	90
US 12	120	121	3	4	43	75	79
US 12	121	122	0	26	43	75	101
US 12	183	184	11	1	41	67	68
US 12	184	185	10	2	32	42	44