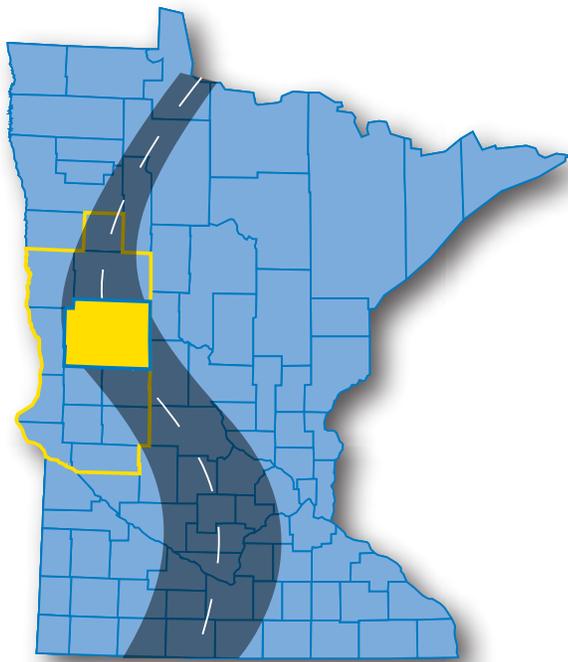


# Otter Tail County

## COUNTY ROADWAY



August 2011



# Safety

PLAN

Moving Toward **ZERO** Deaths

Prepared by:  
CH2M HILL  
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## Executive Summary

This Safety Plan for Otter Tail County was prepared as part of the Minnesota statewide highway safety planning process. The Plan was data driven, with a goal to reduce severe crashes (those involving fatalities and serious injuries) by documenting at-risk locations, identifying effective safety improvement strategies and better positioning the county to compete for available safety funds. The Plan includes a description of the connection to safety planning efforts at the national, State (through Minnesota's Strategic Highway Safety Plan and the Highway Safety Improvement Program) and regional (all of the counties in Area Transportation Partnership 4) levels.

Specifically, this Otter Tail County Safety Plan includes:

- A description of the Safety Emphasis Areas.
- Identification of a short list of high priority, low-cost Safety Strategies.
- Documentation of at-risk locations along the County's highway system that are considered candidates for safety investment. At-risk locations include roadway segments, horizontal curves and intersections with multiple severe crashes or with roadway geometry and traffic characteristics similar to other locations in Minnesota where severe crashes have occurred.
- Development of \$7,191,803 of suggested safety projects at high priority locations. In addition, \$33,400 of county nominated projects were identified.

The information in this Plan is consistent with best practices in safety planning as presented in guidance prepared by the Federal Highway Administration (FHWA), the American Association of State Highway and Transportation Officials (AASHTO) and the National Cooperative Highway Research Program (NCHRP). This information is provided to Otter Tail County in an effort to reduce the number of severe crashes on their highway system and it is understood that the final decision to implement any of the suggested projects resides with the Otter Tail County Engineer. It should also be noted that rankings are provided of County roadway facilities based on a comparison to documented risk factors. There is no expectation or requirement that Otter Tail County pursue safety projects in the exact rank order. The ranking suggests a general priority and it is understood that actual project development decisions will be made by County staff based on consideration of economic, social and political issues and coordination with other projects already in the County's Capital Improvement Program. It should be further noted that some of the at-risk locations and suggested safety projects involve the intersection of a County roadway and a State trunk highway. It is acknowledged that in these cases, the County does not have the authority to implement projects on the State's right-of-way. The County is encouraged to coordinate with Mn/DOT in order to pursue a partnership that identifies a path toward implementation. This Plan does NOT set requirements or mandates, is NOT a standard and is neither intended to be, nor does it establish a legal standard of care.

In an effort to help reduce the potential exposure to claims of negligence associated with motor vehicle crashes on Otter Tail County's highway system, three key points should be considered:

1. Federal law (23 U.S.C. Section 409) established that information generated as part of the statewide safety planning process is considered privileged and unavailable to the public. The privileged status includes crash data, where value/detail has been added by analysts during the safety planning process (for example; computation of crash rates,



disaggregation of crashes by type or severity, documentation of contributing factors, etc), the lists of at-risk locations, and information supporting the development and evaluation of potential safety projects. The federal law and the privileged status of the safety information was upheld by the U. S. Supreme Court in the case of *Pierce County (Washington) v. Guillen*. (See Appendix E)

2. Minnesota tort law provides for discretionary immunity for decisions made by agency officials when there is documentation of the decision and evidence of consideration of social, economic and political issues. In order to help establish immunity for decisions relative to moving forward with development of any of the suggested safety improvement projects, the County Engineer is encouraged to prepare a memo/plan of action for the County Board. This document would identify the projects selected for implementation and those they choose to dismiss and why. A sample is provided in Appendix E.
3. Minnesota tort law also provides for official immunity for decisions made by agency staff where there is written documentation of the thought process supporting project development and implementation.

A final point to note relates to the expected life of this Plan. As with any transportation plan, the expected shelf life of this document is not infinite – the distribution of crashes can change over time as well as roadway and traffic conditions that can contribute to the occurrence of crashes. This Plan contains \$7.2 million of potential safety projects, which could provide Otter Tail County with a sufficient backlog of projects for up to five years. As a result, Otter Tail County is encouraged to consider periodically updating this Safety Plan when they have run out of safety projects to develop or after approximately five years.

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## LIST OF ACRONYMS

“A-Injury” Crash - Serious Injury Crash

AASHTO - American Association of State Highway and Transportation Officials

ADT - Average Daily Traffic

ATP - Area Transportation Partnerships

CEA - Critical Emphasis Areas

CPS - Child Passenger Safety

CR - County Road

CRSP - County Road Safety Plan

CSAH - County State-Aid Highway

DPS - Department of Public Safety

DWI - Driving While Intoxicated

EMS - Emergency Medical Service

FHWA - Federal Highway Association

GDL - Graduated Drivers License

HEAT - Highway Enforcement of Aggressive Traffic

HMVMT - Hundred Million Vehicle Miles Travelled

HSIP - Highway Safety Improvement Program

“K” Severity Crash - Fatal crash

LED - Light-Emitting Diode

Mn/DOT - Minnesota Department of Transportation

MnCMAT - Minnesota Crash Mapping Analysis Tool

MnMUTCD - Minnesota Manual on Uniform Traffic Control Devices

MSAS -Municipal State Aid Highway

MUN - Municipal Roadway

MVM - Million vehicle miles

NCHRP - National Cooperative Highway Research Program

NETS - Network of Employers for Traffic Safety

NHSTA - National Highway Traffic Safety Administration

NightCAP - Nighttime Concentrated Alcohol Patrol

OTS - Office of Traffic Safety

SAFETEA-LU - Safe Accountable Flexible Efficient Transportation Equity Act: A Legacy for Users

SHSP - Strategic Highway Safety Plan

TH - Trunk Highway

TZD - Towards Zero Deaths

US - State Highway

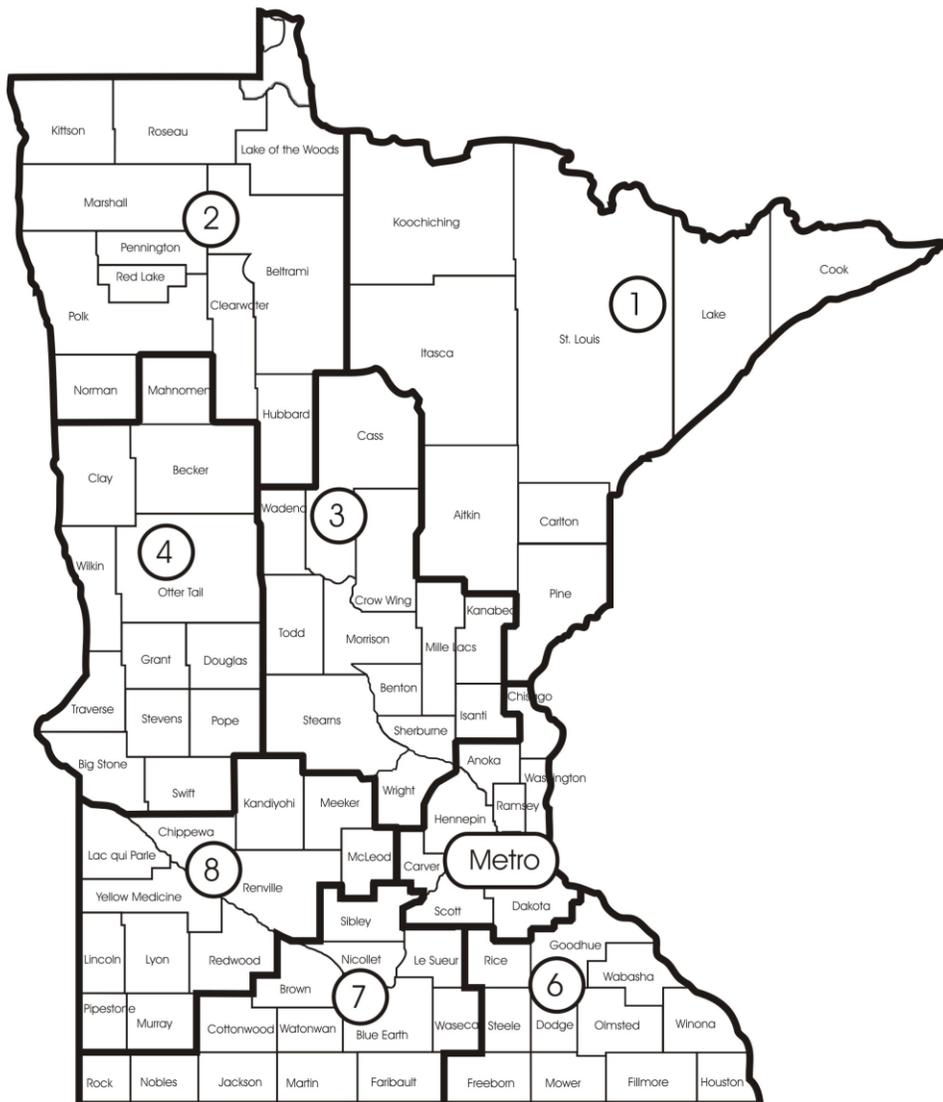


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# 1.0 Introduction

The Minnesota Department of Transportation (Mn/DOT) along with representatives from Area Transportation Partnerships (ATPs) and county representatives have prepared this County Roadway Safety Plan (CRSP or Plan) as part of a comprehensive effort to reduce the number of fatal and life changing injury crashes that occur on county highway systems. ATPs were created by Mn/DOT to emphasize greater public involvement and coordination in the preparation of transportation plans and programs—including development of system planning and capital investment documents such as the CRSPs. There are a total of eight ATPs in Minnesota, shown in Figure 1-1.



**Figure 1-1**  
**Minnesota's Eight Area Transportation Partnerships**

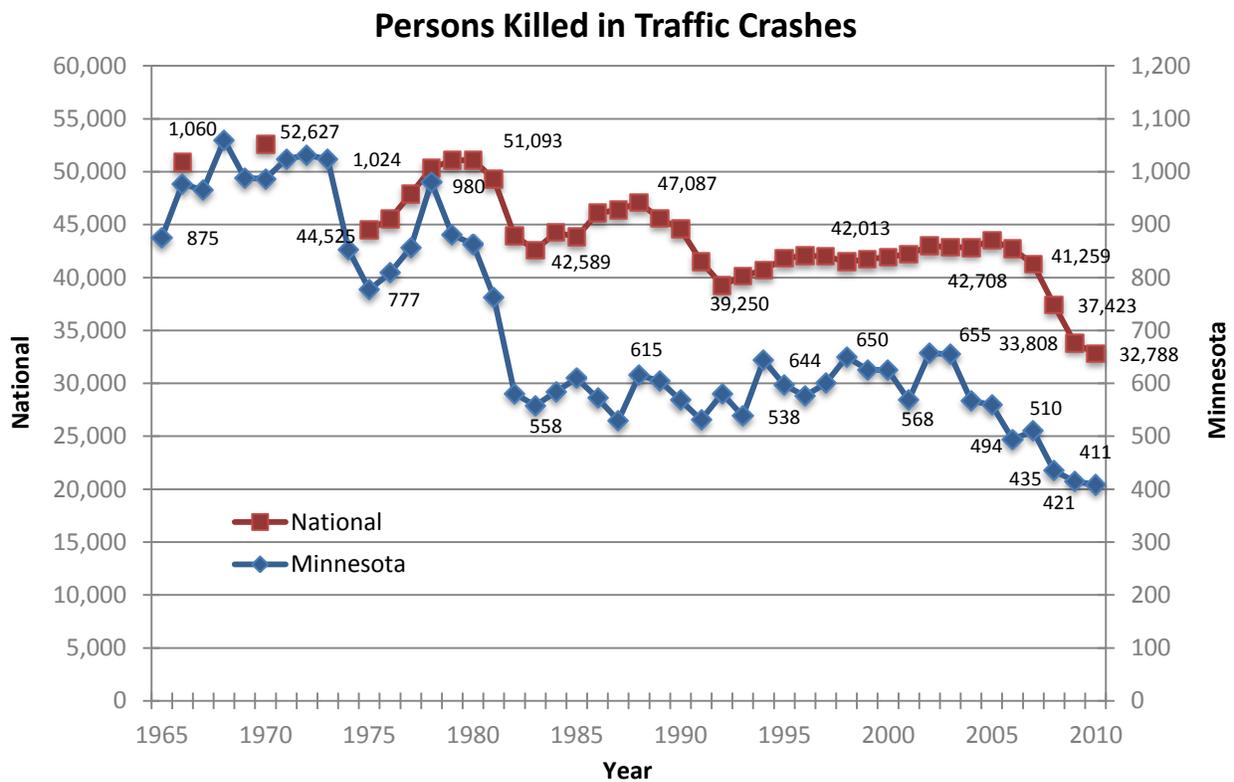
The traffic safety priorities identified in this CRSP are the result of a data driven analysis of the over 16,000 crashes that occurred in ATP 4 over the five year period between 2005 and 2009. The primary objective of this CRSP is to identify a specific set of safety oriented projects (the implementation of specific strategies at specific locations) and to have these projects directly linked to the causation factors associated with the most severe crashes on the county highways within the ATP.

## 1.1 Context of CRSP

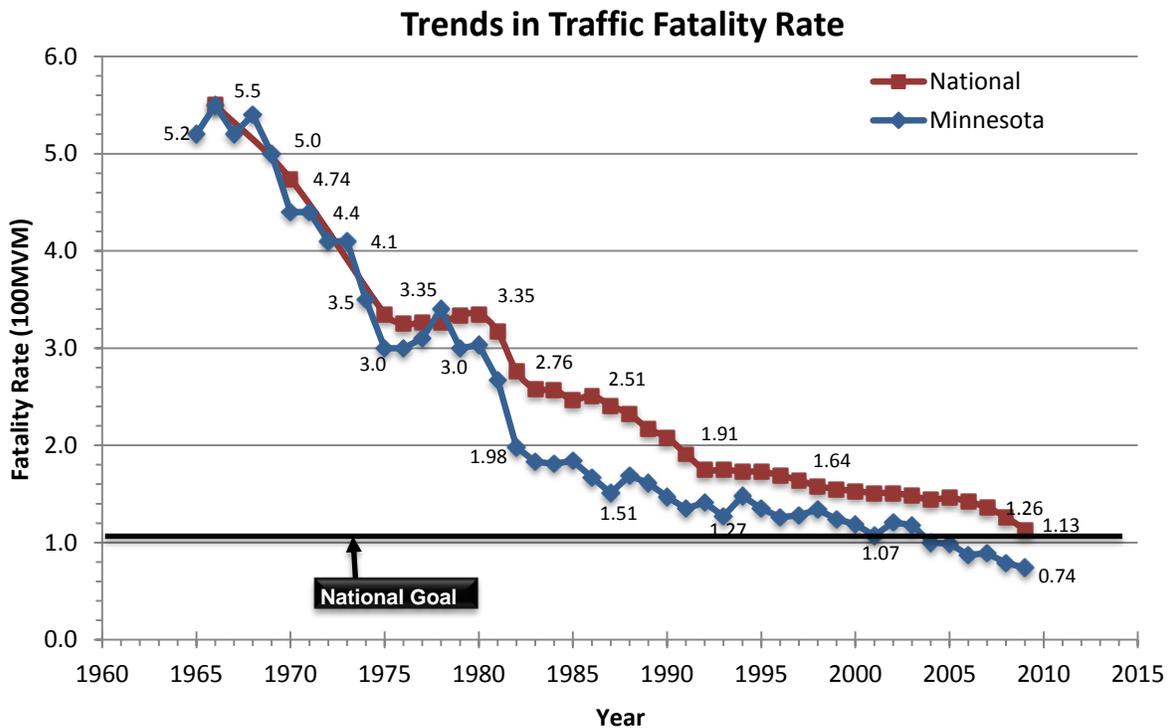
### 1.1.1 National Context

Fatal and life changing crashes are a major public health issue in the United States. In 2010, approximately 32,800 were killed in traffic crashes—an average of 90 killed every day; an additional 2.5 million people were injured.

As shown in Figures 1-2 and 1-3, traffic fatalities and the fatality rate decreased significantly and steadily in the 1970s and 1980s. The overall national traffic fatality rate has remained at approximately 1.45 fatalities per hundred million vehicle miles travelled (HMVMT) (see Figure 1-3).



**Figure 1-2**  
*Trend in Traffic Fatalities in United States and Minnesota*



**Figure 1-3**  
*Trend in Traffic Fatality Rate in United States and Minnesota*

The Federal Highway Administration (FHWA) and American Association of State Highway and Transportation Officials (AASHTO) have placed a renewed focus on the most severe crashes—including fatal and life changing—using a data driven process. The agencies have also placed a renewed emphasis on the Four Es—Education, Enforcement, Engineering, and Emergency Medical Services (EMS). Those involved with the Four Es are encouraged to set new goals, and determine new ways to measure progress.

FHWA and AASHTO have set a goal to reduce the number of traffic fatalities by 1,000 each year for the next 20 years. FHWA has determined that this goal will only be reached if they partner with individual states. Partnering will lead to more successful project implementation and result in programs that target the factors that contribute to the greatest number of fatal and severe crashes.

#### **AASHTO’s Strategic Highway Safety Plan and Critical Emphasis Areas**

AASHTO published a nationally focused Strategic Highway Safety Plan (SHSP) in 1997; the plan was updated in 2004. The SHSP focused on 22 specific highway safety challenges, or Critical Emphasis Areas (CEAs), that are divided into the six parts or categories listed below (also see Table 1-1).

- Drivers,
- Special Users,
- Vehicles,
- Highways,
- Emergency Services, and
- Management.

**TABLE 1-1**  
AASHTO State Highway Safety Plan (SHSP) Critical Emphasis Areas

<b><u>Part 1: Drivers</u></b>	<b><u>Part 4: Highways</u></b>
1. Instituting Graduated Licensing for Young Drivers	14. Reducing Vehicle-Train Crashes
2. Ensuring Drivers are Licensed and Fully Competent	15. Keeping Vehicles on the Roadway
3. Sustaining Proficiency in Older Drivers	16. Minimizing the Consequences of Leaving the Road
4. Curbing Aggressive Driving	17. Improving the Design and Operation of Highway Intersections
5. Reducing Impaired Driving	18. Reducing Head-On and Across Median Crashes
6. Keeping Drivers Alert	19. Designing Safer Work Zones
7. Increasing Driver Safety Awareness	<b><u>Part 5: Emergency Medical Services</u></b>
8. Increasing Seat Belt Usage	20. Enhancing Emergency Medical Capabilities to Increase Survivability
<b><u>Part 2: Special Users</u></b>	<b><u>Part 6: Management</u></b>
9. Making Walking and Street Crossing Safe	21. Improving Information and Decision Support Systems
10. Ensuring Safer Bicycle Travel	22. Creating More Effective Processes and Safety Management Systems
<b><u>Part 3: Vehicles</u></b>	
11. Improving Motorcycle Safety and Increasing Motorcycle Awareness	
12. Making Truck Travel Safer	
13. Increasing Safety Enhancements in Vehicles	

Source: American Association of State Highway and Transportation Officials (AASHTO) Strategic Highway Safety Plan (SHSP), 1997 and 2004.

The SHSP noted that individual state efforts had not effectively lowered the number of fatal crashes and that state efforts were not focused on primary factors that caused fatal crashes. Many state projects being implemented were not always based on the results of a data driven mapping process that linked crash causation to effective mitigation strategies. The SHSP recommended developing a safety programming process that included disaggregation of system wide crash data into the 22 CEAs.

Disaggregating crash data helps agencies identify their safety priorities based on crash analysis for their transportation system. This step also reduces the universe of safety strategies to those specifically associated to an agency’s specific system (see Section 2.7 for more information about safety strategies). Finally, crash data disaggregation and identification of CEAs helps agencies select the most effective strategies for reducing crashes and determine where limited highway and safety improvement funds should be invested to have the most positive impact.

### 1.1.2 State Context

#### Minnesota’s Comprehensive Safety Planning Efforts

Similar to the national trends, Minnesota experienced a significant reduction in traffic fatalities and the fatal crash rate from the mid-1970s through the 1980s (see Figures 1-2 and 1-3).



Between 1980 and 2000, the number of traffic fatalities increased slightly, while the fatal crash rate decreased as a result of increasing levels of vehicles traveled. Since the year 2000, the number of traffic fatalities and the fatal crash rate has dropped by approximately 35 percent.

AASHTO's SHSP was used as the basis for developing the Minnesota's SHSP. Mn/DOT in cooperation with the Minnesota Department of Public Safety developed the Minnesota Comprehensive Highway Safety Plan (CHSP) in December 2004. The CHSP identified the following:

- A unified approach for addressing traffic fatalities in Minnesota,
- Key crash types to target (also referred to as Critical Emphasis Areas), and
- High priority strategies intended to form the focus of future programs and projects (also referred to as Critical Strategies).

The CHSP was updated in 2007 to comply with federal legislative requirements set forth in the Safe, Accountable, Flexible, Efficient Transportation Equity Act (SAFETEA-LU, the current federal law governing surface transportation programs). As the name suggests, SAFETEA-LU has several important safety requirements, including the development of state Strategic Highway Safety Plans. The CHSP was re-named the Minnesota Strategic Highway Safety Plan (SHSP). The Minnesota SHSP established a new traffic safety goal—to reduce the number of traffic fatalities to 400 or fewer by 2010. The original traffic safety goal set in the 2004 CHSP was to reduce traffic fatalities to 500 by 2008. This goal was achieved when 494 fatalities were recorded in 2008. Even though Minnesota has made steady progression reducing the number of traffic fatalities, the 2010 goal of fewer than 400 fatalities was not achieved – there were 411 fatalities in 2010.

### **Crashes on CSAH and CR Roads**

Minnesota's CSAH and CR transportation system encompasses more than 50,000 miles of roadway out of a total of 134,000 miles statewide. Approximately one-half of statewide traffic fatalities occur on this system, making rural local roads perhaps the most at-risk part of the state's entire system. In response, the Minnesota SHSP identified the proactive and systemic deployment of low-cost strategies to cost-effectively address the high frequency, but very low density of severe crashes across many miles of rural roadways. The overrepresentation of severe and fatal crashes on the local roadways is reflected in ATP 4 and counties within the ATP. This reinforces the importance of efforts to implement a safety program that focuses on the local system, in addition to the state system of highways.

As noted earlier, both FHWA and Mn/DOT have adopted a focus of addressing traffic fatalities and life changing injuries, and this includes a heavy focus on rural areas. However, shifting from a focus on reducing the overall number of crashes to reducing the number of most severe crashes poses some challenges. The random, widely distributed nature of severe crashes makes it difficult to identify specific at-risk locations based only on crash statistics. For example, in Minnesota, approximately one-third of fatal crashes (190 per year) involve a single vehicle running off the road; 75 percent (145 per year) of these are in rural areas and 62 percent of these are on the local system. These severe road departure crashes occur on over 45,000 miles of county rural two-lane highways in Minnesota, which translates into the very low density of 0.002 fatal road departure crashes per mile. The majority of rural county locations have had few or no crashes during a typical five year study period. The random and widely distributed nature of severe crashes reinforces the need to incorporate a system based approach into the safety planning process.

## Minnesota's State Highway Critical Emphasis Areas (CEAs)

Based on an updated state crash analysis conducted in 2010, Mn/DOT reviewed the number of fatalities related to each of the AASHTO Emphasis Areas summarized in Table 1-1. Detailed information about this effort is included in an update to the Technical Memorandum, Statewide Emphasis Area Analysis, 2004-2008 (December 4, 2009). This analysis identified the number of fatalities in each Emphasis Area along with the percentage represented of the total number of crashes (see Table 1-2).

**TABLE 1-2**  
Summary of Minnesota's State Highway 2005-2009 Fatalities by AASHTO's Emphasis Area

	Emphasis Area	Minnesota Fatalities*	Percent
Part 1: Drivers	Instituting Graduated Licensing for Young Drivers	495 fatalities involved a driver under 21	20%
	Ensuring Drivers are Licensed and Fully Competent	201 fatalities involved a driver with an invalid license	8%
	Sustaining Proficiency in Older Drivers	461 fatalities involved a driver over 64	19%
	Curbing Aggressive Driving	638 fatalities involved a speeding driver	26%
	Reducing Impaired Driving	841 fatalities were alcohol related	35%
	Keeping Drivers Alert	386 fatalities involved an inattentive driver	16%
	Increasing Driver Safety Awareness	-- Not Quantifiable --	
	Increasing Seat Belt Usage and Improving Airbag Effectiveness	891 vehicle occupant fatalities were not using a restraint device**	49%
Part 2: Special Users	Making Walking and Street Crossing Safer	175 pedestrian fatalities	7%
	Ensuring Safer Bicycle Travel	42 bicyclists fatalities	2%
Part 3: Vehicles	Improving Motorcycle Safety and Increasing Motorcycle Awareness	304 motorcyclists fatalities	13%
	Making Truck Travel Safer	397 fatalities involving heavy vehicles	16%
	Increasing Safety Enhancements in Vehicles	-- Not Quantifiable --	
Part 4: Highways	Reducing Vehicle-Train Crashes	26 fatalities involving a collision with a train	1%
	Keeping Vehicles on the Roadway	751 single vehicle run-off the road fatalities Top 5 most harmful events for single vehicle run -off the road fatalities were: - Overturn/Rollover (50%) - Collision with a tree/shrubbery (17%) - Collision with an embankment/ditch/curb (10%) - Collision with a utility pole (3%) - Collision with guardrail (3%)	31%
	Minimizing the Consequences of Leaving the Road		
	Improving the Design and Operation of Highway Intersections	873 fatalities at an intersection	36%
	Reducing Head-On and Across-Median Crashes	532 head-on and across-median fatalities	22%
	Designing Safer Work Zones	35 work zone fatalities	1%

**TABLE 1-2**  
Summary of Minnesota's State Highway 2005-2009 Fatalities by AASHTO's Emphasis Area

Emphasis Area		Minnesota Fatalities*	Percent
Part 5: EMS	Enhancing Emergency Medical Capabilities to Increase Survivability	In 2007, the average response time (time of crash to arrival hospital) was 47.4 minutes for 85 rural fatal crashes. For 42 urban fatal crashes, the average response time was 37.0 minutes.***	
Part 6: Management	Improving Information and Decision Support Systems	-- Not Quantifiable --	
	Creating More Effective Processes and Safety Management Systems	-- Not Quantifiable --	

\* Source: Minnesota Crash Records (2005 – 2009); not including fatalities due to the I-35W Bridge collapse.  
 \*\* Between 2005 and 2009, there were 1,824 vehicle occupant fatalities.  
 \*\*\* Information regarding EMS response times was from *Traffic Safety Facts 2007* (Source: NHTSA).  
 NOTE: Between 2005 and 2009, there were 2,209 fatal crashes that resulted in 2,427 fatalities.

Based on the results shown in Table 1-2, the top ten Emphasis Areas for the Mn/DOT state transportation system are documented in Table 1-3.

**TABLE 1-3**  
Mn/DOT State Highway Top Ten Safety Emphasis Areas

Top 10 Emphasis Areas (Based on 2005-2009 MN Data)	Related Fatalities		Rank	CEAs included in 2007 MN SHSP
	Number	%		
Increasing Seat Belt Usage and Improving Airbag Effectiveness	891	49%	1	✓
Improving the Design and Operation of Highway Intersections	873	36%	2	✓
Reducing Impaired Driving	841	35%	3	✓
Keeping Vehicles on the Roadway (combined with Minimizing the Consequences of Leaving the Road)	751	31%	4	✓
Curbing Aggressive Driving	638	26%	5	✓
Instituting Graduated Licensing for Young Drivers	532	22%	6	✓
Reducing Head-On and Across-Median Crashes	495	20%	7	✓
Sustaining Proficiency in Older Drivers	461	19%	8	
Keeping Drivers Alert	397	16%	9	
Making Truck Travel Safer	386	16%	10	
Increasing Driver Safety Awareness				✓
Improving Information and Decision Support Systems				✓

Source: Minnesota Crash Records; not including fatalities due to the I-35W Bridge collapse.  
 2005-2009: 2,209 fatal crashes; 2,427 fatalities; 1,824 vehicle occupant fatalities

### 1.1.3 Area Transportation Partnership (ATP) and County Context

During development of the Minnesota SHSP, detailed county-level crash analysis was identified as a potential low cost countermeasure that could reduce the number of fatal and life changing crashes. Based on this observation, Mn/DOT has undertaken development of a Roadway Safety Plan for each Minnesota ATP and county.



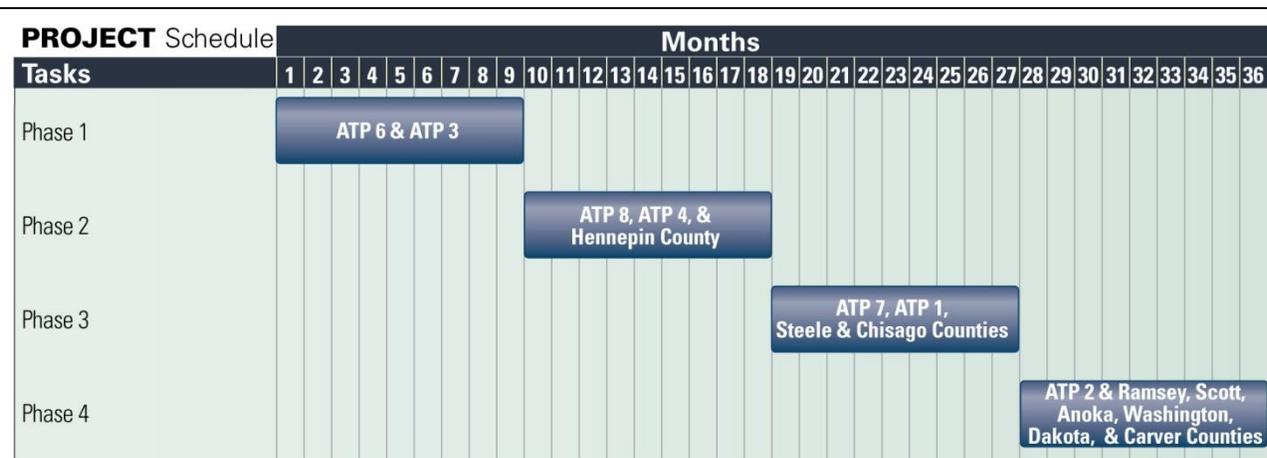
The plans document ATP and county-specific crash trends, along with the range of available proactive safety measures to address these trends. The plans are intended to assist county engineers in identifying corridors that may benefit from systematic, low-cost safety improvements. Once corridors have been identified, county engineers can then more effectively prioritize the county’s roadway safety needs and systematically implement safety measures across the entire county. These safety plans will provide counties an advantage towards securing future safety funding because systematic identification of crash problems and potential countermeasures is currently the focus of funding safety projects at the state and national level, and will be for the foreseeable future.

### 1.1.4 Partnering Agencies and Organizations

The national and Minnesota SHSPs were developed through coordination with a variety of stakeholders from public and private agencies. In Minnesota, the SHSP and this CRSP process includes working with stakeholders outside of the traditional safety planning process—including planning organizations, cities, or tribal units of government—when developing countermeasures to address county-specific safety issues. Individuals representing the 4 Es (Engineering, Education, Enforcement, and Emergency Medical Services) were invited to participate in the CRSP process. Those representing other modes of transportation—bicycle, pedestrian, commercial vehicles, motorcycles, etc.—were also encouraged to participate.

## 1.2 CRSP Delivery Phases and Schedule

The CRSP Project has been broken into four phases, as shown in Figure 1-4. Each phase covers at least two ATPs; Phases 2 through 4 also include individual planning efforts for counties located in the Twin Cities metropolitan area.



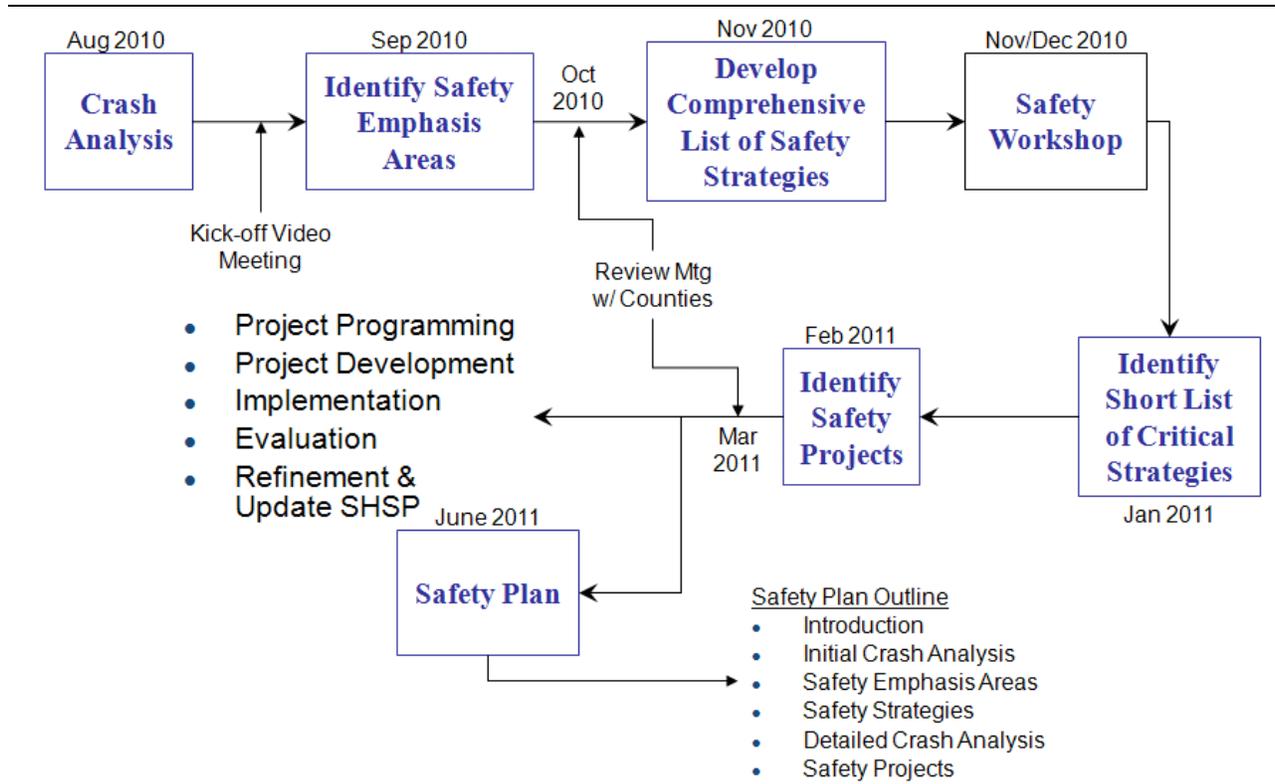
**Figure 1-4**  
**CRSP Schedule of Delivery, 4 Phases**

The timing of these phases is as follows:

- Phase I—November 2009 through August 2010
- Phase II—August 2010 to May 2011
- Phase III—May 2011 to February 2012
- Phase IV—February 2012 to October 2012

### 1.3 CRSP Project Approach

Figure 1-5 shows the approach used to develop the CRSPs during Phase II for counties included in ATPs 4 and 8. Beginning with the crash analyses for each county and concluding with these CRSP reports, this process is the culmination of more than a year of working with Mn/DOT and involved counties.



**Figure 1-5**  
**CRSP Project Approach**

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	2.11.1 Infrastructure Based Safety Projects .....	2-23

## 2.0 ATP 4 Overview

The first step in the process is conducting a crash analysis overview of each county and the ATP as a whole.

### 2.1 Minnesota Crash Mapping Analysis Tool

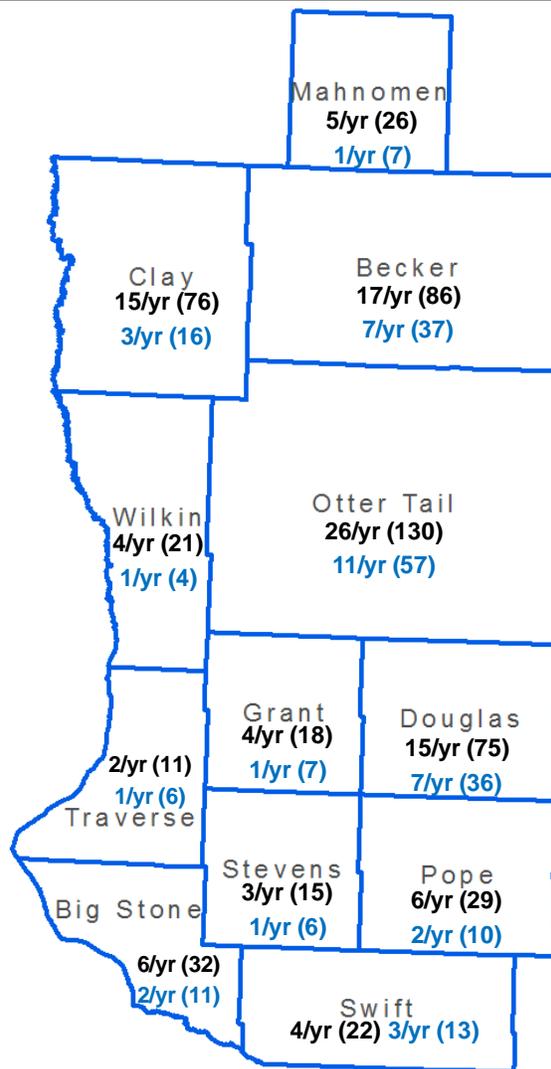
Crash analyses for counties were done using the Minnesota Crash Mapping Analysis Tool (MnCMAT). This map-based computer application provides a crash database for every Minnesota county and spatially locates individual crashes by reference point along all roadways in a county. Over 70 pieces of information are provided for each crash, including: route, reference point, day/date/time, severity, crash and road characteristics, and driver condition.

### 2.2 Crash Data Sets

For both the ATP and individual counties, a data set consisting of five years of crash records was assembled. For all counties included in ATP 4, this data set included a total of 16,311 crashes for the years 2005-2009. Data for 2005-2009 was used as this was the most recent data available when the analysis of Phase II began.

When performing safety analyses, it is generally recommended to use more than one year of data to reduce the possibility of basing recommendations on the events of a single, possibly atypical year. Using five years of data provides statistically reliable results. However, using more than five years of data increases the possibility that results will reflect road conditions that no longer exist; this may occur if a roadway has been reconstructed, traffic control or speed limits have changed, etc.

Additionally, it is recommended to analyze datasets of 100 data points to produce statistically reliable analysis. For a majority of counties in ATP 4, the number of severe crashes in each county, as shown in Figure 2-1, does not support a statistically reliable dataset. The approach this project took was to use ATP totals and provide a comparison to the county data.



#### Legend

**15/yr (76 total)** - Severe crashes on any jurisdiction

**3/yr (16 total)** - Severe crashes on CSAH/CR

MnCMAT Crash Data, 2005-2009

Severe = K (fatal) + A (life-changing injury)

**Figure 2-1**  
**ATP 4 Crash Overview**

## 2.3 Facilities Analyzed

The crash analysis was broken into three main facility types: segments, curves and intersections.

1. Segments analyzed in this project included only paved CSAH or CR roads. Gravel roads were removed from the detailed analysis due to lack of infrastructure based strategies that can be applied to gravel roads and the fact that gravel roads only account for a low percentage of severe crashes (see Section 2.10.1).
2. Intersections included the analysis of CSAH and CR with state highways (US and TH), other county roads (CSAH and CR) or Municipal State-Aid roads. CSAH or CR intersecting with Township roads were removed from the analysis due to the very low number of crashes at these types of intersections.
3. Paved curves on CSAH and CR were included in the analysis if the radius was less than 3,000 feet. When a curve's radius exceeds 3,000 feet, the crash rate of the curve nears the expected crash rate of tangent sections.

## 2.4 Information Provided by Counties

The initial list of intersections, segments and curve locations was assembled and then submitted to the counties for review and revising, where necessary. The counties then identified in-place traffic control devices, street lights and other information describing their facilities. This is the complete list of information provided by the counties for intersections and roadway segments:

### Intersections

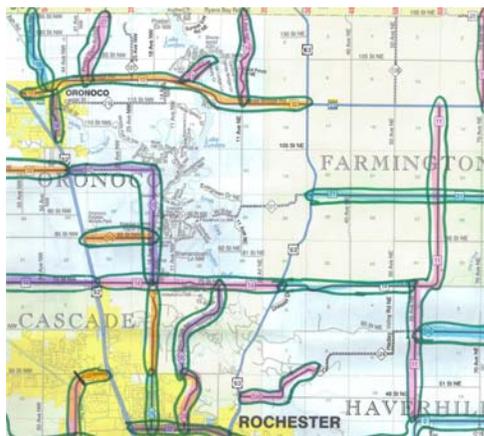
- Traffic control devices
- Street lights
- Distance from previous STOP sign (see section 2.4.2)

### Segments

- Logical termini
- Facility type (2-lane, 4-lane, etc.)
- Installed rumble strips (center and/or edgeline)
- Installed chevrons

#### 2.4.1 Segmentation of County Roads

Properly segmenting roadways into logical termini is important for identifying safety projects (see Figure 2-2). Segments should have similar speed limits, average daily traffic (ADT), and geometrics. In rural areas, roadway segments should range from three to ten miles; with a minimum segment length of one mile and maximum of 15 miles.

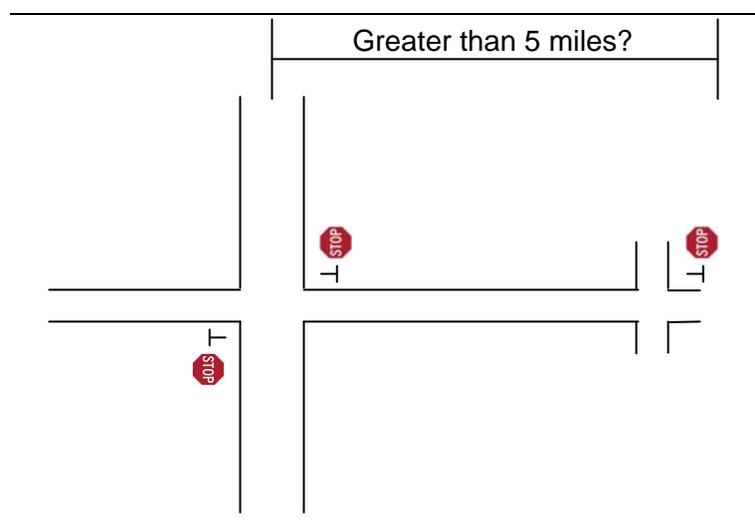


Route	#	Start	End
CSAH	3	South County Line	TH 30
CR	135	CSAH 3	East County Line

**Figure 2-2**  
**Sample County Road Segmentation**

## 2.4.2 Distance From Previous STOP Sign

For thru-STOP and all-way STOP intersections, counties documented whether any STOP-leg approaches have a controlled approach with more than five miles from the previous stop sign (see Figure 2-3). This information is important because it has been identified as a risk factor associated with STOP-controlled intersections, including drivers being drowsy or not anticipating the stop sign. Research has indicated that STOP controlled intersections that are more than 5 miles from the previous STOP sign are more at-risk for intersection-related crashes. The reasons behind the increased risk are not completely understood –it may be related to drivers being less attentive to advance intersection warnings the longer they drive without seeing a STOP sign. This observed increased risk related to the distance to the previous STOP sign does NOT in any way translate to a suggestion to add STOP signs. It may suggest, depending on the presence of other risk factors (traffic volume, geometry, railroad crossing, etc) the need to consider improvements at the existing STOP controlled intersection.



**Figure 2-3**  
***Distance from Previous STOP Sign***

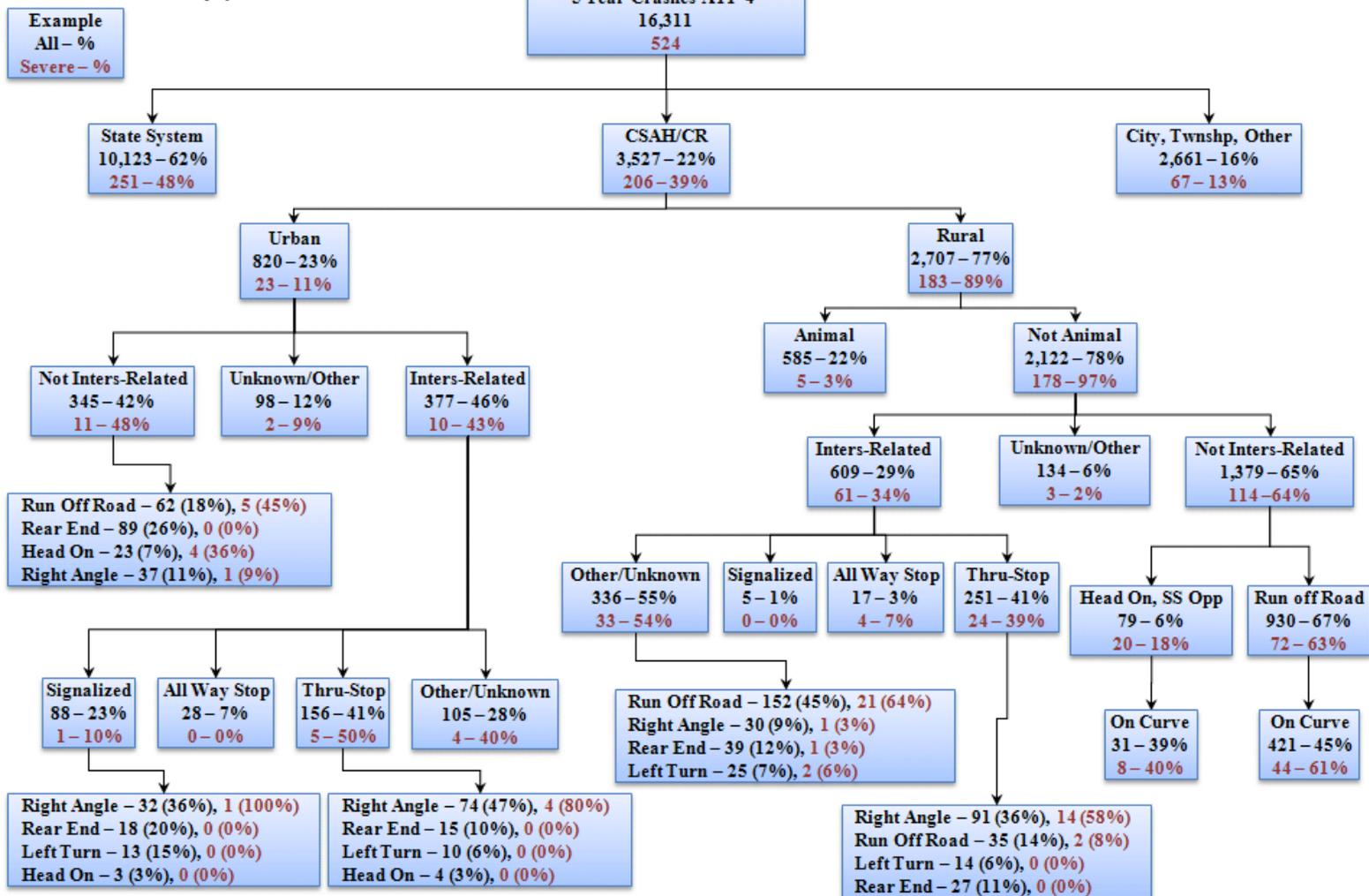
## 2.5 ATP 4 Crash Disaggregation

Figure 2-4 on the following page illustrates the disaggregated results for all crashes that occurred in ATP 4 from 2005-2009. Some highlights from this data set include:

- 39% of severe crashes occurred on the county system (CSAH and CR), whereas 48% occurred on the state system
- 89% of severe crashes on the county system occurred in rural areas
- 63% (72 of 183) of severe rural crashes are road departure crashes. Of these crashes, 61% occurred on curves
- 34% (61 of 183) of severe rural crashes on the county system are intersection related

Source: MnCMAT Crash Data, 2005-2009

Severe is fatal and serious injury crashes (K+A).



NOTE: Categories shown are to highlight key crash data - since not all crash data is shown percentages may not add up to 100%.

**Figure 2-4**  
**ATP 4 County Crash Data Overview**

## 2.6 Top Five Critical Emphasis Areas for ATP 4

The second step of the process involves identifying the Safety Emphasis Areas. These emphasis areas were originally identified by AASHTO and FHWA to provide a measure of consistency across the states in assigning severe crashes to specific categories. In addition, identifying safety emphasis areas represents the initial effort to help states and counties prioritize their safety planning efforts. The safety emphasis areas are pools of similar types of crashes that represent the greatest opportunities for reductions in severe crashes. The emphasis areas also assist in the identification of a short list of potential safety strategies. The notion being that most safety strategies are intended to mitigate a specific type of crash, instead of all severe crashes. As a result, the most comprehensive source of suggested safety strategies (the NCHRP 500 series) is broken down by safety emphasis areas:

### 2.6.1 ATP 4 Top 5 Critical Emphasis Areas

The results of the crash data analysis for ATP 4 in relation to AASHTO’s 22 Safety Emphasis Areas are summarized in Table 2-2. Based on the crash analysis, the top five Safety Emphasis Areas for ATP 4 are:

- Aggressive driving and speeding
- Drug and alcohol-related
- Unbelted vehicle occupants
- Road departure crashes
- Intersection crashes

ATP 4’s emphasis areas were generally consistent with the State’s emphasis areas. However, unlike the State’s emphasis areas, ATP 4 does not include the “young drivers (under 21)” emphasis area. Instead, ATP 4 has the emphasis area “Aggressive driving and speeding.”

Strategies to reduce crashes depend on whether a CEA is infrastructure-based or driver-behavior-based. Infrastructure-based emphasis areas refer to characteristics of the area in which crashes occur. Driver-behavior-based emphasis areas refer to motorist characteristics or actions that contribute to crashes. ATP 4’s top five CEAs can be categorized as shown in Table 2-1.

Because driver behavior is tied to laws made at the national or state level, agencies generally have less ability to address driver-behavior-based CEAs. The most effective approach to addressing driver-behavior-based CEAs is to focus on public education, law enforcement, and cooperation and collaboration with other county departments, agencies, and schools. There are generally more opportunities for counties to address infrastructure-based CEAs, as many of the associated strategies can be implemented as separate roadway improvement projects, or along with other planned improvements. The infrastructure-based and driver behavior-based strategies brought to the participants of the workshops are listed in Tables 2-3 through 2-10.

TABLE 2-1 Infrastructure-based and Driver Behavior-based Critical Emphasis Areas	
<b>Infrastructure-based CEAs</b>	
Road Departure Crashes	
Intersection Crashes	
<b>Behavior-based CEAs</b>	
Aggressive driving and speeding	
Drug and alcohol-related	
Unbelted vehicle occupants	

TABLE 2-2 ATP 4 Critical Emphasis Areas, Based on Crash Data Analysis			
Emphasis Area		Statewide %	ATP 4 (CSAH/CR)
Drivers	Young drivers (under 21)	26%	16% (36)
	Unlicensed drivers	7%	7% (16)
	Older drivers (over 64)	13%	15% (34)
	Aggressive driving and speeding-related	21%	27% (62)
	Drug and alcohol-related	26%	39% (89)
	Inattentive, distracted, asleep drivers	20%	19% (43)
	Safety awareness	--	- -
	Unbelted vehicle occupants	26%	38% (87)
Special Users	Pedestrians crashes	8%	3% (7)
	Bicycle crashes	4%	2% (5)
Vehicles	Motorcycles crashes	15%	18% (41)
	Heavy vehicle crashes	9%	7% (16)
	Safety enhancements	--	- -
Highways	Train-vehicle collisions	0%	0% (0)
	Road departure crashes	27%	49% (113)
	Consequences of leaving road	--	- -
	Intersection crashes	42%	36% (82)
	Head-On and Sideswipe (opposite) crashes	15%	23% (54)
	Work zone crashes	1%	1% (2)
EMS	Enhancing Emergency Capabilities	--	- -
Management	Information and decision support systems	--	- -
	More effective processes	--	- -
Total Fatal and Serious Injury Crashes		9,122	230

DPS Crash Data Records, 2005 to 2009

Critical Emphasis Areas (based on top 5 ATP 4 numbers)

Note: Numbers in this table do not add up to total crash numbers because one crash may be categorized into multiple emphasis areas. For example, one crash may involve a young driver at an intersection and therefore be included in both of these emphasis areas.

## 2.7 Safety Strategies for Counties in ATP 4

### 2.7.1 NCHRP Safety Strategies

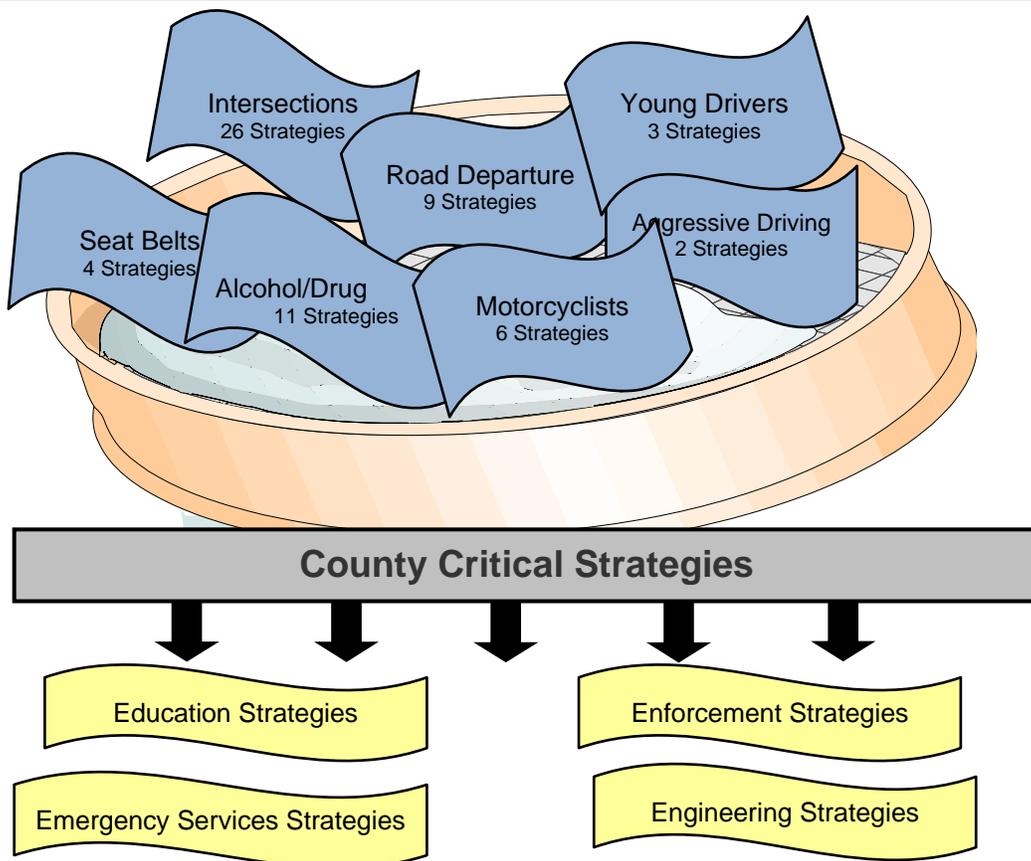
A variety of strategies are available to address each Critical Emphasis Area by assisting state and local agencies reduce traffic-related fatalities and injuries. The National Cooperative Highway Research Program (NCHRP) has developed a series of guides that correspond to each of the 22 CEAs. This effort is part of NCHRP Project 17-18(3); Report 500 series. The guides correspond to the emphasis areas outlined in AASHTO's SHSP. Each guide includes a description of the problem, strategies for addressing the problem, and model implementation processes. The guides also categorize the safety strategies as proven, tried, and experimental, to provide practitioners with an idea of how wide-spread a particular strategy has been used. Proven strategies have been used in multiple locations with multiple studies showing them to be

effective. Tried strategies have been implemented in a number of locations but have not had rigorous evaluations completed to determine effectiveness. Experimental strategies represent ideas that have been considered sufficiently promising but have not been widely implemented or evaluated.

### 2.7.2 Safety Strategies Brought to Safety Workshops

NCHRP safety strategies were the basis for identifying safety strategies for ATP 4 and the counties. For the CRSP process, Mn/DOT and stakeholders sought to identify viable safety strategies for the top five Critical Emphasis Areas (see Section 2.6 and Figure 2-5), as well as young drivers and motorcyclists.

Even though the process sought safety strategies to address just five emphasis areas, there were still too many strategies for stakeholders to feasibly consider at workshops. Given this constraint, Mn/DOT and the CRSP team reviewed the full range of safety strategies, and did an initial screening based on cost and effectiveness. For example, the NCHRP report lists over 70 potential strategies to address intersection safety. The screening conducted by Mn/DOT's CRSP team narrowed this list down to twenty-six strategies considered to be the most applicable in ATP 4. These twenty-six strategies were then brought to the workshops and discussed with the workshop participants. The strategies considered to be the highest priority at the workshops were then brought to county staff.



**Figure 2-5**  
**Screening of NCHRP Safety Strategies**

**TABLE 2-3**  
Infrastructure Safety Strategies Addressing Road Departure Crashes Considered at Safety Workshops

Objectives	Strategies	Relative Cost to Implement and Operate	Effectiveness	Typical Timeframe for Implementation
<b>15.1 A—Keep vehicles from encroaching on the roadside</b>	15.1 A1—Install shoulder rumble strips	Low	Proven*	Short
	15.1 A2—Install enhanced pavement markings, edgeline rumble strips or modified shoulder rumble strips on section with narrow or no paved shoulders	Low	Experimental/ Tried	Short
	15.1 A3—Install centerline rumble strips	Low	Proven*	Short
	15.1 A4—Provide enhanced shoulder or delineation and marking for sharp curves	Low	Tried/Proven	Short
	15.1 A5—Provide improved highway geometry for horizontal curves	High*	Proven	Long
	15.1 A8—Apply shoulder treatments: *Eliminate shoulder drop-offs; *Shoulder edge; *Widen and/or pave shoulders	Moderate*	Experimental/ Proven	Medium
	18.1 A-1-Install centerline rumble strips for two-lane roads	Low	Tried	Short
<b>15.1 B—Minimize the likelihood of crashing into an object or overturning if the vehicle travels off the shoulder</b>	15.1 B1—Design safer slopes and ditches to prevent rollovers	Moderate to High*	Proven	Medium
	15.1 B2—Remove/relocate objects in hazardous locations	Moderate to High	Proven	Medium
<b>Relative Cost to Implement and Operate:</b>		<b>Typical Timeframe for Implementation:</b>		
Low = <\$10,000/mile; Moderate = \$10,000-\$100,000/mile; High = >\$100,000/mile		Short = < 1 year, Medium = 1-2 years, Long = > 2 years		
Source: NCHRP 500 Series (2003); *Updated by CH2M HILL				



**TABLE 2-4**  
Infrastructure Strategies Addressing Intersection Crashes at Signalized Intersections Considered at Safety Workshops

Objectives	Strategies	Relative Cost to Implement and Operate	Effectiveness	Typical Timeframe for Implementation
<b>17.2 A—Reduce frequency and severity of intersection conflicts through traffic control and operational improvements</b>	17.2 A1—Optimize signal operation (phasing/timing, etc.)	Low	Tried/Proven	Short
	17.2 A2—Optimize clearance intervals	Low	Proven	Short
	17.2 A4—Employ signal coordination along a corridor or route	Low*	Proven	Medium
	17.2 A6—Improve operation of pedestrian and bicycle facilities at signalized intersections	Low	Tried/Proven	Short
	17.2 A7—Remove unwarranted/unnecessary signal	Low	Proven	Short
<b>17.2 D -- Improve driver awareness of intersections and signal control</b>	17.2 D2 -- Improve visibility of signals and signs at intersections	Low	Tried	Short
<b>17.2 E -- Improve driver compliance with traffic control devices</b>	17.2 E2 -- Supplement conventional enforcement of red-light running with confirmation lights	Low	Tried	Short
<b>17.2 F—Improve access management near signalized intersections</b>	17.2 F1—Restrict access to properties using driveway closures or turn restrictions	Low	Tried	Short
	17.2 F2—Restrict cross-median access near intersections	Low	Tried	Short
<b>17.2 G -- Improve safety through other infrastructure treatments</b>	17.2 G5 -- Restrict or eliminate parking on intersection approaches	Low	Proven	Short
<b>Relative Cost to Implement and Operate:</b> Low = <\$50,000/intersection; Moderate = \$50,000-\$500,000/intersection; High = >\$500,000/intersection		<b>Typical Timeframe for Implementation:</b> Short = < 1 year; Medium = 1-2 years; Long = > 2 years		
Source: NCHRP 500 Series (2003); *Updated by CH2M HILL				



TABLE 2-5  
Infrastructure Strategies Addressing Intersection Crashes at Unsignalized Intersections Considered at Safety Workshops

Objectives	Strategies	Relative Cost to Implement and Operate	Effectiveness	Typical Timeframe for Implementation
<b>17.1 A—Improve management of access near unsignalized intersections</b>	17.1 A1 -- Implement driveway closure/relocations	Moderate	Tried	Medium
	17.1 A2—Implement driveway turn restrictions	Low	Tried	Short
<b>17.1 B -- Reduce the frequency and severity of intersection conflicts through geometric design improvements</b>	17.1 B12 -- Restrict or eliminate turning maneuvers by providing channelization or closing median openings	Low	Tried	Short
	17.1 B13 -- Close or relocate "high-risk" intersections	High	Tried	Long
	17.1 B16 -- Realign intersection approaches to reduce or eliminate intersection skew	High	Proven	Medium
	17.1 B17 -- Use indirect left-turn treatments to minimize conflicts at divided highway intersections	Moderate	Tried	Medium
<b>17.1 C -- Improve sight distance at unsignalized intersections</b>	17.1 C1 -- Clear sight triangle on stop- or yield-controlled approaches to intersections	Low	Tried	Short
<b>17.1 D -- Improve availability of gaps in traffic and assist drivers in judging gap sizes at unsignalized intersections</b>	17.1 D1 -- Provide an automated real-time system to inform drivers of suitability of available gaps for making turning and crossing maneuvers	Moderate	Experimental	Medium
<b>17.1 E -- Improve driver awareness of intersections as viewed from the intersection approach</b>	17.1 E1 -- Improve visibility of intersections by providing enhanced signing and delineation	Low	Tried	Short
	17.1 E2 -- Improve visibility of intersections by providing lighting	Moderate to High	Proven	Medium
	17.1 E3 -- Install splitter islands on the minor-road approach to an intersection	Moderate	Tried	Medium
	17.1 E4 -- Provide a stop bar (or provide a wider stop bar) on minor-road approaches	Low	Tried	Short
	17.1 E6 -- Call attention to the intersection by installing rumble strips on intersection approaches	Low	Tried	Short
<b>17.1 F -- Choose appropriate intersection traffic control to minimize crash frequency and severity</b>	17.1 F3 -- Provide roundabouts at appropriate locations	High	Proven	Long
<b>17.1 H -- Reduce operating speeds on specific intersection approaches</b>	17.1 H1 -- Provide targeted speed enforcement	Moderate	Proven	Short
	17.1 H2 -- Provide traffic calming on intersection approaches through a combination of geometrics and traffic control devices	Moderate	Proven	Medium
<b>Relative Cost to Implement and Operate:</b>		<b>Typical Timeframe for Implementation:</b>		
Low = <\$50,000/intersection; Moderate = \$50,000-\$500,000/intersection; High = >\$500,000/intersection		Short = < 1 year; Medium = 1-2 years; Long = > 2 years		
Source: NCHRP 500 Series (2003); *Updated by CH2M HILL				



**TABLE 2-6**  
Behavior-based Safety Strategies Addressing Young Driver (under 21) and Bicycle Crashes Considered at Safety Workshops

<b>Objectives</b>	<b>Strategies</b>	<b>Effectiveness</b>	<b>Programs &amp; Tactics*</b>	<b>Impact</b>
<b>1.1B—Publicize, enforce, and adjudicate laws pertaining to young drivers</b>	1B—Publicize and conduct a high visibility enforcement Graduated Drivers License restrictions, underage drinking and driving and seatbelt laws	Proven	Publicizing is best done through community events for the local media and a public education campaign in the community about the enforcement.  High visibility enforcement is when multiple jurisdictions and/or multiple squads are out at the same time patrolling in brightly colored vests and signage about the enforcement.	High
<b>1.1C—Assist parents in managing their teens' driving</b>	1C.1—Engage parents through outreach programs designed to educate parents about driving tips for their teens, facilitate parental supervision and management of young drivers, encourage selection of safety vehicles for young drivers.	Tried	N/A	Medium
<b>Ensuring Safety Bicycle Travel</b>	10D—Increase bicycle helmet usage, enhanced enforcement of bicycle laws and publicize issues		Advocate for policy change	Low

Source: NCHRP 500 Series (2003); \*Revised by Mn/DOT Office of Traffic, Safety and Technology

TABLE 2-7  
Behavior-based Safety Strategies Addressing Drug and Alcohol Related Crashes Considered at Safety Workshops

Objectives	Strategies	Effectiveness	Programs & Tactics*	Impact
<b>5.1 A—Eliminate Drinking and Driving*</b>	5.1 A2—Require Responsible Beverage Service Policies for Alcohol Servers and Retailers	Proven	Advocate for Server Training and strong management support	Medium
	5.1 A4—Employ Screening and Brief Interventions	Tried	These do not need to be in health care settings. A screening and brief intervention could be very effective after a DWI arrest (traumatic event)	Medium
	5.1 A5—Support Community Programs for Alternative Transportation*	Tried	Safe Cab is a partnership between beer distributors, bar owners and community program in Isanti County.	Medium
<b>5.1 B—Enforce DWI Laws</b>	5.1 B1—Conduct Regular Well-Publicized DWI Saturations*	Proven	A saturation is a multi-agency, multi-squad car enforcement effort. These agencies and cars enforce the same community or roadway with the number of squad cars proportionate to the community size.	High
	5.1 B3—Conduct education and awareness campaign of the targeted enforcement of Zero Tolerance Laws for Drivers Under Age 21*	Proven	Publicizing is best done through community events for the local media and a public education campaign in the community about the enforcement.  High visibility enforcement is when multiple jurisdictions and/or multiple squads are out at the same time patrolling in brightly colored vests and signage about the enforcement.	Low
<b>5.1 C—Prosecute, Impose Sanctions on, and Treat DWI Offenders</b>	5.1 C1—Suspend Driver's License Administratively Upon Arrest	Proven	Minnesota revokes driving privileges 7 days after alcohol test failure of 0.08 or above or test refusal	High
	5.1 C3—Eliminate Diversion Programs and Plea Bargains	Tried	N/A	High
<b>5.1 D—Control High-BAC and Repeat Offenders</b>	5.1 D2—Require Ignition Interlocks as a Condition for License Reinstatement	Proven	Governor proposed legislation in Jan 2010	High
	5.1 D3—Monitor Convicted DWI Offenders Closely	Proven	DWI courts or Intensive Supervision Programs	Low
	5.1 D4—Include stronger sentence guidelines that are enforced	Proven	DWI courts or Intensive Supervision Programs	Low

Source: NCHRP 500 Series (2003); \*Revised by Mn/DOT Office of Traffic, Safety and Technology



TABLE 2-8  
Behavior-based Safety Strategies Addressing Unbelted Vehicle Occupant Crashes Considered at Safety Workshops

Objectives	Strategies	Effectiveness	Programs & Tactics*	Impact
<b>8.1 A—Maximize use of occupant restraints by all vehicle occupants</b>	8.1 A1—Conduct highly publicized enforcement campaigns to maximize restraint use. Specifically, night time belt enforcement saturation*	Proven	Publicizing is best done through community events for the local media and a public education campaign in the community about the enforcement. High visibility enforcement is when multiple jurisdictions and/or multiple squads are out at the same time patrolling in brightly colored vests and signage about the enforcement. Methods for night time enforcement include having multi-agency and multiple squad cars in well lit areas where slow moving vehicles are passing and conducting for a limited time slot.	High
	6.1 D3—Encourage employers to 1)offer education programs to employees and to 2)enact traffic safety policies with clear consequences for failure to comply	Proven	Utilize materials and policy statements designed for employers by Network of Employers for Traffic Safety	Unknown
<b>8.1 B—Ensure that restraints, especially child and infant restraints, are properly used</b>	8.1 B2—Conduct high-profile “child restraint inspection” events at multiple community locations.	Proven	N/A	Low
	8.1 B3—Train advocates to check for proper child restraint use.	Tried	N/A	Low

Source: NCHRP 500 Series (2003); \*Revised by Mn/DOT Office of Traffic Safety

TABLE 2-9  
Behavior-based Safety Strategies Addressing Aggressive Driving at Safety Workshops

Objectives	Strategies	Effectiveness	Programs & Tactics*	Impact
<b>4.1 – Deter aggressive driving in specific populations, including those with a history of such behavior, and at specific locations</b>	4.1 A1- Publicize and conduct high visibility targeted enforcement of speeding and aggressive driving	Tried	<u>Publicizing</u> is best done through community events for the local media and a public education campaign in the community about the enforcement. <u>High visibility enforcement</u> is when multiple jurisdictions and/or multiple squads are out at the same time patrolling in brightly colored vests and signage about the enforcement.	High
	4.1 A3- Impose sanctions against repeat offenders	Experimental		unknown

Source: NCHRP 500 Series (2003); \*Revised by Mn/DOT Office of Traffic, Safety and Technology



TABLE 2-10  
Behavior-based Safety Strategies Addressing Motorcycle Crashes Considered at Safety Workshops

Objectives	Strategies	Effectiveness	Programs & Tactics*	Impact
<b>11.1 B Reduce the number of motorcycle crashes due to rider impairment</b> <b>11.1 C Reduce the number of motorcycle crashes due to unlicensed or untrained motorcycle riders</b>	*Publicize and conduct a high visibility enforcement of all laws pertaining to motorcycle riding.	Proven	Publicizing is best done through community events for the local media and a public education campaign in the community about the enforcement. <u>High visibility enforcement</u> is when multiple jurisdictions and/or multiple squads are out at the same time patrolling in brightly colored vests and signage about the enforcement. <u>Methods for night time enforcement</u> include having multi-agency and multiple squad cars in well lit areas where slow moving vehicles are passing and conducting for a limited time slot.	High
	*11.1 B3-Target law enforcement to specific motorcycle rider impairment behaviors that have been shown to contribute to crashes.	Proven	Motorcycle DWI Detection Guide or Detection of DWI Motorcyclists	Medium
	11.1 C2 Ensure that licensing and rider training programs adequately teach and measure skills and behaviors required for crash avoidance.	Tried	*Training courses provided around the state at Motorcycle Safety Center training sites.	Low
<b>11.1 D Increase visibility of riders</b>	11.1 C3 Identify and remove barriers to obtaining a motorcycle endorsement.	Tried	*Licensing laws: Motorcycle Skills Testing Program- From our own survey of participants, we found that approximately 1/3 would not have bothered to obtain their endorsement if it wasn't for this program.	Medium
	11.1 D1 Increase the awareness of the benefit of high-visibility clothing *Rider conspicuity: NHTSA's guidelines for motorcycle safety programs recommend that states educate riders on how to be more conspicuous to other drivers, and we have good resources via <a href="http://www.highviz.org">www.highviz.org</a> .	Experimental	Publicizing is best done through the local media and a public education campaign in the community.	Low
<b>11.1 E Reduce the severity of motorcycle crashes</b>	11.1 E1 Increase the use of FMVSS 218 compliant helmets.	Proven	Pass statewide legislation requiring helmets for all riders.	High

Source: NCHRP 500 Series (2003); \*Revised by Mn/DOT Office of Traffic, Safety and Technology

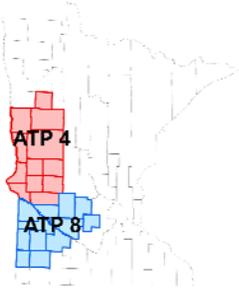


## 2.8 ATP 4 Safety Meetings

A series of meetings were conducted with each county during the project. The following is a summary of the various meetings.

### 2.8.1 Project Kickoff Meeting

On August 12, 2010, representatives from ATP 4 and ATP 8 met via video conference for a CRSP project kickoff meeting. Counties and engineers participating in Phase II of the CRSP are listed below (Figure 2-6).

<u>ATP 4</u>		<u>ATP 8</u>
<ul style="list-style-type: none"> <li>• Becker – Brad Wentz</li> <li>• Big Stone – Nicholas Anderson</li> <li>• Clay - David Overbo</li> <li>• Douglas - David Robley</li> <li>• Grant – Tracey Von Bargaen</li> <li>• Mahnomen – Jon Large</li> <li>• Otter Tail – Richard West</li> <li>• Pope – Brian Noetzelman</li> <li>• Stevens – Brian Giese</li> <li>• Swift – Andy Sander</li> <li>• Traverse – Larry Haukos</li> <li>• Wilkin – Tom Richels</li> </ul>		<ul style="list-style-type: none"> <li>• Chippewa – Steve Kubista</li> <li>• Kandiyohi – Gary Danielson</li> <li>• Lac Qui Parle – Steve Kubista</li> <li>• Lincoln – Lee Amundson</li> <li>• Lyon – Sahail Kanwar</li> <li>• McLeod – John Brunkhorst</li> <li>• Meeker – Ronald Mortensen</li> <li>• Murray – Randy Groves</li> <li>• Pipestone – David Halbersma</li> <li>• Redwood – William Rabenberg</li> <li>• Renville – Marlin Larson</li> <li>• Yellow Medicine – Andy Sander</li> </ul>

**Figure 2-6**  
**CRSP Kickoff Meeting (August 12, 2010) Participants**

### 2.8.2 County Safety Review Meeting 1

Two ATP 4 Statewide Roadway Safety Plan review meetings were held in October 2010. Prior to attending these meetings, Mn/DOT’s CRSP team completed crash analyses for each county within the ATP 4. The results of these analyses were shared with the county engineers. The CRSP process was described, including a discussion of the safety strategies workshops that were held in December 2010. The first county safety review meeting was held on October 27, 2010, and was attended by representatives from the following counties:

- |          |              |            |
|----------|--------------|------------|
| • Becker | • Douglas    | • Mahnomen |
| • Clay   | • Otter Tail | • Wilkin   |

The second meeting was held on October 28, 2010, and was attended by representatives from the following counties:

- |             |            |           |
|-------------|------------|-----------|
| • Grant     | • Traverse | • Stevens |
| • Big Stone | • Pope     | • Swift   |

### 2.8.3 Safety Strategies Workshops

Three Safety Planning Workshops were held for counties located within ATP 4 during December 2010/January 2011. The primary focus of the safety workshops was discussion and prioritization of safety strategies. Specifically, meeting participants prioritized safety strategies for the top five critical emphasis areas for ATP 4, as described above in Section 2.6. Table 2-11 lists which counties participated in each of the three workshops.

All of the safety strategies listed in Tables 2-3 through 2-10 were brought to the safety workshops for consideration and discussion by meeting participants. The following two tables show the results of the prioritization exercise that occurred at these workshops. Table 2-12 lists the top ranked infrastructure strategies while Table 2-13 lists the top ranked behavioral strategies.

TABLE 2-11  
ATP 4 Safety Work Shop Schedule and Participating Counties

Date	Participating Counties
December 13, 2010 Fergus Falls	Becker Clay Douglas Otter Tail
December 15, 2010 Fergus Falls	Grant Mahnomon Traverse Wilkin
January 12, 2011 Morris	Big Stone Pope Stevens Swift

### 2.8.4 County Safety Review Meeting 2

ATP 4 Statewide Roadway Safety Plan review meetings were held in March 2011. The first meeting was a webinar held on March 8, 2011. During this meeting, the CRSP process; the facility prioritization process; and the project development process were reviewed. Prior to attending this meeting, the CRSP team completed the prioritization of at-risk location process and generated a list of projects for review by the county. During the second meeting, two counties were brought in to discuss and share feedback on their projects.

TABLE 2-12  
Top-ranked Infrastructure Safety Strategies, Based on ATP 4 Workshop Voting Results

Objectives	Strategies	Votes
<b>15.1 A—Keep vehicles from encroaching on the roadside</b>	15.1 A1—Install shoulder rumble strips	47
	15.1 A2—Install enhanced pavement markings, edge line rumble strips or modified shoulder rumble strips on section with narrow or no paved shoulders	29
	15.1 A4—Provide enhanced shoulder or delineation and marking for sharp curves	48
	15.1 A8—Apply shoulder treatments *Eliminate shoulder drop offs, safety wedge, and widen and/or pave shoulders	29
<b>17.1 C—Improve sight distance at unsignalized intersections</b>	17.1 C1 -- Clear sight triangle on approaches and in medians by clearing grub, eliminating parking, etc	14
<b>17.1 E—Improve driver awareness of intersections as viewed from the intersection approach</b>	17.1 E2—Improve visibility of intersections by providing lighting	41



TABLE 2-13  
 Top-ranked Behavior-based Safety Strategies, Based on ATP 4 Workshop Voting Results

Objectives	Strategies	Votes
<b>1.1B—Publicize, enforce, and adjudicate laws pertaining to young drivers</b>	1B—Publicize and conduct a high visibility enforcement GDL restrictions, cell and texting laws, underage drinking and driving and seatbelt laws	36
<b>6.1 C—Increase driver awareness of the risks of drowsy and distracted driving and promote driver focus</b>	6.1 C2—Conduct high visibility enforcement for existing statutes to deter distracted and drowsy driving	40
<b>8.1 A—Maximize use of occupant restraints by all vehicle occupants</b>	8.1 A1—Conduct highly publicized enforcement campaigns to maximize restraint use. Specifically, night time belt enforcement saturation.	57
<b>5.1 B—Enforce DWI Laws</b>	5.1 B1—Conduct Regular Well-Publicized DWI Saturations	33
<b>4.1 A—Deter aggressive driving in specific populations, including those with a history of such behavior, and at specific locations</b>	4.1 A1—Publicize and conduct high visibility targeted enforcement of speeding and aggressive driving	28
<b>11.1E—Reduce the severity of motorcycle crashes</b>	11.1 E1 increase the use of FMVSS 218 compliant helmets	26

## 2.9 Use of Crash Surrogates to Identify Candidates for Safety Investment

The current best practices approach to safety planning is based on the Federal Highway Administrations (FHWA) advice to be data driven when developing the statewide strategic highway safety plan. In practice this advice translates to disaggregating a states severe crashes (fatal + A injury) in order to identify categories of crashes with large numbers that represent the greatest opportunities for reductions. In addition, this analytical effort also identifies key characteristics – locations, systems, crash data (type, frequency, rate, density, severity, etc.) and contributing factors that provide insight about the development and deployment of highway safety improvement projects at specific candidate locations along an agency’s highway system.

There are currently two primary analytical methods to support the identification of candidate locations for the allocation of safety resources – the “black spot” method and the systemic method.

### 2.9.1 Black Spot Method

The black spot method has been the one most commonly used by transportation agencies, suggested guidelines have been in published literature for more than 30 years and there has been a great deal of research conducted that has refined the process in attempts to achieve results with higher levels of statistical reliability. The objective of black spot analysis is to find locations that exhibit unusually high frequencies or rates of crashes. The base crash data are analyzed and problem locations are identified, prioritized and ranked. Infrastructure based countermeasures, such as improved roadway geometry or traffic control devices are then applied to address documented safety deficiencies at specific locations.

The technical analysis of black spots has historically considered all crashes because severe crashes are too rare (fatal and A-injury crashes generally account for about 2% of all crashes), too random and widely distributed geographically to efficiently identify specific problem locations. However, the use of all crashes as the safety performance measure generally points analysts toward locations with high traffic volumes in urban areas. As a result, common black spot locations are intersections, particularly signalized intersections along multi-lane urban arterial roadways.

Black spot analysis is clearly a necessary component of a comprehensive program to address safety deficiencies along Minnesota's highways. In urban areas, where traffic volumes and crash frequencies are high, black spot analysis will likely continue to be the most commonly used analytical technique for allocating safety resources. Intuitively, it seems to make sense to target limited safety funds at locations that have documented safety deficiencies. However, black spots analysis has not proven to be effective in Minnesota at reducing the number of fatal and serious injury crashes that are widely distributed across the State's 135,000 miles of roads – crashes that are not concentrated enough to identify candidate sites for improvement through a process that is based solely on the total number of crashes.

As proof of the limited ability of the black spot methodology to identify candidates for statewide safety investment, see the following examples.

1. Minnesota has a long history of identifying black spots and annually publishes a Top 200 list of intersections along the 12,000 trunk highway system based on crash cost, frequency and severity. These Top 200 intersections are overwhelmingly signalized (70%) and urban (69%). However, this approach does not do a very good job of identifying intersections with fatal crashes (fewer than 10% of fatal crashes occurred at intersections in the Top 200 list) and it does not adequately identify at-risk intersections in rural areas where 66% of intersection related fatalities occur.
2. A comprehensive review of 1,862 intersections in 12 counties in ATP 4 found a total of 191 crashes per year (an average of less than 0.10 crashes per intersection per year) of which 71 were severe (occurring at approximately 4% of all intersections, and an average of 0.01 severe crashes per intersection per year). Out of the 1,862 intersections, only three (less than 0.2%) were found to have had two fatalities in a five year period. These three intersections averaged between less than one to two total crashes per year. As a result, even though these three intersections are the worst in a twelve county area (based on fatalities), they would not have ranked high enough to enter the Highway Safety Improvement Program (HSIP) as black spots.

## 2.9.2 Systemic Method

The systemic method has been added to the safety planning process in Minnesota to better address the over representation of severe crashes, the very low density of these crashes in rural areas and to complement the black spot component of the safety program. Approximately 70% of severe crashes occur in rural areas, but rural segments average approximately 0.01 severe crashes per mile per year, rural intersections average 0.02 severe crashes per intersection per year and there are virtually no black spots in these rural areas. The challenge associated with identifying candidates for safety investment in rural areas with low densities of severe crashes applies to both the state and local highway systems where severe crashes are almost equally divided.

The objective of the systemic method is the same as for the black spots, to identify candidates for the deployment of safety improvement projects. However, this method makes one fundamental change in the approach. The black spot method assumed that the presence of

(large numbers of) crashes equaled risk and that the absence of crashes indicated that there was no risk. The systemic method is based on the assumption that the absence of crashes does not equate to no risk.

The adoption of this premise about risk presented one very significant challenge – Mn/DOT previously had no method to assess risk using any measure other than crashes. In order to support the development of a new approach that defines risk based on crashes plus a variety of surrogate measures, research was conducted that identified rural segments and intersections with crashes and then documented the geometric and traffic features that were common among the various locations. This research identified a series of risk rating factors that could then be applied to the analysis of the key elements of rural systems – segments, horizontal curves and intersections in order to help distinguish those elements that are most at-risk.

This risk rating method can then be used to help answer the question – are all miles of rural segments, all horizontal curves and all intersections on my system equally at risk? The incorporation of this method into the process of preparing strategic highway safety plans for rural Mn/DOT Districts and counties suggests that the answer is NO; only about 15% to 20% of these facilities represent a high risk of severe crashes and therefore appear to be good candidates for safety investment through Minnesota’s Highway Safety Improvement Program (HSIP).

A description of the risk rating factors that were applied to rural road segments, horizontal curves and intersections is provided in the following paragraphs.

## 2.10 Identification and Prioritization of At Risk Locations

The crash overview of each county in ATP 4 indicated that the elements of their system that contained the greatest number of severe crashes, and therefore represent the greatest opportunity for crash reduction include; rural segments, curves and intersections. The analytical process used to identify risk and prioritize specific locations is described in the following paragraphs.

### 2.10.1 Rural Gravel Segments

The twelve counties in ATP 4 are responsible for the operation of 5,877 miles of County State Aid Highway and County Roads, of which 3,425 miles are paved and 2,452 miles are gravel. In order to focus the analytical efforts on the roadways that represent the greatest opportunity for crash reduction, the first step in the process disaggregated severe crashes on the system by road surface – paved versus gravel. This analysis determined that gravel roads make up 42% of the system but fewer than 15% of all severe crashes occur on these roads. In addition, one-third of the counties have no severe crashes on their gravel roads and no county averages one severe crash per year on these roads. As a result, the analytical process focuses

TABLE 2-14  
ATP 4 Segment Summary

County	Gravel Mileage	Severe Crashes on Gravel	Paved Mileage	Severe Crashes on Paved
Becker	211	2	433	18
Big Stone	240	0	157	1
Clay	448	3	256	6
Douglas	140	3	352	16
Grant	289	1	149	2
Mahnomen	141	2	132	3
Otter Tail	0	0	1004	32
Pope	107	2	243	7
Stevens	N/A	0	163	0
Swift	226	1	218	14
Traverse	361	4	119	0
Wilkin	292	0	199	3
<b>Total</b>	<b>2,452</b>	<b>18</b>	<b>3,425</b>	<b>102</b>

Note: Some counties removed gravel roads from analysis, thus mileage could not be determined

on the paved roads where over 85% of the severe crashes occur and includes an overview of the gravel roads to confirm that there are no locations with multiple severe crashes.

### 2.10.2 Prioritizing Rural CSAH/CR Segments

A prioritization process was completed for the 3,425 miles of rural two-lane paved CSAH/CR segments in ATP 4 (Table 2-14). Levels of risk were assigned to a segment based on five risk factors. If a segment fit the criteria for a risk factor, it received a star. The highest priority segments have received the most stars (★). In cases where segments received the same number of stars, tie breaks of risk assessment and then road departure density were used to determine priority. The risk factors are:

- ADT Range
- Access Density
- Road Departure Density
- Critical Radius Curve Density
- Edge Risk Assessment

For additional information regarding the risk factors, see section 3.3.1.

Table 2-15 is a summary of the ATP 4 segment prioritization. Approximately 30 percent of the mileage (1,237 miles out of a total 3,425 miles) was considered high priority and received a proposed project.

TABLE 2-15  
ATP 4 Segment Prioritization Summary

ATP 4	Total Mileage	Number of Segments						High Priority Mileage	
		5★	4★	3★	2★	★	-		
Becker	433	5	17	27	34	25	1	202	47%
Big Stone	157	0	1	19	33	41	7	97	24%
Clay	256	2	2	8	23	28	15	99	39%
Douglas	352	2	6	17	24	23	14	90	17%
Grant	149	0	2	5	13	11	3	90	60%
Mahnomen	132	0	1	13	3	6	3	69	25%
Otter Tail	1004	4	12	26	61	62	28	335	33%
Pope	243	0	4	9	14	15	7	91	37%
Stevens	163	1	0	8	10	11	1	101	62%
Swift	218	0	1	14	18	46	0	101	22%
Traverse	119	0	0	5	10	5	0	87	73%
Wilkin	199	0	1	5	19	12	3	77	39%
	<b>3,425</b>	<b>14</b>	<b>47</b>	<b>156</b>	<b>262</b>	<b>285</b>	<b>82</b>	<b>1,237</b>	<b>30%</b>
		0%	1%	3%	6%	6%	2%		

### 2.10.3 Prioritizing Curves on Rural CSAH/CR System

As was done for rural highway segments (see above), an analysis was completed to prioritize the 2,496 horizontal curves in ATP 4 based on the relative degree of risk. Table 2-16 provides a summary of crashes and curve counts in each county. The analysis of crashes related to curves in ATP 4 provided the following results:

- 2,118 of the 2,296 (92%) curves did not experience a crash during the study period
- 2 curves with multiple fatal crashes and 3 curves with multiple severe crashes
- Average curve severe crash density of 0.004 severe crashes/curve/year

The information provided above supports the notion that traditional methods of assigning safety risk based on the number of crashes would not effectively address the overrepresentation of severe and fatal crashes on horizontal curves. There are simply too few crashes on these curves to serve as a reliable indicator of the relative degree of risk. As a result, the CRSP team used a relatively new technique to assess the risk of curves, which used the following:

- Characteristics of curves for multiple counties where crashes had previously occurred
- Results from recently published Mn/DOT research (*Cost-Benefit Analysis of In-Vehicle Technologies and Infrastructure Changes to Avoid Crashes Along Curves and Shoulders*; completed by University of Minnesota and CH2M HILL, June 2009)

TABLE 2-16  
 ATP 4 Curve Summary

County	Curve Count	Severe Crashes	Total Crashes	Chevrons Installed
Becker	462	12	72	31
Big Stone	180	0	4	37
Clay	47	2	16	17
Douglas	518	11	137	121
Grant	69	1	11	27
Mahnomen	90	3	8	2
Otter Tail	707	10	194	268
Pope	146	4	22	27
Stevens	42	0	7	26
Swift	177	5	20	113
Traverse	21	1	2	9
Wilkin	37	2	8	22
<b>Total</b>	<b>2,496</b>	<b>51</b>	<b>501</b>	<b>700</b>

The above sources of material suggest that five features were found to increase the level of risk at individual curves and used in the prioritization process of rural curves. The five features are:

- Curve Radius
- Traffic Volumes
- Intersection in the Curve
- Visual Trap
- Crash Experience

For a more detailed description of these features, see section 3.3.2. A summary of the curve prioritization can be found in Table 2-17. Roughly 18 percent (448 out of 2,296) of the curves in ATP 4 were considered high priority (typically 3 or more stars).

TABLE 2-17  
ATP 4 Curve Prioritization Summary

ATP 4	Total	5★	4★	3★	2★	★	-	High Priority	
Becker	462	1	13	35	144	182	87	49	11%
Big Stone	180	0	2	7	45	90	36	9	5%
Clay	47	0	2	4	12	17	12	6	13%
Douglas	518	0	13	39	79	137	250	52	10%
Grant	69	1	9	9	20	18	12	19	28%
Mahnomen	90	2	7	7	28	32	14	16	18%
Otter Tail	707	1	39	110	201	249	107	150	21%
Pope	146	2	25	21	48	35	15	48	33%
Stevens	42	0	3	8	18	12	1	11	26%
Swift	177	1	17	41	44	54	20	59	33%
Traverse	21	0	5	7	3	5	1	12	57%
Wilkin	37	1	8	8	6	12	2	17	46%
<b>Total</b>	<b>2,496</b>	<b>9</b>	<b>143</b>	<b>296</b>	<b>648</b>	<b>843</b>	<b>557</b>	<b>448</b>	<b>18%</b>
		0%	6%	12%	26%	34%	22%		

#### 2.10.4 Rural STOP Controlled Intersections

There are 1,862 intersections within ATP 4, 1,833 of which are thru/stop intersections (Table 2-18). The average severe crash density is 0.10 severe crashes/intersection/year. This low density supports the notion of a prioritization process that assesses an intersection's risk. There are seven risk factors and a star is given to an intersection for each factor. The highest priority intersections received the most stars (★). In cases where intersections received the same number of stars, crash costs were used to break ties and determine priority. The risk factors include:

- Geometry of Intersection (skew)
- Geometry of Roadway (on/near curve)
- Commercial Development in Quadrants
- Distance to Previous STOP Sign
- ADT Ratio
- Railroad Crossing on Minor Approach
- Crash History

For more detailed information on the rural thru/stop intersection risk factors, see section 3.3.3. Table 2-19 summarizes the rural thru/stop prioritization process. Approximately 24 percent of these intersections were high priority (typically three or more stars) and received a proposed safety project.

TABLE 2-18  
ATP 4 Rural Thru/Stop Intersection Summary

County	Intersections
Becker	174
Big Stone	27
Clay	240
Douglas	222
Grant	182
Mahnomen	86
Otter Tail	244
Pope	100
Stevens	70
Swift	149
Traverse	172
Wilkin	167
<b>Total</b>	<b>1,833</b>

TABLE 2-19  
ATP 4 Rural Thru/Stop Intersection Prioritization Summary

ATP 4	Total	7★	6★	5★	4★	3★	2★	★	-	High Priority
Becker	174	0	0	4	8	37	50	53	22	49
Big Stone	27	0	0	0	4	8	30	56	43	12
Clay	240	0	0	1	7	17	36	107	72	45
Douglas	222	0	1	4	18	38	50	48	16	61
Grant	182	0	0	0	2	15	30	71	64	47
Mahnomen	86	0	0	0	3	7	18	34	24	10
Otter Tail	244	0	0	11	19	46	75	65	28	76
Pope	100	0	0	1	7	16	27	32	17	33
Stevens	70	0	0	0	1	6	19	25	19	26
Swift	149	0	1	1	14	19	55	43	16	35
Traverse	172	0	0	0	2	6	22	80	62	30
Wilkin	167	0	0	1	2	11	36	64	53	14
	<b>1,833</b>	<b>0</b>	<b>2</b>	<b>23</b>	<b>87</b>	<b>226</b>	<b>448</b>	<b>678</b>	<b>436</b>	<b>438</b>
		0%	0%	1%	5%	12%	24%	36%	23%	

## 2.11 Application of Safety Strategies to At Risk Locations

One of the key objectives of this safety planning effort involved identifying low cost safety related projects that are focused on the County’s documented safety emphasis areas. These safety emphasis areas contain the greatest number of severe crashes occurring along the County’s system of highways. Deploying mitigations for the factors contributing to these crashes represent the best opportunity to move Minnesota Towards Zero Deaths. The need for low cost projects that can be widely deployed across the County’s system of highways is based on the low density found among the county systems.

The list of potential projects is greater than what can reasonably be undertaken in a single year based on funding limitations. Also, the actual schedule for implementation of individual projects will be a function of securing funding from the State’s Highway Safety Improvement Program (HSIP). Also, the high priority safety strategies are among those recommended for local systems in the State’s Strategic Plan.

### 2.11.1 Infrastructure Based Safety Projects

The following is a summary of the infrastructure based safety projects for rural segments, curves and intersections. In order to support a consistent approach for developing the suggested safety projects, a series of decision trees were developed for highway segments, horizontal curves and intersections.

These tools identify the factors that were considered and the thought process that resulted in the suggested improvement at a particular location. It should be noted that all of the strategies included in the decision trees were selected because they were either determined to be proven effective at reducing crashes (by NCHRP and/or FHWA) or the majority of the safety studies found in the literature documented crash reductions. For example, edge line rumble strips, enhanced curve delineation, roundabouts and street lighting are all considered proven effective and are included in the decision trees. In addition, enhanced indirect turn median designs and dynamic warning signs are considered to have been tried at a sufficient number of locations and

the majority of evaluations have documented a decrease in crashes and these strategies are also included in the decision trees.

Several other possible strategies were not included because either there is no documentation of effectiveness (flashing LEDs at Stop Signs) or the majority of evaluations found an increase in the number of crashes (transverse rumble strips in FHWA's Clearinghouse on Crash Reduction). The decision tree for identifying roadway segment projects is shown in Figure 2-8 and indicates the roadway, traffic volume and adjacent land use factors considered in the project identification process.

The basic premise is that all high priority locations will have a project suggested, but not the same project. The actual project suggested for a specific location will depend on a variety of factors present at that location. For example, the basic roadway edge treatment is a rumble strip or stripe, depending on whether or not the segment has a paved shoulder. However, if the segment has a very low traffic volume (less than 200 vehicles per day), where the probability of a road departure crash is less, the suggested strategy is a less costly 6-inch edge line. Finally, where there is a high density of noise sensitive receivers adjacent to the road (residential, golf courses, hospitals, schools, etc.), the suggested strategy is an embedded wet reflective pavement marking which would not result in the same noise levels as an edge line rumble.

### 2.11.1.1 Rural Highway Segments

Seven types of projects were considered for implementation on each of the high priority rural highway segments. The project types are listed below. Several are also shown in Figure 2-7:

- **2' Shoulder Paving + Safety Wedge + Rumble Strip**—Install two feet of shoulder paving, typically over an existing two foot gravel shoulder, along with a rumble strip and a safety wedge. No more than six miles of this strategy was suggested within a single year due to HSIP funding constraints. Estimated Cost: \$40,000 per mile.
- **Rumble Strip**—Install a rumble strip on paved shoulders. Estimated Cost: \$3,000 per mile.
- **Centerline Rumble Strip** – Install a rumble strip on centerline. Estimated Cost: \$1,500 per mile.
- **Rumble StripE**—Install a rumble stripE on road edges. A rumble stripE differs from a rumble strip in that the white fog line is painted over the grooves. A rumble stripE allows for better retroreflectivity during wet conditions, as a vehicle's head lights will be reflected by the beads on the sides of the grooves. This strategy does not require paved shoulders but is limited only to segments with either a paved shoulder or 12 foot lane. Estimated Cost: \$3,500 per mile.
- **6" Wet Reflective Epoxy in Grooves**—Install a 6-inch wet reflective epoxy marking within a groove. A contractor must cut a 20 mil groove in the edge of the pavement, and then install a wet reflective marking within the groove. The wet reflective beads in the marking reflects light during wet conditions and better delineates road edges for driving in wet conditions. The groove protects the more expensive marking from damage by the snow plows. This strategies relatively higher costs and unproven (based on the NCHRP definition of widely deployed and subject to a rigorous statistical evaluation) safety benefits limits its use only to noise sensitive or Amish areas where edge line rumble strips are not feasible. Estimated Cost: \$8,500 per mile.
- **6" Latex Marking**—Install 6 inch latex marking, typically along ultra low volume (ADT less than 200 vehicles per day) roadways. Estimated Cost: \$650 per mile.

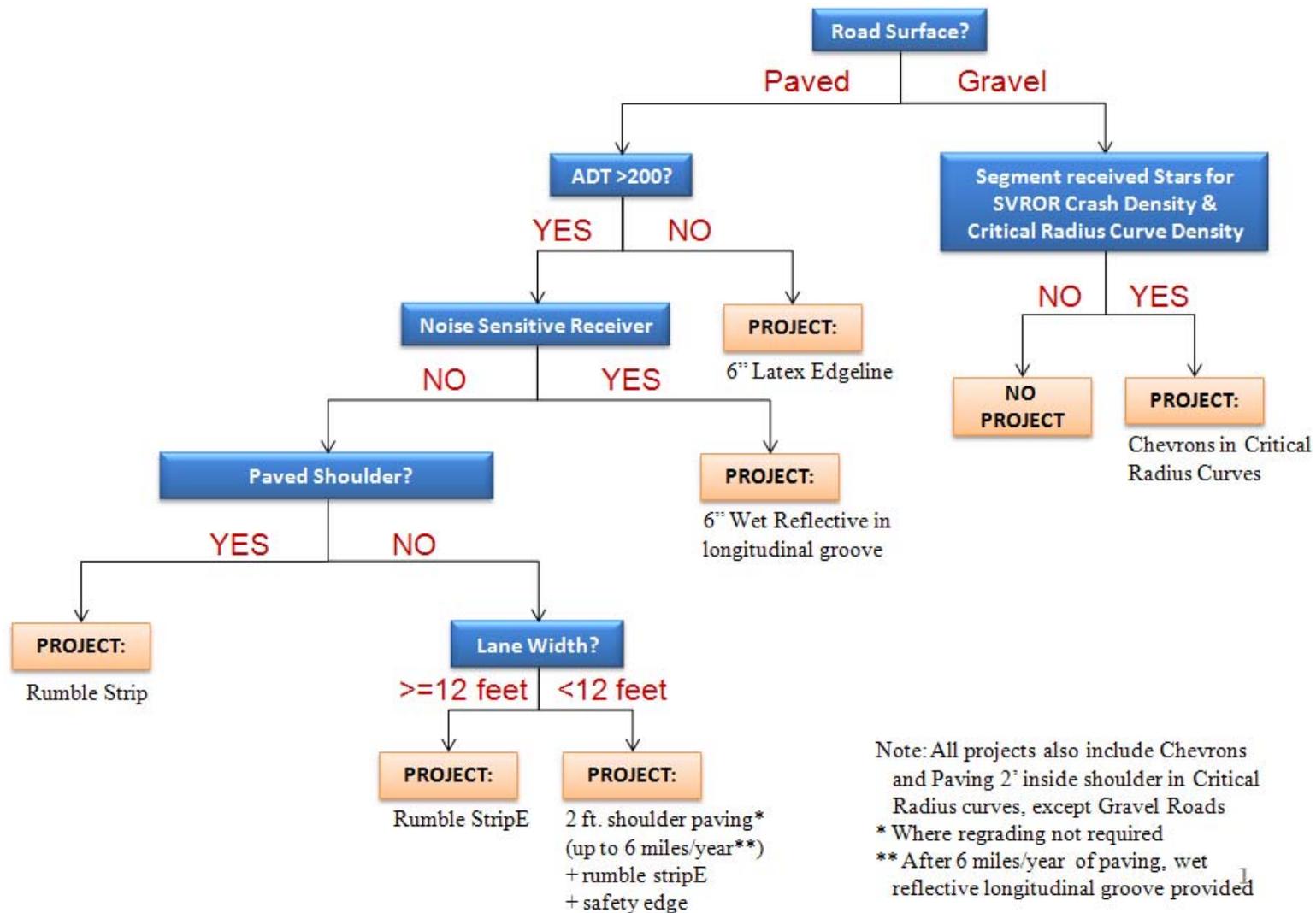
- **Chevrons + 2' Shoulder Paving in Critical Radius Curves**—Install chevrons and pave 2 feet of shoulder on both shoulders of critical radius curves in high priority segments. These projects are tallied within the curve projects. Estimated Cost: \$40,000 per mile for the shoulder paving plus \$3,300 per curve for the chevrons.
- **Field Access Removal/Consolidation**—Remove or consolidate field access on rural segments with greater than the average access density. This project was applicable to three counties within ATP 4 based on the County's interest. Estimated Cost: \$5,000 per access.

A decision tree shown in Figure 2-8 was developed to support a consistent approach for developing safety projects. This tool allows counties to choose between four different types of pavement edge treatments based on factors that include traffic volume and adjacent land use. Where traffic volumes are low or where the adjacent land use is considered noise sensitive (high density residential, parks, etc.), enhanced edge lines are the suggested treatment. On higher volume roadways, with few noise sensitive land uses, the suggested treatments are either rumble strips or stripEs.

A project form was prepared for each high priority segment (see Figure 3-17) that provides a description of the segment, brief crash history, list of deficiencies, a picture from the Video Log and the identified strategy.



**Figure 2-7**  
**Segment Safety Strategies Considered for Deployment**



**Figure 2-8**  
**Segment Project Identification Process**

Throughout ATP 4, a total of 1,125 miles received a suggested project, totaling \$10,008,0155. Table 2-20 provides a summary of the project mileage and total cost for each county.

TABLE 2-20  
ATP 4 Segment Project Summary (in miles)

ATP 4	2' Shoulder Pave+RS+Safety Wedge	Rumble Strip	Rumble StripE	6 inch edgelines	Ground In Wet- Reflective Markings	Total Project Value
Becker	11	9	60	3	21	\$835,428
Big Stone	9	-	17	32	-	\$305,545
Clay	8	59	3	9	1	\$510,932
Douglas	26	10	20	4	27	\$1,363,260
Grant	0	0	54	25	6	\$255,673
Mahnomen	8	7	39	0	2	\$499,730
Otter Tail	18	13	136	34	113	\$2,218,875
Pope	29	20	0	32	3	\$1,247,109
Stevens	29	0	16	8	29	\$1,455,190
Swift	0	0	50	14	1	\$191,880
Traverse	14	0	41	0	0	\$715,492
Wilkin	6	3	47	-	-	\$408,900
	157	121	483	161	203	\$10,008,015

### 2.11.1.2 Horizontal Curves on Rural 2-Lane Roads

Curves were nominated for a project in three cases:

1. High priority curves and those in close proximity for uniformity and cost effectiveness (columns labeled ★Ranking and Proximity in Table 2-21)
2. Curves located on a high priority segments and with a radius between 500' and 1,200' (column labeled HP Seg + Crit Rad in Table 2-21),
3. Updating currently installed chevrons at curves where the signs are old and need to be updated.

Curves identified for a project received the following:

- **2' Shoulder Paving + Safety Wedge + Rumble Strip**—Install two feet of shoulder paving, typically over an existing two foot gravel shoulder, along with rumble strip and a safety wedge. Estimated Cost: \$40,000 per mile.
- **Chevrons/Arrow Boards**—Install chevrons for guiding vehicles in both directions of travel. Figure 2-9 shows a typical example of installed chevrons. Estimated Cost: \$3,300 per curve for Chevrons and \$500 per curve for Arrow Boards.



**Figure 2-9**  
**Typical Chevron Installation**

1. Throughout ATP 4, a total of 2,501 curves received a proposed project totaling \$9,749,702. Table 2-21 summarizes the curve projects for each county.

TABLE 2-21  
ATP 4 Curve Project Summary

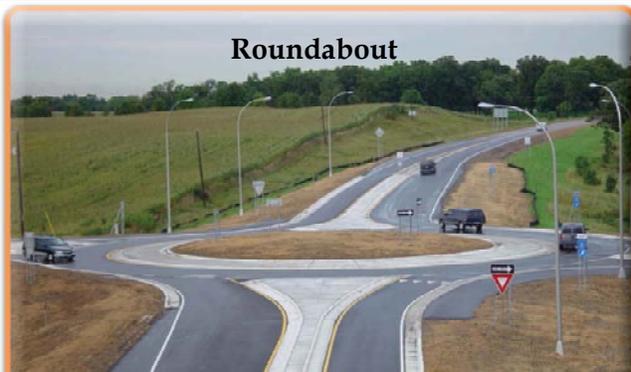
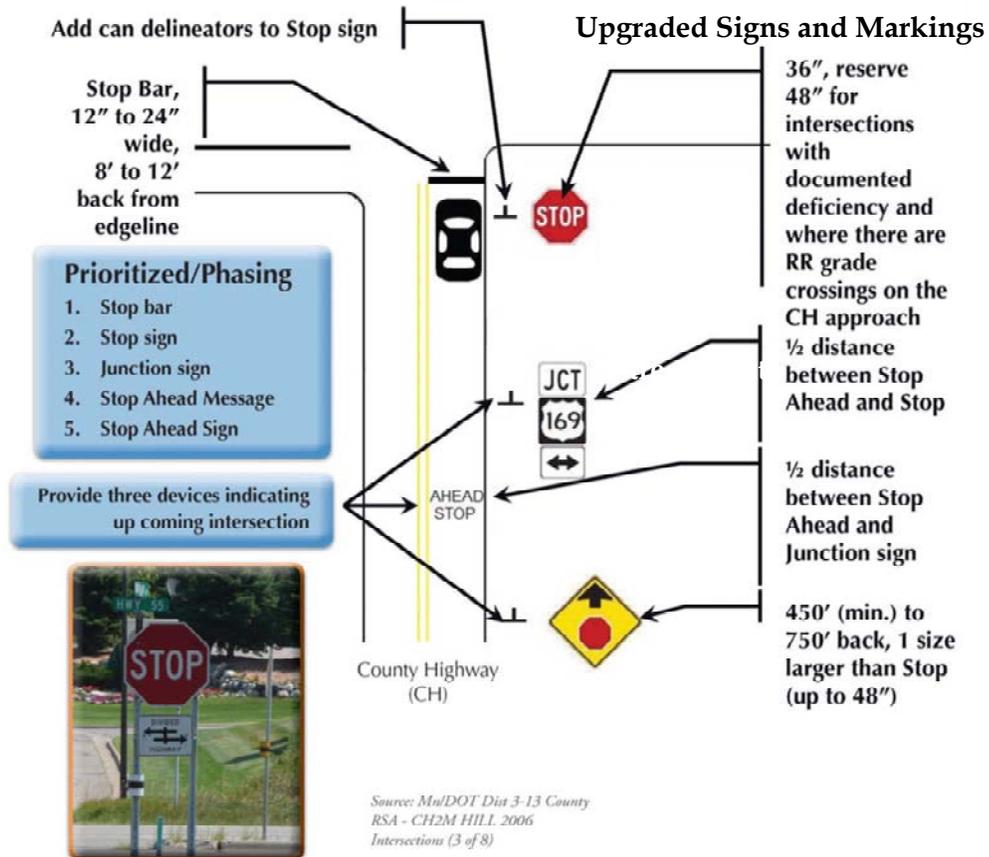
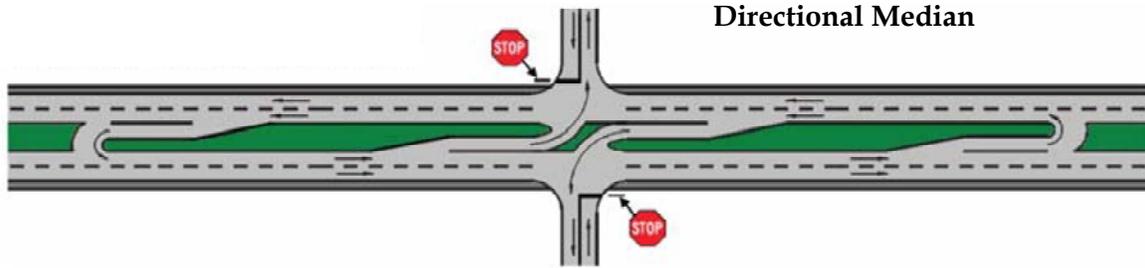
ATP 4	Currently Installed Chevrons	★ Ranking	Proximity	HP Seg + Crit Rad	Total Project Value
Becker	31	49	123	191	\$1,806,983
Big Stone	37	9	63	29	\$298,184
Clay	17	6	5	19	\$109,228
Douglas	121	49	141	49	\$644,132
Grant	27	19	6	42	\$414,120
Mahnomen	2	16	25	40	\$440,043
Otter Tail	268	150	116	188	\$3,951,728
Pope	27	48	13	72	\$560,826
Stevens	26	11	10	27	\$321,673
Swift	113	59	107	59	\$941,750
Traverse	9	12	0	13	\$131,604
Wilkin	22	17	4	14	\$129,431
	<b>700</b>	<b>445</b>	<b>613</b>	<b>743</b>	<b>\$9,749,702</b>

### 2.11.1.3 Rural Thru/Stop Intersections

Several project types were considered for implementation on each of the high priority rural thru/stop intersections. Intersection strategies are suggested for use based on two primary factors –1) the ability to mitigate the most common type of severe crash at rural, thru/stop intersections and 2) the results of the prioritization exercise with safety partners. The project types, illustrated in Figure 2-10, include:

- **Roundabout**—Construct a roundabout in place of the thru/stop intersection. This strategy is proven effective, as evidenced with an 80 to 100 percent reduction in right angle crashes. A candidate intersection must have experienced multiple severe right angle crashes and meet volume thresholds for installing a traffic signal. Estimated Cost: \$1,000,000 per intersection.

- **Directional Median**—On mainline divided roadways, close the median for minor leg crossings and left turn maneuvers and build turnarounds downstream of the intersection. This is considered a tried strategy; initial studies in Minnesota and other states have found an 80 to 90 percent reduction in right angle crashes using this strategy. Estimated Cost: \$150,000 per intersection.
- **Mainline Dynamic Warning Sign**—Install loop detectors on the minor leg approaches and a dynamic flashing sign on the major leg approaches. When a vehicle approaches on a minor leg, the loop detectors send a signal to the mainline sign and flashers warn drivers of a vehicle at the stop sign. This is considered an experimental strategy but initial evaluations in other states indicate a 25 to 35 percent reduction in right angle crashes. Estimated Cost: \$30,000 per intersection.
- **Street Lights**—Install destination style street lights at the intersection. Counties were given the opportunity to choose between one or two street lights. Some chose two at all intersections; some chose one light at all intersections, while others chose a tiered approach with one light at T intersections and two lights at four leg intersections. This is considered a proven effective strategy with 25 to 35 percent reduction in crashes. Estimated Cost: \$8,000 for one light per intersection and \$13,000 for two lights per intersection.
- **Upgraded Signs and Markings**—Install a standard set of signs and pavement markings on the minor intersection approaches. This is considered a tried strategy but initial evaluations in other states indicate a 25 percent reduction in right angle crashes. Estimated cost of the entire layout is \$1,850 per minor leg approach. In the event that a county has already upgraded signs at an intersection, the pavement markings estimated cost is \$700 per minor leg approach.
- **Clearing and Grubbing** – Improve sight distance at intersections by clearing and grubbing adjacent right-of-way. Estimated Cost: \$4,500 for four-leg intersection and \$2,450 for 3-leg intersection.



**Figure 2-10**  
**Intersection Safety Strategies Considered for Deployment**

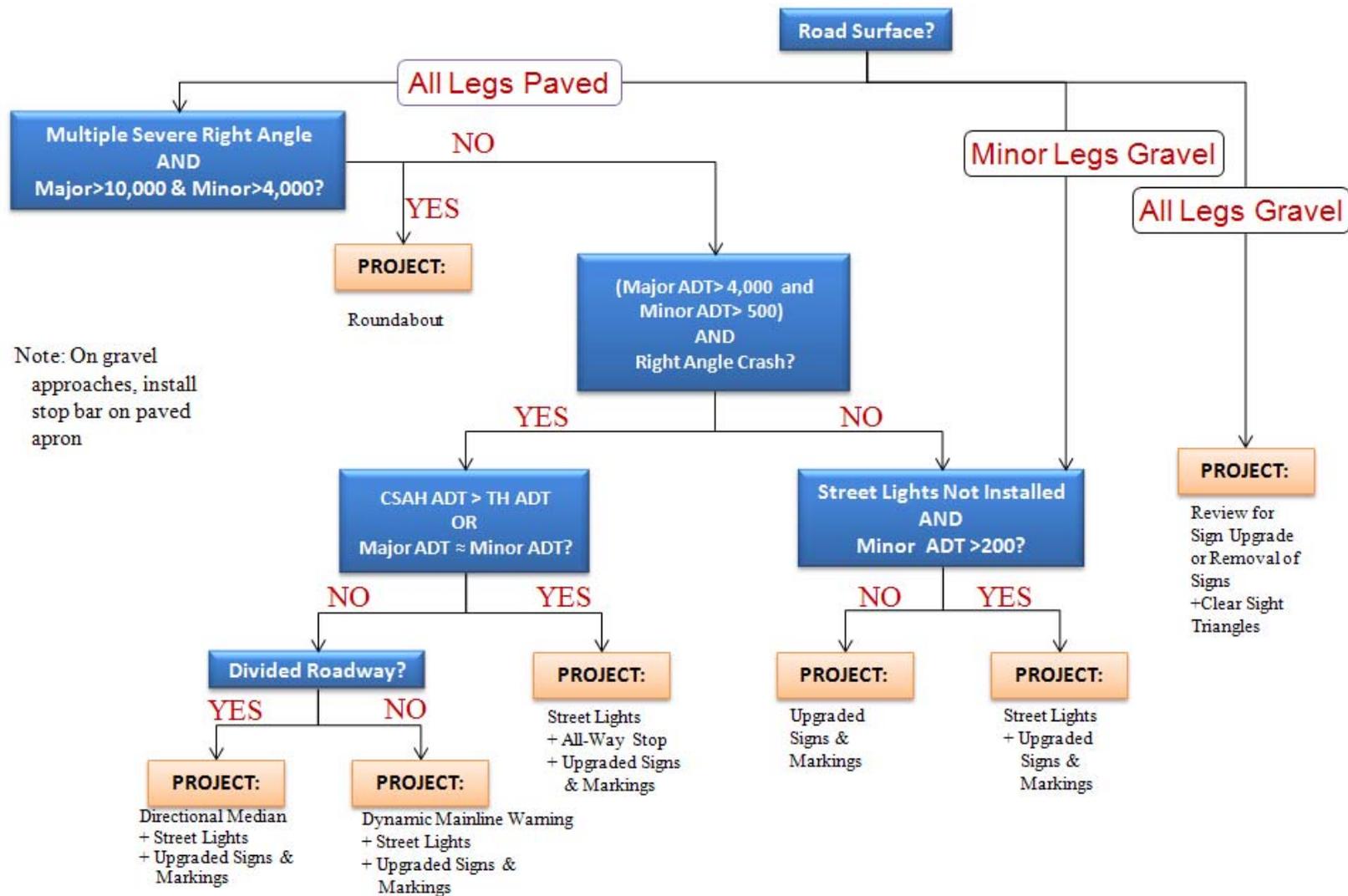
A decision tree was developed (see Figure 2-11) to ensure a consistent approach for proposed intersection project implementation. A project form was completed for each high priority intersection (see Figure 3-19 for an example). Each form includes an intersection description, a brief crash history, a list of deficiencies, an aerial photograph, and the identified strategy. Project forms for all high priority intersections are located in Appendix D.

The evaluation process used to develop a project for each of the high priority intersections considered the volume of traffic at the intersection, the geometry on the major approaches and whether or not there was a history of right angle crashes. The base project suggests the lowest level of investment (upgrade signs and markings on the minor approach) at intersections with very low volumes on the minor approaches (under 200 vehicles per day). The base project for intersections with slightly higher volumes on the minor approach (over 200 vehicles per day) also included installation of a destination style street light. Increase levels of investment are suggested at intersections with higher volumes and the presence of right angle crashes; this may include a dynamic mainline warning sign where the major road is divided with a median and a roundabout at intersections where the volumes would be high enough to meet the traffic volume warrants in the MNMUTCD for signalization.

Table 2-22 summarizes the 438 high priority and county nominated intersections in ATP 4 and suggested safety strategies, which include 4 directional median projects, 15 mainline dynamic warning signs, 220 street light installations, 467 sign and marking upgrades and 23 intersections to review signs and clear sight triangles. (Note: Intersections may receive more than one project type.)

TABLE 2-22  
ATP 4 Intersection Project Summary

ATP 4	Roundabout	All-Way STOP	Directional Median	Dynamic Warning Sign	Street Lights	Signs & Markings	Review Signs & CST	Total Project Value
Becker	-	-	2	-	33	48	1	\$745,550
Big Stone	-	-	-	-	3	11	-	\$62,700
Clay	-	-	1	1	16	38	2	\$507,750
Douglas	-	-	-	9	25	66	-	\$742,400
Grant	-	-	-	-	7	41	6	\$153,300
Mahnomen	-	-	-	-	12	24	4	\$191,100
Otter Tail	-	-	1	2	64	76	-	\$1,021,200
Pope	-	-	-	2	19	28	4	\$355,200
Stevens	-	-	-	-	9	24	2	\$136,100
Swift	-	-	-	-	9	35	1	\$195,000
Traverse	-	-	-	-	5	26	3	\$120,650
Wilkin	-	-	-	1	18	50	-	\$322,150
	<b>0</b>	<b>0</b>	<b>4</b>	<b>15</b>	<b>220</b>	<b>467</b>	<b>23</b>	<b>\$4,553,100</b>



**Figure 2-11**  
*Intersection Project Identification Decision Tree*

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<b>3.0</b>	<b>Otter Tail County Crash Analysis and Recommended Safety Projects .....</b>	<b>3-1</b>
3.1	County-wide Crash Overview .....	3-1
3.1.1	Otter Tail County CSAH/CR System Crash Analysis Breakdown ..	3-1
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## 3.0 Otter Tail County Crash Analysis and Recommended Safety Projects

### 3.1 County-wide Crash Overview

Otter Tail County's crash analysis was conducted using the Minnesota Crash Mapping Analysis Tool (MnCMAT). The data set used covered five years, from 2005-2009 and included a total of 3,799 crashes. A map of the Otter Tail County highway system is shown in Figure 3-1.

#### 3.1.1 Otter Tail County CSAH/CR System Crash Analysis Breakdown

Otter Tail County averages 11 severe crashes per year on their system. Details about the characteristics of these crashes are shown in Figure 3-2 and 3-3 and highlights include:

##### Rural Crashes on the CSAH/CR System

- 91 percent of the CSAH/CR severe crashes occurred in rural areas
- **Non-Intersection Related Crashes**
  - 62 percent of the CSAH/CR rural severe crashes are non-intersection related.
  - 81 percent of the CSAH/CR rural severe non-intersection related crashes are run off road crashes; 52 percent of these occurred on a curve.
- **Intersection Related Crashes:**
  - 38 percent of the CSAH/CR rural severe crashes are intersection related.
  - 37 percent of the CSAH/CR rural severe intersection related crashes occurred at a thru-STOP intersection; 71 percent of these were right angle crashes

##### Urban Crashes on the CSAH/CR System

- 9 percent of the CSAH/CR severe crashes occurred in urban areas

Highlights from the Otter Tail County crash data graphs shown on Figure 3-3 show that:

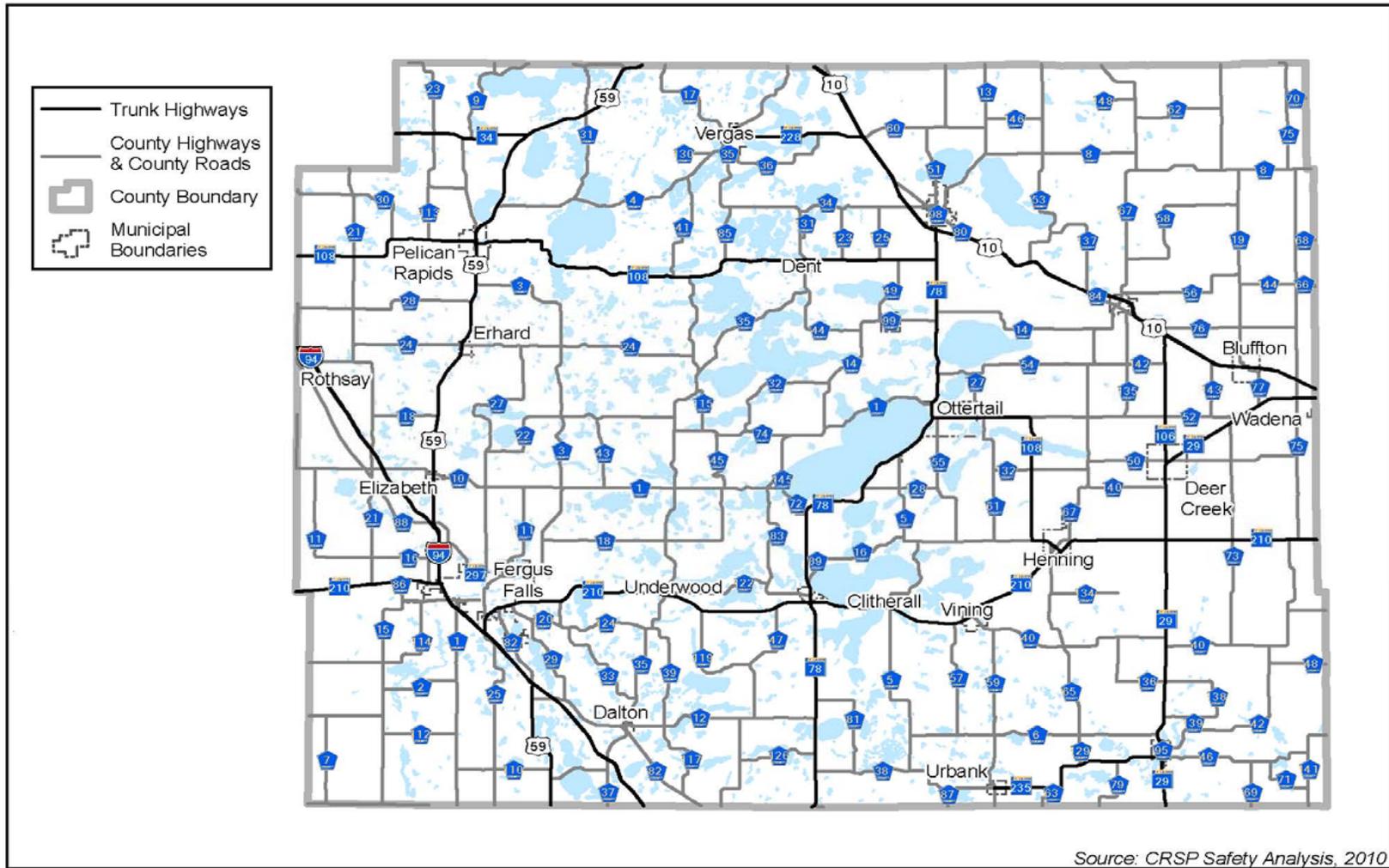
- CSAH roads have only 27 percent of the vehicle miles travelled (VMT) and 36 percent of severe crashes occur on these roads
- Otter Tail County CSAH and CRs have high crash severity rates [CSAHs = 4.3 severe crashes per 100 million vehicle miles (mvm) and CRs = 17.4 severe crashes per 100 mvm]

#### 3.1.2 Township and Municipal Roadway Review

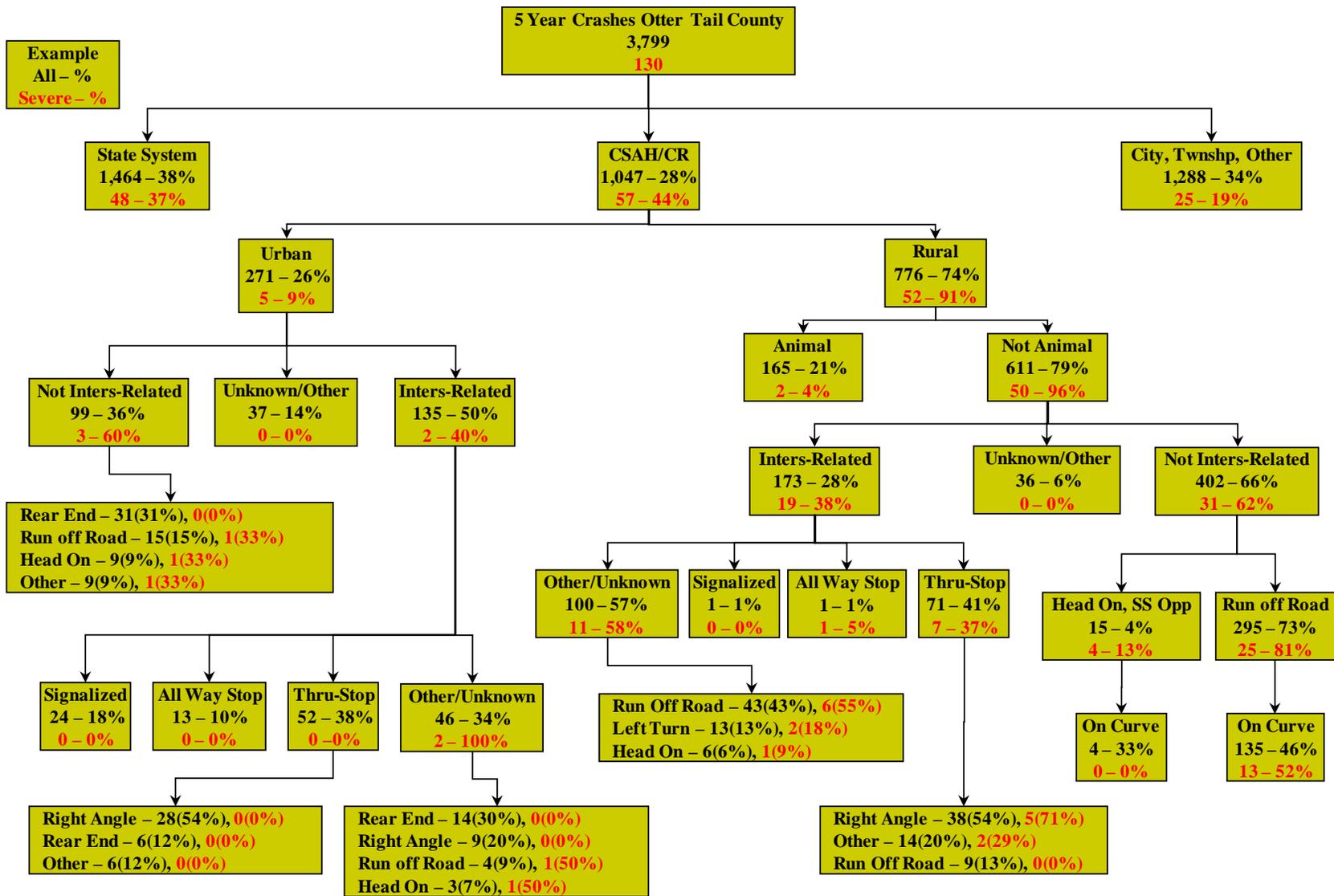
A review of the township and municipal crashes identified 25 severe crashes during the study period. No intersections were identified as experiencing multiple severe crashes, and no segments were identified as having multiple severe crashes.

#### 3.1.3 Otter Tail County Critical Emphasis Areas

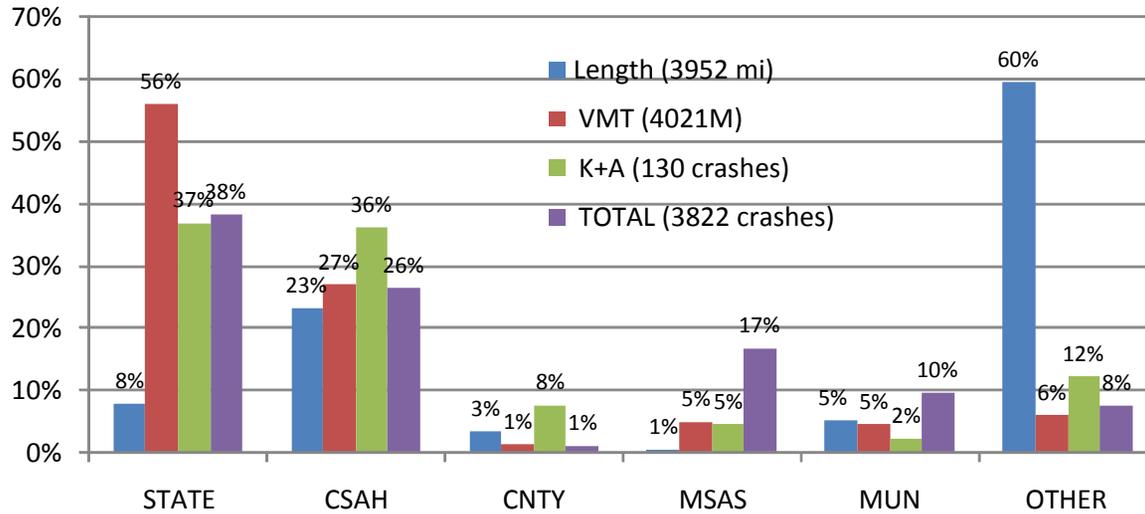
Figure 3-4 provides a summary of Otter Tail County's critical emphasis areas along with how these compare to ATP 4 and Statewide critical emphasis areas. Four of Otter Tail County's CEAs are the same as the Statewide CEAs (crashes involving: drug and alcohol-related; unbelted vehicle occupants; road departure and intersection). Aggressive driving and speed-related crashes are CEAs for ATP 4 and Otter Tail County, while young drivers is a statewide CEA.



**Figure 3-1**  
**Otter Tail County Road Map**



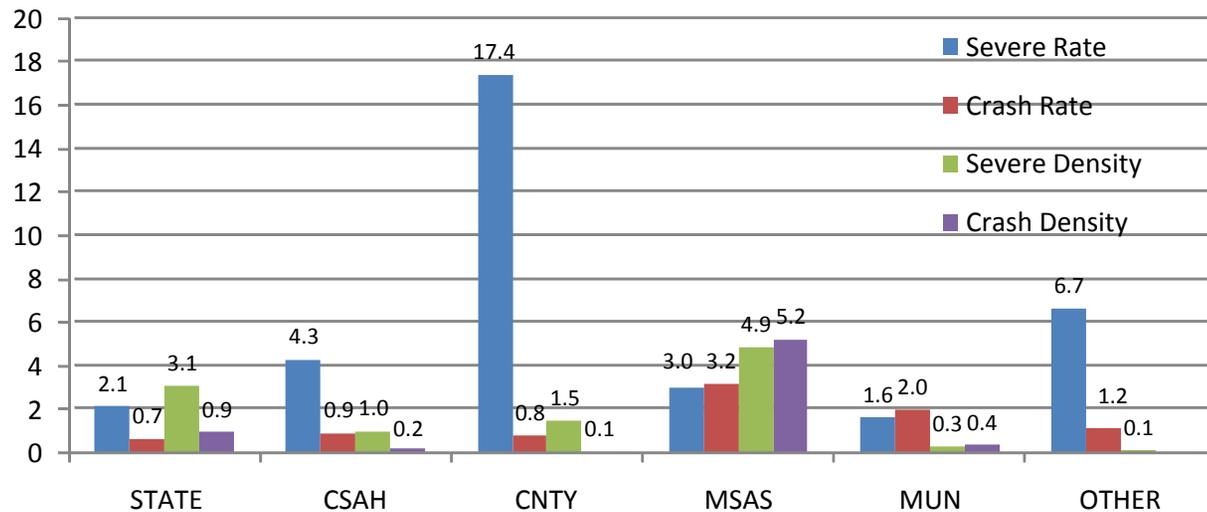
**Figure 3-2**  
 Otter Tail County Crash Data Overview



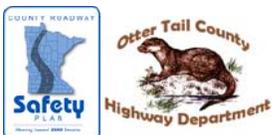
- The state system has the highest VMT at 56% but only 8% of the mileage
- CSAH/CR make up 44% of the severe crashes and only 28% of the VMT (26% of mileage)

- CSAH/CR have high severity rates.
  - CSAH severity rate = 4.3
  - CR severity rate = 17.4

Source: Mn/DOT TIS, 2005 -2009  
Rate – Crashes/MVM, Density – Crashes per Mile per Year  
Severe is fatal and serious injury crashes (K+A).



**Figure 3-3**  
**Otter Tail County Crash Data Graphs**



## Otter Tail County Emphasis Areas

Emphasis Area		Statewide Percentage	ATP 4			Group 4A	Otter Tail County		
			Interstate, US & TH	CSAH & CR	Twnshp & Other	CSAH & CR	Interstate, US & TH	CSAH & CR	City, Twnshp & Other
Total Fatal and Serious Injury Crashes		9,122	249	230	94	369	49	56	26
Drivers	Young drivers (under 21)	26%	26% (65)	16% (36)	29% (27)	4% (16)	27% (13)	18% (10)	38% (10)
	Unlicensed drivers	8%	6% (16)	7% (16)	9% (8)	3% (11)	6% (3)	7% (4)	15% (4)
	Older drivers (over 64)	13%	24% (60)	15% (34)	10% (9)	6% (22)	14% (7)	13% (7)	8% (2)
	Aggressive driving and speeding-related	21%	20% (50)	27% (62)	22% (21)	12% (44)	22% (11)	29% (16)	23% (6)
	Drug and alcohol-related	26%	20% (51)	39% (89)	32% (30)	15% (57)	22% (11)	39% (22)	35% (9)
	Inattentive, distracted, asleep drivers	20%	23% (58)	19% (43)	17% (16)	6% (23)	12% (6)	16% (9)	15% (4)
	Safety awareness	--	--	--	--	--	--	--	--
	Unbelted vehicle occupants	26%	31% (78)	38% (87)	31% (29)	13% (49)	27% (13)	34% (19)	42% (11)
Special Users	Pedestrians crashes	8%	4% (10)	3% (7)	7% (7)	2% (6)	4% (2)	2% (1)	4% (1)
	Bicycle crashes	4%	0% (0)	2% (5)	6% (6)	1% (3)	0% (0)	0% (0)	0% (0)
Vehicles	Motorcycles crashes	15%	9% (23)	18% (41)	18% (17)	7% (27)	8% (4)	18% (10)	19% (5)
	Heavy vehicle crashes	9%	19% (47)	7% (16)	2% (2)	3% (11)	20% (10)	7% (4)	4% (1)
	Safety enhancements	--	--	--	--	--	--	--	--
Highways	Train-vehicle collisions	0%	1% (2)	0% (0)	6% (6)	0% (0)	0% (0)	0% (0)	4% (1)
	Road departure crashes	27%	28% (69)	49% (113)	31% (29)	19% (70)	33% (16)	57% (32)	42% (11)
	Consequences of leaving road	--	--	--	--	--	--	--	--
	Intersection crashes	42%	34% (84)	36% (82)	37% (35)	12% (46)	22% (11)	38% (21)	31% (8)
	Head-On and Sideswipe (opposite) crashes	15%	22% (54)	23% (54)	13% (12)	7% (26)	22% (11)	14% (8)	15% (4)
	Work zone crashes	1%	1% (3)	1% (2)	0% (0)	0% (1)	0% (0)	0% (0)	0% (0)
EMS	Enhancing Emergency Capabilities	--	--	--	--	--	--	--	--
Management	Information and decision support systems	--	--	--	--	--	--	--	--
	More effective processes	--	--	--	--	--	--	--	--

DPS Crash Data Records, 2005 to 2009  
 Top 5 Emphasis Areas by Jurisdiction  
 Note: Numbers are not additive, as one crash may involve a young driver at an intersection.  
 The numbers represent severe crashes (Fatal and A-type Injury crashes)

- Workshop Group 4A
  - Becker
  - Clay
  - Douglas
  - Otter Tail

**Figure 3-4**  
**Otter Tail County Critical Emphasis Areas**



## 3.2 County Road Safety Workshop

### 3.2.1 Workshop Details

As described in Section 2.8, Otter Tail County participated in a safety planning workshop on December 13, 2010 at the Otter Tail Government Center in Fergus Falls, Minnesota. This was one of three workshops that focused on counties in ATP 4; two of these meetings were held in December 2010 and one was held in January 2011, which was postponed due to weather.

A total of 47 stakeholders participated in the workshop. In addition to ten participants from Otter Tail County, representatives from Becker, Clay, and Douglas Counties were also present, as well as Minnesota State Patrol representatives, DPS staff and Mn/DOT staff. A complete roster of those in attendance at this workshop is located in Appendix A. The agenda for all safety workshops included:

8:30 – 9:00	Registration and Coffee	
9:00 – 9:15	Introduction/Welcome	
9:15 - 10:30	Overview of Current Programs	
9:15	Overview of Crash Data	Brad Estothen, Mn/DOT
9:30	Dept of Public Safety, Office of Traffic Safety	Laura Turek, DPS
9:45	Local Speakers	Various
10:00	Dept of Public Safety, "Young Forever" video	MN State Patrol
10:30 – 10:45	Break	
10:45 - 11:30	Crash Data Overview & Breakout Objectives	Howard Preston, CH2M HILL
11:30 - 12:00	Breakout Group Discussion	
	Discuss shortlist and prioritize strategies	
12:00 – 12:30	Lunch	
12:30 – 2:00	Breakout Group Discussion	
2:15-2:30	Break	
2:30 - 2:45	Review Breakout Discussion	
2:45 – 3:00	Voting Exercise	
3:00	Adjourn	

Photos from the safety workshop that Otter Tail County representatives participated in are shown in Figure 3-5.



**Figure 3-5**  
**Photos from December 13, 2010 ATP 4 Safety Workshop**

### 3.2.2 Results of Stakeholder Prioritization Exercise

At each of the safety workshops, participants prioritized safety strategies. The safety strategy prioritization began with an education session during the morning that provided information on the safety planning process and crash data to support the safety strategies, and presentations from DPS and Mn/DOT. Workshop participants were asked to help the County prioritize the safety strategies.

Participants were divided into two groups: an infrastructure group and a driver behavior group. Each group was tasked with prioritizing the strategies and identifying those with the highest priority. Typically, the list was narrowed down to ten strategies. Participants were given dots to vote on their preferred safety strategies. They had the option of placing all dots on one strategy or distributing the dots across multiple strategies. The voting results of the December 13, 2010, workshop and the cumulative totals of all workshops held within ATP 4 are displayed in Appendix A.

Table 3-1 summarizes Otter Tail County’s top infrastructure safety strategies based on votes received at the December 13, 2010, workshop. Table 3-2 summarizes the top driver behavior safety strategies based on votes received at the workshop. Tables 3-1 and 3-2 also provide the combined voting results at all three ATP 4 workshops.

TABLE 3-1  
 Otter Tail County Infrastructure Safety Strategies Voting Results

Strategy	12/13/2010 Workshop Votes	ATP 4 Votes
1. Provide lighting to improve intersection visibility	22	41
2. Install shoulder rumble strips	21	47
3. Safety Edge/Pave Shoulders	18	29
4. Enhanced shoulder or delineation/markings for sharp curves	13	48
5. Edgeline Rumble Strips/StripEs	9	29
6. Clear sight triangle on approaches by clearing grub	1	14
7. Enhance signing and delineation to improve intersection visibility	1	4

TABLE 3-2  
 Otter Tail County Driver Behavior Safety Strategies Voting Results

Strategy	12/13/2010 Workshop Votes	ATP 4 Votes
1. Regular, Well-publicized DWI Saturations	19	33
2. Publicize and conduct high visibility targeted enforcement of speeding and aggressive driving	19	28
3. Restraint use enforcement, including night time enforcement.	18	57
4. Enforcement of GDL restrictions, cell and texting laws, underage drinking & driving, seatbelt laws	15	36
5. Distracted/Drowsy Enforcement	13	40
6. Increase use of FMVSS 218 compliant helmets	13	26

### 3.3 Otter Tail County Detailed Crash Analysis

The initial county-wide analysis of crashes found that of the 209 crashes that occur on Otter Tail County highways annually, 74 percent of these occur in rural areas. Of the severe crashes (fatal and A-injury), 91 percent occur in rural areas. Following is a more detailed analysis focused on prioritizing Otter Tail County’s rural segments, rural intersections and rural curves.

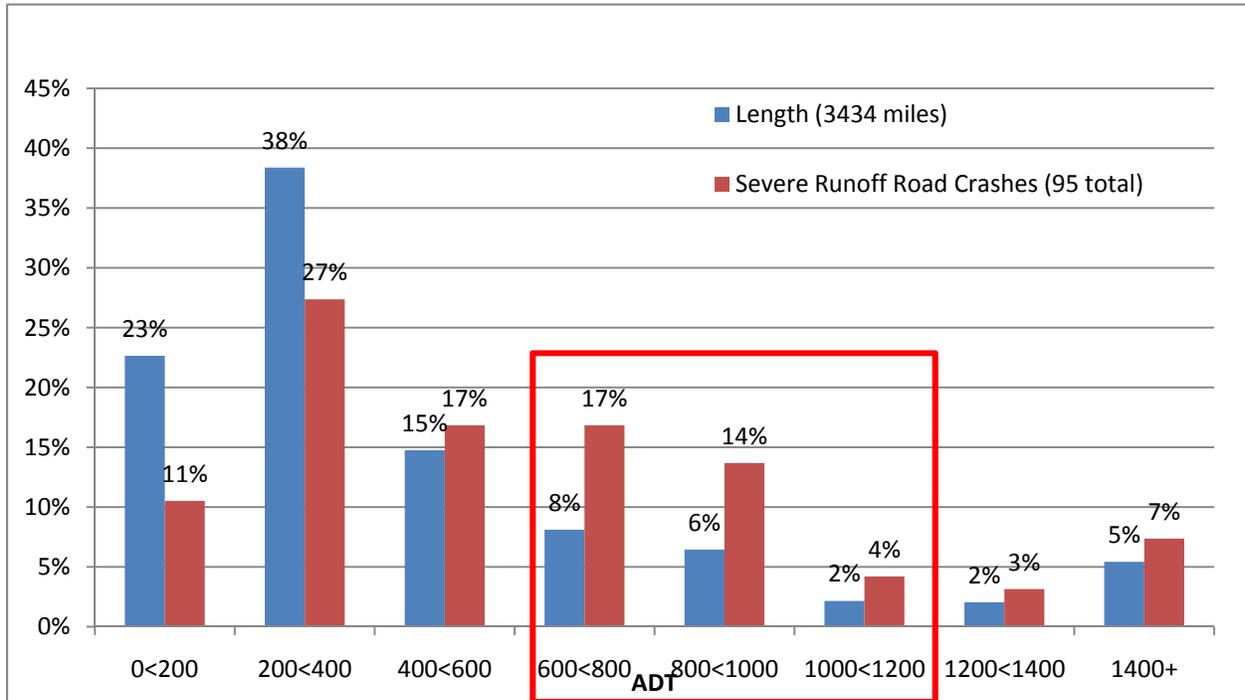
#### 3.3.1 Prioritizing Rural CSAH/CR Segments

There are 1,004 miles of rural highway in Otter Tail County’s system. Reviewing the Otter Tail crash data, the predominant type of crash on these roads is vehicles running off the road, which accounts for 73 percent of rural non-intersection crashes and 81 percent of severe rural non-intersection crashes.

Given that the goal of the CRSP is to provide a list of county-specific safety projects that will mitigate conditions at specific locations, it is important to identify rural highway segments that are at higher risk for severe crashes. For this purpose, rural highways in Otter Tail County were broken down into 193 segments. A prioritization process was then completed where levels of risk were assigned to a segment based on five risk factors. If a segment fit the criteria for a risk factor, it received a star. The highest priority segments have received the most stars (★). In cases where segments received the same number of stars, tie breaks of edge risk assessment and then road departure crash density were used to determine priority. The risk factors are:

**ADT Range** - Figure 3-6 illustrates that 16 percent of the rural system in ATP 4 has between 600 and 1,200 ADT. These segments also experience a high amount of road departure crashes (35 percent). Roadways in Otter Tail County with an ADT between 600 and 1,200 ADT received a star.

**Access Density** – Otter Tail County’s rural roadways average approximately 10.8 access points per mile (which includes field entrances, commercial entrances, etc). Roadways experiencing higher access density received a star.

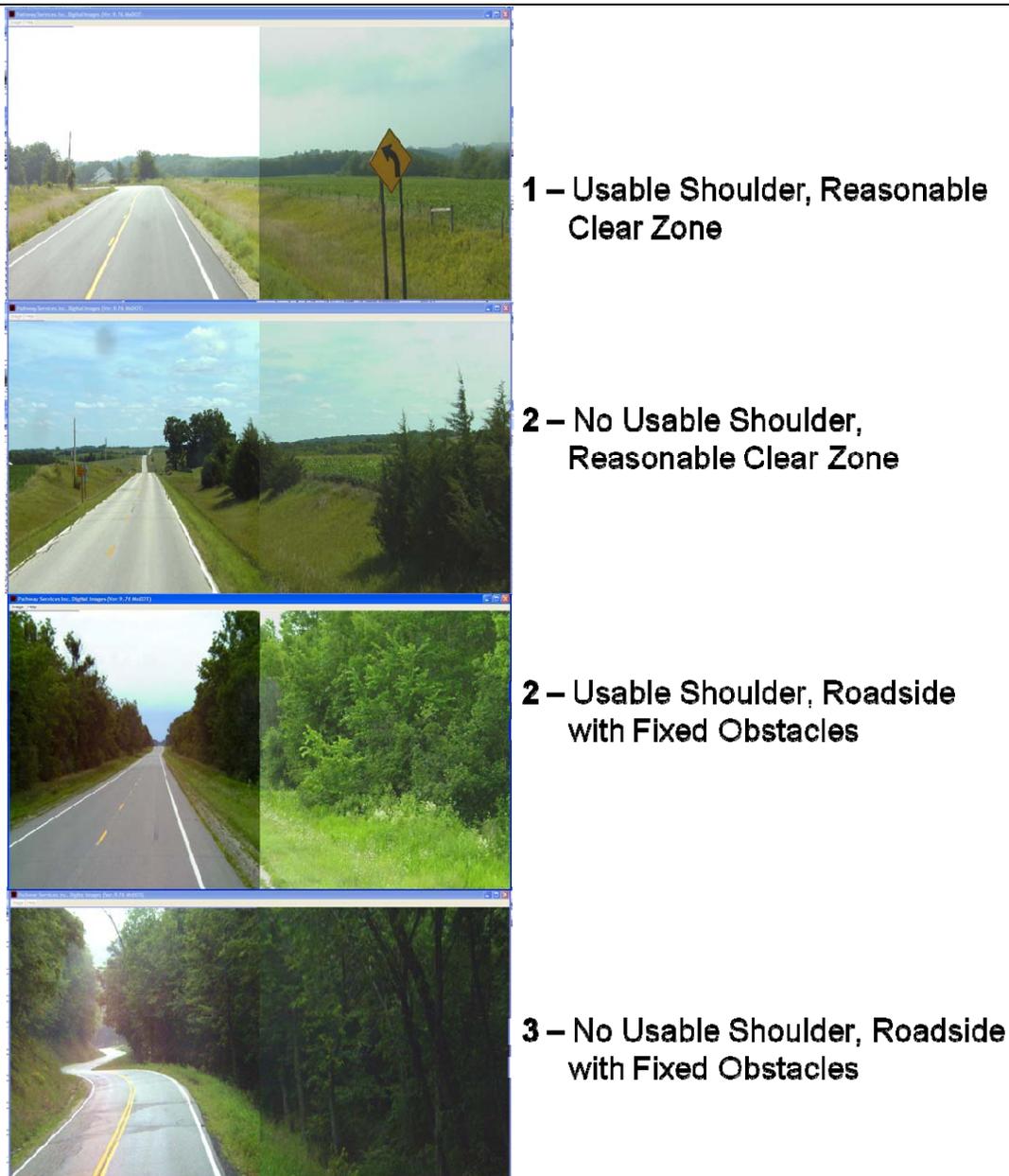


**Figure 3-6**  
**ATP 4 CSAH/CR Mileage and Road Departure Crashes by ADT**

**Road Departure Density** - Otter Tail County rural segments had an average road departure density of 0.08 road departure crashes per mile per year. Any segment experiencing a road departure density higher than the average received a star.

**Critical Radius Curve Density** - With curve-related road departure accounting for 52 percent of the severe road departure crashes, curves are an important factor in identifying risk. In ATP 4, curves with a radius between 500 and 1,200 feet experienced 68 percent of the severe road departure crashes. Otter Tail County curves within this critical radius experienced 50 percent of the severe road departure crashes. An average density of these types of curves was computed for the segments (0.35 curves per mile) and any segments with a higher than average density received a star.

**Edge Risk Assessment** – A rating system was developed to categorize the risk level of vehicles leaving the travel lane. Roads with a usable shoulder and reasonable clear zone received a rating of one. Roads with little or no usable shoulder, but a reasonable clear zone received a rating of two, as did roads with a usable shoulder but fixed objects in the clear zone. Roads with no usable shoulder and fixed objects in the clear zone received a rating of three. Examples of these edge risks are shown in Figure 3-7. Roads were evaluated by analysts via Mn/DOT’s video log to determine the rating. Roads with a rating of two or three received a star.



**Figure 3-7**  
**Sample Edge Risk Assessment Photos**

Figure 3-8 illustrates a portion of the raw data that was used to prioritize segments on the Otter Tail County highway system. The information includes a list of highway segments as well as present risk factors. The complete data set used for the rural highway segment analysis is provided in the Appendix B.

Corridor	Route #	Start	End	Length	Runoff Road Crashes	Intersection Crashes	ADT	RD Density	Access Density	Curves w/ Critical Radius / Mile	Edge Risk Assesment
1.01	CSAH 1	GRANT COUNTY LINE	FERGUS FALLS CORP	11.6	10	6	903	0.17	10.6	0.00	1
1.03	CSAH 1	FERGUS FALLS CORP	CSAH 10	5.5	6	7	3031	0.22	16.7	0.00	1
1.04	CSAH 1	CSAH 10	CSAH 35	5.9	4	9	2383	0.14	11.4	0.00	1
1.05	CSAH 1	CSAH 35	Oak Ridge Beach Rd	11.4	9	5	1556	0.16	10.4	0.26	1
1.06	CSAH 1	Oak Ridge Beach Rd	OTTERTAIL CORP LMTE	4.6	1	2	1586	0.04	41.5	0.65	1
2.01	CSAH 2	WILKIN CNTY LINE	CSAH 1	8.3	2		133	0.05	7.6	0.00	2
3.01	CSAH 3	CSAH 10	CSAH 24	8.4	6	1	596	0.14	14.2	0.36	2
3.02	CSAH 3	CSAH 24	USTH 59	7.5	3		664	0.08	10.1	0.40	2
4.01	CSAH 4	USTH 59	CSAH 31	4.1	6	5	1300	0.29	14.6	0.24	1

**Figure 3-8**  
**Sample of Otter Tail County Rural Highway Segment Data**

Table 3-3 summarizes the results of the prioritized segments from Figure 3-9.

**TABLE 3-3**  
Summary of Otter Tail County Prioritized Segments

Segment Ranking	# of Segments	% of Segments	Miles	% of Miles
★★★★★	4	2%	26.0	3%
★★★★	12	6%	67.9	7%
★★★	26	13%	138.2	14%
★★	61	32%	303.7	30%
★	62	32%	325.4	32%
-	28	15%	142.9	14%
	<b>193</b>	<b>100%</b>	<b>1004.1</b>	<b>100%</b>

Analysis completed on the data resulted in the priority ranking of these corridors for future improvements. Table 3-4 provides the high priority segments identified through the segment analysis process. High priority segments were those with three or more stars or segments with two stars and an edge risk assessment of two or three. Figure 3-9 includes a map showing the location of the high priority segments. Complete results of the segment analysis are included in the Appendix B.

TABLE 3-4  
Otter Tail County High Priority Rural Highway Segments

Rank	Corridor	Route	#	Start	End	Length	ADT	ADT Range	RD Density	Access Density	Curve Critical Radius Density	Edge Risk	Totals	Tiebreakers	
														Edge Risk	RD Density
1	34.01	CSAH	34	CSAH 35	PERHAM CORP LMTS	6.8	1,148	*	*	*	*	*	*****	3	0.32
2	4.04	CSAH	4	VERGAS CORP LMTS	BECKER COUNTY LINE	4.7	1,170	*	*	*	*	*	*****	3	0.13
3	35.07	CSAH	35	CSAH 41	DENT CORP LMTS	9.3	684	*	*	*	*	*	*****	2	0.17
4	9.03	CSAH	9	MNTH 34	BECKER COUNTY LINE	5.2	863	*	*	*	*	*	*****	2	0.15
5	31.02	CSAH	31	USTH 59	CSAH 20	2.9	558		*	*	*	*	****	3	0.21
6	64.01	CSAH	64	MNTH 78	DOUGLAS COUNTY LIN	0.6	350		*	*	*	*	****	2	0.67
7	35.05	CSAH	35	UNDERWOOD CORP L	CSAH 1	6	1,115	*	*	*	*	*	****	2	0.43
8	5.03	CSAH	5	CLITHERALL CORP LMT	CSAH 16	4.7	650	*	*	*	*	*	****	2	0.21
9	35.01	CSAH	35	USTH 59	DALTON CORP LMTS	5.8	602	*	*	*	*	*	****	2	0.21
10	3.01	CSAH	3	CSAH 10	CSAH 24	8.4	596		*	*	*	*	****	2	0.14
11	33.01	CSAH	33	CSAH 35	MNTH 210	8.5	251		*	*	*	*	****	2	0.12
12	83.02	CSAH	83	BATTLE LAKE CORP L	CSAH 1	8.5	388	*	*	*	*	*	****	2	0.12
13	122.02	CNTY	122	UNDERWOOD CORP L	CSAH 83	5.4	611	*	*	*	*	*	****	2	0.11
14	3.02	CSAH	3	CSAH 24	USTH 59	7.5	664	*	*	*	*	*	****	2	0.08
15	20.01	CSAH	20	CSAH 9	USTH 59	5.1	994	*	*	*	*	*	****	1	0.20
16	111.02	CNTY	111	FERGUS FALLS CORP	CSAH 10	4.5	870	*	*	*	*	*	****	1	0.18
17	4.02	CSAH	4	CSAH 31	VERGAS CORP LMTS	8.9	1,222	*	*	*	*	*	****	3	0.29
18	31.01	CSAH	31	CSAH 4	USTH 59	5.1	573		*	*	*	*	****	3	0.08
19	67.03	CSAH	67	CSAH 52	NEW YORK MILLS COR	6.9	676	*	*	*	*	*	****	3	0.06
20	35.03	CSAH	35	DALTON CORP LMTS	UNDERWOOD CORP L	8.3	559		*	*	*	*	****	2	0.14
21	24.05	CSAH	24	ERHARD CORP LMTS	CSAH 3	4.8	589		*	*	*	*	****	2	0.13
22	56.02	CSAH	56	NEW YORK MILLS COR	CSAH 19	6.6	344		*	*	*	*	****	2	0.09
23	55.01	CSAH	55	CSAH 16	OTTERTAIL CORP LMTS	6.8	290		*	*	*	*	****	2	0.09
24	29.01	CSAH	29	CSAH 82	MNTH 210	7.4	471		*	*	*	*	****	2	0.08
25	72.01	CSAH	72	MNTH 78	CSAH 83	3	1,358		*	*	*	*	****	2	0.07
26	75.01	CSAH	75	CSAH 40	MNTH 210	4.5	140		*	*	*	*	****	2	0.04
27	23.01	CSAH	23	CSAH 9	MNTH 34	5.2	165		*	*	*	*	****	2	0.04
28	16.01	CSAH	16	MNTH 78	CSAH 5	5.7	607	*	*	*	*	*	****	2	0.04
29	41.01	CNTY	41	CSAH 35	MNTH 108	6	547		*	*	*	*	****	2	0.03
30	36.01	CSAH	36	CSAH 35	MNTH 228	6.6	290		*	*	*	*	****	2	0.03
31	45.02	CSAH	45	CSAH 1	CSAH 74	3.9	219		*	*	*	*	****	2	0.00
32	61.01	CSAH	61	CSAH 16	MNTH 108	7.5	224		*	*	*	*	****	2	0.00
33	119.01	CNTY	119	CSAH 47	MNTH 210	6.1	191		*	*	*	*	****	2	0.00
34	115.01	CNTY	115	CSAH 74	CSAH 35	2.5	235		*	*	*	*	****	2	0.00
35	145.01	CNTY	145	CSAH 72	CSAH 1	1	630	*	*	*	*	*	****	2	0.00
36	84.03	CSAH	84	NEW YORK MILLS COR	USTH 10 EAST	0.5	1,350		*	*	*	*	****	1	0.80
37	80.03	CSAH	80	PERHAM CORP LMTS	USTH 10 EAST	1.7	2,599		*	*	*	*	****	1	0.47
38	75.03	CSAH	75	MNTH 29	USTH 10	1	1,050	*	*	*	*	*	****	1	0.40
39	10.03	CSAH	10	ELIZABETH CORP LMTS	CSAH 1	6.5	1,187	*	*	*	*	*	****	1	0.25
40	17.02	CSAH	17	VERGAS CORP LMTS	BECKER COUNTY LINE	6.3	1,400		*	*	*	*	****	1	0.22
41	53.01	CSAH	53	USTH 10	CSAH 8	7.9	294		*	*	*	*	****	1	0.18
42	35.10	CSAH	35	CSAH 34	CSAH 36	7.5	986	*	*	*	*	*	****	1	0.03
43	10.01	CSAH	10	WILKIN COUNTY LINE	ELIZABETH CORP LMTS	6.7	357		*	*	*	*	****	3	0.09
44	30.02	CSAH	30	CSAH 21	MNTH 108	4.4	255		*	*	*	*	****	3	0.00
45	131.01	CNTY	131	CSAH 35	CSAH 35	1.5	54		*	*	*	*	****	2	0.27
46	19.02	CSAH	19	BLUFFTON CORP LMTS	CSAH 56	4.9	460		*	*	*	*	****	2	0.16
47	113.01	CNTY	113	MNTH 108	CSAH 23	3	140		*	*	*	*	****	2	0.13
48	50.03	CSAH	50	DEER CREEK CORP L	CSAH 75	6.1	330		*	*	*	*	****	2	0.10
49	15.01	CSAH	15	GRANT COUNTY LINE	CSAH 2 North	6.7	153		*	*	*	*	****	2	0.09
50	24.02	CSAH	24	ROTHSAY CORP LMTS	CSAH 21 South	2.6	315		*	*	*	*	****	2	0.08
51	52.01	CSAH	52	MNTH 108	MNTH 106	7.2	860	*	*	*	*	*	****	2	0.06
52	142.01	CNTY	142	CSAH 67	MNTH 106	3.9	230		*	*	*	*	****	2	0.05
53	137.01	CNTY	137	USTH 10	CSAH 53	6	290		*	*	*	*	****	2	0.03
54	42.02	CSAH	42	PARKERS PRAIRIE CO	CSAH 40	10.2	161		*	*	*	*	****	2	0.02
55	73.02	CSAH	73	MNTH 210	MNTH 29	6.7	218		*	*	*	*	****	2	0.00
56	126.01	CNTY	126	CSAH 47	MNTH 78	4.2	100		*	*	*	*	****	2	0.00
57	132.01	CNTY	132	CSAH 61	MNTH 108	2	150		*	*	*	*	****	2	0.00
58	146.01	CNTY	146	CSAH 13	CSAH 53	3	80		*	*	*	*	****	2	0.00
59	5.04	CSAH	5	CSAH 16	MNTH 78	4.8	404		*	*	*	*	****	2	0.00
60	32.01	CSAH	32	CSAH 74	CSAH 14	6.6	225		*	*	*	*	****	2	0.00
61	71.01	CSAH	71	DOUGLAS COUNTY LIN	CSAH 46	4.3	175		*	*	*	*	****	2	0.00
62	128.01	CNTY	128	MNTH 78	CSAH 55	4	223		*	*	*	*	****	2	0.00
63	138.01	CNTY	138	MNTH 29	CH 136	4.3	115		*	*	*	*	****	2	0.00



It is notable that nine of the segments in Otter Tail County's rural highway system experienced multiple severe crashes. These nine segments are listed in Table 3-5.

TABLE 3-5  
 Otter Tail County Highway Segments Experiencing Multiple Severe Crashes

Corridor	Route #	Start	End	Area	Length (mi.)	Fatal Crash	Serious Injury Crash	Severe Road Departure
9.02	CSAH 9	PELICAN RAPIDS CORP LMTS	MNTH 34	Rural	4.9	2	1	3
17.02	CSAH 17	VERGAS CORP LMTS	BECKER COUNTY LINE	Rural	6.3	0	2	2
24.03	CSAH 24	CSAH 21 South	ERHARD CORP LMTS	Rural	6.0	0	2	2
35.01	CSAH 35	USTH 59	DALTON CORP LMTS	Rural	5.8	0	2	2
40.02	CNTY 40	VINING CORP LMTS	MNTH 29	Rural	10.6	3	1	3
52.01	CSAH 52	MNTH 108	MNTH 106	Rural	7.2	0	2	0
82.03	CSAH 82	DALTON CORP LMTS	USTH 59	Rural	5.2	0	2	2
111.02	CNTY 111	FERGUS FALLS CORP LMTS	CSAH 10	Rural	4.5	1	1	2
142.01	CNTY 142	CSAH 67	MNTH 106	Rural	3.9	1	1	0
<b>TOTALS</b>						<b>7</b>	<b>14</b>	<b>16</b>

There were a total of 21 severe crashes on the nine segments listed in the table. The majority of these crashes involved road departure crashes (16 of the 21 crashes). The following list highlights other points related to the 21 severe crashes:

- 16 road departure crashes
- 2 right angle crashes
- 1 head-on crash
- 1 left-turn crash

### 3.3.2 Prioritizing Curves on Rural CSAH/CR System

The detailed crash analysis also studied horizontal curves. This subset of the rural highway system received additional attention because emerging research indicates that horizontal curves with certain characteristics contribute to the overall frequency of road departure crashes. The 1,004 miles of rural Otter Tail County highways contain 707 horizontal curves; the total length of these curves is 140 miles, which is 14 percent of the county highway system mileage. However, approximately 52 percent of severe road departure crashes occur on horizontal curves (see Table 3-6). As a result, horizontal curves were identified as an at-risk element of Otter Tail County's rural highway system.

TABLE 3-6  
 Crashes on Otter Tail County CSAH/CR System, Including Horizontal Curves

	Rural Road Departure Crashes	Rural Road Departure Crashes On Horizontal Curves	% of Crashes on Horizontal Curves
<b>All Crashes</b>	295	135	46%
<b>Severe Crashes (K+A)</b>	25	13	52%

As was done for rural highway segments an analysis was completed to prioritize horizontal curves based on the relative degree of risk. The analysis of crashes related to curves in Otter Tail County provided the following results:

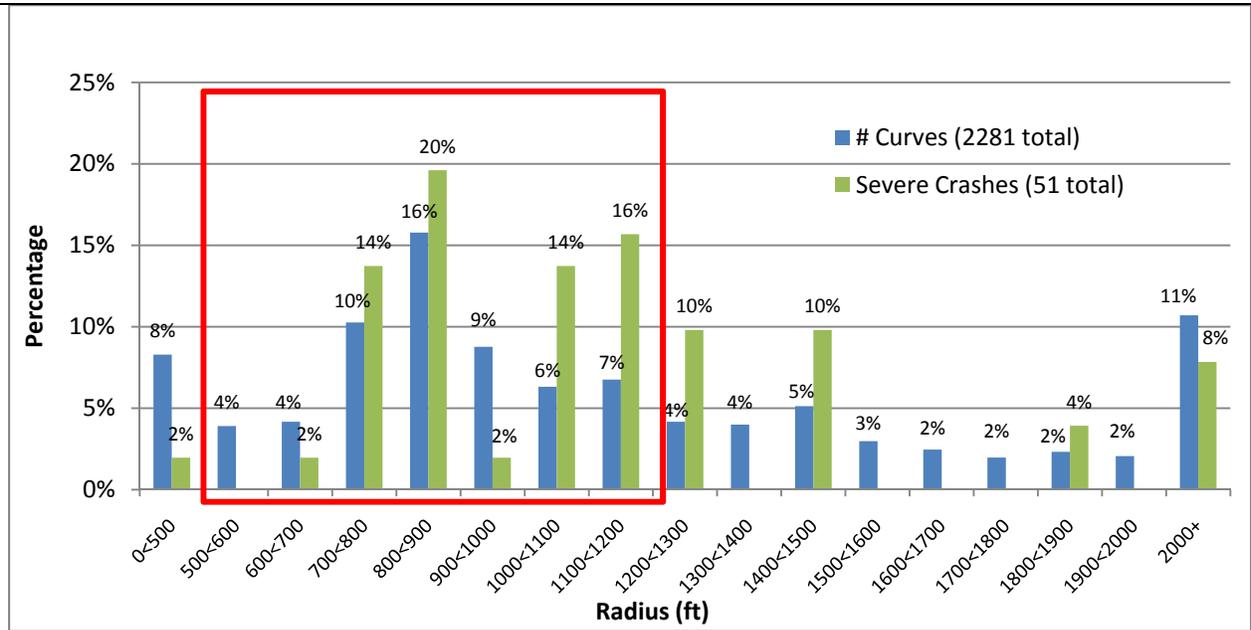
- Crashes occurred on 140 of the 707 (roughly 20 percent) horizontal curves on Otter Tail County's CSAH/CR system.
- Severe injury or fatal crashes occurred on only 10 curves during the 5 year study period, meaning that these types of crashes occurred on only 1.4 percent of the curves.
- Four total fatal crashes occurred on four different curves.
- No curves experienced multiple severe crashes over the 5 year study period; supporting that these crashes occur randomly across the system and that the presence of a severe crash is not sufficient to identify the risk associated with horizontal curves.

This information supports the idea that traditional methods of assigning safety risk based on the number of crashes would not effectively address the overrepresentation of severe and fatal crashes on horizontal curves. There are simply too few crashes on these curves to serve as a reliable indicator of the relative degree of risk. As a result, the CRSP team used a relatively new technique to assess the risk of curves, which used the following:

- Characteristics of curves in Otter Tail County where crashes had previously occurred, as well as available information from similar analysis for neighboring Minnesota counties
- Results from Mn/DOT research (*Cost-Benefit Analysis of In-Vehicle Technologies and Infrastructure Changes to Avoid Crashes Along Curves and Shoulders*; completed by University of Minnesota and CH2M HILL, June 2009)

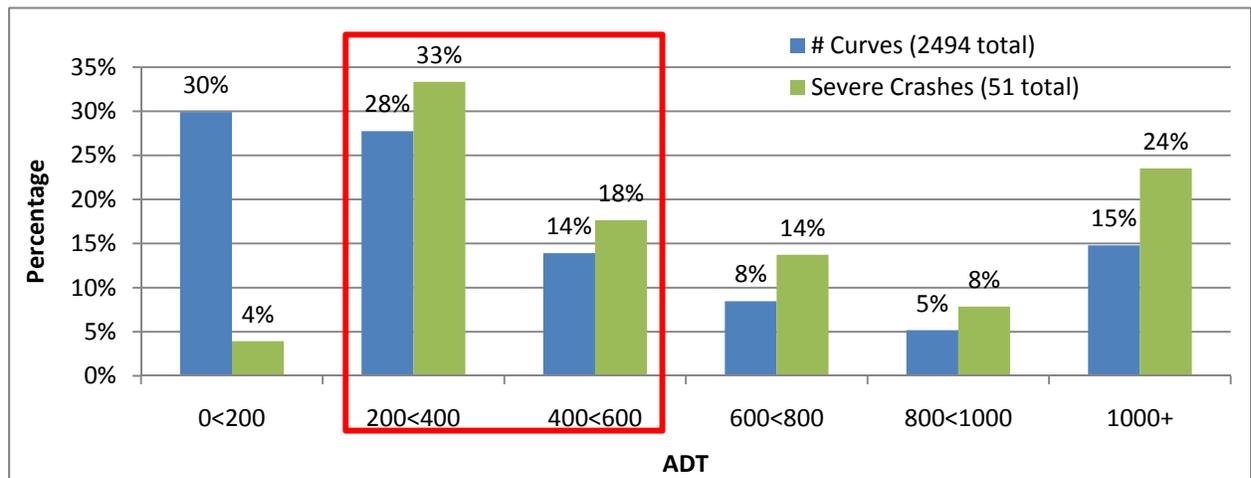
These sources of material suggest that five roadway features were found to increase the level of risk at individual curves and were used in the prioritization process of rural curves.

**Curve Radius** - Shorter curve radii results in higher overall crash density, however 68 percent of the severe crashes occurred on curves with 500 to 1,200 foot radius within ATP 4 (see Figure 3-10). This relationship is similar to that found in Mn/DOT and other national research. Another factor in support of establishing a 1,200 foot radius as the upper limit for the range of at-risk curves is the fact that this radii approximates a 55 mph design speed based on Table 3-3.02A in Mn/DOT's Road Design Manual. As a result curves with a radius between 500 and 1,200 feet received a star or were considered to be at risk.



**Figure 3-10**  
**ATP 4 Severe Crashes on Curves and Curve Radius**

**Traffic Volumes** - There is a range of volumes in each system that is overrepresented relative to the frequency of curve-related crashes. In ATP 4, curves in the volume range between 200 and 600 vehicles per day accounted for 51 percent of severe crashes on curves (see Figure 3-11). Curves with an ADT between 200 and 600 vehicles per day received a star.



**Figure 3-11**  
**ATP 4 Severe Crashes on Curves and Curve ADT**

**Intersection in the Curve** - The presence of an intersection in the curve increased the level of crash risk; therefore these curves received a star.

**Visual Trap** - The presence of a visual trap increases the level of crash risk. A visual trap exists when a crest vertical curve occurs prior to the beginning of the horizontal curve or when a minor road, tree line, or line of utility pole continues on a tangent (see Figure 3-12). These curves received a star.



**Figure 3-12**  
**Example of a Visual Trap**

**Crash Experience** - If a curve had experienced a severe crash over the five-year study period, it received a star.

A sample of the data analysis results for curve prioritization is shown in Figure 3-13. Complete results of the data analysis and prioritization ranking can be found in Appendix C.

Curve Count	ID	Corridor	Segment	Start	End	K	A	K	A	Radius (ft)	Length Curve (ft)	ADT	Intersection on Curve	Chevrons	Visual Trap	Rank	Proximity
1	10C	10.01	CSAH 10	WILKIN COUNTY LINE	ELIZABETH CORP LMTS	-	-	-	-	722	1,275	420	Yes	Yes	Yes	★★★★	-
2	10G	10.02	CSAH 10	ELIZABETH CORP LMTS	ELIZABETH CORP LMTS	-	-	-	-	1,232	1,006	1,250	Yes	No	No	*	-
3	10H	10.03	CSAH 10	ELIZABETH CORP LMTS	CSAH 1	-	-	-	-	2,774	2,296	1,250	Yes	No	No	*	-
4	10I	10.03	CSAH 10	ELIZABETH CORP LMTS	CSAH 1	-	-	-	-	1,259	920	1,250	No	No	Yes	*	-
5	10J	10.03	CSAH 10	ELIZABETH CORP LMTS	CSAH 1	-	-	-	-	770	701	1,150	Yes	Yes	No	★★	-
6	10K	10.04	CSAH 10	USTH 10	BECKER COUNTY LINE	-	-	-	-	747	700	1,050	Yes	No	Yes	★★★	-
7	111E	111.02	CNTY 111	FERGUS FALLS CORP	CSAH 10	-	-	1	-	1,155	1,521	960	No	No	No	★★	-
8	111G	111.02	CNTY 111	FERGUS FALLS CORP	CSAH 10	1	-	-	-	1,057	775	550	Yes	Yes	No	★★★★	-
9	111H	111.02	CNTY 111	FERGUS FALLS CORP	CSAH 10	-	-	-	-	869	976	550	No	Yes	No	★★	-
10	111I	111.02	CNTY 111	FERGUS FALLS CORP	CSAH 10	-	-	-	-	1,109	614	550	No	Yes	Yes	★★★★	-
11	113A	113.01	CNTY 113	MNTH 108	CSAH 23	-	-	-	-	2,051	561	140	No	No	No	-	-
12	113B	113.01	CNTY 113	MNTH 108	CSAH 23	-	-	-	-	1,011	534	140	No	No	No	*	-
13	113C	113.01	CNTY 113	MNTH 108	CSAH 23	-	-	-	-	2,308	532	140	No	No	No	-	-
14	113D	113.01	CNTY 113	MNTH 108	CSAH 23	-	-	-	-	371	434	140	No	Yes	Yes	*	-
15	114A	114.02	CNTY 114	CSAH 15	CSAH 15	-	-	-	-	812	1,249	70	No	Yes	No	*	-
16	114B	114.02	CNTY 114	CSAH 15	CSAH 15	-	-	-	-	821	1,473	70	Yes	Yes	No	★★	-
17	114C	114.02	CNTY 114	CSAH 15	CSAH 15	-	-	-	-	848	1,306	165	Yes	Yes	Yes	★★★	-

**Figure 3-13**  
**Sample of Otter Tail County Curves Data and Prioritization**

In summary, one curve in Otter Tail County received 5 stars. 150 curves received a high priority ranking of 3 stars or more (22 percent). Figure 3-14 includes a map showing all high priority curves that are assigned a proposed safety project. Appendix C also includes information—both a map and table—of curves which were analyzed but were not recommended for a project. Table 3-7 summarizes the results of the prioritization.

**TABLE 3-7**  
 Summary of Otter Tail County Prioritized Curves

Curve Ranking	# of Curves	% of Curves	Chevroned	% of Chevroned
★★★★★	1	0%	1	0%
★★★★	39	6%	32	12%
★★★	110	16%	84	31%
★★	201	28%	89	33%
★	249	35%	62	23%
-	107	15%	0	0%
	707	100%	268	100%

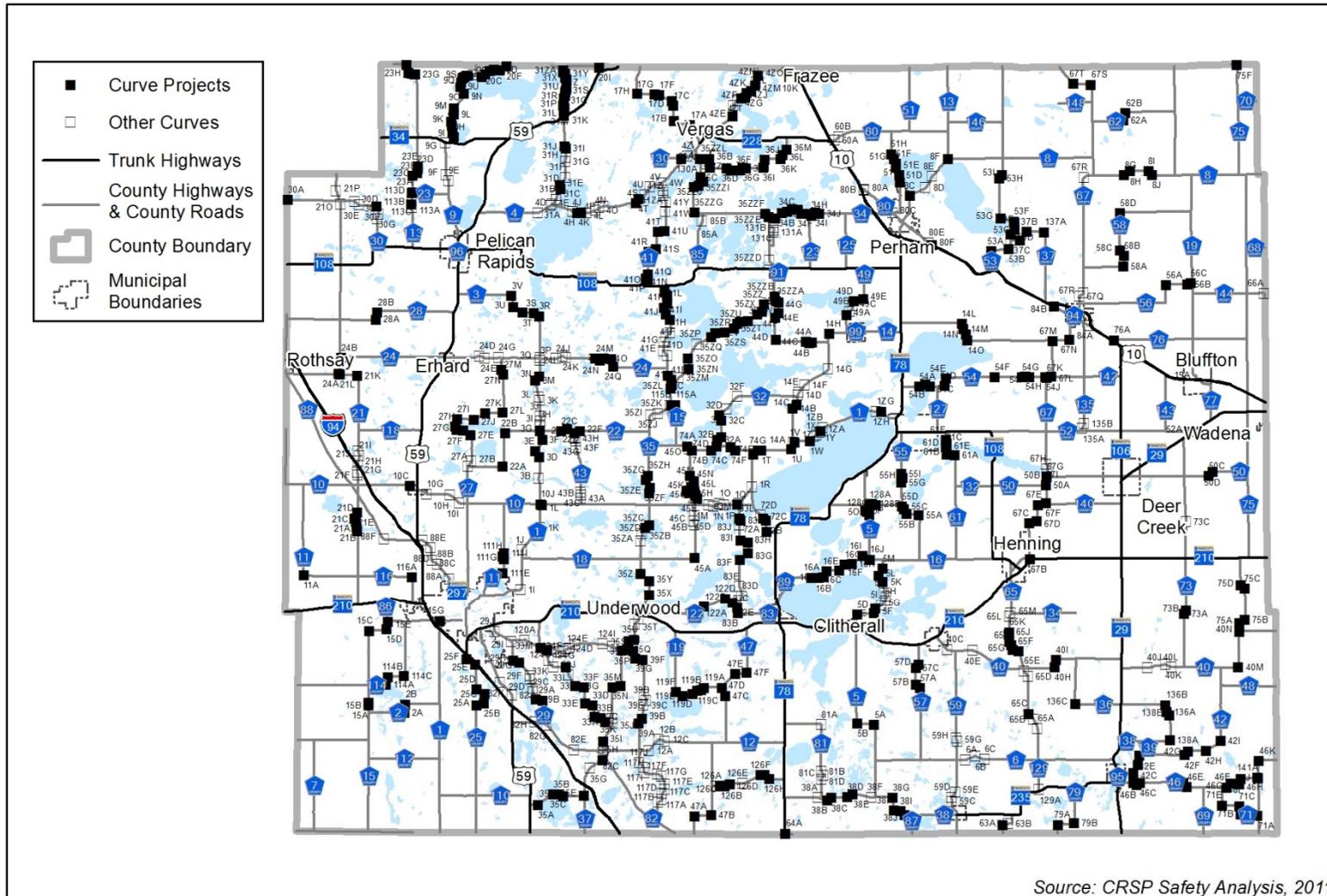


Figure 3-14  
Otter Tail County Curve Project Map

### 3.3.3 Rural STOP Controlled Intersections

There were only seven severe crashes on Otter Tail County's rural CSAH/CR system at STOP controlled intersections. Looking at the ATP 4 level however, there are 24 rural CSAH/CR system crashes at thru-STOP controlled intersections. The most severe type of crash occurring at these intersections is a right-angle crash. Given that there are 244 of these intersections across the County, a prioritization process is needed to focus the County's efforts in implementing safety projects. The prioritization process assesses an intersection's risk exposure for seven factors and a star is given to an intersection for each risk factor. The highest priority intersections received the most stars (★). In cases where intersections received the same number of stars, crash costs were used to break ties and determine priority. The risk factors include:

**Geometry of Intersection** - Previous research has shown that skewed intersections have a higher risk of crashes. If an intersection has a skewed approach of greater than 15 degrees, it received a star.

**Geometry of Roadway** - Previous research has shown that intersections located on or near a horizontal curve are subject to a higher level of risk. Intersections located on or near horizontal curves received a star.

**Commercial Development in Quadrants** - Previous research has shown that intersections with commercial development located in one or more of the intersection quadrants have a higher level of risk. Private residences or farms were not included in this category. Intersections with commercial development in a quadrant received a star.

**Distance to Previous STOP Sign** - Previous research has shown that drivers lose attention when traveling for longer distances without a STOP sign. Therefore, intersections with minor leg approaches without a STOP sign within 5 miles received a star.

**ADT Ratio** - There is a range of ADT ratio (minor/major) on the County system that is more susceptible to severe crashes than others. Intersections with an ADT ratio between 0.4 and 0.8 received a star.

**Railroad Crossing on Minor Approach** - Intersections on or near a railroad line are subject to an increased level of risk. Drivers must navigate the railroad tracks while approaching the intersection. Therefore, if an intersection has a railroad crossing on one of the minor leg approaches to the intersection it received a star.

**Crash History** - If an intersection had experienced a crash during the five-year study period, it received a star.

Figure 3-15 provides a sample of the raw data that was used in the prioritization of rural thru-STOP intersections, as well as their risk criteria. The complete data set used for the rural intersection analysis is provided in Appendix D.

Int #	Sys	Num	Intersection Description	Skew	On/Near Curve	Development	RR Xing	ADT	Previous STOP (>5mi)	Total Crashes	Ratio (Min/Maj)	Crash Cost
1.01	CSAH	1	CSAH 1 and CSAH 26	No	No	No	No	995	Yes	3	0.38	\$ 115,000
1.02	CSAH	1	CSAH 1 and T 1196 CNTY 110 RT (120TH	No	No	No	No	774.5	Yes	1	0.11	\$ 12,000
1.03	CSAH	1	CSAH 1 and CNTY 112 140TH ST	No	No	No	No	767.5	No	1	0.19	\$ 12,000
1.04	CSAH	1	CSAH 1 and CSAH 2 (170TH ST)	No	No	No	No	974.5	No	1	0.11	\$ 91,000
1.06	CSAH	1	CSAH 1 and CSAH 15	No	Yes	No	No	3487	Yes	1	0.38	\$ 91,000
1.22	CSAH	1	CSAH 1 and CSAH 18	No	No	No	No	3225	Yes	1	0.26	\$ 12,000
1.23	CSAH	1	CSAH 1 and CSAH 10	No	Yes	No	No	2925	No	1	0.49	\$ 91,000
1.24	CSAH	1	CSAH 1 and CSAH 43	No	No	No	No	2540	No	0	0.16	\$ -
1.25	CSAH	1	CSAH 1 and CSAH 35	No	No	No	No	3150	Yes	5	0.48	\$ 342,000
1.26	CSAH	1	CSAH 1 and CSAH 45 WEST	No	No	No	No	1893	Yes	0	0.10	\$ -
1.27	CSAH	1	CSAH 1 and CSAH 45 EAST	No	No	No	No	1965	No	0	0.18	\$ -
1.28	CSAH	1	CSAH 1 and CSAH 83	Yes	Yes	No	No	1905	Yes	0	0.12	\$ -
1.29	CSAH	1	CSAH 1 and CNTY 145	No	Yes	Yes	No	1540	No	1	0.51	\$ 91,000
1.30	CSAH	1	CSAH 1 and CSAH 74	No	Yes	No	No	1573	Yes	0	0.25	\$ -
1.31	CSAH	1	CSAH 1 and CSAH 14	No	Yes	No	No	1645	Yes	0	0.35	\$ -
2.01	CSAH	2	CSAH 2 and T 1152 CSAH 7	No	No	No	No	184.5	Yes	0	0.54	\$ -
2.02	CSAH	2	CSAH 2 and CSAH 15 , T 1153 SOUTH	No	No	No	No	262	Yes	0	0.50	\$ -
2.03	CSAH	2	CSAH 2 and CSAH 15 NORTH	No	No	No	No	412	Yes	0	0.32	\$ -
3.01	CSAH	3	CSAH 3 and CSAH 10	No	Yes	No	No	1560	Yes	2	0.71	\$ 24,000

**Figure 3-15**  
**Sample of Otter Tail County Rural Intersection Data**

Table 3-8 summarizes the results of the prioritized intersections from Figure 3-16.

**TABLE 3-8**  
 Summary of Otter Tail County Prioritized Intersections

Intersection Ranking	# of Intersections	% of Intersections
★★★★★★★	0	0%
★★★★★★	0	0%
★★★★★	11	5%
★★★★	19	8%
★★★	46	19%
★★	75	31%
★	65	27%
-	28	11%
	<b>244</b>	<b>100%</b>

Analysis completed on the data referenced in Figure 3-15 resulted in the prioritization of rural thru-STOP intersections for future improvements. Table 3-9 lists the high priority intersections. Complete results of the rural thru-STOP intersection analysis are included in Appendix D. All intersections with 3 or more stars were considered high priority (32 percent) and were assigned a proposed safety project. Locations of the high priority intersections are shown on a map in Figure 3-16.

TABLE 3-9  
Otter Tail County High Priority Rural Intersections

Rank	Int #	Sys	#	Intersection Description	Skew	On/Near Curve	Development	RR Xing	Previous STOP (>5mi)	Total Crashes	Ratio (Min/Maj)	Priority	Crash Cost
1	60.01	CSAH	60	CSAH 60 and USTH 10	*	*		*	*	*	*	*****	\$ 275,000
2	9.03	CSAH	9	CSAH 9 and MNTH 34 WEST	*	*			*	*	*	*****	\$ 251,000
3	21.02	CSAH	21	CSAH 21 and CSAH 88	*			*	*	*	*	*****	\$ 136,000
4	35.07	CSAH	35	CSAH 35 and MNTH 210		*	*		*	*	*	*****	\$ 103,000
5	35.11	CSAH	35	CSAH 35 and CSAH 41	*	*			*	*	*	*****	\$ 103,000
6	35.12	CSAH	35	CSAH 35 and CSAH 44	*	*			*	*	*	*****	\$ 103,000
7	52.01	CSAH	52	CSAH 52 and MNTH 108	*	*			*	*	*	*****	\$ 103,000
8	8.03	CSAH	8	CSAH 8 and CSAH 13	*	*			*	*	*	*****	\$ 12,000
9	10.03	CSAH	10	CSAH 10 and CSAH 88	*			*	*	*	*	*****	\$ 12,000
10	14.06	CSAH	14	CSAH 14 and CSAH 67	*	*			*	*	*	*****	\$ 12,000
11	9.05	CSAH	9	CSAH 9 and CSAH 20	*	*	*		*	*	*	*****	\$ -
12	53.01	CSAH	53	CSAH 53 and USTH 10	*	*			*	*	*	*****	\$ 740,000
13	4.07	CSAH	4	CSAH 4 and MNTH 228 NORTH	*	*			*	*	*	*****	\$ 424,000
14	40.03	CSAH	40	CSAH 40 and CSAH 65		*			*	*	*	*****	\$ 412,000
15	5.03	CSAH	5	CSAH 5 and MNTH 210 , T 1461	*		*		*	*	*	*****	\$ 272,000
16	16.05	CSAH	16	CSAH 16 and MNTH 108		*			*	*	*	*****	\$ 251,000
17	75.04	CSAH	75	CSAH 75 and USTH 10	*			*	*	*	*	*****	\$ 218,000
18	64.01	CSAH	64	CSAH 64 and MNTH 78	*	*			*	*	*	*****	\$ 148,000
19	22.01	CSAH	22	CSAH 22 and CSAH 27	*	*			*	*	*	*****	\$ 148,000
20	28.01	CSAH	28	CSAH 28 and USTH 59	*	*			*	*	*	*****	\$ 103,000
21	1.29	CSAH	1	CSAH 1 and CNTY 145	*	*	*		*	*	*	*****	\$ 91,000
22	35.05	CSAH	35	CSAH 35 and CNTY 124	*	*			*	*	*	*****	\$ 91,000
23	40.09	CSAH	40	CSAH 40 and CSAH 75	*	*			*	*	*	*****	\$ 91,000
24	35.04	CSAH	35	CSAH 35 and CSAH 82	*	*			*	*	*	*****	\$ 24,000
25	3.01	CSAH	3	CSAH 3 and CSAH 10		*			*	*	*	*****	\$ 24,000
26	80.01	CSAH	80	CSAH 80 and USTH 10 EAST	*	*			*	*	*	*****	\$ 12,000
27	4.02	CSAH	4	CSAH 4 and CSAH 31	*	*			*	*	*	*****	\$ 12,000
28	4.03	CSAH	4	CSAH 4 and CSAH 41	*				*	*	*	*****	\$ 12,000
29	19.05	CSAH	19	CSAH 19 and CSAH 56		*			*	*	*	*****	\$ 12,000
30	47.02	CSAH	47	CSAH 47 and CNTY 119	*	*			*	*	*	*****	\$ -
31	52.04	CSAH	52	CSAH 52 and MNTH 106					*	*	*	****	\$ 594,000
32	82.01	CSAH	82	CSAH 82 and USTH 59					*	*	*	****	\$ 436,000
33	52.02	CSAH	52	CSAH 52 and CSAH 67					*	*	*	****	\$ 412,000
34	1.25	CSAH	1	CSAH 1 and CSAH 35					*	*	*	****	\$ 342,000
35	4.01	CSAH	4	CSAH 4 and USTH 59		*			*	*	*	****	\$ 273,000
36	6.04	CSAH	6	CSAH 6 and MNTH 29		*			*	*	*	****	\$ 273,000
37	84.03	CSAH	84	CSAH 84 and USTH 10 EAST		*	*		*	*	*	****	\$ 239,000
38	8.10	CSAH	8	CSAH 8 and CSAH 75 EAST					*	*	*	****	\$ 227,000
39	15.04	CSAH	15	CSAH 15 and CSAH 86		*			*	*	*	****	\$ 182,000
40	50.03	CSAH	50	CSAH 50 and CSAH 67 NORTH		*			*	*	*	****	\$ 136,000
41	5.01	CSAH	5	CSAH 5 and CSAH 38					*	*	*	****	\$ 136,000
42	20.01	CSAH	20	CSAH 20 and CSAH 31		*			*	*	*	****	\$ 136,000
43	33.03	CSAH	33	CSAH 33 and CNTY 120		*			*	*	*	****	\$ 136,000
44	57.01	CSAH	57	CSAH 57 and MNTH 210		*			*	*	*	****	\$ 136,000
45	21.06	CSAH	21	CSAH 21 and CSAH 28					*	*	*	****	\$ 136,000
46	24.03	CSAH	24	CSAH 24 and CSAH 27		*			*	*	*	****	\$ 103,000
47	33.04	CSAH	33	CSAH 33 and MNTH 210		*			*	*	*	****	\$ 103,000
48	1.06	CSAH	1	CSAH 1 and CSAH 15		*			*	*	*	****	\$ 91,000
49	1.23	CSAH	1	CSAH 1 and CSAH 10		*			*	*	*	****	\$ 91,000
50	8.04	CSAH	8	CSAH 8 and CSAH 53					*	*	*	****	\$ 91,000
51	16.01	CSAH	16	CSAH 16 and MNTH 78					*	*	*	****	\$ 91,000
52	34.02	CSAH	34	CSAH 34 and CNTY 123	*	*			*	*	*	****	\$ 91,000
53	35.06	CSAH	35	CSAH 35 and CSAH 39		*			*	*	*	****	\$ 91,000
54	38.02	CSAH	38	CSAH 38 and CSAH 81	*				*	*	*	****	\$ 91,000
55	41.01	CSAH	41	CSAH 41 and MNTH 108 EAST		*			*	*	*	****	\$ 91,000
56	54.03	CSAH	54	CSAH 54 and CSAH 67		*			*	*	*	****	\$ 91,000
57	85.01	CSAH	85	CSAH 85 and MNTH 108	*	*			*	*	*	****	\$ 12,000
58	143.01	CNTY	143	CNTY 143 and USTH 10	*			*		*	*	****	\$ 12,000
59	12.04	CSAH	12	CSAH 12 and CSAH 47 WEST					*	*	*	****	\$ 12,000
60	63.01	CSAH	63	CSAH 63 and MNTH 235					*	*	*	****	\$ 12,000
61	18.01	CSAH	18	CSAH 18 and CSAH 35					*	*	*	****	\$ 12,000
62	1.28	CSAH	1	CSAH 1 and CSAH 83	*	*			*	*	*	****	\$ -
63	3.02	CSAH	3	CSAH 3 and CSAH 22		*			*	*	*	****	\$ -
64	3.03	CSAH	3	CSAH 3 and CSAH 24		*			*	*	*	****	\$ -
65	21.05	CSAH	21	CSAH 21 and CSAH 24 NORTH		*			*	*	*	****	\$ -
66	29.02	CSAH	29	CSAH 29 and CNTY 120	*	*			*	*	*	****	\$ -
67	31.01	CSAH	31	CSAH 31 and USTH 59	*	*			*	*	*	****	\$ -
68	35.14	CSAH	35	CSAH 35 and MNTH 108 EAST	*			*	*	*	*	****	\$ -
69	50.02	CSAH	50	CSAH 50 and CSAH 67 SOUTH	*	*			*	*	*	****	\$ -
70	67.02	CSAH	67	CSAH 67 and CSAH 67		*			*	*	*	****	\$ -
71	119.01	CNTY	119	CNTY 119 and MNTH 210	*	*			*	*	*	****	\$ -
72	137.01	CNTY	137	CNTY 137 and USTH 10	*			*	*	*	*	****	\$ -
73	21.04	CSAH	21	CSAH 21 and CSAH 24 SOUTH		*			*	*	*	****	\$ -
74	29.01	CSAH	29	CSAH 29 and CSAH 82	*	*			*	*	*	****	\$ -
75	29.03	CSAH	29	CSAH 29 and MNTH 210	*		*		*	*	*	****	\$ -
76	32.01	CSAH	32	CSAH 32 and CSAH 74	*	*			*	*	*	****	\$ -





## 3.4 County Safety Projects

One of the key objectives of Otter Tail County's safety planning effort involved identifying low cost safety related projects that are focused on the County's documented safety emphasis areas. These safety emphasis areas contain the greatest number of severe crashes occurring along the County's system of highways. Deploying mitigations for the factors contributing to these crashes represent the best opportunity to move Otter Tail County Towards Zero Deaths.

The need for low cost projects that can be widely deployed across the County's system of highways is based on the fact that Otter Tail County averages eleven severe crashes (Fatal and A-Injury) per year and these are spread across 1004 miles of rural County highways and hundreds of intersections. As a result, the density of these severe crashes is very low and Minnesota's Strategic Highway Safety Plan has demonstrated that the most effective programmatic approach involves a wide application of relatively low cost safety projects.

The effort to develop low-cost safety projects is based on the application of high priority strategies at the most at-risk locations that were identified as part of the detailed analysis of the County's system of highways. High priority safety strategies identified in Section 3.2 (and which were the direct outcomes of the December 13, 2010, County Roadway Safety Workshop) basically consist of the following types of improvements:

- Improvements to the edges of rural highways and enhanced delineation of horizontal curves in rural areas.
- Upgrading the signs and pavement markings, installing street lights at rural STOP controlled intersections.
- Improve sight distance at unsignalized intersections.
- Behavioral campaigns to increase seat belt compliance, reduce impaired driving, increase motorcycle helmet usage, decrease speeding (aggressive driving) and support the graduated driver license law.

The at-risk locations are documented in Section 3.3, and include rural County highway segments, rural STOP controlled intersections and horizontal curves along rural two-lane facilities. The low cost safety projects that are suggested for implementation are described in the following sections.

The list of potential projects is greater than what can reasonably be undertaken in a single year based on funding limitations. The actual schedule for implementation of individual projects will be a function of securing funding from the State's Highway Safety Improvement Program (HSIP). This safety plan, prepared for Otter Tail County, is consistent with the Minnesota's Strategic Highway Safety Plan. Also, the high priority safety strategies are among those recommended for local systems in the State's Strategic Plan. Both of these items put Otter Tail County in a better position to be successful at securing HSIP funding.

### 3.4.1 Infrastructure Based Safety Projects

This section summarizes the infrastructure based safety projects considered and ultimately identified for rural segments, curves and intersections.

### 3.4.1.1 Rural Highway Segments

Five types of projects were considered for implementation on each of the high priority rural highway segments. Project types are also discussed in Section 2.11 and shown in Figure 2-7. The project types and costs are:

- **2' Shoulder Paving + Safety Wedge + Rumble Strip** - Estimated Cost: \$40,000 per mile.
- **Rumble Strip** - Estimated Cost: \$3,000 per mile.
- **Rumble StripE** - Estimated Cost: \$3,500 per mile.
- **6" Wet Reflective Epoxy in Grooves** – Estimated Cost: \$8,500 per mile. This strategy's relatively higher costs and unproven safety benefits limits its use only to noise sensitive or Amish areas.
- **6" Latex Marking** - Estimated Cost: \$650 per mile.

A decision tree shown in Figure 2-8 was developed to support a consistent approach for developing safety projects. This tool allows counties to choose between five different types of pavement edge treatments based on factors that include traffic volume and adjacent land use. Where traffic volumes are low, 6" Latex Marking is the suggested treatment. Where the adjacent land use is considered noise sensitive (high density residential, parks, etc.), 6" Wet Reflective Epoxy in Grooves is the suggested treatment. On higher volume roadways, with few noise sensitive land uses, the suggested treatments are either rumble strips or stripEs, depending on these segment's lane and shoulder widths.

Table 3-10 summarizes the high priority segments and suggested strategies, which includes 18 miles of 2 foot shoulder paving+safety wedge+rumble strip, 13.4 miles of rumble strips, 135.8 miles of rumble stripEs, 112.9 miles of 6" wet reflective epoxy in grooves, and 33.6 miles of 6" latex marking.

A project form was completed for each high priority segment. Figure 3-17 shows an example project form, including a description of the segment, brief crash history, ranking factors, a picture from the Video Log and the identified strategy. Project forms for all high priority segments are included in Appendix B.

TABLE 3-10  
 Otter Tail County Segment Project Summary

Rank	Corridor #	Route #	Start	End	Length	Ranking	2' Shoulder Pave+RS +Safety Wedge	Rumble Strip	Rumble StripE	6" Latex Marking	6" Wet Reflective Epoxy in Grooves	Project Cost
1	34.01	CSAH 34	CSAH 35	PERHAM CORP LMTS	6.8	★★★★★	4.8	0.0	0.0	0.0	2.0	\$209,882
2	4.04	CSAH 4	VERGAS CORP LMTS	BECKER COUNTY LINE	4.7	★★★★★	0.0	0.0	3.9	0.0	0.8	\$20,445
3	35.07	CSAH 35	CSAH 41	DENT CORP LMTS	9.3	★★★★★	0.0	0.0	6.0	0.0	3.3	\$48,825
4	9.03	CSAH 9	MNTH 34	BECKER COUNTY LINE	5.2	★★★★★	3.0	0.0	0.0	0.0	2.2	\$139,204
5	31.02	CSAH 31	USTH 59	CSAH 20	2.9	★★★★	0.0	0.0	0.0	0.0	2.9	\$24,650
6	64.01	CSAH 64	MNTH 78	DOUGLAS COUNTY LINE	0.6	★★★★	0.6	0.0	0.0	0.0	0.0	\$24,000
7	35.05	CSAH 35	UNDERWOOD CORP LMTS	CSAH 1	6.0	★★★★	6.0	0.0	0.0	0.0	0.0	\$240,000
8	5.03	CSAH 5	CLITHERALL CORP LMTS	CSAH 16	4.7	★★★★	0.0	0.0	0.0	0.0	4.7	\$39,950
9	35.01	CSAH 35	USTH 59	DALTON CORP LMTS	5.8	★★★★	3.6	0.0	0.0	0.0	2.2	\$162,574
10	3.01	CSAH 3	CSAH 10	CSAH 24	8.4	★★★★	0.0	4.6	3.8	0.0	0.0	\$27,090
11	33.01	CSAH 33	CSAH 35	MNTH 210	8.5	★★★★	0.0	0.0	8.5	0.0	0.0	\$29,750
12	83.02	CSAH 83	BATTLE LAKE CORP LMTS	CSAH 1	8.5	★★★★	0.0	0.0	5.8	0.0	2.7	\$43,350
13	122.02	CNTY 122	UNDERWOOD CORP LMTS	CSAH 83	5.4	★★★★	0.0	0.0	2.7	0.0	2.7	\$32,400
14	3.02	CSAH 3	CSAH 24	USTH 59	7.5	★★★★	0.0	6.6	0.0	0.0	0.9	\$27,450
15	20.01	CSAH 20	CSAH 9	USTH 59	5.1	★★★★	0.0	0.0	3.8	0.0	1.3	\$24,225
16	111.02	CNTY 111	FERGUS FALLS CORP LMTS	CSAH 10	4.5	★★★★	0.0	0.0	4.5	0.0	0.0	\$15,750
17	4.02	CSAH 4	CSAH 31	VERGAS CORP LMTS	8.9	★★★	0.0	0.0	3.0	0.0	5.9	\$60,520
18	31.01	CSAH 31	CSAH 4	USTH 59	5.1	★★★	0.0	0.0	1.6	0.0	3.5	\$35,445
19	67.03	CSAH 67	CSAH 52	NEW YORK MILLS CORP LMTS	6.9	★★★	0.0	0.0	6.9	0.0	0.0	\$24,150
20	35.03	CSAH 35	DALTON CORP LMTS	UNDERWOOD CORP LMTS MNTH 210	8.3	★★★	0.0	0.0	0.0	0.0	8.3	\$70,550
21	24.05	CSAH 24	ERHARD CORP LMTS	CSAH 3	4.8	★★★	0.0	0.0	4.8	0.0	0.0	\$16,800
22	56.02	CSAH 56	NEW YORK MILLS CORP LMTS	CSAH 19	6.6	★★★	0.0	0.0	6.6	0.0	0.0	\$23,100
23	55.01	CSAH 55	CSAH 16	OTTERTAIL CORP LMTS	6.8	★★★	0.0	0.0	6.8	0.0	0.0	\$23,800
24	29.01	CSAH 29	CSAH 82	MNTH 210	7.4	★★★	0.0	0.0	4.6	0.0	2.8	\$39,960
25	72.01	CSAH 72	MNTH 78	CSAH 83	3.0	★★★	0.0	0.0	0.0	0.0	3.0	\$25,500
26	75.01	CSAH 75	CSAH 40	MNTH 210	4.5	★★★	0.0	0.0	0.0	0.0	0.0	\$0
27	23.01	CSAH 23	CSAH 9	MNTH 34	5.2	★★★	0.0	0.0	0.0	5.2	0.0	\$3,380
28	16.01	CSAH 16	MNTH 78	CSAH 5	5.7	★★★	0.0	0.0	3.2	0.0	2.5	\$32,490
29	41.01	CNTY 41	CSAH 35	MNTH 108	6.0	★★★	0.0	0.0	3.7	0.0	2.3	\$32,400
30	36.01	CSAH 36	CSAH 35	MNTH 228	6.6	★★★	0.0	0.0	3.1	0.0	3.5	\$40,590
31	45.02	CSAH 45	CSAH 1	CSAH 74	3.9	★★★	0.0	0.0	2.8	0.0	1.1	\$19,110



TABLE 3-10 (Continued)  
Otter Tail County Segment Project Summary

Rank	Corridor #	Route #	Start	End	Length	Ranking	2' Shoulder Pave+RS +Safety Wedge	Rumble Strip	Rumble StripE	6" Latex Marking	6" Wet Reflective Epoxy in Grooves	Project Cost
32	61.01	CSAH 61	CSAH 16	MNTH 108	7.5	★★★	0.0	0.0	5.9	0.0	1.6	\$34,125
33	119.01	CNTY 119	CSAH 47	MNTH 210	6.1	★★★	0.0	0.0	0.0	6.1	0.0	\$3,965
34	115.01	CNTY 115	CSAH 74	CSAH 35	2.5	★★★	0.0	0.0	1.6	0.0	0.9	\$13,250
35	145.01	CNTY 145	CSAH 72	CSAH 1	1.0	★★★	0.0	0.0	0.0	0.0	1.0	\$8,500
36	84.03	CSAH 84	NEW YORK MILLS CORP LMTS	USTH 10 EAST	0.5	★★★	0.0	0.5	0.0	0.0	0.0	\$1,500
37	80.03	CSAH 80	PERHAM CORP LMTS	USTH 10 EAST	1.7	★★★	0.0	1.7	0.0	0.0	0.0	\$5,100
38	75.03	CSAH 75	MNTH 29	USTH 10	1.0	★★★	0.0	0.0	0.0	0.0	1.0	\$8,500
39	10.03	CSAH 10	ELIZABETH CORP LMTS	CSAH 1	6.5	★★★	0.0	0.0	0.0	0.0	6.5	\$55,250
40	17.02	CSAH 17	VERGAS CORP LMTS	BECKER COUNTY LINE	6.3	★★★	0.0	0.0	0.0	0.0	6.3	\$53,550
41	53.01	CSAH 53	USTH 10	CSAH 8	7.9	★★★	0.0	0.0	5.7	0.0	2.2	\$38,710
42	35.1	CSAH 35	CSAH 34	CSAH 36	7.5	★★★	0.0	0.0	4.6	0.0	2.9	\$40,875
43	10.01	CSAH 10	WILKIN COUNTY LINE CSAH 11	ELIZABETH CORP LMTS	6.7	★★	0.0	0.0	6.7	0.0	0.0	\$23,450
44	30.02	CSAH 30	CSAH 21	MNTH 108	4.4	★★	0.0	0.0	2.2	0.0	2.2	\$26,400
45	131.01	CNTY 131	CSAH 35	CSAH 35	1.5	★★	0.0	0.0	0.0	1.5	0.0	\$975
46	19.02	CSAH 19	BLUFFTON CORP LMTS	CSAH 56	4.9	★★	0.0	0.0	1.8	0.0	3.1	\$32,585
47	113.01	CNTY 113	MNTH 108	CSAH 23	3.0	★★	0.0	0.0	0.0	3.0	0.0	\$1,950
48	50.03	CSAH 50	DEER CREEK CORP LMTS	CSAH 75	6.1	★★	0.0	0.0	0.0	0.0	6.1	\$51,850
49	15.01	CSAH 15	GRANT COUNTY LINE CSAH 26	CSAH 2 North	6.7	★★	0.0	0.0	0.0	0.0	0.0	\$0
50	24.02	CSAH 24	ROTHSAY CORP LMTS	CSAH 21 South	2.6	★★	0.0	0.0	2.6	0.0	0.0	\$9,100
51	52.01	CSAH 52	MNTH 108	MNTH 106	7.2	★★	0.0	0.0	3.1	0.0	4.1	\$45,720
52	142.01	CNTY 142	CSAH 67	MNTH 106	3.9	★★	0.0	0.0	0.0	0.0	3.9	\$33,150
53	137.01	CNTY 137	USTH 10	CSAH 53	6.0	★★	0.0	0.0	6.0	0.0	0.0	\$21,000
54	42.02	CSAH 42	PARKERS PRAIRIE CORP LMTS	CSAH 40	10.2	★★	0.0	0.0	0.0	0.0	0.0	\$0
55	73.02	CSAH 73	MNTH 210	MNTH 29	6.7	★★	0.0	0.0	0.0	0.0	6.7	\$56,950
56	126.01	CNTY 126	CSAH 47	MNTH 78	4.2	★★	0.0	0.0	0.0	4.2	0.0	\$2,730
57	132.01	CNTY 132	CSAH 61	MNTH 108	2.0	★★	0.0	0.0	0.0	2.0	0.0	\$1,300
58	146.01	CNTY 146	CSAH 13	CSAH 53	3.0	★★	0.0	0.0	0.0	3.0	0.0	\$1,950
59	5.04	CSAH 5	CSAH 16	MNTH 78	4.8	★★	0.0	0.0	0.0	0.0	4.8	\$40,800
60	32.01	CSAH 32	CSAH 74	CSAH 14	6.6	★★	0.0	0.0	5.5	0.0	1.1	\$28,710
61	71.01	CSAH 71	DOUGLAS COUNTY LINE	CSAH 46	4.3	★★	0.0	0.0	0.0	4.3	0.0	\$2,795
62	128.01	CNTY 128	MNTH 78	CSAH 55	4.0	★★	0.0	0.0	4.0	0.0	0.0	\$14,000
63	138.01	CNTY 138	MNTH 29	CH 136	4.3	★★	0.0	0.0	0.0	4.3	0.0	\$2,795
<b>TOTAL (miles)</b>							<b>18.0</b>	<b>13.4</b>	<b>135.8</b>	<b>33.6</b>	<b>112.9</b>	<b>\$2,218,875</b>

Note: The final decision to submit any project to compete for HSIP funding, and if successful, to pursue project development, is the responsibility of the County Engineer.





### 3.4.1.2 Horizontal Curves on Rural 2-Lane Roads

Curves were nominated for a project in three cases:

1. High priority curves and those in close proximity (for uniformity and cost effectiveness)
2. Curves located on a high priority segments and with a radius between 500' and 1,200'
3. Updating currently installed chevrons where the signs need to be updated

Curves identified for a project received the following:

- **2' Shoulder Paving + Safety Wedge + Rumble Strip** - Cost: \$40,000 per mile.
- **Chevrons** - Install chevrons for guiding vehicles in both directions of travel. Estimated Cost: \$3,300 per curve. (See Figure 2-9 for an example of a typical chevron installation).

In all, 488 curves were identified for projects at a total of over \$3,950,000 (see Table 3-11). A project form has been completed for each high priority curve on a segment by segment basis (see Figure 3-18). The project form describes the segment, lists curves on the segment, ranking criteria, and provides estimated project costs. Project forms for all high priority curves can be found in Appendix C.

Corridor #	Curves	Project Cost (\$)
1.03	1	\$1,388
1.05	6	\$8,283
1.06	2	\$4,034
2.01	2	\$18,221
3.01	6	\$24,106
3.02	5	\$57,291
4.02	4	\$29,962
4.04	7	\$58,285
5.01	2	\$15,554
5.03	6	\$71,026
5.04	3	\$21,555
8.02	2	\$13,934
8.04	4	\$50,790
9.03	14	\$91,795
10.01	1	\$8,492
10.03	1	\$3,698
10.04	1	\$3,698
11.01	1	\$14,118
14.01	3	\$23,517
14.04	4	\$24,468
15.02	5	\$39,686
15.03	1	\$3,506
16.01	9	\$89,359
16.02	1	\$7,936
17.02	7	\$71,632
20.01	7	\$10,871
21.01	5	\$35,373
21.02	2	\$19,877
22.01	2	\$20,520
22.02	4	\$33,414



**TABLE 3-11  
 OTTER TAIL COUNTY CURVE PROJECT SUMMARY**

<b>Corridor #</b>	<b>Curves</b>	<b>Project Cost (\$)</b>
23.01	5	\$27,577
23.02	3	\$26,762
24.02	1	\$11,615
24.03	1	\$19,095
24.06	5	\$42,603
25.01	6	\$51,826
27.03	10	\$101,211
28.02	2	\$17,456
29.01	4	\$32,736
30.01	1	\$14,702
30.02	1	\$9,836
31.01	4	\$23,866
31.02	15	\$103,029
32.01	4	\$43,105
33.01	10	\$85,312
34.01	10	\$90,279
35.01	6	\$54,865
35.03	7	\$81,044
35.05	5	\$54,424
35.06	5	\$6,723
35.07	14	\$38,222
35.09	1	\$8,121
35.1	7	\$74,858
36.01	13	\$122,285
38.01	4	\$33,669
38.02	4	\$43,700
39.01	6	\$71,262
40.02	2	\$29,994
40.03	2	\$20,203
41.01	9	\$18,038
41.02	7	\$58,021
42.02	7	\$69,205
44.01	7	\$44,304
45.01	1	\$12,982
45.02	10	\$94,026
46.02	11	\$89,030
47.01	2	\$28,873
47.02	4	\$52,876
49.02	3	\$26,949
50.01	2	\$23,055
50.03	2	\$23,252
51.02	6	\$34,990
52.02	1	\$11,391
53.01	8	\$61,434
54.01	10	\$95,230
55.01	7	\$40,997
56.02	3	\$20,262
57.01	4	\$25,970
58.01	4	\$45,658



**TABLE 3-11**  
**OTTER TAIL COUNTY CURVE PROJECT SUMMARY**

<b>Corridor #</b>	<b>Curves</b>	<b>Project Cost (\$)</b>
61.01	6	\$39,121
62.01	2	\$18,914
63.01	1	\$5,967
64.01	1	\$15,391
65.01	1	\$8,823
65.02	6	\$24,301
67.02	6	\$45,871
67.03	4	\$48,367
67.07	2	\$16,750
71.01	4	\$34,488
72.01	3	\$25,582
73.01	2	\$17,486
74.01	1	\$7,869
74.02	6	\$24,661
75.01	4	\$38,056
75.05	1	\$9,713
76.01	1	\$6,065
79.01	2	\$27,130
80.03	1	\$3,701
83.02	8	\$83,774
84.03	1	\$3,790
111.02	4	\$37,310
113.01	2	\$13,933
114.02	3	\$12,189
115.01	2	\$22,630
116.01	1	\$9,115
119.01	6	\$53,302
122.02	4	\$25,804
126.01	6	\$54,037
128.01	3	\$23,718
130.01	1	\$11,255
136.01	2	\$22,403
136.02	1	\$14,270
137.01	3	\$23,834
138.01	2	\$22,835
141.01	1	\$5,967
<b>TOTAL</b>	<b>488</b>	<b>\$3,951,728</b>

Note: The final decision to submit any project to compete for HSIP funding, and if successful to pursue project development, is the responsibility of the County Engineer.

### Curves on CSAH 1 from FERGUS FALLS CORP LMTS to CSAH 10

Agency: Otter Tail County

#### Curve Data

Curve ID	K	A	Radius (ft)	ADT	Intersection on Curve	Visual Trap	Risk Ranking	Proximity	High Priority Segment + Critical Radius	Chevron Candidate	2' Shoulder Pave+RS+Safety Wedge Candidate	RS Candidate
1I	0	0	1249	4625	Yes	Yes	**	-	-	-	-	-
1J	0	0	1588	2350	Yes	Yes	**	-	-	-	-	-
1K	0	0	1503	2350	Yes	No	*	-	-	-	-	-
1L	0	0	1606	2350	Yes	No	*	-	-	Installed	No	Yes

\*Curve numbering not consecutive, as some curves may have been removed from further analysis because a large radius, located on a gravel road, etc

\*\*Curves with radius greater than 1,200 feet did not receive a new or replacement chevron project.

#### Ranking Criteria

<table border="0"> <tr> <td style="text-align: right;">Criteria</td> <td></td> </tr> <tr> <td style="text-align: right;">Severe Crashes</td> <td>&gt; 0</td> </tr> <tr> <td style="text-align: right;">Radius</td> <td>500 to 1200</td> </tr> <tr> <td style="text-align: right;">ADT</td> <td>200 to 600</td> </tr> <tr> <td style="text-align: right;">Intersection on Curve</td> <td>Yes</td> </tr> <tr> <td style="text-align: right;">Visual Trap</td> <td>Yes</td> </tr> </table>	Criteria		Severe Crashes	> 0	Radius	500 to 1200	ADT	200 to 600	Intersection on Curve	Yes	Visual Trap	Yes	<p>Curves are selected for project if:</p> <ul style="list-style-type: none"> <li>- 3 or more *s</li> <li>- x in proximity column</li> <li>- x in High Priority Segment + Critical Radius column</li> <li>- Curve currently has chevrons installed</li> </ul>
Criteria													
Severe Crashes	> 0												
Radius	500 to 1200												
ADT	200 to 600												
Intersection on Curve	Yes												
Visual Trap	Yes												

#### Short List of Strategies Considered

Description	Type	Unit Cost	Units	Total cost
Chevrons	Proactive	\$3,300 per curve	1 curves	\$0
Arrow Board Only	Proactive	\$500 per curve	0 curves	\$0
Rumble Strip	Proactive	\$3,000 per mile	.5 miles	\$1,388
2' Shoulder Pave+RS+Safety Wedge	Proactive	\$40,000 per mile	.0 miles	\$0
				<b>\$1,388</b>

#### Implementation Cost

Federal Funds	\$1,249
Local Match (10% of Total project cost)	\$139
Total Project Cost	\$1,388

2005-2009 MnCMAT Crash Data

Page: 1  
Segment ID: 1.03  
Date: 4/28/2011

**Figure 3-18**  
**Sample Curve Project Form**



### 3.4.1.3 Rural Thru-STOP Intersections

Several project types were considered for implementation on each of the high priority rural thru-STOP intersections. Intersection strategies are suggested for use based on two primary factors –1) the ability to mitigate the most common type of severe crash at rural, thru-STOP intersections and 2) the results of the prioritization exercise with safety partners. The project types and estimated costs are listed, and are described in Section 2.11.3 and illustrated in Figure 2-10.

- **Roundabout** - Estimated cost: \$1,000,000 per intersection.
- **Directional Median** - Estimated cost: \$150,000 per intersection.
- **Mainline Dynamic Warning Sign** - Estimated Cost: \$30,000 per intersection.
- **Street Lights** - Install destination style street lighting at the intersection. Estimated Cost: \$8,000 for one street light per intersection, \$13,000 for two street lights.
- **Upgraded Signs and Markings** - Estimated Cost: (entire layout) \$1,850 per minor leg approach.
- **Review Signs and Clear Sight Triangle** - Estimated Cost: \$2,450 per approach

A decision tree was developed (see Figure 2-11) to ensure a consistent approach for proposed rural intersection project implementation. A project form was completed for each high priority intersection (see Figure 3-19 for an example). Each form includes an intersection description, a brief crash history, ranking criteria, an aerial photograph, and the identified strategy. Project forms for all high priority intersections are located in Appendix D.

The evaluation process used to develop a project for each of the high priority intersections considered the volume of traffic at the intersection, the geometry on the major approaches and whether or not there was a history of right angle crashes. The base project suggests the lowest level of investment (upgrade signs and markings on the minor approach) at intersections with very low volumes on the minor approaches (under 200 vehicles per day). The base project for intersections with slightly higher volumes on the minor approach (over 200 vehicles per day) also included installation of a destination style street light. Increased levels of investment are suggested at intersections with higher volumes and the presence of right angle crashes; this may include a dynamic mainline warning sign, a directional median where the major road is divided, or a roundabout at intersections where the volumes would be high enough to meet the traffic volume warrants in the MNMUTCD for signalization.

Table 3-12 summarizes the 76 high priority intersections and suggested safety strategies, which includes one directional median, two mainline dynamic warning signs, 64 street light installations, and 76 sign and marking upgrades.

It should be further noted that some of the at-risk locations and suggested safety projects involve the intersection of a County roadway and a State trunk highway. It is acknowledged that in these cases, the County does not have the authority to implement projects on the State's right-of-way. The County is encouraged to coordinate with Mn/DOT in order to pursue a partnership that identifies a path toward implementation.

## CSAH 9 and MNTH 34 WEST

**Agency: Otter Tail County**

---

**Intersection Data**

Configuration: T  
 Configuration (2): Undivided  
 True Mile: 5.4  
 Urban/Rural: Rural  
 County: Otter Tail  
 ATP: 4  
 Entering ADT: 3075  
 Traffic Control Device: Thru STOP  
 Street Lights: No  
 Flashers: No  
 Major ADT: 2400  
 Minor ADT: 1350



---

**Crash Data**  
 2005-2009 MnCMAT Crash Data 5 years

	Total	Angle	K+A
Crashes	4	0	0
Rate (per MVM)	0.7	0.0	0.0

---

**Ranking Criteria**

	Value	Critical	Risk Ranking
Skew	Yes	Yes	★
On/Near Curve	Yes	Yes	★
Development	No	Yes	
Near RR Crossing	No	Yes	
Distance from previous STOP	Yes	Yes	★
Volume Ratio	0.56	0.4 - 0.8	★
Total Crashes	4	>0	★

★★★★★

---

**Short List of Strategies Considered**

Description	Unit Cost	Selected	Notes - -
Roundabout	\$1,000,000 per intersection	-	Notes - -
Directional Median	\$150,000 per intersection	-	
Mainline Dynamic Warning Sign	\$30,000 per intersection	-	
Installing Street Lights	\$8,000 per intersection	x	
Upgrade Signs	\$1,150 per intersection	x	Notes -
Upgrade Markings	\$700 per intersection	x	
Upgrade Stop Bar Only	\$250 per intersection	-	
Review Signs and CST	\$2,450 per intersection	-	

Signs and Markings and Street Light project costs vary by the number of minor legs associated with the intersection.

---

**Implementation Cost**

	Federal Funds	\$8,865
	Local Match (10% of Total project cost)	\$985
	<b>Total Project Cost</b>	<b>\$9,850</b>

Rank: 2  
 Intersection ID: 9.03  
 Date: 5/9/2011

**Figure 3-19**  
**Sample Intersection Project Form**

TABLE 3-12  
 Otter Tail County Intersection Project Summary

Rank	Int. ID	System	#	Description	Risk Ranking	Round-about	Directional Median	Mainline Dynamic Warning Sign	Install Street Lights	Signs & Marking	Review Signs & Clearing/Grubbing	Project Cost (\$)
1	60.01	CSAH	60	CSAH 60 and USTH 10	★★★★★	-	X	-	X	X	-	\$166,700
2	9.03	CSAH	9	CSAH 9 and MNTH 34 WEST	★★★★★	-	-	-	X	X	-	\$9,850
3	21.02	CSAH	21	CSAH 21 and CSAH 88	★★★★★	-	-	-	X	X	-	\$16,700
4	35.07	CSAH	35	CSAH 35 and MNTH 210	★★★★★	-	-	X	-	X	-	\$33,700
5	35.11	CSAH	35	CSAH 35 and CSAH 41	★★★★★	-	-	-	X	X	-	\$9,850
6	35.12	CSAH	35	CSAH 35 and CSAH 44	★★★★★	-	-	-	X	X	-	\$9,850
7	52.01	CSAH	52	CSAH 52 and MNTH 108	★★★★★	-	-	-	X	X	-	\$9,850
8	8.03	CSAH	8	CSAH 8 and CSAH 13	★★★★★	-	-	-	X	X	-	\$9,850
9	10.03	CSAH	10	CSAH 10 and CSAH 88	★★★★★	-	-	-	X	X	-	\$16,700
10	14.06	CSAH	14	CSAH 14 and CSAH 67	★★★★★	-	-	-	X	X	-	\$9,850
11	9.05	CSAH	9	CSAH 9 and CSAH 20	★★★★★	-	-	-	X	X	-	\$9,850
12	53.01	CSAH	53	CSAH 53 and USTH 10	★★★★	-	-	-	X	X	-	\$16,700
13	4.07	CSAH	4	CSAH 4 and MNTH 228 NORTH	★★★★	-	-	-	X	X	-	\$9,850
14	40.03	CSAH	40	CSAH 40 and CSAH 65	★★★★	-	-	-	X	X	-	\$16,700
15	5.03	CSAH	5	CSAH 5 and MNTH 210 , T 1461 EAST	★★★★	-	-	-	X	X	-	\$16,700
16	16.05	CSAH	16	CSAH 16 and MNTH 108	★★★★	-	-	-	X	X	-	\$9,850
17	75.04	CSAH	75	CSAH 75 and USTH 10	★★★★	-	-	X	X	X	-	\$46,700
18	64.01	CSAH	64	CSAH 64 and MNTH 78	★★★★	-	-	-	X	X	-	\$9,850
19	22.01	CSAH	22	CSAH 22 and CSAH 27	★★★★	-	-	-	X	X	-	\$16,700
20	28.01	CSAH	28	CSAH 28 and USTH 59	★★★★	-	-	-	X	X	-	\$16,700
21	1.29	CSAH	1	CSAH 1 and CNTY 145	★★★★	-	-	-	X	X	-	\$9,850
22	35.05	CSAH	35	CSAH 35 and CNTY 124	★★★★	-	-	-	-	X	-	\$1,850
23	40.09	CSAH	40	CSAH 40 and CSAH 75	★★★★	-	-	-	X	X	-	\$1,850
24	35.04	CSAH	35	CSAH 35 and CSAH 82	★★★★	-	-	-	X	X	-	\$16,700
25	3.01	CSAH	3	CSAH 3 and CSAH 10	★★★★	-	-	-	X	X	-	\$9,850
26	80.01	CSAH	80	CSAH 80 and USTH 10 EAST	★★★★	-	-	-	X	X	-	\$9,850
27	4.02	CSAH	4	CSAH 4 and CSAH 31	★★★★	-	-	-	X	X	-	\$9,850
28	4.03	CSAH	4	CSAH 4 and CSAH 41	★★★★	-	-	-	X	X	-	\$9,850



TABLE 3-12  
 Otter Tail County Intersection Project Summary

Rank	Int. ID	System	#	Description	Risk Ranking	Round-about	Directional Median	Mainline Dynamic Warning Sign	Install Street Lights	Signs & Marking	Review Signs & Clearing/Grubbing	Project Cost (\$)
29	19.05	CSAH	19	CSAH 19 and CSAH 56	★★★★	-	-	-	X	X	-	\$9,850
30	47.02	CSAH	47	CSAH 47 and CNTY 119	★★★	-	-	-	X	X	-	\$9,850
31	52.04	CSAH	52	CSAH 52 and MNTH 106	★★★	-	-	-	X	X	-	\$16,700
32	82.01	CSAH	82	CSAH 82 and USTH 59	★★★	-	-	-	X	X	-	\$9,850
33	52.02	CSAH	52	CSAH 52 and CSAH 67	★★★	-	-	-	X	X	-	\$16,700
34	1.25	CSAH	1	CSAH 1 and CSAH 35	★★★	-	-	-	X	X	-	\$16,700
35	4.01	CSAH	4	CSAH 4 and USTH 59	★★★	-	-	-	X	X	-	\$9,850
36	6.04	CSAH	6	CSAH 6 and MNTH 29	★★★	-	-	-	X	X	-	\$9,850
37	84.03	CSAH	84	CSAH 84 and USTH 10 EAST	★★★	-	-	-	X	X	-	\$9,850
38	8.1	CSAH	8	CSAH 8 and CSAH 75 EAST	★★★	-	-	-	X	X	-	\$9,850
39	15.04	CSAH	15	CSAH 15 and CSAH 86	★★★	-	-	-	X	X	-	\$9,850
40	50.03	CSAH	50	CSAH 50 and CSAH 67 NORTH	★★★	-	-	-	X	X	-	\$9,850
41	5.01	CSAH	5	CSAH 5 and CSAH 38	★★★	-	-	-	X	X	-	\$9,850
42	20.01	CSAH	20	CSAH 20 and CSAH 31	★★★	-	-	-	X	X	-	\$9,850
43	33.03	CSAH	33	CSAH 33 and CNTY 120	★★★	-	-	-	-	X	-	\$9,850
44	57.01	CSAH	57	CSAH 57 and MNTH 210	★★★	-	-	-	-	X	-	\$1,850
45	21.06	CSAH	21	CSAH 21 and CSAH 28	★★★	-	-	-	-	X	-	\$3,700
46	24.03	CSAH	24	CSAH 24 and CSAH 27	★★★	-	-	-	X	X	-	\$1,850
47	33.04	CSAH	33	CSAH 33 and MNTH 210	★★★	-	-	-	-	X	-	\$9,850
48	1.06	CSAH	1	CSAH 1 and CSAH 15	★★★	-	-	-	X	X	-	\$3,700
49	1.23	CSAH	1	CSAH 1 and CSAH 10	★★★	-	-	-	X	X	-	\$9,850
50	8.04	CSAH	8	CSAH 8 and CSAH 53	★★★	-	-	-	X	X	-	\$16,700
51	16.01	CSAH	16	CSAH 16 and MNTH 78	★★★	-	-	-	X	X	-	\$9,850
52	34.02	CSAH	34	CSAH 34 and CNTY 123	★★★	-	-	-	-	X	-	\$9,850
53	35.06	CSAH	35	CSAH 35 and CSAH 39	★★★	-	-	-	-	X	-	\$1,850
54	38.02	CSAH	38	CSAH 38 and CSAH 81	★★★	-	-	-	-	X	-	\$3,250
55	41.01	CSAH	41	CSAH 41 and MNTH 108 EAST	★★★	-	-	-	X	X	-	\$9,850
56	54.03	CSAH	54	CSAH 54 and CSAH 67	★★★	-	-	-	X	X	-	\$9,850
57	85.01	CSAH	85	CSAH 85 and MNTH 108	★★★	-	-	-	X	X	-	\$16,700



**TABLE 3-12**  
 Otter Tail County Intersection Project Summary

Rank	Int. ID	System	#	Description	Risk Ranking	Round-about	Directional Median	Mainline Dynamic Warning Sign	Install Street Lights	Signs & Marking	Review Signs & Clearing/Grubbing	Project Cost (\$)
58	143.01	CNTY	143	CNTY 143 and USTH 10	★★★	-	-	-	-	X	-	\$3,250
59	12.04	CSAH	12	CSAH 12 and CSAH 47 WEST	★★★	-	-	-	X	X	-	\$9,850
60	63.01	CSAH	63	CSAH 63 and MNTH 235	★★★	-	-	-	X	X	-	\$9,850
61	18.01	CSAH	18	CSAH 18 and CSAH 35	★★★	-	-	-	X	X	-	\$16,700
62	1.28	CSAH	1	CSAH 1 and CSAH 83	★★★	-	-	-	X	X	-	\$9,850
63	3.02	CSAH	3	CSAH 3 and CSAH 22	★★★	-	-	-	X	X	-	\$16,700
64	3.03	CSAH	3	CSAH 3 and CSAH 24	★★★	-	-	-	X	X	-	\$16,700
65	21.05	CSAH	21	CSAH 21 and CSAH 24 NORTH	★★★	-	-	-	X	X	-	\$9,850
66	29.02	CSAH	29	CSAH 29 and CNTY 120	★★★	-	-	-	X	X	-	\$9,850
67	31.01	CSAH	31	CSAH 31 and USTH 59	★★★	-	-	-	X	X	-	\$16,700
68	35.14	CSAH	35	CSAH 35 and MNTH 108 EAST	★★★	-	-	-	X	X	-	\$9,850
69	50.02	CSAH	50	CSAH 50 and CSAH 67 SOUTH	★★★	-	-	-	X	X	-	\$9,850
70	67.02	CSAH	67	CSAH 67 and CSAH 67	★★★	-	-	-	X	X	-	\$9,850
71	119.01	CNTY	119	CNTY 119 and MNTH 210	★★★	-	-	-	X	X	-	\$16,700
72	137.01	CNTY	137	CNTY 137 and USTH 10	★★★	-	-	-	X	X	-	\$16,250
73	21.04	CSAH	21	CSAH 21 and CSAH 24 SOUTH	★★★	-	-	-	-	X	-	\$1,850
74	29.01	CSAH	29	CSAH 29 and CSAH 82	★★★	-	-	-	-	X	-	\$1,850
75	29.03	CSAH	29	CSAH 29 and MNTH 210	★★★	-	-	-	X	X	-	\$16,700
76	32.01	CSAH	32	CSAH 32 and CSAH 74	★★★	-	-	-	X	X	-	\$9,850
<b>TOTAL</b>						<b>0</b>	<b>1</b>	<b>2</b>	<b>64</b>	<b>76</b>	<b>0</b>	<b>\$1,021,200</b>

Note: The final decision to submit any project to compete for HSIP funding and if successful to pursue project development, are the responsibility of the County Engineer.



### 3.4.1.4 County Nominated Projects

Otter Tail County had additional projects that were nominated outside of the data driven process. These projects include the installation of street lights and upgraded signs and markings. The County nominated projects include the following intersections, as shown in Table 3-13.

**TABLE 3-13**  
 Otter Tail County Nominated Intersection Projects

Int ID	System	Route #	Description	Risk Ranking	Install Street Lights	Signs & Markings	Project Cost (\$)
1.01	CSAH	1	CSAH 1 and CSAH 26	★★	x	x	\$16,700
10.06	CSAH	10	CSAH 10 and CSAH 27	★★	x	x	\$16,700

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## 4.0 Driver Behavior Safety Strategies

### 4.1 Why is Driver Behavior Important to Include in a County Plan?

Traffic crashes are the leading killer of Minnesotans, ages 1-34 — each year more than 400 people are killed on our roads and 31,000 are injured.

These deaths and injuries are all preventable and predictable. In most cases, unsafe driver behavior is the primary contributing factor for crashes. Traffic crashes can be prevented and reduced if motorists buckle up, drive at safe speeds, pay attention and plan ahead to avoid impaired driving.

The most effective method to encourage these safe driving behaviors is to apply enforcement efforts coupled with educational outreach. Research indicates education alone is not effective, and enforcement alone will not sustain a change in driver behavior.

At the foundation of Minnesota and the nation's driving issues is a complacency toward driving — there is little outrage about the deaths or serious action to prevent them. The public seems to accept that these crashes will always occur. The challenge is to sculpt and foster a new driving culture, where Minnesotans practice and promote safe driving — and join in the vision that these tragedies are preventable.

### 4.2 Teenage Drivers, Impaired Driving, Seat Belts, Speeding, Distraction

The data presented in this chapter is specifically for Area Transportation Partnership (ATP) 4. This is the same data that was presented at each of the County Safety Plan Workshops in ATP 4. You will remember that the data suggests that contributing factors for this region most often are inexperienced drivers, impaired driving, failure to use seat belts, speeding and distracted driving.

#### 4.2.1 Teenage Drivers

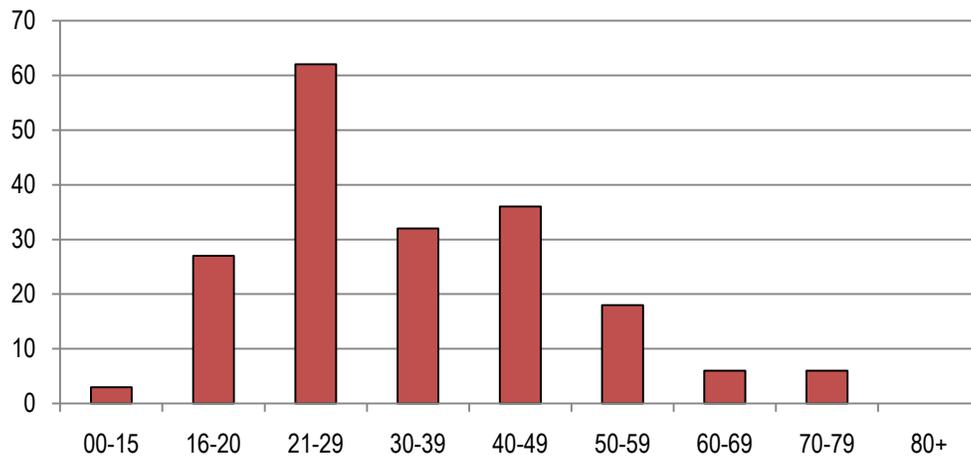
Traffic crashes are the leading killer of Minnesota teens. Teenage drivers' inexperience behind the wheel puts them at significantly higher risk for fatal and serious injury crashes. Also contributing to these crashes are low seat belt compliance rates, risk-taking behind the wheel, and distractions, such as other passengers in the vehicle (see charts on the following pages). A main issue regarding teen drivers is that they are still developing their decision-making and judgment skills up until their early 20s.

There have been legislative efforts to support safe teen driving. The Graduated Driver's License law helps newly licensed teen drivers hone their driving skills during the first year of licensure by minimizing exposure to two high-risk situations: carrying multiple teen passengers and driving late at night. New teen drivers are also banned from all cell phone use.

Parents are critical factors in developing safe teen drivers. Parents need to continue to monitor and train teen drivers, even after licensure, reinforce state laws, set reasonable rules and limits specific to their teen driver — and be safe role models behind the wheel.

#### 4.2.2 Alcohol-Related Crashes

Each year, alcohol-related deaths account for one-third of the state's total death count, while more than 30,000 motorists are arrested for DWI annually. Young adult males are the primary offenders and those most often killed in alcohol-related crashes. In ATP 4, motorists ages 21–29 have the highest level of involvement in alcohol-related fatal and serious injury crashes (see Figure 4-1).

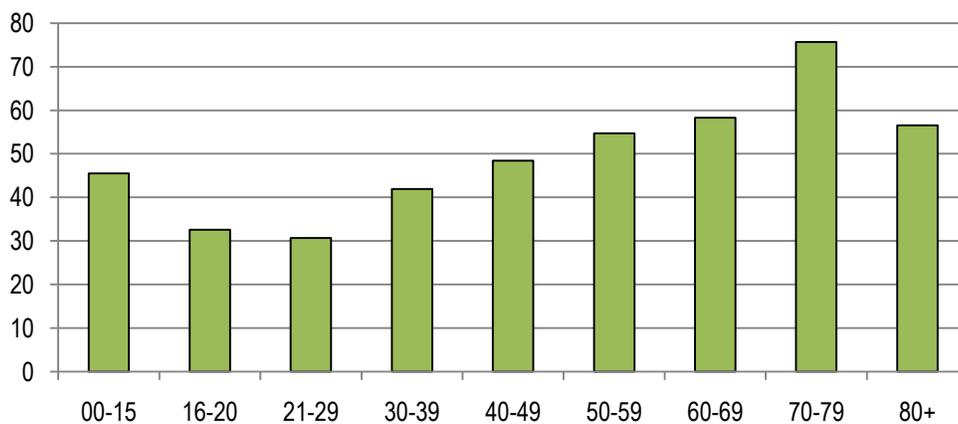


**Figure 4-1**  
**2005 – 2009 Alcohol-Related Fatalities and Severe Injuries by Age in ATP 4**

Alcohol-related fatalities and severe injuries typically occur on the weekends, at night and early morning hours, most often in the summer months. The majority of the alcohol-related crashes in ATP 4 are on CSAHs and trunk highways.

#### 4.2.3 Seat Belts

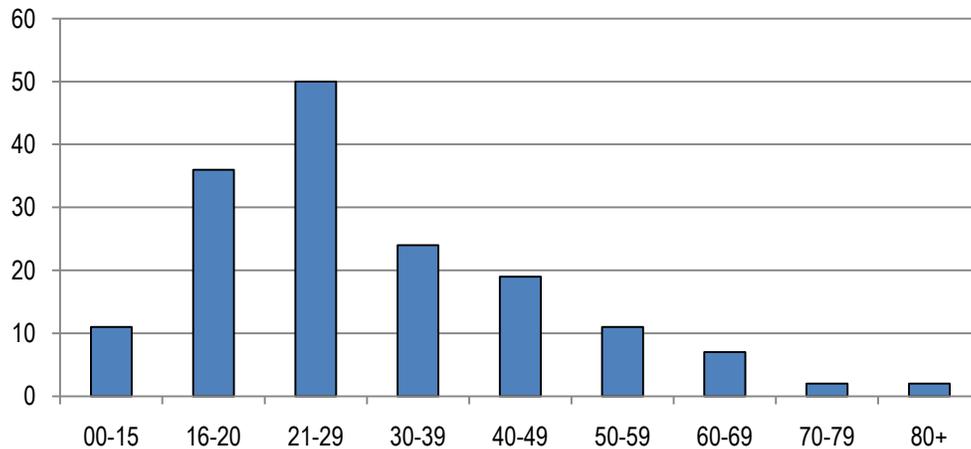
Each year, more than half of the state’s vehicle occupant fatalities are unbelted. Minnesota’s seat belt compliance rate hit a daytime record-high of 92 percent in 2010 following the passing of the primary seat belt law in 2009. Data reveal, however, that belt use is lower at night — for example, 75 percent of drinking drivers killed in crashes are also not buckled up. Belt use is generally lower on county roads or CSAH’s. The groups with the lowest seat belt use rates are rural males — mostly teens and young adults (see age groups in Figure 4-2) and pickup truck drivers.



**Figure 4-2**  
**2005 – 2009 Percentage of Fatalities and Severe Injuries – Belted during Crash by Age in ATP 4**

#### 4.2.4 Unsafe and Illegal Speeding and Aggressive Driving

Illegal or unsafe speed is a leading factor in fatal crashes. Each year, almost 70 percent of speed-related fatal crashes occur on rural roads. Aggressive driving behavior (speeding, tailgating, running lights, unsafely changing lanes, etc.) is primarily a young driver issue. Speed-related fatalities and serious injuries typically occur on weekend evenings and early mornings. The drivers are most often males, ages 16-20 and 21-29 (see Figure 4-3).

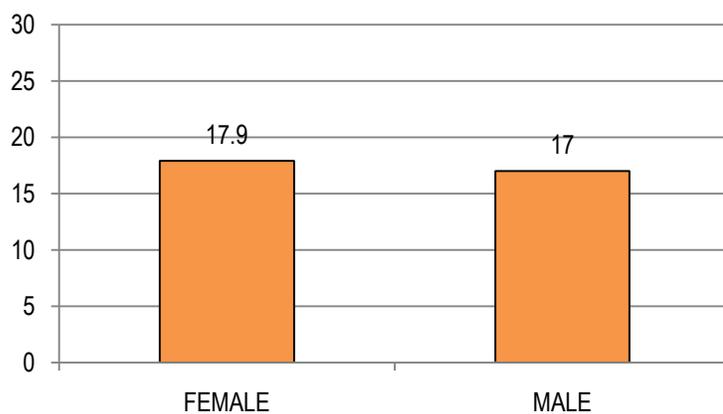


**Figure 4-3**  
**2005 – 2009 Speed-Related Fatalities and Severe Injuries by Age in ATP 4**

#### 4.2.5 Distracted/Inattentive Driving

There are a range of distractions in a vehicle — including daydreaming, conversations, cell phone use/texting, reaching for items, eating, grooming and more. Each year, distracted driving accounts for at least one-quarter of all crashes, resulting in 70 deaths and 350 serious injuries — these numbers are low as it is a challenge for law enforcement to determine “distraction” as a crash factor.

While much focus of distraction is on teens/young adults, new studies show that adults are just as active on cell phones and texting behind the wheel. In Minnesota, it is illegal for drivers to read/compose/send texts or emails, or access the Web on a wireless device while the vehicle is in motion or part of traffic — including while stopped in traffic



**Figure 4-4**  
**2005 – 2009 Percentage of Fatalities and Severe Injuries that were Inattention-Related by Gender in ATP 4**

or at a stop light. Women are disproportionately represented in inattention-related fatal and serious injury crashes (see the gender breakdown in Figure 4-4).

### 4.3 Driver Behavior Change Strategies: Proven, Experimental, Tried

The Minnesota Department of Public Safety Office of Traffic Safety created a list of driver behavior change strategies that could be implemented by all communities. The strategies included were based on the research provided by the National Cooperative Highway Research Program (NCHRP) 500 Series and the National Highway Traffic Safety Association (NHTSA)-produced Countermeasures that Work, 5th edition. The strategies were chosen to address each of the most prevalent contributing factors to fatal and severe injuries on Minnesota roads, outlined below. Based on the research of the strategy, each was rated for effectiveness in addressing an issue and impact on the problem when implemented.

#### 4.3.1 Behavior Change Strategies — Traffic Safety Policy Work: State Law and Worksite Policy

##### State Law Policy

State-level legislative efforts to improve traffic safety have been researched and proven effective in many states. Local community groups can advocate for laws by contacting local legislators or educating community members about the benefits of proposed legislation/current laws.

If the laws currently exist, it is important to maintain those laws and enforce them. To stay involved in traffic safety policy efforts, advocates should support law enforcement efforts to enforce laws, and voice support for enforcement initiatives to the local government (city council or county commissioners).

TABLE 4-1  
 Strategies for State Legislation

Strategies	Contributing Factor	Effectiveness	Impact
Require ignition interlocks as a condition for license reinstatement	Impaired	Proven	High
Suspend driver's license administratively upon arrest	Impaired	Proven	High
Eliminate diversion programs and plea bargains	Impaired	Tried	High
Pass statewide legislation requiring helmets for all motorcycle riders	Motorcycle	Proven	High
Pass statewide legislation identifying licensing requirements for all motorcycle riders	Motorcycle	Tried	Low
Pass statewide legislation requiring helmets for all bicyclists	Bicyclists	Tried	Low
Impose sanctions against repeat offenders for speed	Speed	Experimental	Unknown

##### Worksite Policy

Many Minnesota employers have implemented policies for employees that support traffic safety such as seat belt use, speed, alcohol and cell phone use. Policies can offer protection to employees, employee's families and the employer. Employee productivity and employer liability are the main reasons employers focus on traffic safety policies. In the liquor establishment setting, a policy requiring responsible beverage service training is helpful in protecting the establishment from liability.

**TABLE 4-2**  
 Strategies for Worksites

Strategies	Contributing Factor	Effectiveness	Impact
Encourage employers to offer fatigue management programs to employees working nighttime or rotating shifts	Distraction	Proven	Medium
Encourage employers to enact traffic safety policies with clear consequences for failure to comply	Distraction/Seat Belts/Alcohol	Proven	Medium

### 4.3.2 Behavior Change Strategies — High Visibility Enforcement of Traffic Laws: A Priority for All Counties

#### What is High-Visibility Enforcement?

High-visibility enforcement employs a multiple jurisdictional and/or multiple squad approach to saturate specific corridors. The efforts use electronic or static signage on officer-saturated traffic corridors (for example, to alert motorists they’ve entered a “DWI Arrest Zone”). Participating officers also wear “DWI Enforcement” reflective gear to increase enforcement visibility. This enforcement strategy can be used to enforce laws pertaining to DWI, seat belt use and speeding and aggressive driving.

#### Which laws are enforced?

- Publicize and conduct high-visibility targeted enforcement of laws pertaining to speeding and aggressive driving.
- Conduct highly publicized enforcement campaigns to maximize restraint use. Specifically, nighttime belt enforcement saturation.
- Conduct on-going, well-publicized DWI saturations.

#### Who are potential partners?

- Local law enforcement (State Patrol, county sheriff, city police).
- Community partners (coalitions or county public health educators, school officials, parents).
- Local media (newspaper, radio, cable/TV).

#### How is it done?

- Public education outreach and enforcement activity are coordinated. A wide range of media will be used for public education. Signs in the community will advertise that an enforcement campaign is taking place.
- For the media — craft and issue a news release; officers or community members can conduct interviews and offer ride-a-longs; conduct live, call-in radio talk shows; kick-off news conference with many officers and squads present, as well as ambulances/fire trucks and families of crash victims.
- Community efforts include writing letters to the editor during the same time period, as well as distributing posters, coasters, window clings and other promotional items with the enforcement message to local businesses and schools. Communities should be creative in how they promote traffic safety.
- The enforcement could include officers wearing highly visible vests, big orange signs on the roadside that announce the enforcement, and use of changeable message signs (banks or other businesses often will place a message on their sign advertising the enforcement). Use three or more squad cars on a small corridor or area looking for the same thing — such as seat belt non-use or impaired driving.

**TABLE 4-3**  
 Strategies for High Visibility Enforcement

Strategies	Contributing Factor	Effectiveness	Impact
Conduct highly publicized enforcement campaigns to maximize restraint use—specifically, night time belt enforcement saturation	Seat Belts	Proven	High
Conduct on-going well-publicized DWI saturations	Impaired	Proven	High
Publicize and conduct high visibility targeted enforcement of speeding and aggressive driving	Speed	Tried	High
Publicize enhanced enforcement of bicycle laws, and publicize bicycle helmet usage	Young Drivers/ Riders	Tried	High
Conduct high visibility enforcement of existing statutes to deter distracted and drowsy driving	Distraction	Experimental	High
Motorcyclist rider conspicuity campaigns — publicizing is best done through the local media and a public education campaign in the community	Motorcycle	Tried	Low
Conduct education and awareness campaign of the targeted enforcement of Zero Tolerance Laws for Drivers Under Age 21	Young Drivers	Proven	Low

### 4.3.3 Behavior Change Strategies — Community Training and Program Development

#### Community Training

To effectively address driver behavior, communities should provide training opportunities for motorcycle riders, child passenger safety advocates, bicyclists and parents. The training provides updated safety information or practices to different groups of stakeholders. Community trainings bring the traffic topic to the foreground and provide an opportunity for questions and answers by those receiving the information or skills.

**TABLE 4-4**  
 Strategies for Community Training

Strategies	Contributing Factor	Effectiveness	Impact
Training courses provided for motorcycle riders around the state at Motorcycle Safety Center training sites	Motorcycle	Tried	Medium
Publicize use of bicycle helmets with bicyclists	Young Bicyclists	Tried	Low
Engage parents through outreach programs designed to educate parents about: <ul style="list-style-type: none"> <li>• teen driving risks</li> <li>• driving tips for their teens</li> <li>• parental supervision</li> <li>• managing young drivers</li> <li>• selecting safer vehicles for young drivers</li> </ul>	Young Drivers	Tried	Medium
Conduct high-profile “child restraint inspection” events at multiple community locations	Seat Belts	Proven	Low
Train child passenger safety advocates to check for proper child restraint use	Seat Belts	Tried	Low

## Community Program Development

Developing community programs to address impaired driving can be useful in multiple settings. In liquor establishments, promotion of enforcement efforts and alternative transportation options (buses, cabs, light rail) can be effective in deterring impaired driving. Intensive supervision of DWI offenders can help with accountability and reducing recidivism. Finally, interventions in the emergency department or jail, during a teachable moment, may be effective in directing individuals to chemical health services.

**TABLE 4-5**  
 Strategies for Program Development

Strategies	Contributing Factor	Effectiveness	Impact
Support community programs for alternative transportation-partnership between beer distributors, bar owners and community program	Impaired	Tried	Medium
Monitor convicted DWI offenders closely — DWI courts or intensive supervision programs	Impaired	Proven	Low
Employ screening and brief interventions	Impaired	Tried	Medium

## 4.4 Call for Innovative and New Ideas from the Community

These innovative ideas proposed from County Highway Safety Plan workshops have not been evaluated or studied, but may have the potential to be effective strategies in changing driver behavior. Each of these ideas has strengths and limitations. The Department of Public Safety Office of Traffic Safety (OTS) has included comments to consider below for each idea.

### Law Enforcement and Traffic Citations

*“Administrative citations could be an option to giving out state citations. Law enforcement may be more likely to issue an administrative citation, as it costs the offender less money. This part of the state has historically had a lower median income and this may have an effect on the number of citations and warnings issued.”*

OTS encourages thoughtful consideration before communities adopt administrative citations. The benefit of the administrative citation is that it is less expensive and may lead to officers giving a citation for lower speed violations, rather than a warning. But there are concerns. Administrative citations would not allow for identifying high-risk drivers having multiple citations, as the administrative citation does not go on the driving record.

### Seat Belt Citation Cost

*“Lower the cost of seat belt citations. Law enforcement may be deterred from writing seat belt citations, because of the high cost and low median income in this area of the state.”*

Research has demonstrated that it often takes several citations to change the behavior of a driver.

### Car Technology Legislation

*“Pass legislation to require vehicle companies to build their vehicles with new technologies incorporated. Examples of these technologies are: phones automatically turning off when the vehicle is started, ignition interlocks, locking out max speeds, smart keys, GPS navigating the vehicle, and exterior vehicle sensors.”*

OTS supports the use of car technology to improve safety, but does not have a comment on specific legislation.

### **Distraction Legislation**

*“Pass legislation to pass a hands-free law. This means no dialing, texting, or e-mailing would be legal. The current law allows drivers 18 years and over dial cell phones when driving. Therefore it is difficult for law enforcement to know whether the driver is making a call or texting. The use of new technology to curb texting and cell phone use while driving could be helpful. One example shared was applications that disable cell phones when going over five miles per hour (www.eyesuup.com).”*

OTS is concerned with endorsing hands-free cell phone use while driving, as the cognitive distraction is still very much there. While hands-free is step in the right direction, it is still not a safe way to drive a vehicle.

### **Technology and Law Enforcement**

*“Information sharing between state, county, and local law enforcement agencies could be improved with technology. This means updating the technology so that all citations are computerized in a central database which is accessible by all law enforcement across the state.”*

OTS believes this would be an expensive and time consuming undertaking. It would require a significant amount of cooperation from all law enforcement agencies in Minnesota to build and transition to using a new system.

### **Teens – High Visibility Enforcement Waves Around High Schools**

*“Law enforcement issuing citations to teens around the school they attend may have a ripple effect and get the message out that there is a strong possibility that they may get cited if they break traffic laws. It is important to note that education along with targeted enforcement is a proven strategy.”*

OTS greatly supports high-visibility efforts around locations where young drivers are present. OTS encourages law enforcement to partner with local schools to combine awareness efforts with the enforcement.

### **Peer Education in Schools**

*“Implement peer driven programs in schools that promote safe driving.”*

OTS encourages traffic safety awareness and education efforts, as long as they are conducted in conjunction with law enforcement efforts.

### **Parents and Driver’s Ed**

*“Parent involvement in driver’s education should be mandatory. Parents should be required to attend an initial meeting before their teen begins driver’s education, similar to the mandatory sports meetings that they have to attend to participate in high school sports.”*

OTS encourages communities to commit to providing parent education opportunities to learn about how to work with and manage their teen drivers.

## **4.5 Barriers to Implementing Behavior Change Strategies**

During the planning process, it is important to consider the barriers to implementing driver-behavior based strategies. These barriers will vary according to the proposed strategy to be implemented.

One of the most cited barriers to implementing many strategies is the political environment. This barrier is most evident when implementing new law enforcement efforts. County and local law enforcement agencies are governed by elected boards. Sometimes targeted law enforcement is considered infringing on people’s rights or viewed as a revenue stream for the city or county. Alcohol compliance checks and liquor server training can also be quite controversial, especially in small, rural communities.

Another significant barrier is funding sources for overtime traffic enforcement as well as other traffic safety programs. The state does issue a limited amount of grant funds for traffic safety coalitions and for overtime enforcement. Not all areas utilize these funds and in some cases departments are not able to find enough staff willing to take the overtime hours. This is particularly evident in smaller

communities with limited staff. Furthermore, some communities do not feel traffic safety is a top priority, even though the data points to traffic crashes as a primary cause of death.

One way to get beyond these barriers is to educate those with authority or political positions. It is important to use data to back up the request for the community to focus on changing driver behavior. Rarely are crashes actual “accidents.” Most crashes could have been prevented if drivers in each community had followed safe driving practices.

## 4.6 Resources for Implementing Effective Behavior Change Strategies

The focus of all traffic safety efforts needs to be data driven. All strategies used to change driver behavior begin with identifying the local problem areas. Find county-specific fact sheets on various topics and comprehensive Minnesota Motor Vehicle Crash Facts reports at the OTS website: [www.dps.state.mn.us/ots](http://www.dps.state.mn.us/ots), click on “Crash Data and Reports”. Use this information to choose strategies to implement in your community and to better localize your news items for media/outreach.

Actionable intervention strategies are described below for a community concerned with traffic safety, specifically with the issues of young drivers, impaired driving, seat belt use, speed and distraction.

For each intervention strategy, there is:

- Description of the activity
- Time and funding needed to implement
- Barriers to implementing the strategy in the community
- Potential partners in the community
- Specific actions a county could take to support the strategy
- Contact information for finding out what is currently being implemented in your county

Almost all of these interventions are currently being implemented throughout the state. The programs and contacts at OTS are a great place to start if there is interest in pursuing any of these methods to change driver behavior in your county.

## 4.7 Actionable Interventions for a Community Concerned with Traffic Safety (young drivers, impairment, belts, speed, distraction)

- Driving Behavior Safety and Enforcement Messages
- High Visibility Enforcement (young drivers, impairment, belts, speed and distraction)
- Community Support for Law Enforcement Efforts (young drivers, alcohol, belts, speed and distraction)
- Community Traffic Safety Coalitions
- Regional Partnerships
- Worksite Education and Policy (young drivers, alcohol, belts, speed and distraction)
- Child Passenger Safety – Technician Training and Community Clinics (belts)
- Working with Parents of Young Drivers (young drivers)
- Mock Crash at Local School (young drivers)
- Crash Video Targeted to Minnesota Youth (young drivers)
- Alternative Rides Home (impairment)
- Intensive Supervision of DWI Offenders (impairment)
- Reducing Impaired Driving- Ignition Interlock (impairment)
- Motorcycle Initiatives (motorcyclist, impairment, speed, distraction)

## Enforcement Focus: Speed, Seatbelts, Impaired Driving, Distracted Driving, Young Drivers

Driver behavior change strategies will use public outreach or messaging as part of the implementation process. These are messages developed by the National Highway Traffic Safety Administration that Minnesota adopts. Taglines indicated below should be repeated at the community level for a strong and coherent message.

- Buckle Up. Click it or Ticket.
- Drive at Safe Speeds — Obey the Sign or Pay the Fine.
- Drunk Driving. Over the Limit, Under Arrest.
- Always have a plan for a safe and sober ride.

### Educational Materials Available



*Promote Safe Driving Behavior and Ongoing Enforcement Efforts in the Community*

**Description:** Partners are encouraged to post and distribute these materials at business/locations that deliver a teen/young adult target (fast food, bars, convenience stores, etc.). Items include bar coasters, brochures, flyers, posters, window clings, and other materials to promote enforcement in the community. Use these items in combination with added enforcement. Public service announcements (TV, radio, print) also available to download at [www.dps.state.mn.us/ots](http://www.dps.state.mn.us/ots), click on “Public Service Announcements.”

**Funding:** Free resources for promoting law enforcement and traffic safety efforts are available at no charge through the Office of Traffic Safety website: [www.dps.state.mn.us/ots](http://www.dps.state.mn.us/ots), click on “Resource Catalog”.

## Enforcement Focus: Speed, Seatbelts, Impaired Driving, Distracted Driving, Young Drivers



*High Visibility Enforcement and Publicity about Enforcement*

**Description:** High visibility enforcement is when multiple jurisdictions and/or multiple squads are out in relatively close proximity on a single roadway, often using brightly colored vests and enforcement signs. Enforcement effort lengths can vary. Publicizing is done through community events for the local media and a public education campaign (posters, letter to the editor) in the community about the enforcement. OTS funded programs include: Heightened Enforcement of Aggressive Traffic (HEAT), Night Concentrated Alcohol Patrol (Night CAP) and Safe and Sober overtime enforcement grants.

**Time:** example for an agency grant - total hours working Safe and Sober Waves: 460 hours  
October Belt Wave: 96 hours  
December DWI Wave: 79 hours  
Memorial Day Belt Wave: 96  
June Motorcycle Wave: 10  
July Speed Wave: 44  
Ted Foss Move Over Law Enforcement: 9  
Labor Day DWI Wave: 106  
Outside of Wave hours: 20

**Funding:** For information on funding and opportunities for getting involved in enforcement projects, go to the OTS website [www.dps.state.mn.us/ots](http://www.dps.state.mn.us/ots).

**Who is currently working on this in your county?** To find out more about this effort or what is currently occurring in your county, please go to [www.dps.state.mn.us/ots](http://www.dps.state.mn.us/ots) or Shannon Swanson at [shannon.swanson@state.mn.us](mailto:shannon.swanson@state.mn.us) or Jean Ryan at [jean.m.ryan@state.mn.us](mailto:jean.m.ryan@state.mn.us).

### Barriers to Success

- Low public awareness and low public support for enforcement
- Low support for enforcement from community leadership (Mayors, business owners, city council or county commissions, school boards)

### Potential Agency Partners

- Minnesota State Patrol, county sheriff's offices, city police departments
- Regional partners and neighboring counties

### Specific Actions a County Could Take to Support Strategy

- Write letters to the editor during pre-media effort in support of law enforcement efforts to give citations.
- Assist with identifying locations with high crash involvement for targeted enforcement.
- Discuss the enforcement with local government officials and/or attend and speak at a kick-off press conference.
- Order materials with enforcement messages from the Office of Traffic Safety website and post in community.

## Community Support for Law Enforcement Efforts



Letters to the Editor in the Local Paper

**Description:** Community members can submit letters to the editor of local news publications from multiple perspectives — first responder, family of victim, chief/sheriff, community stakeholders. The letters can be original or from a template. The purpose of these letters is to address a traffic safety issue in the community due to a crash or during an enforcement effort. Letters give the public the perception that the community, not simply law enforcement and traffic safety advocates, value the efforts of traffic enforcement in the area.

Elected officials have influence on enforcement and implementation of sanctions related to driving offenses (sheriffs, judges, township/county boards). A community group could ask those running for public office what their position is on traffic safety related items. This could be tied to a letter to the editor piece or part of a larger traffic safety effort by local public health or community coalition advocates.

A newspaper commentary from a county judge discusses his views on the primary seat belt law and its importance. This commentary could be customized and shared with local county officials, judges and city councils as a way to start discussion regarding seat belt citations and the court system.

**Time:** The time involved in this effort would include the time to write the piece and submit it to your local publication.

**Funding:** Free template letters, talking points and data for your county are on the OTS website [www.dps.state.mn.us/ots](http://www.dps.state.mn.us/ots).

**Who is currently working on this in your county?** To find out more about this effort or what is currently occurring in your county, please go to [www.dps.mn.us/ots](http://www.dps.mn.us/ots) or contact Laura Turek at [laura.turek@state.mn.us](mailto:laura.turek@state.mn.us).

### Barriers to Success

- Low public support for enforcement
- Lack of support from local business owners for traffic safety
- Low support for enforcement from community leadership (Mayors, business owners, city council or county commissions, school boards)

### Potential Agency Partners

- Minnesota State Patrol, county sheriff's offices, city police departments
- School administrators
- Judges and attorneys
- Community members impacted by traffic crashes
- County public health educators
- County engineers

### Specific Actions a County Could Take to Support Strategy

- Write a letter to the editor in support of law enforcement efforts.
- Order materials with enforcement messages from the OTS website and post in your community.

## Community Traffic Safety Coalitions



### TZD Safe Roads Grant Program

**Description:** TZD Safe Roads incorporates three elements: the development of local coalitions made up of diverse community partnerships that focus on traffic safety, the fatal review committees which analyze community traffic deaths and the identification of practices and strategies that might have prevented them.

TZD Safe Roads grants focus on connecting crash data and statewide efforts with local collaborations and activities. It also makes use of research and evaluation studies that point to the activities and best practices that have the greatest impact in reducing traffic deaths and serious crashes.

**Time:** The time involved in this effort would include the time to apply for the grant, the coordinators time to set up and hold meetings and follow up on activities in the community. Time of coalition members is typically donated by their employers if it is during the normal business day.

**Funding:** Funding ranges from \$5,000 to \$28,000. A community may apply to the TZD Safe Roads Program each year for funding to support a coalition coordinator position and basic materials for activities. The request for proposals will be on the OTS website [www.dps.state.mn.us/ots](http://www.dps.state.mn.us/ots).

**Who is currently working on this in your county?** To find out more about this effort or what is currently occurring in your county, please go to [www.dps.mn.us/ots](http://www.dps.mn.us/ots) or contact Laura Turek at [laura.turek@state.mn.us](mailto:laura.turek@state.mn.us).

### Barriers to Success

- Low public support for traffic safety
- Lack of awareness of the target groups over represented in the data
- Funding and time for coordination
- Lack of continuity of effort due to staff turnover

### Potential Agency Partners

- Minnesota State Patrol, county sheriff's offices, city police departments
- School administrators or community members impacted by traffic crashes
- Judges and attorneys
- County public health or county engineers
- Regional partners and neighboring counties

### Specific Actions a County Could Take to Support Strategy

- Call a meeting with several community members who also have an interest in traffic safety. Typical options are law enforcement, ambulance or hospital staff, school administrators or driver's education instructors and public health educators.
- Allow time for you or your staff to attend and support coalition meetings and events.

## Regional Partnerships for Traffic Safety



*Towards Zero Deaths (TZD) Regional Steering Committees and Workshops*

**Description:** The role of the regional steering committees in the TZD effort is to work with local partners to reduce deaths and serious injuries on local roadways. This can be accomplished by reaching out to the counties and communities within the region to create awareness of current traffic crash trends and presenting evidence-based solutions to prevent crashes (for engineering, enforcement, education and emergency medical services). The steering committee can gather key stakeholders to create an action plan to implement traffic safety projects in the region.

**Time:** The time involved in this effort would include the time to attend steering committee meetings once per month, assist in community level activities in the region and contribute to the planning and attend the spring workshop in your region.

**Funding:** The primary funding for each region comes from three state sources: the Minnesota Department of Transportation, Office of Traffic, Safety and Technology and the Operations budget in each district and the Department of Public Safety, Office of Traffic Safety.

**Who is currently working on this in your county?** To find out more about this effort or what is currently occurring in your county, please go to [www.minnesotatzd.org](http://www.minnesotatzd.org) or contact Laura Turek at [laura.turek@state.mn.us](mailto:laura.turek@state.mn.us).

### Barriers to Success

- Low public support for enforcement
- Lack of support from local business owners for traffic safety
- Low support for enforcement from community leadership (Mayors, business owners, city council or county commissions, school boards)

### Potential Agency Partners

- Minnesota State Patrol, county sheriff's offices, city police departments
- School administrators
- Judges and attorneys
- Community members impacted by traffic crashes
- County public health
- County engineers

### Specific Actions a County Could Take to Support Strategy

- Attend your regional workshop as a traffic safety stakeholder and encourage your colleagues to attend.
- Contact your regional coordinator to be added to the mailing list for email and event updates.
- Contact your regional coordinator to be added to the steering committee.
- Offer your skills to a project that the region is undertaking. Examples include workshop planning, seatbelt use observation studies or speaking at a media event.

## Worksite Policy on Traffic Safety Laws



### Network of Employers for Traffic Safety

**Description:** Minnesota Network of Employers for Traffic Safety (NETS) is a non-profit, public-private partnership, dedicated to reducing traffic deaths and injuries within our nation's work force. Resources for employers in the community are available through NETS. Businesses in the community can be encouraged to establish traffic safety policies for their employees. They can also proactively educate their staff about key traffic safety messages. The NETS Program offers tools, such as brochures, sample policies/procedures, interactive website ([www.minnesotasafetycouncil.org/nets/](http://www.minnesotasafetycouncil.org/nets/)) and lectures to help initiate/enforce traffic safety programs in businesses.

**Time:** The amount of time to implement worksite strategies can vary from the five minutes to five hours. Examples of strategies include forwarding emails about an upcoming enforcement effort to all employees or placing a poster in the break room, organizing a lunch presentation for staff on traffic safety or placing banners in employee parking lots.

**Funding:** There are free promotional materials, newsletters and staff available to give presentations through the Network of Employers for Traffic Safety and the Office of Traffic Safety.

**Who is currently working on this in your county?** For more information on worksites involved in NETS in your county, traffic safety programs or model policies with education materials, contact Lisa Kons at 800-444-9150 or [kons@minnesotasafetycouncil.org](mailto:kons@minnesotasafetycouncil.org) or [www.dps.state.mn.us/ots](http://www.dps.state.mn.us/ots).

### Barriers to Success

- Lack of support for traffic safety from human resources or leadership at worksite
- Low public support for worksite policies
- Lack of enforcement of worksite policies
- Low public support for enforcement
- Low support for enforcement from community leadership (e.g. mayor, business owners, city council, county commissions, school boards)

### Potential Agency Partners

- Chambers of commerce
- Service clubs in the community (e.g. Rotary, Lions)
- County sheriff 's offices
- County public health

### Specific Actions a County Could Take to Support Strategy

- Forward OTS media release emails about the upcoming enforcement effort to all employees.
- Order posters or banners from the OTS website and place in the break room or employee parking lots.
- Contact NETS to organize a lunch presentation for staff or a booth at an employee health fair.
- Bring a sample distracted driving policy to your human resource department.

## Child Passenger Safety



### *Car Seat Clinics and Technician Training*

**Description:** Communities use car seat clinics to educate new or expecting parents. In order to hold a clinic, a community would need at least one, but ideally six CPS technicians to be available for appointments with families. A CPS technician has to receive training to be able to provide:

- One-on-one CPS awareness education to families
- Presentations on traffic safety for parent classes, community groups, etc.
- Safety seat inspections at a clinic or by appointment
- Instruction for daycare / foster care child passenger safety classes.

**Time:** To become a CPS Technician you need to take a 32 hour course, which is typically done in three or four days. A clinic can be run as often as is needed and is usually run by appointment. Each appointment takes 30-45 minutes.

**Funding:** Upcoming classes and clinics are listed on our website, [www.buckleupkids.state.mn.us](http://www.buckleupkids.state.mn.us).

**Who is currently working on this in your county?** To find out more about this effort or what is currently occurring in your county, please go to <http://www.buckleupkids.state.mn.us/> or contact Heather Darby at [heather.darby@state.mn.us](mailto:heather.darby@state.mn.us).

### Barriers to Success

- Low employer support for technicians to keep up their certifications by working at clinics
- Shift in job duties may make clinic attendance difficult
- Technicians may find it difficult to stay certified due to time commitments
- Lack of funds set aside for the program
- Low support for enforcement of child passenger safety laws from community leadership (mayor, business owners, city council or county commissions, school boards)

### Potential Agency Partners

- Minnesota State Patrol, county sheriff's offices, city police departments
- County public health
- Hospitals
- EMS child passenger safety advisory board

### Specific Actions a County Could Take to Support Child Passenger Safety

- Encourage CPS training, especially with law enforcement, and support CPS as part of employee duties.
- Allow training time for instructors and technicians.
- Encourage community members to become instructors in order to keep technicians in the area current.

## Working with Parents of Young Drivers



### Information and Tools for Parents

**Description:** There are many ways the traffic safety community can reach out to and involve parents in their teen's driving. The first step is to offer basic information on the risks and the laws that impact new drivers. The second step is to empower parents to work with their teen consistently, create driving contracts, monitor and, if needed, withdraw the teen's license.

#### Information for Parents from Local School

A simple method to get information to parents is posting information on teen driving laws on the school website. Some communities have mailed out letters from the school resource officer to parents highlighting risks to teens and laws for new drivers. For teen driving laws, see the "Teen Drivers" page on the Office of Traffic Safety website ([www.dps.mn.us/ots](http://www.dps.mn.us/ots)).

#### Parent Class through Driver Education Programs

Experts agree that more effective parental involvement holds significant promise for further reducing teen crashes. Implementing a parental education module in driver education programs across the state can enhance parental awareness of teen driver safety issues. For parent education curriculum content ideas, see the "Teen Drivers" page on the Office of Traffic Safety website ([www.dps.mn.us/ots](http://www.dps.mn.us/ots)).

#### Teen-Parent Contract and Teen Driving Skills Checklist

Provide tools to high schools and driver schools in your areas to encourage parents to set limits with their teen driver, and to closely monitor their teen's driving skills. For teen driving tools, see the "Teen Drivers" page on the Office of Traffic Safety website ([www.dps.mn.us/ots](http://www.dps.mn.us/ots)).

#### Teenage Monitoring Systems

There is technology being used to assist parents in monitoring youth driving behavior. Intense monitoring of teenage driving with electronic devices is becoming a popular approach to young driver safety issues. It could be used as a tool to support Graduated Drivers Licensing laws (GDL) and collaboration between teens and parents about the importance of safe driving. There are several technologies in development (e.g. University of Minnesota, [www.humanfirst.umn.edu](http://www.humanfirst.umn.edu), Iowa) and those already commercially available through insurance companies (American Family, [www.drivecam.com](http://www.drivecam.com)). There are various options available for implementation as part of an insurance program, a field trial or a parent buying an application for a teen's Smartphone. For studies on this technology, go to <http://www.drivecam.com/our-markets/family/testimonials-and-research-proof>.

Withdrawal of Parental Consent/Voluntary Surrender form (PS33061). This is the form parents can use to legally remove a child's license until they are 18 years old. Many parents do not know about this option. Educate your community about this item, and encourage parents to have a discussion with their teen about the privilege of driving and to make a teen/parent contract. The parent needs to set the expectations about wearing a seat belt, putting the cell phone out of reach, obeying the laws about speed and driving focused. In the case that the expectations are not met, the form can be used as the consequence. To get a copy of the form go to <http://www.dps.state.mn.us/dvs/PDFForms/FormFrame.htm>

**Time:** The time for these activities can range from one hour to create a letter to the editor or to parents all the way to eight to ten hours monthly to staff and support a parent program for driver education.

**Funding:** Free resources for parent driver education class and parent tools are available from the OTS. Costs may be needed for instructor time and facility costs to hold a parent class. If letters are mailed, the mailing costs could be shared with the school if letter goes out with another mailing or a local insurance company. The cost of the Drive Cam program may be higher (see website).

**Who is currently working on this in your county?** To find out more about this effort or what is occurring in your county, please go to [www.dps.mn.us/ots](http://www.dps.mn.us/ots) or contact Gordy Pehrson at [gordy.pehrson@state.mn.us](mailto:gordy.pehrson@state.mn.us).

#### Barriers to Success

- Lack of parent awareness for risks, laws and tools to use with teen
- Competing interests from parents (e.g. work commitments, other children's activities)
- Lack of support from school administration or teachers
- High expense and time intensive program (specific to Drive Cam)

#### Potential Agency Partners

- School administration and staff
- Local insurance companies
- Driver's education instructors
- Parents
- County public health
- Minnesota State Patrol, county sheriff's offices, city police departments

#### Specific Actions a County Could Take to Support Strategy

- Coordinate a mailing of parent letters to parents with teen driving information. It is common to share costs with the school to include the letter with another mailing.
- Facilitate parent education classes with the driver education programs in your county.
- Make parents aware of the Withdrawal of Parental Consent/Voluntary Surrender form by explaining its purpose at parent/student events (sports meetings, school conferences).
- Write a letter to the editor to make parents aware of teen driving risks, laws, the important role they play in developing a safe driver.
- Encourage high visibility enforcement near popular teen hang-outs, schools, during periods of greater risk (prom, graduation, 4th of July, late summer before school starts).

## Mock Traffic Crash at Local Schools



Mock Crash Guide

**Description:** A mock crash is a simulated emergency response to a crash scene. Mock crashes are usually conducted for groups of students at high schools or colleges. The goal of a mock crash is to educate teenagers and young adults about the dangers of impaired driving and the importance of seat belts. Community groups can organize this presentation with law enforcement, emergency services and schools. A comprehensive guide is available to help guide and organize this event. It is a good idea to focus any mock crash events in October or May, as it will support seat belt enforcement efforts going on statewide.

**Time:** Time investment can vary depending on the role, however the planning process takes three to five months. Preparation the day of the event can be four to five hours and the event itself is at least one hour.

**Funding:** Funding for a mock crash generally includes food and beverage for volunteers, staff time from the school involved and the community volunteers and minimal supply costs. Mock Crash Guide is available on [www.dps.state.mn.us/ots](http://www.dps.state.mn.us/ots) , click on “Safe Communities.”

**Who is currently working on this in your county?** Many local high schools may be hosting a mock crash each year, or every other year. Contact local principals in your county or the local driver’s education instructors. To find out more about this effort or what is occurring in your county, please go to [www.dps.state.mn.us/ots](http://www.dps.state.mn.us/ots) or contact Laura Turek at [laura.turek@state.mn.us](mailto:laura.turek@state.mn.us). For up to date contact lists for high school student groups or drivers educators, contact Gordy Pehrson at [gordy.pehrson@state.mn.us](mailto:gordy.pehrson@state.mn.us).

### Barriers to Success

- Lack of community support for event
- Difficulty in school scheduling or with the weather

### Potential Agency Partners

- EMS in the community or county public health educators
- Minnesota State Patrol, county sheriff’s offices, city police departments
- School administration and staff, coaches, parents or drivers education instructors

### Specific Actions a County Could Take to Support Strategy

- Coordinate an event with teachers, coaches or driver educators by connecting with other traffic safety stakeholders and the high school, technical school or college.
- Write a letter to the editor after the event to give it more publicity.
- Encourage high visibility enforcement near popular teen hang-outs, schools, during periods of greater risk (prom, graduation, 4th of July, late summer before school starts, etc).

## Crash Video Targeted to Minnesota Youth



*How to Save a Life Video or Young Forever*

**Description:** How to Save a Life and Young Forever videos were created by the Minnesota State Patrol and feature tragic stories from teens and young adults involved in fatal or serious injury crashes in Minnesota. The video features hard-hitting, graphic images of crash scenes married with relevant music tracks. The video must be presented by a state trooper and is a great piece to show at high schools and community groups. To bring this video to your community, contact your local State Patrol District.

**Time:** The program and video together run for 60 minutes in a class room or auditorium setting.

**Funding:** The program is offered for free through the Minnesota State Patrol.

**Who is currently working on this in your county?** If you would like a Trooper to come and present Young Forever to your group contact the Minnesota State Patrol District in which you reside. For a list of Minnesota State Patrol Districts click on District Index.

<http://www.dps.state.mn.us/patrol/distindex/index.htm>. For more specific questions, please contact Lt. Eric Roeske, [eric.roeske@state.mn.us](mailto:eric.roeske@state.mn.us).

### Barriers to Success

- Lack of awareness of film availability
- Availability of state patrol troopers to give presentation with the video
- Availability of time in school schedule for presentation

### Potential Agency Partners

- Minnesota State Patrol
- Drivers education instructors
- School administration and staff
- Coaches and parents
- County public health educators
- Regional partners and neighboring counties

### Specific Actions a County Could Take to Support Strategy

- Coordinate a video and presentation with teachers, coaches or driver educators by contacting the State Patrol district for your county at [www.dps.mn.us/patrol](http://www.dps.mn.us/patrol).
- Write a letter to the editor after the presentation to give it more publicity in the community.
- Encourage high visibility enforcement near popular teen hang-outs, schools, during periods of greater risk (prom, graduation, 4th of July, late summer before school starts, etc).

## Alternative Rides Home



### Safe Ride Guide

**Description:** A strategy embraced by many communities to prevent impaired driving is to provide alternative transportation services. The goal of this effort is to provide critical information about alternative transportation or safe ride programs to individuals or communities interested in providing similar services. With a solid understanding of the elements necessary to build strong safe ride programs, interested stakeholders can create an effective local program that provides a valuable service while reducing impaired driving in their communities. The Safe Ride Guide is available on [www.minnesotatzd.org](http://www.minnesotatzd.org).

**Time:** Program development can take between three months and one year to get the system created and the users adjusted to the model. It helps to have a coalition coordinator or community member who has several hours a week to work on logistics and call meetings to communicate with stakeholders.

**Funding:** The amount of funding needed can vary from \$300-\$800 per month to print, advertise and pay the time for coordination. In some programs the local beer distributor pays a portion, the bar owners pay a portion and the rider pays a portion of each ride.

**Who is currently working on this in your county?** In 2011, there are several counties working to develop Safe Ride programs: Isanti, Kanabec, Pine, Wright, Sherburne, Otter Tail. To find out more about this effort or what is occurring in your county, please go to [www.dps.mn.us/ots](http://www.dps.mn.us/ots) or contact Jean Ryan at [jean.m.ryan@state.mn.us](mailto:jean.m.ryan@state.mn.us).

### Barriers to Success

- Low public awareness of program
- Lack of alternative transport
- Lack of support for program from enforcement
- Lack of early involvement from liquor establishment owners
- Lack of funding

### Potential Agency Partners

- Local liquor establishment owners and workers and local beer distributors
- Local judges and attorneys
- Minnesota State Patrol, county sheriff's offices, city police departments

### Specific Actions a County Could Take to Support Strategy

- Write letters to the editor during pre-media efforts in support of law enforcement efforts for DWI.
- Assist with identifying liquor establishments or beer distributors interested in participating in the program.
- Discuss the program with local government officials.
- Advertise the program to your colleagues and friends.
- Encourage law enforcement to partner with bars involved in the program to handle issues as they arise.

## Intensive Supervision Programs for DWI Offenders



DWI Courts

**Description:** A DWI Court is a team-based approach that seeks to enhance public safety through the reduction of DWI recidivism by providing effective chemical dependency evaluation and treatment, intensive supervision and offender accountability. A DWI Court team requires judicial leadership, prosecutors, defense attorneys, probation and law enforcement officers, a case management worker, and a network of relevant and supportive community resources to work with repeat DWI offenders who have substance abuse issues. The DWI Courts follow ten guiding principles: 1) target the population by identifying a subset of the DWI offender population for inclusion in the DWI court program, 2) perform a clinical assessment of the impaired-driving offender, 3) develop a treatment plan, 4) supervise the offender, 5) forge agency, organization, and community partnerships, 6) take a judicial leadership role, 7) develop case management strategies, 8) address transportation issues, 9) evaluate the program, and 10) create a sustainable program.

**Time:** Court time is two to four hours per week for all team members. Probation and DWI Court Program Coordinators require additional time for their responsibilities.

**Funding:** OTS provides grants to assist new DWI courts that average \$92,000 annually. For more information on DWI Courts, go to <http://www.mncourts.gov/?page=626>.

**Who is currently working on this in your county?** In 2011, there are ten DWI Courts in Minnesota. They are located in Beltrami, Cass, Crow Wing, Hennepin, Itasca, Lake of the Woods, Ottertail, Ramsey, Roseau and So. St. Louis County.

To find out more about this effort or what is occurring in your county, please go to [www.dps.mn.us/ots](http://www.dps.mn.us/ots) or contact Jody Oscarson at [jody.oscarson@state.mn.us](mailto:jody.oscarson@state.mn.us).

### Barriers to Success

- Lack of funding
- Difficulty in finding replacement for team members

### Potential Partners

- State Court Administration Office
- Bureau of Indian Affairs
- City councils or county boards
- County attorneys

### Specific Actions a County Could Take to Support Strategy

- Write a letter to editor in support of DWI courts.
- Secure funding to support the program.
- Write a letter to city council members/county boards in support of DWI courts.
- Write a letter to your senator or representative in support of DWI courts.

## Reducing Impaired Driving in the Community



### Community Promotion of Ignition Interlock

**Description:** Ignition interlock is a breath testing system installed on a motor vehicle that is designed to prevent an individual from driving impaired. To start the vehicle, a driver is required to blow into a tube that measures their alcohol concentration (AC) level. In Minnesota, if the device detects alcohol at a 0.02 AC level or above the vehicle will not start. The device also requires the driver to provide additional breath samples randomly while they are driving to assure that the person driving the car is not impaired. Research has demonstrated that recidivism (re-offense) rates are reduced 64% while a person has ignition interlock installed. However, once it is removed, recidivism rates return to the level equivalent to those that did not install ignition interlock. Therefore, it is important to require DWI offenders to also participate in programs that will change long-term drinking and driving behavior.

**Time:** Time on ignition interlock can range from 90 days to six years.

**Funding:** Participants pay for the ignition interlock device. Currently the cost is approximately \$100 per month, which averages three to four dollars per day. Starting July 1, 2011, service providers will be required to provide an ignition interlock at a reduced rate for those that the Department of Public Safety has determined to be indigent.

**Who is currently working on this in your county?** To find out more about this effort or what is occurring in your county, please go to [www.dps.mn.us/ots](http://www.dps.mn.us/ots) or contact Jean Ryan at [jean.m.ryan@state.mn.us](mailto:jean.m.ryan@state.mn.us).

### Barriers to Success

- Low participation by DWI offenders
- Minimal consequences for driving illegally compared to the cost to reinstate driving privileges
- Misperception about ignition interlock – example: drivers can use a balloon to start their vehicle or ignition interlock is being “soft” on impaired drivers.
- Not understanding the public safety benefits of ignition interlock

### Potential Agency Partners

- Minnesota State Patrol, county sheriff’s offices, city police departments
- County public health educators
- Prosecuting attorneys
- Defense attorneys
- District court judges

### Specific Actions a County Could Take to Support Strategy

- Educate judicial partners on the benefits of ignition interlock and encourage their use.
- Educate the community on the benefits of ignition interlock and how it can be used to enhance public safety.

## Motorcycle Training



**Description:** The Minnesota Motorcycle Safety Center offers a complete motorcycle safety package to accomplish this mission by providing high-quality motorcycle safety education and training through on-cycle and classroom rider training courses; media relations, events, campaigns, and informational materials; and third party skills testing for motorcycle license endorsement through the Basic Rider Course and evening motorcycle testing project at select DVS Exam Stations.

The Minnesota Motorcycle Safety Center relies on the support of the motorcycling community, dealers, clubs, and motorcycle rights organizations. These groups serve as partners for events such as the annual Washout, rider training course promotion, education and outreach, and through a motorcyclist advisory committee. All of this information is available at [www.motorcyclesafety.state.mn.us](http://www.motorcyclesafety.state.mn.us)

**Time:** Courses take between half and full weekend days.

**Funding:** Costs of seminars and courses can range from \$20-\$160 dollars.

**Who is currently working on this in your county?** To find out more about this effort or what is occurring in your county, please go to [www.dps.mn.us/ots](http://www.dps.mn.us/ots) or contact Bill Shaffer at [William.shaffer@state.mn.us](mailto:William.shaffer@state.mn.us) See what courses are offered in Minnesota by going to <http://cfapp.southcentral.edu/motorcycle/>

### Barriers to Success

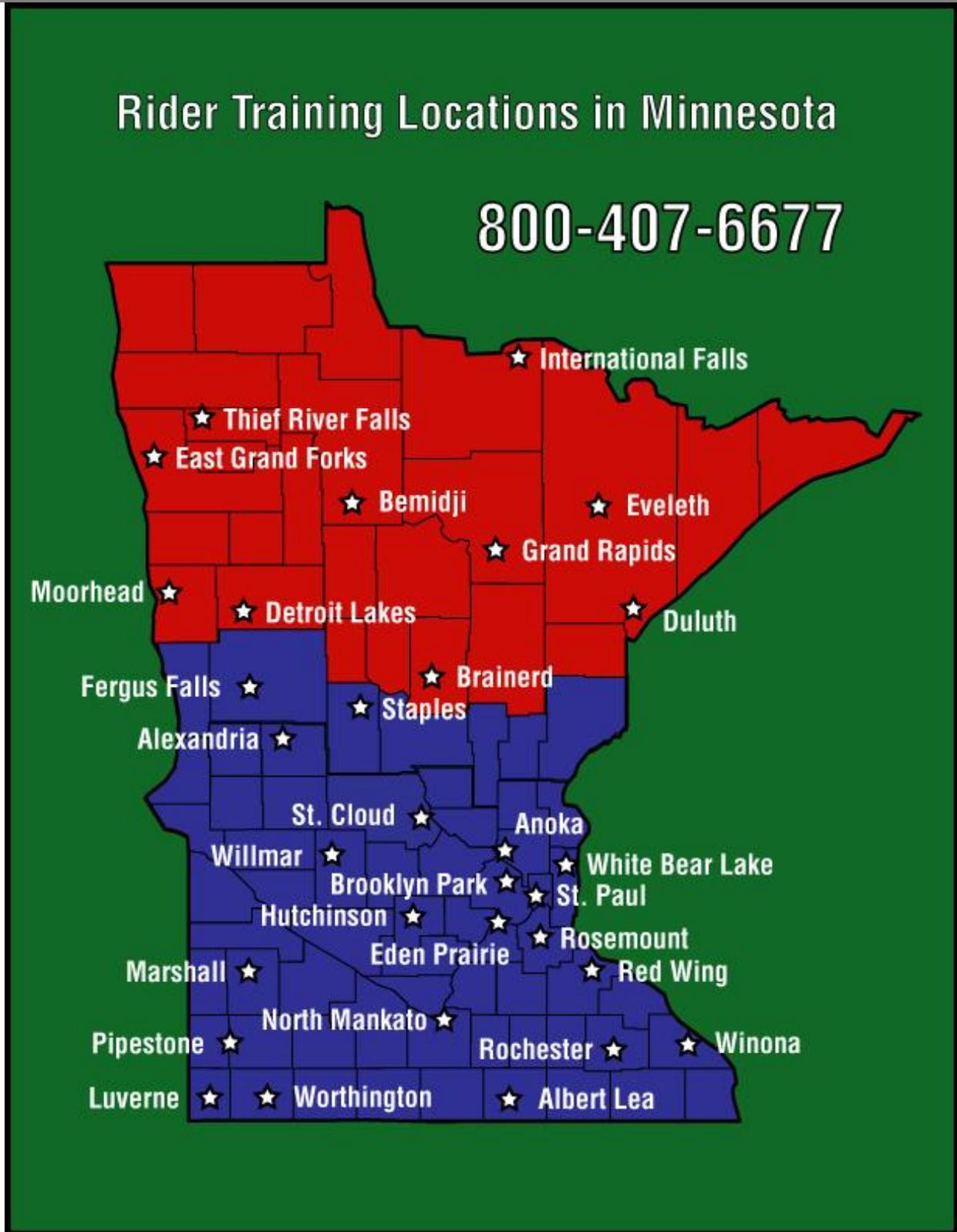
- Low social support for training, helmets and high visibility gear
- People don't realize the benefits of receiving training
- Motorcyclists don't realize the great availability of training options

### Potential Agency Partners

- Motorcycling community
- Dealers
- Clubs
- Motorcycle rights organizations
- Minnesota State Patrol, county sheriff's offices, city police departments
- Regional partners and neighboring counties

### Specific Actions a County Could Take to Support Strategy

- Educate and encourage riders to get trained and licensed.
- Educate the community on awareness of motorcycles on the roads.



## 4.8 Minnesota Department of Public Safety Office of Traffic Safety Programs

- *Toward Zero Deaths (TZD) Safe Roads Community Coalitions* — Public health groups and other advocates partner with law enforcement to promote enforcement and traffic safety messages locally.
- *Communications/Educational Outreach/Paid Media* — Deliver messages to media outlets via news releases/advisories/interviews, etc.; provide tools/materials for communities to promote messages locally; and conduct year-long \$2.5 million advertising buys targeting key demographics.
- *HEAT (Highway Enforcement of Aggressive Traffic)* — Partnership between MnDOT and State Patrol to enforce speed limits and educate motoring public on dangers of unsafe speeds.
- *Safe & Sober* — Statewide, aggressive overtime traffic safety enforcement and education efforts, federally funded.
- *Night CAP (Nighttime Concentrated Alcohol Patrol)* — Enhanced DWI enforcement and education efforts in the counties with the highest number of alcohol-related fatalities and serious injuries.
- *DWI Courts and Court Monitoring* — Intensive supervision methods used with DWI offenders.
- *Alternative Rides Home Programs* — Programs that create safe transportation options in rural areas to prevent impaired driving.
- *Worksite Policies and Training* — Tools for employers to educate and enforce traffic safety policies with employees.
- *Motorcycle Safety Training Centers*— Get information on rider training, licensing and public information and education.

**Minnesota Department of Public Safety Office of Traffic Safety**  
**[www.dps.state.mn.us/ots](http://www.dps.state.mn.us/ots)**