Moving Towards Zero Deaths on WMSRDC Michigan Roads

2017 Regional Transportation Safety Plan







WMSRDC | WEST MICHIGAN SHORELINE REGIONAL DEVELOPMENT COMMISSION

MDOT Michigan Department of Transportation

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Regional Transportation Safety Plan

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The Regional Transportation Safety Plan for
the West Michigan Shoreline Regional Development Commission
has been accepted by the Steering Committee on June 2nd, 2017.

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Executive Summary

The overarching goal of the Regional Transportation Safety Plan (RTSP) is the reduction of fatal and serious injury crashes within the West Michigan Shoreline Regional Development Commission. The process is directed by the FHWA guiding document, "Developing Safety Plans: A Manual for Local Rural Road Owners" and includes the following six steps:

1. Establishing Strong Leadership & Advocates
2. Analyzing Safety Data
3. Determining Emphasis Areas
4. Identifying Strategies & Countermeasures
5. Prioritizing and Incorporating Strategies
6. Evaluating and Updating the RTSP

This report includes the initial five steps of the process while the final step is conducted on a regular basis to help ensure that the RTSP remains current and relevant to the local communities it is designed to serve. Additionally, while typical reports include countermeasures designed around engineering related treatments, the RTSP employs the four E's when addressing the identified Emphasis Areas, including:

- Engineering,
- Education,
- Enforcement, and;
- Emergency Services.

As mentioned, during this process a high-level analysis of historic crash data available in the area was completed to help assess existing conditions and identify potential Emphasis Areas to guide specific crash reduction efforts. Additional consultation meetings were conducted with a wide range of stakeholders including representatives from each of the four E's. Based on the combined review of the crash analysis and stakeholder guidance and feedback, eight Emphasis Areas were identified for the Region, listed in alphabetical order below:

- Driver Age Related Concerns
- Driver Behavior Related Concerns
- Impaired Driver Involved Crashes
- Intersection Related Crashes
- Motorcycle Involved Crashes
- Roadside Related Concerns
- Signs & Delineation
- Vulnerable Road User Involved Crashes

The selected Emphasis Areas and guidance from region stakeholders were used to categorize practical treatment strategies for addressing the identified target crashes. Detailed treatment information and information from the crash analysis and stakeholder consultation is available in the report and accompanying appendices.

Glossary of Terms

4 E's	Engineering, Enforcement, Education and Emergency Services
ADA	Americans with Disabilities Act
ARIDE	Advance Roadside Field Sobriety Test Program
CMAQ	Congestion Mitigation and Air Quality Improvement (CMAQ) Program
Crash Severity	Fatal injury (K), incapacitating injury (A), non-incapacitating injury (B), possible injury (C) or property damage only (O)
DRE	Drug Recognition Expert Program
EMS	Emergency Management Systems
FHWA	Federal Highway Administration
GTSAC TIM	Governor's Transportation Safety Advisory Committee Traffic Incident Management Action Team
MDOT	Michigan Department of Transportation
MI-TIME	Michigan's Traffic Incident Management Effort
MPO	Metropolitan Planning Organization
MVMT	Million Vehicle Miles Traveled
OHSP	Office of Highway Safety Planning
RTSP	Regional Transportation Safety Plan
SFST	Standard Field Sobriety Testing Program
SR2S	Safe Routes to School Program
STP	Surface Transportation Improvement Grants
TAP	Transportation Alternatives Program
TIM	Traffic Incident Management
Trunkline	The State Trunkline Highway System consists of all state highways in Michigan, including those designated as Interstate (I-), United States Numbered (US-), or State Trunkline (M-) highways.
TSN	Traffic Safety Network
WMSRDC	West Michigan Shoreline Regional Development Commission, which includes Lake, Mason, Muskegon, Newaygo, and Oceana Counties.

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1 Introduction

The Michigan Department of Transportation (MDOT) has been working towards zero deaths on Michigan roadways. While substantial progress has been made at the state and local levels, additional assistance and direction is required. This is due, in part, to the fact that while only 19 percent of the United States population lives in rural areas, roughly 54 percent of all traffic fatalities occur there[1]. In addition, the rural fatality rate is roughly 2.6 times higher than the urban fatality rate[2]. A significant portion of these crashes, roughly one quarter, occur on non-federal aid highways[3]. As a part of this drive for progress, the Department has been working with regional planning councils and commissions to help facilitate the development of Regional Transportation Safety Plans (RTSP). The intent of these RTSP is to collect and analyze crash data and other safety information for a more locally focused analysis and combine that with the knowledge and concerns of the local agencies and citizens to help drive down the occurrence of fatal and incapacitating injury crashes.

1.1 Background

The MDOT has taken steps to support the development of RTSPs for the 14 State Planning and Development Regions in Michigan based on each of the local planning commissions or councils. The intent is to utilize local knowledge and expertise as well as existing or potential inter-agency relationships to assist in the development process and future revisions to the plan. The focus area for this RTSP is the area encompassed by the West Michigan Shoreline Regional Development Commission (WMSRDC), consisting of Lake, Mason, Muskegon, Newaygo, and Oceana counties. Figure 1 provides the geographic extent to be covered under this plan.

The goal of this document, as previously stated, is to help provide local agencies with guidance regarding local areas of concern identified during the development and consultation process. From these areas, a series of treatment strategies are presented which come from any of the four E's; Engineering, Education, Enforcement, and Emergency Services. Upon completion of the final report, local agencies will be responsible for the evaluation and maintenance of the plan, to ensure that it reflects the changing needs and characteristics of the Region.

[1] National Highway Traffic Safety Administration, National Center for Statistics and Analysis, Traffic Safety Facts, Rural/Urban Comparison, 2013 Data (PDF), DOT HS 812 181
[2] FHWA Highway Statistics (2013) - http://www.fhwa.dot.gov/policyinformation/statistics/2013/
[3] Ibid.

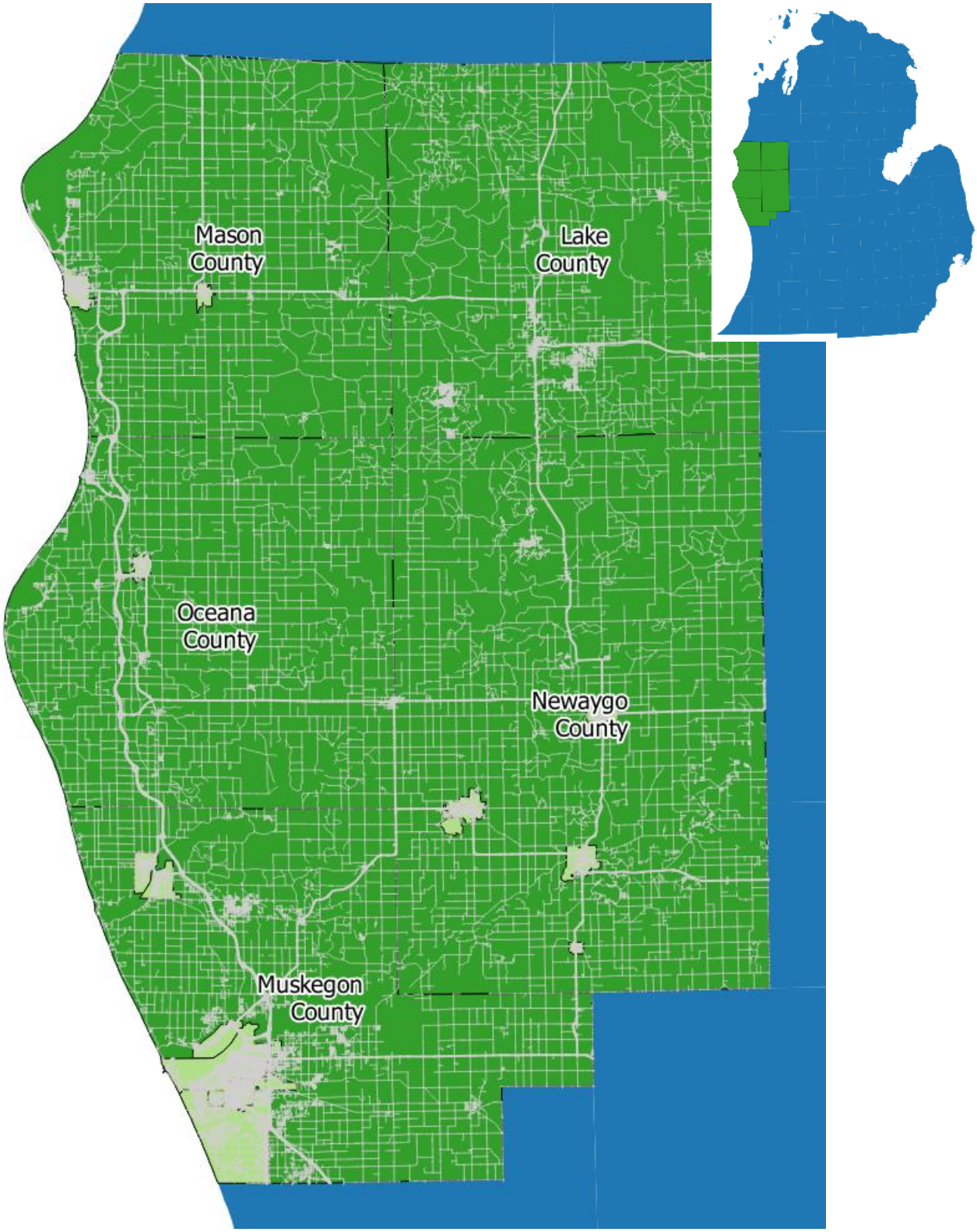


Figure 1 - West Michigan Shoreline Regional Development Commission Counties

1.2 Mission, Vision & Goals

The mission of the WMSRDC RTSP is guided by the State's Strategic Highway Safety Plan and is as follows:

Improve traffic safety in the West Michigan Shoreline Region by fostering effective communication, coordination, and collaboration among public and private entities.

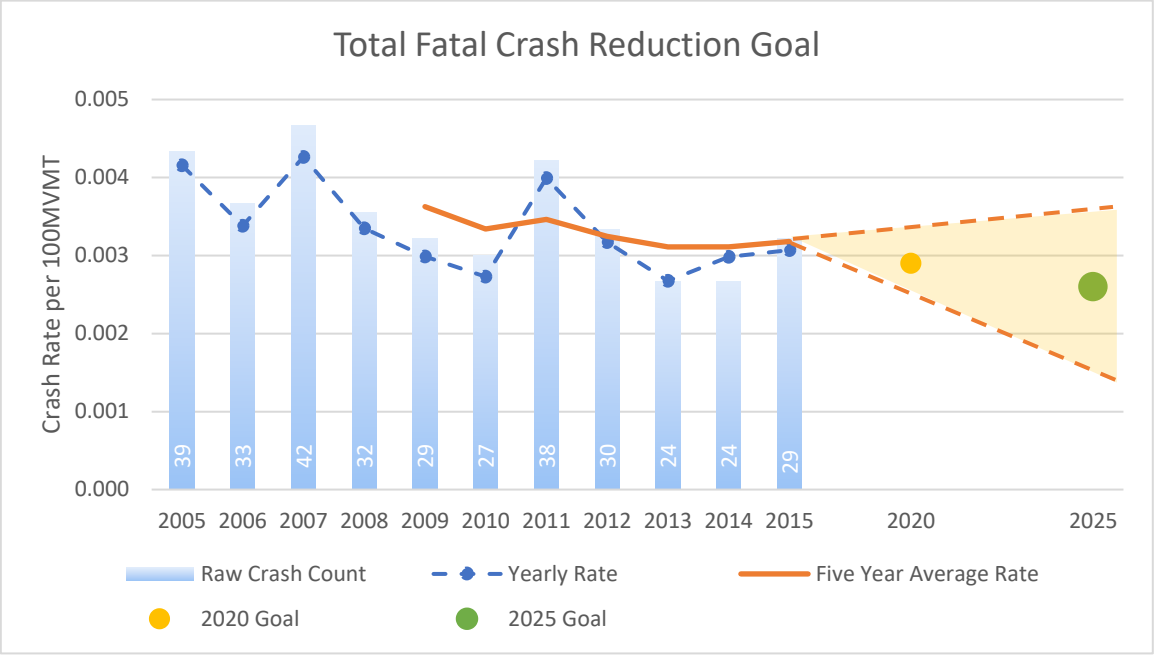
This mission supports the more general vision commonly adopted by the State of Michigan and at various municipal levels regarding transportation safety. That is, the desire to work towards significant reductions in traffic fatalities, consequently reducing the prevalence of other crash severities as well. This vision is commonly phrased as:

Toward Zero Deaths on West Michigan Shoreline Region Roadways.

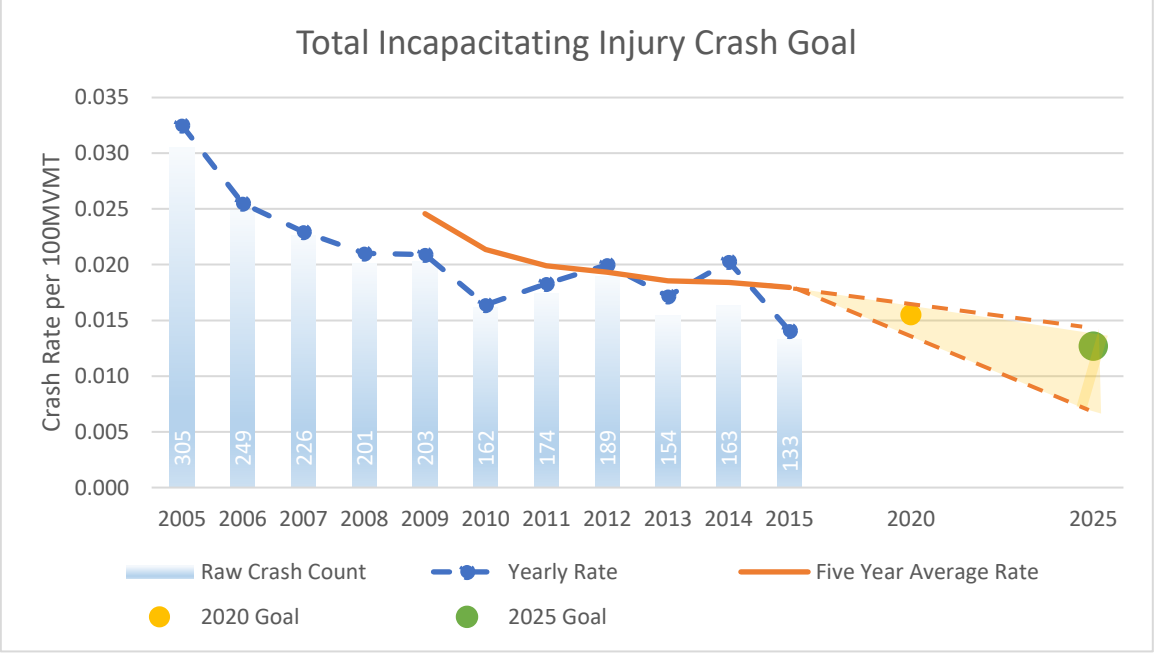
The goals of the RTSP take the mission and vision a step further and ties them to specific targets for the plan in terms of real values and measurable targets. The following goals are based on the crash history experienced in the Region, the five-year rolling average for the 2010 – 2014 period, and concerns raised by local stakeholders.

Each goal is followed by a graph which includes the targets measured in crashes per one hundred million vehicle miles traveled (crashes per 100MVMT) as well as the raw yearly crash total for each category. Each measurement is important to consider in tandem. The crash rate includes the effects of exposure as crashes tend to increase with increases in traffic volumes. This aspect is omitted when viewing only the raw crash counts. The raw counts, however, are more easily grasped and can be used to counter potentially misleading crash rate reductions which could be due to lower traffic volumes instead of raw crashes.

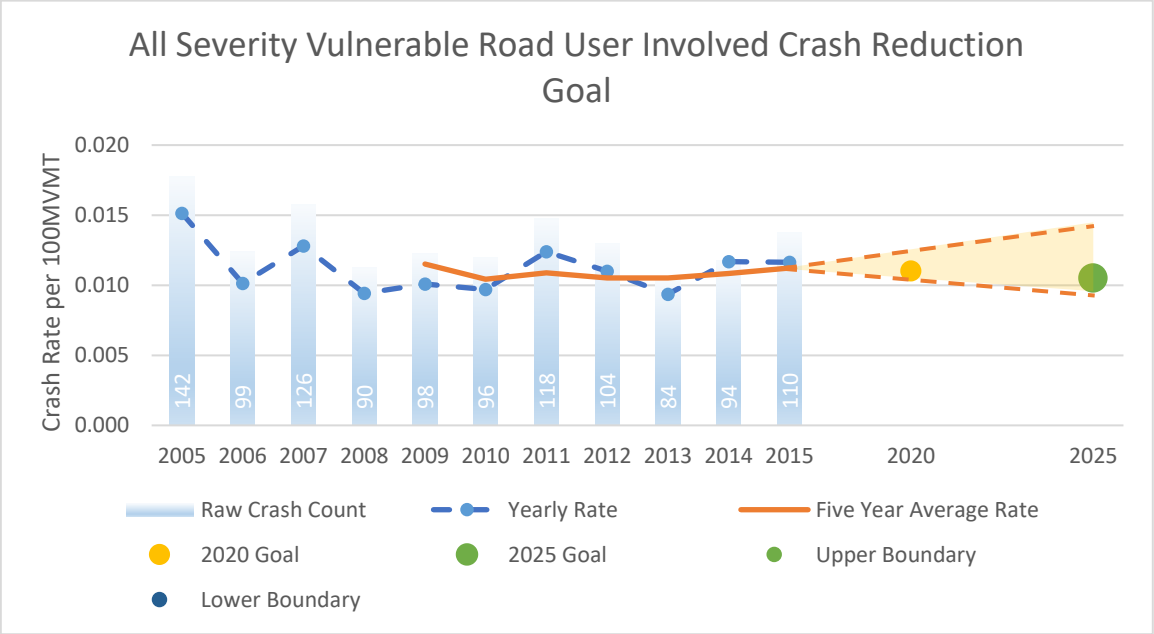
Reduce the traffic fatality rate by approximately 15% from 0.0031 crashes per 100MVMT in 2015 to no more than 0.0026 crashes per 100MVMT in 2025.



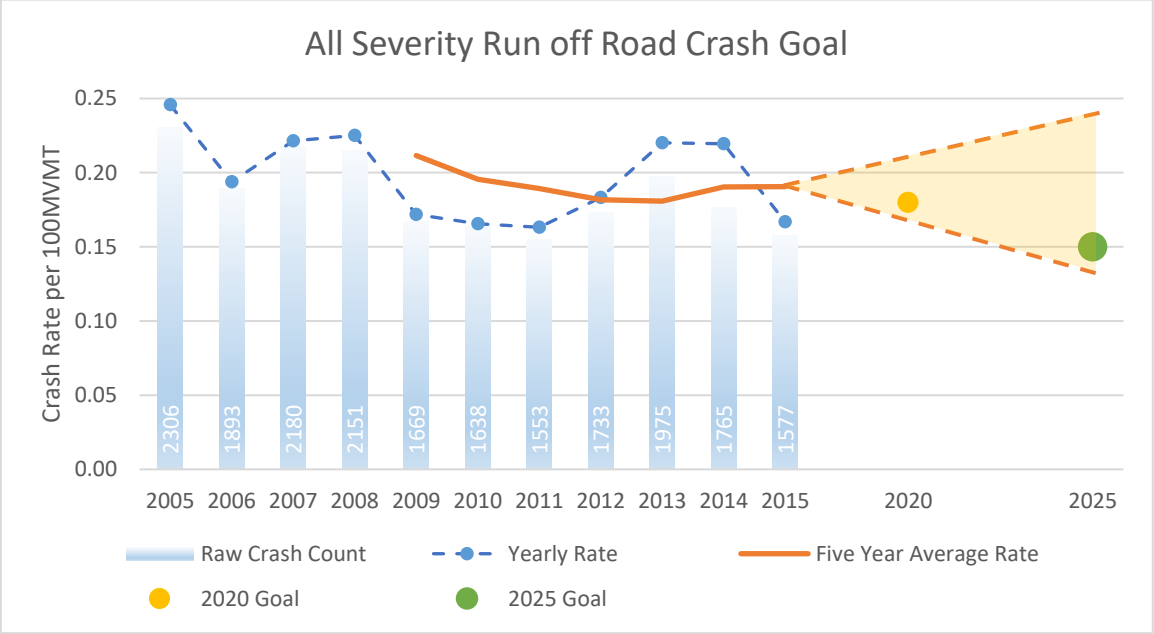
Reduce the incapacitating injury crash rate by 10% from 0.0141 crashes per 100MVMT in 2015 to no more than 0.0127 crashes per 100MVMT in 2025.



Reduce the vulnerable road user crash rate by 10% from 0.116 crashes per 100MVMT in 2015 to no more than 0.105 crashes per 100MVMT in 2025.



Reduce the run off road crash rate by 10% from 0.167 crashes per 100MVMT in 2015 to 0.150 crashes per 100MVMT in 2025.



Identify and implement three collaborative (i.e. multi-disciplinary) safety initiatives by 2022.

1.3 Introduction to the Four "E's" of Safety

While a significant portion of transportation safety studies tend to focus on the potential to employ engineering safety treatments, potential countermeasures considered for the RTSP also include strategies related to enforcement, education and emergency services. This is designed to better leverage the various components, related agencies and opportunities to reduce the prevalence of traffic crashes in addition to engineering improvements. Figure 2 provides a summary of each of the 4 E's and examples of treatments related to each.

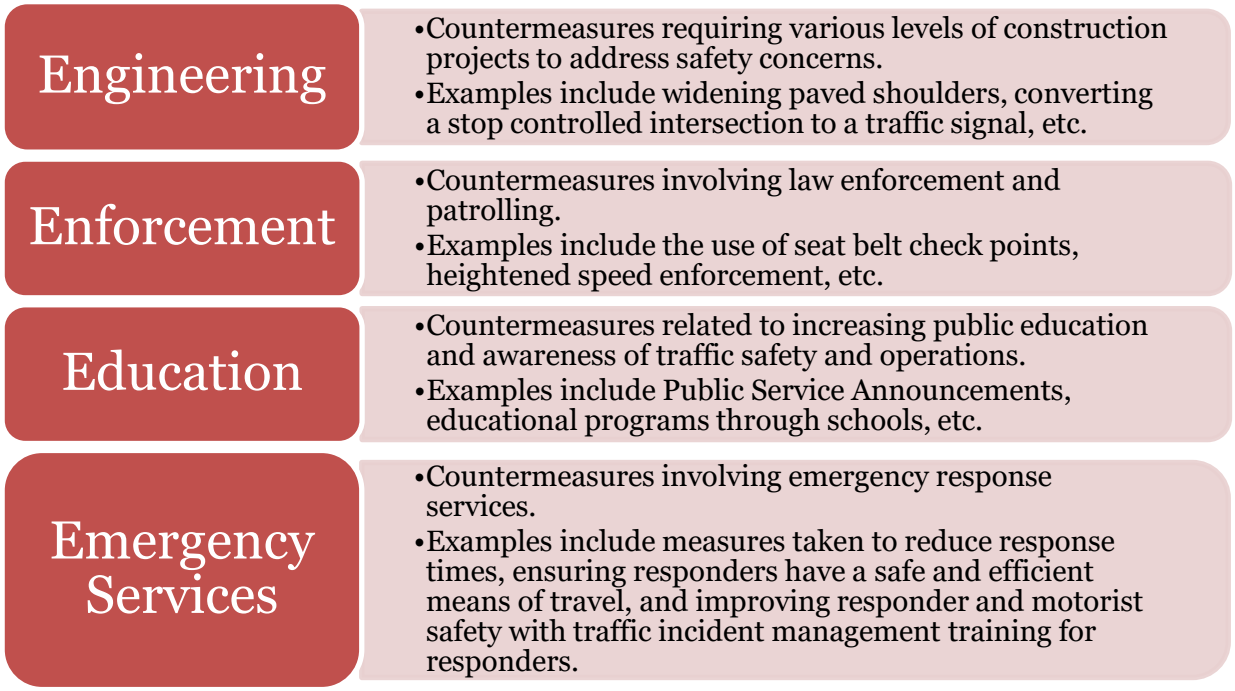


Figure 2 - Four "E's" of a Regional Transportation Safety Plan

2 Regional Transportation Safety Plan Methodology

Crash data for the region was obtained from the Michigan Department of Transportation (MDOT). An initial crash analysis consisted of a review of historic crash data from 2005 through 2014 to review the high-level trends over this time period. More in-depth analysis has been conducted on the data collected from 2010-2014 with an addendum added for available 2015 data. This information was used to help guide initial discussions with the Steering Committee and stakeholders as discussed in the following sections.

2.1 Crash Data Analyses, 2010-2014

A crash analysis was conducted for the entire five county region to develop a profile of a number of significant crash statistics. It should be noted that deer involved crashes have been excluded from the analysis. Where possible, county and region wide crash rates were used for analysis and comparisons as they take exposure rates into account. This helps to normalize the crash information by taking traffic volumes into account and allowing for a fairer comparison. Figure 3 shows the comparison of each county's average portion of yearly vehicle miles traveled versus their yearly average portion of fatal and incapacitating injury crashes in the region.

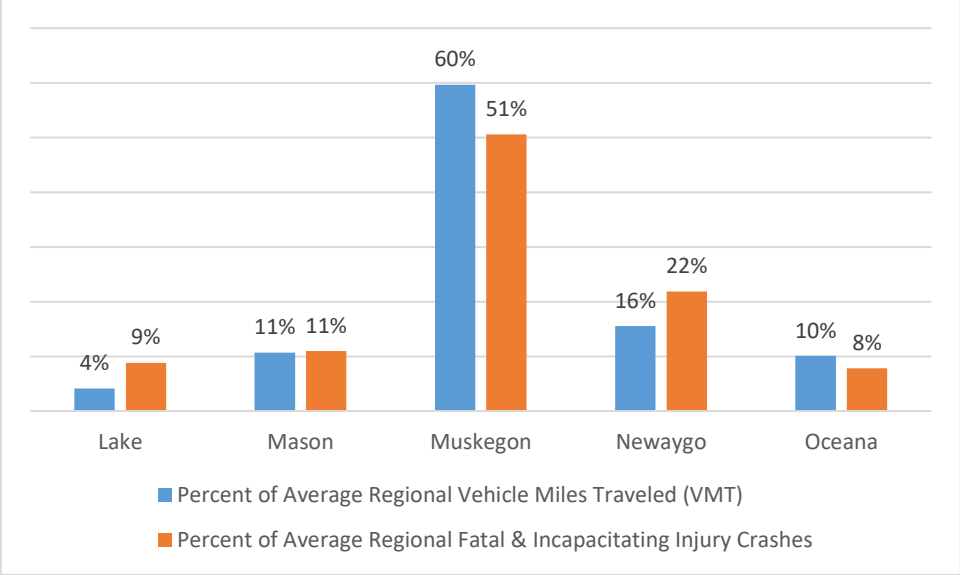


Figure 3 - Comparison of Regional VMT vs. Fatal & Incapacitating Injury Crashes

As illustrated in the preceding figure, Lake and Newaygo Counties have disproportionately higher percentages of the average yearly fatal and incapacitating injury crash counts when compared to their portions of the average yearly VMT. The following tables and figures provide comparisons between the counties and the state as well as between trunkline and non-trunkline systems, among others. These comparisons help to provide a high-level understanding of how the network has been performing over the past five years. For clarification, the following definitions hold for the memo with additional clarification provided as needed.

- **Statewide Network** – Includes the full road network within the state, including the West Michigan Shoreline Region Development Commission, as well as local and state maintained roadways and associated crashes.
- **Regional Network** – Includes the full road network within the five county region including local and state maintained roadways and associated crashes.
- **Trunkline System** – Includes the state maintained roadway network including Interstate, US, and Michigan designated routes (I-, US-, and M-) and associated crashes.
- **Non-Trunkline System** – Includes the non-state maintained roads, i.e. *excluding* Interstate, US, and Michigan designated routes.

Figure 4 below provides a comparison in the crash severity distribution for the crashes which occurred in the state and in the region during the 2010 through 2014 period. The region has historically had a greater portion of fatalities and confirmed injuries when compared to the statewide total. This suggests that crashes in the region have a greater likelihood of resulting in a fatality or injury.

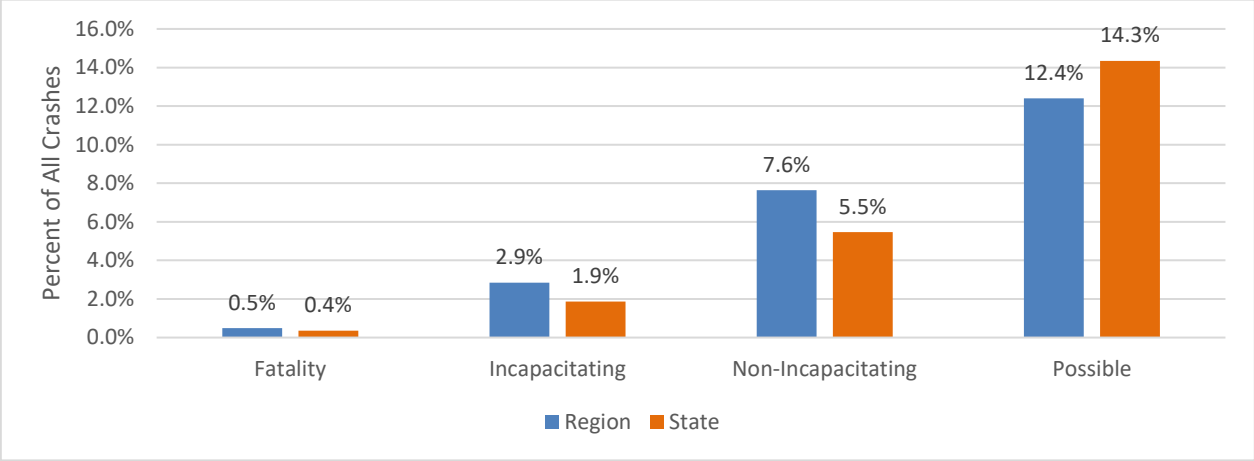


Figure 4 - Comparison of State and Region Crash Severity Distributions

During the five-year period, more than three percent of the crashes experienced in the region resulted in a fatality or a serious, incapacitating injury which is slightly higher than the State's fatal and incapacitating injury experience.

In addition to a comparison between the state and the region, the distribution of crash severities was considered across the trunkline and non-trunkline portions of the system. Figure 5 provides a summary of this information, with both systems tending to track fairly closely with each other in terms of the distribution of crash severities. However, when considering fatal and incapacitating injury crashes across the entire network, approximately two-thirds of the crashes occurred on the non-trunkline portion of the road network, as shown in the crash summary in Figure 11.

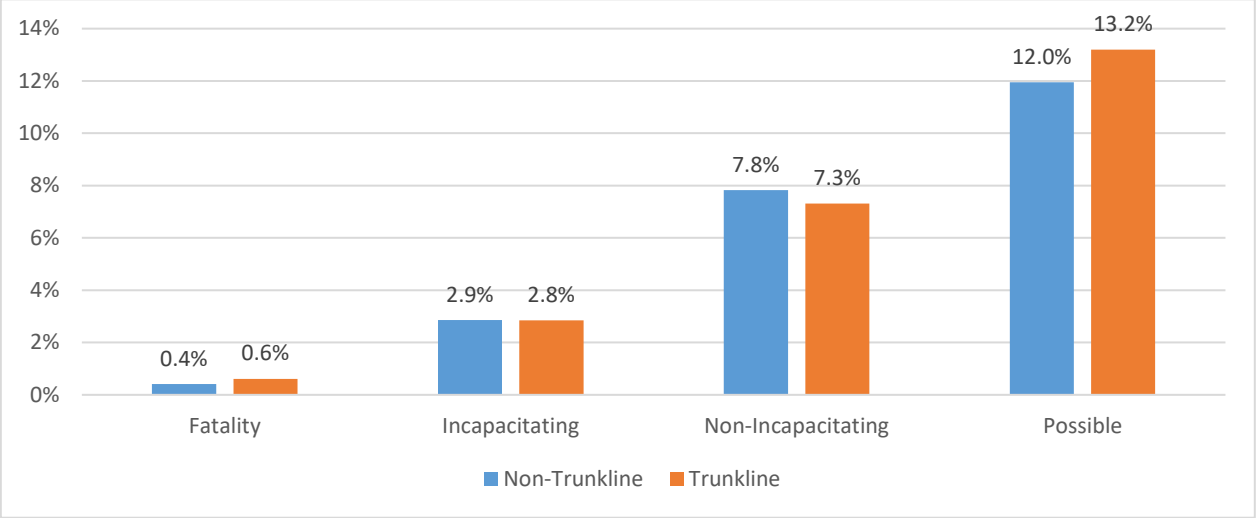


Figure 5 - Comparison of Trunkline and Non- Trunkline Severities

Figure 6 provides a comparison between the distribution of crash types for fatal and incapacitating crashes for trunkline and non-trunkline routes. The crash types are ranked in order of the most prevalent crash types occurring on the non-trunkline portion of the system. The top three crash types are the same for both systems but the ranking of the top three differs. The most frequently cited crash type for fatal and incapacitating injury crashes on the non-trunkline were run off road crashes, followed by angle and rear end crashes.

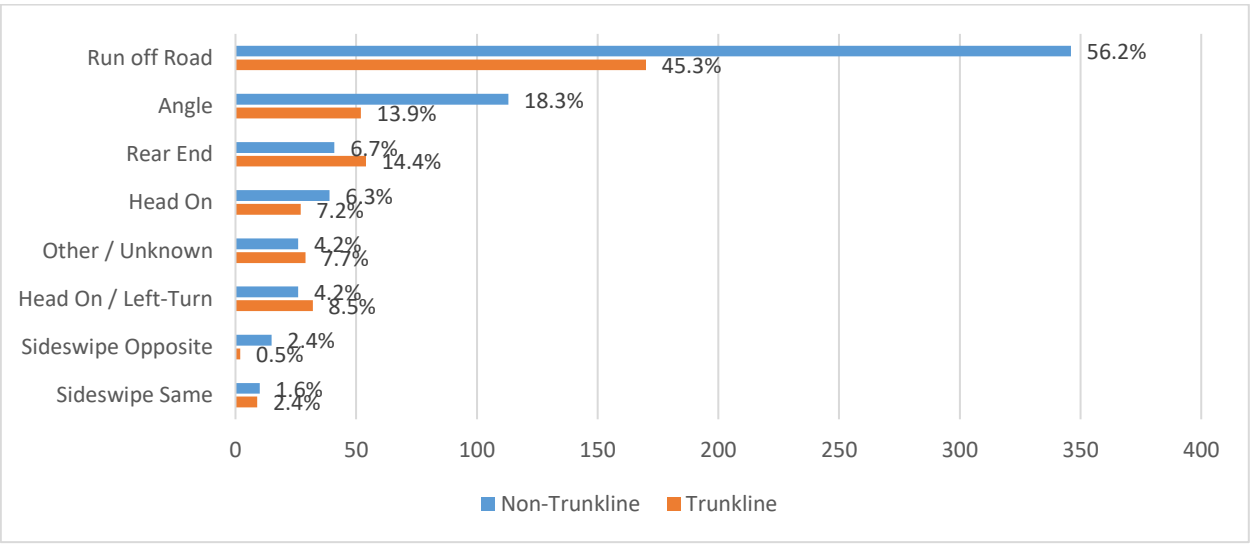


Figure 6 - Comparison of Fatal & Incapacitating Injury Crashes by Type and System

Figure 7 provides a similar comparison as that shown in Figure 6. However, this chart shows the differences in crash distribution in the region when looking at all crash severity levels versus fatal and incapacitating injury crashes. Again, the three most prevalent crash types remain the same when looking across the two categories with only their ranking changing. Most significantly, run of road crashes account for over half of all fatal and incapacitating injury crashes in the region, followed by angle and read end crashes.

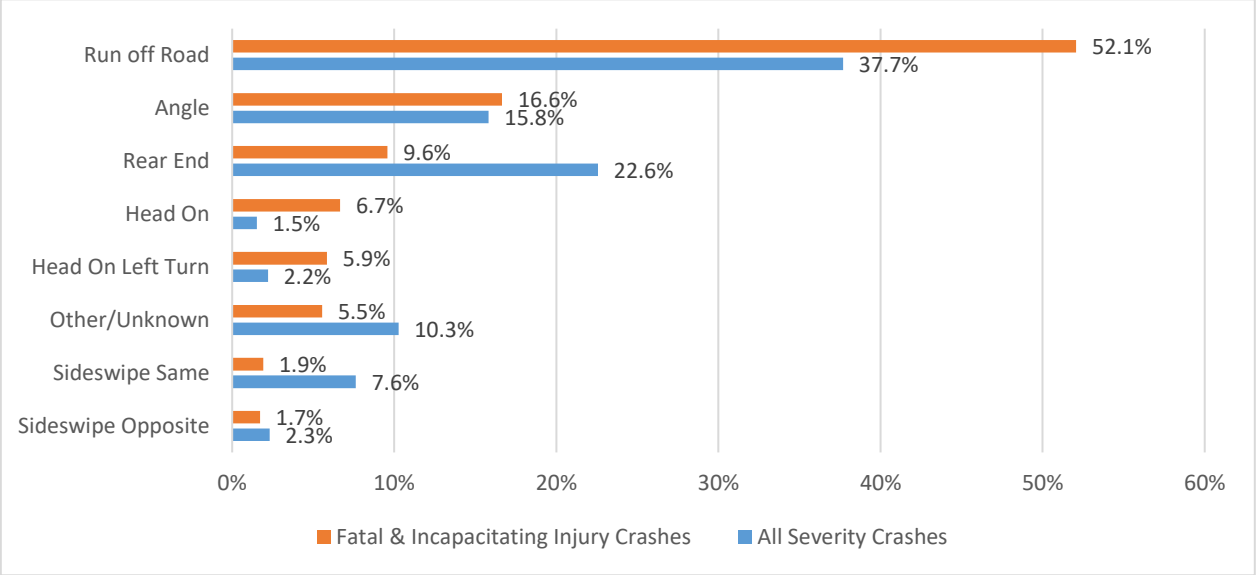


Figure 7 - Crash Type Distribution for All Severity vs. Fatal and Incapacitating Injury Crashes in the Region

When considering crash distributions by month of year, the region tends to track fairly closely with the state. This includes an increase in crashes of all severities during the winter months. This increase is slightly more pronounced for the WMSRDC region, accounting for approximately a third (34.3 percent) of all crashes during the five-year study period, as shown in Figure 8.

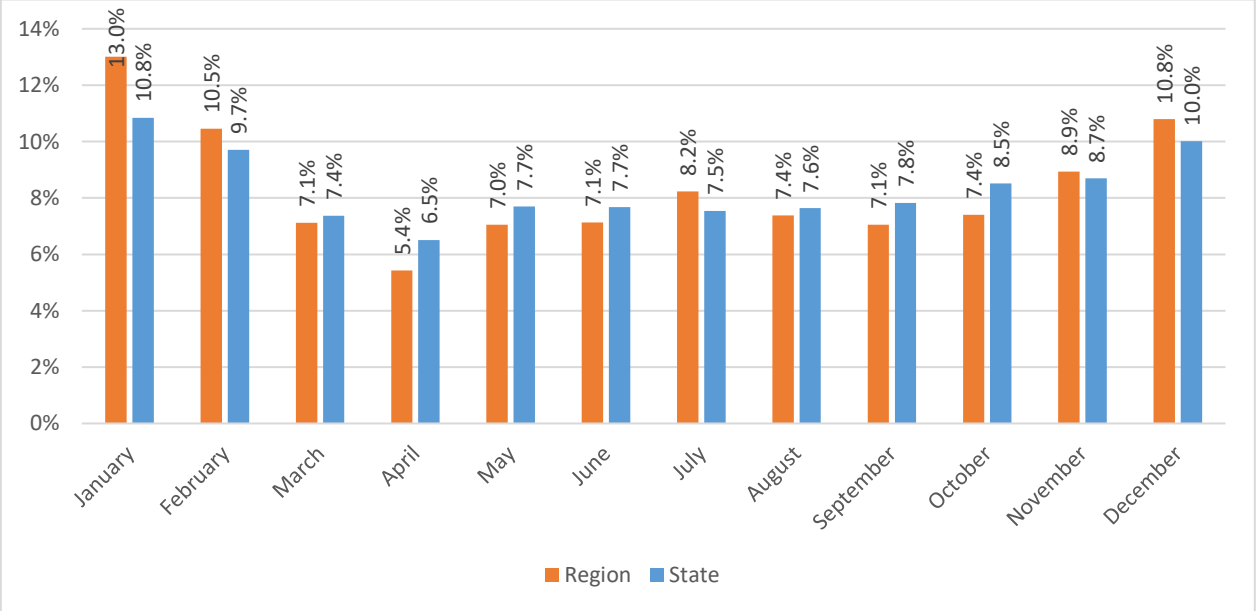


Figure 8 - Comparison of State and Region Monthly Crash Distribution

When reviewing the monthly crash distribution based on severity in the region, crashes of all severities have historically peaked during the winter months. However, as shown in Figure 9, when considering only fatal and incapacitating injury crashes, the numbers tend to peak during the summer months.

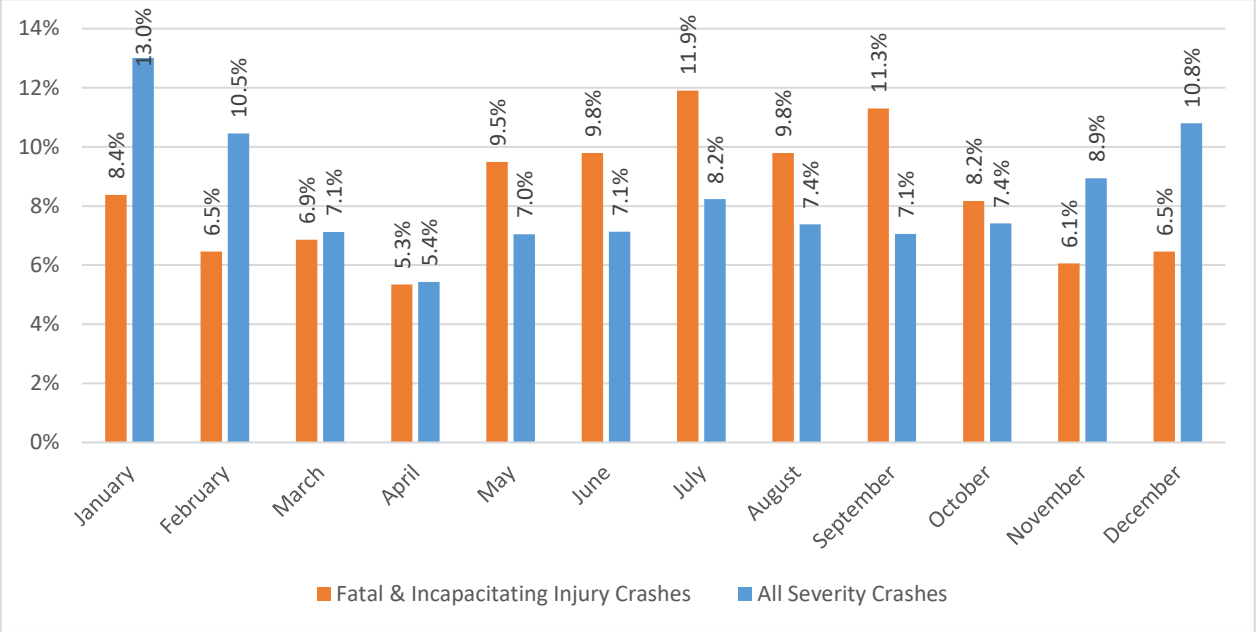


Figure 9 - Comparison of Crash Distribution by Month and Severity

Figure 10 generally supports the results provided in Figure 9. When considering crashes of all severities, WMSRDC tended to experience a slightly greater portion of wet, snowy, icy, and slushy road crashes while a greater portion of fatal and incapacitating injury crashes occurred under dry road conditions.

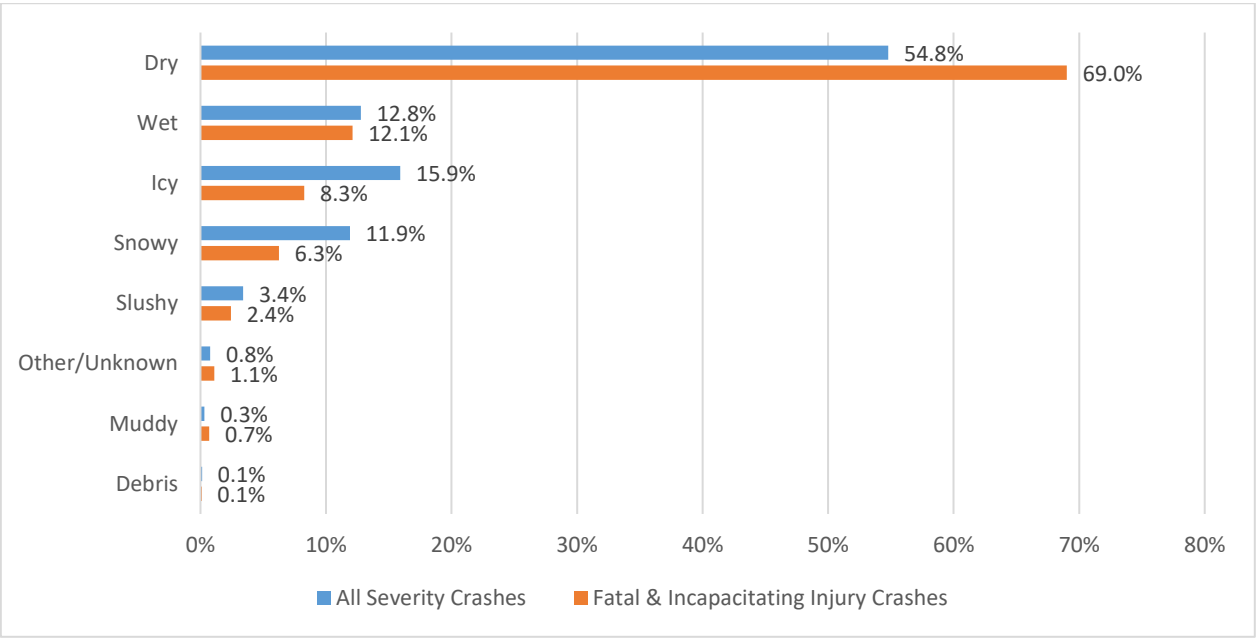


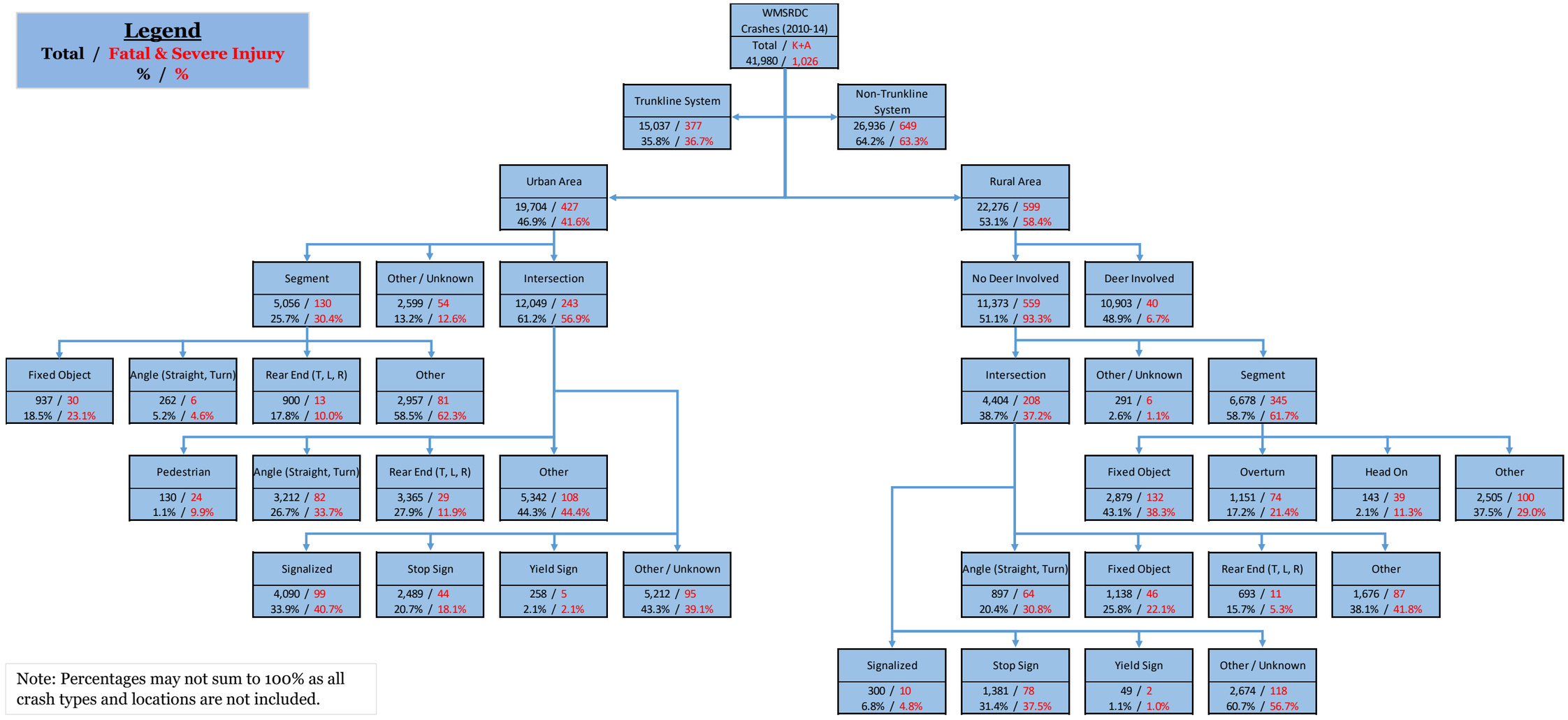
Figure 10 - Comparison of Surface Condition vs Crash Severity

2.2 Initial Crash Data Analysis, 2015

Several preliminary trends were identified in the 2015 data and have been included here in the following table. Unless otherwise stated, all values are based on fatal and incapacitating injury crash counts.

	2014				2015
Total Crashes	6,485	Decreased by	8.4%	to	5,943
Incapacitating Crashes	163	Decreased by	18.4%	to	133
Fatal Crashes	24	Increased by	20.8%	to	29
Run off Road Crashes	64	Decreased by	1.6%	to	63
Angle Crashes	43	Decreased by	37.2%	to	27
Rear End Crashes	17	Decreased by	11.8%	to	15
Vulnerable Road User Involved Crashes	13	Increased by	61.5%	to	21
Motorcycle Involved Crashes	20	Increased by	60.0%	to	32
Driving Under the Influence	30	Increased by	16.7%	to	35

As shown, initial high level trends are mixed when comparing 2014 and 2015 crash data. It is important to note that due to the nature of traffic crashes, it is inappropriate to draw any strong conclusions from the data presented in this section. However, it is useful to understand the basic observations and consider them when analyzing the full data set as it becomes accessible.



Note: Percentages may not sum to 100% as all crash types and locations are not included.

Figure 11 - WMSRDC Region Crash Divisions (Deer Included)

2.3 Stakeholder Consultation

On Monday, November 8th, 2016 a meeting was conducted at the Grand Valley State University Innovation Hub in Muskegon, MI. A range of stakeholders were in attendance including representatives from several county road commission, the Michigan State Police and local sheriffs, as well as members of the WMSRDC, MDOT, and local health agencies. In addition to providing a brief overview of the RTSP development process and initial data analysis, one of the items of discussion included the identification of potential Emphasis Areas. The following list includes a representative sample of the issues and concerns discussed at the meeting, in no particular order:

- **Winter Weather** (Whiteout, Black Ice, etc.)
- **Roadside Concerns** (Shoulder Edge Drop-offs, Clear Zone Maintenance, etc.)
- **Intersection Concerns** (Rural High Speed, Sight Distance, etc.)
- **Vulnerable Road Users** (Pedestrian Crossings, Non-motorized Users on Roadside, etc.)
- **Driver Behavior** (Unfamiliar, Speeding, Distracted Driving, etc.)
- **Motorcycle Involved Crashes** (Helmet Use, Severity, etc.)
- **School Areas** (School Speed Zones, Pedestrian Crossings, School Bus Stops, etc.)
- **Traffic Signals** (Upgrading Infrastructure, Driver Behavior during Signal Outages, etc.)
- **Construction / Work Zone Safety**
- **Sign & General Delineation Concerns** (Visibility, Placement, etc.)



Figure 12 - WMSRDC Stakeholder Meeting

2.4 Emphasis Areas and Strategies

The concerns and topics discussed at the stakeholder meeting were used to guide and focus the crash analysis and identify an initial list of Emphasis Areas. Based on the crash analysis and working group discussions, the following potential Emphasis Areas for the RTSP have been identified, in alphabetical order:

- **Driver Age Related Concerns**
- **Driver Behavior Related Crashes**
- **Impaired Driver Involved Crashes**
- **Intersection Related Concerns**
- **Motorcycle Involved Crashes**
- **Roadside Related Concerns**
- **Signs & Delineation**
- **Vulnerable Road User Involved Crashes**

These Emphasis Areas collectively account for approximately 98 percent of the fatal and incapacitating injury crashes which have historically occurred in the region. Of the 985 fatal or incapacitating injury crashes reported in the region from 2010 to 2014, 967 fall under at least one of the eight proposed Emphasis Areas. The following table provides a basic breakdown of each Emphasis Area, the types of crashes which have been included under each, and their portion of fatal, incapacitating injury, and total crashes. It should be noted that as there are multiple contributing factors for each crash, the following percentages will exceed 100 percent as crashes have been counted under multiple categories. Additionally, deer related crashes have been removed.

Table 1 - Emphasis Areas

Emphasis Area	Portion of ***29,636*** Total Crashes	Portion of ***985*** Fatal & Incapacitating Injury Crashes	Portion of ***143*** Fatal Crashes
Driver Age Related Concerns	55.1%	52.0%	52.4%
Driver Behavior Related	67.7%	65.4%	55.9%
Impaired Driver Involved	5.5%	21.5%	36.4%
Intersection Related	33.7%	29.7%	21.7%
Motorcycle Involved	2.2%	14.0%	19.6%
Roadside Related	29.2%	39.0%	38.5%
Sign & Delineation Related		*Unavailable*	
Vulnerable Road User Involved	1.7%	9.6%	14.0%
All Emphasis Area Related Crashes	**93.6%**	**97.9%**	**98.6%**

The following sections provide additional information regarding each of the Emphasis Areas with a list of potential strategies. Additional details regarding each of the potential countermeasures is included in Appendix B. It must be noted that while each countermeasure is listed with their most closely applicable Emphasis Area, it may also prove beneficial for addressing several Emphasis Areas. An applicability matrix is provided in Appendix B to help illustrate this.

2.4.1 Driver Age Related Concerns

Crashes included under this Emphasis Area include drivers under the age of 25 and over the age of 65 years. In Figure 13, highlighted intersections and segments represent locations which experienced at least one fatal and / or incapacitating injury in this category during the five-year period (2010 – 2014).

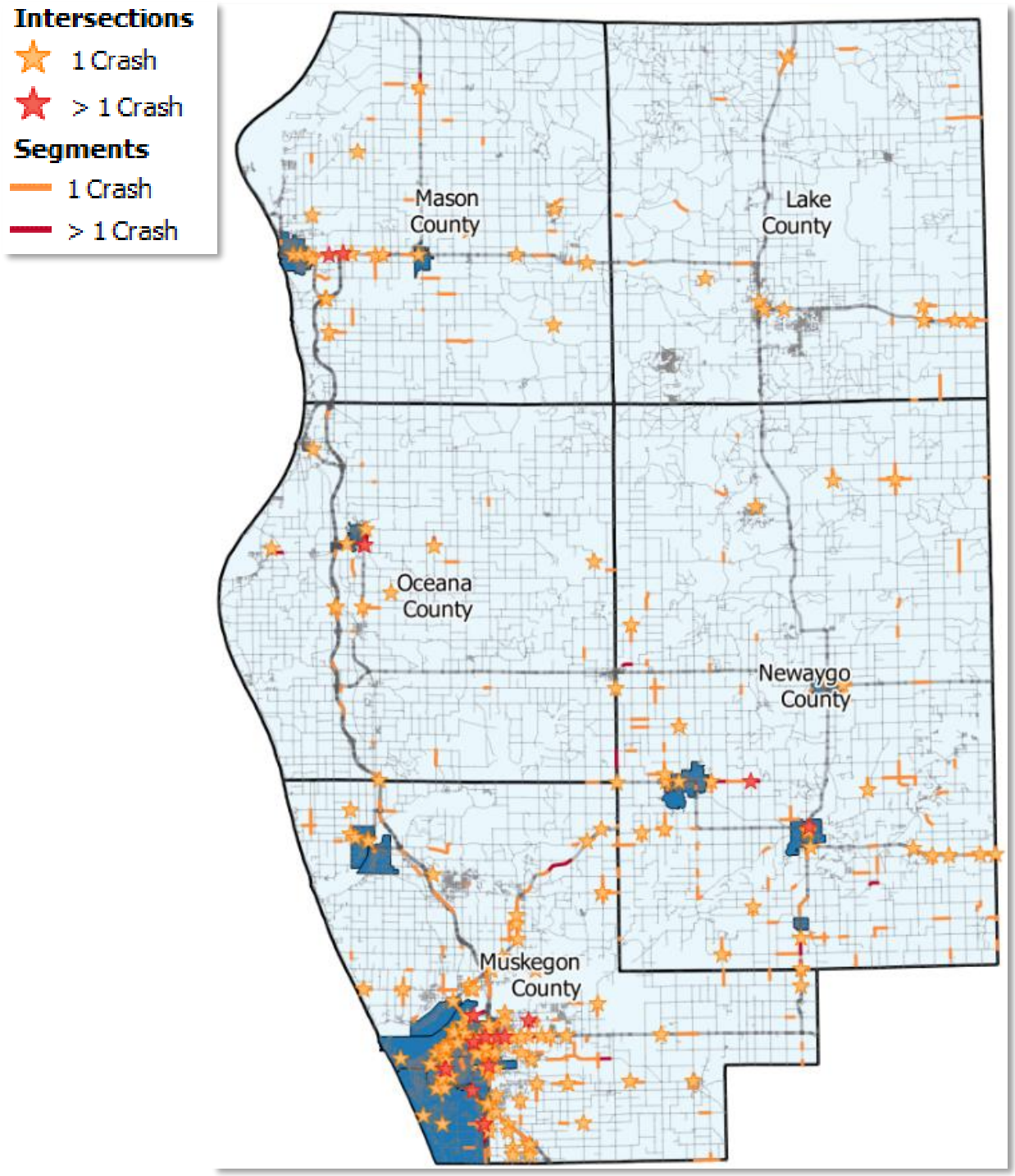


Figure 13 - Fatal & Incapacitating Injury Driver Age Crash Locations (2010-2014)

2.4.1.1 Drivers 24 Years of Age and Younger

Younger drivers generally have less experience driving than other drivers. This is paired with an anecdotal propensity to take greater risks and potentially misjudge circumstances and situations out on the road. The WMSRDC Region has historically experienced an increased rate of younger driver crashes than the State, as illustrated in Figure 14. In addition, drivers under the age of 25 are twice as likely to be impaired by drugs and / or alcohol when involved in a fatal or serious injury crash when compared to drivers between 25 and 64 years of age, which is illustrated in Figure 15. It was also noted, based on the available crash data, that younger drivers have a higher incidence of speeding, failing to yield, disobeying traffic control devices, and failing to stop in an assured clear distance, as illustrated in Figure 16. This could be due to a number of issues ranging from a simple lack of experience to impaired driving.

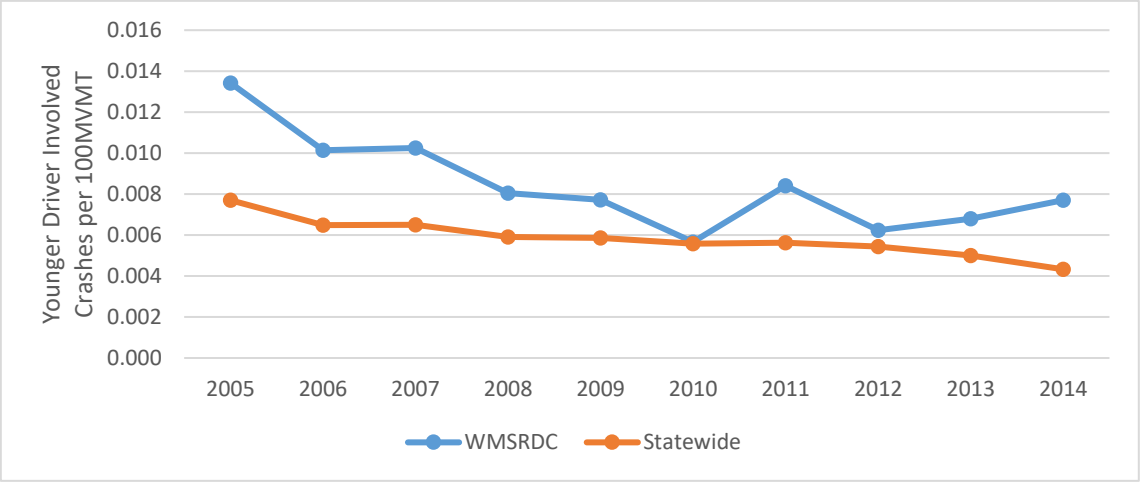


Figure 14 - Young Driver Crash Fatal & Incapacitating Injury Comparison

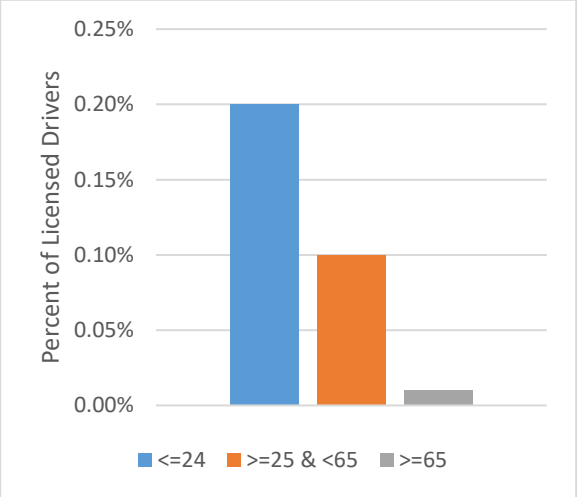


Figure 15 - Portion of Impaired Licensed Drivers Involved Fatal & Incapacitating Injury Crashes

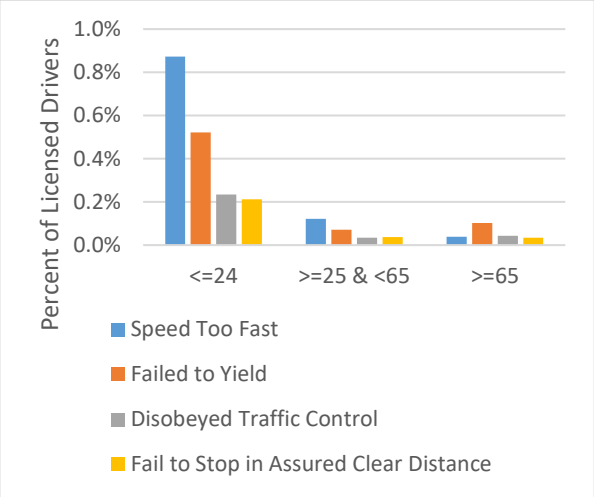


Figure 16 - Portion of Licensed Drivers Involved in Various Hazardous Action Crashes

2.4.1.2 Drivers 65 Years of Age and Older

The WMSRDC Region has historically experienced a greater rate of older driver crashes than the State. This crash rate has increased in recent years as shown in Figure 17. Typically, as individuals age they are faced with diminished vision, hearing, reflexes, mobility, and cognitive functions. This can have a negative impact on their ability to drive and respond to potentially rapidly changing situations. The slight increase in older drivers' involvement in failure to yield and disobeying traffic control devices, as shown in Figure 18, could be due in part to this occurrence. Additionally, older drivers have a reduced ability to withstand physical impacts sustained in a crash. It should be noted that older drivers tend to be involved in similar portions of fatal and injury crashes as younger drivers.

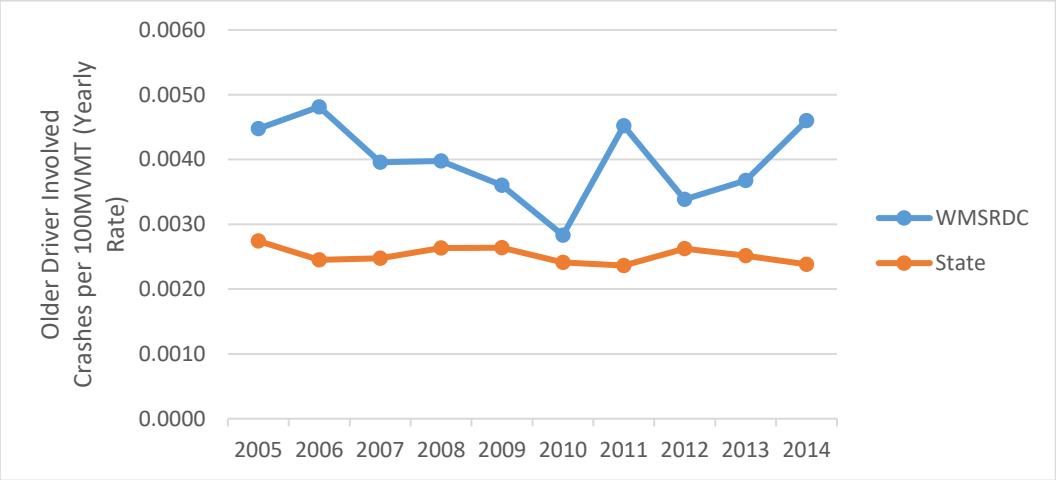


Figure 17 - Older Driver Fatal & Incapacitating Injury Comparison

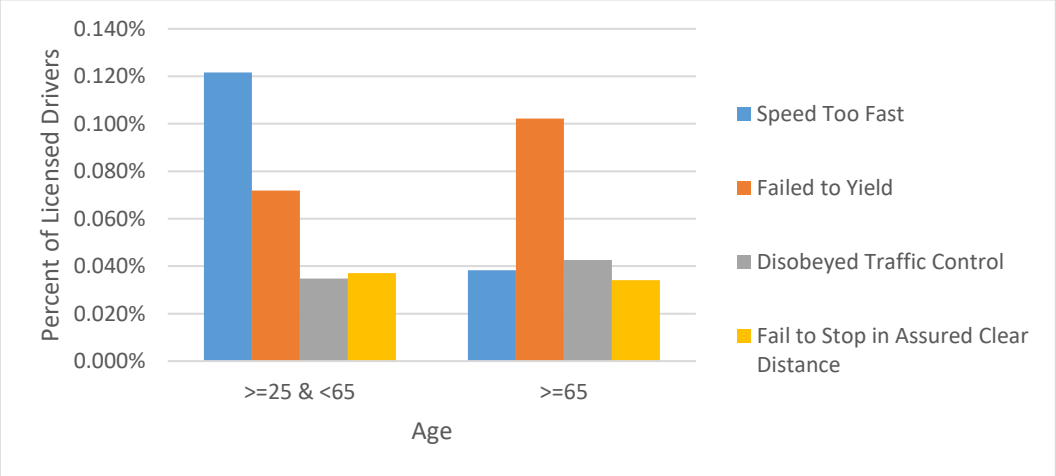


Figure 18 - Portion of Licensed Drivers Involved in Various Hazardous Action Crashes

2.4.1.3 Strategies for Drivers 24 Years of Age and Younger

Education and Enforcement Outreach

Education and enforcement outreach programs to younger drivers, especially those in high school, have had a positive impact in the region. Such programs include presentations and discussions led by law enforcement around different driver behavior and responsibilities when behind the wheel as well as mobile simulators and other tools to help show younger drivers what it's like to drive while intoxicated. Continue to promotion of these types of activities is encouraged as it provides another education opportunity for the students as well as contact point with law enforcement.

Young Driver Education & Enforcement Outreach

Driver retraining and refresher courses could be provided to offer drivers of all ages an opportunity to renew skill sets and test their current abilities. This would not be predicated on a driver's age alone and would be open to all drivers. These types of courses are typically required or recommended after a moving violation or other infraction has already occurred. By proactively promoting attendance for interested drivers, it is expected that attendees will be able to correct minor issues which could have led to more significant crashes. It may also be possible to work with local insurance companies and other road safety partners to advertise and / or provide financial assistance to promote and host these courses.

2.4.1.4 Strategies for Driver 65 Years of Age and Older

Review Signing, Traffic Control, and other Roadside Components

A number of countermeasures have been identified which benefit all drivers, but which have an especially positive impact for older drivers. Use of high intensity yellow reflective sheeting, pedestrian countdown timers, and arrow per lane guidance signs are some of examples of treatments which have been shown to reduce the potential for older driver and other crash types. These improvements have also been shown to improve safety for drivers of all ages.

Review Transit Availability and Accessibility

Existing transit routes and on-demand services could be reviewed to identify any gaps in availability or connectivity. Additional advertisement and community education surrounding their use could promote awareness and help to increase ridership. Steps should be taken to review the location, condition, and ADA compliance for bus stops and other transit ride areas throughout the region. By providing more reliable, connected transit options, drivers who may not feel comfortable behind the wheel would have other options to go about their daily activities. These improvements would benefit not only older drivers but the general public as well.

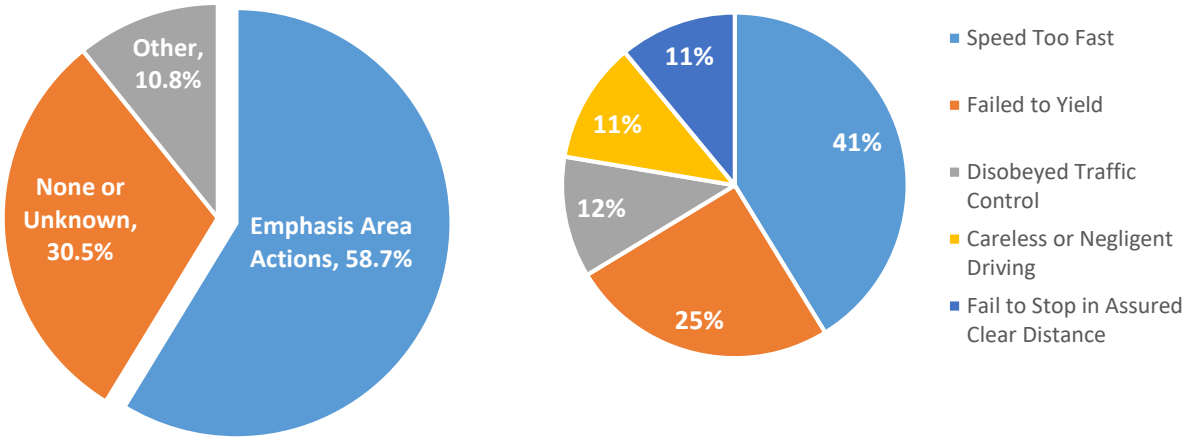
2.4.2 Driver Behavior Related Crashes

Previous studies have shown that driver behavior plays a role in the vast majority of traffic crashes. The majority of all fatal and incapacitating injury crashes were associated with at least one driver related issue. This is despite the fact that the driver condition information tends to be underrepresented in the crash data. While a wide range of potential actions or issues could be included under this category, for the purposes of this analysis, the conditions and behaviors listed below were considered.

Driver Condition	+	Cited Hazardous Action
Driver Distracted *Driver Using Cellular Phone*		*Speed Too Fast* *Failed to Yield* *Disobeyed Traffic Control* *Failure to Stop in Assured Clear Distance* *Careless or Negligent Driving*

As shown in Table 1, driver behavior related crashes falling under the aforementioned actions and conditions accounted for approximately two-thirds of crashes of all severities as well as fatal and incapacitating injury crashes. As with all crashes, there are almost always several contributing factors leading up to the event, but steps can be taken to help reduce the likelihood and / or the impact of each factor.

The number of crashes where drivers were cited as being distracted or using their cellphones is relatively low during the study period. These categories are generally seen as being underreported for a number of reasons. Studies have repeatedly shown frequent cellphone use by drivers of all ages and still represent an important concern for the region.[4] Recent revisions to Michigan's crash reporting form should provide more detailed information regarding these behaviors moving forward.



[4] "Crashes Involving Cell Phones" – National Safety Council (http://www.nsc.org/DistractedDrivingDocuments/NSC-Under-Reporting-White-Paper.pdf)

Figure 19 - Portion of Fatal & Incapacitating Injury Crashes by Hazardous Action

As shown in Figure 19, the hazardous actions identified for the Driver Behavior Emphasis Area account for almost sixty percent of the fatal and incapacitating injury crashes. Of those top five, speeding and failure to yield were the most frequent. Moving forward, strategies identified under this area will be focused on addressing the top five most frequently cited hazardous actions. Figure 20, highlights the locations which experienced at least one fatal or incapacitating injury in this category during the five-year period (2010 – 2014).

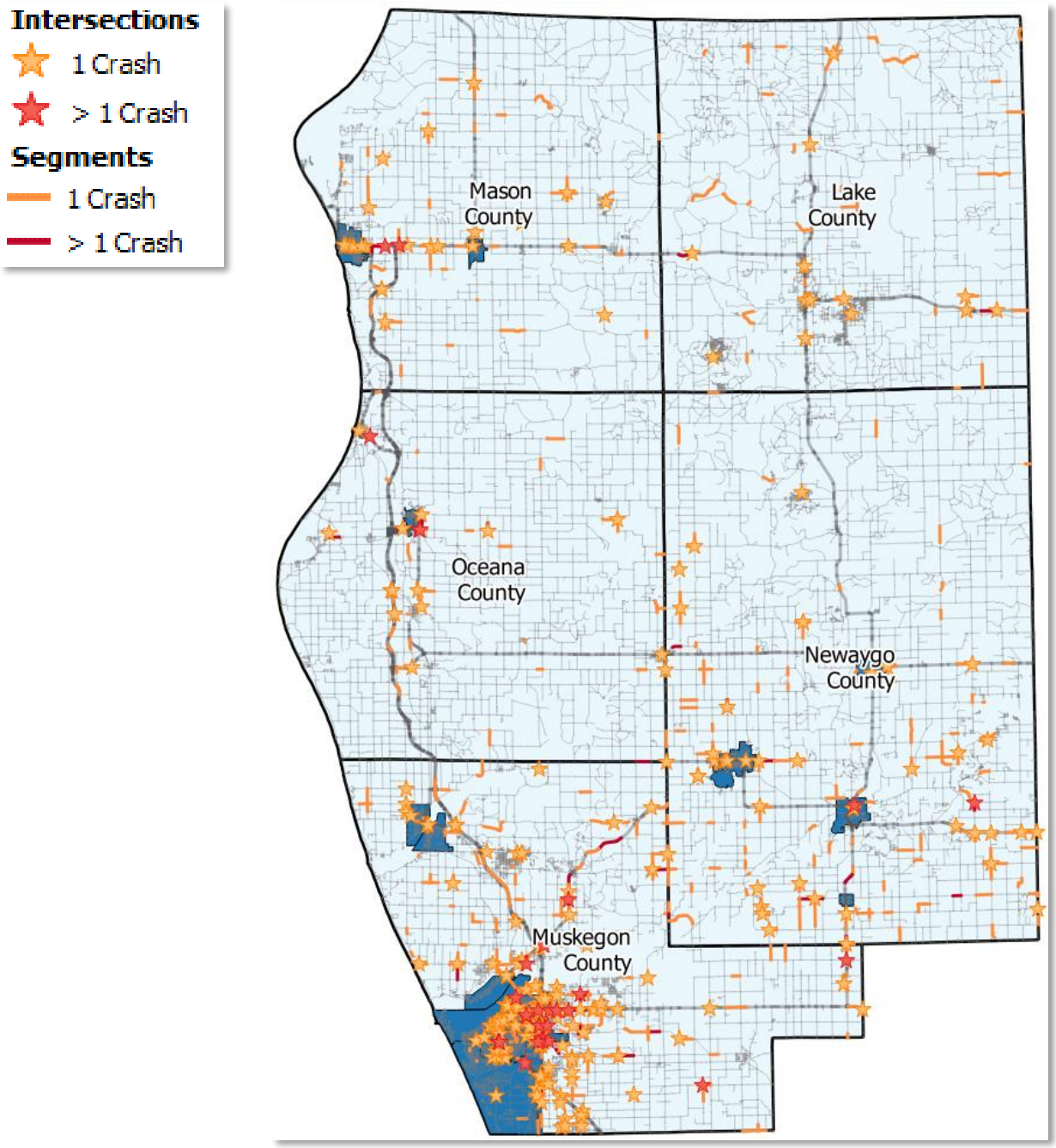


Figure 20 - Fatal & Incapacitating Injury Driver Behavior Crash Locations (2010-2014)

2.4.2.1 Strategies

Distracted Driver Education Campaign

Distracted driver education campaigns have been used to great effect. Delivery of any such campaign should include a range of delivery mediums depending on the target audience. Social media campaigns have been used in recent years to bring the message to the individual level and drive home the importance of maintaining focus on the road ahead. More standard means, such

as television commercials and billboards, could be paired with online social networks and other forms of mass media.

Mobile & Fixed Speed Feedback Signs

Mobile Speed Trailers may be placed at locations experiencing higher rates of speed violations. These trailers detect and display the speed of the oncoming vehicle and are often paired with supplemental speed limit signs. This provides the driver with real-time feedback and reinforces the speed limit. While this particular treatment has limited staying power after the trailer has been removed, it can be cycled through problem areas to help at multiple locations. Alternative fixed installation have also been used in problem locations, such as reduced school speed zones or two lane roads.



Figure 21 - Michigan Mobile Speed Trailer

Randomized Enforcement Locations

The presence of law enforcement tends to provide a calming presence for traffic flow and encourages drivers to obey the speed limits and other traffic laws. While increasing the number of officers can be beneficial, randomizing the patrols and locations can also help. By changing staging and monitoring points for law enforcement, drivers have a more difficult time avoiding known enforcement areas, effectively increasing the influence of law enforcement in the area.

Study Potential Road Diet Locations

Road diets involve the reduction in travel lanes along a corridor for a number of different reasons depending on the need of each location. A typical example is the reduction of a four-lane road (two travel lanes in each direction) to a three-lane road (one lane in each direction with a center two way left turn lane). In this particular example, it has the potential to improve traffic flow by removing left turning vehicles from travel lanes and reduce speeds by providing the opportunity to narrow the travel lanes through the addition of on street parking and / or bicycle lanes.

The specific benefits and drawbacks will depend on the specific conditions and proposed changes at each location, but road diets have been shown to offer several positive impacts when implemented properly. Consideration should be given to road diet studies, especially at locations consisting of multilane roads which may no longer have the higher traffic volumes to support multiple lanes of traffic in each direction.

Traffic Calming Projects



Several methods exist to help lower traffic speeds in lower volume areas. As drivers tend to travel at speeds they feel comfortable at rather than posted speed limits, steps can be taken to safely lower the speed drivers feel comfortable driving at. Some examples include narrowing lane widths, installing/allowing on-street parking, and installing curb bump-outs.

Figure 22 - Traffic Calming Example: Chicane
(Source: FHWA)

2.4.3 Impaired Driver Involved Crashes

Driving under the influence of drugs or alcohol is a serious issue as it limits the ability of the driver to comprehend and react to hazards. This not only endangers the driver and any passengers in their vehicle but other drivers and bystanders as well. The prevalence, or at least awareness, of drug use has increased recently in Michigan and much of the country. This tends to complicate law enforcement's task when identifying impaired drivers determining the correct course of action.

Crashes included under this Emphasis Area include drivers under the influence of illegal substances or alcohol. In Figure 23, the highlighted segments represent locations which experienced at least one fatal and / or incapacitating injury in this category during the five-year period (2010 – 2014).



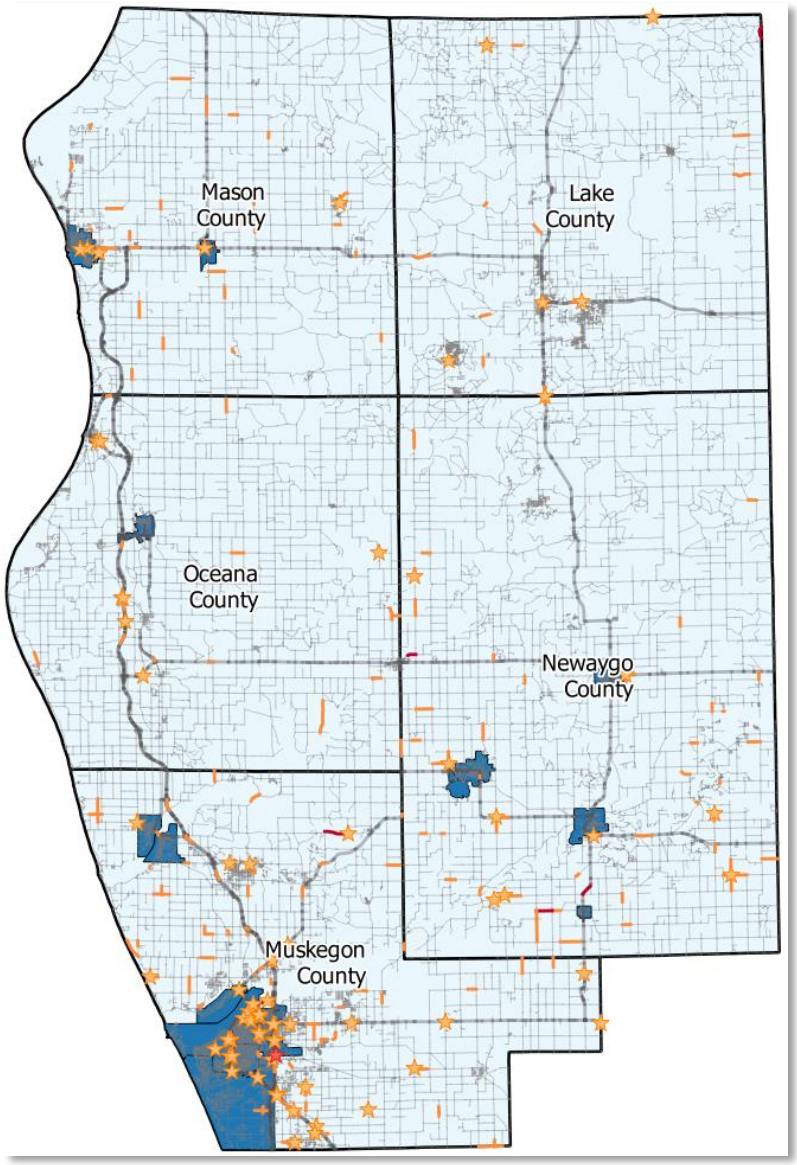


Figure 23 - Fatal & Incapacitating Injury Impaired Driver Crash Locations (2010-2014)

While drug or alcohol impaired driver involved crash rates have generally declined since 2005, the region continues to experience a higher rate of these types of crashes than the state as a whole. This is illustrated in Figure 24.

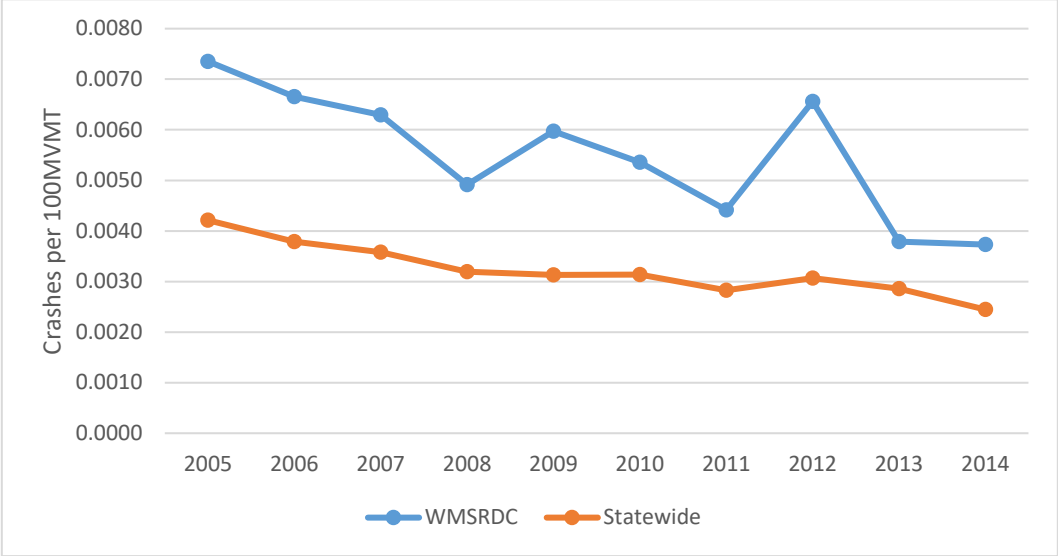


Figure 24 - Impaired Fatal and Incapacitating Injury Crash Rates

Impaired driver involved crashes in the Region also tend to be more severe when compared to all crashes occurring in the five-year study period. Figure 25 provides a comparison look at the crash severity for each grouping. As shown in the figure, crashes involving an impaired driver were approximately twice as likely to result in a fatality or injury (including incapacitating, non-incapacitating, and possible injury).

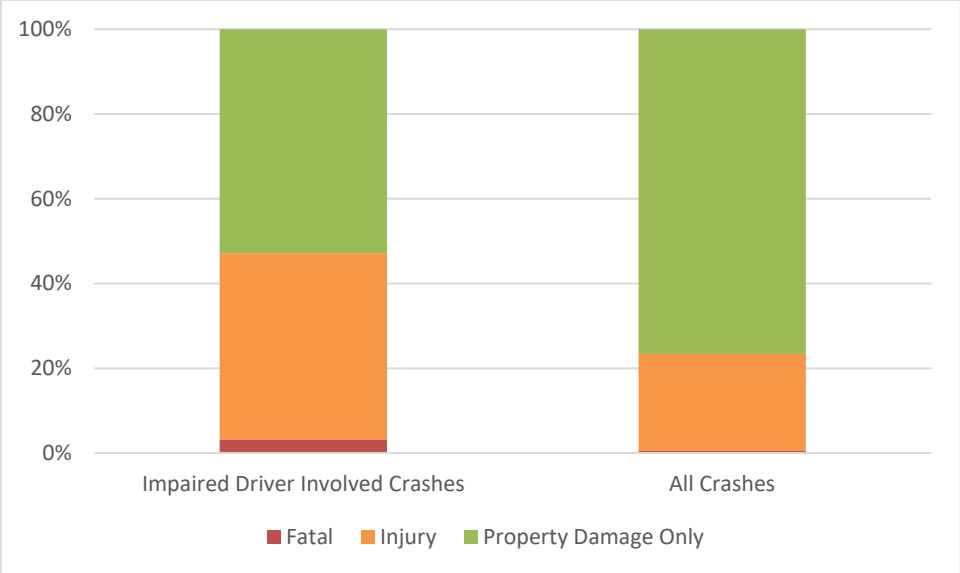


Figure 25 - Comparison of Severity Proportions

2.4.3.1 Strategies

Drug Recognition Expert (DRE) Training

Law enforcement serves as the front lines when protecting the public from drivers operating under the influence of alcohol or other intoxicants. Michigan offers a series of training courses to assist officers in identifying potentially intoxicated drivers based on driving behaviors and other cues and signals. Three programs provide the backbone of the training including the Standardized Field Sobriety Testing Program (SFST), the Advanced Roadside Impaired Driving Enforcement Program (ARIDE), and finally the Drug Recognition Expert program (DRE). Any new officers or those that haven't already taken these courses should do so when available, understanding that funding, particularly for the DRE program, is extremely limited.



Figure 26 - Law Enforcement Training Courses
(Source: Michigan State Police OWI Enforcement Training)

Education Campaign

Due in part to past education campaigns, the vast majority of drivers view drunk driving as a negative behavior. It is important to continue these efforts and inform drivers and the general public of the risk and consequences of driving while impaired. This extends to increases in the occurrence and awareness of drivers impaired through drug use. Successes and lessons learned from drunk driving educations campaigns should be applied to parallel campaigns designed to drive down instances of drug use and driving.

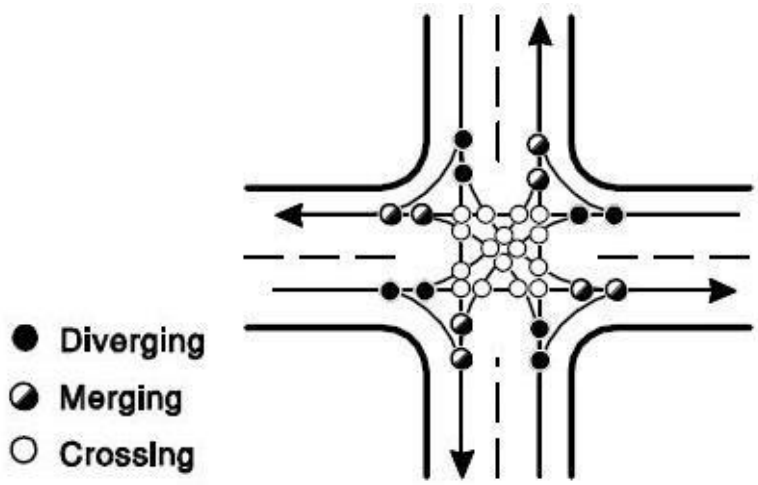
Enforcement Campaign

Enforcement campaigns, often in concert with other education and outreach campaigns, provide a significant deterrent to poor driver behavior. A review of prevailing trends or potential hotspots for problematic or unsafe behavior could provide law enforcement with a more targeted approach when planning and running enforcement campaigns. Additionally, cycling randomly through high priority areas could reduce drivers' ability to avoid known law enforcement locations.

Joint campaigns have been conducted with OHSP for various areas and driver behaviors to help with highly visible enforcement. This has the added benefit of educating and alerting all drivers in the area whether they are pulled over or not, as well as increasing enforcement intensity in an attempt to drive down negative behaviors and choices.

2.4.4 Intersection Related Concerns

Intersections represent some of the most complex areas of interaction as they bring together conflicting traffic flows. To further complicate things, they draw all modes of transportation including motor vehicles, transit services, bicyclists, and pedestrians into a central area. This significantly increases the potential for crashes. Figure 27 provides an example intersection configuration showing the number and type of conflict points (i.e. potential locations for opposing traffic).



Source: NCHRP Report 672 Exhibit 5-2

Figure 27 - Vehicle Conflict Points for a Standard Intersection Configuration

Some intersection related concerns are present at all intersections regardless of type or configuration, restricted lines of sight, and drivers failing to yield. Other issues depend on the type of intersection. For example, signalized intersections are susceptible to power outages and may be more impacted by glare from the sun while stop controlled intersections would be more greatly impacted by vegetation overgrowth. Intersection crashes accounted for approximately one-third of the crashes in the region. Of the intersection-related crashes, two-thirds occurred at either a stop controlled or signalized intersection. This proportion remains true when considering only fatal and incapacitating injury crashes. Figure 28 highlights intersections which experienced at least one fatal and / or incapacitating injury in this category during the five-year period (2010 – 2014).

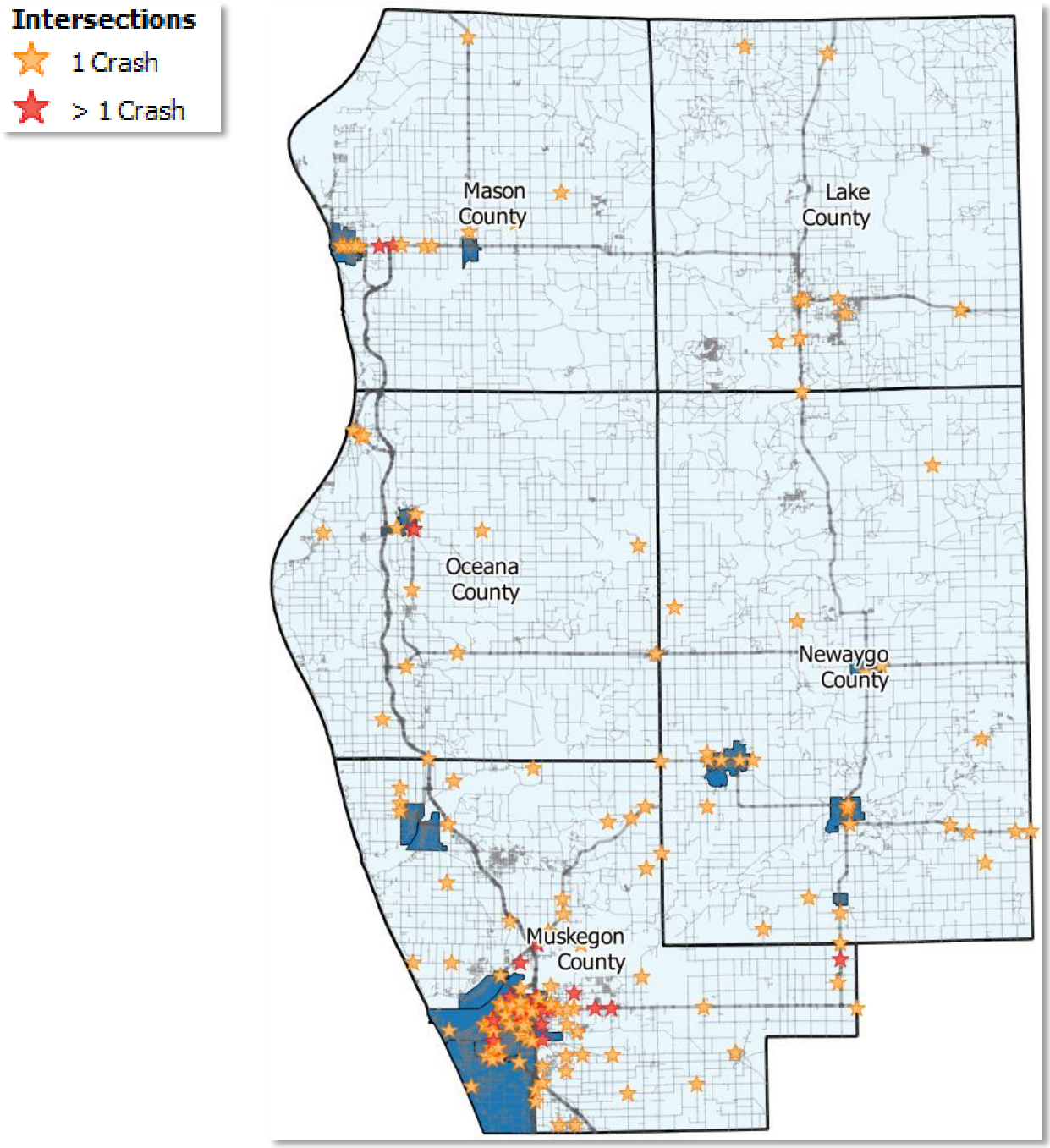


Figure 28 - Fatal & Incapacitating Injury Intersection Crash Locations (2010-2014)

Figure 29 provides an overview of some of the common crash types identified at intersections in the Region. As demonstrated by the crash data and discussed in this section, there are a number of different events, situations, and conditions included under the Intersection Emphasis Area. Any proposed strategies will take these into consideration and work to address the most frequent issues.

It should be noted that the None category appears to be used when the crash occurs along the freeflowing or uncontrolled approach of an intersection (i.e. private drive, freeflowing approach of a partial stop controlled location, etc.). This limits the practicality of drawing any concrete conclusions as None traffic control flagged crashes occur at signalized, stop, and yield controlled locations in addition to truly uncontrolled intersections.

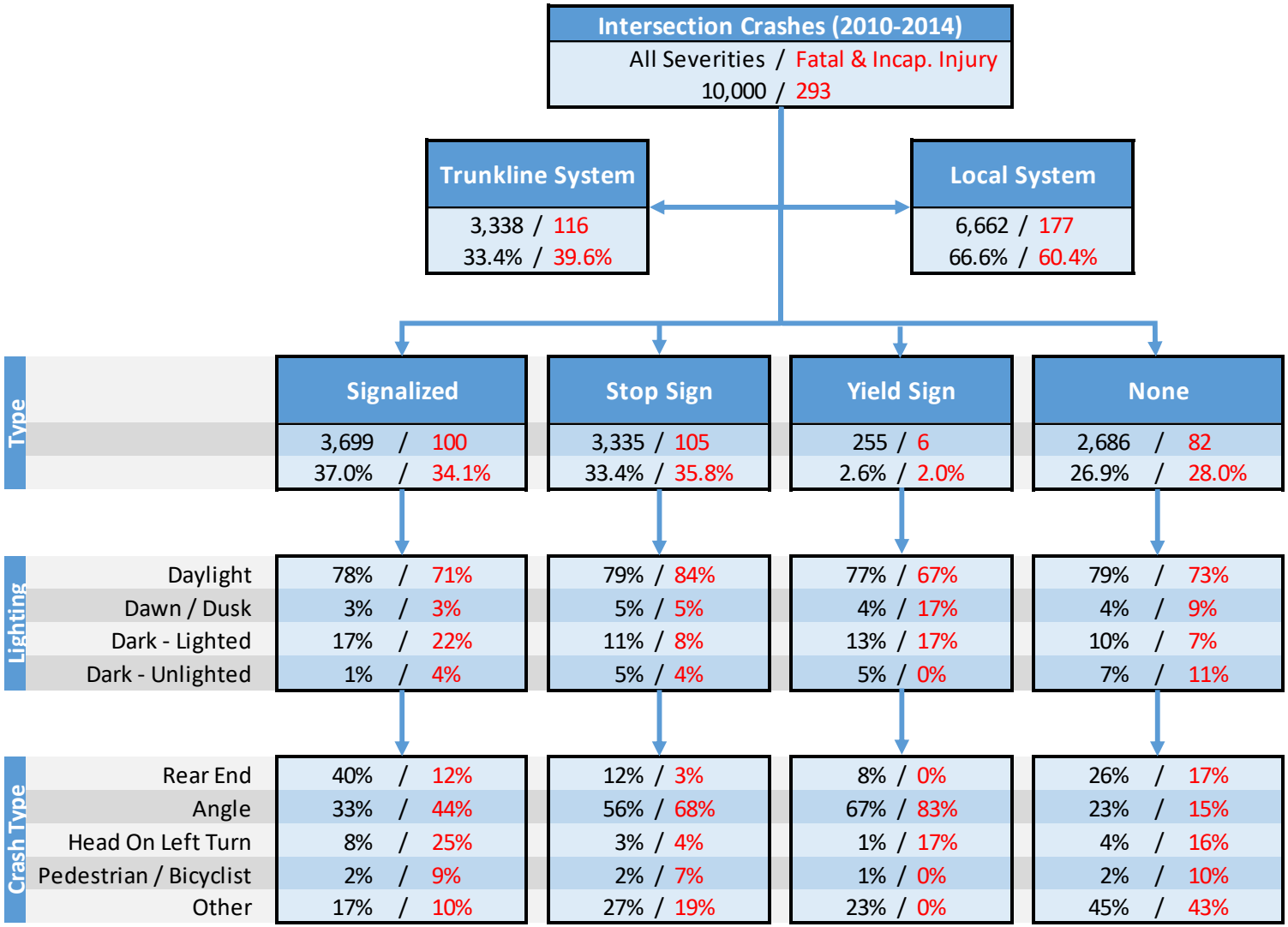


Figure 29 - Intersection Flow Chart

2.4.4.1 Strategies

Advanced Intersection Signage



The installation of new or supplemental intersection warning and/or lane use signs provide drivers with additional information and clarification regarding the operation of the intersection, thus increasing the time drivers have to react to the presence of an upcoming intersection and focus their attention accordingly.

Figure 30 - Advanced Intersection Delineation
(Source: FHWA)

Explore Additional / Alternative Intersection Control Methods for Emergency Conditions

Traffic signals, especially at large or heavy traffic volume intersections, can have a significant negative impact on safety and operations in the event of a power outage or other interruption of service. During power outages, responses by law enforcement vary depending on available resources, personnel, and intersection configuration. It is commonly believed that when a traffic signal loses power, drivers should treat it as an all-way stop control intersection. According to the letter of the law, this is not actually the case, and many drivers become confused or unsure when approaching a dark traffic signal. Options to mitigate this issue include stationing law enforcement personnel at the intersection to manually direct traffic, placing temporary stop signs on all approaches, or operating a back-up generator to power the signal locally.

Areas of the region have already taken proactive steps to outfit some intersections with transfer switches, which allows an authorized individual to switch the traffic signal from utility power to a back-up source. Some members of law enforcement have been provided with mobile generators to be used in conjunction with the transfer switches, allowing for the operation of the intersection signal despite power outages. This helps to mitigate the impact of the power outage and reduces the potential for crashes as drivers try to navigate a dark signal.

Another option is the use of temporary stop signs along each approach to the intersection. Some jurisdictions maintain folded stop signs permanently installed at the interaction while others have mobile signs which may be placed as needed. During normal operations, these signs are folded or otherwise hidden so as not to confuse drivers. During emergency events, however, they can be displayed, providing drivers with guidance for navigating through the intersection while the signal is dark.

Improve Traffic Control Visibility

Improved traffic control visibility can provide drivers with additional time and travel distance to recognize and react to the various cues or instructions being provided at the intersection. Working to address traffic control visibility requires different actions depending on the type of traffic control. For instance, at a stop controlled intersection it would be very important to ensure vegetation has not grown over or in front of the stop sign. Other remedies could include mounting oversized stop signs, adding retroreflective posts, or installing LED stop signs. When considering traffic signal controlled intersections steps could be taken to shift their placement or upgrade signal lenses and add backplates, among others.



Figure 31 - LED Stop Sign
(Source: cts.umn.edu)

Additional methods for improving traffic signal visibility include the installation of signal head backplates, updating older diagonal span configurations to box span, or the addition of low-mounted supplemental signals. These of course will depend on the specific characteristics of each intersection and the concerns being addressed.

Installation of Transverse Rumble Strips

Installation of rumble strips across the travel lanes on approaches to stop controlled intersections provides drivers with audible and tactile feedback – further alerting them to the presence of the intersection – and encouraging lower speeds. In previous studies, transverse rumble strips resulted in a statistically significant reduction in fatal and incapacitating injuries at both three and four legged intersections.[5]



Figure 32 - Transverse Rumble Strips
(Source: Minnesota Department of Transportation)

Review Intersection Lighting

With improvements in LED energy efficiency and costs, more and more municipalities are replacing older lighting systems with LED systems. While there are reduced operation and maintenance costs associated with the switch, it is important to review actual lighting fixture placement and lighting coverage before installing LED systems. Some new systems do not provide the same level of coverage as the old, leaving darker patches between light poles. These should ideally be identified beforehand with

[5] Safety Evaluation of Transverse Rumble Strips on Approaches to Stop-Controlled Intersections in Rural Areas (https://www.fhwa.dot.gov/publications/research/safety/hsis/12047/12047.pdf)

appropriate changes made to address them. This may require installation of additional lighting or a review of lighting needs in the area. Additionally, a number of locations with the older style of lighting are already under lit. These locations should be identified and consideration given to additional lighting or other remedies.

Review Intersection Traffic Control

Conducting a review of intersection traffic control at candidate locations is important to ensure that the control type is still appropriate for the operating conditions at that location. For example, there may be stop- or yield-controlled locations that would benefit from signal or roundabout installations. On the other hand, a signalized intersection may no longer serve the required traffic flows rendering the traffic signal unnecessary. Traffic control violations tend to increase when inappropriate or unnecessary traffic control has been implemented. Correcting these issues when they are identified could help to reduce driver frustration, and consequently, traffic control violations and intersection-related crashes. Additional steps could be taken to help educate the public regarding any new traffic control methods or provide information regarding appropriate navigation and right of way issues associated with existing traffic control. An example of this approach is the Michigan Department of Transportation brochure designed to help educate the public regarding the appropriate way to navigate a roundabout.[6]

Sight Distance Clearance & Maintenance

Ensuring and maintaining proper sight distance at intersection approaches plays an important role in reducing the potential for intersection crashes. When drivers are unable to see around obstacles at intersections the potential for pulling further into the intersection to see around these obstructions increases, potentially resulting in an angle collision. Additionally, drivers may not be able to see, assuming the approach is clear and pull out into cross traffic. Maintaining appropriate sight distances and sight triangles around intersection approaches provides drivers with a clear view of oncoming traffic helping to reduce the potential for these crashes.

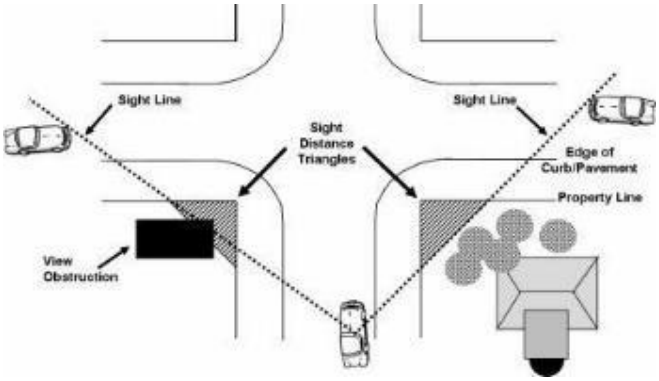


Figure 33 - Intersection Sight Distance
(Source: Edinburg Unified Development Code)

[6] MDOT Roundabout Educational Brochure (http://www.michigan.gov/documents/mdot/MDOT_RoundaboutBrochure_312721_7.pdf)

2.4.5 Motorcycle Involved Crashes

Motorcycles present a unique set of concerns and potential risks given their open nature paired with the potential for high rates of speed. Michigan's mandatory motorcycle helmet law was partially repealed in 2012. This recent change in legislation has allowed riders to operate without a helmet under certain conditions and has been associated with a statewide increase in motorcyclist involved fatal and incapacitating injury crashes.[7] Despite this, the general trend in fatal and incapacitating injury crashes from 2010 – 2014 for the region has been decreasing. While it is not enough to report a statistical trend, it is of note that fatal and incapacitating injury crashes involving motorcycle riders increased from 20 in 2014 to 32 in 2015. Figure 34 illustrates the portion of fatal, injury, and property damage only crashes for motorcycle rider involved incidents.

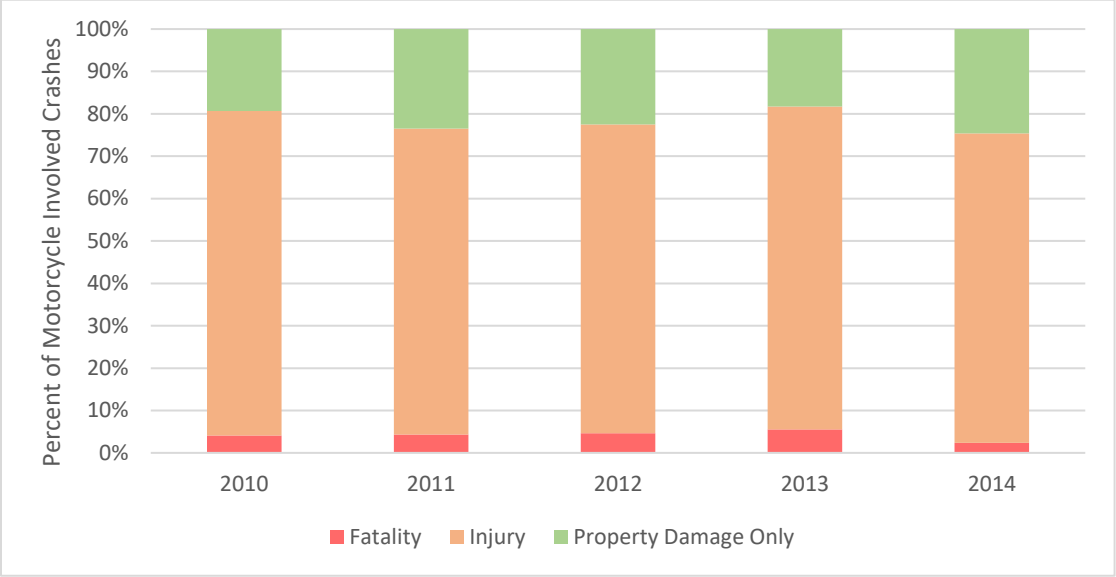


Figure 34 - Motorcycle Crash Involved Severity Distribution

Figure 35 highlights locations which experienced at least one fatal and / or incapacitating injury in this category during the five-year period (2010 – 2014).

[7] Analysis of Motorcycle Crashes in Michigan 2009 – 2013 (https://deepblue.lib.umich.edu/bitstream/handle/2027.42/109726/103142.pdf?sequence=1&isAllowed=y)

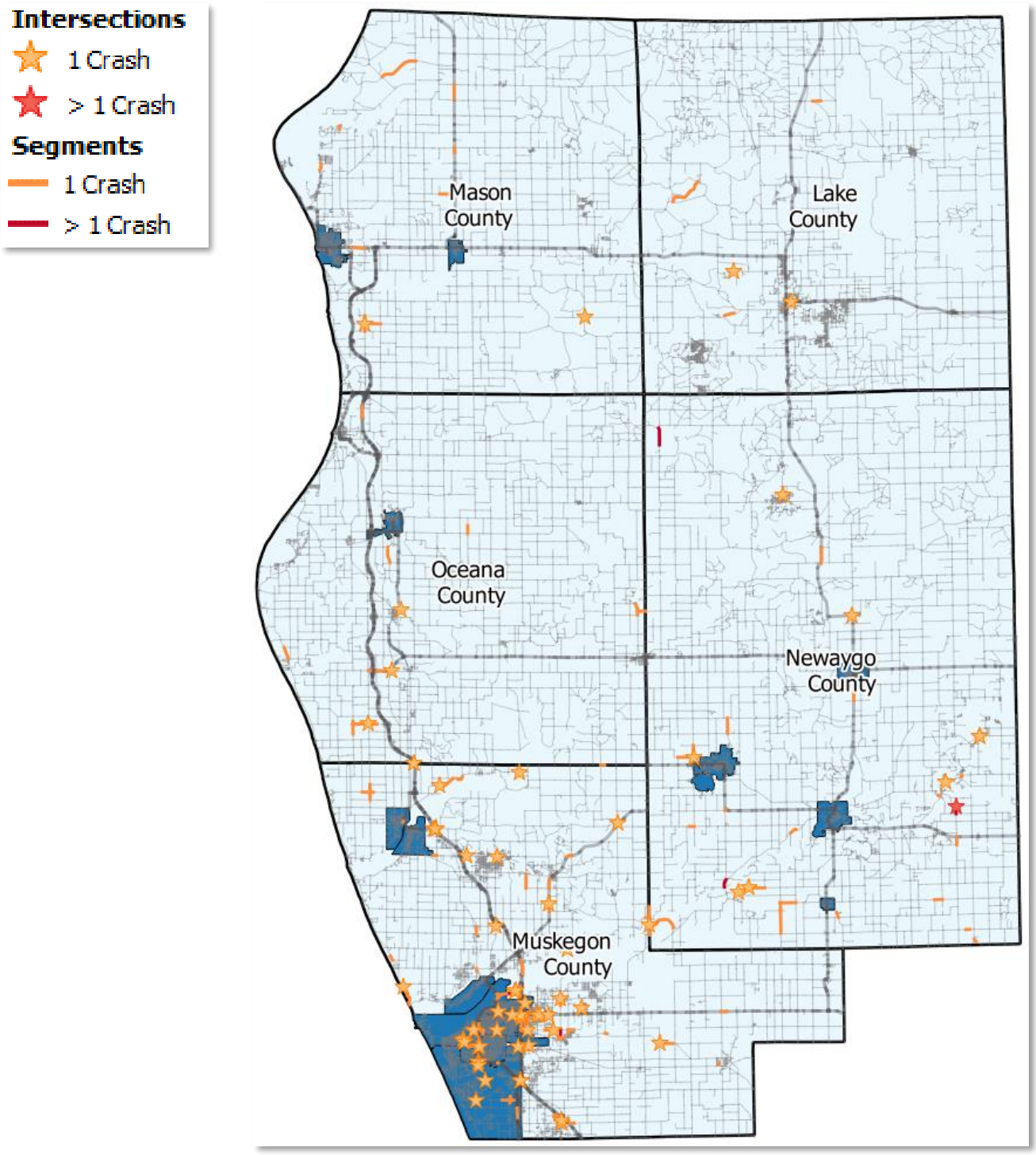


Figure 35 - Fatal & Incapacitating Injury Motorcyclist Involved Crash Locations (2010-2014)

2.4.5.1 Strategies

Motorcycle Education Campaigns



Education campaigns exist to remind drivers to stay aware of motorcyclists on the road and to watch their blind spots. As motorcycles take up less space than standard vehicles, it can be easier to miss them on the road. Some research has suggested that drivers may be "blind" to the presence of motorcycles in some instances as they are preoccupied with their search for other automobiles.[8] Additional training and education for motorcycle riders could also prove beneficial. Recommendations regarding protective gear and the use of high visibility rider apparel would help riders stand out on the road under a number of different environmental conditions. Basically, education campaigns could be employed to remind both drivers and riders of their shared responsibility on the road.

Figure 36 - Education Campaign Example: Ride Safe to Ride Again
(Source: Road Guardians)

Motorcycle Enforcement Campaigns

Targeted enforcement campaigns could be designed to address areas of higher proportions of motorcycle riders or related crashes. For example, as vehicles require a greater distance to come to a complete stop when compared to motorcycles, law enforcement might increase enforcement regarding tailgating. This would potentially help to reduce the number of incidents where vehicles rear-end motorcyclists. Similarly, riders could be pulled over for reckless driving and weaving in and out of traffic. These enforcement activities could be conducted in conjunction with education campaigns to build off each other.

Promote High Visibility Apparel

High visibility and reflective gear improves the likelihood that other drivers and motorists will be able to see motorcyclists on the road. In this way, the likelihood of a crash can be reduced. A study completed in 2012 used a simulator to determine the various distances drivers were able to identify a motorcyclist while driving. Among other results from the study, the research team noted that motorcyclists wearing bright yellow gear were visible from a greater distance than those wearing blue or black gear.[9]

[8] Hazard Perception of Motorcyclists and Car Drivers (https://www.researchgate.net/profile/Amotz_Perlman/publication/50288041_Hazard_perception_of_motorcyclists_and_car_drivers/links/00b7d5374646c8329d000000.pdf)

[9] Motorcycle Conspicuity – What Factors Have the Greatest Impact (http://www.intrans.iastate.edu/research/documents/research-reports/motorcycle_conspicuity_ii_w_cvr.pdf)

Promote Training Courses Targeting Motorcycle Crashes

Given the unique nature of motorcycles and associated crashes, there are a number of injuries that tend to be more typical for motorcycle involved crashes. Training courses exist which cover response methods for both bystanders as well as first responders. One example includes P.A.C.T. (Prevent Further Injury, Assess the Situation, Contact EMS, and Treat the Injured with Life Sustaining Care). This type of training course has also been recommended at the state level and promoted at the National level by the Road Guardians[10].

[10] https://roadguardians.org/

2.4.6 Roadside Related Concerns

Roadside related crashes, considered single vehicle lane departure crashes for the purposes of this report, accounted for almost 40 percent of all fatal and incapacitating injury crashes in the region. In Figure 37, the highlighted segments represent locations which experienced at least one fatal and / or incapacitating injury in this category during the five-year period (2010 – 2014).

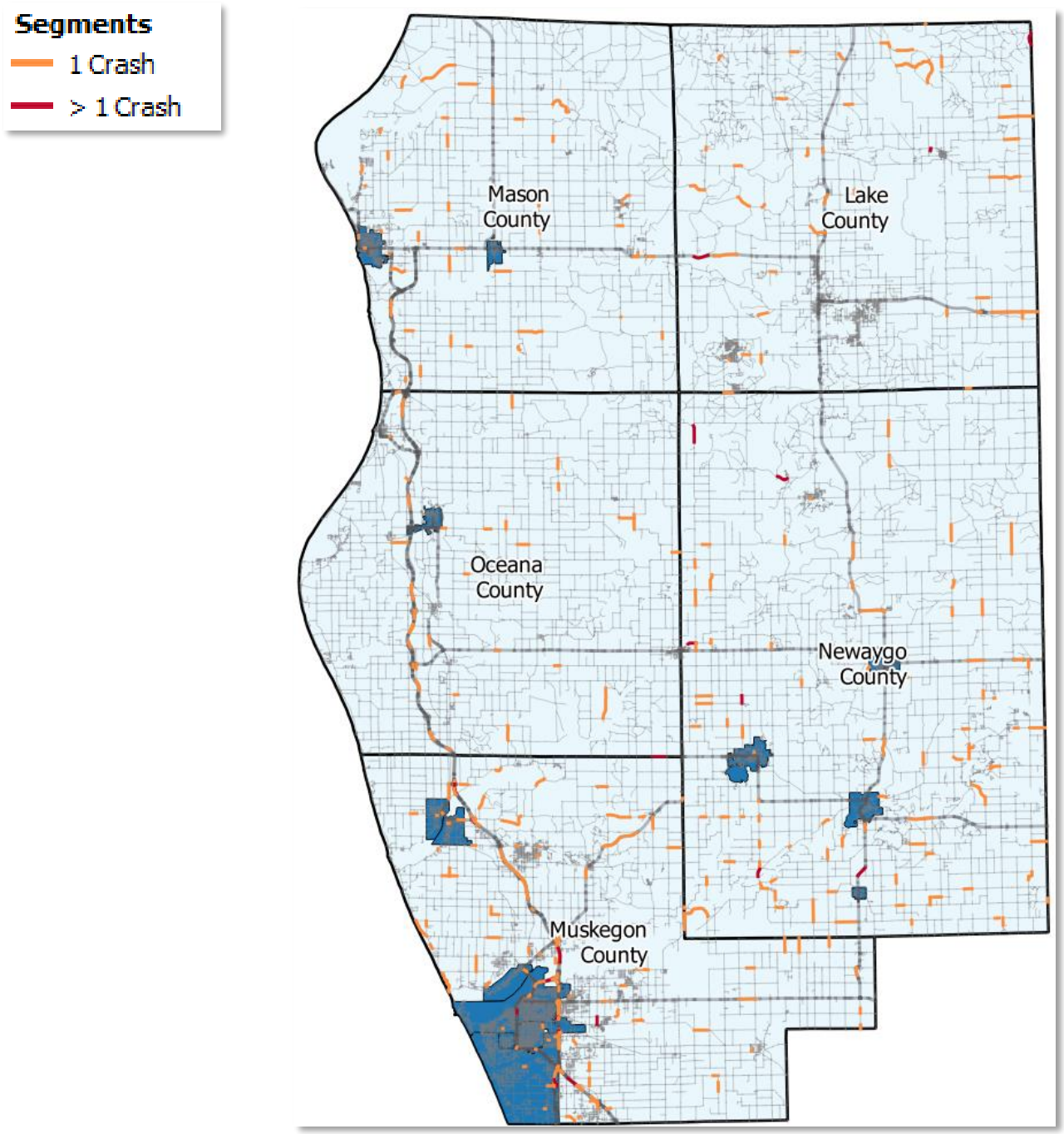


Figure 37 - Fatal & Incapacitating Injury Roadside Related Crash Locations (2010-2014)

Potential contributing factors include impaired driving, drowsy or distracted driving, insufficient or deteriorated roadside delineation, and inclement weather or roadway surface conditions. Almost 50 percent of these crashes involved speeding behavior. Additionally, just under a third of the fatal and incapacitating injury crashes occurred under dark unlit conditions. A wide range of factors may contribute to the potential for a run off road to occur as well as the severity of the crash and the ability of the driver to correct and recover. Figure 38 provides an example of a roadside drop-off issue identified in the state which would not necessarily increase the likelihood of a crash but would make it more difficult to recover. Drivers faced with this situation have been known to over correct and re-enter the road crossing into oncoming traffic.



Figure 38 - Michigan Roadside Drop-off Example

2.4.6.1 Strategies

Advanced Curve Warning and/or Chevrons



Figure 39 - Curve Delineation Example
(Source: FHWA)

Advanced curve warning signs provide drivers with additional time to adjust their speed to prepare for the upcoming curve. These "Curve Ahead" warning signs may be supplemented with advisory warning speeds where warranted based on the geometry of the curve. Additionally, target arrows and chevron signs help to delineate the path of the curve improving the driver's ability to stay in their lane and on the road. Flashing beacons and reflectorized posts may be added to the signs to improve their conspicuity and draw drivers' attention to the curve.

Install Center and Edgeline Rumble Strips



Center and edgeline rumble strips provide the driver with an auditory and tactile alert when they begin to move out of their lane. These strips can be pressed into newly laid pavement or milled in to existing pavement. They are especially effective when addressing run off road crashes involving drowsy or distracted drivers.

Figure 40 - Center & Edgeline Rumble Strip Installation
(Source: FHWA)

Install/Expand Paved Shoulders

While gravel shoulders provide drivers with additional room for correction and vehicle recovery, paved shoulders are more stable and provide improved traction and control. This extra pavement area improves the driver's ability to correct after leaving their lane but before departing from the road itself.



Figure 41 - Paved Shoulder Example
(Source: FHWA)

Improve Nighttime Delineation



Improving the delineation visibility on stretches of dark or unlit roadway improves the tracking ability of drivers. This can be done through the installation of overhead lighting, improved pavement marking retroreflectivity, or other reflective equipment along the roadside. These treatments help to illuminate the road itself as well as the roadside conditions.

Figure 42 - Nighttime Delineation Example
(Source: FHWA)

Install Safety Edge Treatments

Installation of safety edge treatments to paved roadways improves the ability of drivers who have begun to leave the roadway to return. The more traditional vertical edge can present problems when trying to return to the shoulder or travel lane, as there is a tendency to over correct, potentially leading to sideswipe, head on, and other related crashes. The slope of a safety edge treatment is more forgiving in allowing the vehicle to return to the roadway with less chance for overcorrecting.



Figure 43 - Safety Edge Treatment
(Source: FHWA)

2.4.7 Sign & Delineation Related Concerns

During discussions with stakeholders, concerns around signage condition and application as well as delineation in general (i.e. delineators, pavement markings, edgelines, etc.) were raised. These included older signs or those in poor condition in terms of day and nighttime visibility and missing or worn edgelines as some examples. Warning and guidance signs provide crucial information for drivers, especially those unfamiliar with the area, regarding upcoming hazards, conflicting traffic, and other physical or environmental road conditions. Additionally, pavement markings, including lane and edgelines, assist drivers with lane keeping, reducing the potential for sideswipe, head on, and run off road crashes. It is expected that poor, worn, obstructed, or missing signage and delineation may play a role in a wide range of crash types. Figure 44 provides an example of poor levels of sign retroreflectivity. Potential involvement of this type is not typically recorded in crash reports, making it difficult to estimate their direct involvement in the historic crash record.



Figure 44 - Worn Stop Ahead Sign in the Region

2.4.7.1 Strategies

While it is difficult with current information to identify when a missing, worn, or damaged sign has contributed to a crash, it is important to ensure they are continually maintained, and replaced as necessary. Ongoing and regular audits of existing and needed signage and pavement markings should be conducted throughout the region, both to repair or replace signs, and to ensure that existing signs and delineation meet or exceed MUTCD minimum standards. The county road commissions already do this to a certain degree through their daily activities.

Given the restricted availability of funding, it may be more effective to target specific sign or area types when conducting network reviews. For example, in addition to existing sign maintenance and replacement programs, it may be beneficial to identify sharp curve locations throughout the region which may benefit from curve warning, chevron, or other advanced signage. This would also allow road commissions to potentially bundle similar types of work, improving efficiency. Another example could include a review of three-way, stop-controlled intersections for the presence and condition of stop ahead signs and target arrows installed opposite the third leg.

2.4.8 Vulnerable Road User Involved Crashes

When considering crashes of all severities, pedestrian and bicycle involved crashes accounted for approximately 1.7% of all crashes. However, when considering fatal and incapacitating injury crashes specifically the proportion jumps to nearly ten percent (95 out of 985). Concerns around the presence of vulnerable road users was raised during stakeholder discussions as well. Specific concerns included:

- Bicyclists and pedestrian in the travel lanes;
- Poor compliance around mid-block crossings; and,
- Pedestrian / vehicle interaction in school areas.

Figures 45 and 46 highlights locations which experienced at least one fatal and / or incapacitating injury in this category during the five-year period (2010 – 2014).

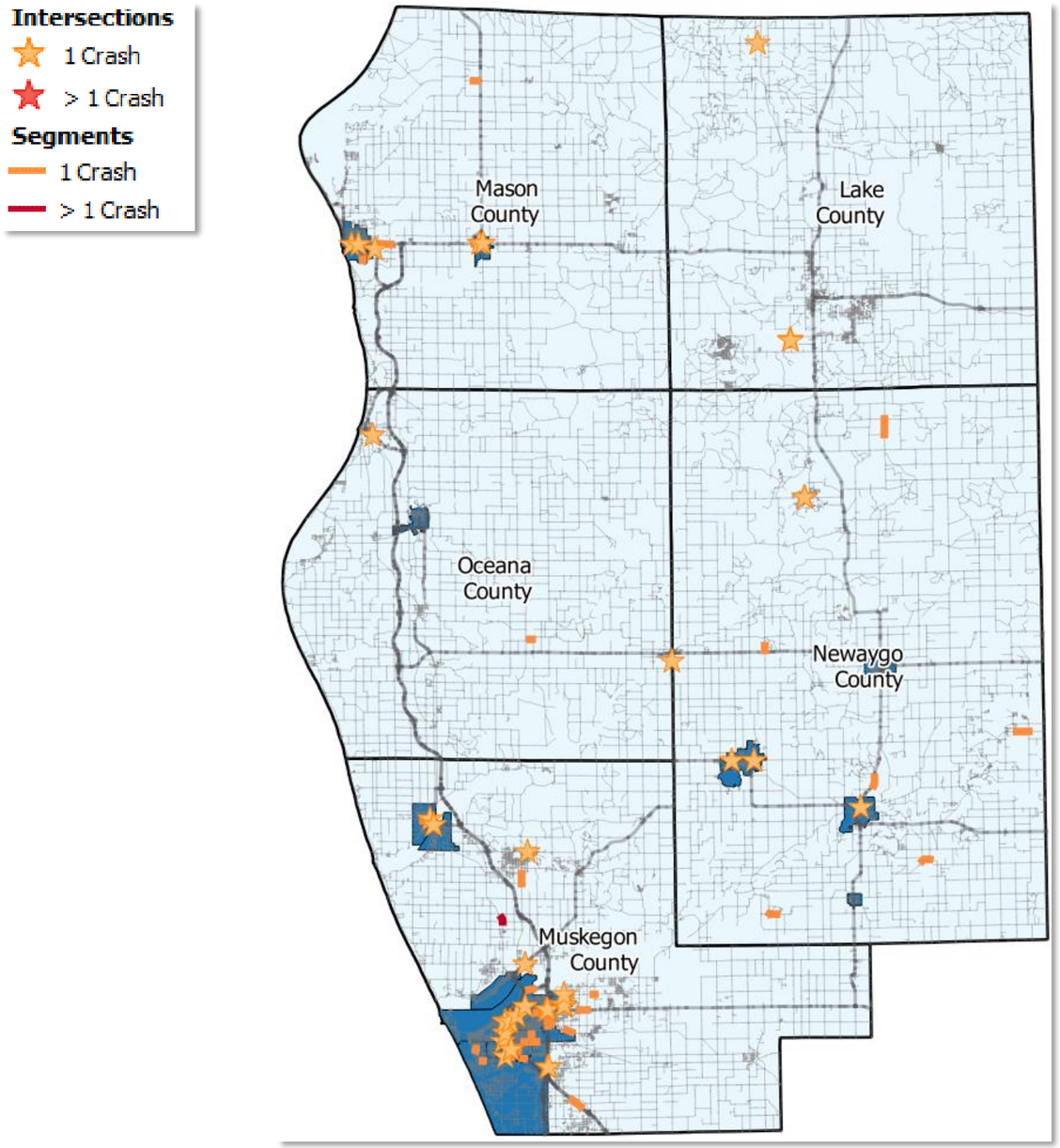


Figure 45 - Fatal & Incapacitating Injury Pedestrian Involved Crash Locations (2010-2014)

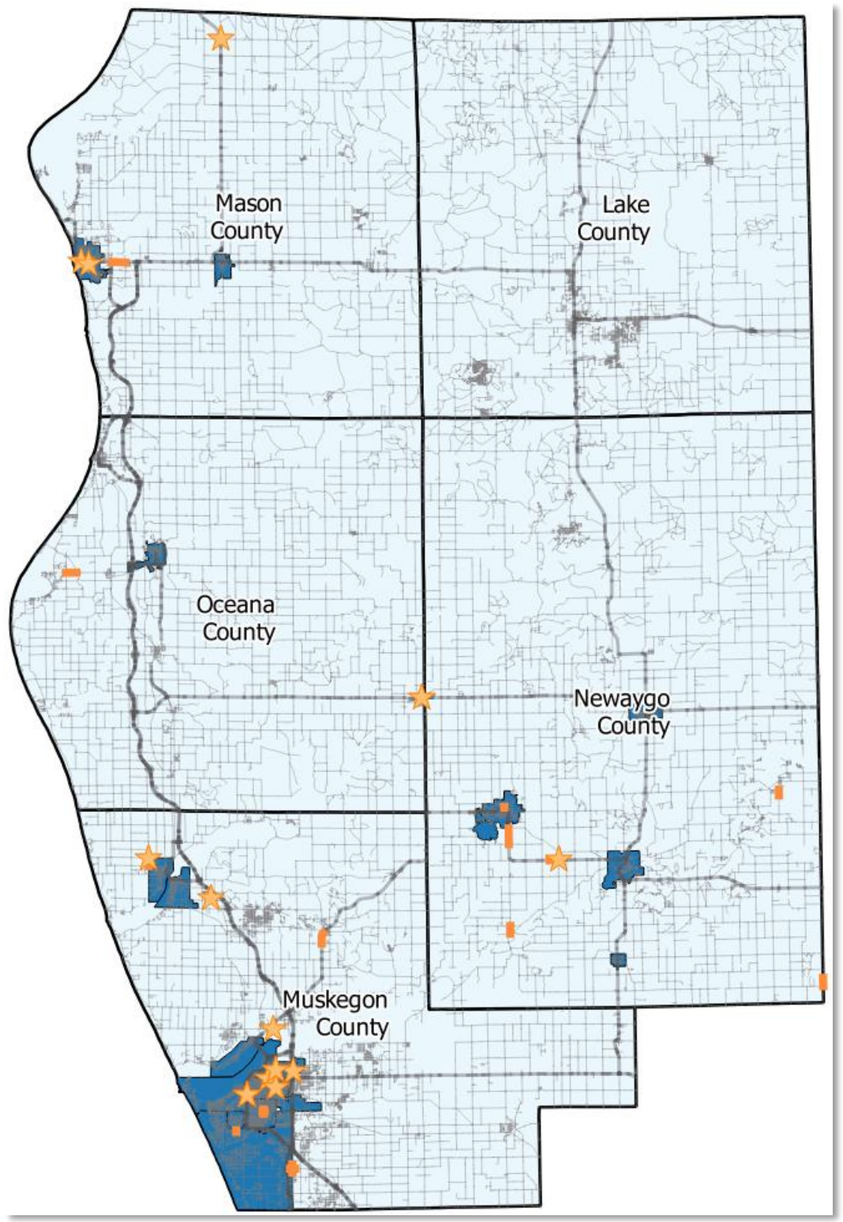


Figure 46 - Fatal & Incapacitating Injury Bicyclist Involved Crash Locations (2010-2014)

While the likelihood of a non-motorized crash occurring is relatively low, the probability that any single non-motorized crash will result in an injury or fatality is disproportionately high. On average, 79 percent of all pedestrian or bicyclist involved crashes from 2010 – 2014 resulted in a fatality or some level of injury (all crash types excluding property damage only). Figures 47 illustrate the distribution of fatal, injury, and property damage only vulnerable road user involved crashes.

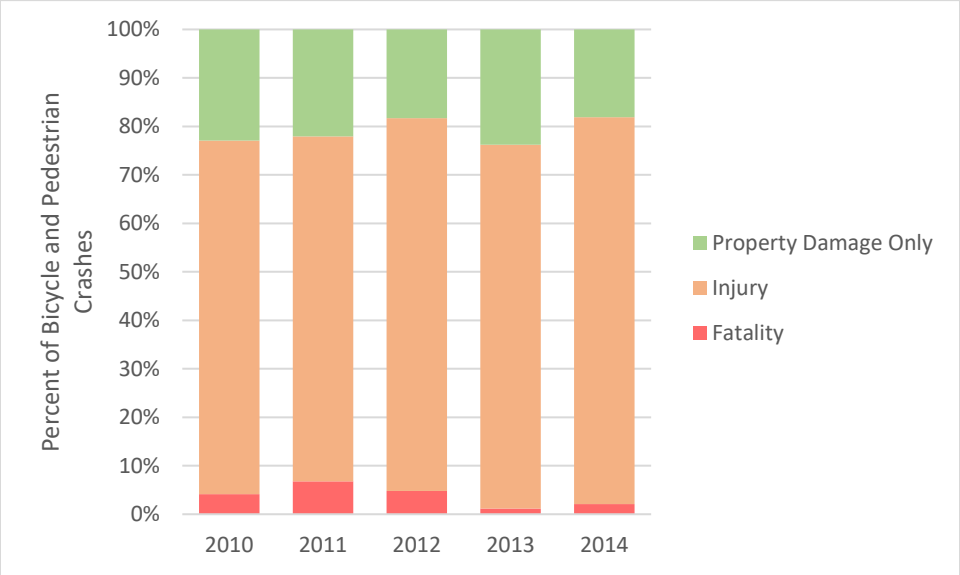


Figure 47 - Portion of Vulnerable Road User Crashes by Severity

Other considerations related to pedestrian, bicyclist, and other non-motorized vehicle-involved crashes include lighting, their relation to the road, and the actions of the driver taken prior to the crash. Based on the crash data, there tends to be a greater propensity for vulnerable road user involved crashes along straight segments and under dark conditions. During the five-year study periods approximately two percent of all vulnerable road user crashes occurred at a midblock crossing. Figure 48 provides a high-level summary of some of these concerns in relation to vulnerable road user involved crashes.

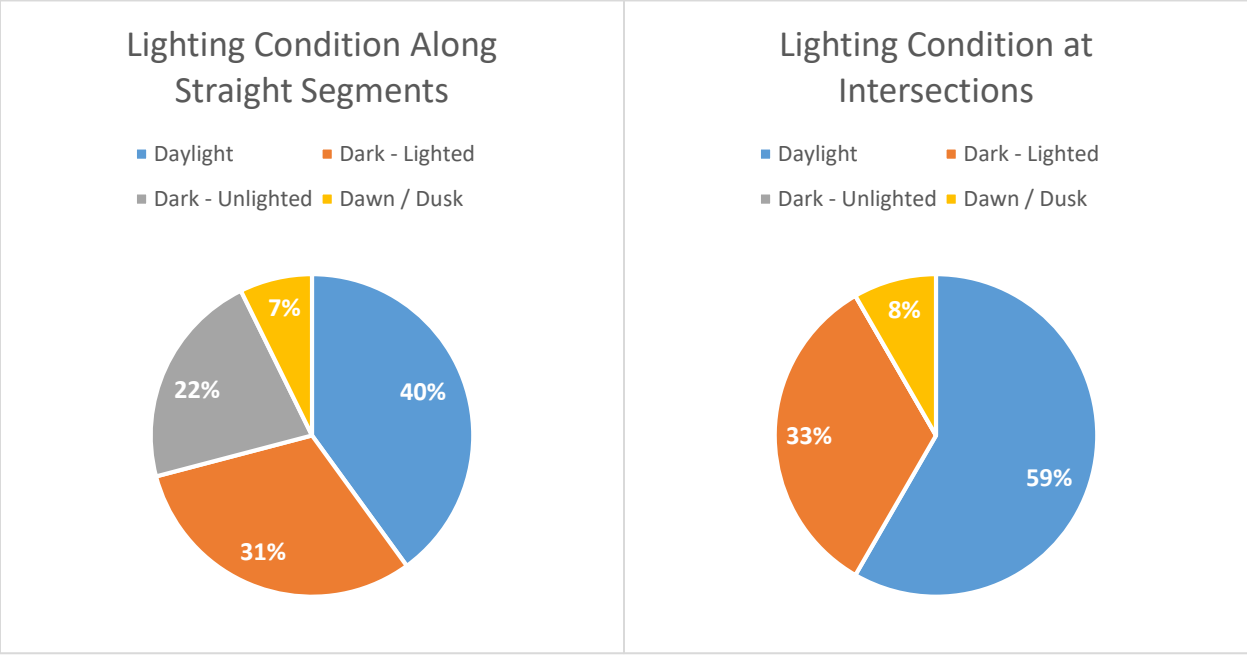


Figure 48 - Vulnerable Road User Involved Fatal & Incapacitating Injury Crash Lighting Condition Summaries

Consideration for the interaction of all road users should be given when implementing any recommended strategies. Different mixes of modes of transportation lend themselves to different types of countermeasures. For example, in areas with heavy pedestrian traffic, it may be better to require bicyclists use the roadway or shoulder rather than share the sidewalk with pedestrians to avoid conflicts in congested areas. Any potential recommendations must be carefully considered to ensure that it meets the needs of all road users whenever possible. It is crucial to help educate all members of the public around appropriate road sharing practices between motor vehicles, bicyclists, and pedestrians.

2.4.8.1 Strategies

Bike Lanes & Sharrows

Installation and maintenance of existing and future bike lanes, sharrows, and other similar treatments provide additional guidance and separation between bicyclists and motor vehicles while allowing both to share existing roadway. Additionally, marked lanes specifically for bicyclists help to improve drivers' awareness of the potential for non-motorized traffic in the vicinity.



Figure 49 - Bike Lane Installation
(Source: FHWA)

Education and public awareness programs regarding the lanes and appropriate use and interaction between vehicles and bicycles and other slower moving traffic could also be considered.

Crosswalk Improvements

Installation of a range of crosswalk improvements would benefit pedestrians and bicyclists and provide greater delineation to drivers. Some examples include marked & signed crosswalks, improved lighting, pedestrian countdown timers and actuated pedestrian signals (pushbuttons). These treatments help to alert drivers of the presence of the crossing and potential for pedestrians in the area.



Figure 50 - Crosswalk Treatment
(Source: FHWA)



Figure 51 - MI HAWK Signal Installation
(Source: Michigan Complete Streets Coalition)

Another important consideration is the maintenance and availability of the crosswalk itself. While a significant number of intersections provide pedestrian crossings, it is fairly common for a pedestrian to cross midblock instead of walking down to the intersection to cross. This possibility should be taken into consideration and the installation of midblock crossings in areas of heavy pedestrian flow should be considered. These midblock crossings could be marked, signed, or signalized through the use of HAWK (High-intensity activated crosswalk) signals or other flashing beacons.

Improve Sidewalk/Multi-use Trail Connectivity & Maintenance



Expanding on the existing sidewalk and multi-use trails would provide pedestrians and bicyclists with another safe area to travel and help separate them from motor vehicle traffic. Implementing or improving on existing maintenance programs would help to ensure that the sidewalks and trails remain a viable route for pedestrians and bicyclists.

Figure 52 - Marked Multi-Use Trail
(Source: FHWA)

Pedestrian & Bicyclist Education & Awareness Programs

A number of pedestrian and bicyclist focused programs could prove beneficial, especially in neighborhood areas around schools. These programs are intended to promote healthy, active lifestyles through walking and biking to school and incorporate educational components. This is particularly important when working with younger children and teaching them the proper and safe ways to share the road with other users. Some examples of more common programs include the Safe Routes to School (SR2S)[11] and walking school busses[12].

Other education and awareness programs could be implemented to assist middle and high school students as well as adults. Anecdotally, there are drivers who don't realize that bicyclists are permitted in the roadway. At the same time, there are bicyclists who don't follow the rules of the road as required. Offering educational materials or programs could improve the mutual understanding of both groups, resulting in more equitable and safer road sharing. One example of such material is a short video produced by the Federal Highways Administration, shown in Figure 53, which provides safety information for bicyclists.[13]



Figure 53 - FHWA Bicycle Safety Video
(Source: USDOT FHWA)

Review Lighting Need & Coverage

Non-motorized road users, by their nature, are more vulnerable when sharing the road with other vehicles. This can be especially true when traversing the network after dark. Pedestrians often lack any

[11] Michigan Safe Routes to School (http://saferoutesmichigan.org/)
[12] Walking School Bus Resource (http://www.walkingschoolbus.org/)
[13] FHWA Safer Bicycle Journey (https://lnkd.in/dV8Vy_8)

lights or reflective clothing and while some bicyclists have reflective panels on their bikes their size, reflectivity, and condition may vary widely. It is important to ensure that roads and other paths used by vulnerable road users are well lit and delineated. This improves navigation for the vulnerable road users as well as helps them stand out more when sharing the network with vehicles.

2.4.9 Additional Traffic Incident Management (TIM) Strategies

A self-sustaining, established traffic incident management (TIM) program promotes safety, improves mobility, and instills ownership of these benefits in incident responders. MDOT, local agencies and first responders have been partnering for more than two decades to promote TIM. Below are several TIM strategies which are suggested for implementation in the West Michigan Shoreline Regional Development Commission region.

Continued promotion of "Steer It Clear It" laws

The quick clearance of incidents has been found to be an effective strategy to reduce the risk of secondary crashes. MDOT in partnership with the Governor's Traffic Safety Action Committee TIM Action Team developed a public information and education campaign to promote the steer it, clear it law. It is proposed that the WMSRDC Region collaborate with the GTSAC TIM Action Team to promote the Captain Clear It campaign in the Region.

Further develop the use of data solutions to enhance TIM

MDOT is currently collecting extensive data with regards to incidents. It is proposed that this data be analyzed and linked to crash data. The feasibility of collecting this data for local roads should also be considered. In addition, it is proposed that agencies work to develop a strategy to increase the use of vehicle probe data as part of TIM activities. This could include using it for incident detection, identification of corridors with high frequency or rates of incidents, and after action reporting.

MI-TIME training

Michigan's Traffic Incident Management Effort (MITIME) is a partnership between agencies, including MDOT, state and local law enforcement, fire, EMS, and towing services, to work together to safely and efficiently clear traffic incidents from Michigan's highways. A key focus of this effort has been to promote the national SHRP2 TIM training course. This course focuses on providing these groups with strategies to reduce the risk to motorist or responder involved in a traffic crash. As approximately 20% of Michigan's first responders have completed this training, it is proposed that additional marketing efforts be undertaken to promote the benefits of this training in the WMSRDC Region.

Pilot test various engineering countermeasures to assist with TIM

Engineering solutions have been found to be an effective strategy for supporting TIM efforts. The use of signs and gates at interchanges, crash investigation sites, other traveler information focused countermeasures have been found to be effective in improving safety. It is proposed that agencies work in partnership to pilot test various countermeasures to determine their effectiveness for potential deployment on a systemic basis.

Promote and educate first responders on the use of high-visibility apparel

The use of high visibility apparel by first responders during incidents has been found to significantly reduce the risk that they may be involved in a traffic crash. It is proposed that organizations and agencies in the WMSRDC Region work to promote the use of high visibility apparel.

2.5 Countermeasure Prioritization

Due to the interconnected nature of transportation safety and treatment strategies, countermeasures may have a varying impact for more than one emphasis area. While this can increase the complexity when attempting to quantify their overall effect, it does provide an opportunity to prioritize treatment strategies, at least in part, on the number of Emphasis Areas they have the potential to impact. Table 2 provides a rudimentary summary of the applicability of each countermeasure within each of the Emphasis Areas. The countermeasures are prioritized based on the potential number of Emphasis Areas which could be impacted by their installation, as well as the number of crashes each emphasis area has historically been associated with. The goal is to prioritize the treatments which have the potential to impact the greatest proportion of crashes within the Region.

Table 2 provides an initial prioritization of the countermeasures identified in this report. As with the Emphasis Areas and the countermeasures themselves, the prioritization should be reviewed and updated regularly to reflect the performance of each countermeasure and the priorities and guidance of the Region.

Table 2 - Countermeasure Prioritization

Ranking	Countermeasure(s)	Driver Age Related Concerns	Driver Behavior	Impaired Driver Involved	Intersection Related Crashes	Motorcycle Related Crashes	Roadside Related Concerns	Sign & Delineation	Vulnerable Road User Involved	Total	Associated Crashes
1	Improve Traffic Control Visibility	✓	✓		✓			✓		4	1,449
2	Driver Training Refresher Course	✓	✓			✓			✓	4	1,389
3	Improve Nighttime Delineation	✓			✓		✓		✓	4	1,283
4	Education and Enforcement Outreach	✓	✓	✓						3	1,368
5	Supplemental Driver Education and Training	✓	✓			✓				3	1,294
6	Review Signing, Traffic Control, and other Roadside Components	✓			✓			✓		3	805
7	Advanced Signage				✓			✓	✓	3	387
8	Install Safety Edge Treatments		✓				✓			2	1,028
9	Randomized Enforcement Locations		✓	✓						2	856
10	Review of Intersection Traffic Control	✓			✓					2	805
11	Traffic Calming Projects		✓						✓	2	739
12	Study Potential Road Diet Locations		✓						✓	2	739
13	Review Transit Availability & Accessibility	✓		✓						2	724
14	Sight Distance / Triangle Clearance & Maintenance				✓		✓			2	677
15	Install Center and Edgeline Rumble Strips			✓			✓			2	596
16	Install / Expand Paved Shoulders						✓		✓	2	479
17	Review and Improve Intersection Lighting				✓				✓	2	387
18	Promote High Visibility Apparel					✓			✓	2	232
19	MI-TIME Training		✓							1	644
20	Mobile & Fixed Speed Feedback Signs		✓							1	644
21	Distracted Driver Education Campaign		✓							1	644
22	Test various engineering countermeasures to assist with TIM		✓							1	644
23	Promote Steer It Clear It Laws		✓							1	644
24	Further develop the use of data solutions to enhance TIM		✓							1	644
25	Advanced Curve Warning and/or Chevrons						✓			1	384
26	Install Transverse Rumble Strips				✓					1	293
27	Explore Alternative Intersection Control Methods for Emergency Situations				✓					1	293
28	DRE Training			✓						1	212
29	Impaired Driving Enforcement Zones			✓						1	212
30	Motorcycle Education Campaign					✓				1	138
31	Motorcycle Enforcement Campaign					✓				1	138
32	Promote Training Courses Targeting Motorcycle Crashes					✓				1	138
33	Improve Sidewalk / Multi-Use Trail Connectivity and Maintenance								✓	1	95
34	Crosswalk Improvements								✓	1	95
35	Bike Lanes & Sharrows								✓	1	95

3 Next Steps

3.1 Implementation Process

While the West Michigan Shoreline Regional Development Commission, County Road Commissions, law enforcement, educators, and emergency responders have taken great strides towards improving road safety in the Region, fatal and incapacitating traffic crashes remain a priority. The Emphasis Areas and strategies outlined in this report provide a foundation for the stakeholders and agencies to draw on when implementing new, or maintaining existing, traffic safety projects and programs. The WMSRDC will continue to work with and foster strong relationships with and between the various stakeholders and agencies to help promote and coordinate these projects and programs. In this way, the WMSRDC may provide assistance on a yearly basis when counties are working to identify projects and tasks for the coming year, law enforcement and emergency responders are considering taking additional steps or implementing new programs, and education providers are considering the implementation of education campaigns.

The regional Traffic Safety Network (TSN) will serve as a central repository where agencies may seek information regarding projects and tasks being considered or currently underway in other jurisdictions. The RTSP should be reviewed on a bi-yearly basis with representatives from each of the four E's present to provide guidance and feedback. Additionally, the RTSP should be used in support of the yearly development of the various Transportation Improvement Plans to help identify areas where safety improvements could be incorporated into design and maintenance projects.

Through the continued cooperation and relationships between the TCRPC, TSN and related agencies, as well as between the agencies themselves, the RTSP provides a high-level document to guide the application of various transportation safety countermeasures throughout the Region.

3.2 Evaluation Process

Given the rapid nature of change in today's technologically driven world, it is crucial that the RTSP be continuously updated and evaluated. Michigan enjoys one of the country's more robust traffic crash reporting systems, which will be used to help evaluate the efficacy of systemic and systematic safety treatments and programs. This will require continued cooperation between the various stakeholders across all five counties in the region. Accurate records regarding the implementation of each safety related engineering improvement, education or public awareness campaign, law enforcement program, and emergency service changes should be maintained by each responsible party. In most, if not all, situations this is already occurring but must be maintained to help ensure enough information is retained to properly evaluate each treatment. This project and process information will be used in conjunction with the crash data as it becomes available to assess the impacts of each treatment on the related fatal and serious injury crashes.

In addition to the treatment evaluations conducted on a regular basis, feedback and concerns should be collected from stakeholders, relevant agencies, and the public to ensure that the most pressing concerns are included in the RTSP. This could be accomplished through a yearly, or bi-annual meeting, held with

all involved agencies and surveys distributed to the public. This information, when used in conjunction with a review of the most recent crash data and treatment effectiveness evaluations, should be used to update the RTSP. In this manner, progress may be tracked against the goals identified in the plan, as well as offering an opportunity to add additional concerns and Emphasis Areas and adjust or update the goals identified in the report.

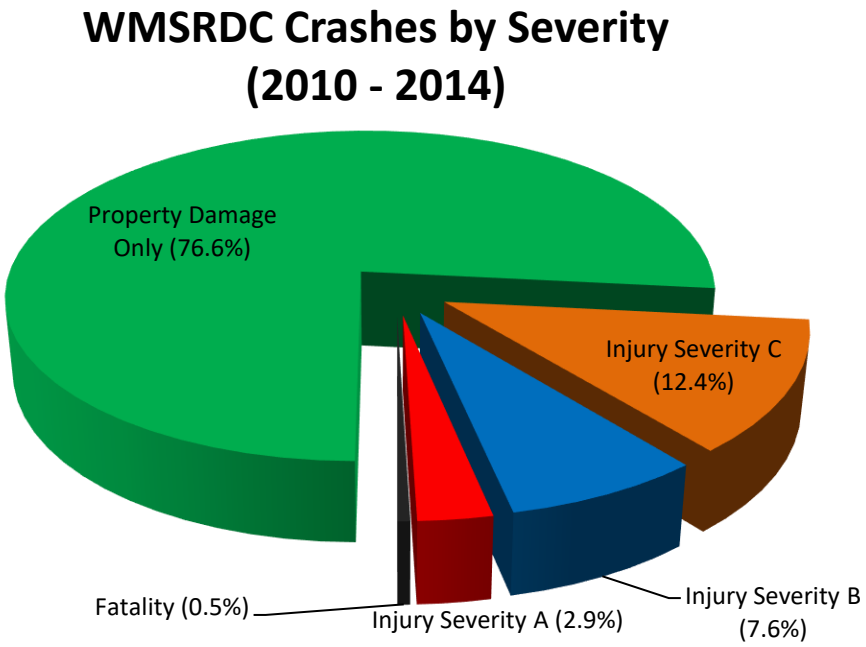
As this plan is a living document, periodic review and updates should address both the crash trends and statistics as well as the opportunity to incorporate new technology, such as Connected Vehicle data and ITS infrastructure.

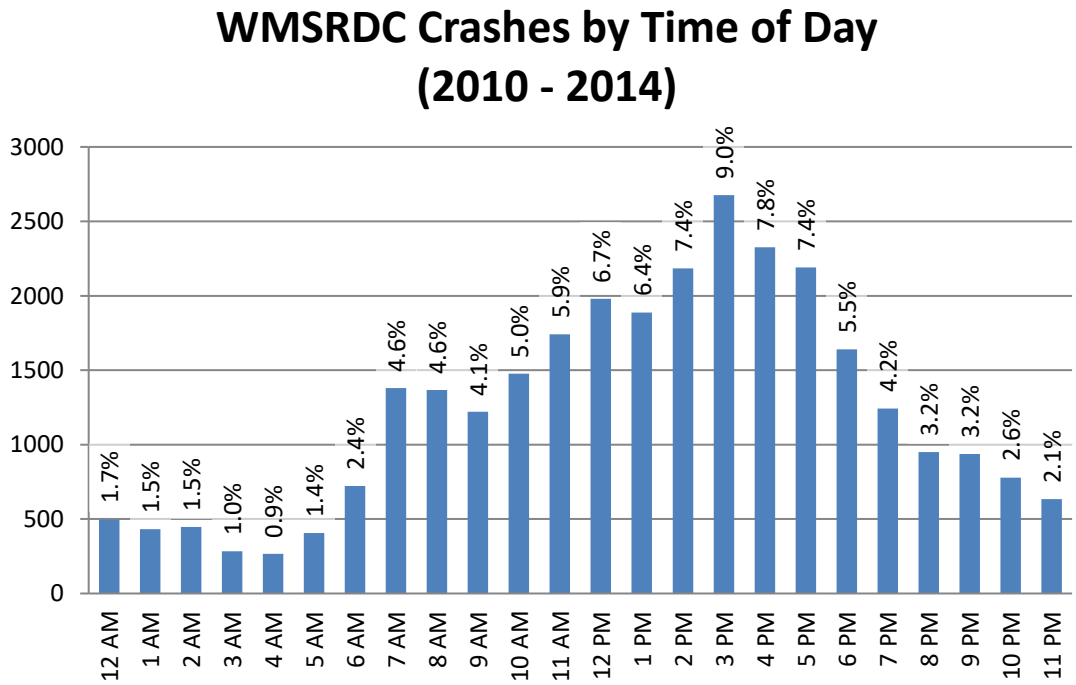
Additionally, as the report is updated and maintained, it should remain publicly available. In this way, the RTSP may remain a living document, adapting and adjusting according to the needs of the local communities it is designed to serve and support.

Appendices

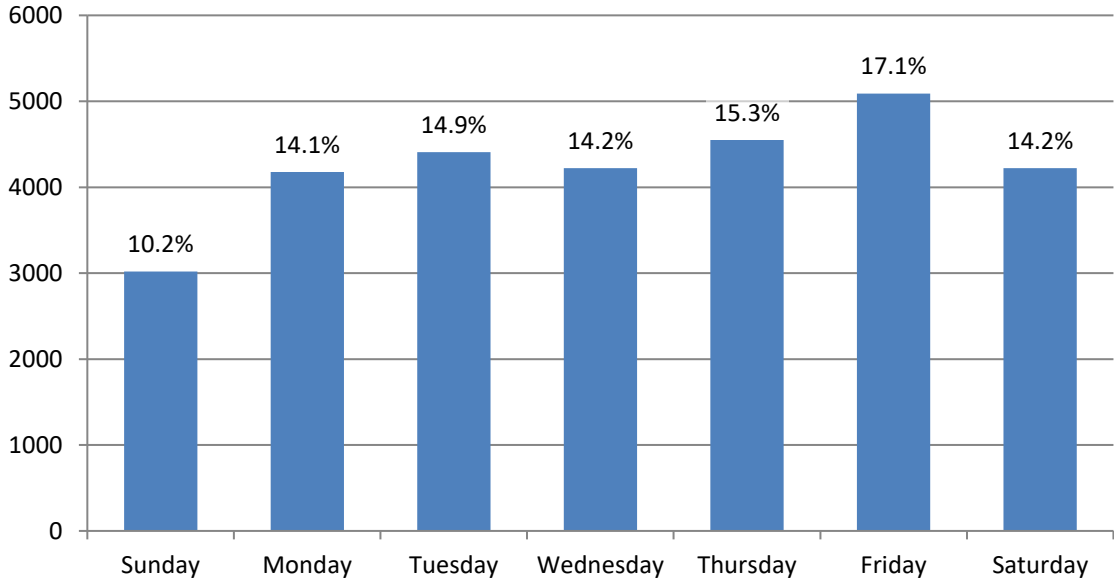
Appendix A – Data Analysis

2010 – 2014 Analysis Summary (Excluding Deer Crashes)

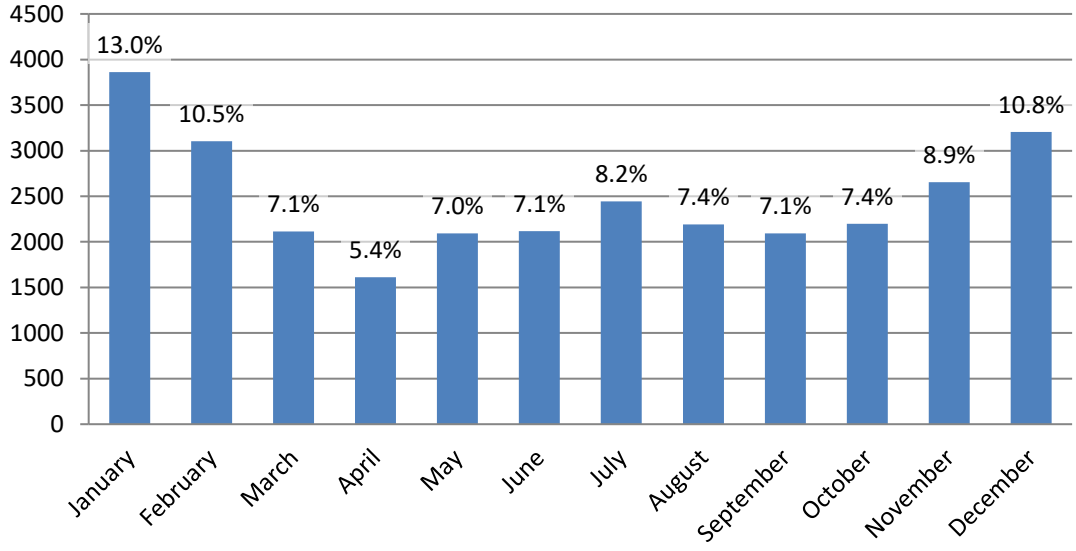


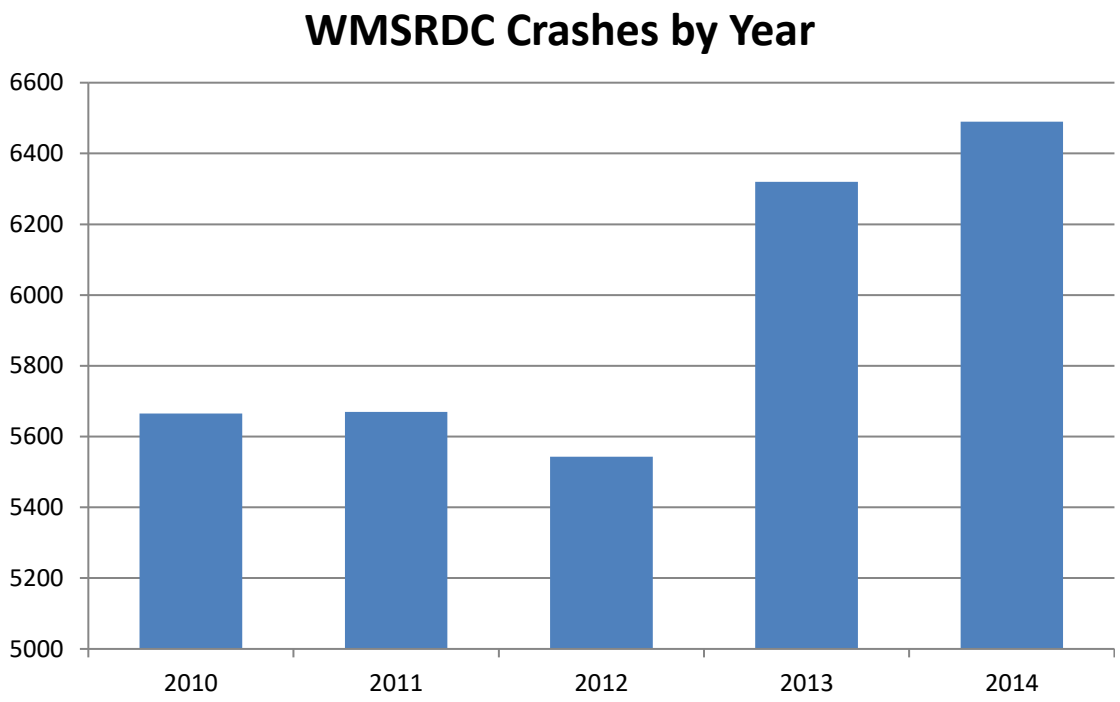


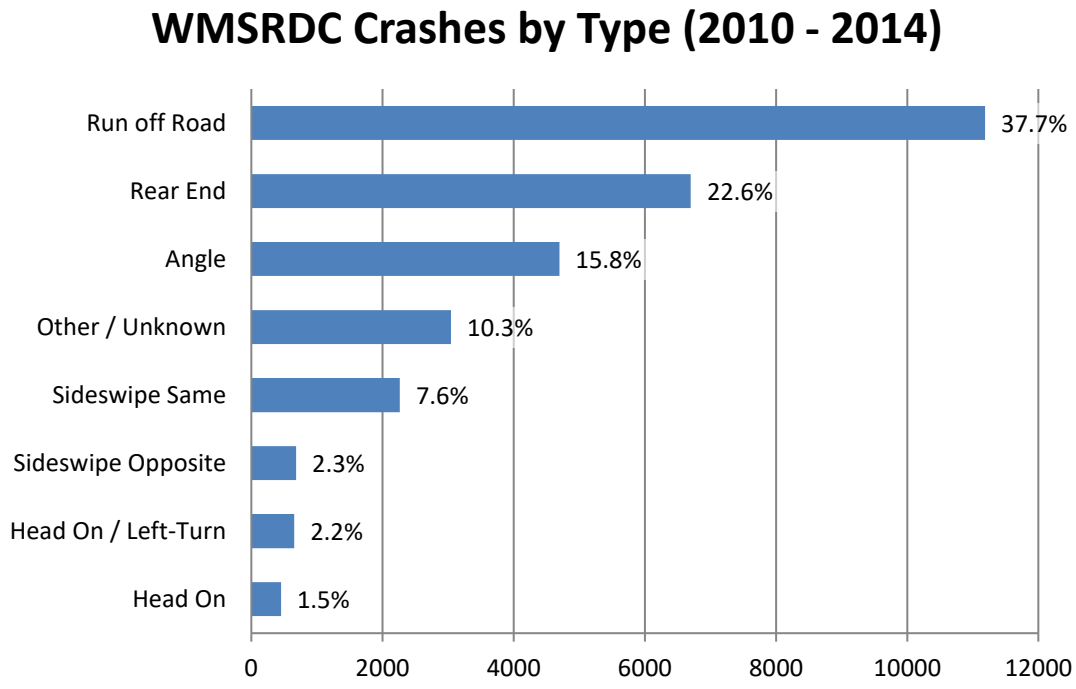
WMSRDC Crashes by Day of Week (2010 - 2014)



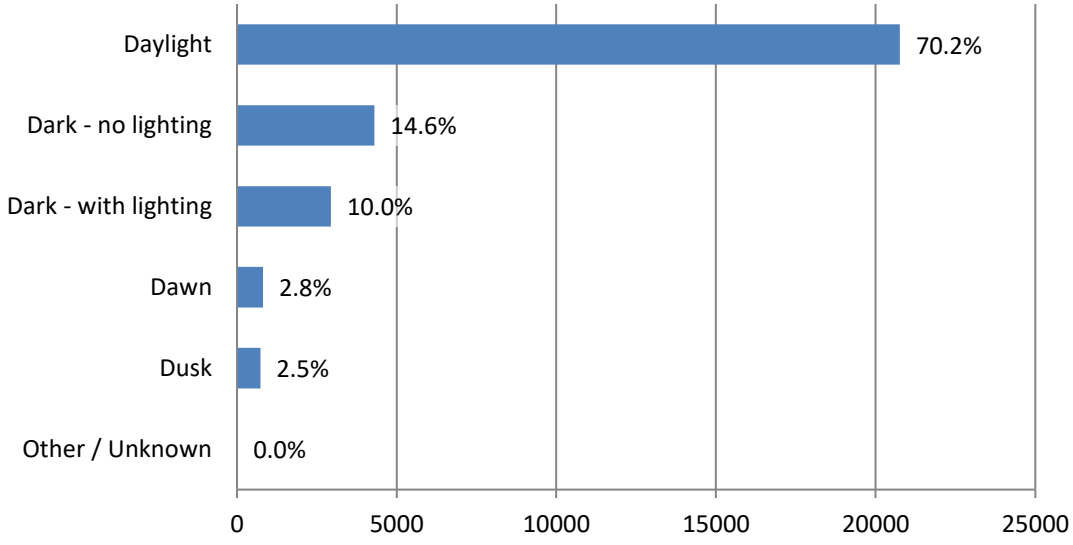
WMSRDC Crashes by Month of Year (2010 - 2014)



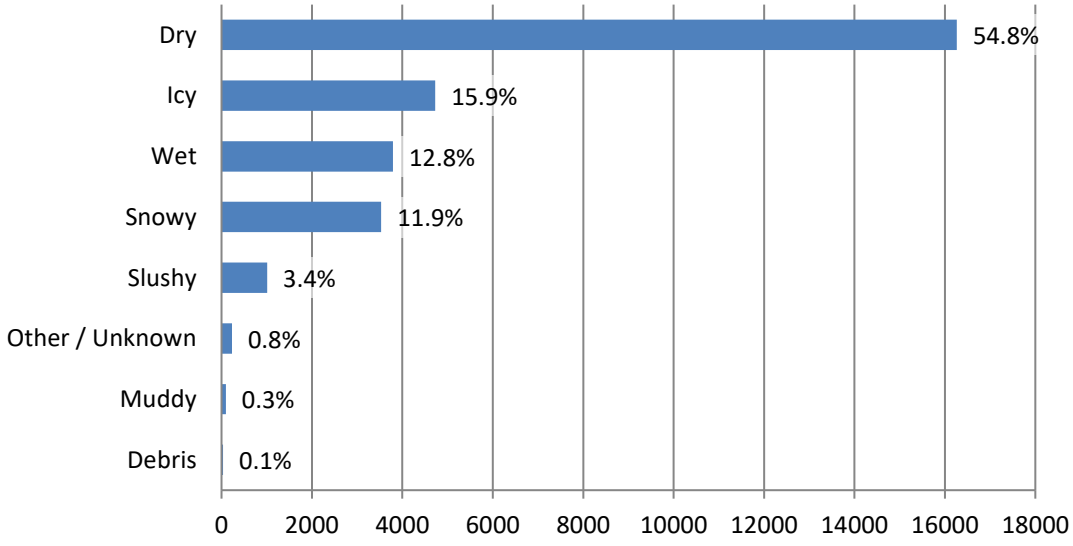

WMSRDC Crashes by Year
6600
6400
6200
6000
5800
5600
5400
5200
5000
2010
2011
2012
2013
2014


WMSRDC Crashes by Type (2010 - 2014)
Run off Road
37.7%
Rear End
22.6%
Angle
15.8%
Other / Unknown
10.3%
Sideswipe Same
7.6%
Sideswipe Opposite
2.3%
Head On / Left-Turn
2.2%
Head On
1.5%
0
2000
4000
6000
8000
10000
12000

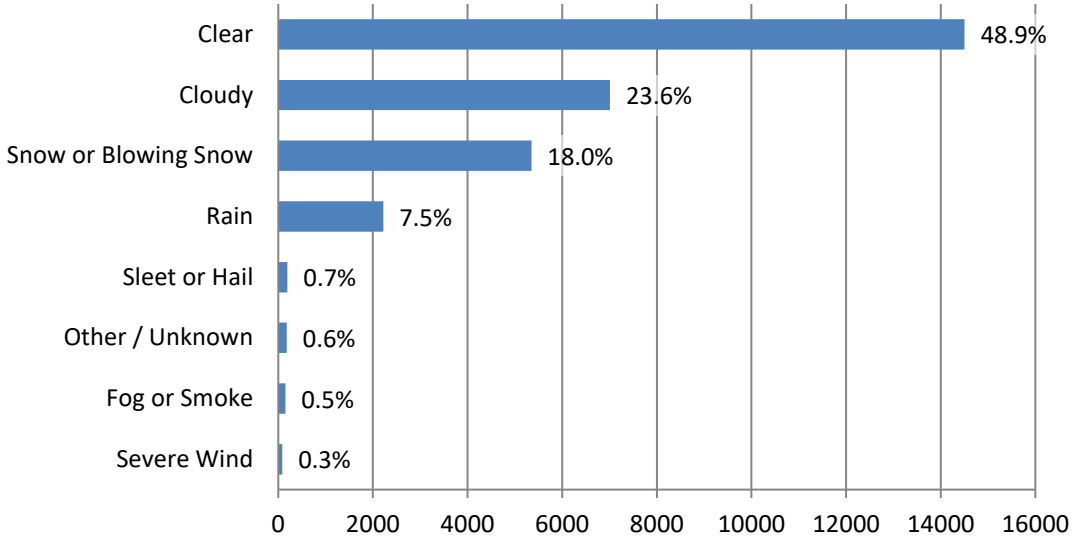
WMSRDC Crashes by Lighting Condition (2010 - 2014)



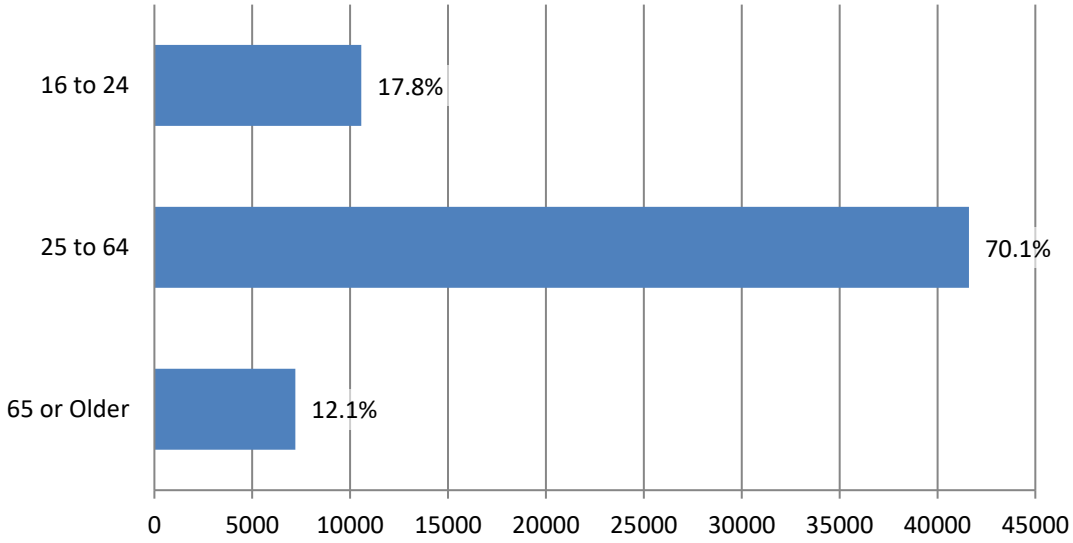
WMSRDC Crashes by Road Surface COndition (2010 - 2014)

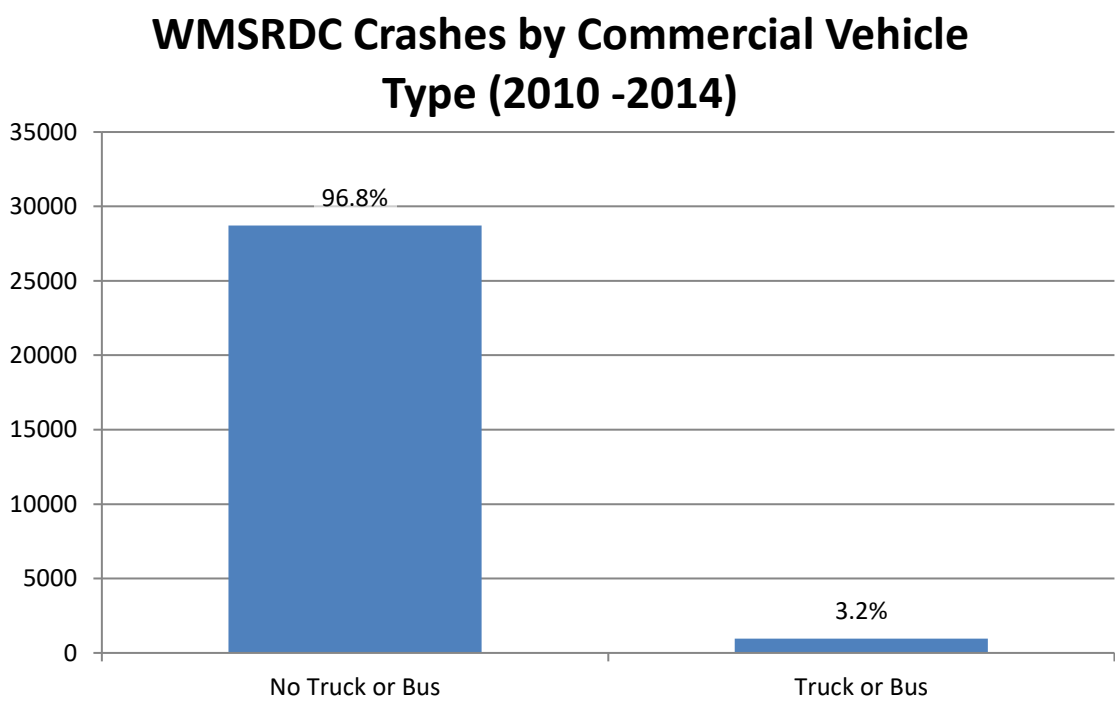


WMSRDC Crashes by Weather Condition (2010 - 2014)



WMSRDC Crashes by Age Group (2010 - 2014)




WMSRDC Crashes by Commercial Vehicle Type (2010 -2014)
35000
30000
25000
20000
15000
10000
5000
0
96.8%
3.2%
No Truck or Bus
Truck or Bus

2015 Preliminary Crash Summary (Excluding Deer Crashes)

Several preliminary trends were identified in the 2015 data and have been included here in the following table. Unless otherwise stated, all values are based on fatal and incapacitating injury crash counts.

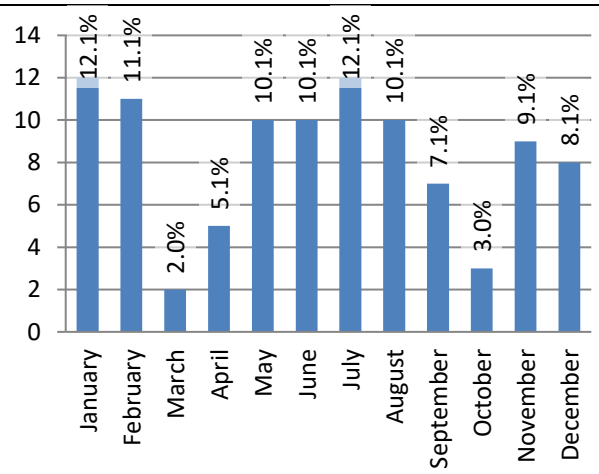
	2014				2015
Total Crashes	6,485	Decreased by	8.4%	to	5,943
Incapacitating Crashes	163	Decreased by	18.4%	to	133
Fatal Crashes	24	Increased by	20.8%	to	29
Run off Road Crashes	64	Decreased by	1.6%	to	63
Angle Crashes	43	Decreased by	37.2%	to	27
Rear End Crashes	17	Decreased by	11.8%	to	15
Vulnerable Road User Involved Crashes	13	Increased by	61.5%	to	21
Motorcycle Involved Crashes	20	Increased by	60.0%	to	32
Driving Under the Influence	30	Increased by	16.7%	to	35

As shown, initial high level trends are mixed when comparing 2014 and 2015 crash data. It is important to note that due to the nature of traffic crashes, it is inappropriate to draw any strong conclusions from the data presented in this section. However, it is useful to understand the basic observations and consider them when analyzing the full data set as it becomes accessible.

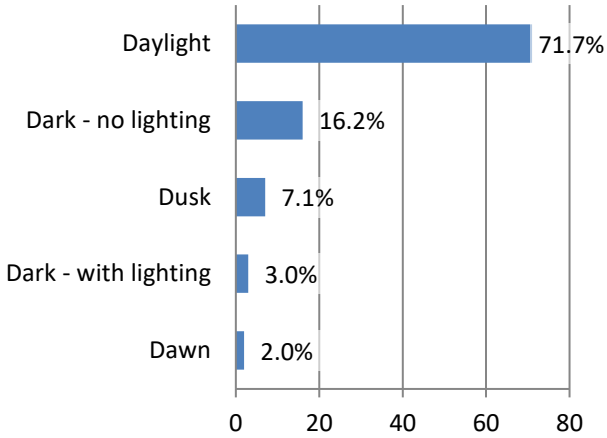
Individual County Summaries (Excluding Deer Crashes)

Lake County

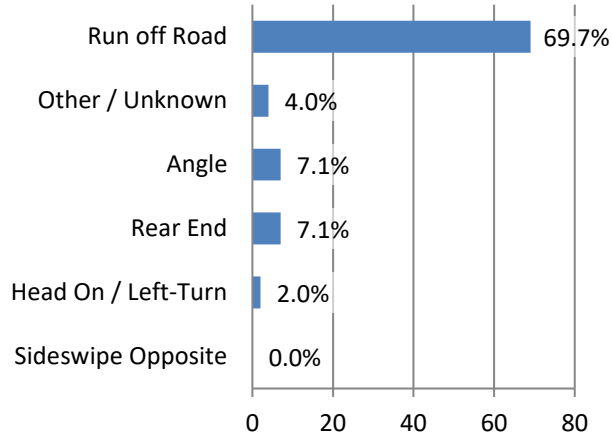
Lake County experienced approximately one tenth (99 of the 985 fatal and incapacitating) of the crashes reported in the WMSRDC Region during the analysis period despite only accounting for approximately three percent of the region's average yearly vehicle miles traveled (VMT). The summary statistics provided here fairly closely mirror those for the Region. One significant exception is the greater proportion of run off road crashes for this county when compared to the region as a whole. The following figures would suggest that fatal and incapacitating crashes in this county peak during both the winter and summer months, which is partially supported by the almost forty percent of crashes which occurred on icy, wet, or snowy road conditions.



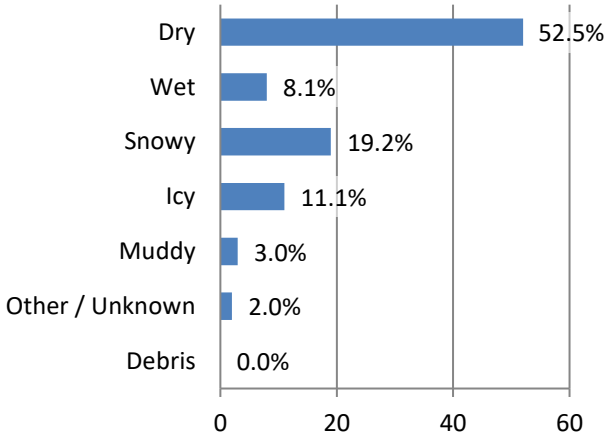
Lake County Monthly Crash Distribution



Lake County Lighting Condition Distribution



Lake County Crash Type Distribution



Lake County Road Condition Distribution

The following figure provides the special distribution of lane departure crashes (i.e. run off road and head on crashes) in the county during the 2010 – 2014 period.

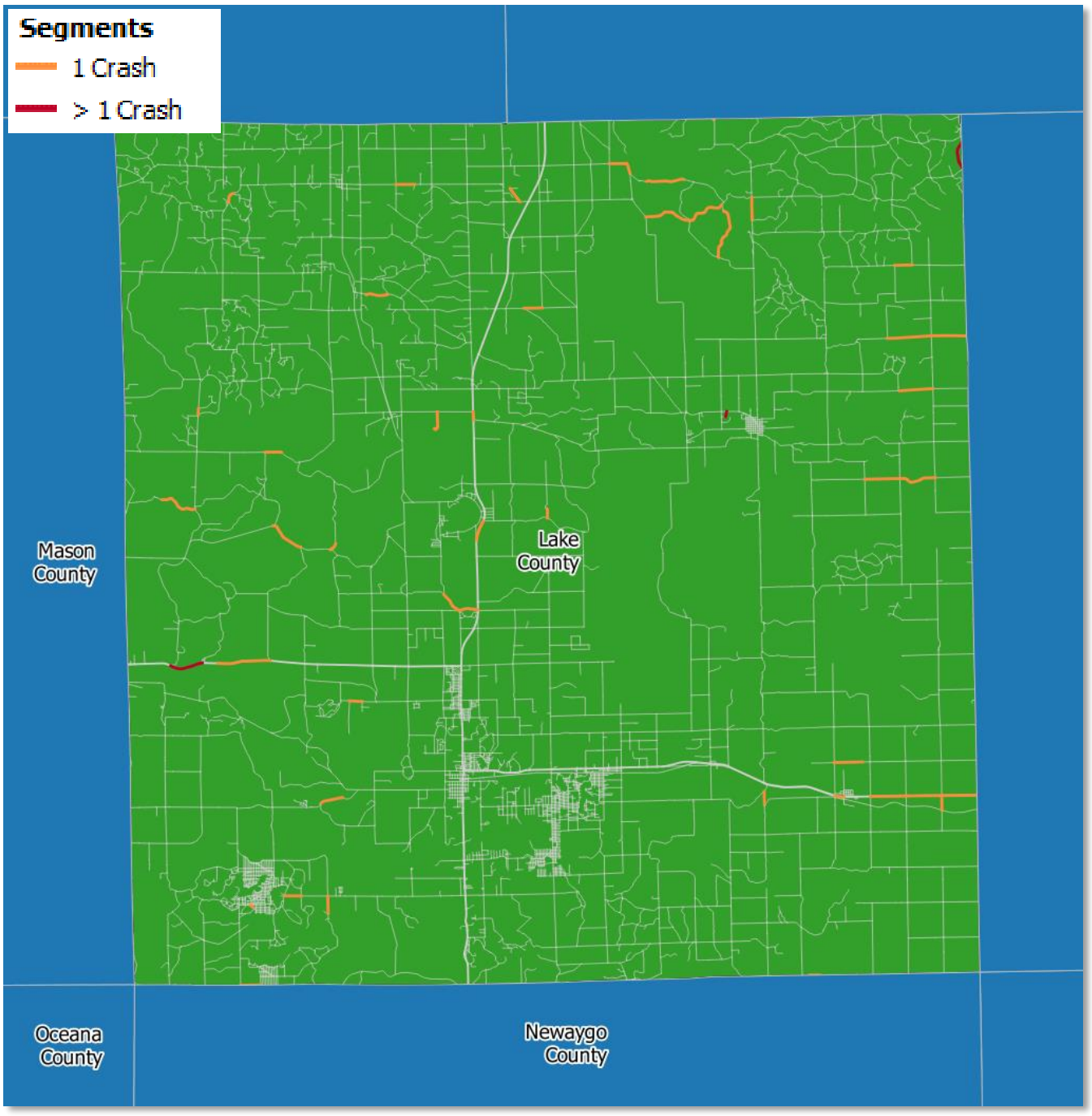
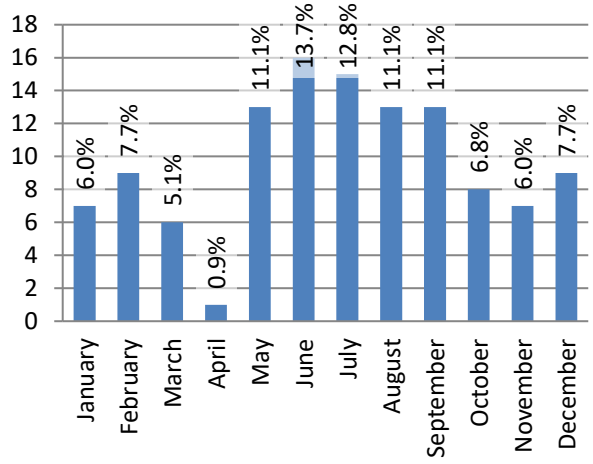


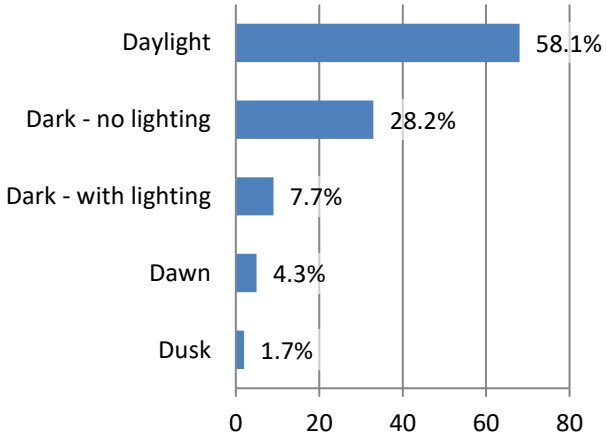
Figure 54 - Lake County Fatal & Incapacitating Injury Lane Departure Locations (2010 - 2014)

Mason County

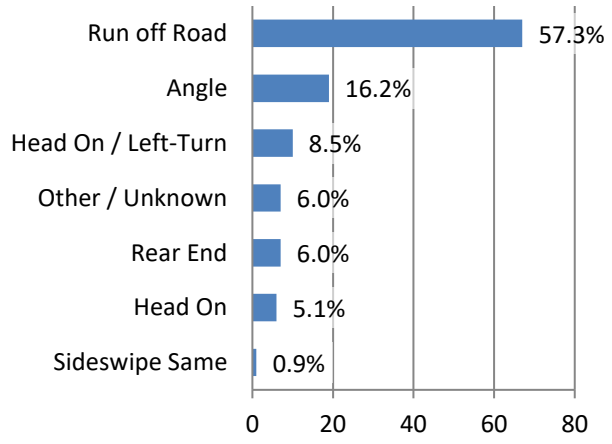
Lake County experienced approximately one tenth (117 of 985 total) of the crashes reported in the WMSRDC Region during the analysis period, while accounting for approximately eleven percent of the average yearly vehicle miles traveled for the region. The summary statistics provided here mirror those for the Region as a whole fairly closely. One significant exception is the greater proportion of run off road crashes for this county when compared to the region as a whole. The following figures would suggest that crashes in this county peak during the summer months. Additionally, almost one-third of crashes in the county occurred under dark, unlit conditions.



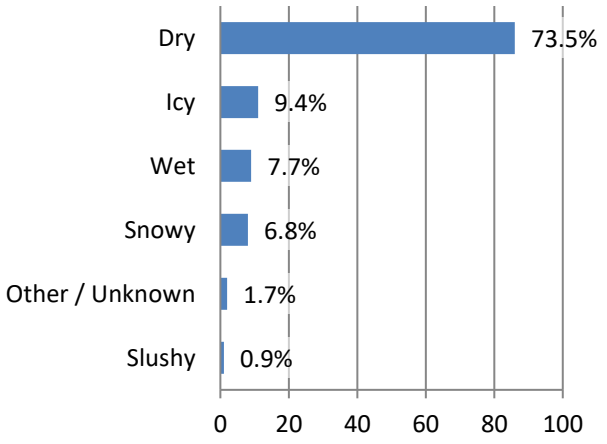
Mason County Crash Monthly Crash Distribution



Mason County Lighting Condition Distribution



Mason County Crash Type Distribution



Mason County Road Condition Distribution

The following figure provides the special distribution of lane departure crashes (i.e. run off road and head on crashes) in the county during the 2010 – 2014 period.

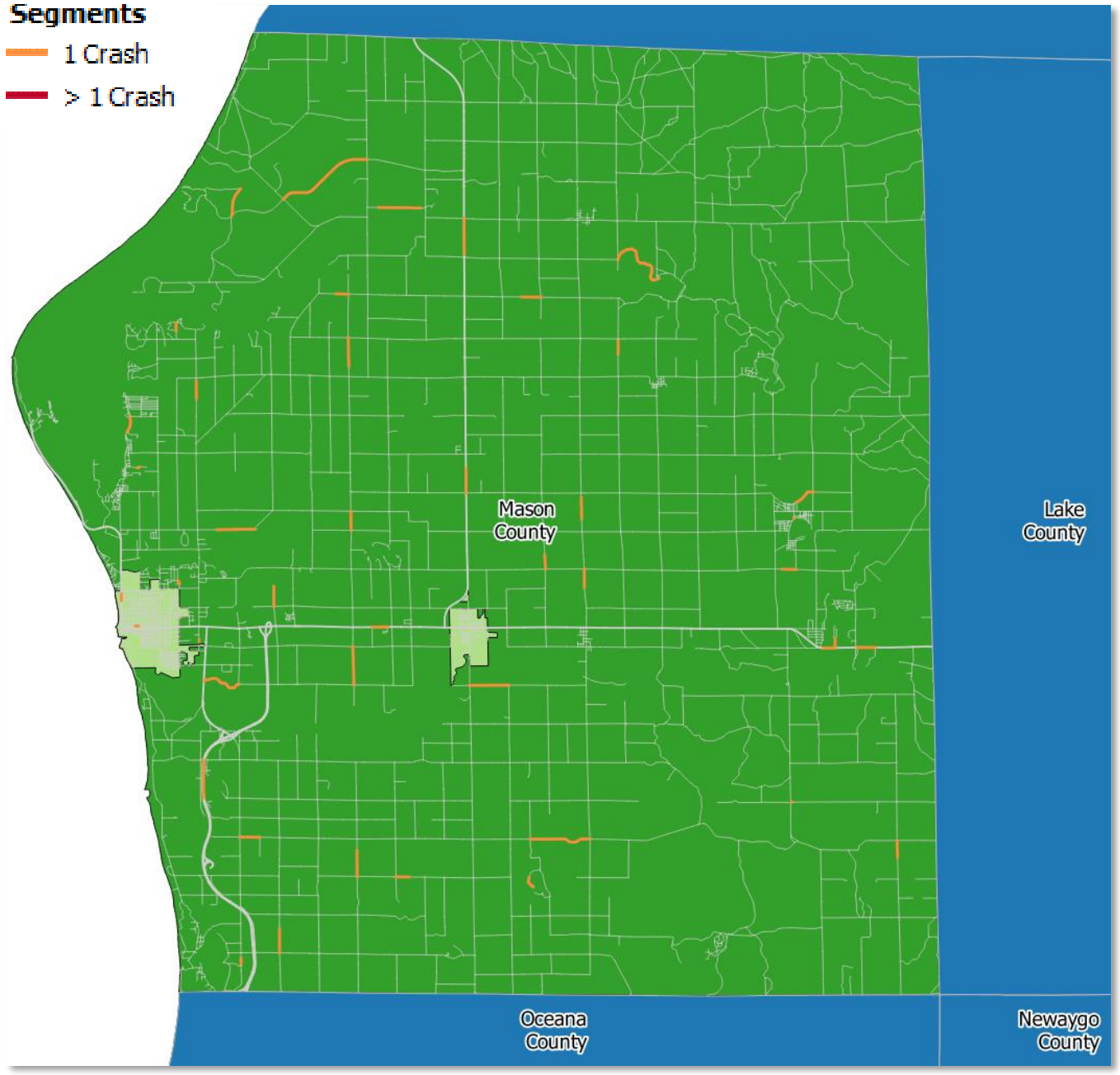
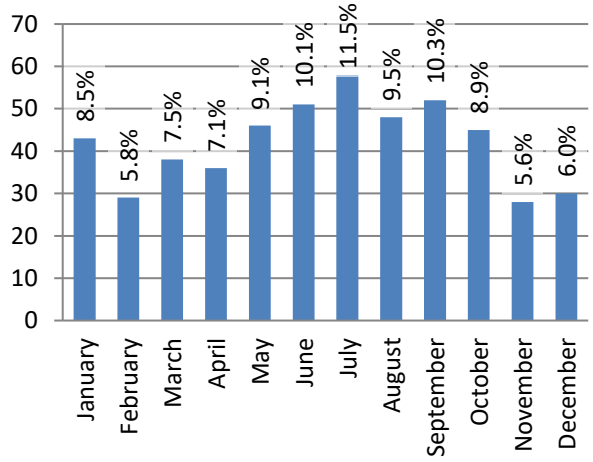


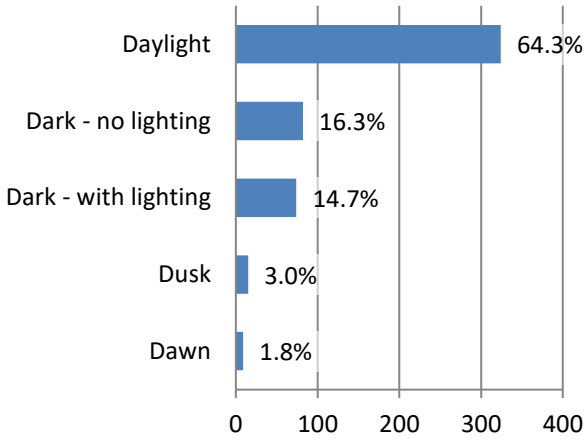
Figure 55 - Mason County Fatal & Incapacitating Injury Lane Departure Crash Locations

Muskegon County

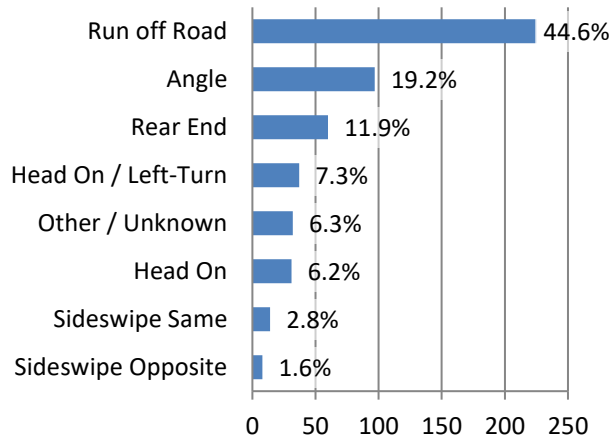
Lake County experienced approximately one half (504 of 985 total) of the crashes reported in the WMSRDC Region during the analysis period, while accounting for approximately fifty-eight percent of the average yearly vehicle miles traveled for the region. The summary statistics provided here mirror those for the Region as a whole fairly closely. While run off road crashes account for the greatest portion of fatal or incapacitating injury crashes, the county also experiences a greater proportion of angle crashes when compared to the region as a whole. The following figures would suggest that crashes in this county peak during the summer months. Additionally, rear end crashes are the third most frequent crash type in the county. This would suggest that intersection related concerns may be a focus area for the county, in addition to run off road crashes.



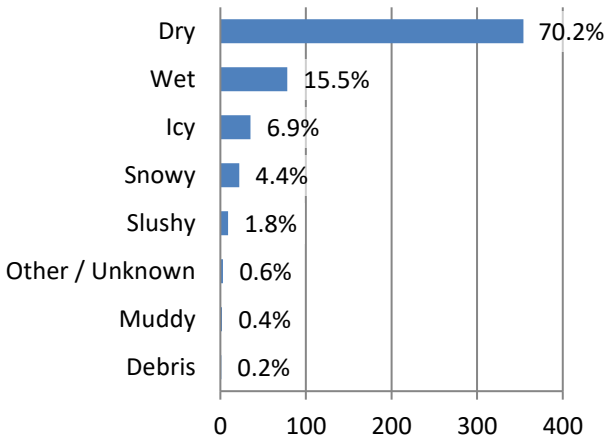
Muskegon County Crash Monthly Crash Distribution



Muskegon County Lighting Condition Distribution



Muskegon County Crash Type Distribution



Muskegon County Road Condition Distribution

The following figure provides the special distribution of fatal and incapacitating injury intersection crashes (i.e. run off road and head on crashes) in the county during the 2010 – 2014 period.

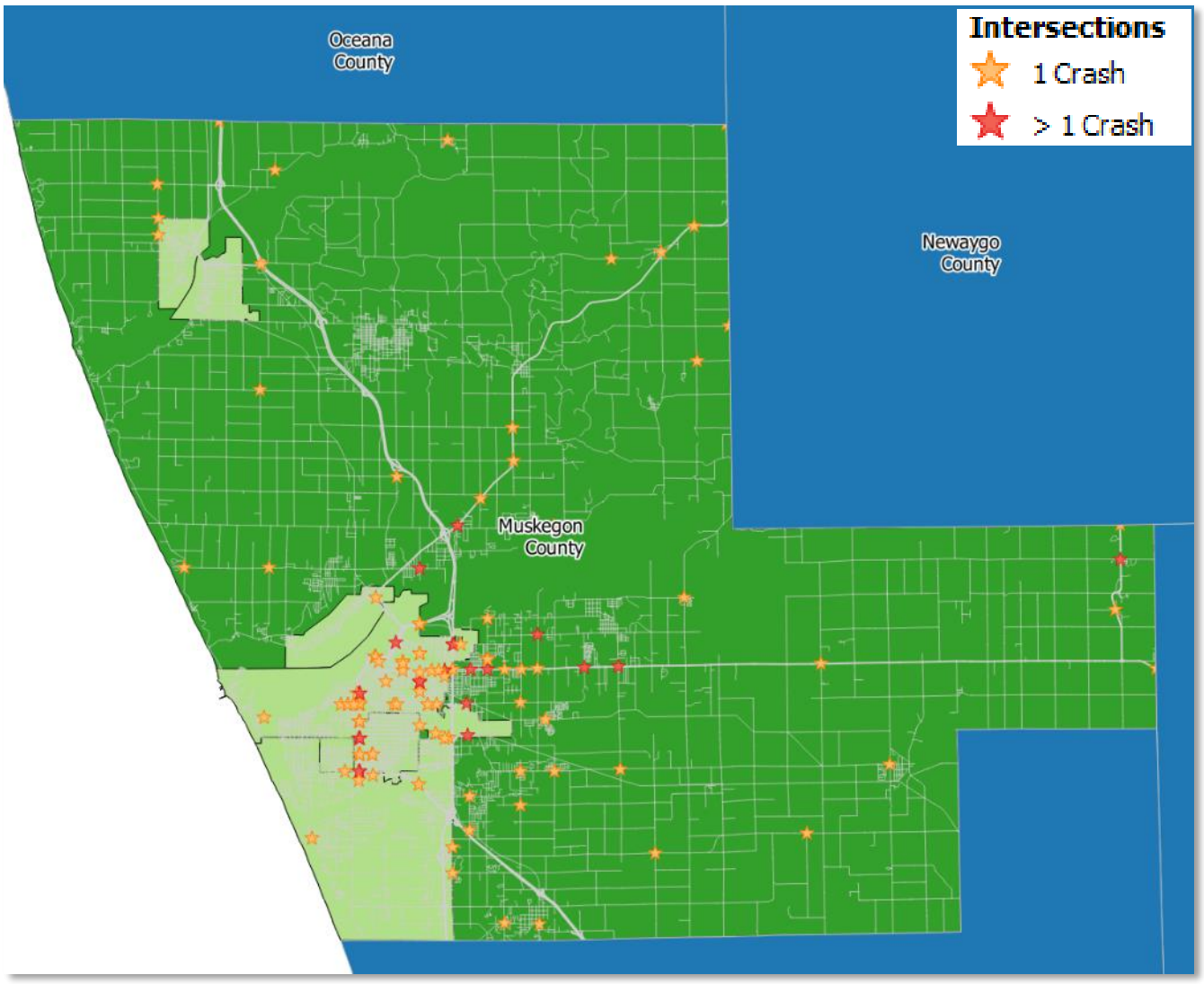
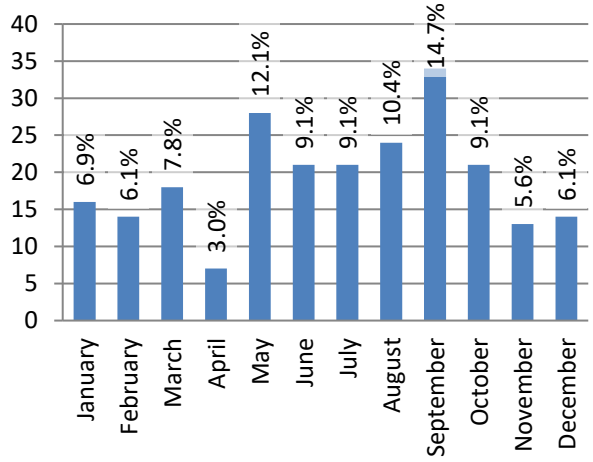


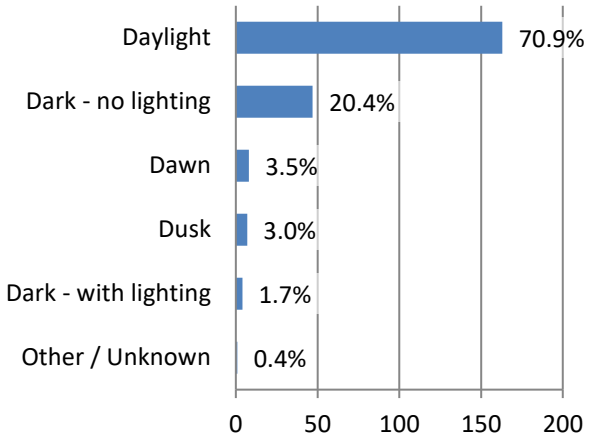
Figure 56 - Muskegon County Fatal & Incapacitating Injury Intersection Crash Locations

Newaygo County

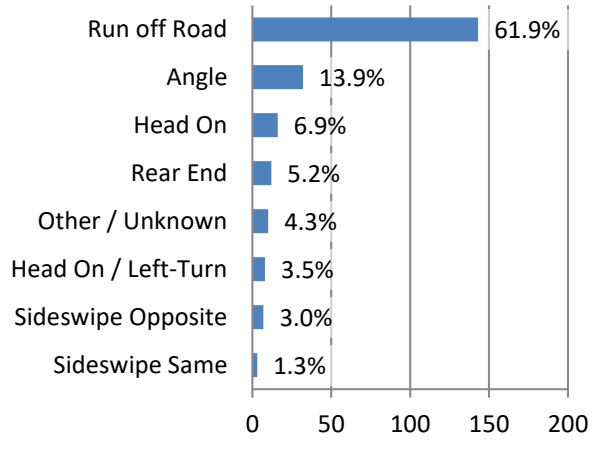
Lake County experienced approximately one quarter (231 of 985 total) of the crashes reported in the WMSRDC Region during the analysis period, despite accounting for approximately seventeen percent of the average yearly vehicle miles traveled for the region. The summary statistics provided here mirror those for the Region as a whole fairly closely. The following figures would suggest that crashes in this county peak during the summer months. Additionally, run off road, angle, and head on crashes account for roughly 83 percent of all crashes in the county.



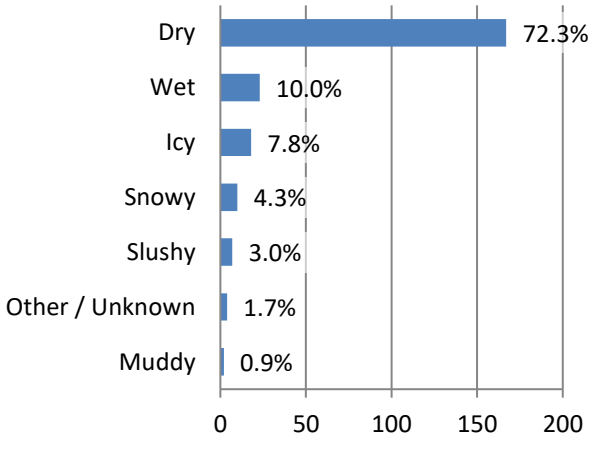
Newaygo County Crash Monthly Crash Distribution



Newaygo County Lighting Condition Distribution



Newaygo County Crash Type Distribution



Newaygo County Road Condition Distribution

The following figure provides the special distribution of lane departure crashes (i.e. run off road and head on crashes) in the county during the 2010 – 2014 period.

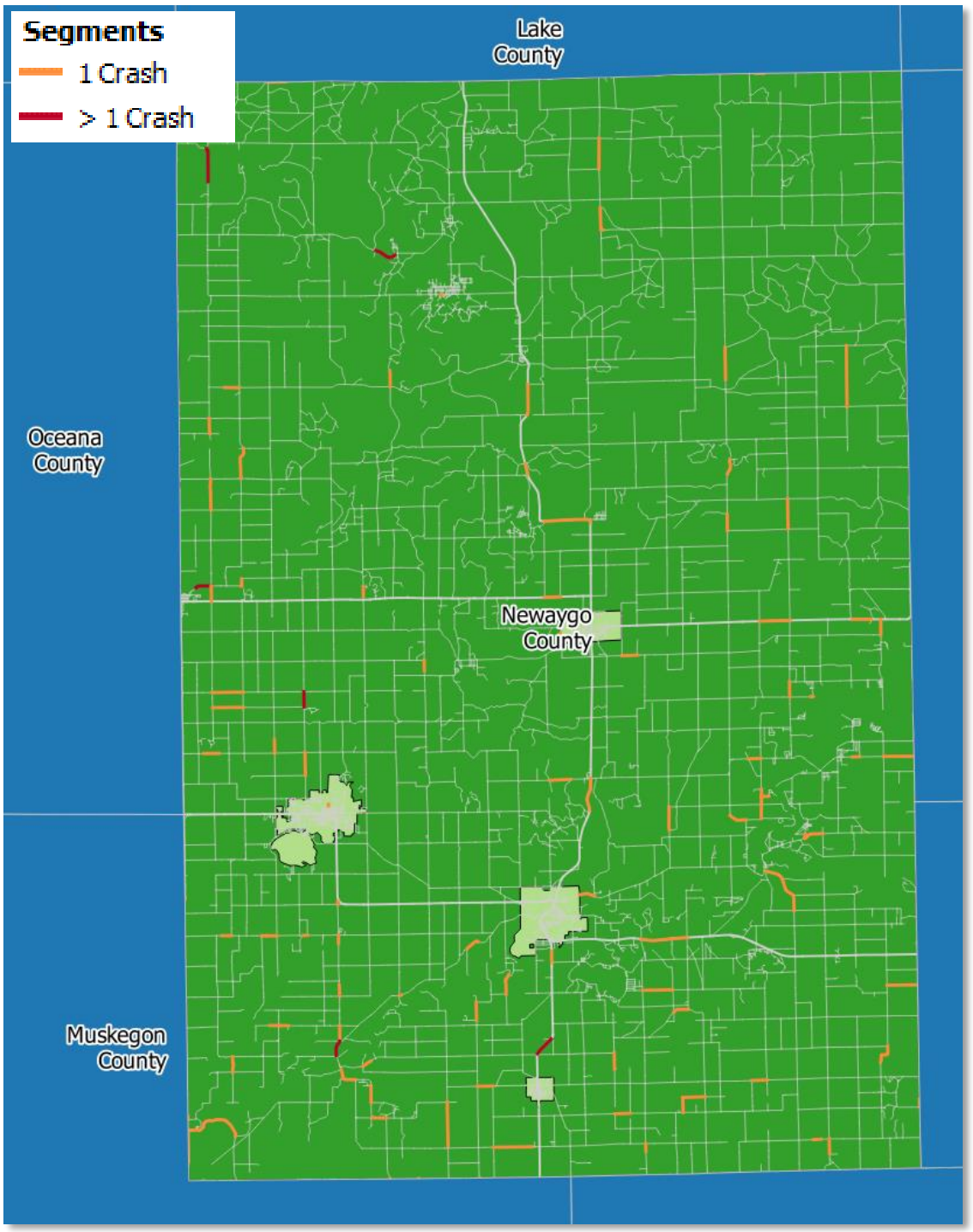
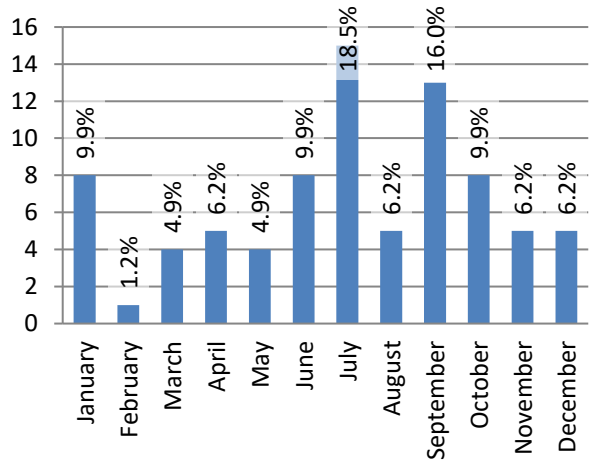


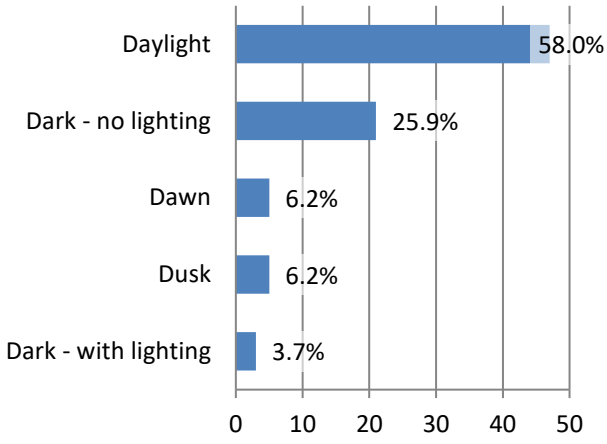
Figure 57 - Newaygo County Fatal & Incapacitating Injury Lane Departure Crash Locations

Oceana County

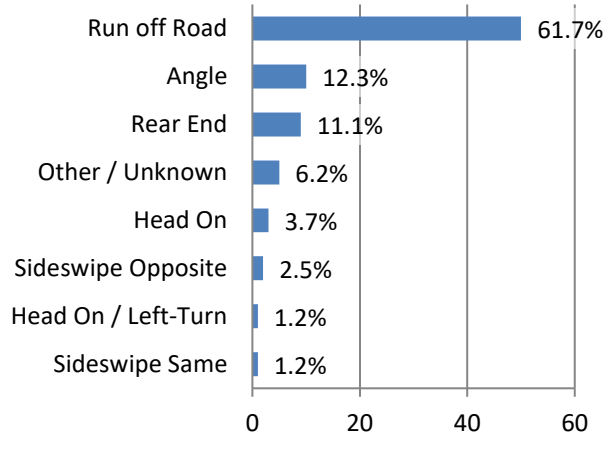
Lake County experienced less than one tenth (81 of 985 total) of the crashes reported in the WMSRDC Region during the analysis period, while accounting for approximately ten percent of the average yearly vehicle miles traveled for the region. The summary statistics provided here mirror those for the Region as a whole fairly closely. The following figures would suggest that crashes in this county peak during the summer months. Additionally, run off road, angle, and rear end crashes account for roughly 85 percent of all crashes in the county.



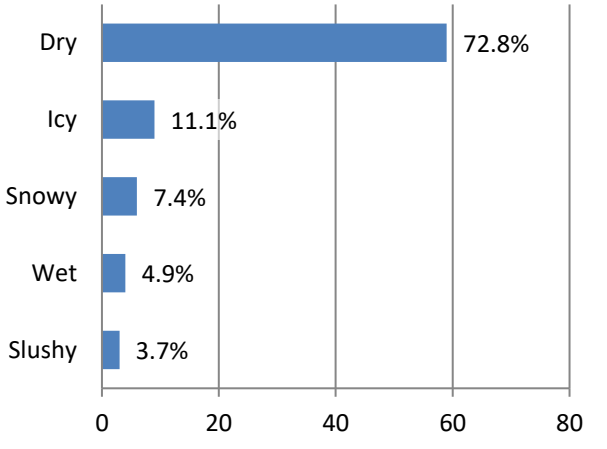
Oceana County Crash Monthly Crash Distribution



Oceana County Lighting Condition Distribution



Oceana Crash Type Distribution



Oceana Road Condition Distribution

The following figure provides the special distribution of lane departure crashes (i.e. run off road and head on crashes) in the county during the 2010 – 2014 period.

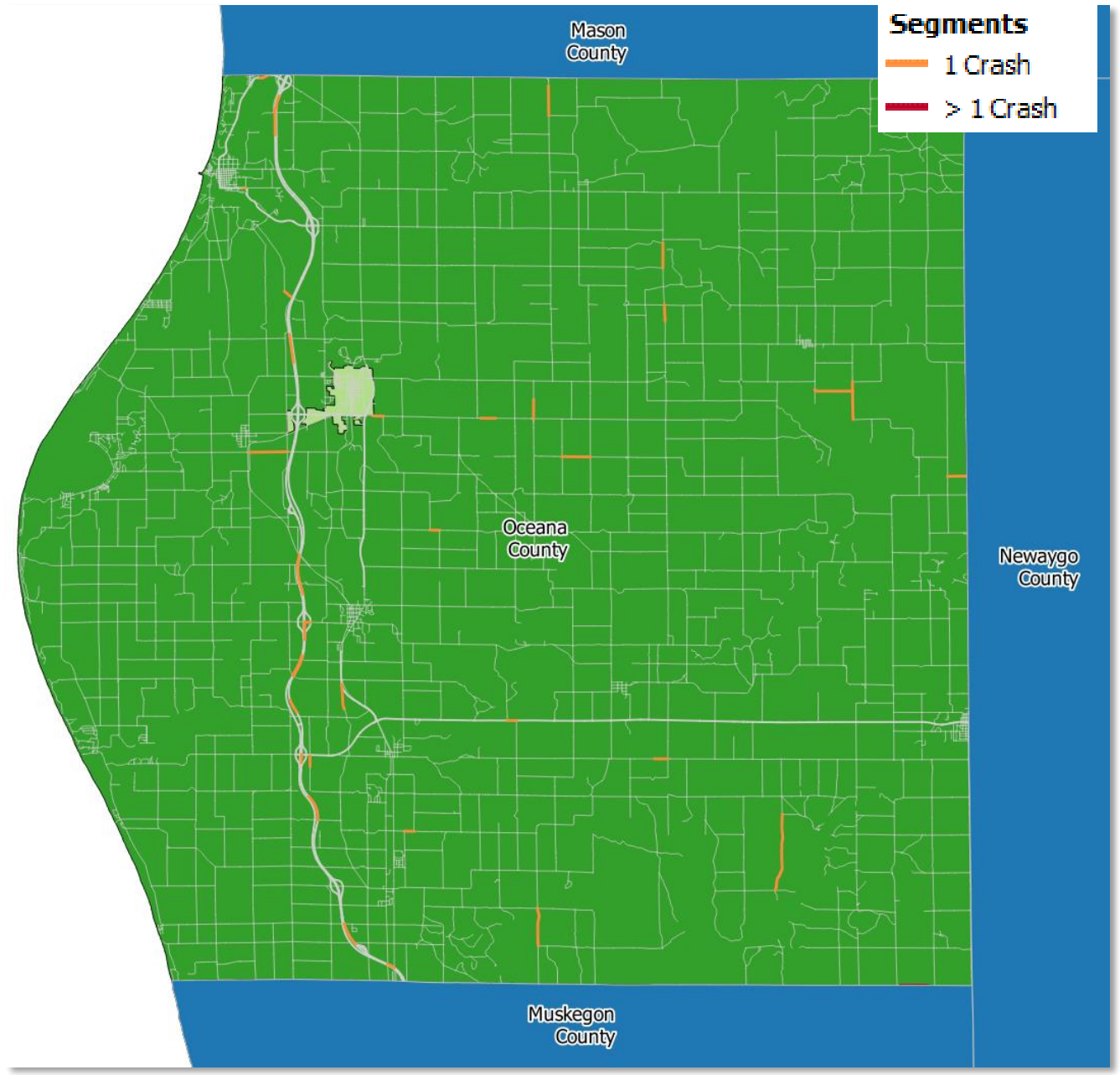


Figure 58 - Oceana County Fatal & Incapacitating Injury Lane Departure Crash Locations

Stakeholder & Steering Committee Meeting Attendance Lists

Kick-Off & Stakeholder Meeting (Nov. 7th, 2016)

MDOT REGIONAL SAFETY MEETING

NOVEMBER 7, 2016

NAME	ORGANIZATION
Mike Seibert	Oceana County RC
MARK TIMMER	OCEANA CRC
Holly Alway	Mercy Health / Lakeshore Traffic Safety Network
Kim Lariviere	MDOT
Nadeesha Samaratunga	MDOT
MARTIN MILLER	MSP-
Pamela Blazo	MDOT Local Agency Programs
Patrick Andrick	PM
Joel Fitzpatrick	WMSRDC
Paul Bauman	Muskegon CRC
Andrew Nichols	Muskegon CRC
Joyce Yassin	Opus
Tim Terry	MDOT-Muskegon TSC
Wayne Schoonover	Mason CRC
Dennis Kent	MDOT - Grand Region
Doug Roesler	Michigan State Police
Suzette Peplinski	MDOT-Grand
Brandon Pool	NSPD
Shane Brown	Muskegon County SD

Steering Committee Meetings

West Michigan Shoreline Regional Development Commission
Regional Transportation Safety Plan
Steering Committee Meeting
Feb. 14th, 2017
10:30am

	Name	Title	Agency / Organization
	Amy Haack	Program Manager	WMSRDC
	Brian Mulnix	Program Mgr	WMSRDC
	Jim Herrema	Field Supervisor	Life Ems Ambulance
	Wayne Schoonover	Mgr Dir	Mason Co Rd Comm
	Joe Fitzpatrick	Program Manager	WMSRDC
	Nadeesha Samarasinghe	Transportation Engineer	MDOT
	Joyce Tessin	Transportation Engineer	Opus
	Holly Alway	Injury Prevention Coord	Mercy Health
	Brandon Poel	Lt.	Norton Shores Police
Absent	Jennifer Bustard	Principal	Mona Shores High School
	Mohammed Alshatti	DPW Director	City of Muskegon

West Michigan Shoreline Regional Development Commission
Regional Transportation Safety Plan
Steering Committee Meeting

Mar. 17th, 2017
10:30am

Name	Title	Agency/Organization
Brandon Poel		NSPD
Brian McInix		WMSRDC
Kerry Irons		Pedal Holland Adventure Cycling Assn.
Jim Herrema		Life EMS Ambulance
Steve Redmond		MDOT-Grand Region
Amy Haack		WMSRDC
Nadeesha Samaratunga		MDOT
Andrew Ceifetz		Opus
Petrich		
Wayne Schoonover	via teleconference	

Appendix B – Countermeasure Summary

The following sections provide brief descriptions of each of the recommended treatment strategies listed alphabetically. While it is expected that several treatments may have a positive impact for more than one Emphasis Area, they are listed with their most closely associated area. Each countermeasure description will maintain the following format:

Countermeasures Name/Title	
4-"E" Area of Focus:	List of applicable focus areas
Countermeasure Definition:	Brief description of the countermeasure(s) including an example photo where applicable.
Types of crashes affected:	List of crash types most commonly addressed by the countermeasure(s).
Locations for use:	Brief description of locations commonly identified as candidate locations for the countermeasure(s).
Estimated Safety Benefit:	Range of applicable crash reduction factors obtained from the Crash Modification Factor Clearing House.
Estimated Cost Tier:	Very High High Moderate Low Minimal

Advanced Curve Warning Signs and/or Chevrons	
4-"E" Area of Focus:	Engineering
Countermeasure Definition:	Advanced curve warning signs provide drivers with additional time to adjust their speed to prepare for the upcoming curve. These "Curve Ahead" warning signs may be supplemented with advisory warning speeds where warranted based on the geometry of the curve. Additionally, target arrows and chevron signs help to delineate the path of the curve improving the driver's ability to stay in their lane and on the road. Flashing beacons may be added to the signs to improve their conspicuity and draw drivers' attention to the curve.  **Source: FHWA**
Types of crashes affected:	Single Vehicle Lane Departure, Sideswipe Opposite, Head On
Locations for use:	In advance of and along unmarked or higher risk curves, particularly sharper curves or compound vertical and horizontal curves.
Estimated Safety Benefit:	4 to 52 percent reduction for crashes of all types and severities 28 to 55.5 percent reduction in run off road crashes of all severities
Estimated Cost Tier:	Minimal

Advanced Intersection Signage	
4-"E" Area of Focus:	Engineering
Countermeasure Definition:	The installation of new or supplemental intersection warning and/or lane use signs provide additional warning to the driver that they are approaching an intersection. This provides them with additional time to take appropriate actions to adjust speed, change lanes, scan for traffic or pedestrians, etc.  **Source: FHWA**
Types of crashes affected:	Angle, Rear End, Head On Left Turn
Locations for use:	High risk/crash intersections or those with a higher proportions of improper lane use, turn, and signal violations.
Estimated Safety Benefit:	Advanced Street Name Sign: 1.6 percent reduction in all crash types of all severities Stop Ahead Pavement Markings: 31 percent reduction in all crash types of all severities
Estimated Cost Tier:	Minimal – Low

Bicycle Lanes & Sharrows	
4-"E" Area of Focus:	Engineering Education
Countermeasure Definition:	Installation and maintenance of existing and future bike lanes which provide a defined area for bicycle traffic in the roadway. Education and public awareness campaigns regarding the lanes and appropriate use and interaction between vehicles and bicycles and other slower moving traffic should be implemented. This is crucial as the installation of bicycle lanes may increase the number of users in the road, which could result in an increase in bicycle related crashes if the knowledge regarding appropriate use is not distributed.  **Source: FHWA**
Types of crashes affected:	Bicycle Involved Crashes
Locations for use:	Could be applied to any roadway with the appropriate cross-section. Generally should be focused on areas with high bicycle traffic demand or areas where an increase in demand is expected.
Estimated Safety Benefit:	13 percent reduction in fatal and injury bicycle involved crashes in urban areas
Estimated Cost Tier:	Low - Moderate

Crosswalk Improvements	
4-"E" Area of Focus:	Engineering Education
Countermeasure Definition:	Installation of a range of crosswalk improvements would improve the conspicuity of the crosswalk, better alerting drivers of the potential for cross traffic. Some examples include marked & signed crosswalks, improved lighting, pedestrian countdown timers and push buttons, flashing beacons, etc. Additional and supplemental education information could be distributed to help improve pedestrian and other non-motorized use of crosswalks and associated features.  **Source: FHWA**
Types of crashes affected:	Vulnerable/Non-motorized Crashes
Locations for use:	Intersections and midblock crossings
Estimated Safety Benefit:	29 percent reduction in crashes of all types and severities in urban or suburban areas 37 to 69 percent reduction in pedestrian involved crashes in urban or suburban areas
Estimated Cost Tier:	Minimal – Moderate

Distracted Driver Education Campaign	
4-"E" Area of Focus:	Education
Countermeasure Definition:	Employing a range of education and training campaigns and messages to have a positive influence on driver behavior. Some well-known examples include education and enforcement campaigns such as "Click It or Ticket" and "Over the Limit, Under Arrest". Distracted driving education campaigns have increasingly been added to the list of campaigns.
Types of crashes affected:	N/A
Locations for use:	Known problem locations experiencing higher violation rates in general.
Estimated Safety Benefit:	N/A
Estimated Cost Tier:	Moderate

Drive Training Refresher Course	
4-"E" Area of Focus:	Education
Countermeasure Definition:	Driver retraining and refresher courses could be provided to offer drivers of all ages an opportunity to renew skill sets and test their current abilities. This would not be predicated on a driver's age alone and would be open to all drivers.
Types of crashes affected:	All Crash Types
Locations for use:	N/A
Estimated Safety Benefit:	Unavailable
Estimated Cost Tier:	Low – High

Drug Recognition Expert (DRE) Training	
4-"E" Area of Focus:	Enforcement Education
Countermeasure Definition:	Michigan offers a series of training courses to assist officers in identifying potentially intoxicated drivers based on driving behaviors and other cues and signals. Three programs provide the backbone of the training including the Standardized Field Sobriety Testing Program (SFST), the Advanced Roadside Impaired Driving Enforcement Program (ARIDE), and finally the Drug Recognition Expert program (DRE).  **Source: Michigan State Police OWI Enforcement Training**
Types of crashes affected:	DUI & DWI Crashes
Locations for use:	Known problem locations experiencing higher violation rates.
Estimated Safety Benefit:	Unavailable
Estimated Cost Tier:	Low

Explore Alternative Intersection Control Methods for Emergency Conditions	
4-"E" Area of Focus:	Enforcement Engineering
Countermeasure Definition:	While the occurrence is relatively rare, it is important to have back-up systems and procedures in place during interrupted signal operations. These could range from back-up generators for traffic signals to moveable or temporary stop and other traffic control signs.
Types of crashes affected:	Intersection Related
Locations for use:	Significant intersections (i.e. high volume, high route priority, etc.)
Estimated Safety Benefit:	N/A
Estimated Cost Tier:	Low - Moderate

Further Develop the Use of Data Solutions to Enhance TIM	
4-"E" Area of Focus:	Engineering Education
Countermeasure Definition:	MDOT is currently collecting extensive data with regards to incidents. The feasibility of collecting this data for local roads should also be considered. This could include, using it for incident detection, identification of corridors with high frequency or rates of incidents and during after action reporting.
Types of crashes affected:	Secondary Crashes
Locations for use:	N/A
Estimated Safety Benefit:	Unavailable
Estimated Cost Tier:	Low – Moderate

Impaired Driving Enforcement Zones	
4-"E" Area of Focus:	Enforcement Emergency Response
Countermeasure Definition:	Enforcement zones can serve as a visible deterrent to individuals considering driving after drinking or taking other substances. They also serve as an active measure used to remove impaired drivers from the road, helping to reduce crashes involving impaired drivers.
Types of crashes affected:	Drinking and/or Drug Involved crashes
Locations for use:	Known problem areas or during large events
Estimated Safety Benefit:	Unavailable
Estimated Cost Tier:	Moderate

Improve Nighttime Delineation	
4-"E" Area of Focus:	Engineering
Countermeasure Definition:	Improving the delineation visibility on stretches of dark or unlit roadways improves the tracking ability of drivers. This can be done through the installation of overhead lighting, improved pavement marking retroreflectivity, or other reflective equipment along the roadside. These treatments help to illuminate the road itself or improve the delineation of the roadside.  **Source: FHWA**
Types of crashes affected:	Single Vehicle Lane Departure
Locations for use:	Road segments experiencing high concentrations of run off road crashes.
Estimated Safety Benefit:	Lighting Installation: 46 to 54 percent reduction in serious and minor injury nighttime crashes Improved Pavement Markings: N/A – the predicted reduction is a function of the change in retroreflectivity Install Raised Pavement Markers: 13 to 19 percent reduction in all crash types of all severity
Estimated Cost Tier:	Minimal – Low

Improve Sidewalk/Multi-use Trail Interconnectivity & Maintenance	
4-"E" Area of Focus:	Engineering Education
Countermeasure Definition:	Building on the existing sidewalk and multi-use trails would provide pedestrians and bicyclists with a safer area to travel and help to separate them from motor vehicle traffic. Implementing or improving on existing maintenance programs would help to ensure that the sidewalks and trails remain a viable route for pedestrians and bicyclists.  **Source: FHWA**
Types of crashes affected:	Vulnerable/Non-Motorized Crashes
Locations for use:	Gaps in sidewalk and trail connectivity as well as higher pedestrian and bicycle volume areas or where increased demand is expected.
Estimated Safety Benefit:	N/A
Estimated Cost Tier:	Low – High

Improve Traffic Control Visibility	
4-"E" Area of Focus:	Engineering
Countermeasure Definition:	Improve the visibility and conspicuity of traffic control devices through the appropriate use of retroreflective posts, LED signs, warning sign installations, signal head backplates, etc. **Source: cts.umn.edu**
Types of crashes affected:	Angle, Rear End, Head-on Left Turn
Locations for use:	Intersection of all traffic control types and around or along vertical and horizontal curves.
Estimated Safety Benefit:	Various
Estimated Cost Tier:	Low – Moderate



Install Center & Edgeline Rumble Strips	
4-"E" Area of Focus:	Engineering
Countermeasure Definition:	Center and edgeline rumble strips provide the driver with an auditory and tactile alert when they begin to move out of their lane. These strips can be pressed into newly laid pavement or milled in after the fact. They are especially effective when drowsy or distracted drivers are concerned.  **Source: FHWA**
Types of crashes affected:	Single Vehicle Lane Departure, Head On, Sideswipe Same Direction
Locations for use:	Road segments experiencing high concentrations of run off road or head on crashes.
Estimated Safety Benefit:	Centerline: 21 percent reduction in head on and sideswipe crashes of all severities Edgeline: 5 to 18 percent reduction in fatal and serious injury crashes of all types
Estimated Cost Tier:	Low – Moderate

Install Safety Edge Pavement Treatments	
4-"E" Area of Focus:	Engineering
Countermeasure Definition:	Installation of safety edges (a 30-degree slope) along the edge of the pavement improves the ability of drivers to safely return to the roadway when correcting for a roadway departure event.  **Source: FHWA**
Types of crashes affected:	Single Vehicle Lane Departure
Locations for use:	Road segments experiencing high concentrations of run off road crashes.
Estimated Safety Benefit:	7.7 to 15.5 percent reduction in all crash types of all severities 4.7 to 14 percent reduction in run off road crashes of all severities
Estimated Cost Tier:	Minimal – Low

Install/Expand Shoulders	
4-"E" Area of Focus:	Engineering
Countermeasure Definition:	Gravel and paved shoulders provide drivers with additional room for correction and vehicle recovery, with paved shoulders being more stable and providing improved traction and control. While paved shoulders are preferred, the installation and maintenance of, at a minimum, gravel shoulders should be considered on roads currently lacking this feature. This extra pavement area improves the driver's ability to correct after leaving their lane but before departing from the road itself.  **Source: FHWA**
Types of crashes affected:	Single Vehicle Lane Departure
Locations for use:	Road segments with little to no paved shoulder. Especially areas with high concentrations of run off road crashes or significant non-motorized volumes sharing the road with vehicles.
Estimated Safety Benefit:	16 to 60 percent reduction in crashes of all types and severities 2 to 18 percent reduction in serious and minor injury fixed object, head on, run off road, and sideswipe crashes
Estimated Cost Tier:	Moderate

Installation of Transverse Rumble Strips	
4-"E" Area of Focus:	Engineering
Countermeasure Definition:	Installation of rumble strips across the travel lanes on approaches to stop controlled intersections.  **Source: FHWA**
Types of crashes affected:	Angle, Rear End, Head-on Left Turn
Locations for use:	Stop controlled intersections with higher risk/crash history and/or higher traffic control violation rates.
Estimated Safety Benefit:	20 percent reduction in all crash types of all severities in rural areas
Estimated Cost Tier:	Low – Moderate

Mi-TIME Training	
4-"E" Area of Focus:	Education Emergency Medical Services Enforcement
Countermeasure Definition:	Michigan's Traffic Incident Management Effort is a partnership between agencies, including MDOT, state and local law enforcement, fire, EMS, and towing services, to work together to safely and efficiently clear traffic incidents from Michigan's highways.
Types of crashes affected:	Secondary Crashes
Locations for use:	N/A
Estimated Safety Benefit:	Unavailable
Estimated Cost Tier:	Moderate

Mobile & Fixed Speed Feedback Signs	
4-"E" Area of Focus:	Enforcement Education
Countermeasure Definition:	Mobile Speed Trailers and fixed speed feedback sign installations may be placed at locations experiencing higher rates of speed violations. These devices detect and display the speed of the oncoming vehicle and are often paired with supplemental speed limit signs. This provides the driver with real-time feedback and reinforces the speed limit. 
Types of crashes affected:	N/A
Locations for use:	Areas with higher proportions of speed violations or areas with increased non-motorized traffic.
Estimated Safety Benefit:	5 percent reduction in all crashes of all types in rural areas
Estimated Cost Tier:	Low

Motorcycle Education Campaign	
4-"E" Area of Focus:	Education
Countermeasure Definition:	Education campaigns exist to remind drivers and motorcycles to cooperate to better share the road. As motorcycles take up less space than standard vehicles it can be easier to miss them on the road which increases the importance for driver and rider vigilance as well as the use of helmets and high visibility gear. Other education campaigns could be employed to remind both drivers and riders of their shared responsibility on the road.
Types of crashes affected:	Motorcycle Crashes
Locations for use:	N/A
Estimated Safety Benefit:	Unavailable
Estimated Cost Tier:	Low – Moderate

Motorcycle Enforcement Campaign	
4-"E" Area of Focus:	Enforcement
Countermeasure Definition:	Targeted enforcement campaigns could be designed to address areas of higher proportions of motorcycles or related crashes. Law enforcement could potentially conduct drivers to pull over drivers who tailgate motorcyclists as the driver would likely be unable to stop in time in the event of an incident. Similarly, riders could be pulled over for reckless driving and weaving in and out of traffic. These enforcement activities could be conducted in conjunction with education campaigns to build off each other.
Types of crashes affected:	Motorcycle Crashes
Locations for use:	N/A
Estimated Safety Benefit:	Unavailable
Estimated Cost Tier:	Low – Moderate

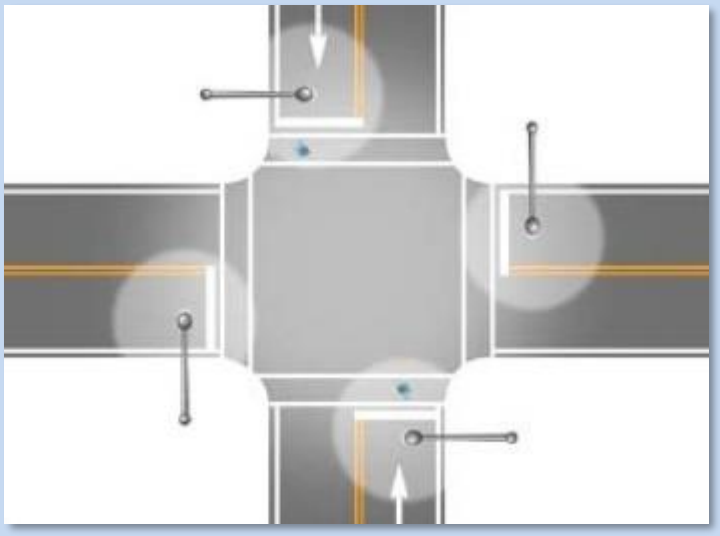
Pedestrian and Bicycle Education & Awareness Programs	
4-"E" Area of Focus:	Education
Countermeasure Definition:	Education programs geared towards pedestrians and bicyclist regarding proper navigation of the trail and road network should prove beneficial in reducing the number of vehicular and non-motorized conflicts. This may be especially helpful for younger children who may not know the proper way to cross the street or how to behave around traffic. Additionally, education regarding bicycle and vehicle interactions is crucial to improve the way drivers and bicycles share the road and respond to each other's presence.
Types of crashes affected:	Bicycle & Pedestrian Involved Crashes
Locations for use:	N/A
Estimated Safety Benefit:	Unavailable
Estimated Cost Tier:	Low – High

Pilot Test Engineering Countermeasures to Assist with TIM	
4-"E" Area of Focus:	Engineering
Countermeasure Definition:	The use of signs and gates at interchanges, crash investigation sites, other traveler information focused countermeasures have been found to be effective in improving safety.
Types of crashes affected:	Secondary Crashes
Locations for use:	N/A
Estimated Safety Benefit:	Unavailable
Estimated Cost Tier:	Low – Moderate

Promote the Use of High Visibility Apparel	
4-"E" Area of Focus:	Education
Countermeasure Definition:	The use of high visibility apparel by first responders, motorcyclists, and other vulnerable road users has been found to significantly reduce the potential for a collision. High visibility vest, helmets, and other apparel can be worn to increase visibility under a range of environmental conditions.
Types of crashes affected:	Emergency Service/First Responder Related, Motorcycle involved, and vulnerable road users
Locations for use:	N/A
Estimated Safety Benefit:	Unavailable
Estimated Cost Tier:	Low

Promote Training Courses Targeting Motorcycle Crash Response	
4-"E" Area of Focus:	Emergency Services
Countermeasure Definition:	Given the unique nature of motorcycles and associated crashes, there are a number of injuries that tend to be more typical for motorcycle involved crashes. Training courses exist which cover response methods for both bystanders as well as first responders. One example includes P.A.C.T. (Prevent Further Injury, Assess the Situation, Contact EMS, and Treat the Injured with Life Sustaining Care).
Types of crashes affected:	Bicycle Involved Crashes
Locations for use:	EMS, Paramedic, and other Enforcement training
Estimated Safety Benefit:	N/A
Estimated Cost Tier:	Moderate

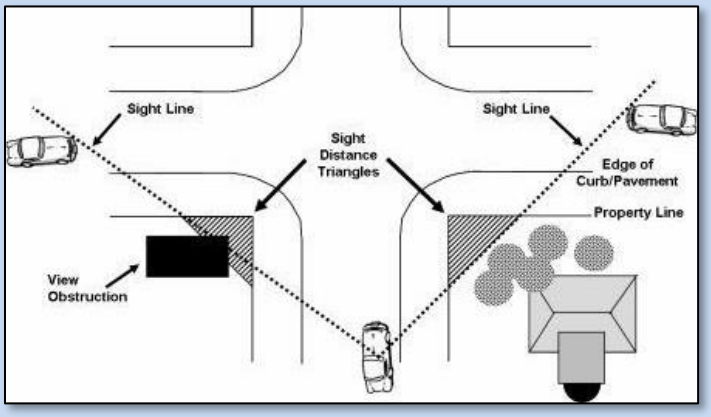
Randomized Enforcement Locations	
4-"E" Area of Focus:	Enforcement Emergency Response
Countermeasure Definition:	The presence of law enforcement tends to provide a calming presence for traffic flow and encourages drivers to obey the speed limits and other traffic laws. While increasing the number of officers can be beneficial, randomizing the patrols and locations can also help. By changing staging and monitoring points for law enforcement, drivers have a more difficult time avoiding known enforcement areas, effectively increasing the influence of law enforcement in the area.
Types of crashes affected:	N/A
Locations for use:	Known problem locations experiencing higher violation rates in general.
Estimated Safety Benefit:	N/A
Estimated Cost Tier:	Moderate

Review and Improve Intersection Lighting	
4-"E" Area of Focus:	Engineering
Countermeasure Definition:	For various reasons, intersection may not have lighting or existing lighting may be insufficient. A review of problematic intersections could help identify locations in need of improvement. This could include intersections without existing lighting, locations when damaged lighting has reduced or eliminated actual light, or locations where lighting exists but is not properly positioned to highlight crucial areas.  **Source: FHWA**
Types of crashes affected:	Dark, Unlit Crashes
Locations for use:	Intersections
Estimated Safety Benefit:	38 percent reduction in nighttime serious and minor injury crashes at intersections
Estimated Cost Tier:	Moderate

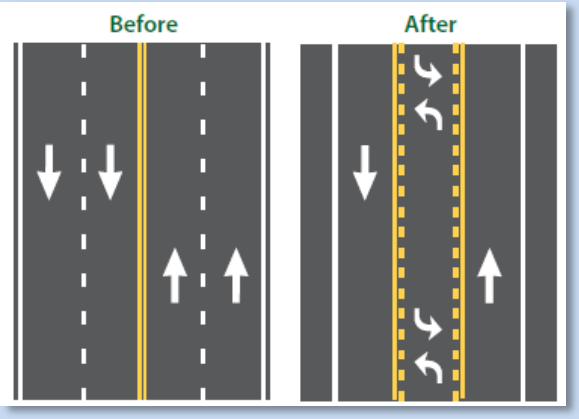
Review Intersection Traffic Control	
4-"E" Area of Focus:	Engineering Education
Countermeasure Definition:	Intersection traffic control type should be reviewed to determine whether or not it is warranted and whether a more appropriate option could be employed. Additional steps could be taken to help educate the public regarding any new traffic control methods or provide information regarding appropriate navigation and right of way issues associated with existing traffic control.  **Source: FHWA**
Types of crashes affected:	Angle, Rear End, Head On Left Turn
Locations for use:	High risk/crash intersections or those with a higher proportions of traffic control violations.
Estimated Safety Benefit:	N/A – Benefit depends heavily on specific existing conditions and proposed reconfiguration
Estimated Cost Tier:	Moderate – Very High

Review Signing, Traffic Control, and other Roadside Components	
4-"E" Area of Focus:	Engineering
Countermeasure Definition:	A number of countermeasures have been identified as benefiting all drivers, but especially older drivers. Use of high intensity yellow reflective sheeting, pedestrian countdown timers, and arrow per lane guidance signs among other treatments have been shown to reduce the potential for older driver and other crash types.
Types of crashes affected:	All Crash Types
Locations for use:	N/A
Estimated Safety Benefit:	Unavailable
Estimated Cost Tier:	Low – High

Review Transit Availability & Accessibility	
4-"E" Area of Focus:	Engineering Education
Countermeasure Definition:	Existing transit routes and on-demand services could be reviewed to identify any gaps in availability or connectivity. By providing more reliable, connected transit options, drivers who may not feel comfortable behind the wheel would have other options to go about their daily activities. This would benefit not only older drivers but all drivers and the general public.
Types of crashes affected:	Older Driver Involved Crashes
Locations for use:	N/A
Estimated Safety Benefit:	Unavailable
Estimated Cost Tier:	Low – High

Sight Distance Clearance & Maintenance	
4-"E" Area of Focus:	Engineering
Countermeasure Definition:	Removal of vegetation and other obstructions which restrict the road users' field of vision.  **Source: Edinburg Unified Development Code**
Types of crashes affected:	Angle, Rear End, Head-on Left Turn
Locations for use:	Intersection of all traffic control types and around or along vertical and horizontal curves.
Estimated Safety Benefit:	56 percent reduction in all fatal crash types 48 percent reduction in all serious and minor injury crash types
Estimated Cost Tier:	Low – Moderate

Steer it Clear it Laws	
4-"E" Area of Focus:	Education Enforcement
Countermeasure Definition:	The quick clearance of incidents has been found to be an effective strategy to reduce the risk of secondary crashes. Support for this and other similar laws can be used to increase awareness and consequently, compliance.
Types of crashes affected:	Secondary Crashes
Locations for use:	Known problem locations experiencing higher violation rates.
Estimated Safety Benefit:	Unavailable
Estimated Cost Tier:	Moderate

Study Potential Road Diet Locations	
4-"E" Area of Focus:	Engineering Education
Countermeasure Definition:	Road diets involved the reduction in travel lanes along a corridor. A typical example is the reduction of a four-lane road to a three-lane road (one lane in each direction with a center two way left turn lane). It has the potential to improve traffic flow by removing left turning vehicles from travel lanes and reduce speeds by providing the opportunity to narrow the travel lanes through the addition of on street parking and / or bicycle lanes.  **Source: FHWA**
Types of crashes affected:	Rear End, Left Turn Head On, etc.
Locations for use:	Overbuilt roadways
Estimated Safety Benefit:	29 percent crash reduction for all crash types and severities in urban areas 9 percent crash reduction for all cash types and severities in rural areas
Estimated Cost Tier:	Moderate

Traffic Calming Projects	
4-"E" Area of Focus:	Engineering Education
Countermeasure Definition:	Several methods exist to help lower traffic speeds in lower volume areas. As drivers tend to travel at speeds they feel comfortable at rather than posted speed limits, steps can be taken to safely lower the speed drivers feel comfortable driving at. Some examples include narrowing lane widths, installing/allowing on-street parking, installing curb bump-outs, etc.  **Source: FHWA**
Types of crashes affected:	N/A
Locations for use:	Lower volume and speed areas experiencing higher rates of speed violations or areas with higher non-motorized traffic.
Estimated Safety Benefit:	N/A
Estimated Cost Tier:	Low – Very High

Young Driver Education & Enforcement Outreach	
4-"E" Area of Focus:	Education
Countermeasure Definition:	As with other areas, education and enforcement campaigns should be used to supplement existing driver training courses to help ensure that novice drivers are able to improve their skills and experience on the road safely. This could include supplemental driver training components and working with schools and other youth organizations to improve outreach efforts.
Types of crashes affected:	All Crash Types
Locations for use:	N/A
Estimated Safety Benefit:	Unavailable
Estimated Cost Tier:	Low – Moderate

Appendix C – Potential Funding Sources

MDOT Safety Program

The Michigan Department of Transportation Safety Program[14] announces a call for projects on a yearly basis. The program operates on a matched funding basis. For projects addressing safety issues that do not include fatalities or serious injuries, the match is 80 percent federal funds / 20 percent local funds. For safety projects which address concerns related to a fatality or serious injury or if the project is an approved systemic project that supports the State Strategic Highway Safety Plan, the match shifts to 90 percent federal funds / 10 percent local. Projects eligible for funding under this program include all safety related projects which meet current standards, warrants and are compliant with the ADA and Buy American Act, among others. Additionally, the program allows for funding of systemic safety projects with monetary goals for projects such as road safety audits, non-motorized facilities, surfacing treatments and rumble strip and guard rail installations, among others.

Transportation Alternatives Program

The Transportation Alternatives Program (TAP)[15] provides competitive grants to agencies in an effort to support and encourage the development of intermodal transportation systems as an alternative to vehicular traffic. The program is open to a wide range of agencies including county road commissions, cities, villages, and regional transportation authorities. As the Safe Routes to School Program has been brought under the umbrella of the TAP, they cover a similar group of eligible project types. Some projects unique to TAP funding include conversion of abandoned railroad corridors to trails, vegetation management practices in rights of way, and boulevards in the right of way of former divided highways. Applications for funding are accepted year-round.

Safe Routes to School Program

The Safe Routes to School Program (SR2S)[16] has three main goals:

- To increase and encourage children of all capabilities to walk and bicycle to school,
- Improve the safety and appeal of walking and biking to school, and;
- To support the planning and implementation of projects and programs to reduce vehicular traffic and emissions in the areas around schools.

The program is currently administered under the Transportation Alternative Program and paired with the Transportation Enhancements and Recreational Trails programs. The program generally includes sidewalk improvements, on-street and off-street bicycle facilities improvements, driver feedback and variable speed limit signs, sidewalk lighting, etc. Additional non-infrastructure projects are included in

[14] MDOT Safety Programs Website (http://www.michigan.gov/mdot/0,4616,7-151-9625_25885_40552---,00.html)
[15] TAP Program Overview (http://www.michigan.gov/documents/mdot/MDOT_TEA_Overview_175763_7.pdf)
[16] Michigan Safe Routes to School Website (http://saferoutesmichigan.org/)

the list of eligible projects such as walk or bike to school day programs, personal safety education programs and volunteer safety patrols among others.

Highway Safety Improvement Program

The main goal of the Highway Safety Improvement Program (HSIP)[17] mirrors that of the RTSP in that it seeks to help reduce the number of fatalities and serious injuries occurring each year on the transportation network. The program spurred the development of the strategic highway safety plans for the states and helps to provide high level direction and guidance. Funds made available through the HSIP may be used for both infrastructure and non-infrastructure programs. Most projects eligible under the program require a 10 percent local match. Some projects, however, may receive 100 percent federal funding depending on the specific project type. While the High Risk Rural Roads fund has been phased out under MAP-21, there are still measures to direct some funding towards high risk rural roads when certain metrics are exceeded.

Local Matches

Regardless of the project type and funding source, collection of local matches for safety projects and programs provide an additional source of funding. Additionally, inclusion of a source of local matches tend to improve the feasibility or reception of funding applications from other sources. It provides evidence for local support for the project and help to offset other matching or federal costs. Local matches can be coordinated with community groups, local business, or other community partners with a stake in the project area or outcome.

Congestion Mitigation and Air Quality Improvement (CMAQ) Program

While CMAQ[18] funding is designated for projects which help to reduce congestion, delay and other operational characteristics, some safety projects may have a positive impact on these metrics. As such, there may be potential to apply for CMAQ funding on eligible projects in support of other safety funding sources. This could provide the opportunity to obtain CMAQ funding that may be used as matching funds for other applications.

Surface Transportation Improvement Grants (STP)

Funds made available through the STP cover a wide range of potential projects. State and local governments may apply for the funding with portions set aside specifically for metropolitan planning areas with populations of varying levels, including below 200,000 and 50,000 people. Potentially eligible projects include:

- Public transportation capital improvements;

[17] Michigan HSIP 2016 Annual Report (https://safety.fhwa.dot.gov/hsip/reports/pdf/2016/mi.pdf)
[18] MDOT CMAQ Improvement Program 2015 Guidance (http://www.michigan.gov/documents/mdot/MDOT_CMAQ_GuidanceDocDraftUpdate2015_505586_7.pdf)

- Car and vanpool projects;
- Fringe and corridor parking facilities;
- Bicycle and pedestrian facilities; and,
- Bus terminals and facilities.

Projects eligible for funding under the STP do not necessarily need to have a safety component. The grants generally require local matches, the amount of which varies depending on the type of project and system the project is occurring on. Generally, a twenty percent matching fund is required.

Metropolitan Planning Program and State Planning and Research Program

A wide range of planning activities may be eligible for funding under either of these programs. Funds are allocated to each state based in part on the state's proportion of urban areas when compared to the nation as a whole. Funds are then distributed by the state to the municipal planning organizations (MPO) based on individual state formulas with each MPO receiving a guaranteed minimum. Projects do not necessarily need to be safety related, although safety related projects are specifically mentioned in the list of eligible project types. Funding may be applied towards planning activities for:

- Developing the economic vitality of the metropolitan area;
- Increasing the safety and security of the transportation system for motorized and non-motorized users;
- Improving the accessibility and mobility of people and freight;
- Protecting and enhance the environment, promote energy conservation;
- Improving the quality of life, and promote consistency between transportation improvements and State and local planned growth and economic development patterns;
- Enhancing the integration and connectivity of the transportation system, across and between modes, for people and freight;
- Promoting efficient system management and operation; and,
- Emphasizing the preservation of the existing transportation system.

Transportation Enhancement Activities

This program[19] covers funding for projects that fall under at least one of twelve specific activities. The States solicit and select projects for funding and may disburse said funding to Federal, Tribal, State, or local government agencies. The twelve activities eligible for funding under this program are summarized as follows:

- Providing facilities for non-motorized users;
- Safety and educational activities for non-motorized users;
- Acquisition of scenic or historic easements or sites;
- Acquisition of scenic or historic highway programs;

[19] Transportation Enhancement Activities Funding – Source and Eligible Uses (https://www.michigan.gov/documents/mdot/MDOT_TEA_Tax_dollars_175757_7.pdf)

- Landscaping and beautification;
- Historic preservation;
- Rehabilitation and operation of historic transportation buildings and facilities;
- Preservation of abandoned railway corridors;
- Management of outdoor advertising;
- Archaeological planning and research;
- Environmental mitigations related to transportation activities; and,
- The establishment of transportation museums.



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