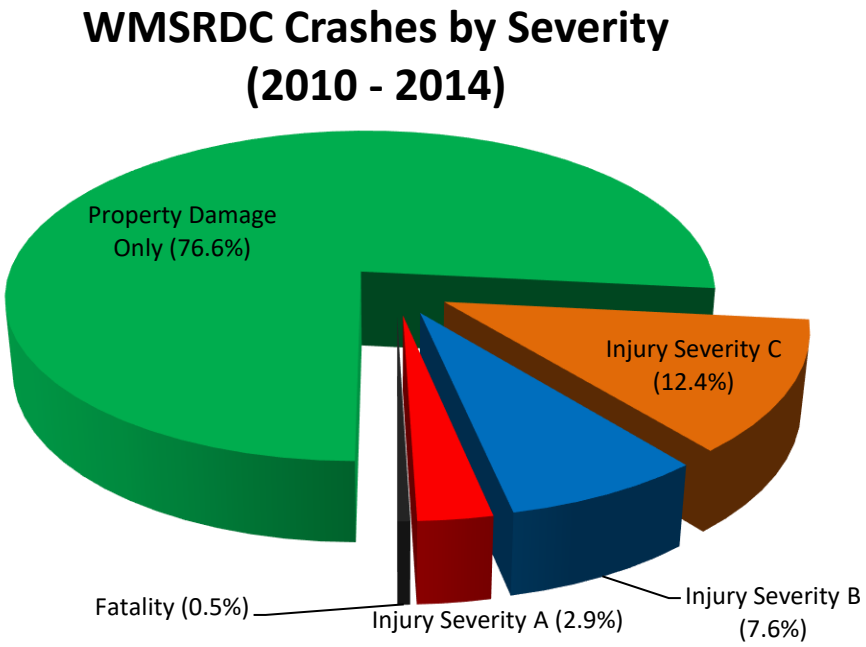
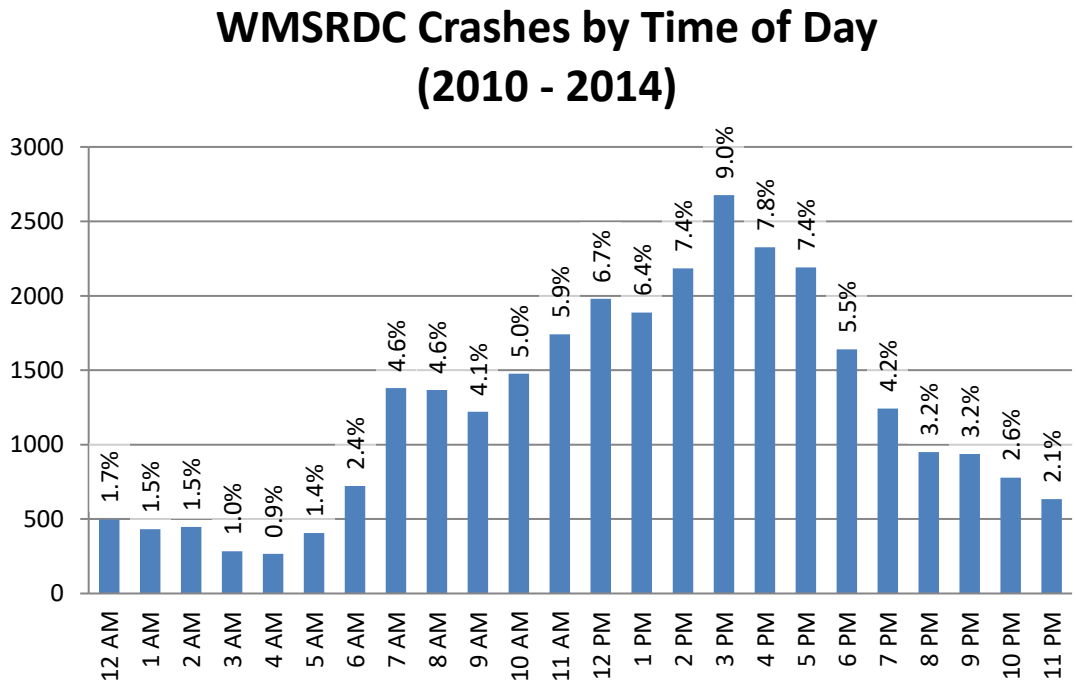
Appendices

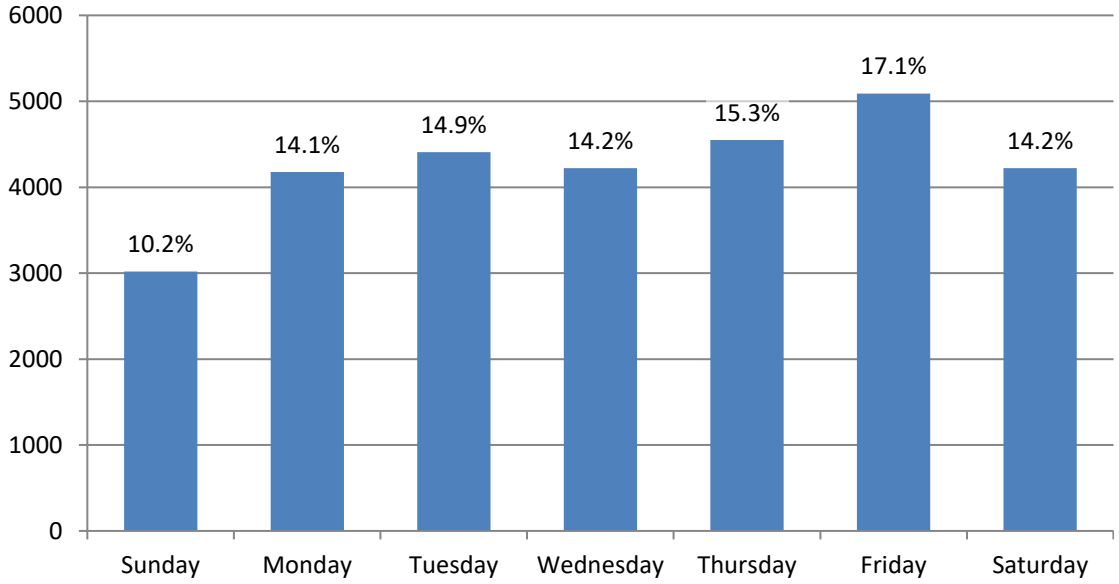
Appendix A – Data Analysis

2010 – 2014 Analysis Summary (Excluding Deer Crashes)

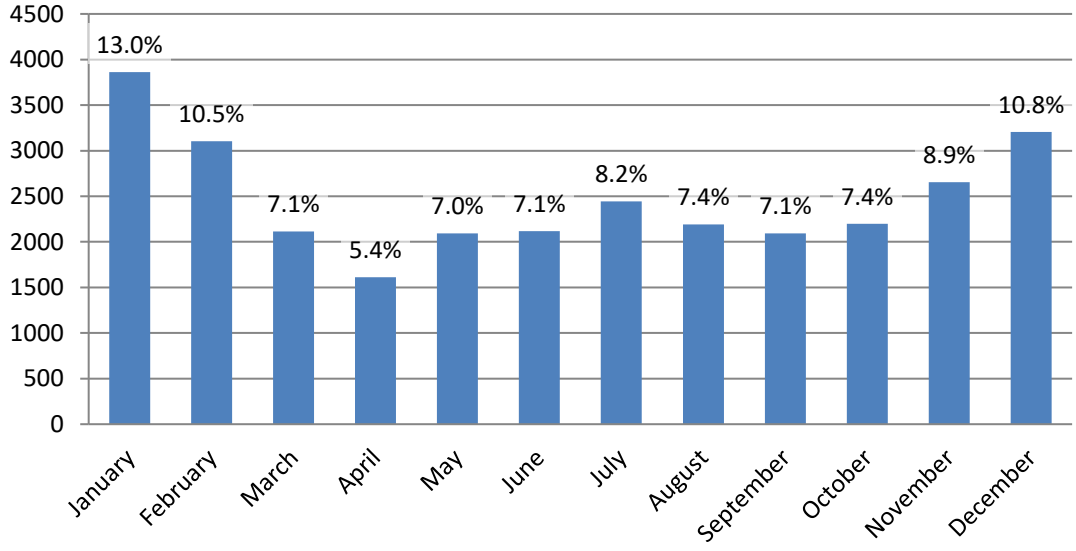


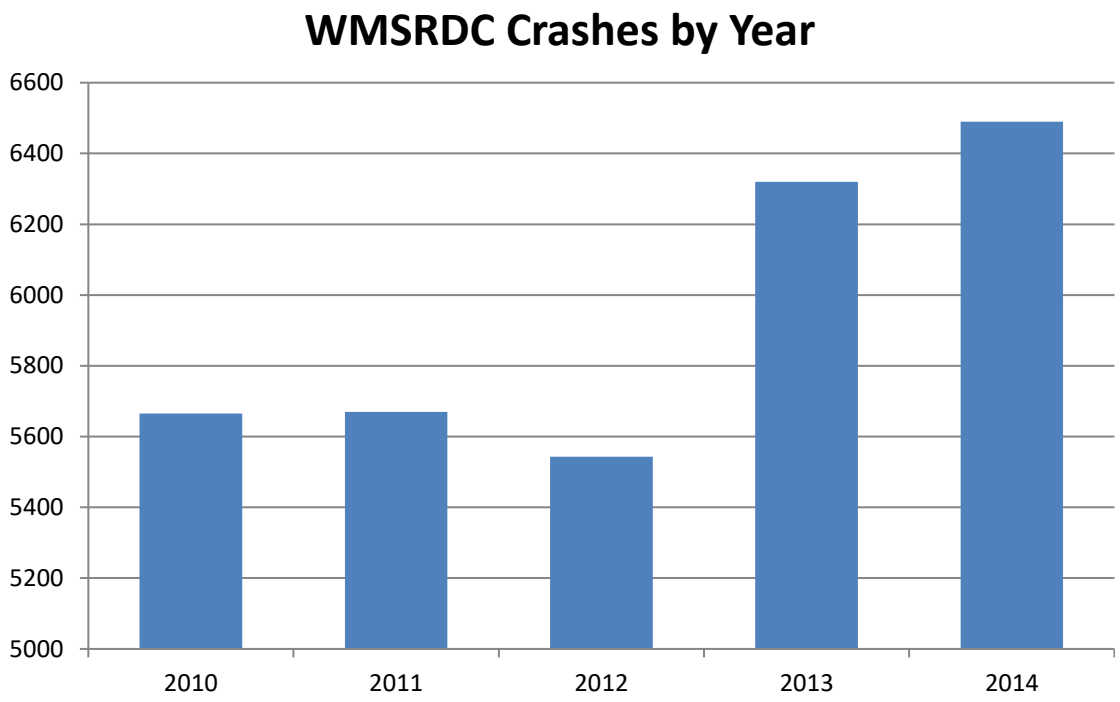


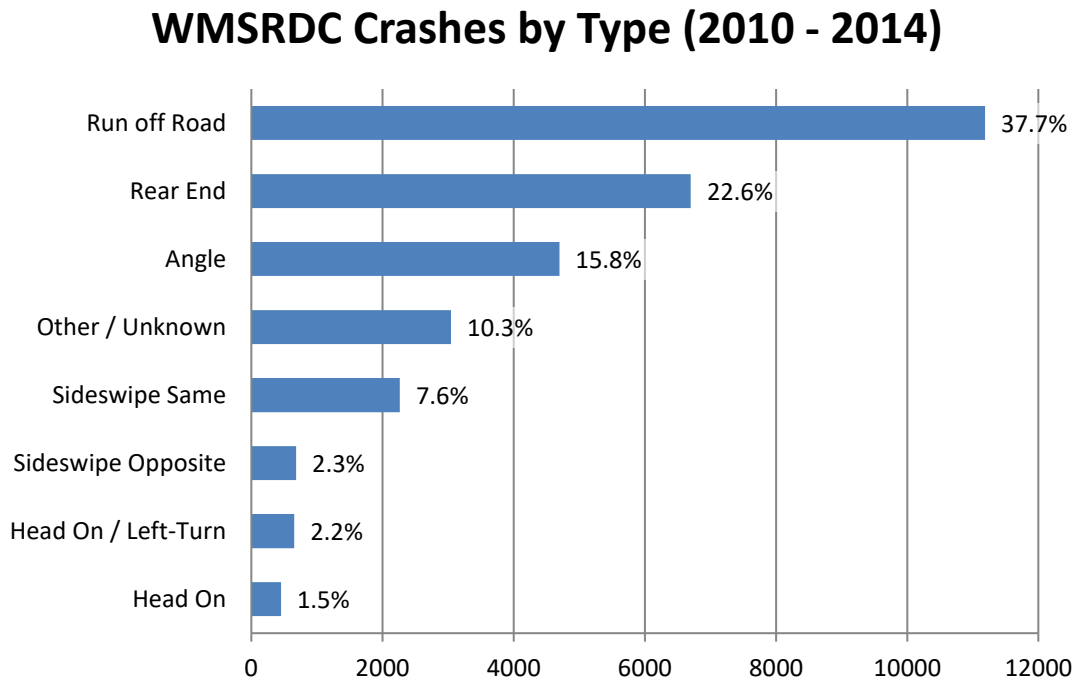
WMSRDC Crashes by Day of Week (2010 - 2014)



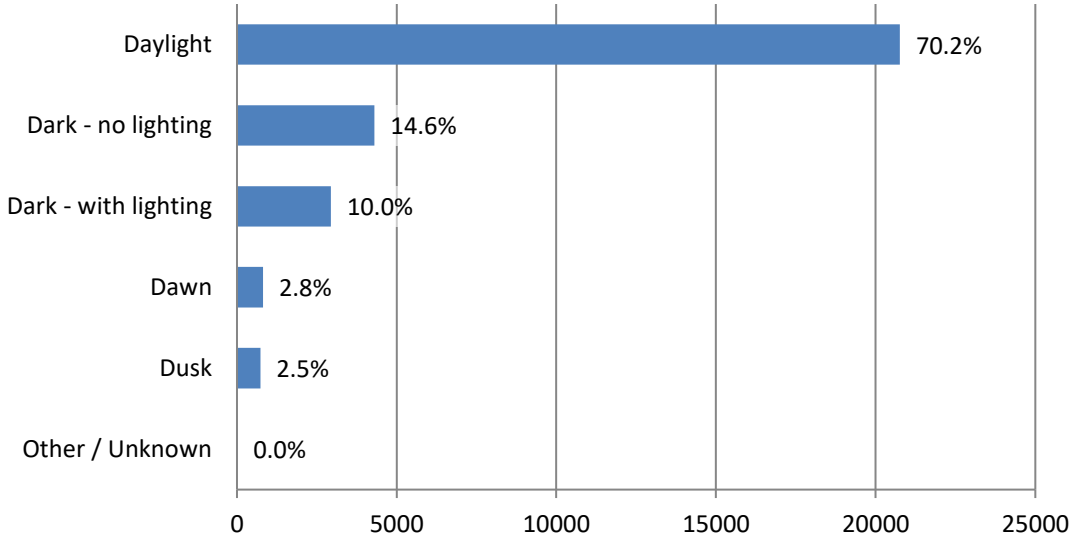
WMSRDC Crashes by Month of Year (2010 - 2014)



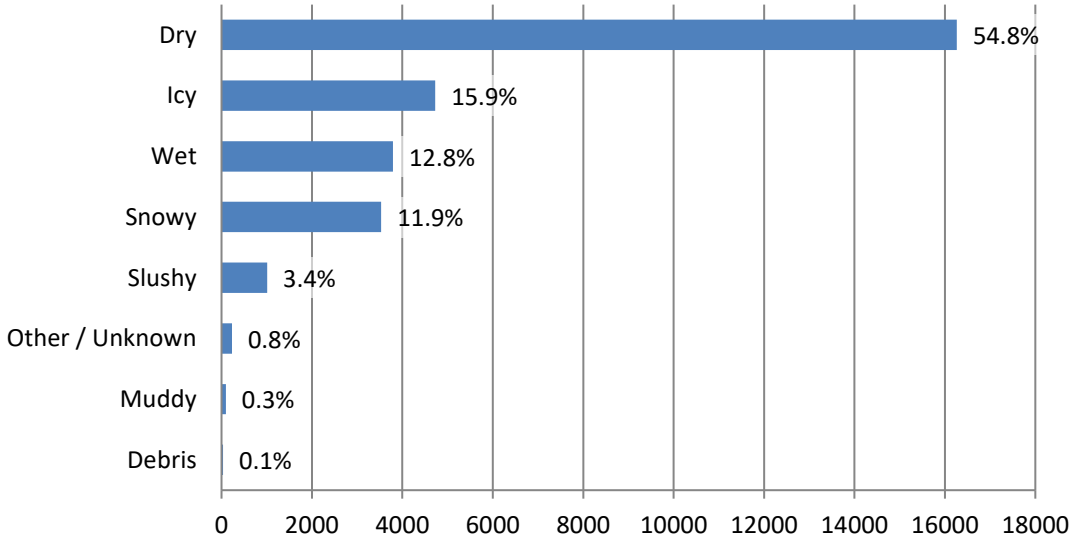

WMSRDC Crashes by Year
6600
6400
6200
6000
5800
5600
5400
5200
5000
2010
2011
2012
2013
2014


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

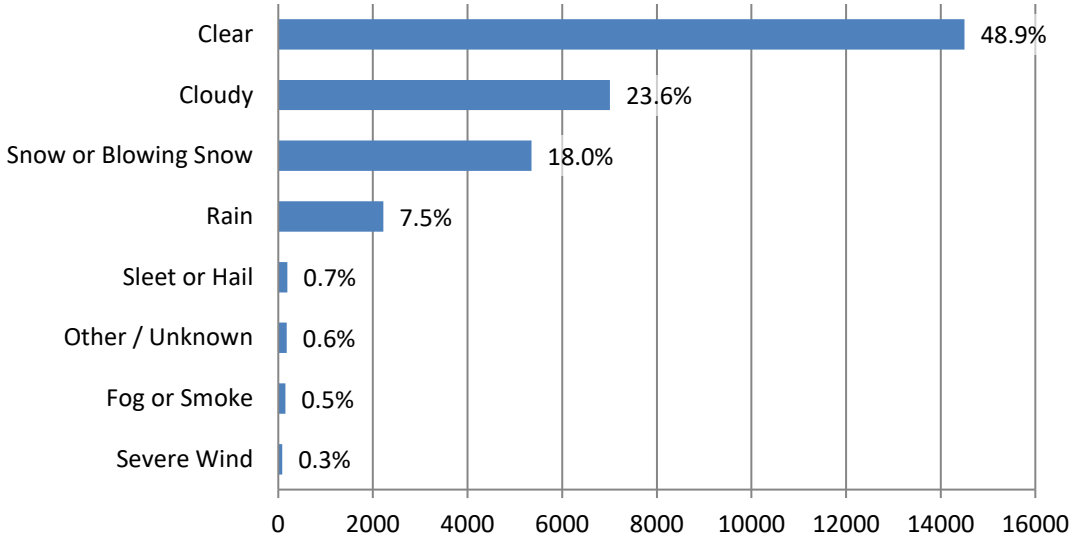
WMSRDC Crashes by Lighting Condition (2010 - 2014)



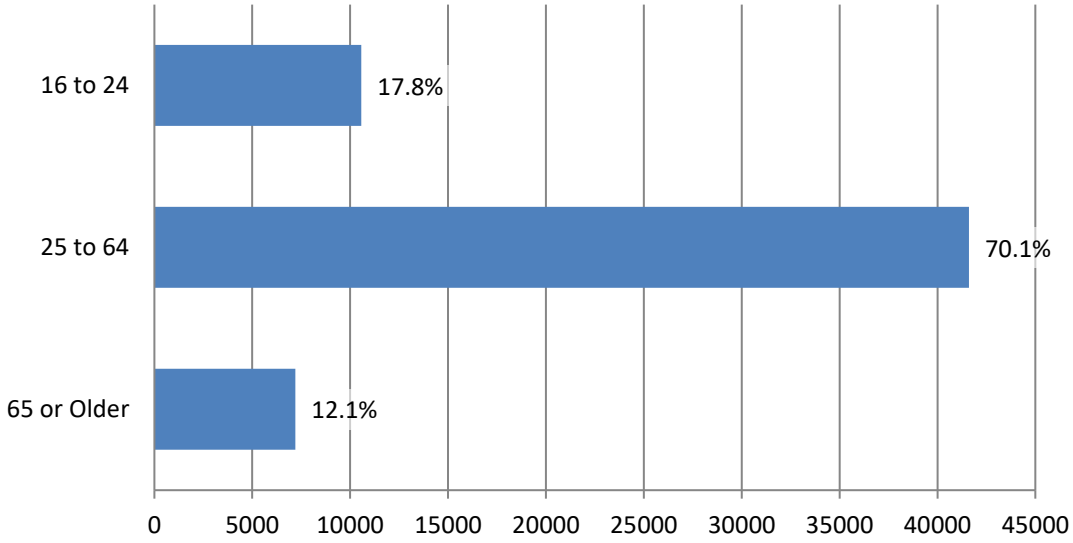
WMSRDC Crashes by Road Surface COndition (2010 - 2014)

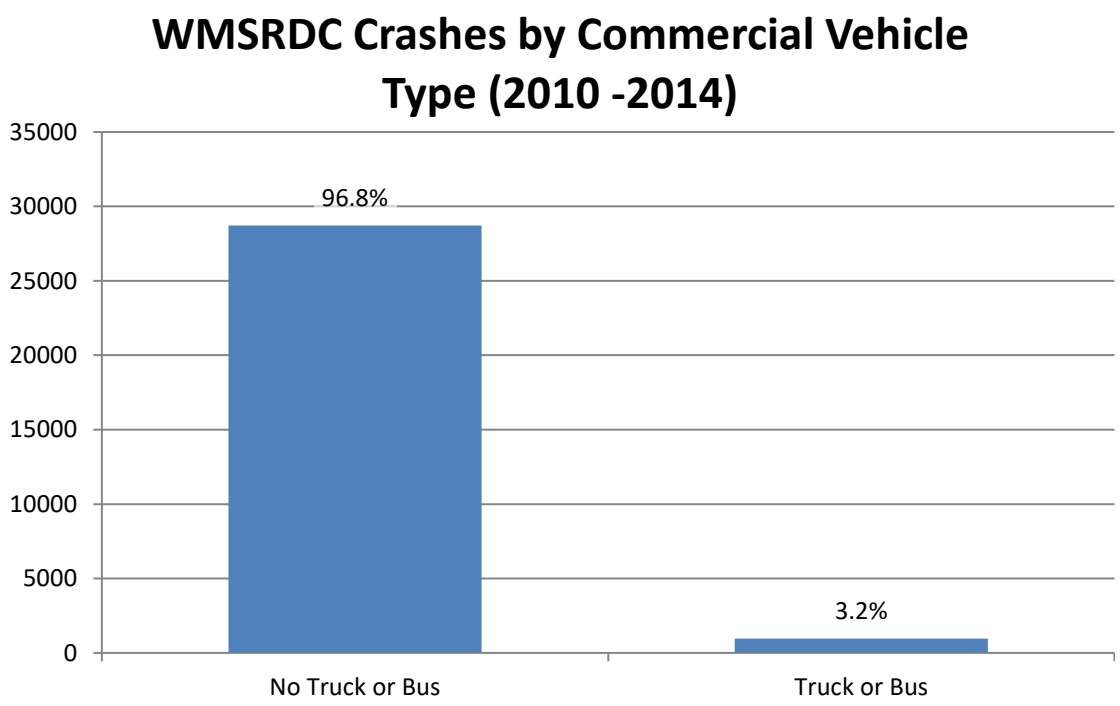


WMSRDC Crashes by Weather Condition (2010 - 2014)



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.

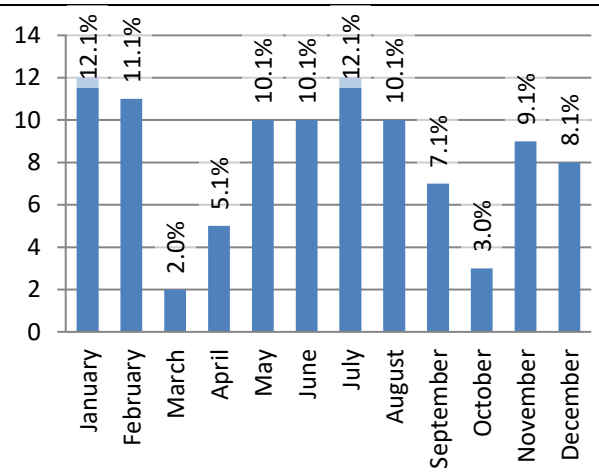
	2014				2015
Total Crashes	6,485	Decreased by	8.4%	to	5,943
Incapacitating Crashes	163	Decreased by	18.4%	to	133
Fatal Crashes	24	Increased by	20.8%	to	29
Run off Road Crashes	64	Decreased by	1.6%	to	63
Angle Crashes	43	Decreased by	37.2%	to	27
Rear End Crashes	17	Decreased by	11.8%	to	15
Vulnerable 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.

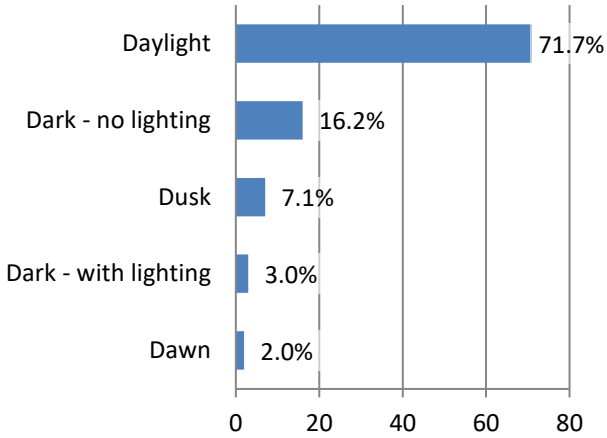
Individual County Summaries (Excluding Deer Crashes)

Lake County

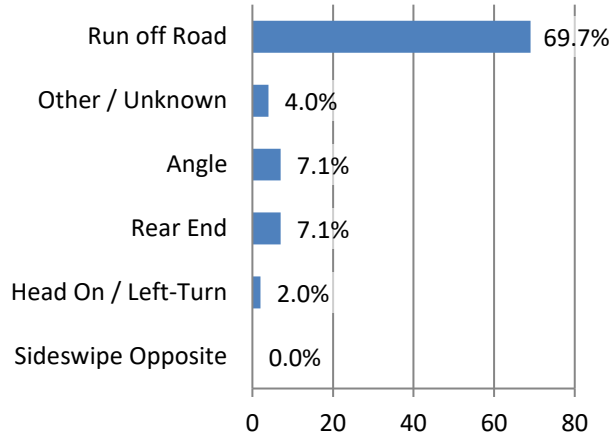
Lake County experienced approximately one tenth (99 of the 985 fatal and incapacitating) of the crashes reported in the WMSRDC Region during the analysis period despite only accounting for approximately three percent of the region's average yearly vehicle miles traveled (VMT). The summary statistics 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.



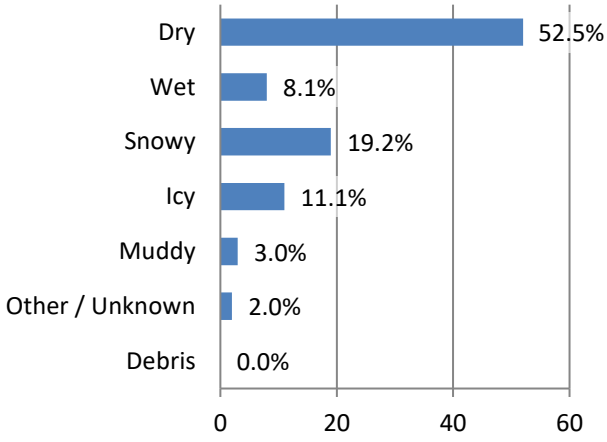
Lake County Monthly Crash Distribution



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.

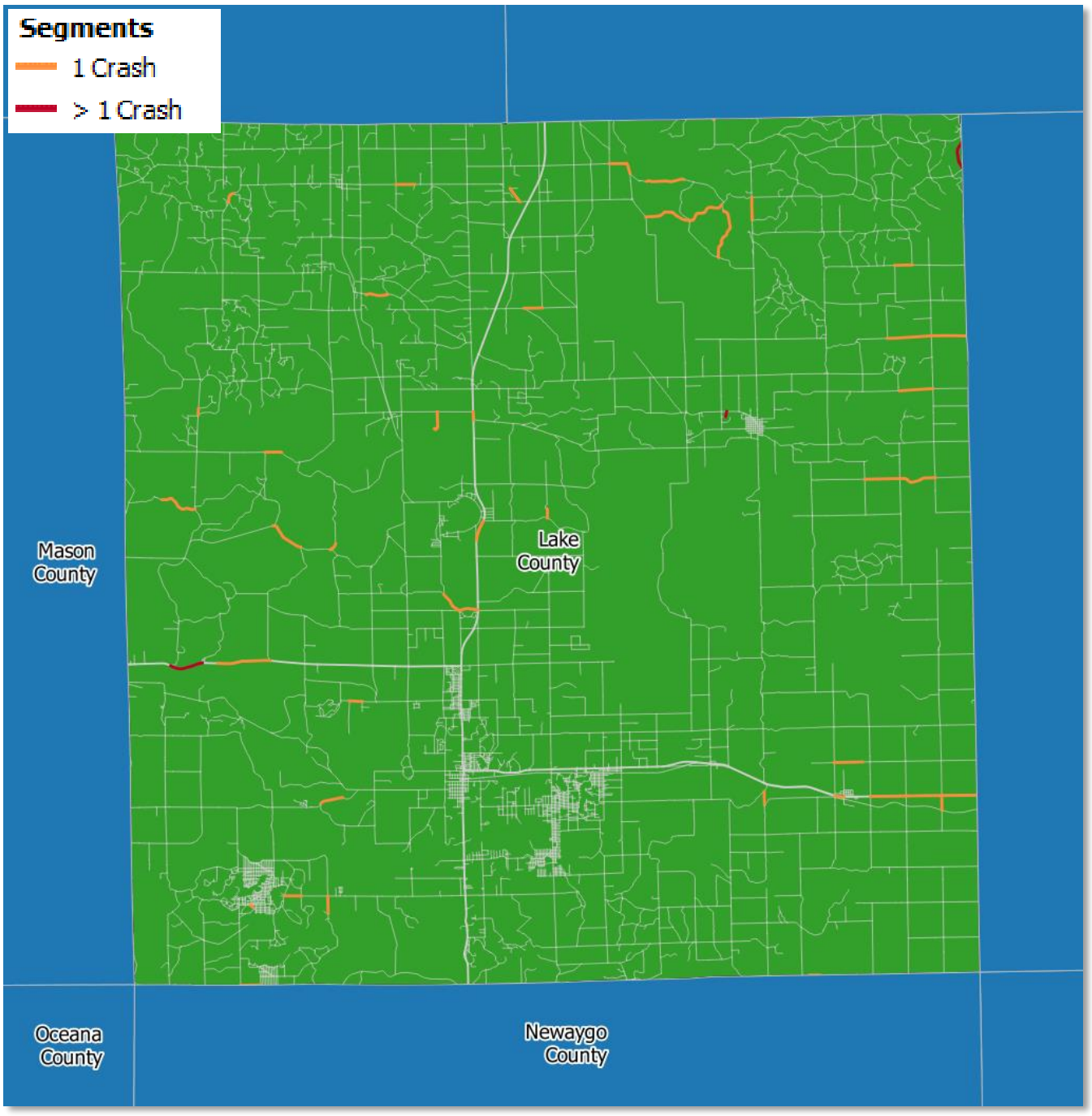
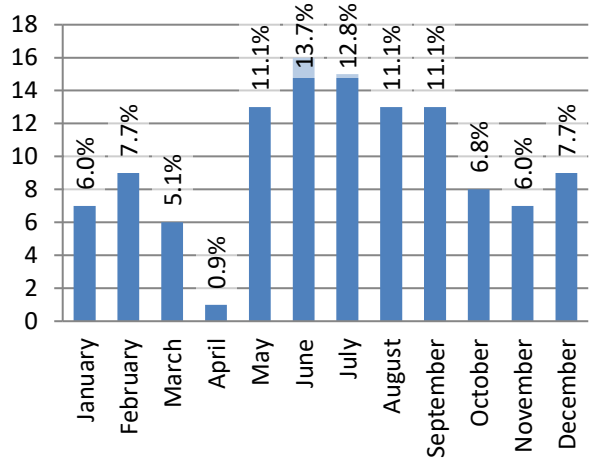


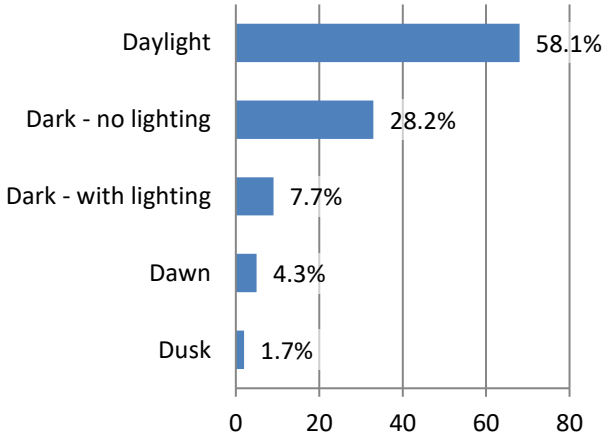
Figure 54 - Lake County Fatal & Incapacitating Injury Lane Departure Locations (2010 - 2014)

Mason County

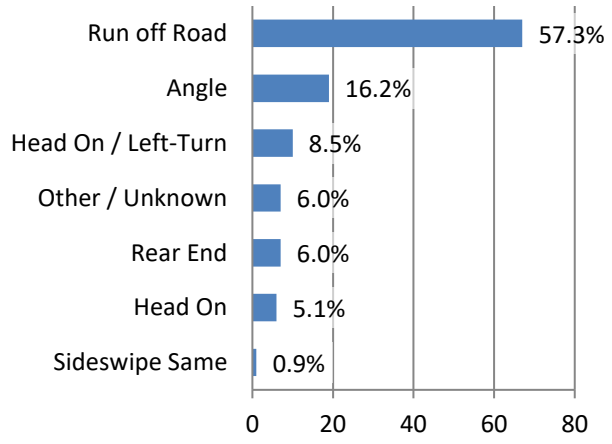
Lake County experienced approximately one tenth (117 of 985 total) of the crashes reported in the WMSRDC Region during the analysis period, while accounting for approximately eleven percent of the average yearly vehicle miles traveled for the region. The summary statistics provided here mirror those 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.



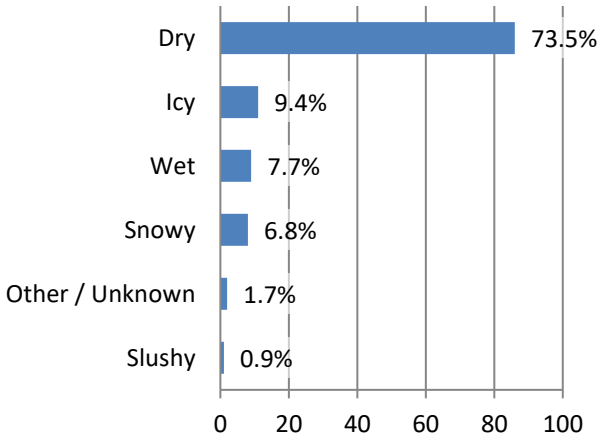
Mason County Crash Monthly Crash Distribution



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.

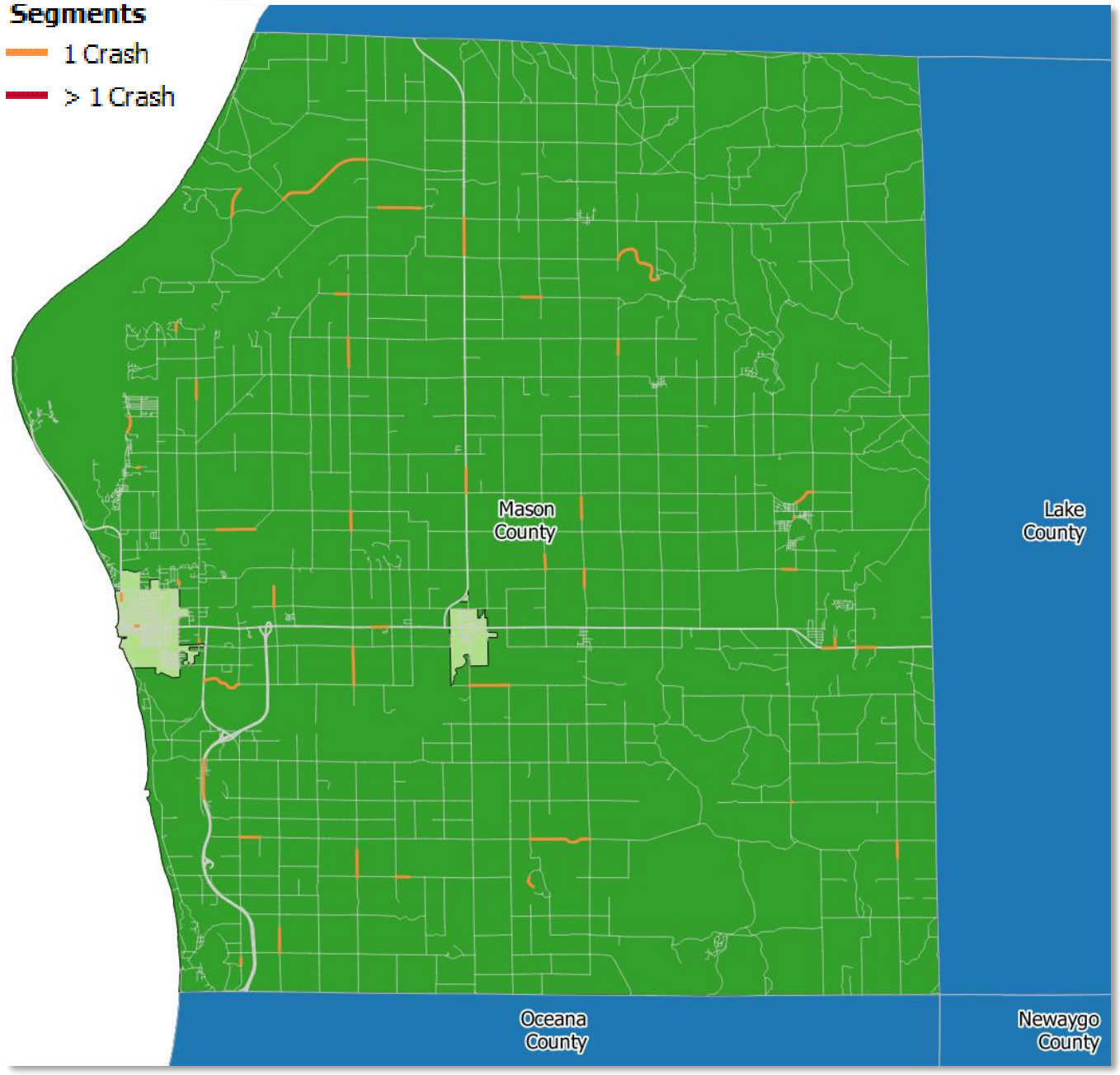
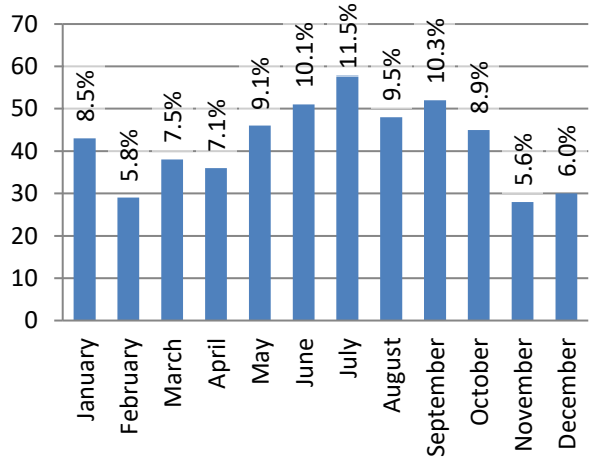


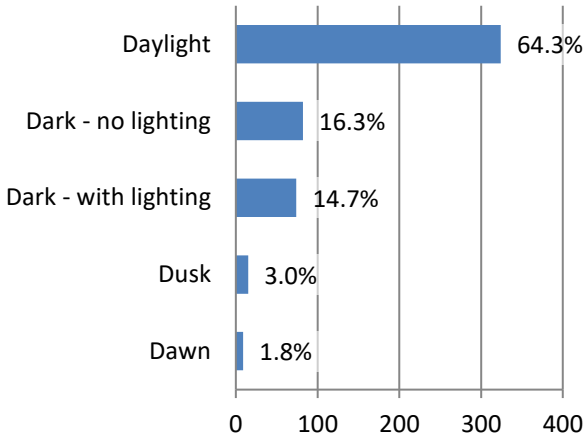
Figure 55 - Mason County Fatal & Incapacitating Injury Lane Departure Crash Locations

Muskegon County

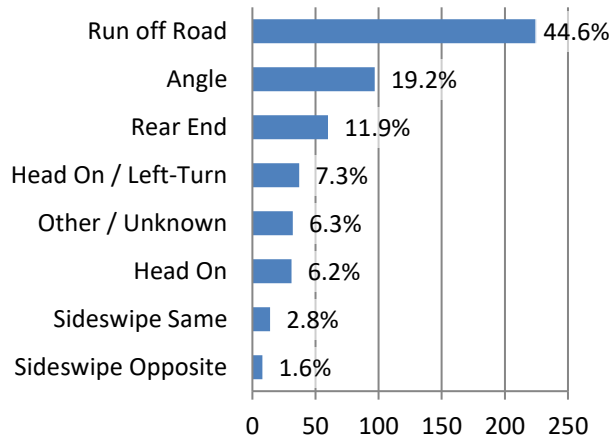
Lake County experienced approximately one half (504 of 985 total) of the crashes reported in the WMSRDC Region during the analysis period, while accounting for approximately fifty-eight percent of the average yearly vehicle miles traveled for the region. The summary statistics provided here mirror those 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.



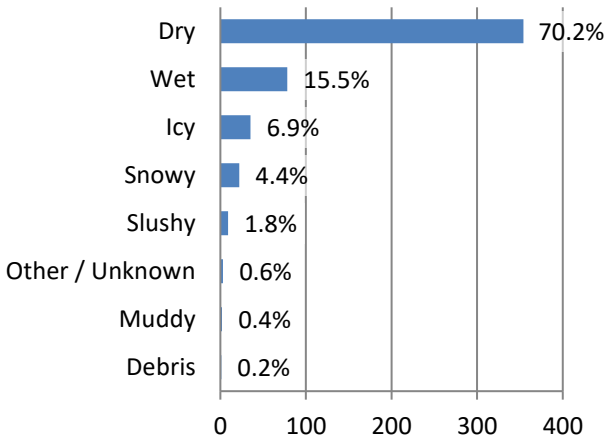
Muskegon County Crash Monthly Crash Distribution



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.

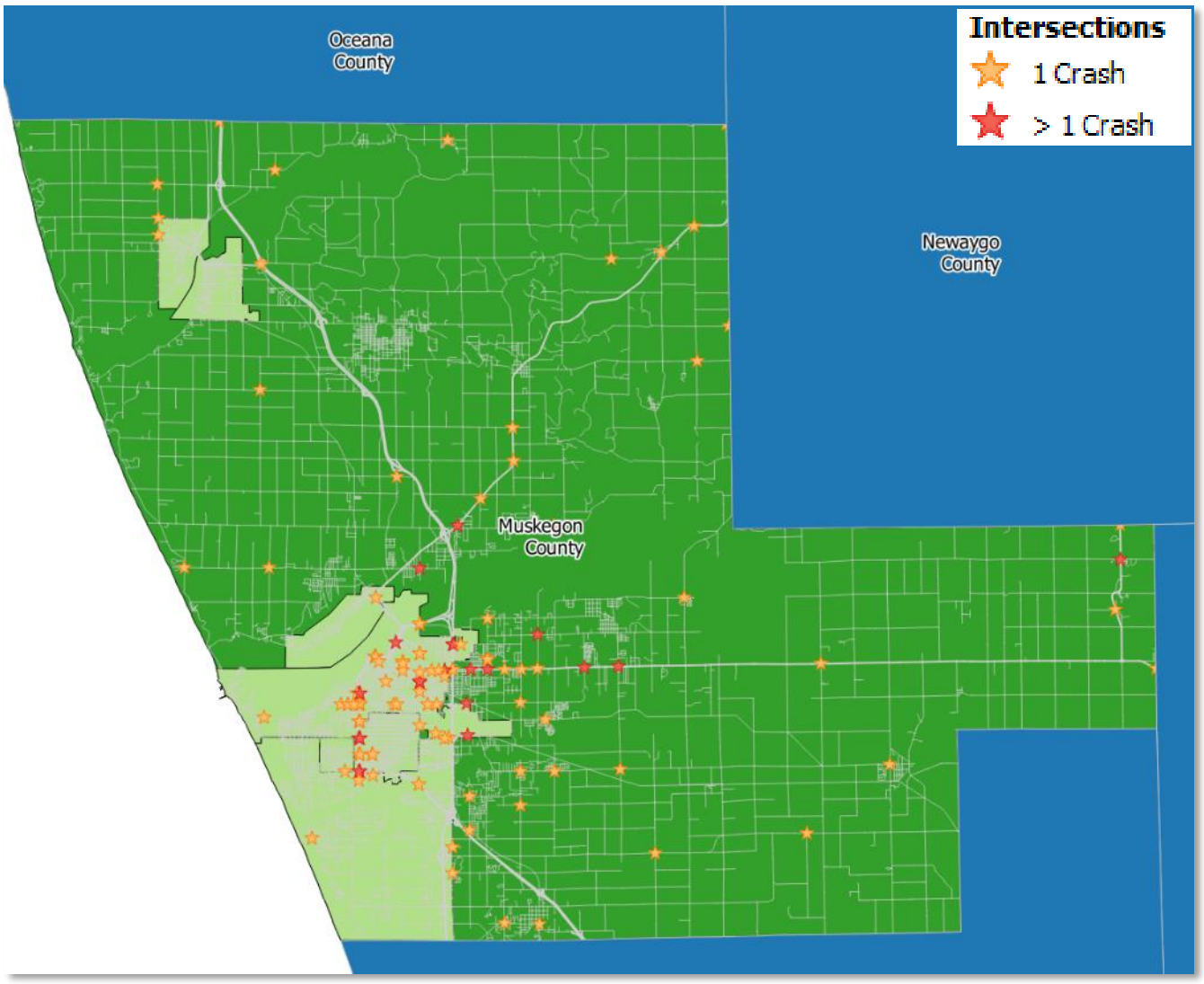
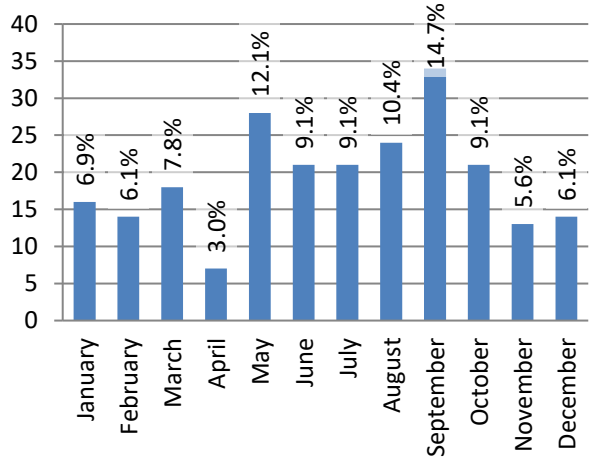


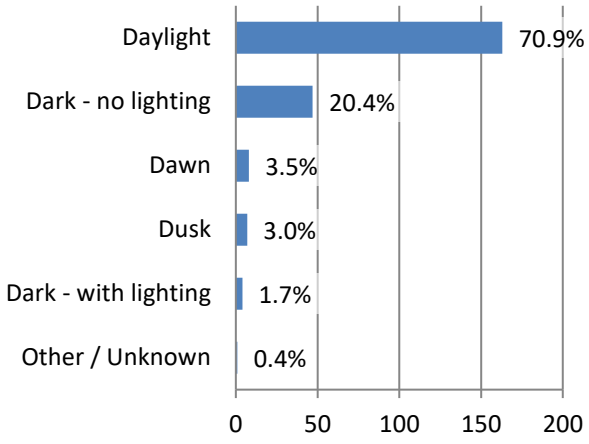
Figure 56 - Muskegon County Fatal & Incapacitating Injury Intersection Crash Locations

Newaygo County

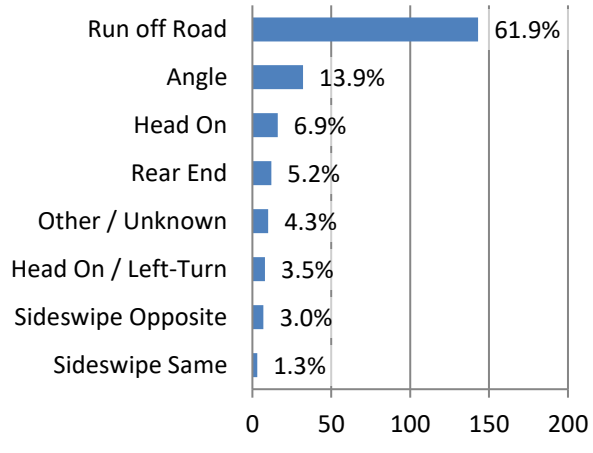
Lake County experienced approximately one quarter (231 of 985 total) of the crashes reported in the WMSRDC Region during the analysis period, despite accounting for approximately seventeen percent of the average yearly vehicle miles traveled for the region. The summary statistics provided here mirror 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.



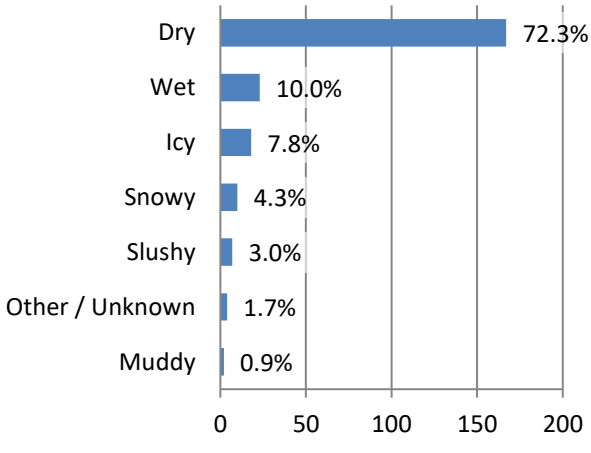
Newaygo County Crash Monthly Crash Distribution



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.

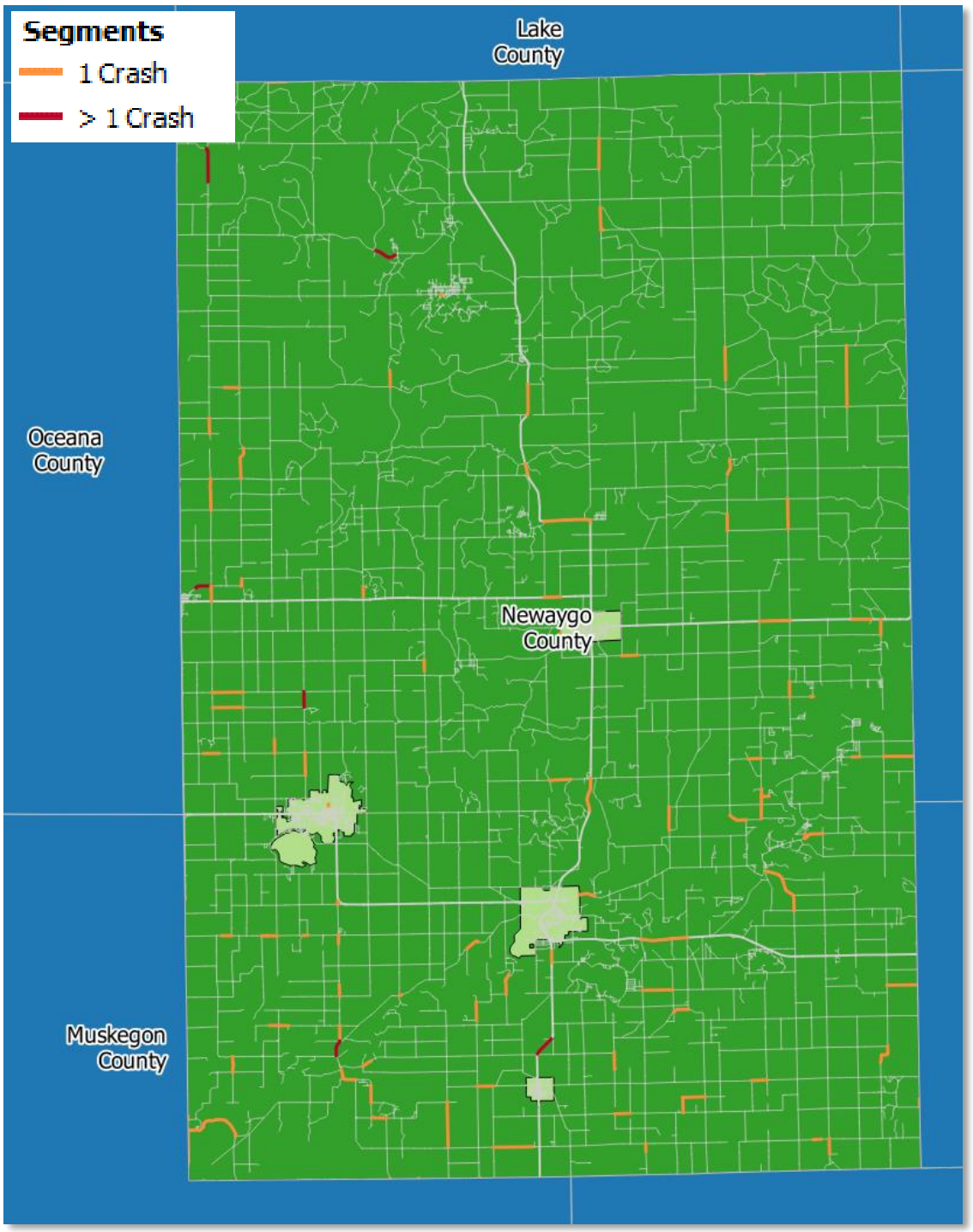
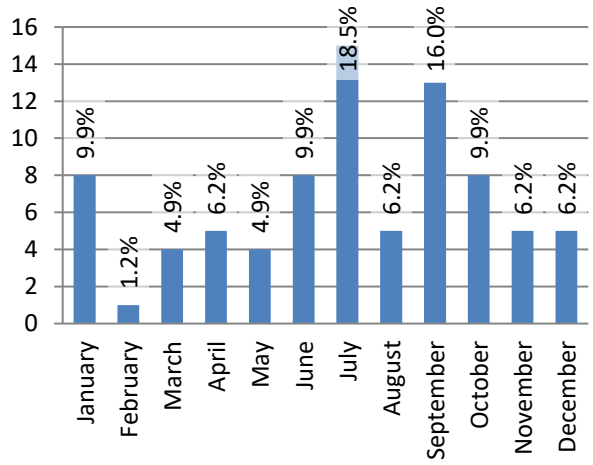


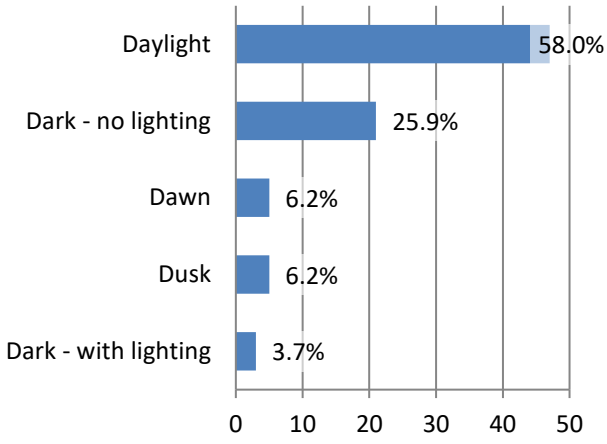
Figure 57 - Newaygo County Fatal & Incapacitating Injury Lane Departure Crash Locations

Oceana County

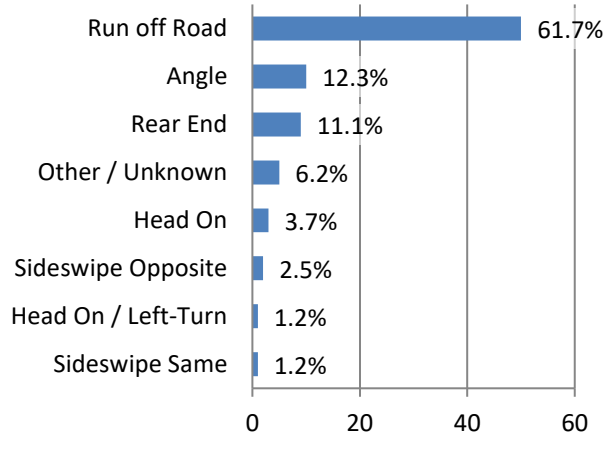
Lake County experienced less than one tenth (81 of 985 total) of the crashes reported in the WMSRDC Region during the analysis period, while accounting for approximately ten percent of the average yearly vehicle miles traveled for the region. The summary statistics provided here mirror those for the 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.



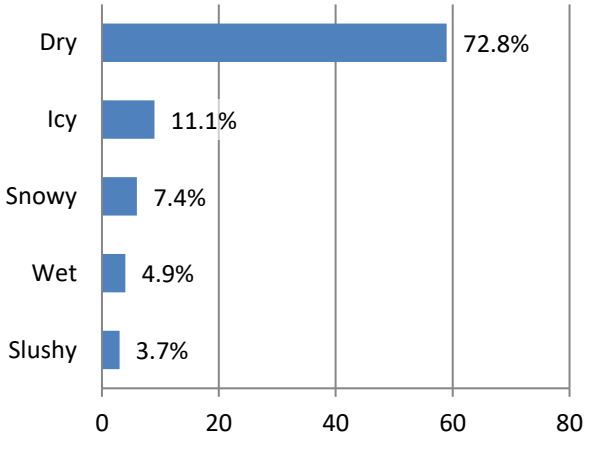
Oceana County Crash Monthly Crash Distribution



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.

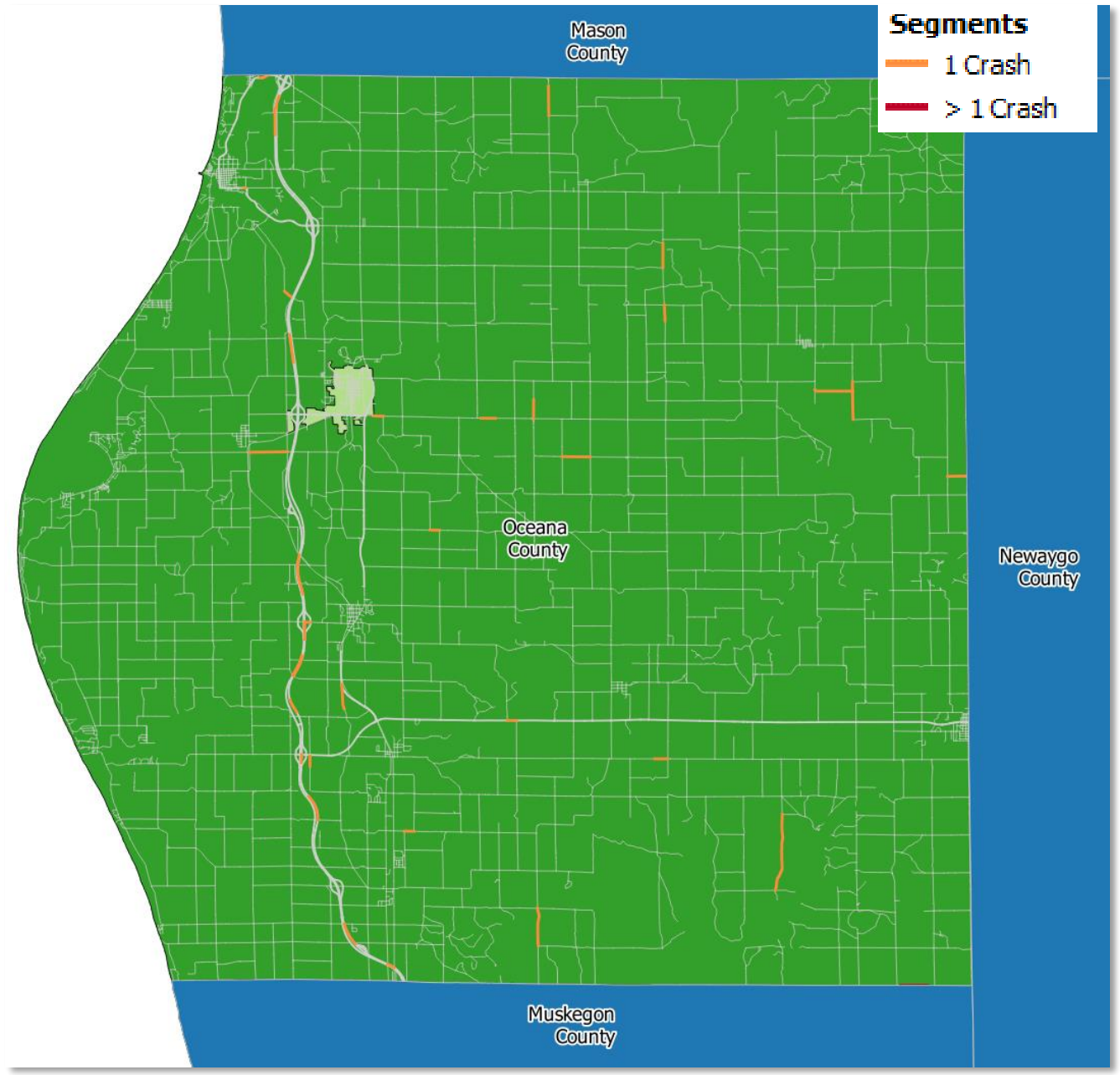


Figure 58 - Oceana County Fatal & Incapacitating Injury Lane Departure Crash Locations

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

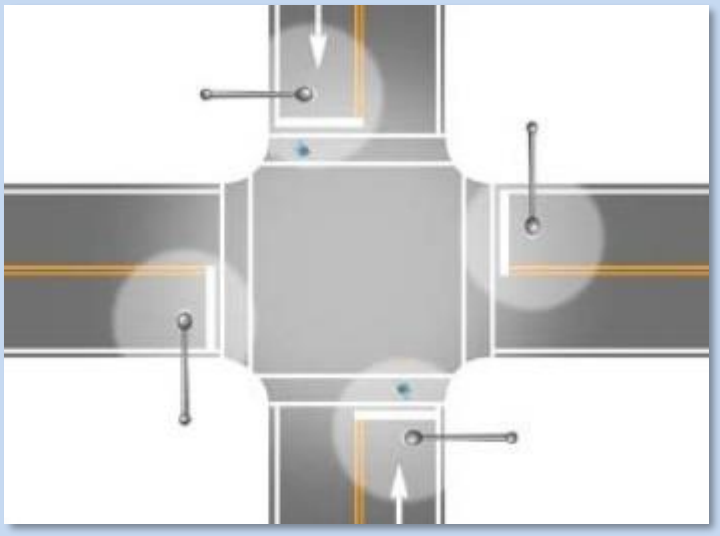
Pedestrian and Bicycle Education & Awareness Programs	
4-"E" Area of Focus:	Education
Countermeasure Definition:	Education programs geared towards pedestrians and bicyclist regarding proper navigation of the trail and road network should prove beneficial in reducing the number of vehicular and non-motorized 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

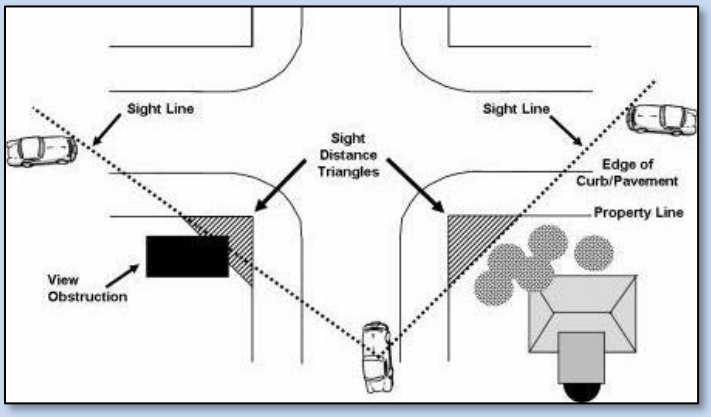
Randomized Enforcement Locations	
4-"E" Area of Focus:	Enforcement Emergency Response
Countermeasure Definition:	The presence of law enforcement tends to provide a calming presence for traffic flow and encourages drivers to obey the speed limits and other traffic laws. While increasing the number of 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

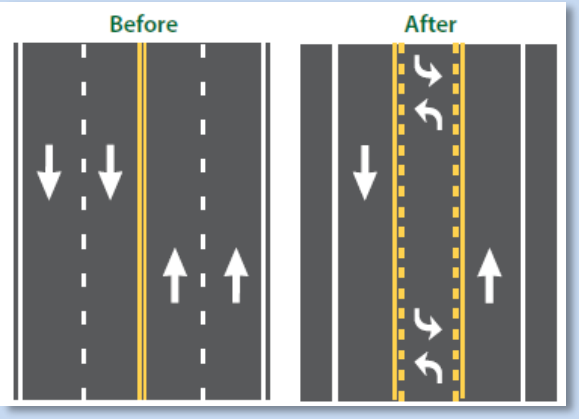
Review Intersection Traffic Control	
4-"E" Area of Focus:	Engineering Education
Countermeasure Definition:	Intersection traffic control type should be reviewed to determine whether or not it is warranted and whether a more appropriate option could be employed. Additional steps could be taken to help 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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