# GVMC Safety Planning Process

May 1

# 2014

Prepared by GVMC Staff

Safety Planning

# Table of Contents

**Section** **Page**

1. Introduction ..... 1

1.1 Purpose .....3

1.2 Background .....3

1.3 A Vision for the Future .....8

1.4 Basic Elements .....8

2. Emphasis Areas ..... 10

2.1 Intersection Safety .....10

2.2 Corridor Safety .....18

2.3 Senior Mobility and Safety .....25

2.4 Young Drivers Safety .....29

2.5 Pedestrian/Bicyclist Safety .....32

2.6 Alcohol-Involved Crashes..... .....36

2.7 Deer Crashes .....38

3. Investment Need .....40

3.1 Itemized Need by Category .....40

Appendix .....A-1

# List of Figures


**Figure** **Page**

**Figure 1: GVMC Study Area Map ..... 5**

**Figure 2: Total Crashes 2008-2012..... 6**

**Figure 3: Fatal Crashes and Fatal Crashes/MVMT 2008-2012..... 7**

**Figure 4: Injury Crashes and Injury Crashes/MVMT 2008-2012..... 7**

**Figure 5: GVMC Intersection Crashes..... 11**

**Figure 6: Intersection Crashes Percentage ..... 12**

**Figure 7: Intersection Fatal and Injury Crashes Percentage..... 13**

**Figure 8: GVMC Corridor Crashes ..... 18**

**Figure 9: Elderly Driver Crashes ..... 26**

**Figure 10: Elderly Driver Fatal Crash Percentage ..... 26**

**Figure 11: Young Driver Crashes ..... 30**

**Figure 12: Young Driver Fatal Crash Percentage ..... 31**

**Figure 13: GVMC Bicycle/Pedestrian Crashes ..... 32**

**Figure 14: GVMC Bicycle/Pedestrian Fatal Crashes ..... 33**

**Figure 15: GVMC Pedestrian/Bicycle Fatal and Injury Crash Percentage..... 34**

**Figure 16: GVMC Alcohol-Involved Crashes ..... 36**

**Figure 17: GVMC Alcohol-Involved Crash Percentages ..... 37**

**Figure 18: GVMC Alcohol-Involved Crash Percentages in Michigan ..... 37**

**Figure 19: GVMC Deer Crashes ..... 39**

**PROTECTION FROM DISCOVERY AND ADMISSION INTO EVIDENCE**

Under 23 U.S.C. 148(g)(4) information collected or compiled for any purpose directly relating to this report shall not be subject to discovery or admitted into evidence in a Federal or State court proceeding or considered for other purposes in any action for damages arising from any occurrence at a location identified or addressed in this report.

## 1. INTRODUCTION – Causes of Traffic Crashes

According to Wikipedia, “a traffic collision is when a vehicle collides with another vehicle, pedestrian, animal, road debris, or other geographical or architectural obstacle. Traffic collisions can result in injury, property damage, and death”. As the factors involved in collisions have become better understood, some organizations have begun to avoid the term "accident," as the word suggests an unpreventable, unpredictable event and disregards the opportunity for the driver(s) involved to avoid the crash. GVMC will for this effort primarily refer to accidents as traffic crashes.

Although auto collisions are rare in terms of the number of vehicles on the road and the distances traveled, addressing the contributing factors can reduce their likelihood. Studies suggest that there are 4 basic causes for traffic crashes: Equipment failure, roadway design, poor roadway maintenance, and driver behavior. Over 95% of crashes can be attributed to some degree of driver behavior combined with one of the other three factors.

Equipment Failure - Manufacturers are required by law to design and engineer cars that meet a minimum safety standard. Computers, combined with companies' extensive research and development, have produced safe vehicles that are easy and safe to drive. The most cited types of equipment failure are loss of brakes, tire blowouts or tread separation, and steering/suspension failure. Combined totals for all reported equipment failure accounts for less than 5% of all motor vehicle accidents.

Roadway Design - Civil engineers, local governments, and law enforcement agencies all contribute to the design of safe road designs and traffic management

systems. In Michigan, MDOT and the FHWA provide guidelines to their construction. Roadways are designed by engineers with special consideration to hazard visibility, roadway surfaces, traffic control devices, behavioral control devices, traffic flow, street signs, and weather.

Poor Roadway Maintenance - Roadway maintenance can often contribute to some motor vehicle accidents. Debris, faded road signs, potholes and road construction can lead to traffic crashes but these factors are not leading causes of traffic crashes.

Driver Behavior - A recent study concluded that 80% of drivers involved in motor vehicle accidents believed that the other party could have done something to prevent the accident. 5% actually admitted that they were the only one at fault. Surveys consistently reveal that the majority consider themselves more skillful and safer than the average driver. Some mistakes occur when a driver becomes distracted, perhaps by a cell phone call or a spilled cup of coffee. Very few accidents result from an 'Act of God,' like a tree falling on a vehicle.

Without question, the faster vehicle is traveling, the greater the risk of an accident. Exceeding the speed limit by only 5 mph in the wrong place can be dangerous. Traffic engineers and local governments have determined the maximum speeds allowable for safe travel on the nation's roadways. Speeding is a deliberate and calculated behavior where the driver knows the risk but ignores the danger. Fully 90% of all licensed drivers speed at some point; 75% admit to committing this offense regularly.

Example: A pedestrian walks out in front of a car. If the car is traveling at just 30 mph, and the driver brakes when the pedestrian is 45 feet away, there will be enough space in which to stop without hitting the pedestrian. Increase the vehicle speed by just 5 mph and the situation changes dramatically. At 35 mph, with the pedestrian 45 feet away and the driver braking at the same point, the car will be traveling at 18 mph when it hits the pedestrian. An impact at 18 mph can seriously injure or even kill the pedestrian.

Nearly 1/3 of all fatal crashes (32.6%) in the GVMC region since 2008 involved impaired drivers. In total, 84 people lost their lives from 2008-2012 as the result of a vehicle being operated by a drunk driver.

GVMC fully supports efforts of state and local law enforcement agencies in their efforts to combat those who put others in peril through negligent use of the transportation system by operating a vehicle in an impaired state, speeding, fleeing, or driving while distracted. Through coordinated efforts on various GVMC committees, GVMC members are well informed of these issues and yield to the expertise of law enforcement.

## 1.1 PURPOSE

The primary purpose of this document is to identify locations on the federal aid system where safety issues may exist and where countermeasures, when applied, can lead to a reduction in the number of crashes at specified locations, thus improving the overall safety of the transportation system in the GVMC region. This effort and indirectly the collaborative efforts of GVMC and its member communities focus on the transportation infrastructure. With this in mind this study focuses on aspects related to transportation infrastructure improvements.

## 1.2 BACKGROUND

The transportation department of the Grand Valley Metropolitan Council (GVMC) is charged with implementing the Metropolitan Planning Organization (MPO) planning process as included in US code 23. The transportation planning process is a multi-modal process. All modes of transportation are planned for including: Highways, Transit, Non-motorized, Aviation, Rail and Freight.

A variety of tools and programs are used to plan for the Grand Rapids metropolitan area including a Congestion Management Process (capacity issues), Asset Management System (system conditions), and this regional strategic safety planning process.

On July 6, 2012, President Obama signed into law P.L. 112-141, the Moving Ahead for Progress in the 21st Century Act (MAP-21). This law established extensive new

resources and opportunities to advance highway safety throughout the country in a comprehensive, strategic manner. MAP-21 raises the stature of the highway safety program by establishing highway safety improvement as a core program, tied to strategic safety planning and performance. MAP-21 devotes additional resources and supports innovative approaches to reducing highway fatalities and injuries.

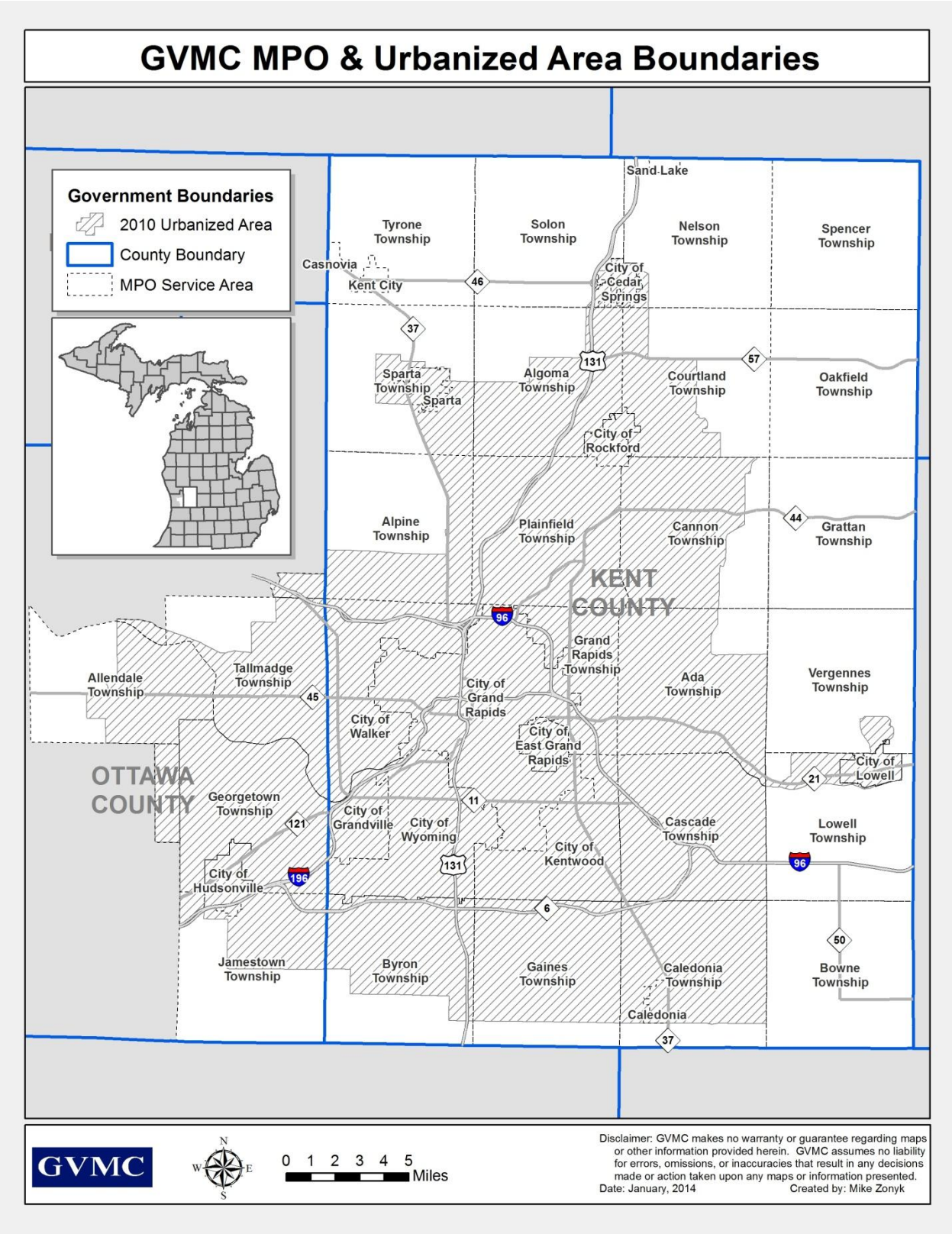
According to the National Highway Traffic Safety Administration, 34,080 people died in US motor vehicle crashes in 2012. Nationwide, motor vehicle traffic crashes are the eighth leading cause of death among Americans of all ages and the number one cause of death for every age from 3 through 33.

In the Grand Valley Metro Council (GVMC) study area (Figure 1), there are an average of about 20,000 traffic crashes each year. Of these 20,000 crashes 3,850 include an injury and unfortunately an average of 50 fatal traffic accidents occur each year.

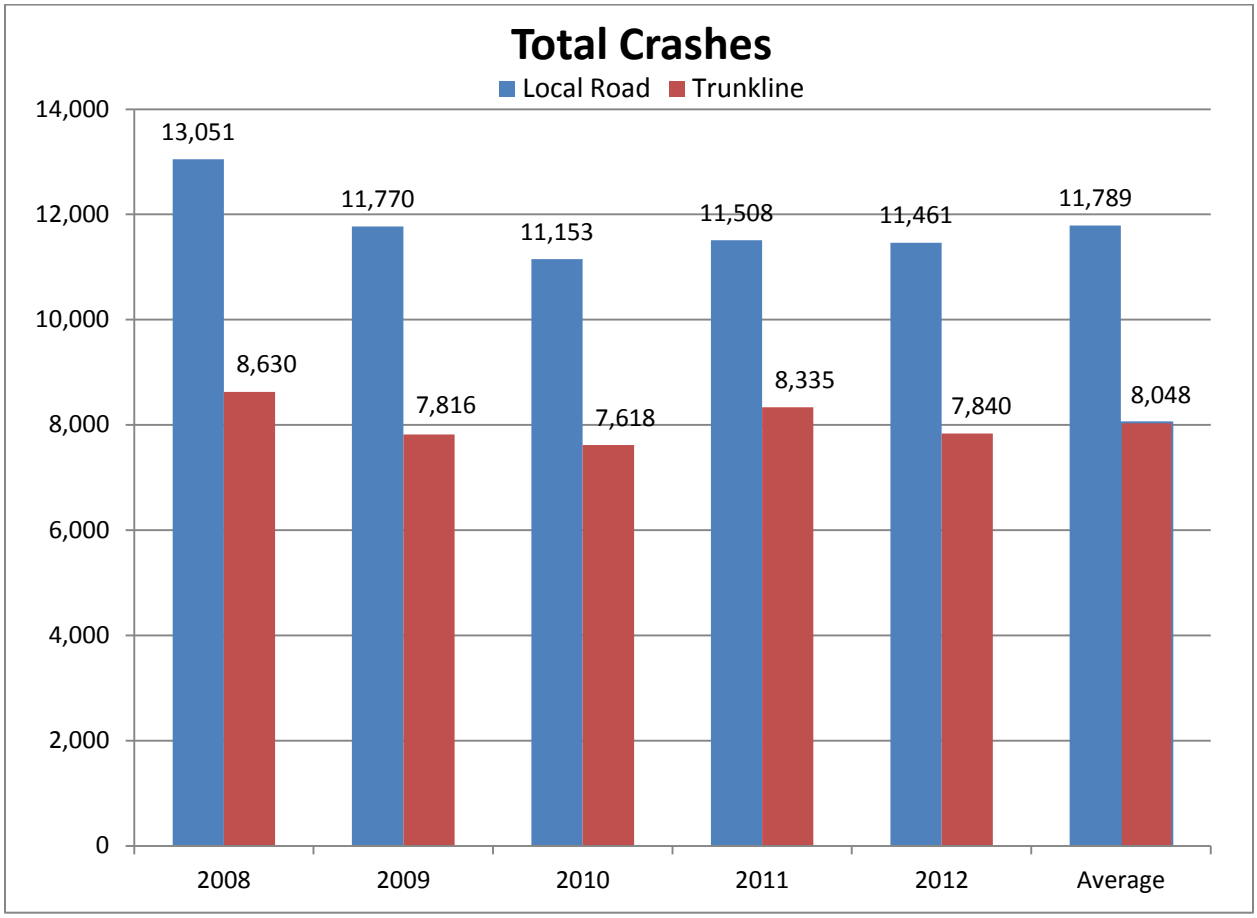
With these statistics in mind, GVMC has undertaken an effort to focus planning resources on traffic crashes in an effort to minimize the impact they have on the economy of the region as well as the loss of human life. This focused effort will ensure that safety planning is integrated into the GVMC overall transportation planning process.

The major difference between most safety plans and this process is that GVMC will identify locations where countermeasures can be implemented to help reduce the number of crashes. This analysis will be the basis for the use of federal funding for safety related improvements.

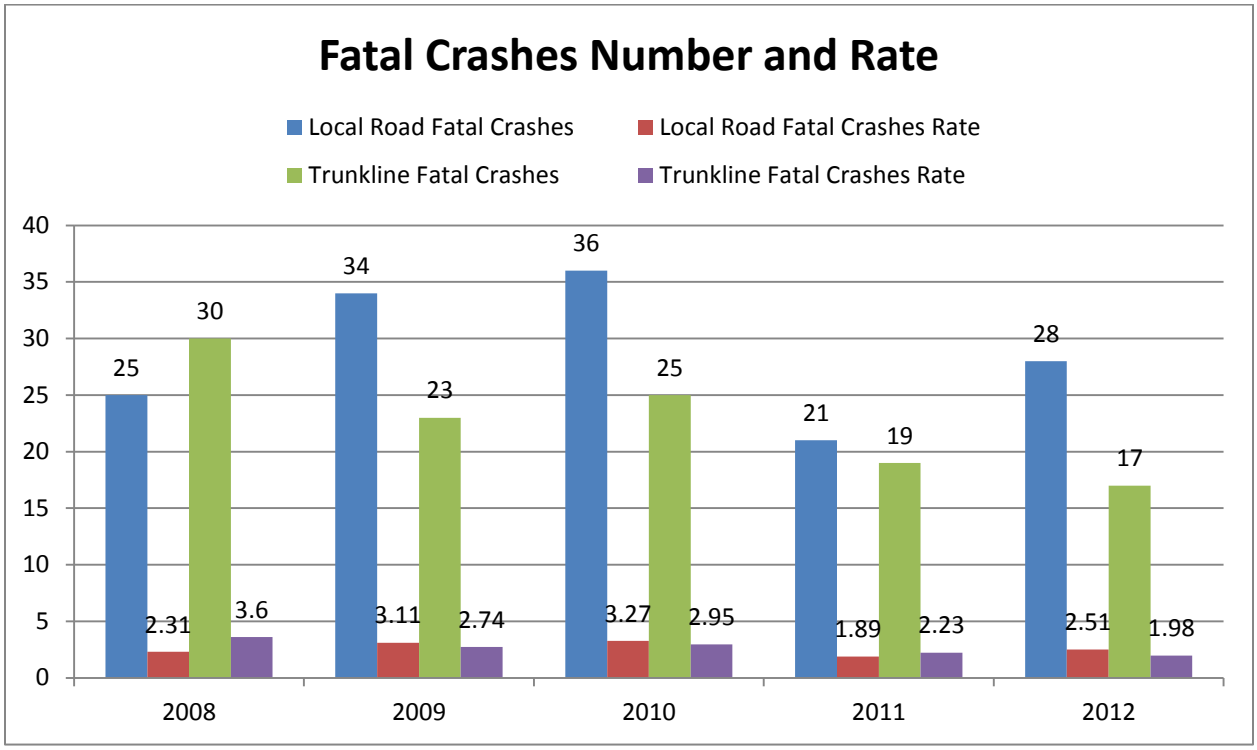
## Figure 1 GVMC Study Area Map



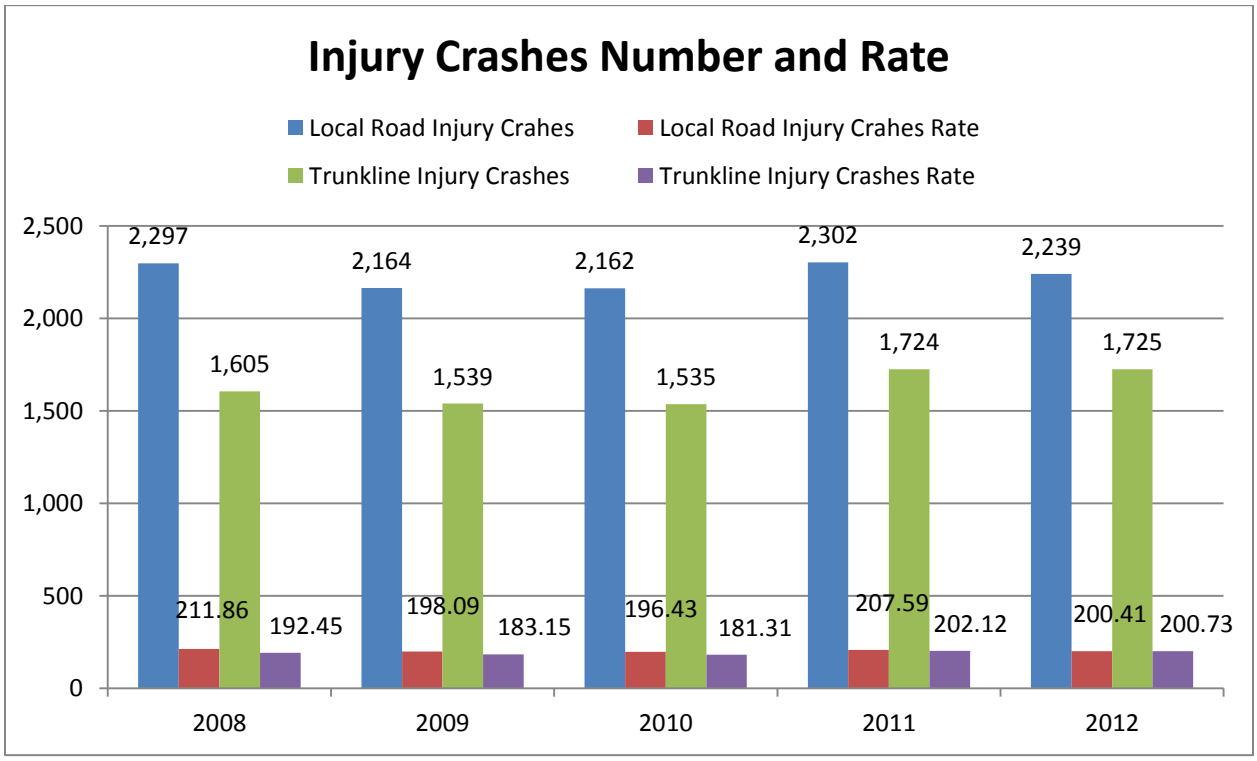
## Figure 2 Total Crashes 2008-2012



## Figure 3 Fatal Crashes and Fatal Crashes/MVMT 2008-2012




## Figure 4 Injury Crashes and Injury Crashes/MVMT 2008-2012



## 1.3 A VISION FOR THE FUTURE

To guide the development of the 2040 Long Range Transportation Plan, the GVMC Policy Committee adopted the following vision:

"*Establish a sustainable multimodal transportation system for the mobility and accessibility of people, goods, and services; it will provide an integrated system that is safe, environmentally sound, socially equitable, economically viable, and developed through cooperation and collaboration.*"

This recognition of the importance of safety and subsequent inclusion of safety in the overall planning process allows GVMC to meet requirements in the MAP-21 legislation. MAP-21 established safety as a core funded program and revised the regulations governing metropolitan and state transportation plans. The new planning rule requires MPOs to consider the State's Strategic Highway Safety Plan (SHSP) when developing their transportation plans.

## 1.4 Basic Elements

The GVMC Strategic Safety Planning Process is built upon 6 basic elements. For each emphasis area (including intersection safety, corridor safety, pedestrian and bikes, senior mobility and safety, Young driver, Alcohol-involved crash and car/deer conflicts.), these elements will be addressed. When complete the application of these elements will form the basis for an action plan. If implemented the action should be applied to address identified safety needs on the regional system. The elements include:

i. Local Policy/Objectives – The development of localized objectives that place focus on each element of the safety program. For example, the goals for intersection safety can be set up as following:

- Reduce total number of intersection crashes
- Reduce fatalities associated with intersection crashes

- Reduce fatality/MVMT(Million VMT) associated with intersection crashes
- Reduce incapacitating injury/MVMT associated with intersection crashes

ii. Data Collection – Provides information to support decisions for identifying the safety inventory, needs, and countermeasures, and monitoring the results of safety decisions (system performance).

iii. Data Analysis - Converts field data into usable information to assist decision makers in identifying safety needs and countermeasures, and monitoring the results of their decisions. Crash data are obtained from MTCF website and MTU Roadsoft program.

iv. Project Prioritization/Program Development – Includes final prioritizing of transportation safety needs, selecting cost effective solutions.

v. Program Implementation – Carries out funded projects resulting in safety enhancements and educational, enforcement, and emergency programs

vi. Performance Monitoring/Annual Report – Measures and analyzes results of transportation safety decisions, countermeasures, and programs; provides information from which "out year" efforts are forecasted and evaluated, and future work programs are developed. GVMC will produce an annual safety report that outlines progress made from safety planning efforts, the results of safety system work efforts, expenditures, and system performance.

Because this document contains multiple emphasis areas, steps 1-4 will be completed and detailed for each emphasis area. The two remaining elements (Implementation and Performance Monitoring will be summarized after all of the emphasis areas have been analyzed.

## 2. Emphasis Areas

The AASHTO Strategic Highway Safety Plan: A Comprehensive Plan to Substantially Reduce Vehicle-Related Fatalities and Injuries on the Nation's Highways, which was published in 2005, identified 22 safety emphasis areas on a national level. The emphasis areas include populations (e.g., older and younger drivers), crash types (e.g., head-on crashes, rear end crashes), infrastructure/hazards (e.g., intersections, tree and utility pole collisions), behavior (e.g., occupant protection, distracted driver), and modes (e.g., pedestrian, bicycle, motorcycle).

After reviewing regional traffic crash data, staff selected seven emphasis areas in GVMC MPO region, which included intersection safety, corridor safety, elderly driver safety, young driver safety, alcohol-involved and car-deer conflictions.

### 2.1 Intersection Safety

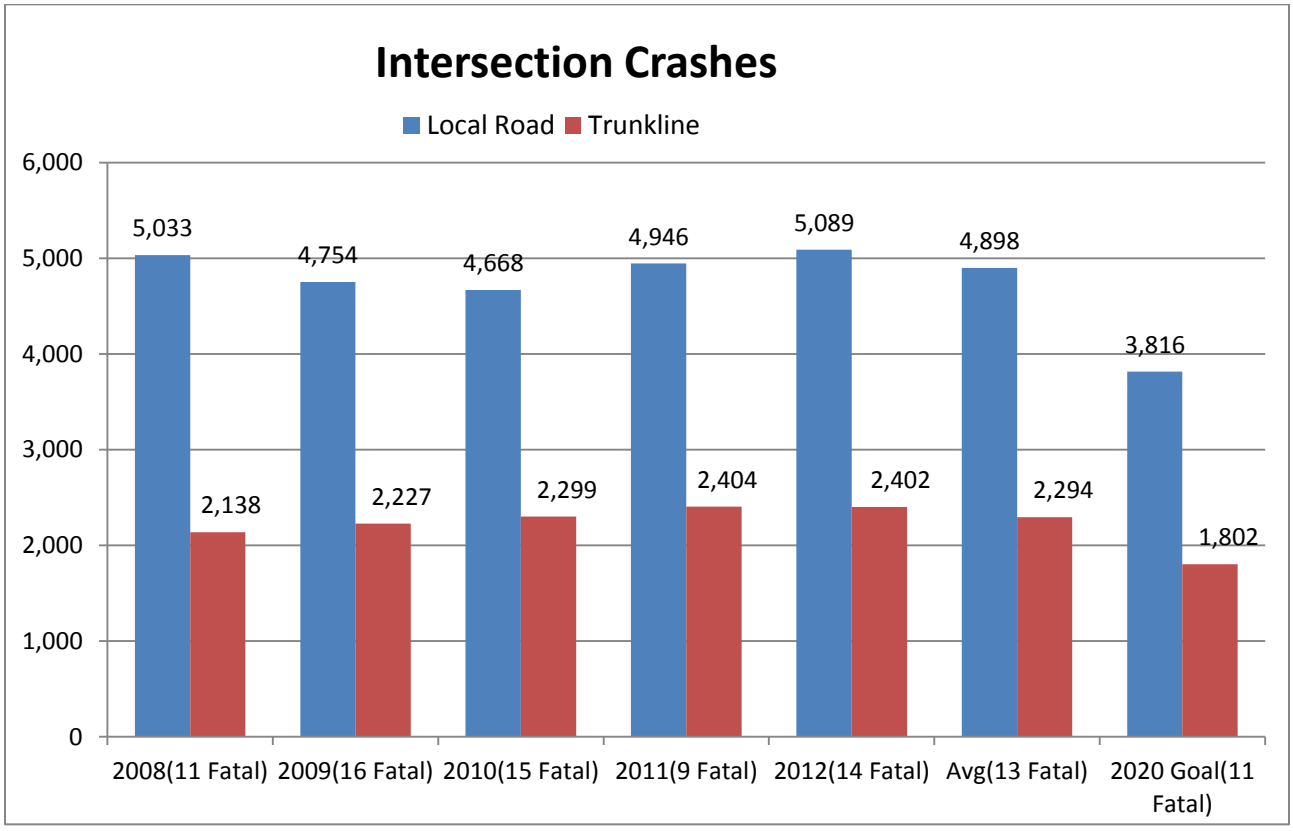
Intersections are the place in the transportation system where all roadway users – cars, trucks, buses, and vulnerable road users (pedestrians, bicyclists, motorcyclists) converge creating potential for conflict. Research indicates low-cost safety improvements such as improved sight distance, channelization, signage, and other infra-structure treatments can produce positive results.

While these infrastructure improvements can improve safety, it is often the behavior of the road user that can cause a crash, e.g., speeding, red light and stop sign running, failure to use a pedestrian crosswalk, etc. These crossing and turning movements at intersections create multiple opportunities for conflict.

In GVMC study region there were 5,618 intersection crashes in 2012 representing 38.81% of all the reported crashes. For the area defined as the MDOT Grand Region and statewide intersection crashes represented 33.10% and 29.71% of the total crashes reported, respectively, as shown in Figure 6. The GVMC region exceeded the ratio of crashes at intersections reported at the state and MDOT regional level.

These intersection crashes within the GVMC region resulted in 14 fatalities in 2012(31% of all roadway fatalities in the region) and 1,881 injuries (47% of all roadway injuries in the region). Nationally intersection crashes accounted for about 21 percent of all fatalities. Statewide and regional ratios for injuries in 2012 are 39.33% and 43.98%, respectively. Again GVMC region exceeded the national ratio for traffic fatality, and the statewide ratio for injuries.

**Figure 5 GVMC Intersection Crashes**



## Figure 6 Intersection Crashes Percentage

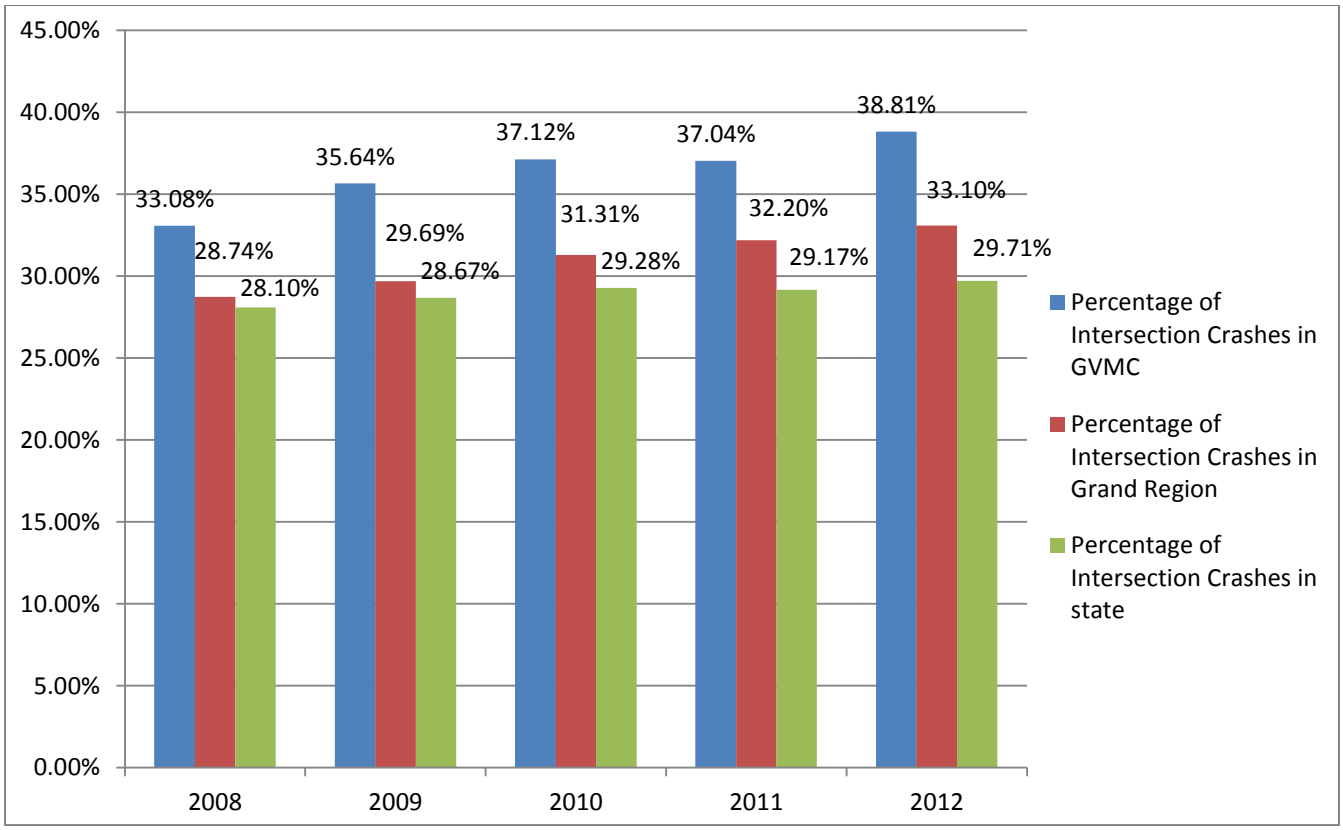
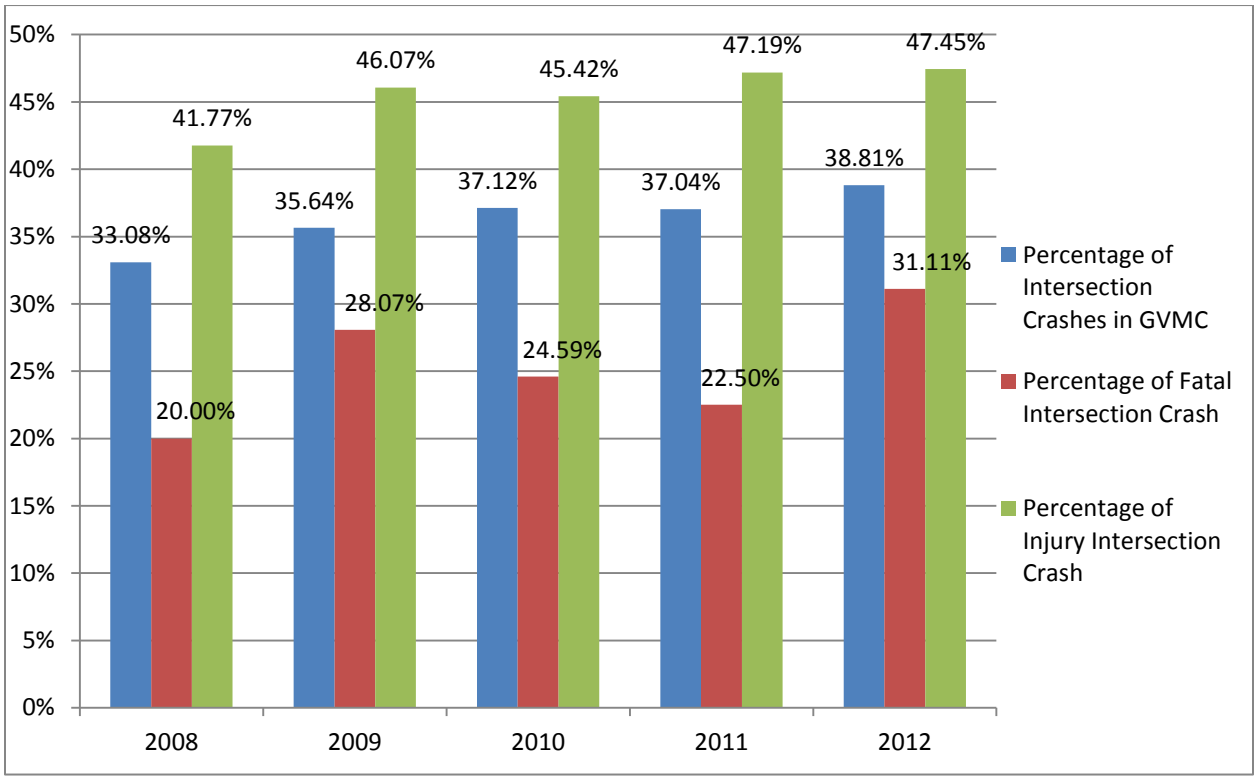


**Figure 7 Intersection Fatal and Injury Crashes Percentage**




**i. Policy/Objective** – The objective for the GVMC region is to outline a course of action that targets a reduction in the number and severity of intersection crashes in the region by 2020. The goals for this plan are as follows:

- Reduce total number intersection crashes
- Reduce fatalities associated with intersection crashes

<u>Benefit Analysis</u>

Theoretically, achieving a reduction of one fatality associated with intersection crashes each year in eight years should result in eight saved lives over those eight years. The National Safety Council estimates in 2012 that the calculable cost of each highway crash fatality was $4,538,000, Incapacitating Injuries $230,000, Non-incapacitating Injuries $58,700, Possible Injuries $28,000 and Property

Damage Only crashes $2,500. Eliminating just eight deaths and the associated reduction in injuries and property damage over eight years would save travelers in the region more than $40 million.

**ii. Data Collection** - Traffic crash data collection is performed statewide by law enforcement agencies at every level. This yearly compilation and analysis of statewide crash data is a valuable web tool for government agencies, researchers, and the general public. The data is provided by the Michigan Department of State Police from their Michigan Traffic Crash Forms (UD-10). Crash data for this report and the subsequent annual report will come from the "Michigan Traffic Crash Data Facts" website (http://www.michigantrafficcrashfacts.org/datatool/build).

Some analysis for specific locations will be completed using the "Roadsoft" program provided by The Center for Technology Training (CTT). The CTT provides and supports the Roadsoft program as a means to efficiently collect, manage and analyze data for public agencies. The CTT established in 1994 is part of the Michigan Tech Transportation Institute at Michigan Technological University.

The data collection step for each of the emphasis areas will be similar to the process noted above. For this reason, this step of the process will not be repeated for each element.

**iii. Data Analysis-** Data analysis for intersections is accomplished through the CTT Roadsoft program using the Safety Analysis routine, and MTCF website (www.michigantrafficcrashfacts.org).

A range of possible safety performance measures can be employed including total crashes, normalized accident rate performance measures (e.g., crashes per million vehicle miles of travel), unit costs and cost-effectiveness measures (e.g., dollars invested in countermeasure), alcohol and drug involved crashes (e.g., number of intoxicated young drivers) and some other measures (e.g., restraint usage rates).

GVMC staff reviewed two logical commonly used approaches when determining a preferred strategy. The first, crash rate, determines a ratio of crashes per million

entering vehicle(MEV). This can allow for comparison of locations region wide on an even field. The drawback for this approach is that crash rates on some facilities will decrease with increasing traffic volumes without safety interventions, thus making comparison across sites debatable, a lower crash rate could just reflect a location with greater traffic volumes.

The intersection crash rate is defined as a ratio of crashes per Million Entering Vehicles (MEV), as shown below,

$$Ri = (2 * C * 1{,}000{,}000)/( V * Y * T)$$

C = Number of crashes at the intersection node location, during the three-year time period

V = Two way AADT (of all approaches)

Y = Years (3-year period)

T = Time, expressed in the number of days in the study period (365)

The second approach is to use the raw crash frequencies. This is simply the total crashes experienced at a location. This approach is not without its drawbacks as crash frequencies by themselves lack an accounting of exposure at a site to the level of risk associated with the amount of traffic present. A poll of GVMC member units did not reveal a preference to any single indicator.

For this initial planning effort, the analysis will be based on total crash frequencies. The rationale for this approach lies in the idea that the locations with the greatest identified problem will benefit the greatest from countermeasures. In time, GVMC may employ an analysis process that incorporates VMT as it may be prudent to examine both crash rates and frequencies. This approach is widely practiced, and rests upon the logic that examining a problem from multiple ‘angles’ will lead to greater problem insight.

The GVMC region contains in excess of 600 signalized intersections. Advanced computer and software systems allow for basic analysis of a broad set of data

related to accidents at signalized intersections. However, there are not sufficient resources or need to analyze each of the 600 locations in great detail.

For intersections, GVMC will employ a ranking process similar to the one used by MDOT. Region wide crash data for the years 2010-2012 were used. A database containing crashes located within 158 feet (0.03 miles) of an intersection was created. The score for an intersection was determined as follows:

The total number of fatal and injury crashes at an intersection was established. Every intersection region-wide with at least two reported fatal or injury crashes was included in the analysis. It was felt that locations with less than 1 monthly crash were truly random and were excluded from the analysis. Locations were ranked, in descending order (the most severe ranked 1), by the total number of fatal and injury crashes at the location.

To establish a measure for "loss" the number of fatalities and/or injuries were used. A straight weighting scheme was used where an assigned dollar value for loss for fatalities and a value for injuries was used (2011 values from the National Safety Council). The number of fatalities was in turn multiplied by that dollar loss and the number of injuries by its respective loss value. The two computed values were added. The value for the variable loss was then ranked with the greatest loss being ranked 1.

A score was assigned to each location and was equal to the sum of the rank for frequency plus the rank for loss. The lower the value of score the "more severe" the location.

The last step is to determine a trend for crashes at intersections. Many intersections over the years will be improved through the implementation of various low cost countermeasures. While the impact of these countermeasures may not be readily apparent to the traveling public, they quite often will improve safety at intersections. These safety measures combined with other factors like increased driver familiarity with intersection geometry and technology will improve safety conditions over time. Conversely, some changes will adversely impact safety at certain intersections. Construction detours, new freeways, and

other factors often lead to increased crash totals due to the increase of vehicles. To mitigate these factors, a last analysis is done to identify intersections where the safety trend is worsening. It is the intersections identified as having worsening trends that should receive further attention through study and the programming of federal funding.

The annual loss attributed to the 92 signalized intersections with worsening crash trends is in excess of $56 million. While some of this can be attributed to factors that cannot be designed for, these 92 intersections should receive priority for designated federal funding through the MPO process. In many cases low cost countermeasures can be applied to reduce the cost of crashes at these locations in the coming years.

The Michigan Department of Transportation Safety Programs Unit has developed a widely used spreadsheet that depicts benefits that can be expected through the implementation of a variety of improvements. This list of countermeasures and expected benefits can be found in **Appendix A**. GVMC will rely on the MDOT benefits sheet to determine the benefit/ cost structure outlined later in this document.

**iv. Project Prioritization/Program Development** – **Appendix B** contains the list of signalized intersections with more than 1 reported crash per month.

**Appendix C** contains the list of 92 signalized intersections with rising crash trends.

Based on the list as well as countermeasures from other resources, such as researches and MPOs in the country, strategies for improving intersection traffic safety in GVMC area are listed as follows,

. Prioritize top crash intersections for potential safety improvements.

. Conduct Road Safety improvements at the most hazardous intersections after prioritization

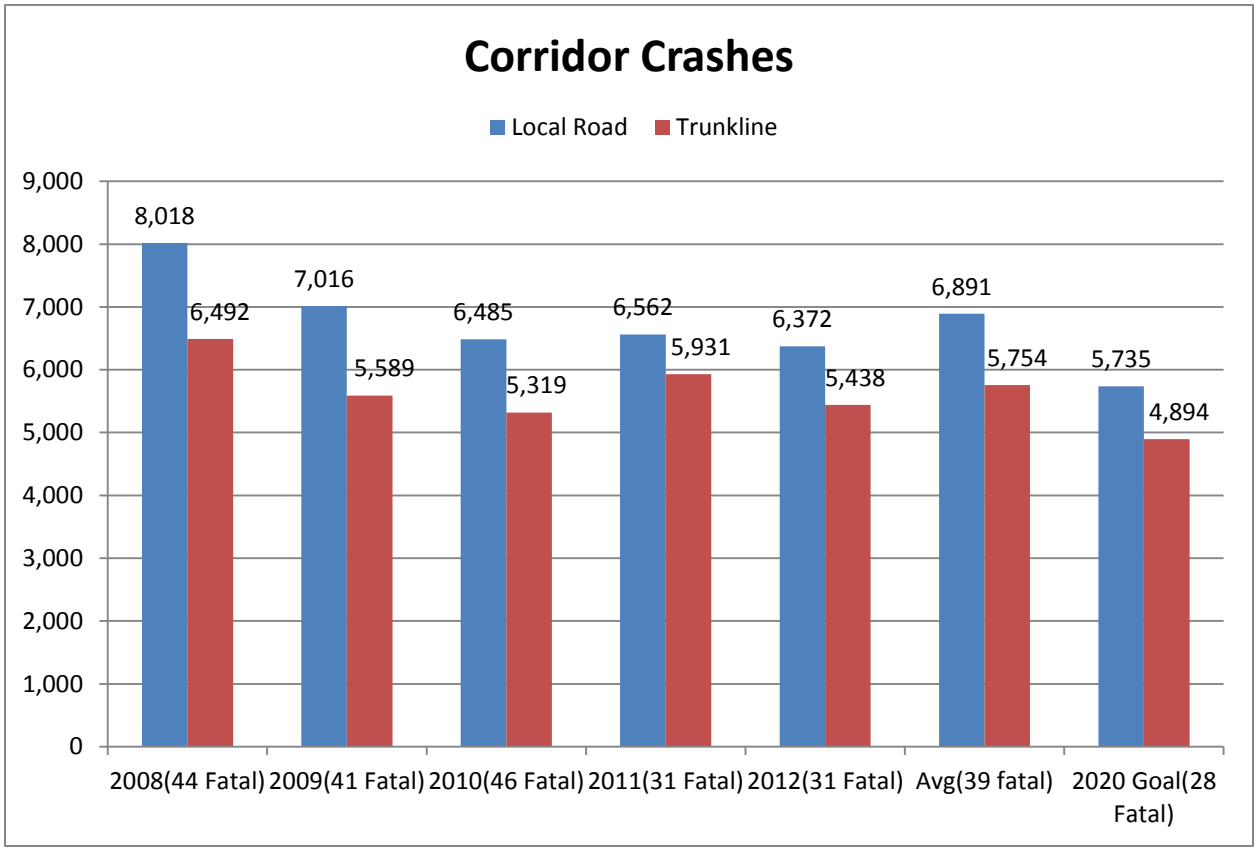
. Conduct before-after studies when countermeasures are made.

. Install automated enforcement at hazardous intersections

## 2.2 Corridor Safety

There was 11,810 corridor crashes in 2012 in the GVMC region (Figure 8), resulting in 34 fatalities and 2,083 injuries. The GVMC region rate for corridor crashes (62%) is lower than the statewide (70%) and MDOT grand region ratios (67%) for crashes within corridors.

**Figure 8 GVMC Corridor Crashes**




**i. Policy/Objective** – The objective for the GVMC region is to outline a course of action that targets a reduction in the number and severity of intersection crashes in the region by 2020. The goals for this plan are as follows:

- Reduce total corridor crashes
- Reduce fatalities associated with corridor crashes
- Reduce fatality/MVMT(Million VMT) associated with corridor crashes
- Reduce incapacitating injury/MVMT associated with corridor crashes

Benefit Analysis

Theoretically, achieving a reduction of three fatalities associated with corridor crashes each year in eight years should result in 24 saved lives over those eight years. The National Safety Council estimates in 2012 that the calculable cost of each highway crash fatality was $4,538,000, Incapacitating Injuries $230,000, Non-incapacitating Injuries $58,700, Possible Injuries $28,000 and Property Damage Only crashes $2,500. Eliminating just 24 deaths and the associated reduction in injuries and property damage over eight years would save travelers in the region more than $100 million.

**ii. Data Collection** - The data collection step for each of the emphasis areas is similar to the process for intersection crashes. For this reason, this step of the process will not be repeated for each element.

**iii. Data Analysis**- Data analysis for corridors is also accomplished through the CTT Roadsoft program using the Safety Analysis routine. The first task in analyzing corridor crashes is determining which locations warrant further, more detailed analysis through the use of identified performance measures.

As was the case with intersections, a range of possible safety performance measures can be employed including crash count-related performance measures (e.g., fatal crashes), normalized accident rate performance measures (e.g., fatal crashes per million vehicle miles of travel), unit costs and cost-effectiveness measures (e.g., dollars invested in countermeasure), alcohol and drug involved crashes (e.g., number of intoxicated young drivers) and some other measures (e.g., restraint usage rates).

GVMC staff reviewed two logical commonly used approaches when determining a preferred strategy. The first, crash rate, determines a ratio of crashes per million vehicle miles traveled. This can allow for comparison of locations region wide on an even field. The drawback for this approach is that crash rates on some facilities will decrease with increasing traffic volumes without safety interventions, thus making comparison across sites problematic, a lower crash rate could just reflect a location with greater traffic volumes.

The segment crash rate is defined as a ratio of crashes per Million Vehicle Miles Traveled(VMT), as shown below,

$$Rs = (C * 1{,}000{,}000)/( V * Y * T*L)$$

C = Number of crashes at the location, during the three-year time period

V = Segment AADT

Y = Years (3-year period)

T = Time, expressed in the number of days in the study period (365)

L = Length of segment (in miles)

The second approach is to use the raw crash frequencies. This is simply the total crashes experienced at a location. This approach is not without its drawbacks as crash frequencies by themselves lack an accounting of exposure at a site to the level of risk associated with the amount of traffic present.

GVMC staff chose to use the crash rate approach as the data for this effort is readily available and generally traffic volume does not have a significant impact on traffic flow along most corridors in the region.

The GVMC region contains in excess of 5,000 miles of public streets and highways. Within these 5,000 miles there are nearly 1,600 miles designated as “federal aid eligible”. Between 2010 and 2012 there were 57,915 reported traffic crashes in the GVMC study region. Of these, nearly 80% were on the federal aid road network. While the federal aid network represents approximately 32% of the total road mileage in the region it carries nearly 90% of the total miles traveled. It stands to reason that a high percentage of the crashes occur on the federal aid system. For this reason and the fact that the MPO is required to limit planning efforts to the federal aid network, corridor crash analysis will be limited to the federal aid system.

With advanced computer and software systems at its disposal GVMC staff was able to conduct basic analysis of a broad set of data related to crashes within the

federal aid corridors. However, there are not sufficient resources or need to analyze each of the 1,600 miles in great detail.

**Appendix D** contains a complete list of each federal aid segment in the GVMC study area. This list is ordered by 3 year crash number from 2010-2012.

For the purposes of this planning effort, GVMC has identified 5 primary types of accidents that occur in greater numbers in the region as focal points for narrowing the list of 1,600 centerline miles down to a list that can be further analyzed. These accident types are: rear end, angle, fixed object, sideswipe,and bike/pedestrian.

For corridors, GVMC employed a ranking process similar to the one used in intersection analysis. Region wide crash data for the years 2010-2012 were used. A database was be created containing crashes located outside the 158 foot (0.03 miles) buffer considered to be the area of influence of each segment. Individual corridor segments were created based on logical segmentation. This logical segmentation follows the same methodology used for the GVMC congestion management and condition analyses. Logical segmentation allows for programming and implementation by segmenting the network into segments that can be reasonably improved over time.

It is also helpful to carry out this analysis to reveal any anomalies that may exist from unusual changes in traffic patterns that were the result of construction detours or other temporary conditions that changed the normal expected conditions for a designated corridor. GVMC tracks road closures and compares these closures/detours. Every effort is made to determine and note where possible when these anomalies occur.

The annual loss attributed to the road segments on the federal aid system is in excess of $400 million. In many cases low cost countermeasures can be applied to reduce the cost of crashes at these locations in the coming years.

The Michigan Department of Transportation Safety Programs Unit has developed a widely used spreadsheet that depicts benefits that can be expected through the implementation of a variety of improvements. This list of countermeasures and

expected benefits can be found in **Appendix A**. GVMC will rely on the MDOT benefits sheet to determine the benefit/cost structure outlined later in this document.

**iv. Project Prioritization/Program Development** – Implementation of improvements for "troubled" corridors requires that the analysis completed, reveal candidate segments for improvement. To narrow the list of possible candidate segments, GVMC determined a recommended minimum threshold for corridors to meet to be considered a project that merits the expenditure of federal funding.

Based on current trends in the region, the predominant segment crash type is rear end crashes. According to the Michigan Department of Transportation Safety Programs Unit, rear end crashes can be reduced by up to 80% with the installation of a center turn lane. Most other accident types that occur in the region, fixed object, sideswipe and head on, typically have causes not based in roadway geometry. For this reason further analysis will focus on rear end crashes.

To identify segments where the introduction of a center turn has the potential for the reduction of rear end crashes GVMC selected crashes that occurred between 2010 and 2012 that were rear end crashes. The crashes were located along their respective corridors.

Ideally this would be the end of the segment crash analysis process and center turn lanes would be constructed on every corridor. However, financial and other constraints require an economic review to determine which segments would experience an overall economic benefit from an investment in a new center turn lane.

Other safety improvements (removal of fixed objects, access point reductions, and sidewalk construction are typically designed into projects as road improvements are made. These "design" improvements address many of the corridor safety factors mentioned earlier. Center turn lanes however, which can reduce rear end accidents by as much as 80%, tend to be costly to implement and require more funding and design effort.

The addition of a center turn lane to all facilities would be an approach that could lead to improved corridor safety, however this is not a luxury that is financially, environmentally, or socially viable. Adding a center turn lane can increase the cost of maintaining a facility between 20% and 33% annually, not to mention the cost (nearly $900,000 per mile) of the initial construction. In some cases these costs can be justified in the improved safety and flow of traffic along a segment. Many times this cost is not justified. With tightening budgets, stagnant funding levels and increasing construction costs being experienced by each of the GVMC member communities, a set of thresholds was created to guide the implementation of center turn lanes on federal aid facilities using federal funding. These thresholds can be used as a guide for programming road improvements.

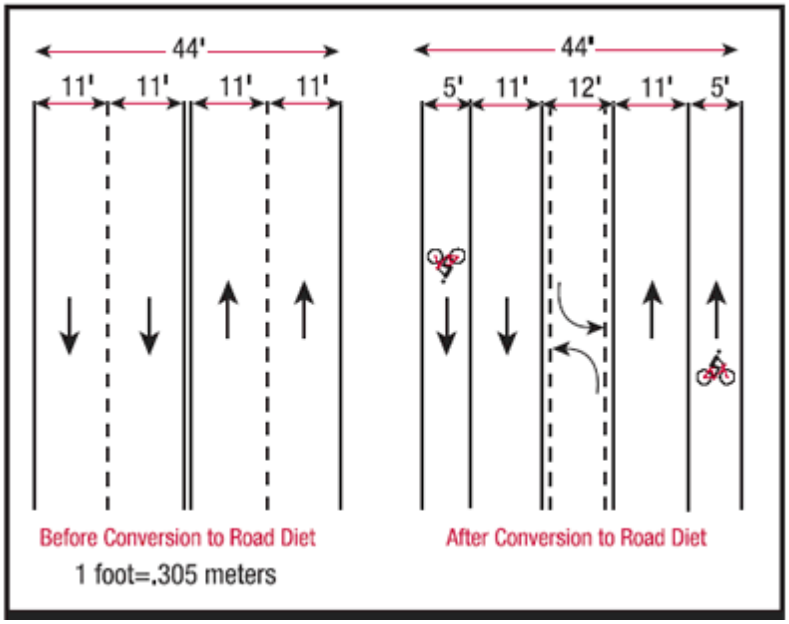
The recommended threshold for the addition of a center turn is based on the rate of return on investment. A new asphalt pavement can be expected to last between 7 and 20 years provided that the facility is properly maintained. GVMC typically experiences a 12 year lifecycle for new reconstruction on asphalt roads. 12 years will be the period used for this cost benefit analysis.

For this analysis the return on investment is based on an initial construction cost of $900,000. Additional maintenance costs of $42,000 (2 crack filling treatments and 1 light overlay) for the additional lane are added to the calculation. The theoretical cost of $942,000 is determined to be the base "cost" of the additional center turn lane. For the addition of the center turn lane to be justified, the expected benefits of that additional lane should exceed $942,000 ($78,500 annually) over a 12 year period.

**Appendix E** contains the results of the analysis completed for rear end segment crashes and outlines segments that would be good candidates for center turn lane implementation. It should be noted that many of the segments listed in Appendix D currently have sufficient pavement width to accommodate a center turn lane without the additional expense of widening. Consideration should be given to these segments when overlay projects are undertaken.

There is a growing trend in recent years to convert 4 lane facilities with less than 20,000 ADT down to a 3 lane configuration. The term "road diet" has been coined

for the process of this roadway conversion. In many cases 4 lanes have excess capacity and are not “community friendly”. Road Diets are often conversions of four lane undivided roads into three lanes (two through lanes and a center turn lane), as shown below. The fourth lane may be converted to bicycle lanes, sidewalks, and/or on-street parking. In other words, existing space is reallocated; the overall area remains the same.




A recent study completed by the Federal Highway Administration revealed that crash rates can be reduced by as much as 6% when a road diet is implemented. It should be noted that in this study crash severity was not impacted. More information on this report can be found at:

http://www.tfhrc.gov/safety/hsis/pubs/04082/index.htm

**Appendix F** lists segments in the region that may be candidates for this type of treatment. Each road segment has unique circumstances that may or may not lend themselves to allowing for a treatment of this kind.

## 2.3 Senior Mobility and Safety

In the GVMC area today there are approximately 715,000 people. Of those, approximately 13% or 93,000 are over the age of 65. Based on currently available data 90% of elderly residents use a passenger vehicle as their primary source of transportation with 70% doing the driving themselves. According to the Michigan Secretary of State there are nearly 70,000 licensed drivers in the GVMC area over the age of 65. This represents nearly 15% of the total number of licensed drivers. By 2030, the elderly population in the GVMC area is expected to nearly double to 177,500 and make up more than 20% of the population.

Crash data shows that the percentage of traffic crash involving senior drivers accounted for about 11 percent from 2009 to 2012, while fatal crashes percentage for senior drivers reduced from 26 percent in 2009 to 8.9 percent in 2012.

**Figure 9 Elderly Driver Crashes**

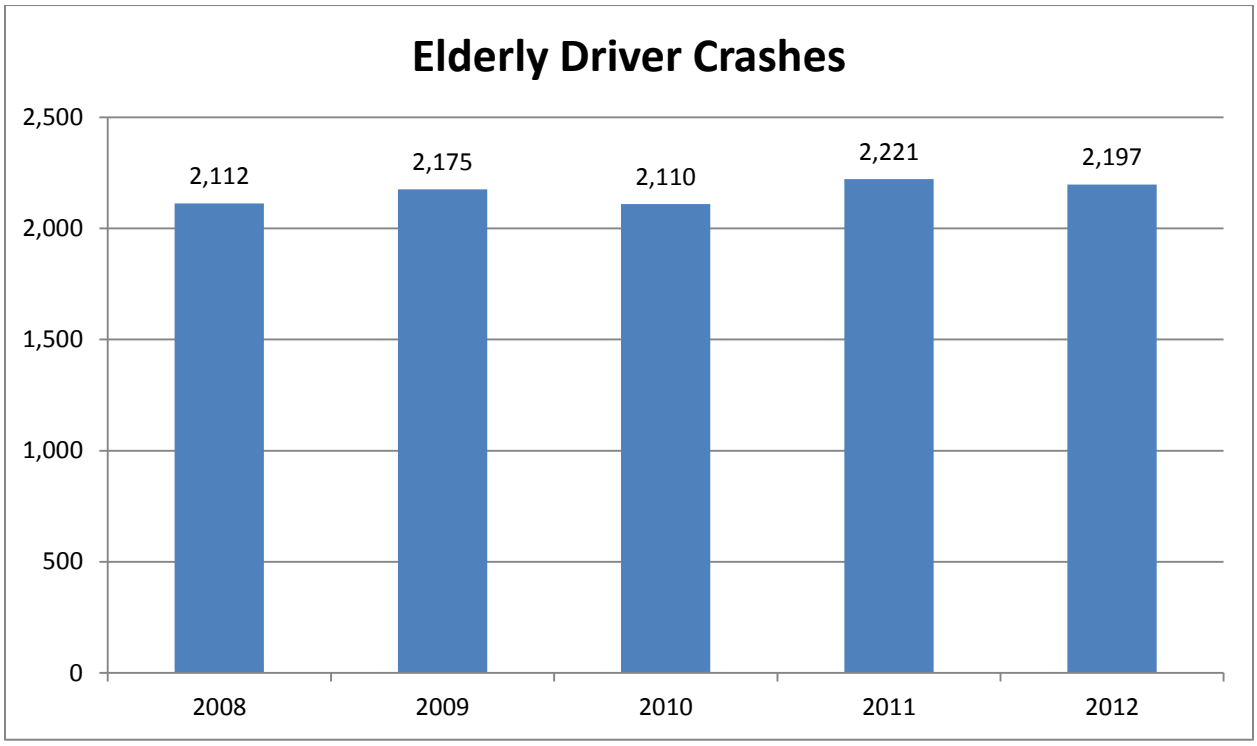
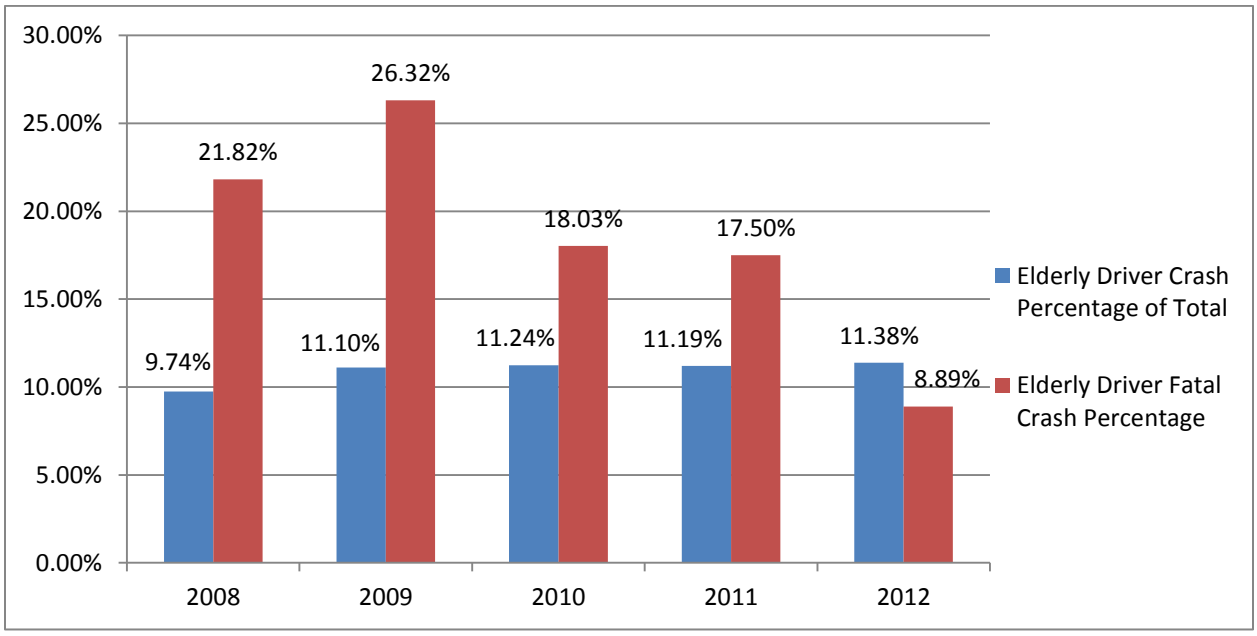



**Figure 10 Elderly Driver Fatal Crash Percentage**



**i. Policy/Objective** – The objective for the GVMC region is to outline a course of action that targets a reduction in the number and severity of crashes involving elderly drivers in the region by 2020. The goals for this plan are as follows:

- Reduce total crashes by elderly drivers
- Reduce fatalities associated with elderly drivers crashes

**ii. Corrective Actions** - Roadway design can play a key role in enhancing safe driving for the elderly. Much of the existing road system was designed and built with standards that did not take into account the needs of an aging population. While retrofitting the entire highway system to accommodate elderly drivers is ideal, financial realities dictate that other approaches are warranted.

A report entitled Guidance for Implementation of the AASHTO Strategic Highway Safety Plan compiled promising strategies to improve the roadway/driving environment to better accommodate the special needs of older drivers.

These include:

• Provide advance warning signs to inform drivers of existing or potentially hazardous conditions on or adjacent to the road.

• Provide advance guide signs and street name signs to give older drivers additional time to make necessary lane changes and route selection decisions, and reduce or avoid excessive or sudden braking behavior.

• Increase size and letter height of roadway signs to better accommodate reduced visual acuity of older drivers.

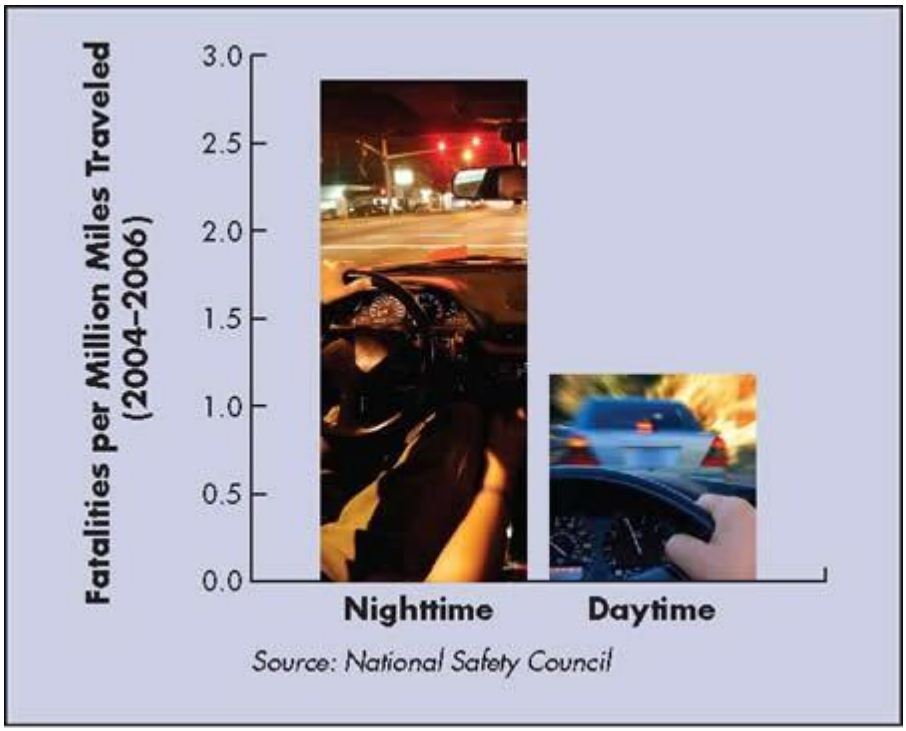
• Provide longer clearance intervals at signalized intersections to accommodate slower perception reaction times of older drivers.

• Provide more protected left turn signal phases at high-volume intersections to avoid difficulties older drivers have with determining acceptable gaps.

• Improve lighting at intersections, horizontal curves, and railroad grade crossings to help older drivers compensate for reduced visual acuity

• Improve roadway delineation so older drivers have better visual cues to recognize pavement markings.

• Improve traffic control at work zones to improve driver expectancy by providing adequate notice to drivers describing the condition ahead, the location, and the required response.




While only one-quarter of all travel occurs at night, about half of the traffic fatalities occur during nighttime hours. To address this disparity, the Federal Highway Administration has adopted new traffic sign retroreflectivity requirements. Published on Dec. 21, 2007 and effective Jan. 22, 2008, this final rule supplements the Manual on Uniform Traffic Control Devices (MUTCD) requirements for maintenance of sign retroreflectivity. The rule provides additional requirements, guidance, and clarification. The new rule encourages flexibility to allow agencies to choose a maintenance method that best fits their specific conditions.

Federal STP funding can be used for sign replacement to meet the new standards. GVMC does not restrict the use of federal funding for sign replacement.

## 2.4 Young Drivers Safety

It is widely known that young drivers lack basic driving experience and are more likely to engage in risky and aggressive driving behaviors (such as speeding and tailgating), they are also more likely to have more passengers in their vehicles. Therefore, young drives are much more likely than other groups to be involved in violent traffic crashes. In GVMC region, Young drivers under age 24 are involved in 39% of all traffic crashes and 49% of fatal crashes in 2012, as well as 41% of all injury crashes. In addition, alcohol was a factor for 10 out of 22 fatal crashes involving young drivers in 2012, and one-half of fatal crashes occurred in the early morning hours between midnight and 6:00 a.m.

Michigan has implemented the "Graduated Driver Licensing" program, which is stated as follows (Michigan Department of State,http://www.michigan.gov/sos/0,4670,7-127-1627_60169_60175---,00.html):

*Graduated Driver Licensing (GDL) is a driver licensing system designed to teach teens to drive by gradually increasing their driving privileges as they advance through the system. GDL consists of two segments of driver education instruction and three licensing levels.*

*The three licensing levels in GDL are: a supervised learner's license (Level 1 License), an intermediate license that limits passengers and unsupervised nighttime driving (Level 2 License), and a full-privilege driver's license (Level 3 License) issued after a teen driver has successfully completed all previous instruction and driving requirements.*

*GDL license levels 1 and 2 have certain restrictions to limit teens' driving exposure to high-risk situations and help protect them while they are learning to drive.*

The GDL program can help young drivers to reduce many at-risk situations and allows then to more comfortably progress through a series of licensing levels.

**Figure 11 Young Driver Crashes**

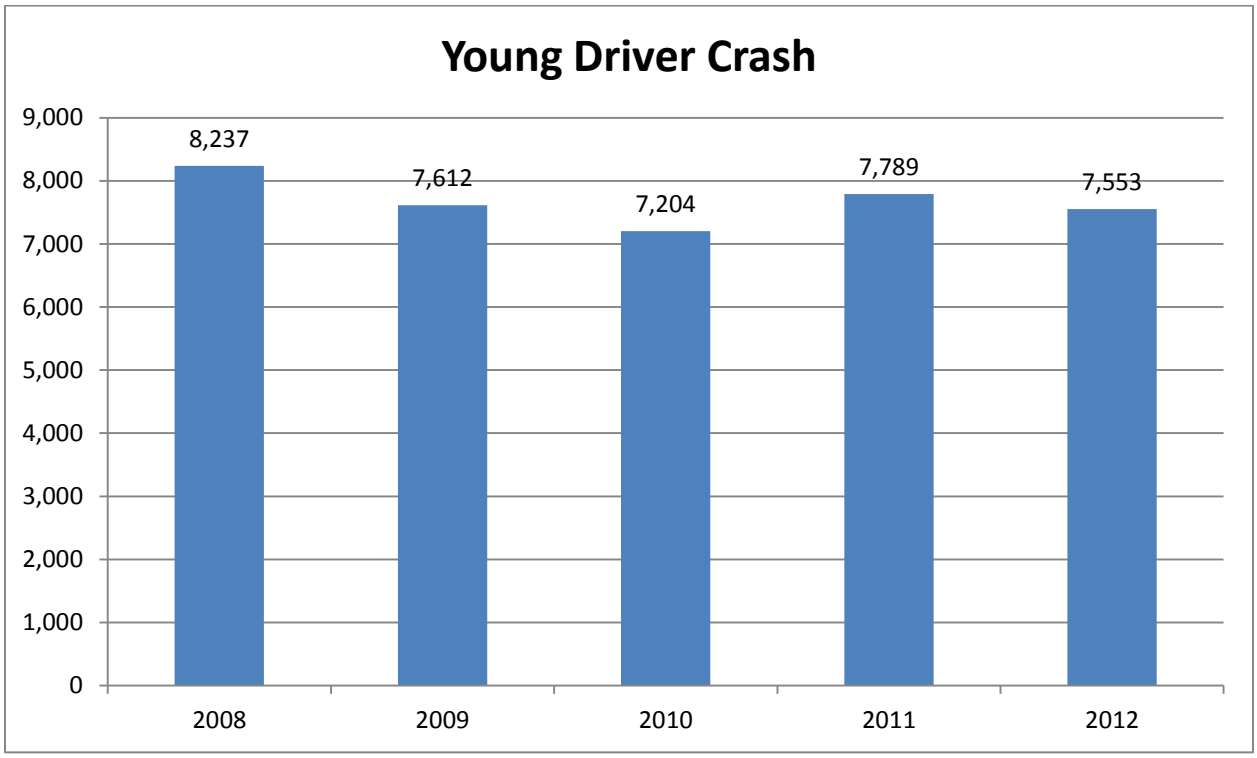
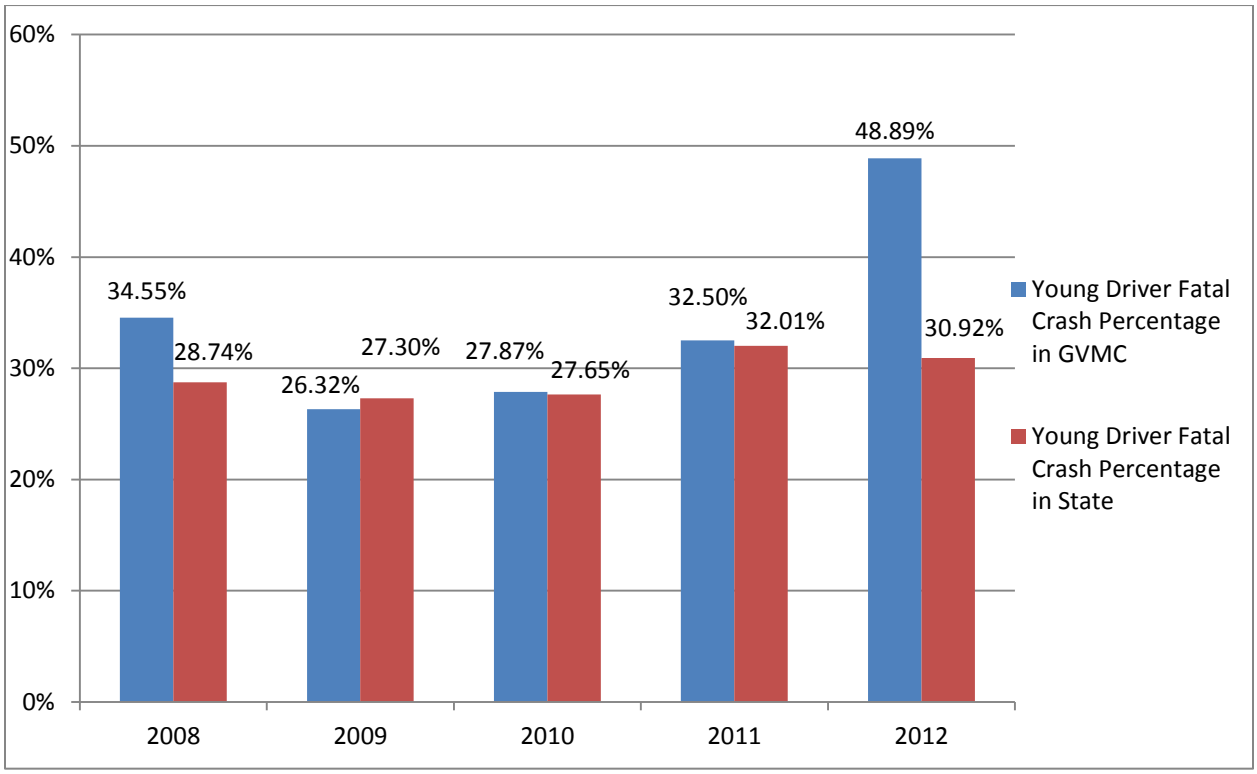


**Figure 12 Young Driver Fatal Crash Percentage**




**i. Policy/Objective** – The objective for the GVMC region is to outline a course of action that targets a reduction in the number of crashes involving young drivers in the region by 2020. The goals for this plan are as follows:

- Reduce total young driver crashes
- Reduce fatalities associated with young drivers

**ii. Strategies**

Strategies that can be used to reduce young driver crashes and fatalities are shown as follows,

- Enhance current Graduated Drivers Licensing Program
- Improve training program for young drivers
- Improve parent education in managing teens' driving
- Employ school-based education and incentive programs

## 2.5 Pedestrian/Bicyclist Safety

Nearly every trip begins and ends with walking. With this in mind GVMC is placing a renewed emphasis on providing support to local communities with a focus on non-motorized transportation safety.

On average there is nearly one crash per day that involves a motor vehicle and bike or pedestrian in the GVMC study area. (see Figure 13 and Figure 14). Pedestrians and bicyclists are most at-risk road users, and are more vulnerable to significant injuries since they lack the protection from the steel and airbags in a vehicle when involved in traffic crashes. Data in Figure 14 showed that while in GVMC area traffic crashes involving pedestrian and bicyclist only accounted for about 2 percent of total traffic crashes in 2012, more than 9 percent of fatal crashes in 2012 were vehicle-pedestrian/Bicycle crashes.

**Figure 13 GVMC Bicycle/Pedestrian Crashes**

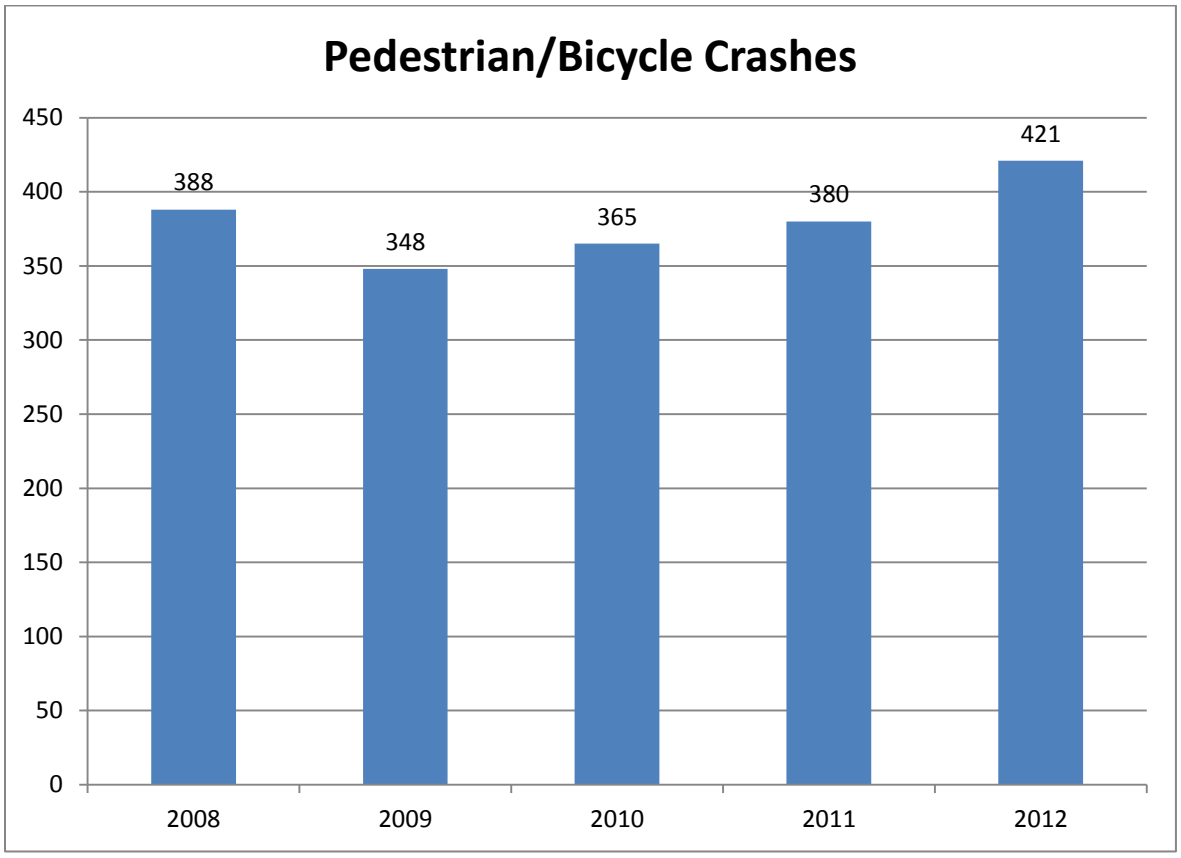


**Figure 14 GVMC Bicycle/Pedestrian Fatal Crashes**

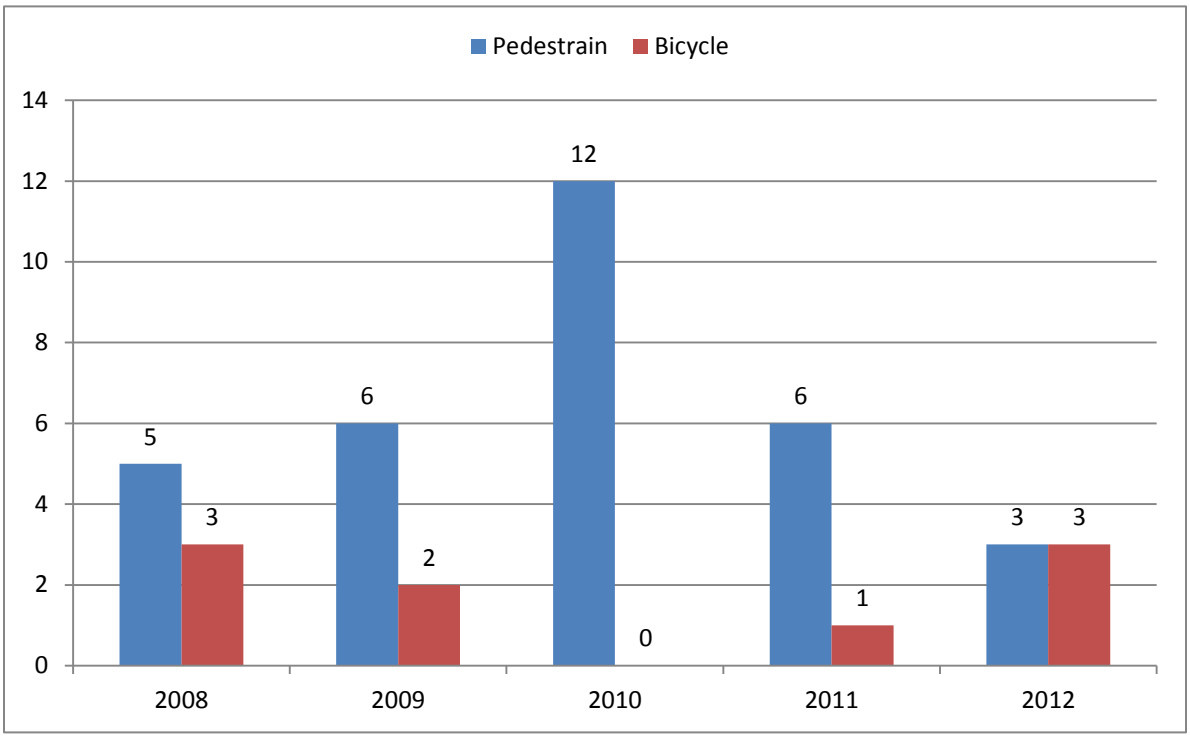
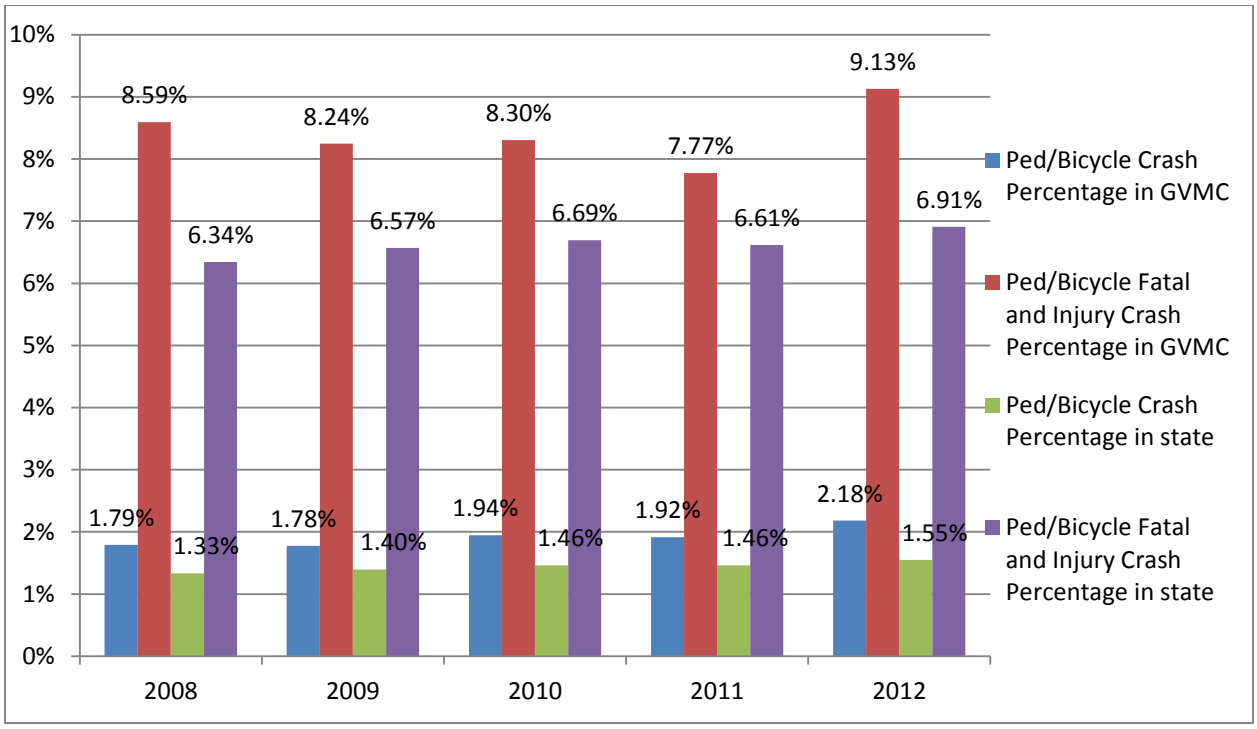


**Figure 15 GVMC Pedestrian/Bicycle Fatal and Injury Crash Percentage**




Although it is often lumped into the same "non-motorized" category bicycle and pedestrian safety requires analysis by specific mode as the causes and often the fault for crashes vary greatly between bikes and pedestrians.

The latest available data (2012) for the GVMC area shows that of the 210 reported bicycle/motor vehicle crashes 60% were the fault of the bicycle operator. The primary causes for crashes where bicycle operators were at fault was excessive speed and ignoring traffic control devices. The primary cause for crashes where vehicles were at fault was failing to yield when entering the roadway either at driveways or side streets. Many cited not seeing the bicyclist.

Pedestrian/motor vehicle crashes reported in 2012 (211 total) revealed a different story in terms of definable fault. More than 60% of the reported crashes were determined to be the fault of the motor vehicle operator, while less than 40% were crashes where the pedestrian was determined to be at fault. The primary area for the causes of these crashes seemed to be when a motor vehicle was making a legal right turn on red. Of the primary causes for crashes where the

pedestrian was at fault the primary cause was not using a cross walk or cutting between cars.

While this document focuses on improvements that can be made to the transportation system to improve safety, analysis in this area seems to lead to the need for more education in terms of the possible interactions between motor vehicles and the non-motorized traveler. Better awareness by the traveling public of the other modes may lead to reducing the crash rates.

This is not to say that geometric upgrades in existing and future roadways that are designed to improve safety for non-motorized travelers will not be beneficial, but increased education would also appear to have an impact as well.

**i. Policy/Objective** – The objective for the GVMC region is to outline a course of action that targets a reduction in the number of crashes involving pedestrian and bicyclists in the region by 2020. The goals for this plan are as follows:

- Reduce total pedestrian/bicycle crashes
- Reduce fatalities associated with pedestrian and bicycle crashes

**ii. Strategies**

Strategies that can be used to reach the goals listed above are shown as follows,

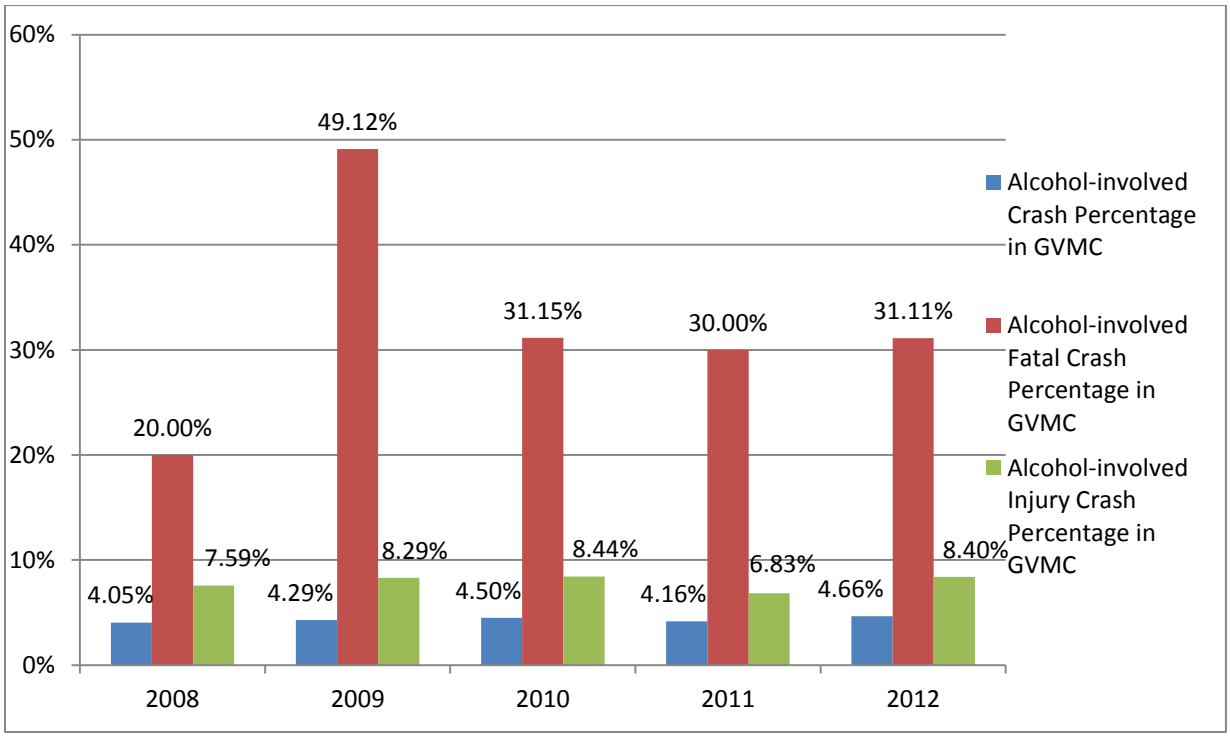
- Reduce pedestrian/bicycle exposure to vehicular traffic
- Improve pedestrian, bicyclist, and motorist safety awareness and behavior
- Construct more sidewalks and bikeways
- Allocate more funding to non-motorized sidewalks and bike routes

## 2.6 Alcohol-Involved Crashes

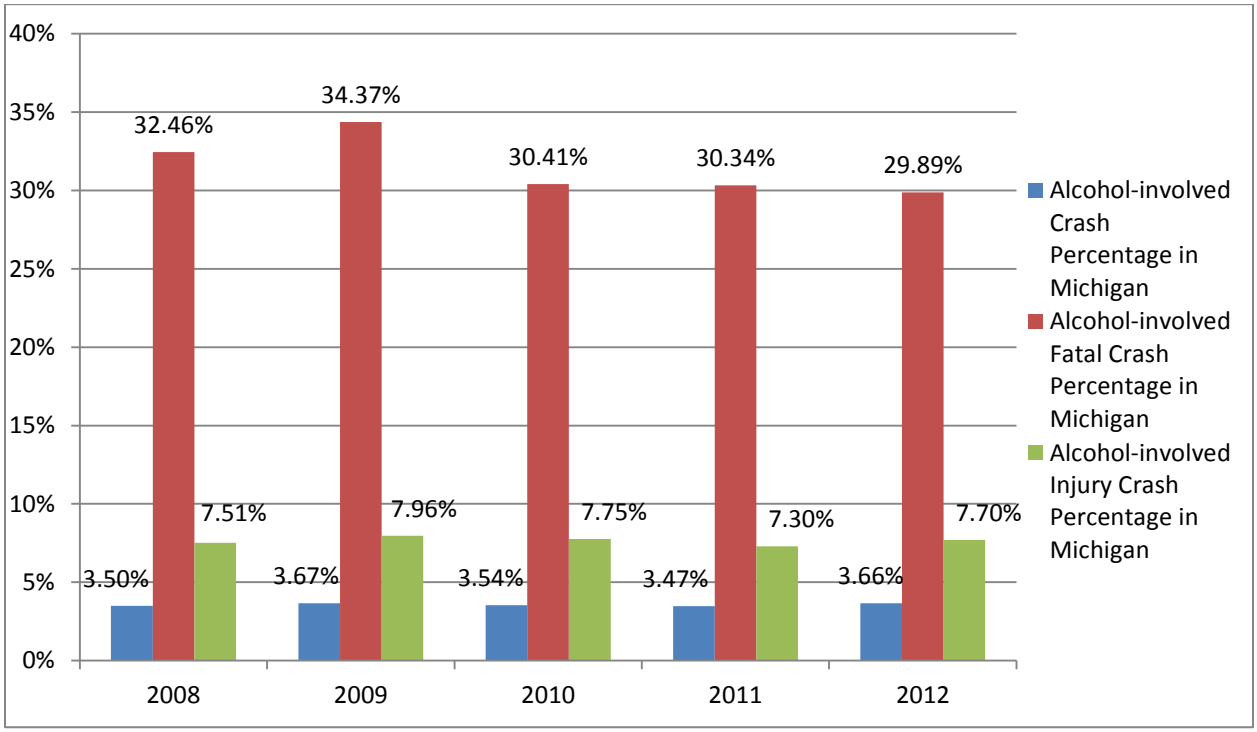
Alcohol is one of the leading causes of traffic crashes in GVMC region, in the state of Michigan, as well as in the United States. While over the course of 2008-2012 alcohol-related traffic crashes accounted for less than 5% of the total crashes in GVMC region, fatal and injury crashes involving alcohol-impaired drivers far exceeded this percentage. For this time period, alcohol-impaired drivers were involved in 32.6% of all fatal crashes as well as 7.9% of all injury crashes in GVMC region. For the state of Michigan over the same time period, these percentages were 31.5% and 7.6%, respectively. The data in the following figures showed the total number of alcohol-related crashes in GVMC region, percentage of alcohol-related crashes in total crashes, as well as the percentages of alcohol-related fatal and injury crashes in GVMC and the state of Michigan.

**Figure 16 GVMC Alcohol-Involved Crashes**

## Figure 17 GVMC Alcohol-Involved Crash Percentages




## Figure 18 Alcohol-Involved Crash Percentages in Michigan



**i. Policy/Objective** – The objective for the GVMC region is to outline a course of action that targets a reduction in the number of crashes involving alcohol in the region by 2020. The goals for this plan are as follows:

- Reduce total alcohol-related crashes
- Reduce fatalities associated with alcohol-impaired crashes

**ii. Strategies**

Strategies that can be used to reach the goals listed above are shown as follows,

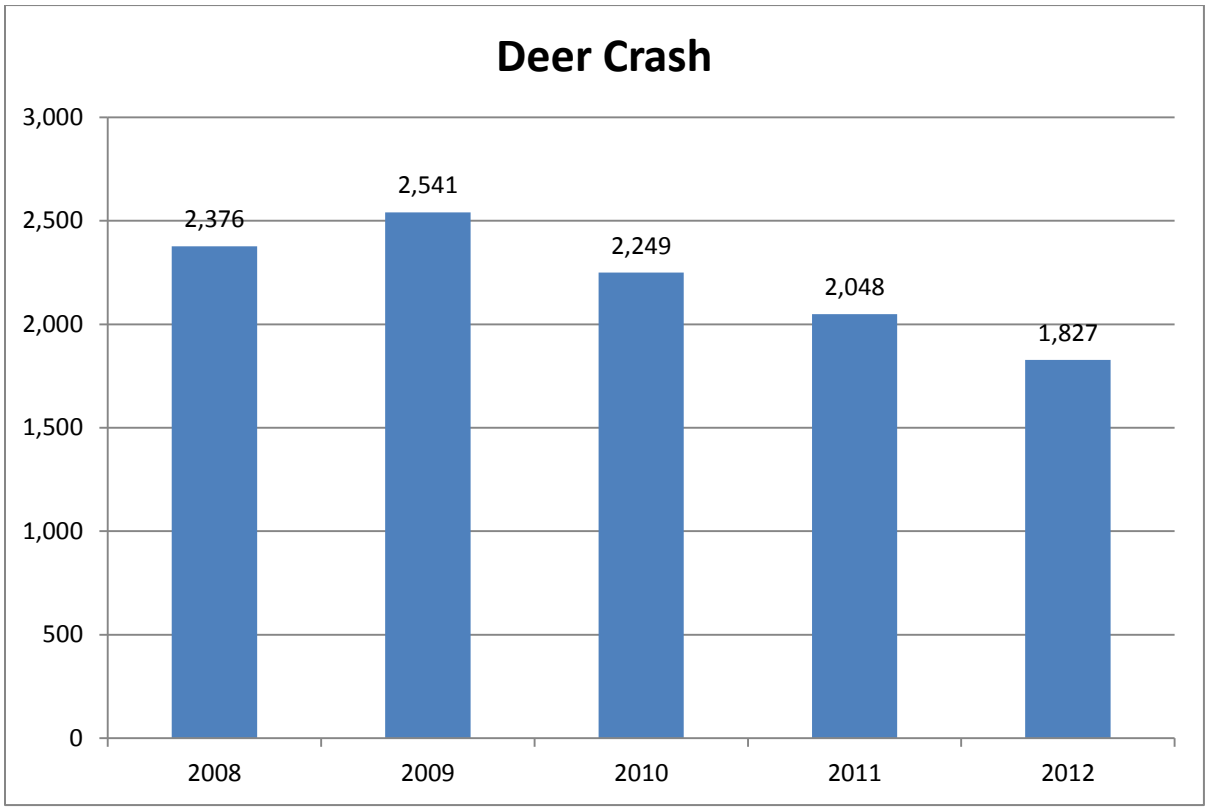
- Use crash data to help police determine the best months, days and times of day for DUI enforcement
- Increase education for targeting high-risk groups with a focus on the consequences of DUI
- Reduce excessive drinking and underage drinking through mass media campaigns and coordination with other outreach campaigns

## 2.7 Deer Crashes

In Michigan in 2012, there were 48,918 reported vehicle-deer crashes with 14 motorists killed. About 80 percent of all car-deer crashes take place on two-lane roads between dusk and dawn. Vehicle-deer crashes are costly. In Michigan, vehicle-deer crashes cost at least $130 million per year; the average insurance claim is about $2,100 in damage, usually to the front of the vehicle. The total number of vehicle-deer crashes from 2008-2012 in GVMC area is provided in the figure below.

GVMC region because of its physical size, amount of travel and areas that are conducive to supporting large deer populations perennially leads the state in the number of car/deer crashes. In 2012, car/deer crashes represented nearly 10% of all traffic crashes in the GVMC study region.

**Figure 19 GVMC Deer Crashes**




Unfortunately, there are no proven methods to reduce the number of these kinds of accidents. Deer whistles, fences and reflective barriers have not proven as an effective means for reducing the conflicts between motor vehicles and deer. The best approach to minimizing the impact of these unfortunate occurrences is to minimize the severity. Often to avoid hitting a deer in the roadway a motorist will react by swerving. This action can have more severe consequences when the vehicle leaves the road or swerves into the path of another vehicle.

Education efforts are underway to bring light to this issue. The Michigan Deer Crash Coalition (MDCC) was established in 1996. The mission of the MDCC is to mitigate both the frequency and severity of vehicle-deer crashes through public information, education, and research.

## 3. Investment Need

For safety, and many of the other transportation concentrations, need is difficult to determine long term. Changing technologies, vehicle improvements, aging populations and shifts in travel patterns and modes all contribute to changes in the needs of the transportation system. For this reason, GVMC will only forecast needs for a 10 year period. This strategic safety plan is designed to be updated every 2-4 years, at a minimum before each Regional Long Range Plan is developed.

## 3.1 Itemized Need by Category

**Drunk/Distracted/Young Driver Awareness Program** – GVMC will need to determine if this area is an area where GVMC would like to expend federal resources. An awareness program similar to the Clean Air Coalition or WESTRAIN could be established to bring a localized presence to this area. On average, drunk driving takes 17 lives in the GVMC study area. In addition, the rising use of the latest technologies (cell phones, GPS, DVD players), are cause for concern as distracted driving appears to be contributing to more and more crashes. Reliable statistics are not yet available on this but in recent months 2 significant fatal accidents have occurred in the GVMC area as a result of distracted driving.

The estimated cost of one fatality now stands at $2,600,000. If GVMC makes an investment of $150,000 per year in a public awareness program, the total investment of the next 10 years would total $1,500,000. If one life were saved as a result of this program over those 10 years, there would be a positive return on the funding invested of nearly 2 to 1.

Current Federal Investment - $0

Possible Federal Investment - $150,000/ Year * 10 Years = $1,500,000

**Intersection Safety** – Table 1 and 2 showed the top 50 high crash intersections in GVMC area. Some of these intersections may appear on this list for reasons that are out of the realm of a solution (new freeway, recent geometric changes, or used as a construction detour). Each year this data will be updated and the list will change due to increasing driver familiarity, changes in geometry, and return to

normal traffic loads after construction. Due to the fluidity of this list it is difficult to develop a hardened list of intersection safety needs.

In the past GVMC and its member communities have partnered with Wayne State University, AAA, and the Michigan OHSP to complete intersection safety studies. Many of the suggested solutions identified during these efforts were low cost solutions that have been implemented by local jurisdiction using local funding sources. Higher cost improvements have either been put on hold waiting for funding or have been completed on a minimal basis using competitive statewide STP Safety funding administered through MDOT.

To proactively address intersection issues, GVMC could work with safety partners as was done in the past to determine intersections that require additional attention. Under this scenario, a focused intersection safety study would be undertaken every 4 years. This study would identify a small number (6-8) of intersections that exhibited characteristics that warranted safety related improvements. Additionally, funding would be dedicated to implement solutions to address issues identified in the study process.

This approach of having funding dedicated to solutions would lead to more efficient alleviation of identified intersection safety issues.

Current Federal Investment - $ Minimal

Possible Federal Investment – Study $100,000 each * 2 studies = $200,000

Intersections (20) * $100,000 = $2,000,000

**Corridor Safety** – As identified by GVMC staff, there are 50 corridors listed that would potentially benefit from the implementation of a center left turn lane. In total the cost to add a center turn lane to each of these 50 segments is simply not financially feasible. There is a twofold approach to address this safety element.

The first is to identify corridors where a road diet might be an acceptable approach. Many of those listed in the corridor list also appear on the list of

potential corridors that would benefit from a reduction in lanes from 4 to 3. This would be a relatively low cost endeavor and could be completed during an overlay. Consideration should be given to place emphasis on these types of projects when condition projects are programmed. Four of the top ten corridors on the list in Appendix E are possible candidates for this low cost approach.

The second more traditional approach would be to construct a dedicated center turn lane. The current average cost for construction of a center turn lane is $900,000 (in addition to the reconstruction of the existing lanes). The proposed approach over the 10 year horizon for this needs assessment would be to complete 2 miles per year. When combined with other projects the cost of the additional lane will be minimized by leveraging funds from various sources. In circumstances where the corridor is not designated as capacity deficient, it may still be eligible for T-EDFC funding.

Example: A road with 10,500 vehicles per day would not qualify as capacity deficient. However, this facility would qualify for T-EDFC funding and a center turn lane could be constructed using these funds.

Current Federal Investment - $ Minimal

Possible Federal Investment – $1,800,000/yr * 10 years = $18,000,000

**Senior Mobility and Safety** – As discussed earlier this non-traditional transportation issue will become more and more apparent as the driving population ages. The primary focus for GVMC can be to emphasize improved signage along major corridors. In combination with the revised MUTCD requirements GVMC can invest federal funding in the identification and replacement of substandard signage. Long considered one of the primary elements of a comprehensive asset management plan, many jurisdictions already have a sign inventory and a methodology for substandard sign replacement. This effort would ensure that appropriate resources are available to all agencies to bring this aspect of the transportation system up to standards and keep them there.

Current Federal Investment - $ 0

Possible Federal Investment – $75,000/yr * 10 years = $750,000

**Bicycle and Pedestrian Safety** – From a safety standpoint investment in physical non-motorized facilities does not appear to be warranted as there are not identifiable locations where additional dedicated non-motorized facilities would provide a safety benefit. This does not imply that efforts to expand the network of non-motorized facilities should not continue, merely that there are not locations where significant crashes exist to justify expenditure of federal funding for separated facilities.

There may be need for public education to increase awareness by the traveling public of the other modes may lead to reducing the crash rates. This could be a localized program similar to Clean Air and WESTRAIN efforts currently underway at GVMC. Partnering with Michigan OHSP local bike shops or other foundations may provide some of the funding necessary to carry on this task.

Current Federal Investment - $ 0

Possible Federal Investment – $35,000/yr * 10 years = $350,000

**Car/Deer Crashes** – As outlined earlier, there are no proven methods or technologies available to improve this safety condition. Short of educating the deer, the only other approach would be to educate the drivers during peak car deer crash periods October – December. An approach could be to implement a localized coordinated effort with the Michigan Deer Crash Coalition (MDCC) to bring this issue to the forefront during peak Fall months.

Current Federal Investment - $ 0

Possible Federal Investment – $25,000/yr * 10 years = $250,000

**10 Year Safety Needs Summary**

| | |
|---|---|
| Drunk/Distracted Driving Campaign | $ 1,500,000 |

| | |
|---|---|
| Intersections | $ 2,000,000 |
| Segments | $18,000,000 |
| Senior Mobility | $ 750,000 |
| Non-Motorized | $350,000 |
| Car/Deer | $ 250,000 |
| Total 10 Year Safety Needs | $22,850,000 |

Possible Sources –

STP Urban

T-EDFC

CMAQ

STP Safety