CAG
Central Arizona Governments
One Region • No Boundaries

CENTRAL ARIZONA GOVERNMENTS

STRATEGIC TRANSPORTATION SAFETY PLAN

FINAL REPORT

JANUARY 2017

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

PARTNER PLEDGE

As a partner in Central Arizona's Strategic Transportation Safety Plan (STSP), my agency/jurisdiction pledges to support reductions in transportation-related fatalities and serious injuries by:

- Supporting the STSP planning process, facilitating implementation of recommended safety strategies and action steps
- Engaging in future STSP updates
- Communicating the STSP vision, goals and emphasis areas to agency staff and partners
- Championing the cause of safety by educating the public on the critical role they play in preventing crashes
- Committing to adopt and institutionalize a change in Central Arizona's transportation safety culture

LIST OF ACRONYMS

ADOT: *Arizona Department of Transportation*

ALISS: *Accident Location Identification Surveillance System*

CAG: *Central Arizona Governments*

EA: *Emphasis Area*

EMS: *Emergency Medical Services*

EPDO: *Equivalent Property Damage Only*

FHWA: *Federal Highway Administration*

GDL: *Graduated Drivers License*

GOHS: *Governor's Office of Highway Safety*

HRRR: *High-Risk Rural Roads*

HSIP: *Highway Safety Improvement Program*

HSP: *Highway Safety Plan*

MAP-21: *Moving Ahead for Progress in the 21st Century*

MDSC: *Multidisciplinary Safety Committee*

MPD: *Multimodal Planning Division*

MPO: *Metropolitan Planning Organization*

NHTSA: *National Highway Traffic Safety Administration*

PARA: *Planning Assistance for Rural Areas*

SHSP: *Strategic Highway Safety Plan*

STP: *Surface Transportation Program*

STSP: *Strategic Transportation Safety Plan*

TAP: *Transportation Alternatives Program*

TIP: *Transportation Improvement Program*

TMA: *Transportation Management Area*

TTAC: *Transportation Technical Advisory Committee*

INTRODUCTION

WHAT IS THE STRATEGIC TRANSPORTATION SAFETY PLAN?

A regional transportation safety plan utilizes the results of crash data analysis and stakeholder/public input to identify proven strategies, actions, programs, and projects to reduce the prevalence of transportation-related fatalities and serious injuries. The purpose of the Central Arizona Governments' (CAG) Strategic Transportation Safety Plan (STSP), the process for developing the document, and how it relates to other safety initiatives in the state and region is described in Section 1.0.

OVERVIEW AND PURPOSE

The development of the STSP is an important step toward reducing fatalities and serious injuries on public roadways in the CAG Transportation Planning Area. Fatalities and serious injuries in the region have fluctuated since 2005, but most of these incidents are predictable and preventable. The STSP provides CAG with a framework for reducing the personal and economic costs of crashes and enhancing livability and public health in the region.

The Plan was developed by CAG, in coordination with the Arizona Department of Transportation (ADOT), local governments, tribal representatives, and other transportation and safety stakeholders. This diverse set of stakeholders represents the four Es of transportation safety: Engineering, Enforcement, Education and Emergency Medical Services (EMS) to ensure the Plan addresses the different facets of safety. It identifies the most important transportation safety issues in the CAG Region, also called emphasis areas, and offers strategies to comprehensively address these issues.

The STSP identifies emphasis areas, strategies and specific actions to cut transportation-related fatalities and serious injuries by 5 percent by 2020.

MDSC COMMITTEE MEMBERS

Central Arizona Governments
Gila and Pinal County
City of Globe
Town of Superior
Town of Mammoth
Town of Kearney
Town of Payson
Town of Miami
Town of Star Valley
Town of Winkelman
Ak-Chin Indian Community
San Carlos Apache Tribe
Coolidge Transit
Arizona Department of Public Safety
Governor's Office of Highway Safety
Arizona Department of Transportation
Federal Highway Administration

STSP PLANNING PROCESS

The development of the STSP was a collaborative process, with oversight provided by the Transportation Technical Advisory Committee (TTAC) and newly formed Multidisciplinary Safety Committee (MDSC). The MDSC took an active role in shaping the plan, including: overseeing and reviewing all task deliverables, developing the safety vision, selecting the emphasis areas, identifying strategies and actions to reduce fatalities in each of the emphasis areas, reviewing the draft and final versions of the STSP, and assisting with Plan implementation. Committee members were chosen because of their knowledge of transportation safety issues in the region, personal commitment to reducing fatal and serious injury crashes, and diverse backgrounds and expertise in the four Es of safety.

Key milestones in the planning process that ultimately led to the development of the draft STSP included:

LATE 2014/EARLY 2015

Crash data analysis was initiated for the CAG Region to identify major trends and potential emphasis areas. A more detailed analysis of crash locations (network screening) was also conducted to inform the development of specific infrastructure projects.

APRIL 2015

A meeting was held with the project team and the MDSC to review crash trends and preliminary findings from the network screening analysis. At this meeting the MDSC selected emphasis areas for the plan and made recommendations to revise the network screening approach slightly.

JUNE 2015

A safety workshop was held with the project team, the MDSC, and other interested transportation and safety stakeholders. Participants reviewed and confirmed the STSP Vision and developed potential strategies and actions for each emphasis area. An additional follow-up call was held to identify strategies and actions for the roadway departure emphasis area.

JULY 2015

A webinar was held with the project team, the MDSC, and other interested transportation and safety stakeholders to discuss and confirm STSP goals, performance measures, and performance targets.

SEPTEMBER 2015

The first draft of the STSP was developed.

COORDINATION WITH OTHER PLANS

It is important for the STSP to complement current safety policies, programs, and projects ongoing in the state or region to avoid duplication or redundancy with other efforts. The STSP takes into account and incorporates information from two required safety planning efforts:

Arizona Strategic Highway Safety Plan (SHSP)

The SHSP is a statewide-coordinated safety plan that identifies Arizona's key safety emphasis areas and guides investment decisions toward strategies and countermeasures with the most potential to save lives and prevent injuries. The Arizona Plan identifies a number of strategies and actions to reduce crashes in the following emphasis areas: speeding and aggressive driving, impaired driving, occupant protection, motorcycles, distracted driving, roadway infrastructure and operations, age related, heavy vehicles/buses/transit, nonmotorized users, natural risks, traffic incident management, and inter-jurisdictional.

The CAG emphasis areas align with the emphasis areas in the SHSP. To save time and resources, relevant SHSP emphasis area strategies and actions were incorporated into the STSP. This alignment better positions CAG to apply for Highway Safety Improvement Program (HSIP) funding.

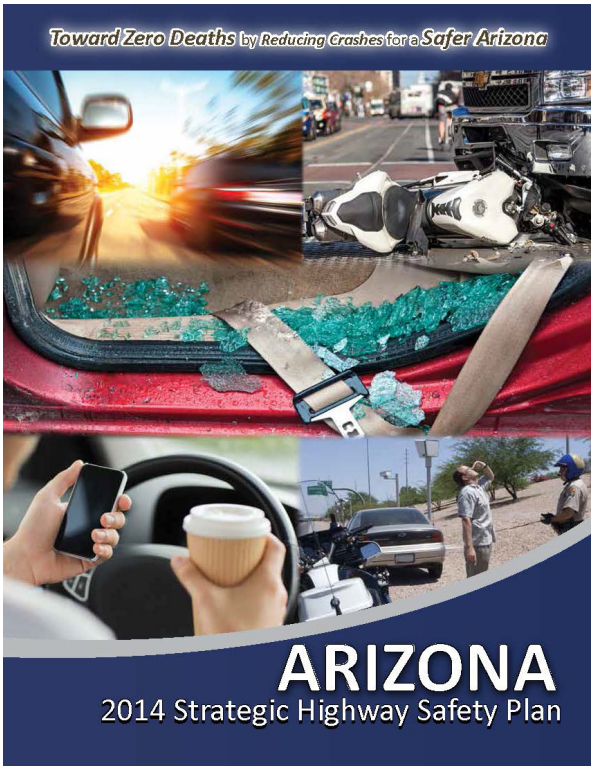
Arizona Highway Safety Plan (HSP)

The Arizona Governor's Office of Highway Safety (GOHS) produces an annual HSP which serves as the implementation guide for highway safety projects throughout Arizona. Similar to the SHSP planning process, GOHS reviews crash and other data to identify the top safety priorities in Arizona. Speeding, unrestrained occupants, and alcohol impairment are the three factors contributing most to crash fatalities. Programs and projects to address these emphasis areas are identified in the HSP.

Other transportation planning documents were reviewed and considered during the development of the STSP. Some of the documents include safety policies that were considered during the development of STSP safety strategies. Other plans, such as the Cobre Valley Comprehensive Transportation Study, identify priority sites for safety improvements.

In addition to these documents, the STSP can and should be integrated into CAG's other planning activities. Most importantly, safety goals and strategies from the STSP will be included in the next update to the long-range transportation plan. Safety projects will also be added to the regional Transportation Improvement Program (TIP).

The CAG emphasis areas align with the top safety priorities in the HSP. To save time and resources, relevant HSP strategies were incorporated into the STSP. This alignment better positions CAG to apply for grant funds through the GOHS annual application process.



COMPLETE LIST OF REVIEWED TRANSPORTATION PLANS

Gila County Comprehensive Plans
Pinal County Comprehensive Plans
Gila County Small Area Transportation Study
Gila County Transportation Study
Payson Transportation Study
Cobre Valley Comprehensive Transportation Study
Pinal County Regionally Significant Routes for Safety and Mobility Plan
Gila River Indian Community Multimodal Pedestrian Safety Study
Ak-Chin Indian Community Transit and Nonmotorized Study

TRANSPORTATION SAFETY IN CENTRAL ARIZONA

To identify emphasis areas, strategies, actions, and projects for the STSP, it was necessary to define the specific geographic area being addressed and fully understand the crash history and trends in that region. The data analysis outlined in Section 2.0 serves as the foundation for the development of the STSP.

CAG PLANNING REGION

The CAG planning area encompasses Gila and Pinal Counties and stretches over 10,000 square miles. However, CAG's transportation planning area only encompasses portions of Pinal County in addition to Gila County that accounts for approximately 7,200 square miles. The east portion of Pinal County as well as the Ak-Chin Indian Community represents Pinal County's portion of CAG's transportation boundaries. The Tohono O'odham Indian Reservation is not part of the CAG transportation boundaries but was included in the analysis. CAG's population as a whole is approximately 450,000, with approximately 95,000 within the transportation boundaries. The terrain within the transportation boundaries is primarily mountainous and as such, most of the region is rural. The full list of jurisdictions in the CAG transportation area includes: Gila and Pinal (portion) Counties; the City of Globe; the Towns of Hayden, Kearny, Mammoth, Marana, Miami, Payson, Star Valley, Superior, and Winkelman; the San Carlos and White Mountain Apache Tribes; and the Ak-Chin Indian Community. The map depicts only the CAG transportation planning boundary, with the addition of Tohono O'odham Indian Reservation, that was analyzed for this STSP.

CRASH DATA

The crash data for the CAG STSP was made available from the ADOT Accident Location Identification Surveillance System (ALISS) database of crash records. This database contains data fields from crash report forms filed by the law enforcement officer responding to a crash incident. The ALISS crash database is dynamic and growing in the sense that reports are submitted continuously to ADOT from reporting entities, which include state, county, city, tribal, and other law enforcement agencies. Crash data for years 2009 through 2013 was used to identify contributing factors and emphasis areas, and data from 2005 through 2014 was used to assess long-term trends.

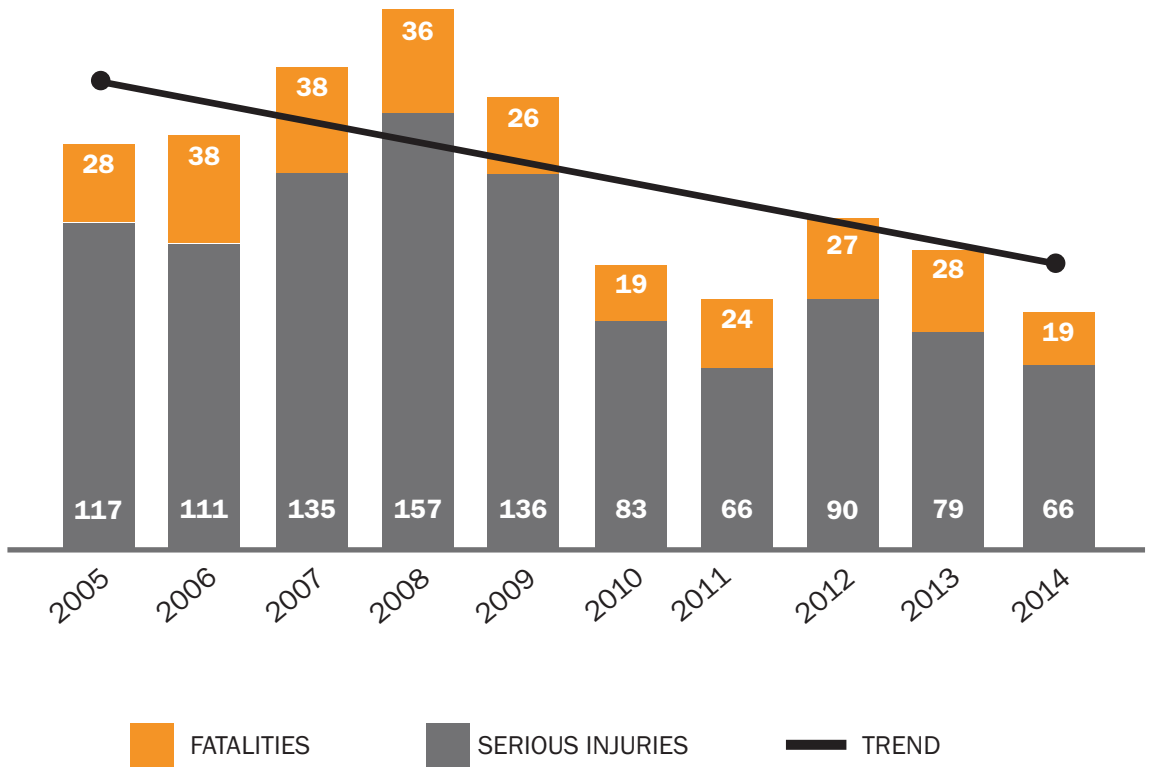
CRASH OVERVIEW

Crash Trend

Over the last five years, the transportation boundaries of the CAG Region (herein within this report as CAG Region) experienced an average of 23 traffic-related fatalities and 77 serious injuries per year. Figure 1 below shows the trend in traffic related fatalities and serious injuries by year from 2005 to 2014. Overall, there was a significant decline over the ten-year period; however, since 2010, there has not been a consistent trend in either direction.

FIGURE 1

Annual Trend in CAG Area Fatalities and Serious Injuries (2005-2014)



Crash Location

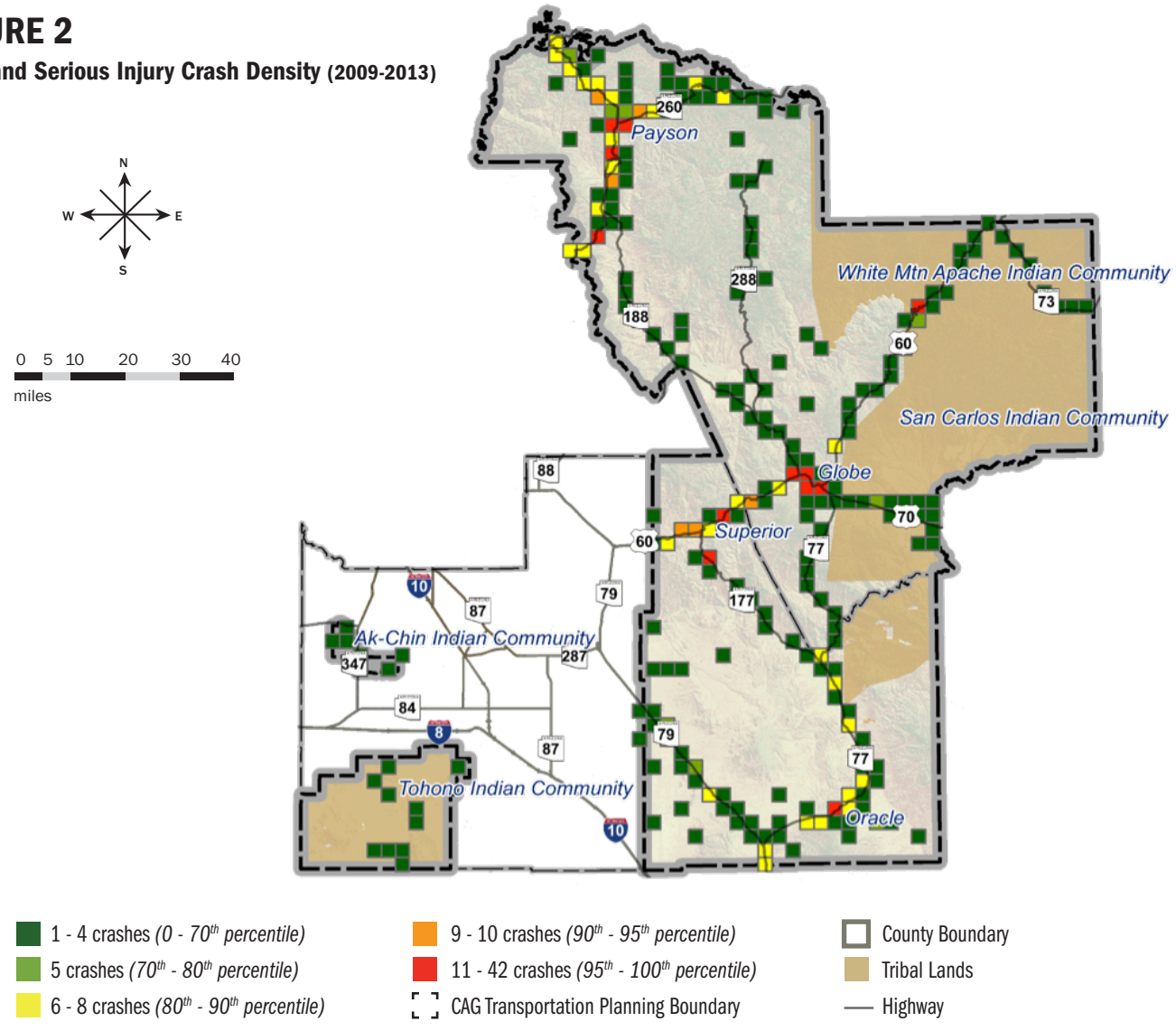
A severe crash density map based on data from 2009 to 2013 is shown in Figure 2. The highest crash locations are typically in or near the urbanized areas, where traffic volumes are the highest. High numbers of severe crashes are also seen on many of the mountainous rural highways throughout the region.

Within incorporated city limits, Globe experienced the highest number of fatalities and serious injuries, followed by Payson. Miami has the next highest number of total crashes with one fatality in the five-year period. Serious injury crashes for this period ranked as follows: Globe, Payson, Star Valley, Superior, and Mammoth.

The majority of severe crashes (82 percent) occurred on the state highway system. Eighty-three percent occurred in rural areas, and 11 percent on tribal lands. It should be noted that Mammoth, having 21 total crashes, had 13 serious injury crashes. Each of the four tribal areas also had a high proportion of severe crashes.

FIGURE 2

Fatal and Serious Injury Crash Density (2009-2013)

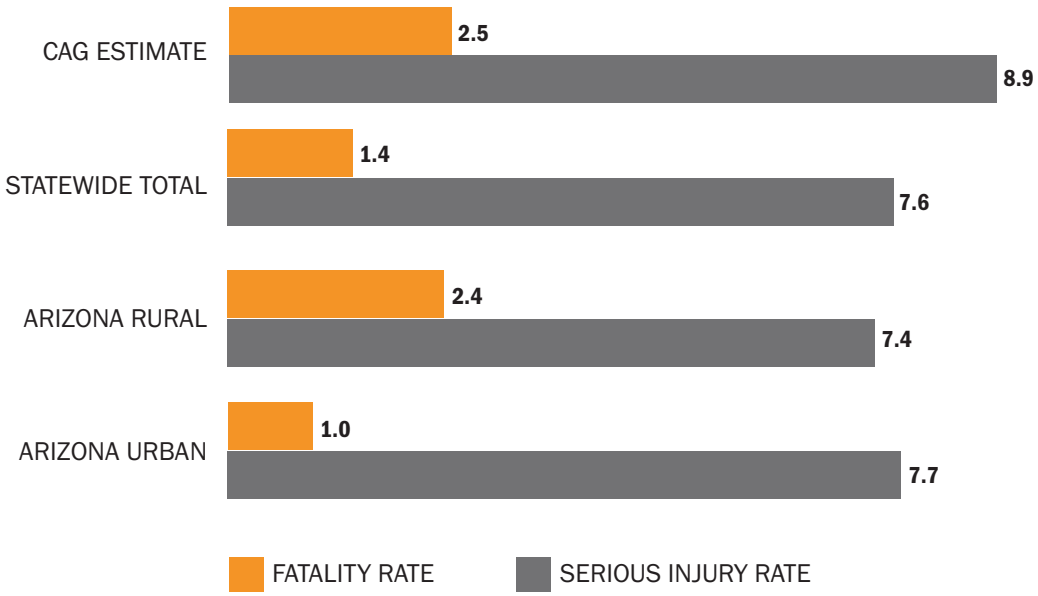


Crash Rate

Crash rate is a measure of the number of fatalities or serious injuries per 100 million vehicle miles traveled. Estimated crash rates for the CAG Region were calculated and are compared with other known statewide rates from Arizona in Figure 3. The fatality and serious injury crash rates are higher in the CAG Region than in the rest of Arizona. The CAG rates are comparable though somewhat higher than the rates in rural Arizona. This may be related to the mountainous terrain that is prevalent in the CAG Region.

FIGURE 3

Comparison of CAG Estimated Fatality and Serious Injury Rate with Arizona Rates (2009-2013 Annual Average)



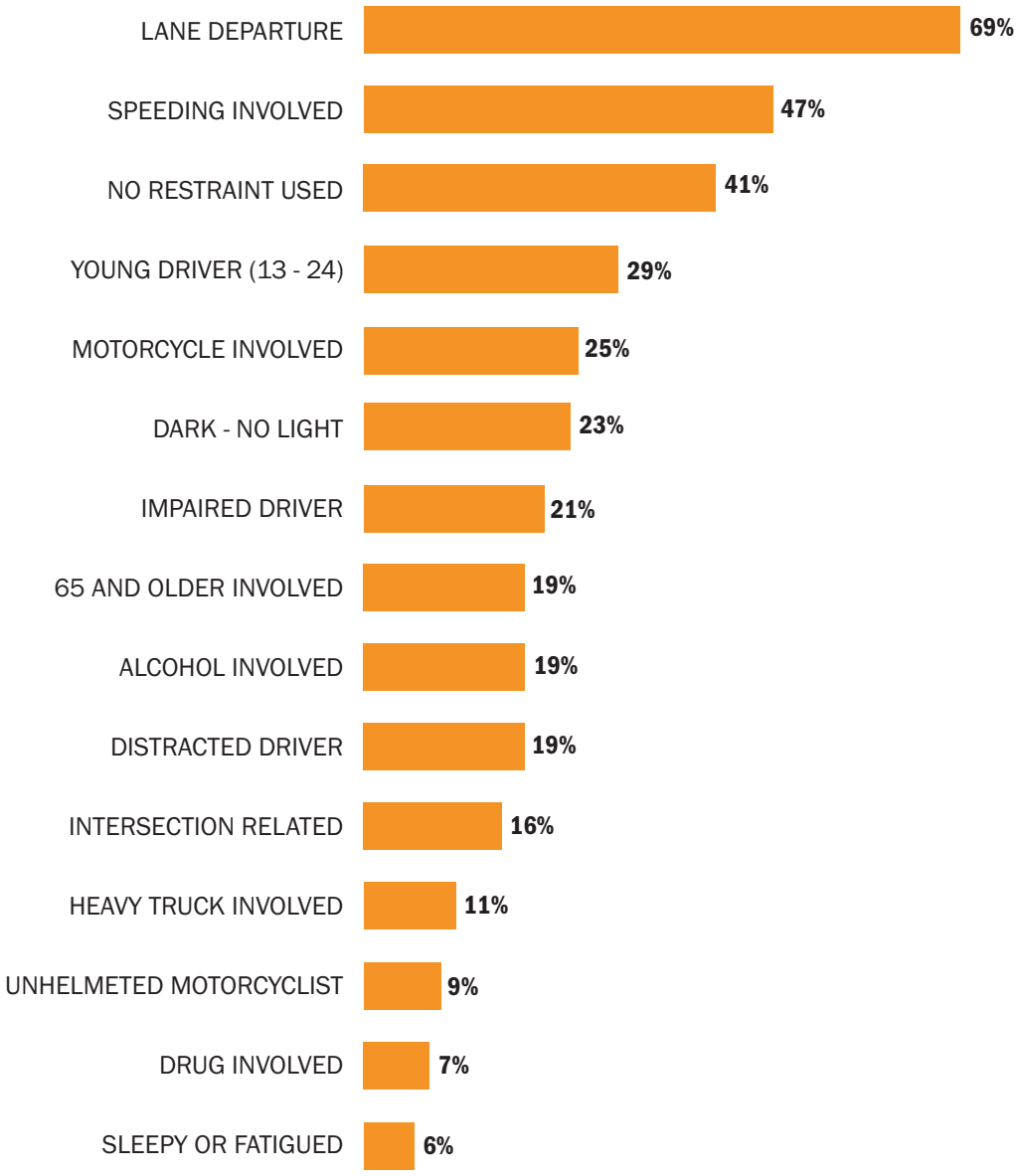
Crash Characteristics and Contributing Factors

Crash data for years 2009 through 2013 were evaluated to identify the characteristics that account for a high percentage of fatalities or serious injuries. The top 15 characteristics are shown in Figure 4. Understanding the portion of total fatalities and serious injuries with certain crash characteristics helped to identify trends specific to the CAG Region where the greatest opportunities exist to improve safety.

Lane departure crashes are the most common characteristic, accounting for 69 percent of all fatalities and serious injuries. Speeding accounts for almost half of fatal and serious injuries (47 percent), and failure to wear seat belts or helmets is also significant (41 percent). More detail on crash characteristics, and identification of emphasis areas, is provided in Section 4 of the Plan.

FIGURE 4

Percentage of Fatalities and Serious Injuries by Crash Characteristics (2009–2013)



ROAD MAP TO REDUCING FATALITIES AND SERIOUS INJURIES

This plan defines what CAG wants to achieve for transportation safety now and in the future, sets measurable goals to further drive down fatalities and serious injuries, and identifies the traffic safety problems that need to be addressed. CAG's safety vision, goals, performance measures and targets, and emphasis areas are defined in Section 3.0.

VISION

A vision statement is a big picture, aspirational idea of what CAG wants to achieve through implementation of the STSP. ***The project team and MDSC identified the following transportation safety vision:***

Make Central Arizona a safer place to live, work, and recreate by reducing transportation fatalities and serious injuries.

GOALS

Goals reflect agreed-upon system-wide priorities and provide direction for future transportation planning activities. Goal statements are believable, attainable and based on identified needs. They answer the question, "What do we want to achieve?" ***The project team and MDSC identified an overarching goal for the STSP, which is based on the National Safety Goal:***

To achieve a targeted reduction in traffic fatalities and serious injuries on all public roads in the CAG Region.

Goal statements were also identified for each of the emphasis areas:

To achieve a targeted reduction in young driver traffic fatalities and serious injuries on all public roads in the CAG Region.	**To achieve a targeted reduction in impaired driving traffic fatalities and serious injuries on all public roads in the CAG Region.**	**To achieve a targeted reduction in unrestrained occupant traffic fatalities and serious injuries on all public roads in the CAG Region.**
To achieve a targeted reduction in motorcycle traffic fatalities and serious injuries on all public roads in the CAG Region.	**To achieve a targeted reduction in roadway departure traffic fatalities and serious injuries on all public roads in the CAG Region.**	**To achieve a targeted reduction in speed-related traffic fatalities and serious injuries on all public roads in the CAG Region.**

PERFORMANCE MEASURES

Performance measures are tied to goals and are used to assess the effectiveness of programs and projects that address transportation issues and deficiencies. While CAG is not an MPO and is not required to set safety performance measures (or targets), it is still good planning practice to track and evaluate safety. For the STSP, CAG will apply the following performance measures to track progress toward each of the emphasis areas. Additional information on performance measure tracking can be found in Section 6.0.

CAG PERFORMANCE MEASURES:

Fatalities
Serious injuries
Roadway departure fatalities
Roadway departure serious injuries
Occupant protection fatalities
Occupant protection serious injuries
Impaired driving fatalities
Impaired driving serious injuries
Speeding fatalities
Speeding serious injuries
Motorcycle fatalities
Motorcycle serious injuries
Young driver fatalities
Young driver serious injuries

PERFORMANCE TARGETS

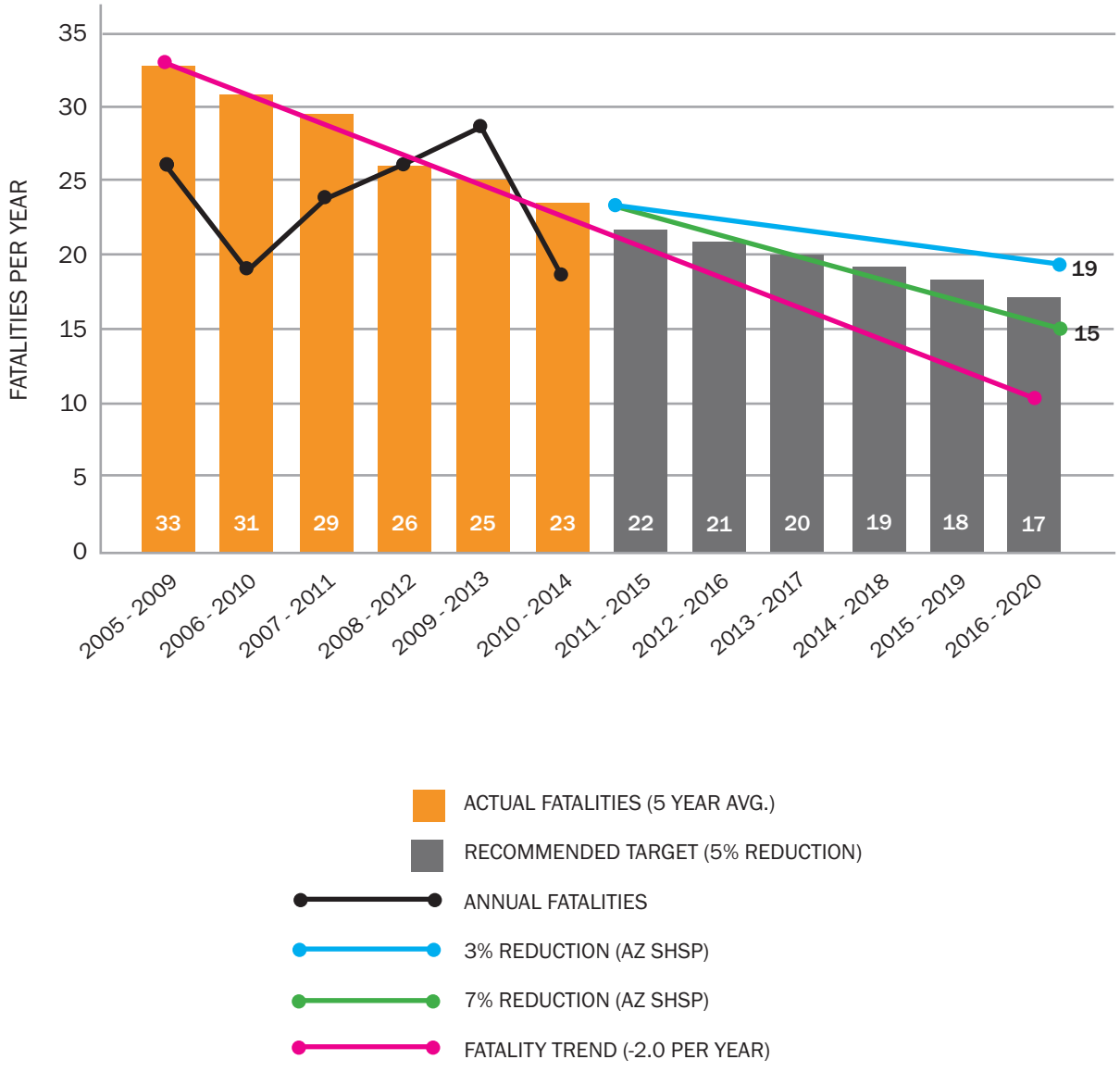
To establish performance targets for the STSP, the MDSC reviewed fatality and serious injury data from 2005 to 2014. For both fatalities and serious injuries, the historic trend indicates a significant reduction. However, it is not clear whether this rate of reduction can be sustained going forward. A particular concern is that the annual number of fatalities and serious injuries has not shown a consistent downward trend.

To set targets, annual percentage reductions ranging from three to seven percent were considered, consistent with the targets in the Arizona SHSP. These are shown in Figures 5 and 6.

Based on the information presented, the recommended five percent annual reduction targets were approved by the MDSC for the Plan.

FIGURE 5

Fatality Target Options

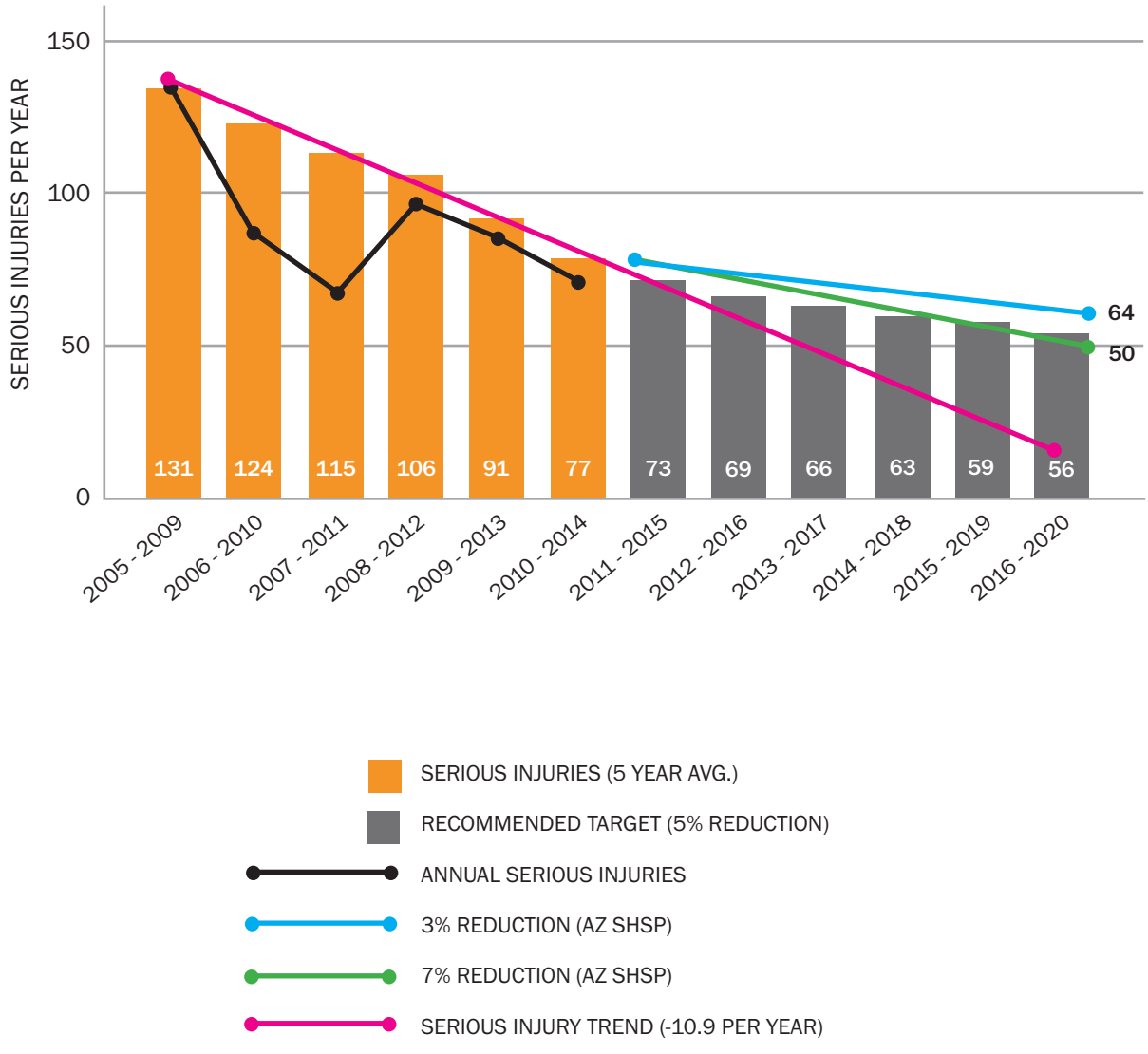


Fatality Target

Reduce the annual average number of fatalities from 23 over the 2010 to 2014 five-year period to 17 over the 2016 to 2020 five-year period, a 5 percent annual reduction.

FIGURE 6

Serious Injury Target Options



Serious Injury Target

Reduce the annual average number of serious injuries from 77 over the 2010 to 2014 five-year period to 56 over the 2016 to 2020 five-year period, a 5 percent annual reduction.

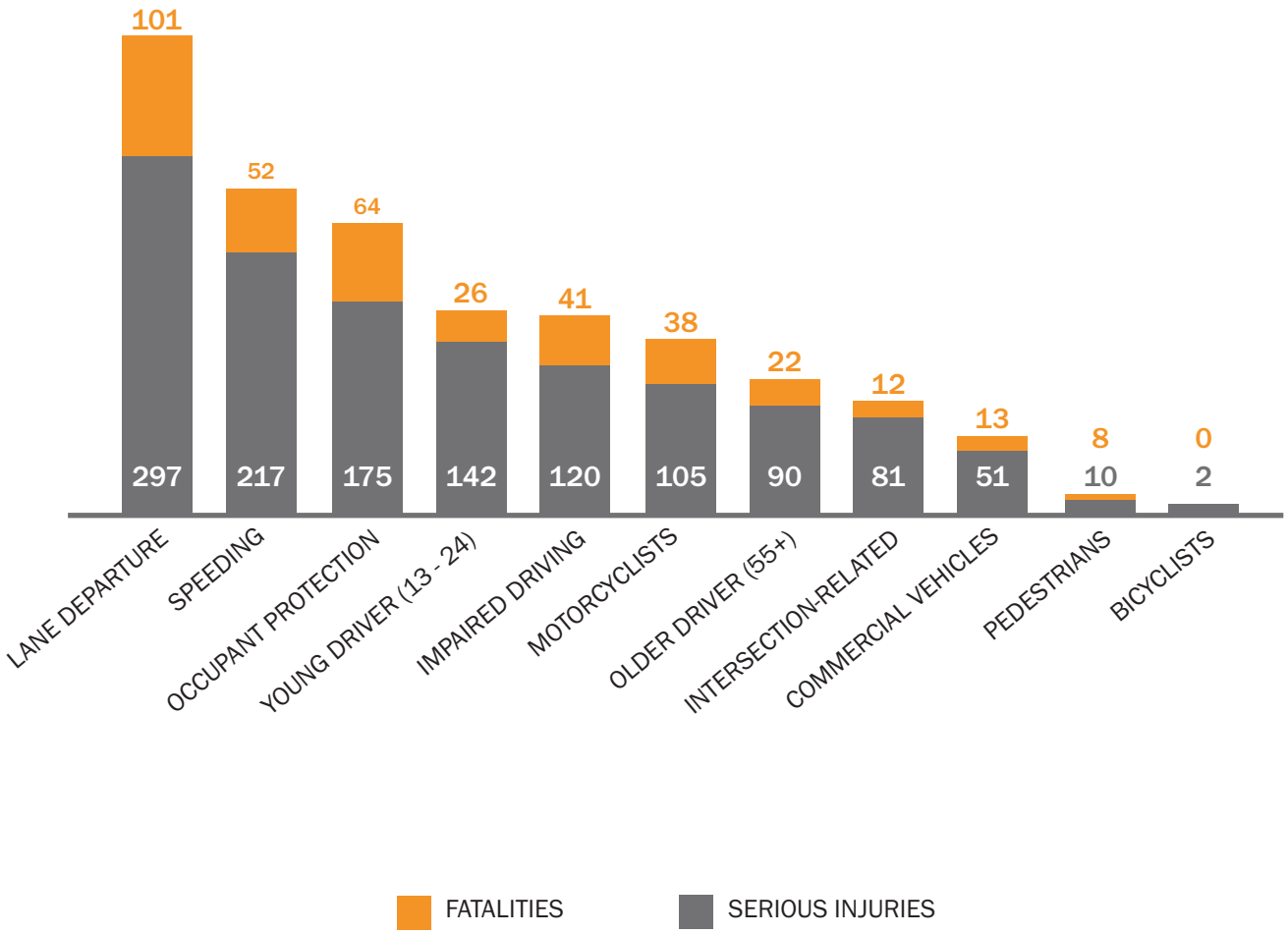
EMPHASIS AREAS

Data-Driven Emphasis Area Identification Process

Emphasis areas represent the key factors contributing to crashes, which if addressed, have the greatest potential to reduce fatalities and serious injuries. To select emphasis areas for the Plan, fatality and serious injury data were presented to the MDSC for 11 crash categories (potential EAs). Five years of crash data (2009-2013) from the ADOT Accident Location Identification Surveillance System database were used in the analysis. The potential EAs considered are shown in Figure 7.

FIGURE 7

Fatalities and Serious Injuries by Potential Emphasis Areas (2009-2013)



Based on the results of the data analysis and committee discussion, the following six emphasis areas with the highest number of fatal and serious injuries in the CAG Region were chosen:

Lane Departure Crashes	*Impaired Driving*	*Young Drivers*
Occupant Protection	*Speeding*	*Motorcycles*

Intersection-related crashes were not identified as an emphasis area, however infrastructure projects at intersections with the highest potential for safety improvements have been identified as part of the network screening process and will be included in the STSP.

The CAG emphasis areas were also chosen, in part, based on their alignment with the Arizona SHSP emphasis areas. HSIP funding in Arizona is primarily spent on programs and projects that will lower fatalities and serious injuries within the twelve statewide emphasis areas. The fact that the STSP is consistent with the SHSP, increases CAG's opportunities to apply for HSIP funding.

EMPHASIS AREAS

CAG organized its strategies and investments into six emphasis areas. These emphasis areas will help direct resources and focus implementation efforts. Section 4.0 describes why the emphasis areas were chosen, and presents the fatality and serious injury reduction goal, performance measures, and proven-effective strategies.

LANE DEPARTURE

Definition

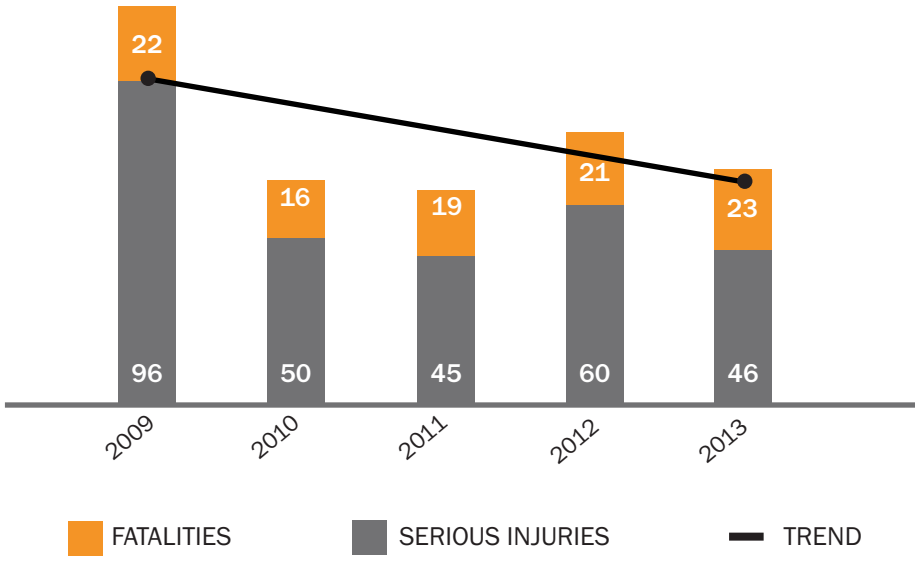
A lane departure crash is a crash in which the manner of collision is head-on or sideswipe, or the first harmful event is overturn or rollover, the vehicle ran off the road, crossed the median or centerline, or collision with a fixed object (as documented in the crash report).

Problem Overview

Lane departure crashes account for 69 percent of total fatalities and serious injuries in the CAG Region. Additionally, many behavior-related crashes also involve the vehicle leaving the lane or entire roadway. For example, lane departure accounts for 94 percent of unrestrained fatal and serious injuries, 87 percent of impaired driving fatal and serious injuries, and 84 percent of speed-related fatal and serious injuries. As such, they are an important focus of the plan. While serious injuries from lane departure crashes in the CAG Region have decreased since 2009, fatalities have been relatively consistent, at around 20 per year (Figure 8).

FIGURE 8

Lane Departure Fatalities and Serious Injuries (2009-2013)

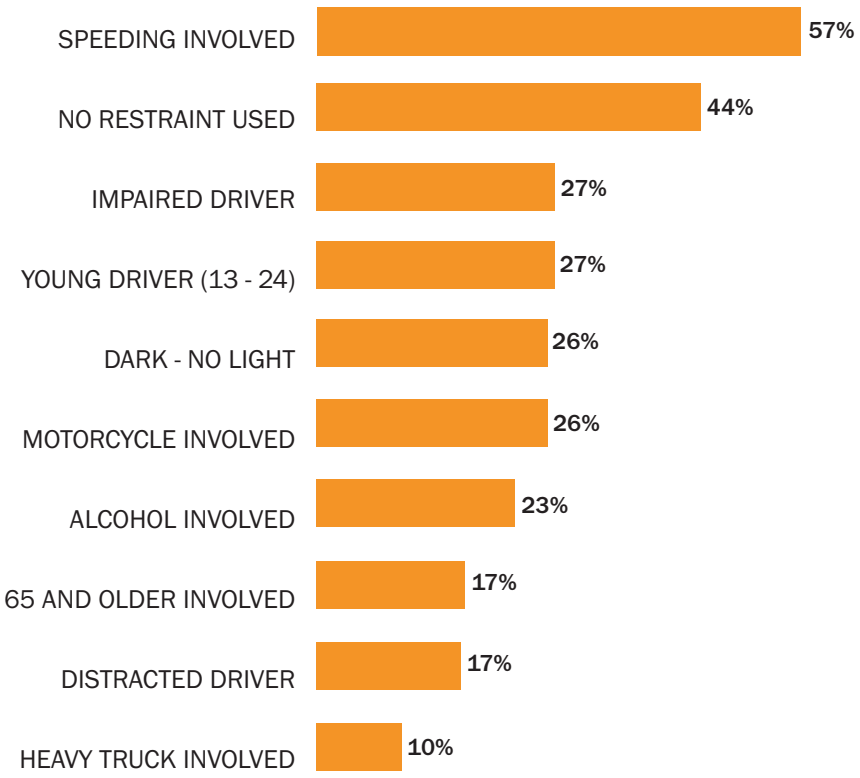


Crash Characteristics and Contributing Factors for Lane Departure Fatalities and Serious Injuries

As shown in Figure 9, speeding is the most significant contributing factor in lane departure fatalities and serious injuries (57 percent), followed by failure to use restraints (44 percent), and impairment (27 percent). This demonstrates the need for multidisciplinary strategies that reduce risky behaviors, while also mitigating the likelihood of drivers leaving their lane, and improving the outcome when they do.

FIGURE 9

Lane Departure Fatalities and Serious Injuries by Top Behavioral and Environmental Risk Factors



Key Facts (Lane Departure Crashes)

- A vast majority (91 percent) of lane departure crash fatalities and serious injuries occur in rural areas.
- While the number of people seriously injured in lane departure crashes has decreased by 21 percent, the number of people killed has increased by 11 percent (2011-2013 average versus 2009-2011 average).
- For every 100 people involved in a lane departure crash, 17 are either killed or seriously injured.
- Lane departures account for about half of all people involved in crashes, but 81 percent of fatalities and around two-thirds of serious injuries.

GOAL

To achieve a targeted reduction in lane departure traffic fatalities and serious injuries on all public roads in the CAG Region.

PERFORMANCE MEASURES

- *Number of lane departure fatalities*
- *Number of lane departure serious injuries*

STRATEGIES

- *Reduce the frequency and severity of lane departure crashes through roadway infrastructure improvements.*
- *For vehicles or motorcycles that run off the road for any reason, minimize the potential for overturning or colliding with another object.*
- *Increase public education on corrective lane departure driving techniques.*

SPEEDING

Definition

A speed-related crash is a crash in which the violation/behavior portion of the crash report indicates the driver's speed was too fast for conditions or exceeded the lawful speed (as documented in the crash report).

Problem Overview

Speeding is a factor in almost half (47 percent) of all fatalities and serious injuries in the CAG Region. Overall, there has been a downward trend in speed-related fatalities and serious injuries; however, fatalities have been relatively consistent from year to year, and serious injuries have also been somewhat consistent since 2010 (Figure 10).

Crash Characteristics and Contributing Factors for Speed-Related Crashes

As noted previously, there is a high level of overlap between speeding and lane departure crashes: 84 percent of speed-related fatal and serious injuries are lane departure crashes (Figure 11). Failure to use restraints is also a common factor (37 percent), along with young driver involvement (34 percent). By comparison, young drivers are involved in only 29 percent of all fatal and serious injuries region-wide, which indicates they are over-represented in speed-related crashes.

FIGURE 10

Speed-Related Fatalities and Serious Injuries (2009-2013)

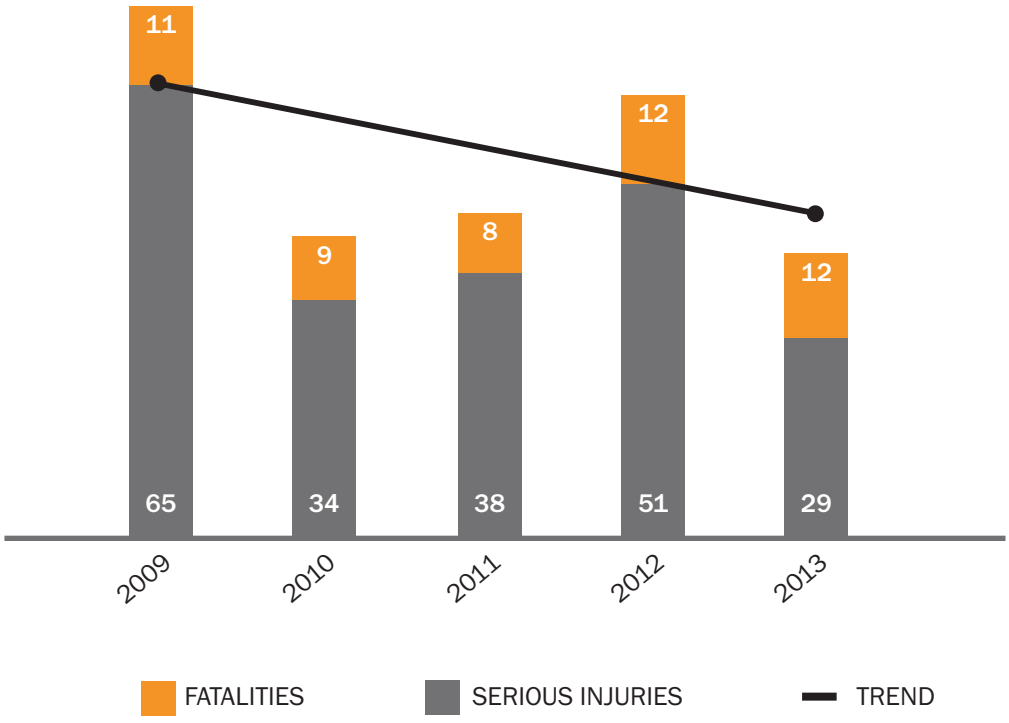
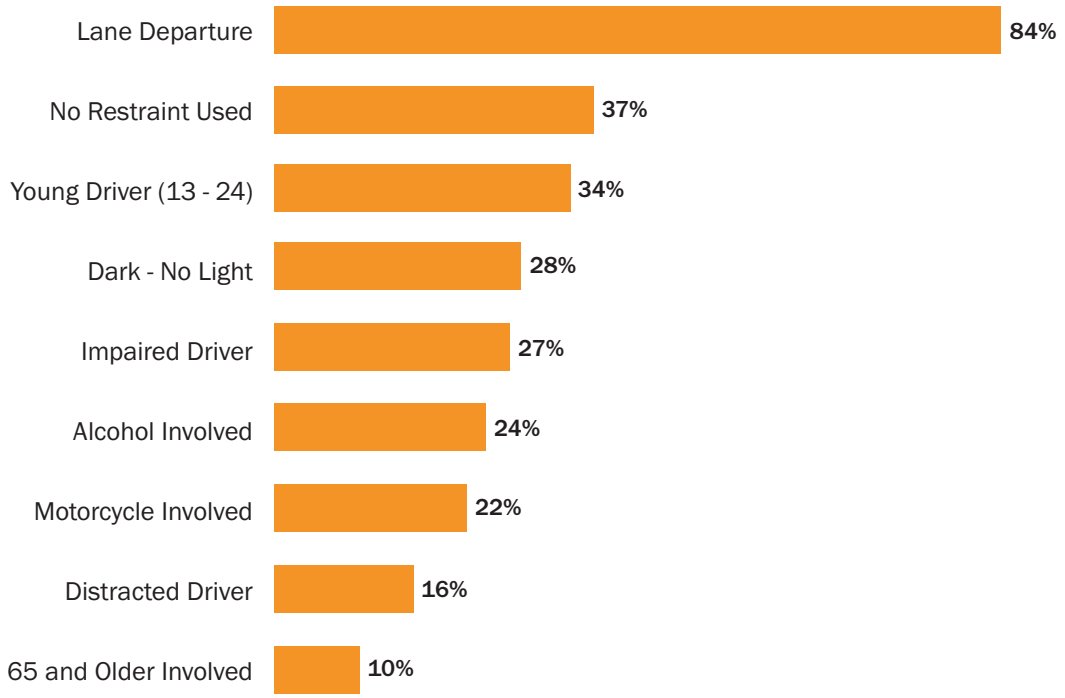


FIGURE 11

Fatalities and Serious Injuries from Speed-Related Crashes by Top Behavioral and Environmental Risk Factors



Key Facts (Speed-Related Crashes)

- A vast majority (90 percent) of speed-related roadway fatalities and serious injuries occur in rural areas.
- When compared in three-year averages, serious injuries decreased by 14 percent, while fatalities increased by 14 percent.
- Speeding was involved in a third (30 percent) of all crashes, but accounted for nearly half of all serious injuries (48 percent) and fatalities (42 percent).

GOAL

To achieve a targeted reduction in speed-related traffic fatalities and serious injuries on all public roads in the CAG Region.

PERFORMANCE MEASURES

- *Number of speed-related fatalities*
- *Number of speed-related serious injuries*

STRATEGIES

- *Increase highly visible and effective enforcement to reduce the frequency of crashes associated with speeding and aggressive driving.*
- *Use engineering design to reduce speeds.*
- *Use crash-related data to target enforcement and public information campaigns.*

OCCUPANT PROTECTION

Definition

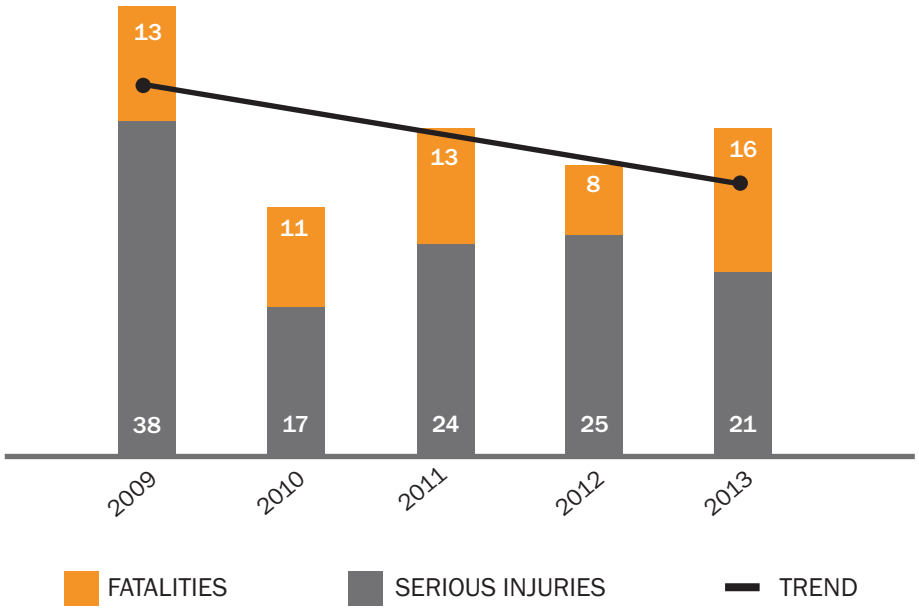
An unrestrained crash is a crash that involves a driver or passenger that was not wearing any type of safety device (as documented in the crash report).

Problem Overview

Seat belts are very effective at reducing the likelihood of injury or death in the event of a crash. Tremendous progress has been made in seat belt use, but failure to use restraints continues to be a significant contributor to fatalities and serious injuries. Overall, it appears that unrestrained occupant fatal and serious injuries is declining in the CAG Region, but progress has stalled in the last few years.

FIGURE 12

Fatalities and Serious Injuries from Unrestrained Crashes (2009-2013)

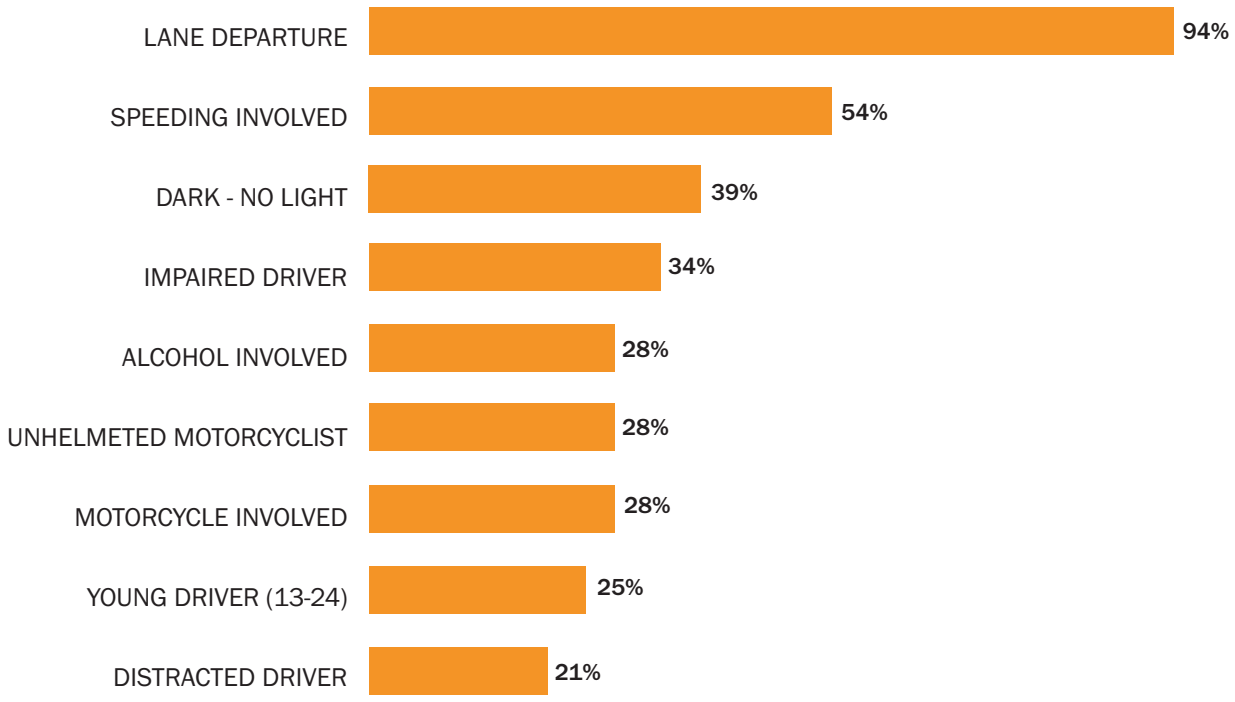


Crash Characteristics and Contributing Factors for Unrestrained Occupant Crashes

Almost all unrestrained fatal and serious injuries (94 percent) result from lane departure crashes. Speeding also contributes to over half (54 percent), while impaired driving contributes to around one-third (34 percent). A high proportion (39 percent) of unrestrained fatal and serious injuries occur on dark, unlit roads.

FIGURE 13

Fatalities and Serious Injuries from Unrestrained Crashes by Top Behavioral and Environmental Risk Factors



Key Facts (Unrestrained Occupant Crashes)

- A majority (89 percent) of fatalities and serious injuries from unrestrained crashes occur in rural areas.
- When compared using three-year averages, the share of fatalities from unrestrained crashes has remained the same, but the number of fatalities in 2013 was highest in the five-year period from 2009-2013.
- The rate of people killed or seriously injured in unrestrained crashes is more than three times the rate of people killed or seriously injured in all crashes.
- Unrestrained crashes account for half (49 percent) of the people killed in all crashes.

GOAL

To achieve a targeted reduction in unrestrained occupant traffic fatalities and serious injuries on all public roads in the CAG Region.

PERFORMANCE MEASURES

- *Number of unrestrained occupant fatalities*
- *Number of unrestrained occupant serious injuries*

STRATEGIES

- *Couple enhanced enforcement of existing restraint-use laws with high-visibility marketing about enforcement efforts.*
- *Strengthen outreach and education about the proper use of seat belts and child-restraint devices to identified target audiences.*
- *Strengthen driver education and safety-restraint-usage outreach to identified target audiences.*

YOUNG DRIVERS

Definition

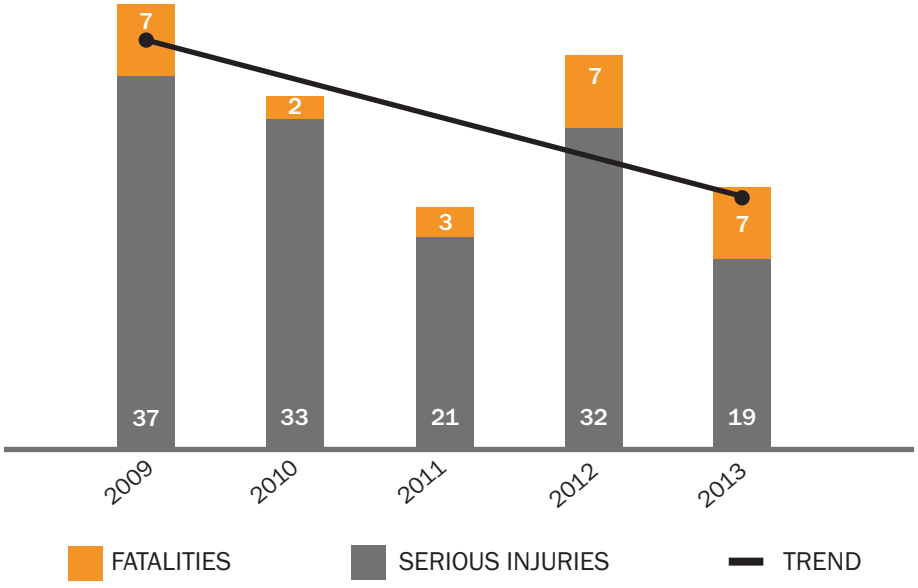
A young driver crash is a crash in which one or more drivers age 24 or younger are involved (as documented in the crash report).

Problem Overview

Fatalities and serious injuries involving a young driver (age 13-24) account for almost 30 percent of the region's total. Young drivers often lack the experience to process the complex set of information that is required to drive safely, and may also be more likely to undertake risky behaviors. Young driver fatalities and serious injuries in the CAG Region have decreased since 2009, but fatalities remained at seven per year in 2012 and 2013.

FIGURE 14

Fatalities and Serious Injuries from Young Driver Crashes (2009-2013)

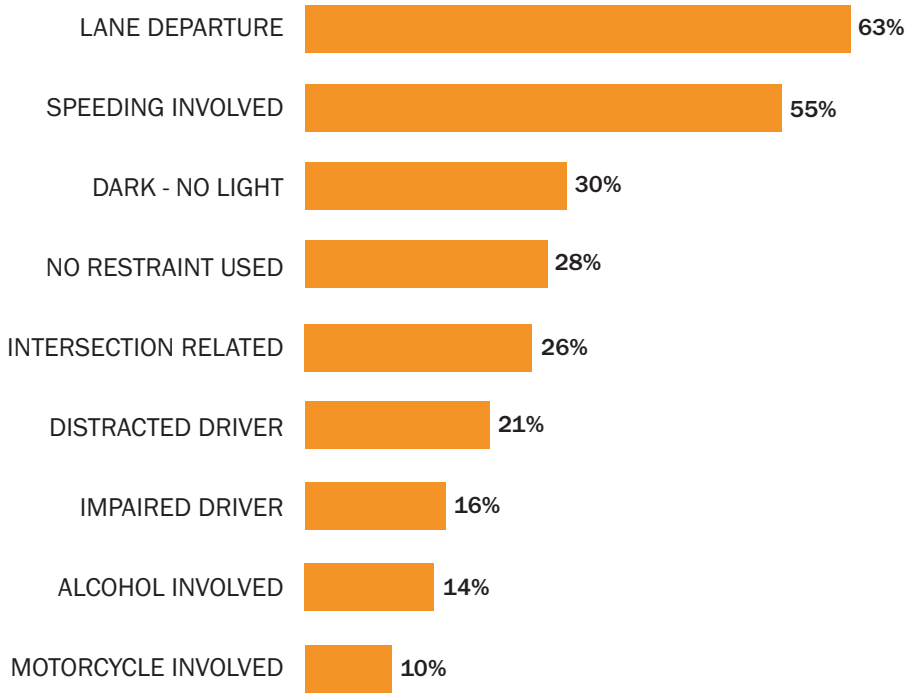


Crash Characteristics and Contributing Factors for Young Driver Crashes

Lane departure crashes account for 63 percent of young driver fatalities and serious injuries; however, this is lower than the regional total (69 percent). Speeding, on the other hand, accounts for 55 percent of young driver fatalities and serious injuries, compared to 47 percent of the region's total. It is encouraging to note that only 28 percent of young driver fatal and serious injuries involved a failure to use restraints, compared to 41 percent for the entire region. Similarly, 16 percent involved an impaired driver, compared to 21 percent for the region.

FIGURE 15

Fatalities and Serious Injuries from Young Driver Crashes by Top Behavioral and Environmental Risk Factors



Key Facts (Young Driver Crashes)

- Over 3/4 of young driver crashes resulting in fatalities or serious injuries occurred in rural areas.
- For every 100 people involved in a young driver crash, around 13 people are either killed or seriously injured.
- People involved in young driver crashes make up a quarter (25 percent) of all people involved in crashes, a third (31 percent) of all people seriously injured, and a fifth (21 percent) of all people killed.

GOAL

To achieve a targeted reduction in young driver traffic fatalities and serious injuries on all public roads in the CAG Region.

PERFORMANCE MEASURES

- *Number of young driver fatalities*
- *Number of young driver serious injuries*

STRATEGIES

- *Strengthen driver education.*
- *Strengthen provisions and policies for graduated driver license (GDL).*
- *Strengthen driver license testing (written and road tests).*
- *Enhance outreach campaigns to young drivers and their families about safe driving behavior and programs.*
- *Promote technology monitoring young driver behavior.*
- *Use or share data to address areas with a prevalence for young driver crashes.*

IMPAIRED DRIVING

Definition

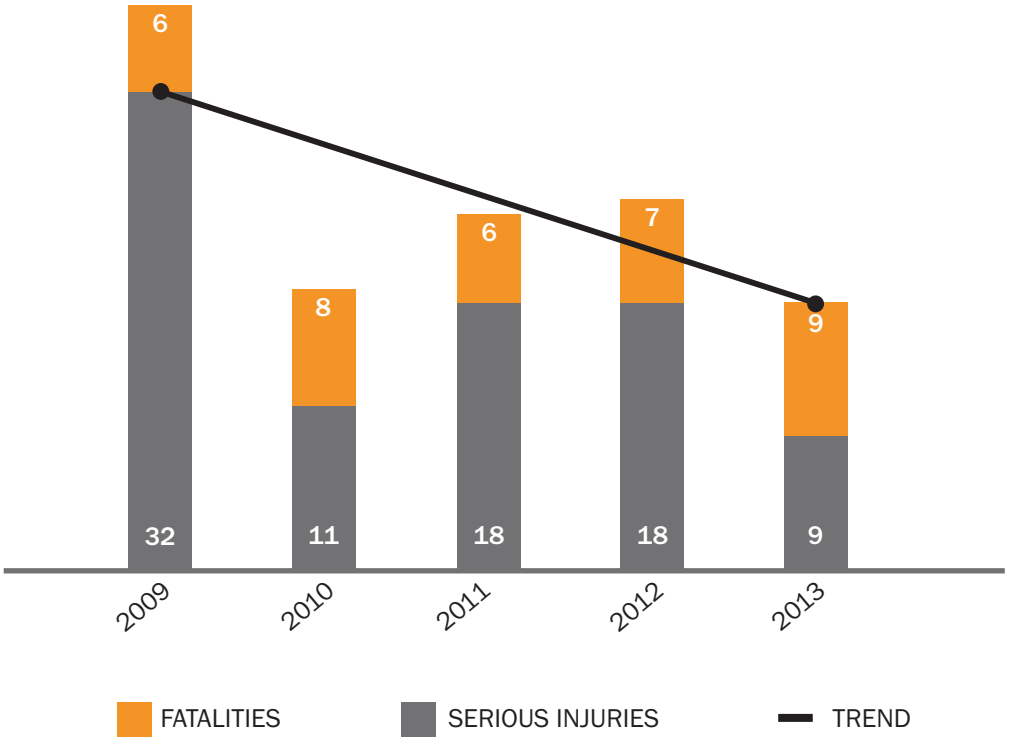
An impaired driving crash is a crash that involves a driver who was affected by alcohol, drugs, or medication (as documented in the crash report).

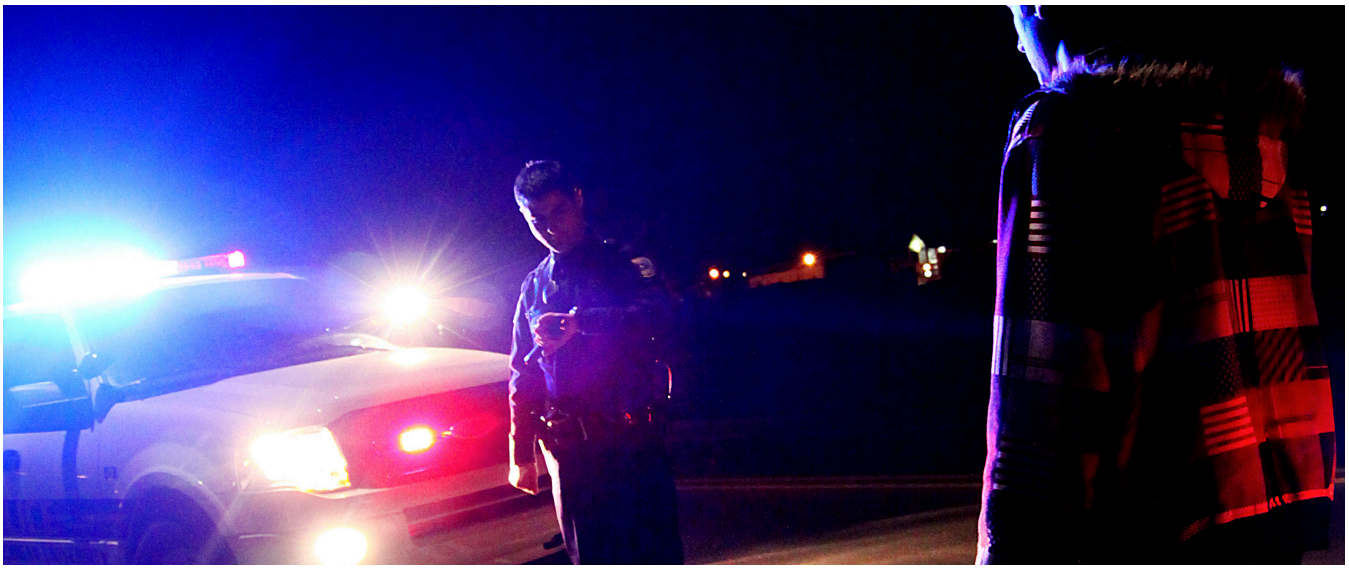
Problem Overview

Impaired drivers were responsible for 21 percent of fatal and serious injuries region-wide from 2009 to 2013. Serious injuries have declined substantially during that time frame, but fatalities have remained consistent, with around six to nine per year (Figure 16).

FIGURE 16

Fatalities and Serious Injuries from Impaired Driving Crashes (2009-2013)



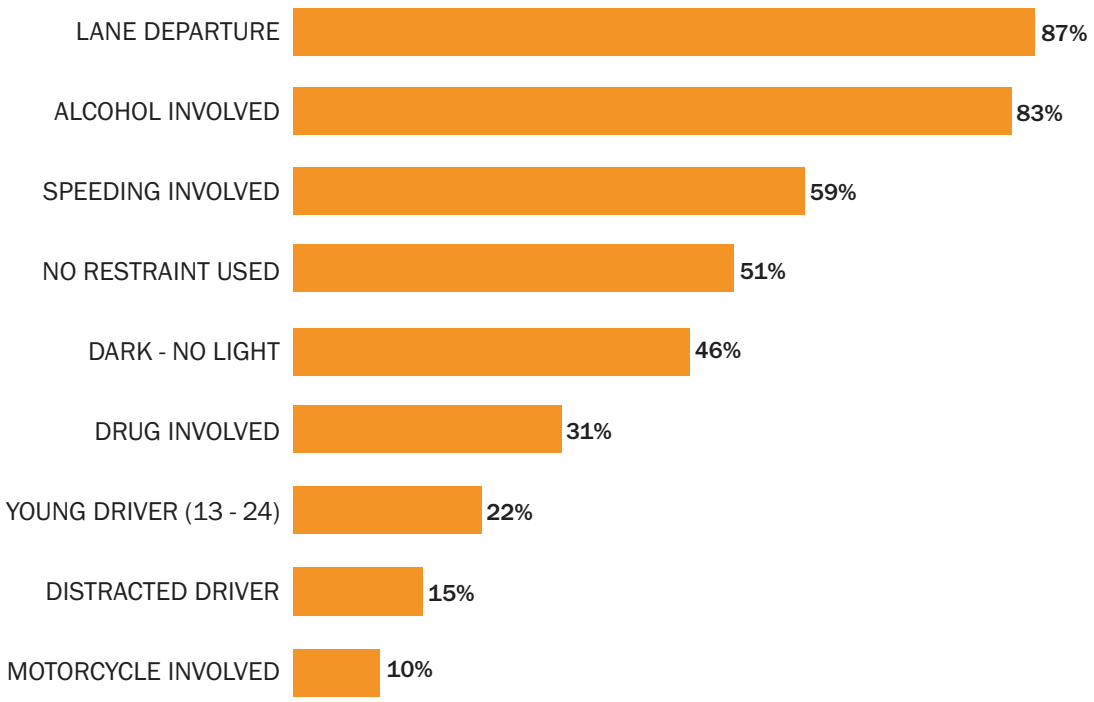


Crash Characteristics and Contributing Factors for Impaired Driving Crashes

Among impaired driving fatalities and serious injuries, 87 percent involved the vehicle leaving the roadway. Alcohol was involved in 83 percent of injuries, and drugs were involved in 31 percent. Speeding and lack of restraint use were also significant factors, accounting for 59 percent and 51 percent of impaired driving fatalities and serious injuries.

FIGURE 17

Fatalities and Serious Injuries from Impaired Driving Crashes by Top Behavioral and Environmental Risk Factors



Key Facts (Impaired Driving Crashes)

- The rate of people killed or seriously injured from impaired driving crashes is nearly three times the rate of people killed or seriously injured in all crashes.
- While impaired driving crashes account for only 8 percent of all crashes, they account for nearly a third of all fatalities.
- A majority (88 percent) of crashes involving impaired drivers occur in rural areas.
- While the number of people seriously injured from impaired driving crashes has decreased by 26 percent, the number of people killed from impaired driving crashes has increased by 10 percent.

GOAL

To achieve a targeted reduction in impaired driving traffic fatalities and serious injuries on all public roads in the CAG Region.

PERFORMANCE MEASURES

- *Number of impaired driving fatalities*
- *Number of impaired driving serious injuries*

STRATEGIES

- *Conduct high-visibility impaired driving enforcement initiatives.*
- *Increase educational efforts for everyone about the dangers and consequences of driving impaired.*
- *Work with the court system to promote policies and practices that result in the imposition of meaningful penalties for impaired driving convictions.*
- *Partner with employers to suggest policies and procedures aimed at reducing impaired driving by their employees.*
- *Improve public awareness of and access to alternate forms of transportation (i.e. transit, taxicabs).*
- *Improve data collection to understand and address impaired driving more effectively.*

MOTORCYCLES

Definition

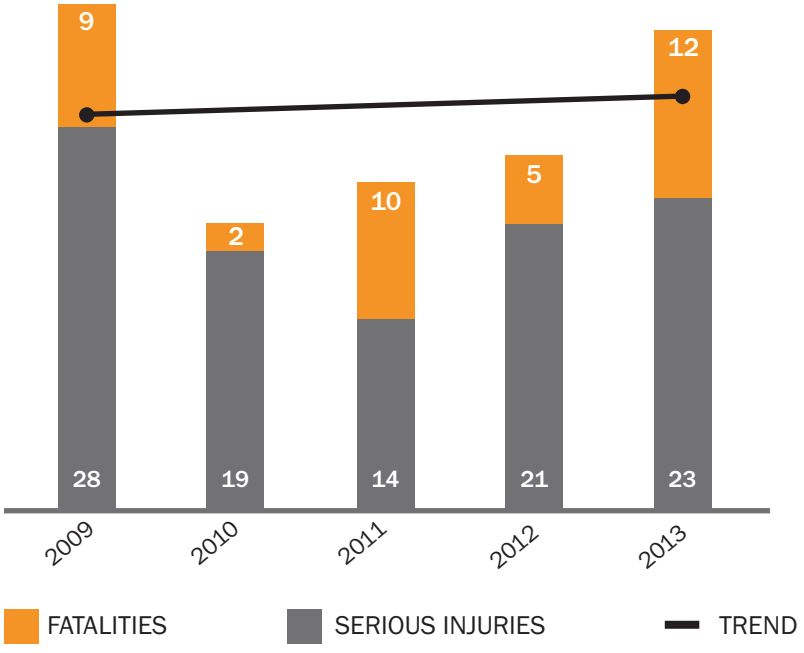
A motorcycle crash is a crash that involves one or more motorcyclists (as documented in the crash report).

Problem Overview

Crashes involving motorcyclists account for around 25 percent of fatal and serious injuries in the CAG Region. Unlike most of the other emphasis areas, motorcycle fatalities and serious injuries have increased since 2009 (Figure 18). Motorcycle crashes are among the most severe types of crashes due to the lack of protection and potentially high speeds.

FIGURE 18

Fatalities and Serious Injuries from Motorcycle Crashes (2009-2013)

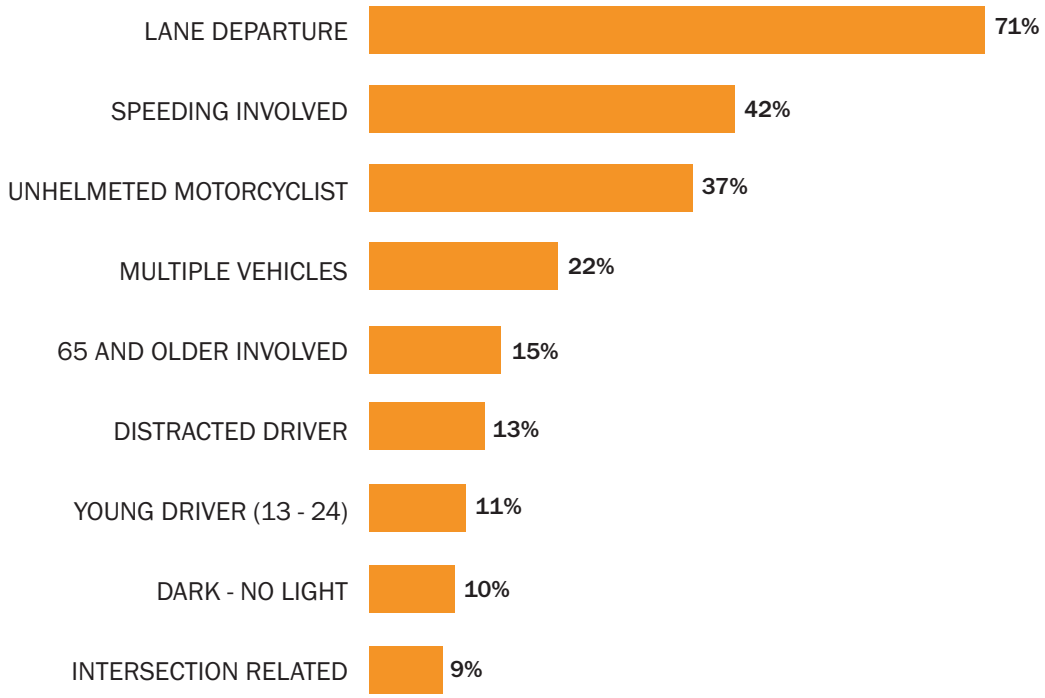


CRASH CHARACTERISTICS AND CONTRIBUTING FACTORS FOR MOTORCYCLE CRASHES

Similar to the regional total, lane departure accounts for around 71 percent of motorcycle fatalities and serious injuries. Speeding and failure to wear helmets each contribute a significant portion (42 and 37 percent, respectively).

FIGURE 19

Fatalities and Serious Injuries from Lane Departure Crashes by Top Behavioral and Environmental Risk Factors



Key Facts (Motorcycle Crashes)

- A majority (88 percent) of motorcycle fatalities and serious injuries occur in rural areas.
- Serious injuries during motorcycle crashes have decreased minimally compared to the rates of all other crash types.
- The rate of people seriously injured or killed from motorcycle crashes was more than four times greater than the rate of people seriously injured or killed in all crashes.
- While motorcycle crashes only accounted for 6 percent of all crashes, they accounted for almost a quarter (23 percent) of all serious injuries and nearly a third (31 percent) of all fatalities.

GOAL

To achieve a targeted reduction in motorcycle traffic fatalities and serious injuries on all public roads in the CAG Region.

PERFORMANCE MEASURES

- *Number of motorcycle fatalities*
- *Number of motorcycle serious injuries*

STRATEGIES

- *Improve public awareness, education and training for motorcyclists, motorists and all safety stakeholders to promote safer driving behaviors.*
- *Enhance rider training programs to improve motorcycle safety.*
- *Improve infrastructure features to help reduce the number and severity of motorcycle crashes.*

SAFETY PROJECT IDENTIFICATION

Using the results of a network screening crash analysis, a large number of intersection and segment locations in the CAG Region were identified for infrastructure improvements. These locations were prioritized based on a set of performance metrics and further narrowed to ten locations (six intersections and four segments) with the most potential for safety improvements. Field investigations were conducted at each location to identify low-, medium-, and high-cost countermeasure solutions. A benefit-cost analysis was used at each location to determine the best solutions for HSIP funding. This section outlines the approach and outcomes from the network screening analysis, prioritization process, field investigations, and benefit-cost analysis.

NETWORK SCREENING ANALYSIS

Network screening is a process for reviewing a transportation network to identify and rank sites from most likely to least likely to realize a reduction in crash frequency or severity following implementation of a countermeasure. *Technical Memorandum #2 – Network Screening Results* documents the entirety of the network screening process including data used, screening approach, and the complete list of screened intersections (55), segments (20), and bicycle and pedestrian (40) locations. The following summarizes the network screening approach for each type of location and the top results.

Intersections – Approach and Results

To identify intersections with the greatest potential for safety improvements, crashes from 2009 to 2013 were first associated with the nearest intersection through a spatial analysis process. Crashes which occurred within 250 feet on an intersection were identified as "intersection crashes." Intersections with more than five total crashes over the five-year analysis period (i.e., more than one per year on average) were selected for further study. Using these criteria, 55 intersections were chosen for evaluation.

For each of the 55 candidate intersections, the following performance measures were then calculated:[1]

- **Crash Frequency:** The average number of crashes occurring at a particular intersection in a one-year period.
- **Equivalent Property Damage Only:** The average number of equivalent property damage only (EPDO) crashes occurring at a particular intersection in a one-year period. The EPDO measure is calculated by applying a weighting factor to each crash according to its severity, and then summing the weighted crash frequency.
- **Crash Rate:** The number of crashes that occur at a given intersection during a certain time period in relation to exposure (the number of vehicles entering the intersection).

Once the performance measures were calculated, the candidate intersections were ranked separately for each measure. The rankings for each performance measure were then summed to develop a composite score for each intersection, which was then sorted to develop the final ranking. Table 1 and Figure 20 show the top ten intersections with potential for safety improvement based on this methodology.

TABLE 1

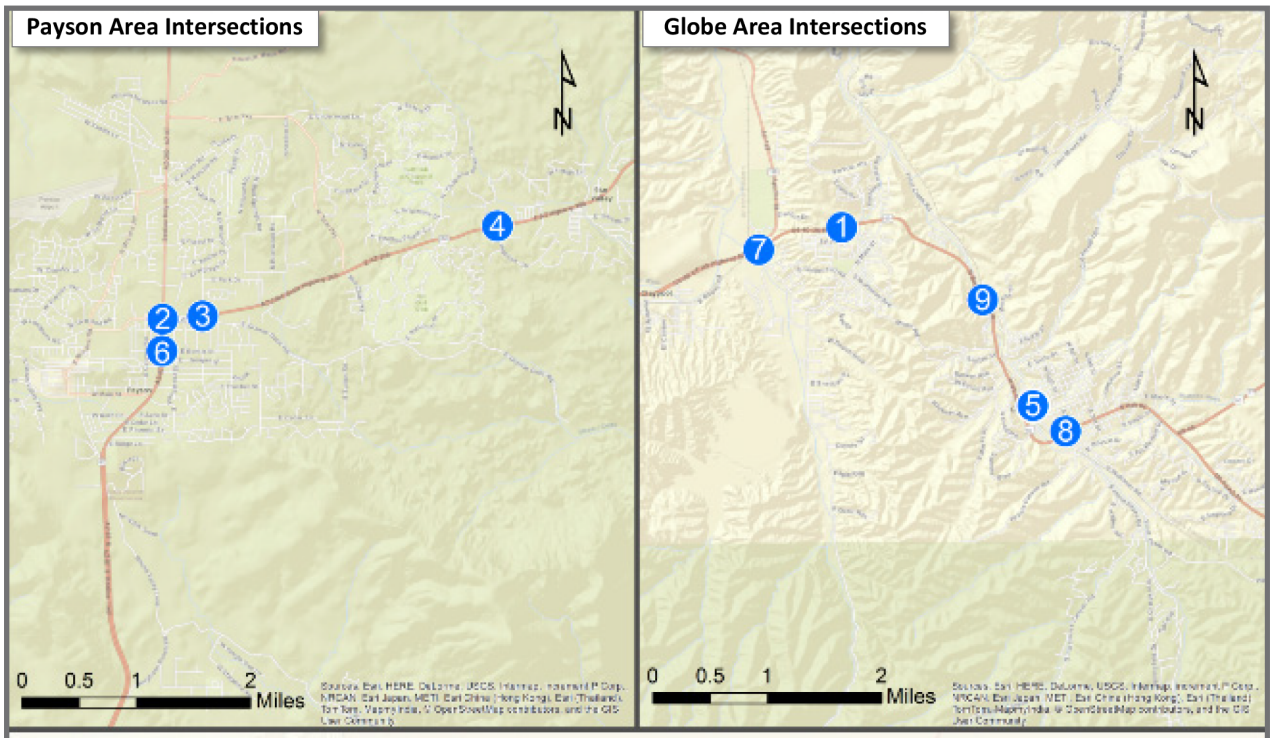
Intersection Screening Results (Final Ranking)

Final Rank	Intersection	Traffic Control	Frequency Rank	EPDO Rank	Crash Rate Rank	Composite Score
1	U.S. 60 at Radanovich Boulevard at Globe Food Mart access road	Signal	4	2	5	11
2	SR 87/Beeline Highway at Longhorn Road at U.S. 260	Signal	1	9	2	12
3	SR 260 at Manzanita Drive at Granite Dells Road	Signal	4	12	7	23
4	SR 260 at Valley Road at Highline Drive	Stop Sign	11	7	6	24
5	Broad Street at Oak Street	Stop Sign	7	16	1	24
6	SR 87/Beeline Highway at Bonita Street	Signal	2	10	14	26
7	SR 188/Apache Trail at U.S. 60 at Russell Road	Signal	7	8	15	30
8	U.S. 60/Ash Street at Hill Street	Signal	6	15	11	32
9	U.S. 60 at Escudilla Drive at Main Street	Signal	3	26	4	33
10	SR 347/John Wayne Parkway at Papago Road	Stop Sign	14	3	24	41

[1] *See AASHTO Highway Safety Manual for more information on these performance measures.*

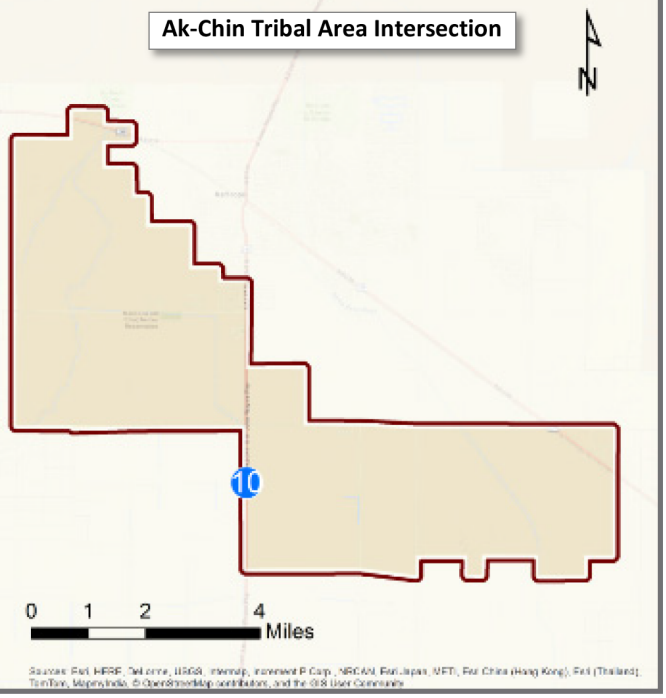
FIGURE 20

Top 10 Intersections with Potential for Safety Improvement



Top 10 Intersections

Rank	Intersection Name
1	U.S. 60 at Radanovich Boulevard at Globe Food Mart access road
2	SR 87/Beeline Highway at Longhorn Road at U.S. 260
3	SR 260 at Manzanita Drive at Granite Dells Road
4	SR 260 at Valley Road at Highline Drive
5	Broad Street at Oak Street
6	SR 87/Beeline Highway at Bonita Street
7	SR 188/Apache Trail at U.S. 60 at Russell Road
8	U.S. 60/Ash Street at Hill Street
9	U.S. 60 at Escudilla Drive at Main Street
10	SR 347/John Wayne Parkway at Papago Road



Segments – Approach and Results

To conduct roadway segment analysis, crashes outside of the 250-foot intersection buffer were associated with the nearest roadway segment from the comprehensive roadway file for the CAG Region. Those within 100 feet of a roadway segment were included in the segment screening process.[2]

Similar to the process for intersections, each segment was evaluated on the basis of several performance measures, including:

- Total crash rate (crashes per million vehicle miles traveled).
- Severe crash density (fatal and serious injury crashes per mile of roadway).
- Severe crash rate (fatal and serious injury crashes per million vehicle-miles traveled).
- Potential for reduction of severe crashes (the number of observed severe crashes minus the anticipated number of severe crashes based on the average severe crash rate for comparable segments).

Once the performance measures were calculated, segments were ranked separately for each measure. Segments within each category were then assigned a score of 1 (low-risk) to 5 (high-risk).[3] Segments with no severe crashes from 2009 through 2013 were automatically placed into the low-risk category. Additionally, segments with only one or two severe crashes were placed into the low-medium risk category. This was necessary to prevent very short segments with only a few severe crashes from being shown as high-risk segments on the basis of crash density and rate. The remaining segments (those with more than two severe crashes from 2009 to 2013) accounted for roughly 15 percent of the roadway mileage in the CAG Region. These segments were divided into medium, medium-high, and high-risk categories for each performance measure, such that each category accounted for roughly 5 percent of the total roadway mileage.

After the segments were categorized for each performance measure, a composite score was developed by summing the individual performance measure scores for each segment and ranking the segments based on this composite score. Segments were again divided into medium, medium-high, and high-risk categories based on the composite score, with each accounting for roughly five percent of the total roadway mileage.

[2] *A 100 foot buffer was chosen to allow for minor misalignment of crashes and roadways). Ninety-two percent of segment crashes were matched within 10 feet of a segment.*

[3] *This categorization scheme is based on the risk mapping process developed in the usRAP Pilot Project, Phase 2 report, with some modifications. Harwood et al. 2008. usRAP Pilot Program Phase II Report. https://www.aaafoundation.org/sites/default/files/usRAPPhaseIIReport.pdf.*

Table 2 and Figure 21 show the top 10 segments with potential for safety improvement based on this methodology.

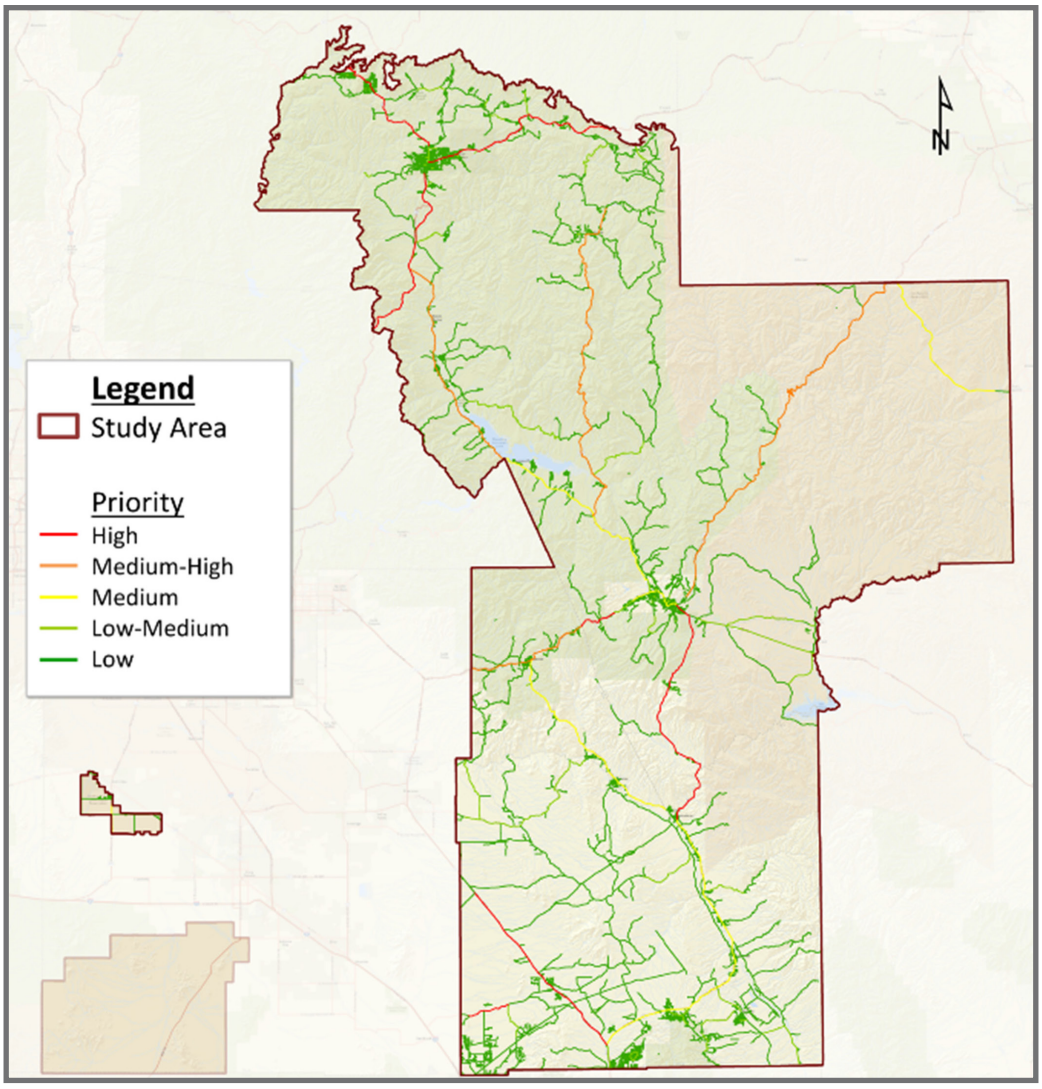
TABLE 2

Segment Screening Results (Final Ranking)

Road	Start	End	Miles	Functional Class	Total	Fatal	Serious Injury	Minor Injury	Possible Injury	PDO
SR 87	Gila/ Maricopa CB	Indian Rd	26	Rural Principal Other	502	11	27	77	45	342
SR 87	0.11 mi S of Private Dr	Strawberry Dr	16	Rural Minor Arterial	214	8	11	27	26	142
SR 77	Gila/Pinal CB	U.S. 70	33	Rural Minor Arterial	122	5	10	19	10	78
SR 260	Tonto NF	Coconino/ Gila CB	16	Rural Principal Other	360	5	12	35	27	281
SR 79	SR 77	Deep Well Ranch Rd	27	Rural Minor Arterial	157	4	19	19	13	102
U.S. 60	Gila/Pinal CB	Globe UB	5	Rural Principal Other	91	1	7	16	6	61
SR 87	Strawberry Dr	Coconino/ Gila CB	2	Rural Major Collector	32	1	3	7	7	14
11 Park Link Dr	Lacerta Ln	Owl Head Ranch Rd	6	Rural Major Collector	13	1	2	3	1	6
U.S. 70	U.S. 60	SR 77	2	Urban Principal Other	30	1	3	5	7	14
SR 87	SR 87	Tonto NF	1	Urban Principal Other	66	0	4	8	4	50

FIGURE 21

Segments for Safety Improvements



Source: CAG, Arizona DOT, Cambridge Systematics, Inc., Esri.

Pedestrian and Bicycle – Approach and Results

Pedestrian and bicycle crash locations were screened on the basis of total crashes from 2004 to 2013. More years of data were used due to the lower number of pedestrian and bicycle-related crashes. Similar to the intersection screening process, crashes involving one or more nonmotorists were assigned to the nearest intersection, within a 250 foot buffer. The pedestrian and bicycle crash location summary is shown in Table 3.

TABLE 3

Pedestrian and Bicycle Crash Locations (2004-2013)

Intersection	Total Crashes	Fatal Crashes	Serious Injury Crashes	Minor Injury Crashes	Possible Inquiry Crashes	PDO Crashes
SR 87/Beeline Highway at Bonita Street	9	0	1	3	4	1
SR 87/Beeline Highway at Longhorn Road at U.S. Highway 260	6	0	1	3	0	2
SR 260 at Forest Drive	4	0	0	3	1	0
S Broad Street at E Sycamore Street	4	0	2	2	0	0
SR 260 at Zurich Drive	3	0	0	0	3	0
W American Avenue at N RockCliff Boulevard	3	0	0	1	1	1
U.S. 60 at East Street	3	0	1	1	1	0
SR 87/Beeline Highway at Phoenix Street	3	0	1	1	1	0
U.S. 60 at Radanovich Boulevard at Globe Food Mart Access Road	3	1	1	0	1	0
U.S. 60/Ash Street at Hackey Avenue at Willow Street	3	2	1	0	0	0

SITES SELECTED FOR FIELD INVESTIGATION AND POTENTIAL IMPROVEMENTS

Intersections

The intersections chosen for further study are based on their overall ranking in the intersection network screening process, their ranking in the bicycle and pedestrian network screening, complimentary projects in the CAG Transportation Improvement Program, and input from the CAG Multidisciplinary Safety Committee on local safety issues and needs. The intersections in Table 4 were studied further with a field investigation.

TABLE 4

Intersection Priority List

Final Rank	Intersection	Traffic Control
1	U.S. 60 at Radanovich Boulevard at Globe Food Mart access road	Signal
2	SR 87/Beeline Highway at Longhorn Road at U.S. 260	Signal
3	SR 260 at Manzanita Drive at Granite Dells Road	Signal
4	SR 260 at Valley Road at Highline Drive	Stop Sign
5	Broad Street at Oak Street	Stop Sign
6	SR 87/Beeline Highway at Bonita Street	Signal

Segment Ranking

Segments were selected for additional study based on the segment network screening results, the ADOT safety project list, and input from the CAG Multidisciplinary Safety Team. However, because there were several more segments identified than could be studied within the scope of the project, the priorities were narrowed to include only those on rural minor arterials and rural principal (other) roadways. These functional classes offer the greatest potential for safety improvements across the entire network because they account for almost 60 percent of severe crashes in the region but only 10 percent of the roadway mileage. Focusing the field investigations on these functional classes revealed opportunities to develop systemic safety improvements to address a high number of crashes throughout the network.[4] Table 5 shows the segments selected for further investigation.

[4] *Two segments, originally identified as top ten priorities, are currently being studied by ADOT, so they were not included in the field investigations.*

TABLE 5

Segment Priority List

Final Rank	Road	Start	End	Miles	Functional Class
1	SR 87	Gila/Maricopa County Boundary	Indian Road	26	Rural Principal Other
3	SR 77	Gila/Pinal County Boundary	U.S. 70	33	Rural Minor Arterial
5	SR 79	SR 77	Deep Well Ranch Road	27	Rural Minor Arterial
7	U.S. 60	Gila/Pinal County Boundary	Globe Urban Boundary	5	Rural Principal Other

Additional information on the prioritization process can be found in the *Technical Memorandum: Intersection and Segment Priorities.*

FIELD INVESTIGATIONS

Field investigations were conducted at each of the study sites. In visiting each site, the field review team captured information on:

- Site characteristics – description of physical transportation attributes at the site;
- Crash characteristics – description of crash severity, first harmful event, and collision manner; and
- Low-, moderate-, high-cost recommendations – a listing of possible countermeasures to be implemented at each site.

The above information is briefly summarized below for each location, but detailed data can be found in the Safety Review Memorandum which also includes a crash map, crash diagram, and further crash characteristics for each site.

Intersection 1: U.S. 60 at Radanovich at Globe Food Mart

Located in Globe, Arizona the intersection of U.S. 60/Radanovich at Globe Food Mart was ranked first according to the intersection network screening.

FIGURE 22

U.S. 60 at Radanovich Boulevard Location Map

Intersection characteristics include:

- U.S. 60 has two through lanes and a left-turn lane in each direction; there also is a westbound right-turn only lane at the intersection.
- The traffic signal is permitted phasing for all approaches, the signal heads have backplates, and there is video detection.
- Overhead lighting is present.
- There are crosswalks, nondirectional ramps, pedestrian countdown heads, and pedestrian buttons. Only the sidewalks on the south side and northwest quadrant provide connectivity beyond the intersection area.

Of the 27 total crashes, one was fatal (a pedestrian) and two were serious injuries. The most common crash type was a rear end collision. Crashes at this intersection occurred primarily during daylight hours, but approximately 15 percent were during dusk and 15 percent during dark-lighted conditions.

Details of optional treatments to address these issues are provided in the *Safety Review Memorandum*. Table 6 shows the cost, benefit/cost ratio (calculated according to ADOT methods), where applicable the Crash Modification Factor associated with each treatment, and recommended improvements.

TABLE 6

Cost Benefit/Cost Ratio for Intersection 1

Treatment #	Total Cost	B/C	CMF	Notes
1. Restripe Intersection	**$14,940.00**	**N/A**	**N/A**	**Standard**
2. Add Reflective Tape to Backplates	**$1,725.00**	**143.6**	**0.97**	**N/A**
3. Initiate a Pedestrian Lead Time	**$100.00**	**3895.2**	**0.63**	**N/A**
4. Install Flashing Yellow Arrow	$4,000.00	0	0.89	B/C is 0 as there are no fatal/serious injury crashes related but it was included as there were PDO crashes that could be mitigated by this countermeasure.
5. Protected Left-Turn Phasing	$4,000.00	0	0.94	B/C is 0 as there are no fatal/serious injury crashes related but it was included as there were PDO crashes that could be mitigated by this countermeasure.
6. Add Detectable Warnings	Included in Ramps	N/A	N/A	ADA, included in price of ramps.
7. Remove Trip hazard-Asphalt Next to Gutter Lip	$80.00	N/A	N/A	ADA
8. Sidewalk Repair and Extension	**$2,831.42**	**N/A**	**N/A**	**ADA**
9. Update Pedestrian Push Buttons	**$8,320.00**	**N/A**	**N/A**	**ADA**
10. Install Directional Pedestrian Ramps	**$2,500.00**	**N/A**	**N/A**	**ADA**
11. Install Pedestrian Lighting	$55,580.00	118.7	0.41	N/A
Recommendation: 1, 2, 3, 8, 9, 10*	$27,585.00	176.4	0.61	N/A

**Calculated combined CMF using treatments 2 and 3.*

Intersection 2: State Route 87/Beeline Highway and State Route 260/Longhorn Road

The intersection of State Route 87/Beeline Highway and State Route 260/Longhorn Road is in Payson. Major intersection characteristics include:

- Left-turn lanes and left-turn signal phasing at all approaches to the intersection.
- A northbound right-turn lane and signal.
- Medians at all four approaches, to control access in the vicinity of the intersection.
- Crosswalks, ramps, countdown pedestrian signal heads, and pedestrian push buttons.
- No bicycle facilities at the intersection or along the roadways leading to the intersection.

FIGURE 23

SR 87 and SR 260 Location Map

There were 78 crashes at this intersection in the study period; only one was classified as serious injury, which also involved a pedestrian. The intersection experiences 43 percent of its crashes during dark-unknown lighting conditions. There were four crashes involving pedestrians and pedalcyclists. The most common collision manner, is rear-end and the second most common is sideswipe (same direction), followed by left turn.

Details of optional treatments to address these issues are provided in the *Safety Review Memorandum*. Table 7 shows the cost, benefit/cost ratio (calculated according to ADOT methods), where applicable the Crash Modification Factor associated with each treatment, and recommended improvements.

TABLE 7

Cost Benefit/Cost Ratio for Intersection 2

Treatment #	Total Cost	B/C	CMF	Notes
1. Restripe Crosswalks	**$13,644.00**	**8.4**	**0.63**	**ADA**
2. Update Signing	**$3,120.00**	**21.2**	**0.85**	**Change signs to be MUTCD compliant.**
3. Add Reflective Tape to Backplates	**$1,725.00**	**8.7**	**0.97**	**N/A**
4. Trim Trees/Bushes	**$2,000.00**	**192.3**	**0.27**	**N/A**
5. Update Pedestrian Signing	$240.00	N/A	N/A	MUTCD Compliance.
6. Provide Dashed Striping for left turns.	$2,520.00	N/A	N/A	Standard.
7. Add a leading pedestrian interval to signal phasing	**$100.00**	**268.6**	**0.63**	**N/A**
8. Update Pedestrian Facilities	$9,360.00	N/A	N/A	ADA
9. Check Overhead Lighting Levels	$1,000.00	N/A	N/A	If overhead lighting levels found to be insufficient, installing appropriate lighting may help to reduce crashes.
10. Provide Pedestrian Lighting	$55,580.00	8.1	0.41	N/A
11. Extend Raised Median on South Leg and Channelized left to Del Taco	$3,787.88	64.2	0.61	N/A
Recommendation: 1, 2, 3, 4, 7*	$20,589.00	79.5	0.22	

**Calculated combined CMF using treatments 1 and 7.*

Intersection 3: State Route 260 and Manzanita/Granite Dells Road

State Route 260 and Manzanita/Granite Dells Road also is in Payson. Major intersection characteristics include:

- A left-turn lane at all four approaches with permissive left-turn phasing at the north-south approach and protected-permissive phasing for SR 260.
- A separate westbound right-turn lane; with through-right turn movements at all other approaches.
- Crosswalks and ramps on all four quadrants, and pedestrian countdown heads.
- The northbound approach comes in off of a curve leading to a slight skew and the thru lane does not line up with the receiving lane. The skewed intersection angle also makes driver interpretation of vehicle speeds and distances more difficult.
- On Manzanita Drive the entrance to the supermarket is within 40 feet of the intersection.

FIGURE 24

SR 260 and Manzanita Location Map

There were 27 total crashes at this intersection, two were classified as serious injury. All but one crash occurred during daylight hours, but four crashes occurred during inclement weather. The most common collision manner is left turn and rear end, followed by angle.

Details of optional treatments to address these issues are provided in the *Safety Review Memorandum*. Table 8 shows the cost, benefit/cost ratio (calculated according to ADOT methods), where applicable the Crash Modification Factor associated with each treatment, and recommended improvements.

TABLE 8

Cost Benefit/Cost Ratio for Intersection 3

Treatment #	Total Cost	B/C	CMF	Notes
1. Restripe Intersection Crosswalks	**$12,600.00**	**N/A**	**N/A**	**Standard practice indicates that crosswalks should be visible for road users.**
2. Add Reflective Tape to Backplates	**$1,725.00**	**17.4**	**0.97**	**N/A**
3. Add Leading Pedestrian Interval to Signal Phasing	$100.00	0	0.63	B/C is 0 due to no fatal/serious injury crashes occurring at this intersection but lesser severity crashes mitigated by this countermeasure did occur.
4. Cut Back Vegetation	$3,000.00	34.9	0.27	N/A
5. Fix Sidewalk Edge Drop Off	$158.40	N/A	N/A	ADA
6. Update Pedestrian Facilities (Total)	$20,820.00	N/A	N/A	ADA
Update Pedestrian Facilities-Ped Buttons and Heads	$8,320.00	N/A	N/A	ADA
Update Pedestrian Facilities-Ped Ramps	$12,500.00	N/A	N/A	ADA
7. Install Flashing Yellow Arrows (3 section)	**$2,000.00**	**28.9**	**0.89**	**N/A**
8. Install Protected/Permissive Phasing (4 section)	**$2,000.00**	**42.1**	**0.84**	**N/A**
9. Install Protected Only Left Turn Phasing	$4,000.00	9.4	0.94	N/A
10. Provide Pedestrian Lighting	$55,580.00	0	0.41	B/C is 0 due to no fatal/serious injury crashes occurring at this intersection but lesser severity crashes mitigated by this countermeasure did occur.
11. Install Red Light Running Cameras	$119,200.00	1.5	0.76	N/A
12. Connect Sidewalk	$1,267.80	N/A	N/A	ADA

Treatment #	Total Cost	B/C	CMF	Notes
13. Move Grocery Store Driveway	$375,000.00	N/A	N/A	Removing driveways from a signals functional area allows for fewer conflict points near the intersection. It is common practice to limit those driveways within the functional areas so as to increase the safety.
14. Realign SR 260 Roadway	$750,000.00	N/A	N/A	Standard practice indicates having a true 90 degree intersection is the safest design.
15. Realign Granite Dells Roadway	$375,000.00	N/A	N/A	Standard practice indicates having a true 90 degree intersection is the safest design.
Recommendation: 1, 2, 7, 8*	$18,325.00	22.3	0.73	

**Calculated combined CMF using treatments 2, 7, and 8.*

**See Appendix D for detailed information on benefit cost analysis.*

Intersection 4: SR 260 and Valley Road at Highline Drive

SR 260 and Valley Road at Highline Drive is a two-way stop controlled intersection just east of the Payson city limit. Major intersection characteristics include:

FIGURE 25

SR 260 and Valley Road/Highline Drive

Major intersection characteristics include:

- Offset side streets.
- Horizontal and vertical curves at or near the intersection.
- SR 260 has two lanes in each direction as well as left-turn lanes, to turn onto the side streets.
- There is a cattle gate and fences on Valley Road in advance of the intersection with SR 260.
- Fixed objects near the intersection include guardrail, signs, an embankment, and trees.
- There is a dynamic messaging sign board just east of SR 260 and Highline Drive.
- There are no pedestrian or bicycle facilities and there is no street lighting.

During the study period, there were 18 crashes at the intersection and one was fatal. Thirty-three percent of the crashes occurred during dark, not-lighted conditions, and 6 percent during dark-lighted, conditions. Another 6 percent of the crashes occur during dawn. Only two of the eighteen crashes occurred during inclement weather (caused by sleet/hail). The most common crash type is animal wild-game. The most common collision manner is a single vehicle collision.

Details of optional treatments to address these issues are provided in the *Safety Review Memorandum*. Table 9 shows the cost, benefit/cost ratio (calculated according to ADOT methods), where applicable the Crash Modification Factor associated with each treatment, and recommended improvements.

TABLE 9

Cost Benefit/Cost Ratio for Intersection 4

Treatment #	Total Cost	B/C	CMF	Notes
1. Add Sign Post Delineators	$120.00	N/A	N/A	Found under the FHWA tried and accepted treatment for rural roadways. Currently does not have any CMF associated with it.
2. Increase STOP Sign Size	**$3,360.00**	**N/A**	**N/A**	**Found within the High Risk Rural Roads guidance, FHWA approves and has seen that increasing the STOP sign size increases the safety.**
3. Install Side Road Warning Signs with Distance Plaque	**$480.00**	**67.6**	**0.99**	**N/A**
4. Install Proper Signing for No Thru Road	**$250.00**	**N/A**	**N/A**	**MUTCD Compliance.**
5. Cut Back Vegetation	$2,000.00	192.3	0.27	N/A
6. Modify Cattle Fencing	$150.00	0	N/A	Cattle fencing is currently cut short so there are areas where the cattle could get out. Modifying it so that it covers these gaps will help to reduce the chance of a vehicle – animal collision. Nonfatal and serious injury crashes occurred that were not included in the benefit/ cost analysis.
7. Install Safety Edge	$2,750.00	0	0.769	Nonfatal and serious injury crashes occurred that were not included in the benefit/ cost analysis.
8. Add Intersection Lighting	$55,580.00	0	0.41	Nonfatal and serious injury crashes occurred that were not included in the benefit/ cost analysis.
9. Add Wild Animal Fencing	**$3,600.00**	**N/A**	**N/A**	**See ADOT's results.**
10. Install Transverse rumbles	**$7,200.44**	**299.2**	**0.785**	**N/A**

Treatment #	Total Cost	B/C	CMF	Notes
11. Cut Back Embankment	$2,840.00	1884.8	0.53	N/A
12. Wild Animal Crossings	$2,500,000	N/A	N/A	See ADOT's current findings on wild animal crossings. They have seen a significant reduction in crashes with wild animals.
13. Realign Side Streets	$250,000.00	N/A	N/A	N/A
14. Raise Valley Road	$25,000.00	N/A	N/A	N/A
15. Move or eliminate ditch on south side of SR 260	$1,136.00	4712	0.53	N/A
Recommendation: 2, 3, 4, 9, 10*	$14,890.44	126.5	0.78	

**Calculated combined CMF using treatments 3 and 10.*

Intersection 5: Broad Street and Oak Street

The intersection of Broad Street and Oak Street is a four-way stop controlled intersection in Globe.

FIGURE 26

Broad Street and Oak Street Location Map

Major intersection characteristics include:

- One lane on each approach.
- Parallel parking on Oak Street, and angled parking on Broad Street.
- Bulbouts, crosswalks, stopbars and ramps for pedestrians on all approaches.
- Thirty-six inches in stop signs at all four approaches.
- There is pedestrian and vehicle lighting.
- There are fixed objects near the intersection including a concrete bench on the edge of the northeast curb return, a fire hydrant, trash cans, and decorative trees.

There were 21 crashes at the intersection in the study period. Six of these crashes involved an injury, one of which was a serious injury. The intersection experiences eight percent of crashes during night-time, lighted conditions. The most common collision manner is rear-to-side (33 percent).

Details of optional treatments to address these issues are provided in the *Safety Review Memorandum*. Table 10 shows the cost, benefit/cost ratio (calculated according to ADOT methods), where applicable the Crash Modification Factor associated with each treatment, and recommended improvements.

TABLE 10

Cost Benefit/Cost Ratio for Intersection 5

Treatment #	Total Cost	B/C	CMF	Notes
1a. Parking Spots-Change to Parallel	**$2,167.50**	**21.2**	**0.65**	**N/A**
1b. Parking Spots-Change to Back in	$3,468.00	13.6	0.65	N/A
1c. Eliminate Angled Parking	$1,734.00	26.1	0.65	N/A
2. Provide Retroreflective Marking on Fixed Objects Near Roadway	$250.00	0	N/A	PDO crashes related to fixed objects in the area.
3. Fix Inlet Hole in Southeast Corner	**$500.00**	**N/A**	**N/A**	**ADA Compliance, Trip Hazard.**
4. Restripe Intersection	**$9,792.00**	**N/A**	**N/A**	**Standard practice to restripe intersections as needed.**
5. Update Signing	**$1,092.00**	**45.6**	**0.85**	**Change signs to be MUTCD compliant.**
Recommendation: 1a, 3, 4, 5*	$13,551.50	14.2	0.55	

**Calculated combined CMF using treatments 1a and 5.*

Intersection 6: SR 87 and Bonita

SR 87 and Bonita is a signalized, four-leg intersection in Payson.

FIGURE 27

SR 87 and Bonita Location Map

Major intersection characteristics include:

- Two lanes in each direction with a two-way-left-turn lane on SR 87.
- Protected/permissive signal phasing on SR 87; and permitted signal phasing on the minor street.
- Overhead vehicular lighting in all quadrants except the northwest quadrant.
- North and southbound sidewalks, ramps, countdown pedestrian heads, push buttons, and crosswalks on all legs.
- No bicycle facilities.

There were 40 crashes at the intersection during the study period. The majority of the crashes occurred during daylight hours and during clear weather. There were two pedestrian crashes and one pedalcycle crash. The most common collision manner was rear end, which is expected at an intersection.

Details of optional treatments to address these issues are provided in the *Safety Review Memorandum*. Table 11 shows the cost, benefit/cost ratio (calculated according to ADOT methods), where applicable the Crash Modification Factor associated with each treatment, and recommended improvements.

TABLE 11

Cost Benefit/Cost Ratio for Intersection 6

Treatment #	Total Cost	B/C	CMF	Notes
1. Add Reflective Tape to Backplates	**$1,725.00**	**8.7**	**0.97**	**N/A**
2. Restripe Intersection	**$9,576.00**	**N/A**	**N/A**	**Standard practice to restripe intersection as needed.**
3. Add Detectable Warnings	**Included in ramp cost.**	**N/A**	**N/A**	**ADA, included in ramp updates.**
4. Initiate a Pedestrian Lead Time	**$100.00**	**268.6**	**0.63**	**N/A**
5. Update Pedestrian Push Buttons	**$8,320.00**	**N/A**	**N/A**	**ADA compliance.**
6. Install Directional Pedestrian Ramps	**$7,500.00**	**N/A**	**N/A**	**ADA compliance.**
7a. Access Control - Remove access onto SR 87 for gas stations	$5,600.00	N/A	N/A	HSM/common practice identifies the reduction in access points within intersection influence areas as a way to reduce conflict points and thus crashes.
7b. Access Control - Limit access for gas station	$7,600.00	N/A	N/A	HSM/common practice identifies the reduction in access points within intersection influence areas as a way to reduce conflict points and thus crashes.
8. Reduce width of Driveways	$4,000.00	N/A	N/A	HSM/common practice identifies the reduction in access points within intersection influence areas as a way to reduce conflict points and thus crashes.
9. Eliminate Access on SR 87	$14,280.00	N/A	N/A	HSM/common practice identifies the reduction in access points within intersection influence areas as a way to reduce conflict points and thus crashes.
10. Move Utilities Further from Roadway	$2,000.00	192.3	0.27	N/A

Treatment #	Total Cost	B/C	CMF	Notes
11. Connect Sidewalks	**$464.86**	**N/A**	**N/A**	**ADA compliance as well as intuitive that connecting sidewalks will keep pedestrians off of the roadway and make the area safer for pedestrians.**
12. Pedestrian Adaptive Signal Timing	$100.00	268.6	0.63	N/A
13. Initiate Bicycle Timing and Detection	$100.00	268.6	0.63	Cost varies on existing equipment. May be able to add in detection with existing video/ radar detection.
14. Initiate Passive Pedestrian Detection	$20,000.00	39.2	N/A	N/A
15. Buffered Bike Lane	$54,000.00	N/A	N/A	Safer as it takes bikes out of vehicular traffic.
16. Create Bike/Ped Path	$166,666.67	N/A	N/A	Safer as it takes vulnerable users out of vehicular traffic.
17. Install Pedestrian lighting	$55,580.00	8.1	0.41	N/A
Recommendation: 1, 2, 3, 4, 5 , 6, 11*	$27,685	9.3	0.61	

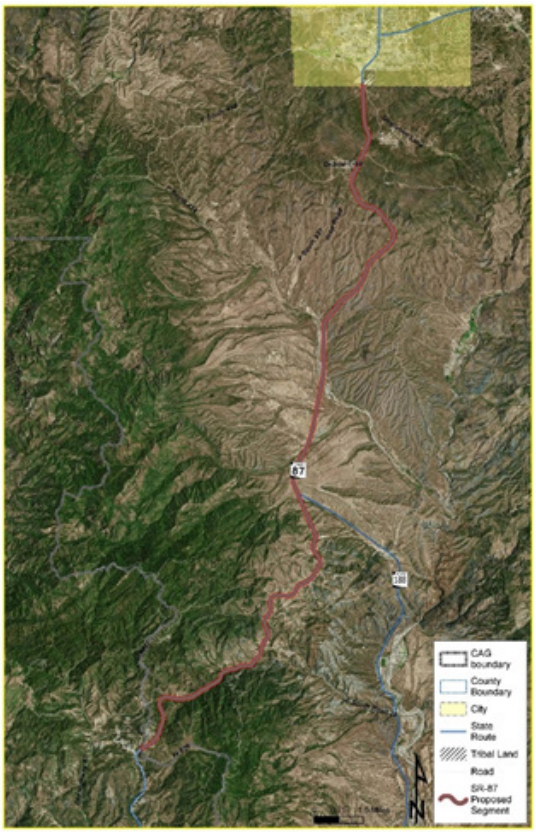
**Combined CMF used treatments 4 and 5.*

Segment 1: SR 87 From Gila/Maricopa County Boundary to Indian Road/Green Valley Parkway

The 33-mile SR 87 begins at the Gila/Maricopa county boundary is a four-lane divided highway with a posted speed limit of 55 mph. Northbound from the county boundary the road has a two-foot shoulder on the left-hand side of the road and six-foot shoulder on the right hand side. The speed limit increases to 65 mph leaving Payson near Lousey Saddle Trail. Continuing northbound, in this area the right hand side of the road has a number of areas with shoulders and rumble strips, while the left hand side has limited shoulders (only occasional two-foot unpaved shoulders) and no rumbles. Pull outs are located sporadically along the route. The area is mountainous with steep drop-offs.

FIGURE 28

SR 87 Location Map



There were 467 crashes in the study period; of these 11 were fatal, and 25 were serious injury crashes. Almost 40 percent of the crashes occurred during dark, unlighted conditions. The most common weather type was clear conditions. Notably, over 50 percent of crashes happen on the weekend (Friday, Saturday, Sunday); and of those three days, Friday is the highest with approximately 21 percent of the crashes. The most common crash type was animal wild game (92 crashes) followed by overturn/rollover crashes (57 percent). By far, the most common collision manner was single vehicle (84 percent). Tabulating crash factors for this segment, the most prevalent factors in fatal and/or serious injury crashes are as follows: heavy vehicles, speeding, unbelted motorists, and motorcycles.

Details of optional treatments to address these issues are provided in the *Safety Review Memorandum*. Table 12 shows the cost, benefit/cost ratio (calculated according to ADOT methods), where applicable the Crash Modification Factor associated with each treatment, and recommended improvements.

TABLE 12

Cost Benefit/Cost Ratio for Segment 1

Treatment #	Total Cost	B/C	CMF	Notes
1. Add Yellow/Red Post Reflectors to Side-Road Stop Signs	$1,820.00	N/A	N/A	Considered a tried safety measure by FHWA. It does not have an associated CMF.
2. Add Safety Edge	$2,904,000.00	14.3	0.77	N/A
3. Add Animal Fencing	$871,200.00	N/A	N/A	See ADOT's Results with animal fencing.
4. Move Signs to Five Feet Above Travelway	**$40.00**	**N/A**	**N/A**	**MUTCD Compliance, at the intersection of SR 87/SR 188.**
5. Breakaway Post Bases	**$1,800.00**	**N/A**	**N/A**	**MUTCD Compliance.**
6. Correct Yield Signs	**$40.00**	**N/A**	**N/A**	**MUTCD Compliance per 2B.10.08.**
7. Striping	$1,089,000.00	N/A	N/A	MUTCD Compliance.
8. Install Chevrons and Speed Plaques for Curve Signs	**$16,000.00**	**59.4**	**0.99**	**N/A**
9. Speed Studies	**$7,000.00**	**N/A**	**N/A**	**Included as the speed differential could cause an increase in safety problems. Also, the changes in speed limit on the route need to be evaluated to see if speed limits are placed appropriately.**
10. Create Clear Zones	**$100,000.00**	**4.4**	**0.43**	**N/A**
11. Rumble Stripes	**$13,305.60**	**4551.9**	**0.64**	**N/A**
12. Install Two Foot or Greater Shoulder	$45,000,000.00	0.5	0.87	Paved Shoulder included in HSM.
13. Realign Roadway	$2,500,000.00	N/A	N/A	Standard, improved geometrics will help increase the safety of the roadway.
14. Provide Animal under or overpasses	$2,500,000.00	N/A	N/A	Arizona has used these on routes with high crashes with animals and have seen significant reduction in crashes. At this time no CMF is published.
Recommendation: 4, 5, 6, 8, 9, 10, 11*	$138,185.60	916.4	0.27	

**Combined CMF used treatments 10 and 11.*

Segment 2: SR 77 from Gila/Pinal County Boundary to U.S. 70

The 33 mile segment of SR 77 is a rural minor arterial located at the Gila/Pinal County Boundary and ending at the intersection of SR 77 and SR 70 in Globe.

FIGURE 29

SR 77 Location Map

Beginning in the town of Winkelman SR 77 has one lane in each direction, and a posted speed limit of 40 mph. Outside of Winkelman, the speed limit increases to 55 mph and intermittent passing lanes are provided. This segment is mountainous with grades as high as eight percent. Pull-outs and runaway truck ramps are also available along the segment. Shoulders are variable along the corridor. In some cases they are not present and in other cases there are 10-foot shoulders. When shoulders are present, a combination of continuous and noncontinuous rumble strips are found.

There were 133 crashes from 2009 to 2013; of these there were 5 fatal crashes, and 10 serious injury crashes. Of the 133 crashes, approximately 35 percent occurred in dark conditions; 13 percent occurring during rain; and 14 percent occurring during cloudy weather. Single vehicle crashes were the most common manner of collision. Tabulating crash contributing factors, the most common for this segment include the following: speeding, heavy vehicles, and motorcyclists.

TABLE 13

Cost Benefit/Cost Ratio for Segment 2

Treatment #	Total Cost	B/C	CMF	Notes
1. Rock Netting	**$12,000.00**	**N/A**	**N/A**	**Need netting between MM 139-143. The safety benefit is unknown but removing objects from within the roadway or near the sides of the roadway decreases the likelihood of a conflict between vehicles and rocks.**
2. Add Distance Plaques to Side-Road Signs	**$20,000.00**	**21.4**	**0.99**	**N/A**
3. Add Yellow/Red Post Reflectors to Side-Road Stop Sign	**$2,800.00**	**N/A**	**N/A**	**Considered a tried safety measure by FHWA. It does not have an associated CMF.**
4. Add Distance Plaques to Stop Sign Ahead Sign	**$30.00**	**631.7**	**0.99**	**Project should be at beginning of route near U.S. 70.**
5. Add Beacon to Stop Ahead Sign	$8,423.00	0	0.84	Found at beginning of Route near U.S. 70. No fatal or serious injury crashes related to this countermeasure but lesser severity crashes were related.
6. Fix Eroding Edge of Roadway	$1,742,400.00	1.5	0.77	N/A
7. Evaluate Passing/No Passing Zones	$10,000.00	N/A	N/A	Noticed NPZ looks short two miles from U.S. 70. No Passing Zones indicate to drivers that it is an acceptable place to pass other vehicles.
8. Rumble Stripes	**$68,006.40**	**59.4**	**0.64**	**N/A**
9. Centerline Rumble Strips	**$51,744.00**	**207.8**	**0.55**	**N/A**
10. Change Rumble Strips to Continuous Rumble Stripes	$5,913.60	594.6	0.64	N/A
11. Trim Overgrowth	**$10,000.00**	**40.8**	**0.43**	**N/A**
12. Install two foot or wider shoulders	$160,000,000.00	0	0.13	Paved Shoulder included in HSM. B/C is 0 due to the high cost of implementing shoulders in this area.
13. Evaluate Speeds	$10,000.00	N/A	N/A	The speed differential on this route seemed large. Studying this difference in more depth may lead to more insight and better managing of the vehicle speeds.

Treatment #	Total Cost	B/C	CMF	Notes
14. Striping	$784,080.00	N/A	N/A	Standard practice to restripe.
15. Chevrons	$15,000.00	367.3	0.87	Curve at MM 159 needs chevrons.
Recommendation: 1, 2, 3, 4, 8, 9, 11*	$154,580.40	5.4	0.15	

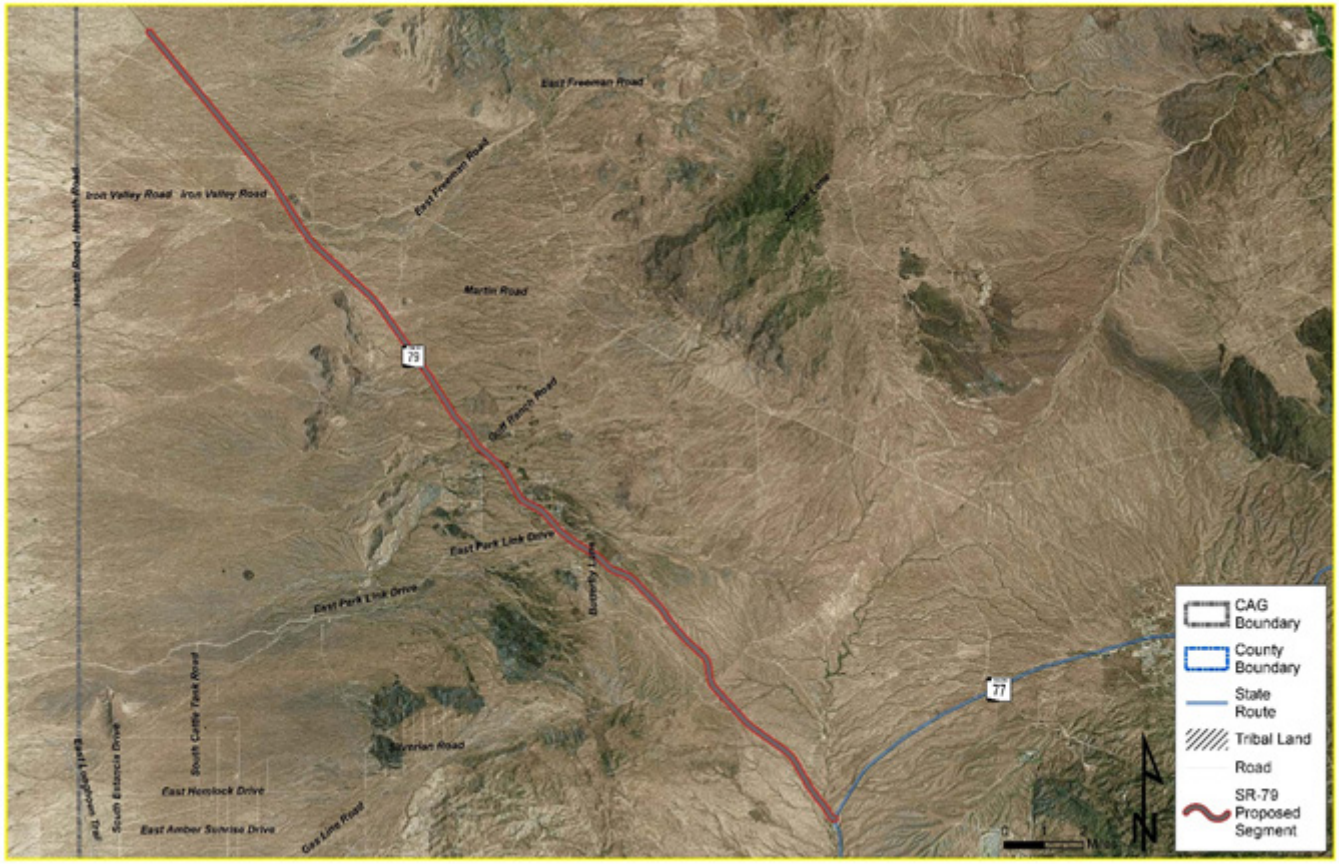
**Combined CMF used treatments 8, 9, and 11.*

Segment 3: SR 79 From SR 77 to Deep Well Ranch Road

SR 79 beginning at SR 77 and ending at Deep Well Ranch Road is a rural minor arterial. The segment is 27 miles long. Traveling southbound from Deep Well Ranch Road, SR 79 has two 12-foot travel lanes and a posted speed limit is 65 mph. The roadway does not have any rumble stripes or strips or centerline rumbles.

FIGURE 30

SR 79 Location Map



There were 164 crashes from 2009 to 2013; 3 fatal crashes, and 20 serious injury crashes. The majority of the crashes occurred during daylight hours but approximately 30 percent occurred during dark, not-lighted conditions and another 9 percent occurred during dawn. The most prevalent weather type, during crashes was clear conditions. Rain and snow also contributed to a small percentage of the crashes at 7 percent and 3 percent respectively. The most common crash type is animal wild-game, followed by tree, bush, and stump (standing) then overturn/rollover. Most crashes were single-vehicle crashes. Tabulating the crash characteristics, the most common factors in fatal and/or serious injury crashes on the segment include the following: speeding, unbelted drivers, impaired drivers, distracted driving, and young drivers.

TABLE 14

Cost Benefit/Cost Ratio for Segment 3

Treatment #	Total Cost	B/C	CMF	Notes
1. Add Yellow/Red Post Reflectors to Side Road Stop Sign	**$500.00**	**N/A**	**N/A**	**Considered a tried safety measure by FHWA. It does not have an associated CMF.**
2. Add Safety Edge	**$167,225.00**	**1**	**0.769**	**N/A**
3. Add Advance Warning of Pull-Off Areas/Picnic Area's	**$840.00**	**225.5**	**0.99**	**N/A**
4. Trim Overgrowth	**Varies**	**Varies**	**0.43**	**See HSM for different CMF factors.**
5. Evaluate Passing/ No Passing Zones	$15,000.00	N/A	N/A	Passing and No Passing Zones indicate to drivers where it is safe for them to attempt to pass. Some passing zones on this route seemed shorter than the required length for passing.
6. Striping	**$213,840.00**	**N/A**	**N/A**	**Standard practice.**
7. Install Chevrons	**$5,240.00**	**436.8**	**0.87**	**N/A**
8. Replace/Move/Fixe Box Culverts	$2,000.00	229.8	0.13	N/A
9. Create Clear Zone	$2,000.00	150.5	0.43	N/A
10. Rumble Stripes	**$79,242.24**	**3.5**	**0.64**	**N/A**
11. Centerline Rumbles	**$3,252.48**	**1377.3**	**0.55**	**N/A**
12. Install 2 foot or Greater shoulder	$268,000,000.00	0	0.2	Paved Shoulder included in HSM. Cost of countermeasure too high for a b/c greater than 0.
Recommendation: 1, 2, 3, 4, 6, 7, 10, 11*	$470,139.72	1.9	0.23	

**Combined CMF calculated using treatments 10, 7, and 4.*

Segment 4: U.S. 60 From Gila/Pinal County Boundary to Globe Urban Boundary

U.S. 60 from the Gila/Pinal County Boundary to the Urban Boundary of Globe is a rural principal. The segment is five miles long. There is one lane in each direction and the posted speed limit is 55 mph. Shoulders vary in width from none present to eight-foot wide. As this rural roadway goes through the mountains, the grades are steep, reaching 8 percent at some points. The steep grades become more problematic at horizontal curves. Most of the curves have advisory speeds of 5-10 mph under the posted speed limit. The roadway includes rumble strips for approximately two miles near the eastern starting point and has no centerline rumbles. Along this route, passing/climbing lanes are provided as well as passing zones. At the end of the segment, near the urban boundary, the speeds reduce to 35 mph.

FIGURE 31

U.S. 60 from the Gila/Pinal County Boundary

There were 93 crashes from 2009 to 2013; of these one was fatal, and six were classified as serious injury. The majority of the crashes occurred during daylight hours, but 26 percent of all the crashes did occur during dark, unlit conditions and 18 percent of crashes occurred when the weather was classified as cloudy. A total of eight crashes occurred during inclement weather, which includes rain and snow. Single-vehicle collisions were the most common. Tabulating the crash contributing factors for fatal and/or serious injury crashes the following were the top factors: speeding, heavy vehicles, and motorcycle.

TABLE 15

Cost Benefit/Cost Ratio for Segment 4

Treatment #	Total Cost	B/C	CMF	Notes
1. Add Distance Plaques to Side-Road Signs	**$30.00**	**22.9**	**0.99**	**N/A**
2. Add Yellow/Red Post Reflectors to Side Road Stop Sign	**$360.00**	**N/A**	**N/A**	**Considered a tried safety measure by FHWA. It does not have an associated CMF.**
3. Evaluate Passing/No Passing Zones	$15,000.00	N/A	N/A	No Passing Zones indicate to drivers where it is safe to pass. If a NPZ is not correct it gives the wrong message to the driver.
4. Trim Overgrowth	**$2,000.00**	**150.5**	**0.43**	**N/A**
5. Evaluate Speeds	$10,000.00	N/A	N/A	Speed limits along route are inconsistent and speed differential between vehicles was noticeable
6. Add Safety Edge	**$528,000.00**	**0**	**0.769**	**B/C of 0 due to lack of fatal/serious injury crashes mitigated by this countermeasure but some PDO and Minor Injury crashes are mitigated by this countermeasure.**
7. Restripe	$237,600.00	N/A	N/A	Standard practice.
8. Rumble Stripes	**$12,862.08**	**395.7**	**0.55**	**N/A**
9. Centerline Rumble Stripes	**$14,931.84**	**0**	**0.64**	**B/C of 0 due to lack of fatal/serious injury crashes mitigated by this countermeasure but there are some PDO/Minor Injury crashes mitigated by this countermeasure.**
10. Change Rumble Strips to Continuous Rumble Stripes	$2,069.76	0	0.64	B/C of 0 due to lack of fatal/serious injury crashes mitigated by this countermeasure but there are some PDO/Minor Injury crashes mitigated by this countermeasure.
11. Install two Foot or Greater Shoulder	$40,000,000.00	0.2	0.2	Paved Shoulder included in HSM.
12. Passing/Climbing Lanes	$1,250,000.00	0.4	0.65	N/A
Recommendation: 1,2,4,6,8,9*	$558,1893.92	14	0.35	

**Combined CMF calculated using treatments 8 and 9.*

MEASURING SAFETY SUCCESS

CAG's STSP is a road map to achieve the plan's vision and goals through effective implementation of the proposed strategies. The goal is for the MDSC or TTAC to oversee and supervise the implementation process. Implementation would occur through regular meetings focused on:

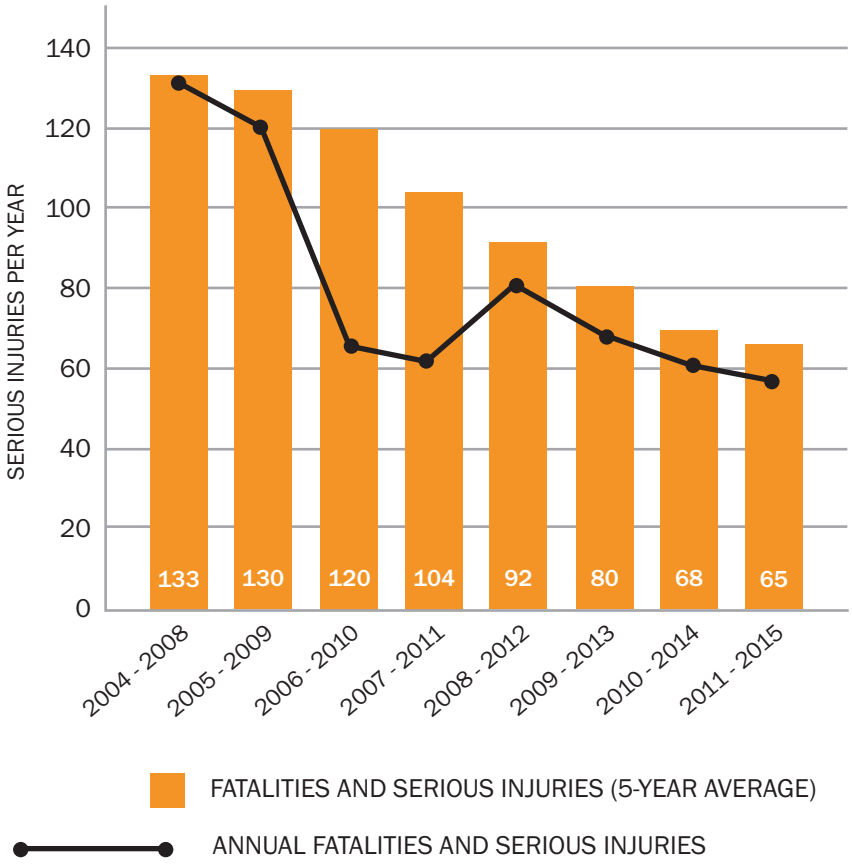
- Tracking and reporting progress in each emphasis area.
- Identifying barriers or problems to implementation.
- Modifying strategies as required.
- Working with ADOT on safety improvements.
- Determining the content and design of future STSP updates.

TRACKING PERFORMANCE MEASURES AND TARGETS

Tracking performance measures and progress toward established targets is critical to determining the effectiveness of the STSP going forward. A simple spreadsheet tool has been developed to assist CAG with performance measure tracking. A sample graph, tracking performance for roadway departure fatalities and serious injuries, is shown in Figure 31 to demonstrate how performance tracking will work. As crash data is updated each year, new data can be entered into the spreadsheet to clearly show the trend for the emphasis areas of interest.

FIGURE 32

Tracking Performance Measures



ONGOING COORDINATION

Technical oversight of the STSP was driven by the MDSC and the TTAC (members of the TTAC were represented on the MDSC). The MDSC was formed during Task 1 activities and has been engaged throughout the STSP planning process. As a result, they are most familiar with the STSP and its contents. Upon completion of the STSP, CAG staff may wish to continue meeting with the members of this committee (or some version of the committee) to participate in STSP implementation or other activities. For instance, this group could participate in road safety audits, develop an annual safety report, focus on safety implementation programs, and act as liaisons between CAG and the local jurisdictions on safety needs. If it is not feasible to continue meetings of the MDST, another option is to incorporate safety discussions into the established CAG committees. Any of the six standing committees could benefit from regular conversations about safety or updates on the STSP.

FUNDING OPPORTUNITIES

This section describes current and potential future funding sources for application toward infrastructure and behavioral safety improvements. The resources listed are those specifically directed to safety projects (i.e., Highway Safety Improvement Program), as well as those that can be leveraged to fund safety elements of transportation projects (i.e., Surface Transportation Program).

HSIP

The Highway Safety Improvement Program (HSIP) funds safety improvement projects to reduce the number and severity of crashes at hazardous locations. As described by FHWA, HSIP funding is guided by the data-driven SHSP. A full list of eligible uses is listed in United States Code, and includes a wide range of activities from transportation safety planning, systemic safety analyses, intersection improvements, improvements for bicycle and pedestrian safety, construction of traffic calming features, to pavement and shoulder widening. HSIP funding is also available for noninfrastructure projects. ADOT is responsible for administering the state HSIP program with oversight from FHWA.

ADOT has recently updated their HSIP manual and project eligibility and prioritization criteria for consistency with MAP-21 and the current Arizona SHSP. Annual HSIP calls-for-projects are expected to be issued at the beginning of each calendar year with an application due date in March. Programs and projects identified in the STSP through a data-driven process will be eligible for HSIP funding.

High-Risk Rural Roads

A high-risk rural road (HRRR) is defined in Arizona as a rural major or minor collector or local road with a fatality rate greater than the statewide average for similarly classified roads, or one that is expected to exceed the average rate in the future. While MAP-21 does not require states to set aside funding to address HRRRs, Arizona has decided to allocate funds to safety projects on roads that meet the definition of a HRRR. Some roads in the CAG Region may be eligible for HRRR funding and thus eligible for additional safety funding through ADOT.

GOHS

The Arizona GOHS provides Section 402 (State and Community Highway Safety Program) and Section 405 (National Priority Safety Program) funds for safety programs and projects that address the key safety needs in the state. Safety programs and projects in Arizona that consistently receive GOHS grant funding include those that address impaired driving, speeding and aggressive driving, and unrestrained vehicle occupants. Programs and projects related to accident investigation, emergency medical services, pedestrians and bicyclists, roadway safety/traffic records, and motorcycles also have been funded in the past.

Every November GOHS sends a letter to political subdivisions, state agencies, and nonprofits regarding the GOHS Proposal Process and priority program areas. Applications for funding are due in mid to late February and programs/projects are selected in May. The STSP identifies behavioral programs/projects within the GOHS priority areas and an application could be submitted. Applications do not need to come directly from CAG, but could be sponsored by a local law enforcement agency or other agencies participating in the STSP development process. Materials related to these grant opportunities can be found at www.azgohs.gov/grant-opportunities.

TIP PROJECTS

Prioritization is the process for evaluating and selecting individual transportation projects. By prioritizing transportation programs and projects for funding in the regional TIP, CAG plays a central role in shaping the future transportation system for the region. Incorporating safety considerations into the project prioritization process for transportation projects has the potential to transform the transportation system over time into a progressively safer system, reducing the loss of life and impact of serious injuries currently experienced on the system. While it is important to prioritize safety countermeasures and improvements using the approach outlined in the Arizona HSIP manual, it is also important to incorporate safety considerations into the decision-making for all transportation projects in the region. Recommendations have been made to CAG's TIP scoring process to better include the results of high-crash locations and the network screening process into the decision-making structure for all transportation projects.

OTHER FUNDING SOURCES

Planning Assistance for Rural Areas Program

The Planning Assistance for Rural Areas (PARA) Program is sponsored by the ADOT Multimodal Planning Division (MPD) and provides federal funds, up to $250,000 per project, to assist tribal governments and counties, cities and towns located outside Transportation Management Area (TMA) planning boundaries with multimodal transportation planning needs. The funding is not for construction or design, but instead to assist rural planners to better understand transportation issues through studies and plans. The network screening and data analyses conducted for the STSP have revealed locations and factors that need to be addressed, but some of these will require further study. This would be an eligible use of PARA funds. Recent PARA grants in the CAG Region include the Gila County Transportation Study and Gila River Indian Community Multimodal Pedestrian Safety Study.

Tribal Transportation Program Safety Funds

Each year under MAP-21, two percent of the available Tribal Transportation Program (TTP) funds are set aside to address safety issues in Native America. Funding is available in four categories including safety planning, engineering improvements, enforcement/EMS, and education. All three tribes in the CAG Region, Ak-Chin Indian Community, White Mountain Apache Tribe, and San Carlos Apache Tribe are eligible to apply for this funding.

Community Development Block Grants

These funds are managed by the Federal Office of Housing and Urban Development and can be used for projects that address community development needs where existing conditions pose a serious threat to the health or welfare of the community. Funding can be dedicated to construction or reconstruction of streets, neighborhood centers, recreation facilities, and other public works; and planning activities. Safety evaluation criteria can be considered during the selection process for these grants.