CENTRAL ARIZONA GOVERNMENTS

STRATEGIC TRANSPORATION SAFETY PLAN

TECHNICAL MEMORANDUM #1

February 5, 2015

ENGINEERING ENFORCEMENT EDUCATION EMERGENCY RESPONSE

PREPARED FOR

CAG

PREPARED BY

CAMBRIDGE SYSTEMATICS

WITH

WILSON & COMPANY

GORDLEY GROUP

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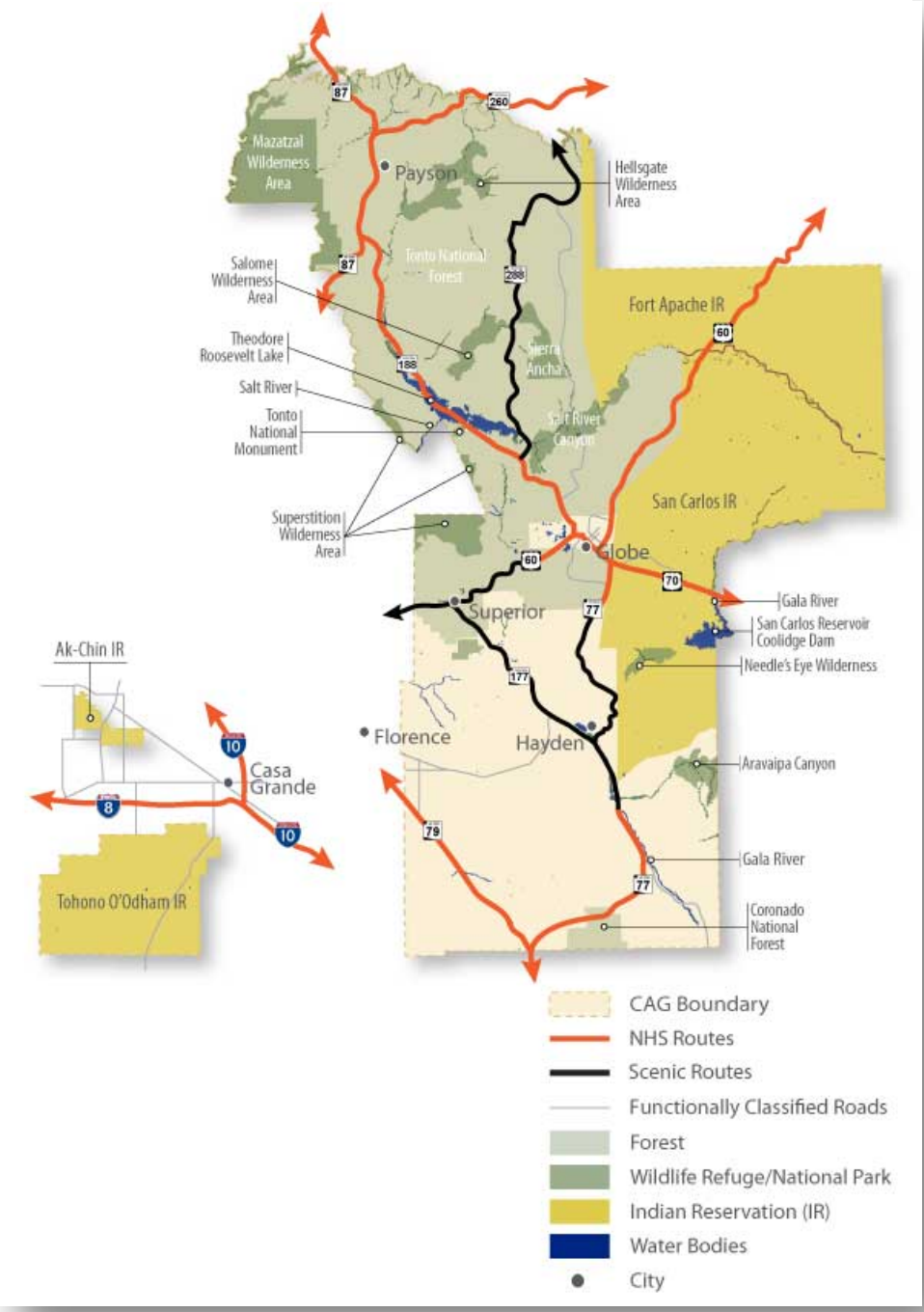
1.0 Introduction

The Central Arizona Governments (CAG) is developing their first Strategic Transportation Safety Plan (STSP) for the region. The STSP will outline policies, programs, and projects for a safe transportation network in the CAG region. This Technical Memorandum documents current safety trends experienced in the CAG region; potential priority safety issue areas; comparative data to understand how the region compares against the rest of the state; and lays the foundation for further evaluation including the network screening analysis.

Figure 1 depicts the CAG geographic area that will be analyzed for this STSP. The region is generally in Gila County, located east of Maricopa and Pinal Counties outside of the Phoenix metropolitan region. In addition, the tribal communities of Ak-Chin and Tohono O'Odaham located in Pinal County south of the Phoenix region are also included within the CAG planning area. The CAG area is largely rural areas with mountainous topography throughout the region.

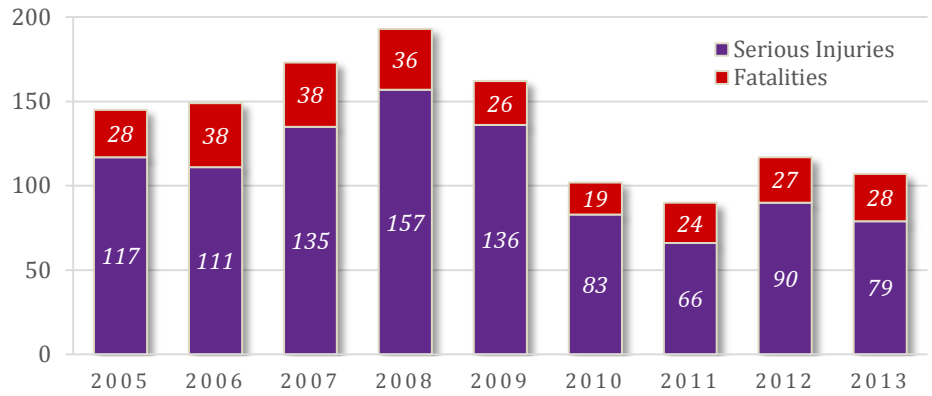
Figure 2 presents the number of fatalities and serious injuries per year from 2005 through 2013 for the CAG region. In 2013 there were 28

Figure 1: CAG Planning Area



traffic related fatalities and 79 serious injuries. As with much of the country and Arizona as a whole, CAG has seen a reduction in the number of traffic fatalities, serious injuries, and overall crashes since 2009. However, this reduction in fatalities and serious injuries has leveled off and begun to rise.

Figure 2: Annual Trend in CAG Area Fatalities and Serious Injuries



2.0 DATA DESCRIPTION

This section describes the data used in summarizing roadway safety for the CAG region. Results shown in this report are developed from the Arizona database of crash records and roadway and traffic information.

2.1 ALISS Crash Database

The crash data source for the CAG STSP is the Arizona Department of Transportation (ADOT) Accident Location Identification Surveillance System (ALISS) database of crash records. This database contains major data fields from crash report forms filed by the law enforcement officer responding to a crash incident. A crash report is required for all crashes resulting in an injury or involving a thousand dollars or more in property damage. The statewide crash report form has been updated as recently as July 2014. The ALISS 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 enforcements agencies. Crash information from the ALISS database has been made available for this study for years 2005 through 2013. Year 2014 data are not be available until after summer of 2015, when records have been received from throughout the state and quality control processes have been performed.

When considering the overall annual crash trends, we have chosen to show data for nine years from 2005 through 2013. However, when developing and analyzing the locations or characteristics of severe crashes, it made sense to consider only the most recent five years from 2009 through 2013. The rationale for this is that changes occur to the transportation network over a ten year period and recent data better reflects traffic volumes, demographics, land uses, and roadway characteristics.

Table 1 summarizes the annual number of crash events in the ALISS database for the CAG region, organized by crash severity. The person injury status on the Arizona crash report form is consistent with the KABCO injury severity scale where K=fatal injury, A=serious (incapacitating) injury, B=nonincapacitating injury, C=possible injury, and O=property damage only or no injury. Note that individual crash events may result in multiple injuries and fatalities. In 2013, for example, there were 28 fatalities associated with the 26 fatal crash events, and 79 serious injuries associated with the 91 serious injury or fatal crash events.

Table 1: ALISS Crash Records for the CAG Region by Incident Severity

Severity	Year									Total
	2005	2006	2007	2008	2009	2010	2011	2012	2013	
(K) Fatal	27	32	31	25	24	18	22	23	26	228
(A) Serious Injury	89	85	104	105	93	49	50	59	65	699
(B) Non-Incapacitating	188	219	206	175	154	141	153	133	123	1,492
(C) Possible Injury	147	146	161	178	100	111	114	100	99	1,156
(O) Property Damage Only	863	879	1,041	872	726	658	695	639	712	7,085
Total Crash Count	1,314	1,361	1,543	1,355	1,097	977	1,034	954	1,025	10,660
Total Percent Change	NA	4%	13%	-12%	-19%	-11%	6%	-8%	7%	-22%

Source: Accident Location Identification Surveillance System (ALISS)

All data recorded on the crash report form can be characterized as either *Incident* information about the actual crash event, *Unit* or vehicle information about the vehicles involved, or *Person* information about the drivers, passengers, or other roadway users involved in the crash. Analysis of the crash data has taken place by relating the tables associated with these three types of information and querying key characteristics associated with the fatal and serious injury crashes.

2.2 Jurisdictional Boundaries

Crash locations have been geolocated using geographic information system (GIS) software to facilitate reviewing spatial trends in the data. GIS files were obtained from ADOT and overlain with the crash points to further characterize locations of crash events. These three layers are the *urban areas*, incorporated *city areas*, and *tribal lands* or reservations. Urban areas are defined by the 2010 census derived urbanized boundary. This information was used to inform Table 2.

2.3 Roadway Network and Traffic Volume Data

Traffic volume and other roadway data for 2013 has been obtained from the ADOT Highway Performance Monitoring System (HPMS) program. The state compiles HPMS data for reporting to the federal government regarding the condition, performance, use, and operating characteristics of the nation's roadways. Traffic volume and other data are available on all state managed roads and a sample of local arterial and collector roadways. Figure 3 shows the roadways and the roadway functional classes where HPMS data is available for the CAG

region. These roadways are primary travel routes in rural and urban areas. Roadway functional class is defined by the states according to a number of specific criteria set by FHWA that relate to the use and connectivity of those facilities. Functional classifications are defined as:

Interstate: Interstate facilities typically are multi-lane, high-speed divided roadway with the primary function of providing the greatest mobility for through movement. These facilities support large volumes of traffic efficiently by assuring minimal interference to through movements.

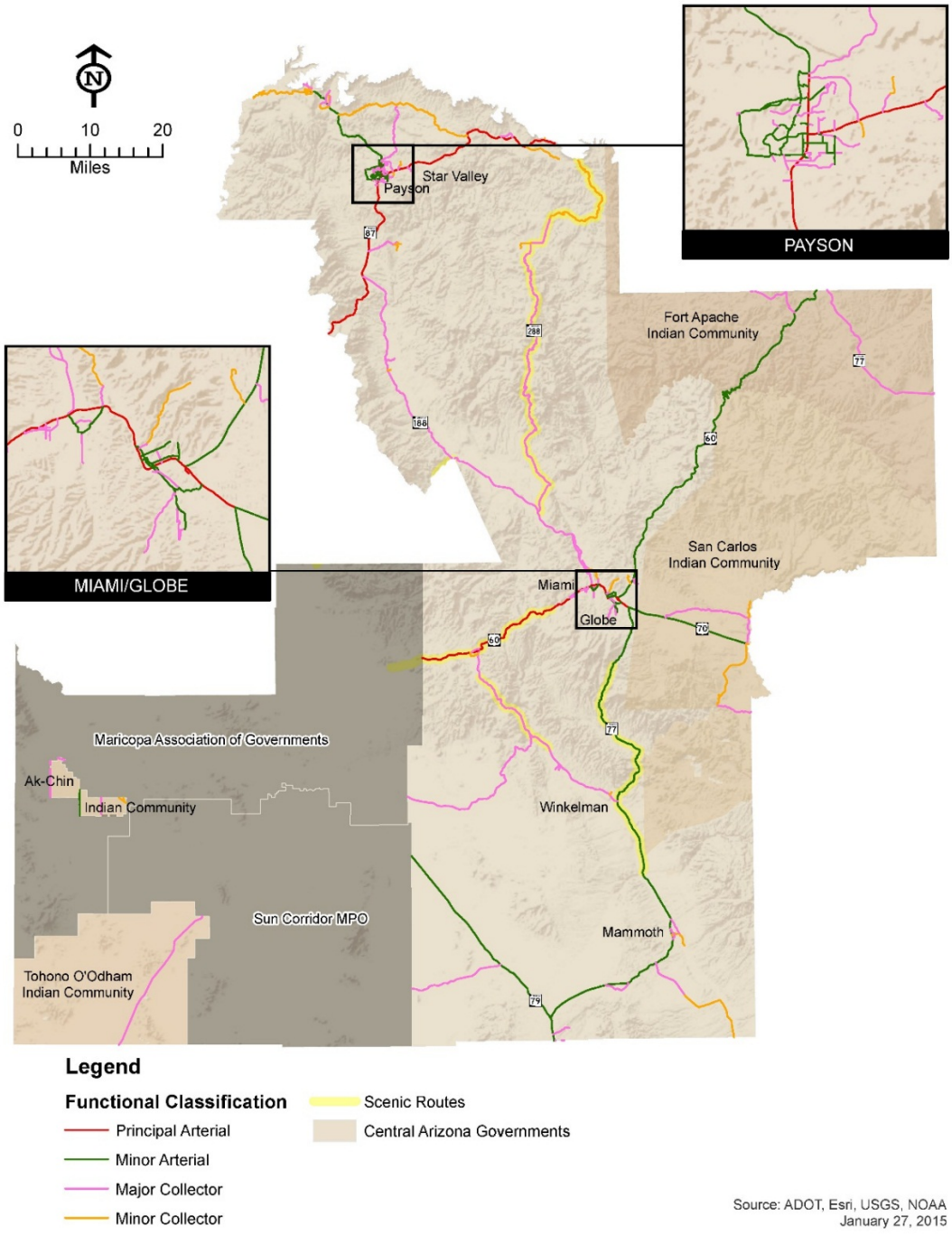
Principal Arterial: Principal Arterials generally serve populated areas, providing an integrated network of efficient roadways for the primary movement of people and goods.

Minor Arterial: These facilities serve larger communities not served by the Principal Arterial system as well as major traffic generators attracting travel over long distances (though shorter than associated with the Principal Arterial system). These facilities support interstate and inter-county travel or regional importance at relatively high speeds with minimum interference to through movement.

Collector: The major collector generally is two lanes with the purpose of supporting travel of intra-county and regional importance, as opposed to statewide movements. These facilities provide connectivity between minor collectors and the local street network to the minor arterial network. They accommodate shorter distance trips and posted speed limits tend to be more moderate than those of the arterial system

Local Streets: Local streets, which are not a prime focus of this study, provide direct access to abutting or adjacent properties and have the greatest amount of access allowed.

Figure 3: CAG Roadway Functional Classification



3.0 Analysis Discussion and Results

The following presents crash data summaries and what the results say about roadway safety in the CAG region. This includes a high-level summary of fatal and serious injury crash locations. Also discussed in this section are the characteristics of the most severe crashes; the temporal tends; the crash type distribution; and fatality and serious injury rates relative to vehicle miles traveled (VMT). The region-wide analyses of the safety data identifies crash locations, types, and contributing factors, which will be discussed in great detail during the Task 4 CAG Safety Workshop to identify strategies and actions with the greatest potential for improving roadway safety.

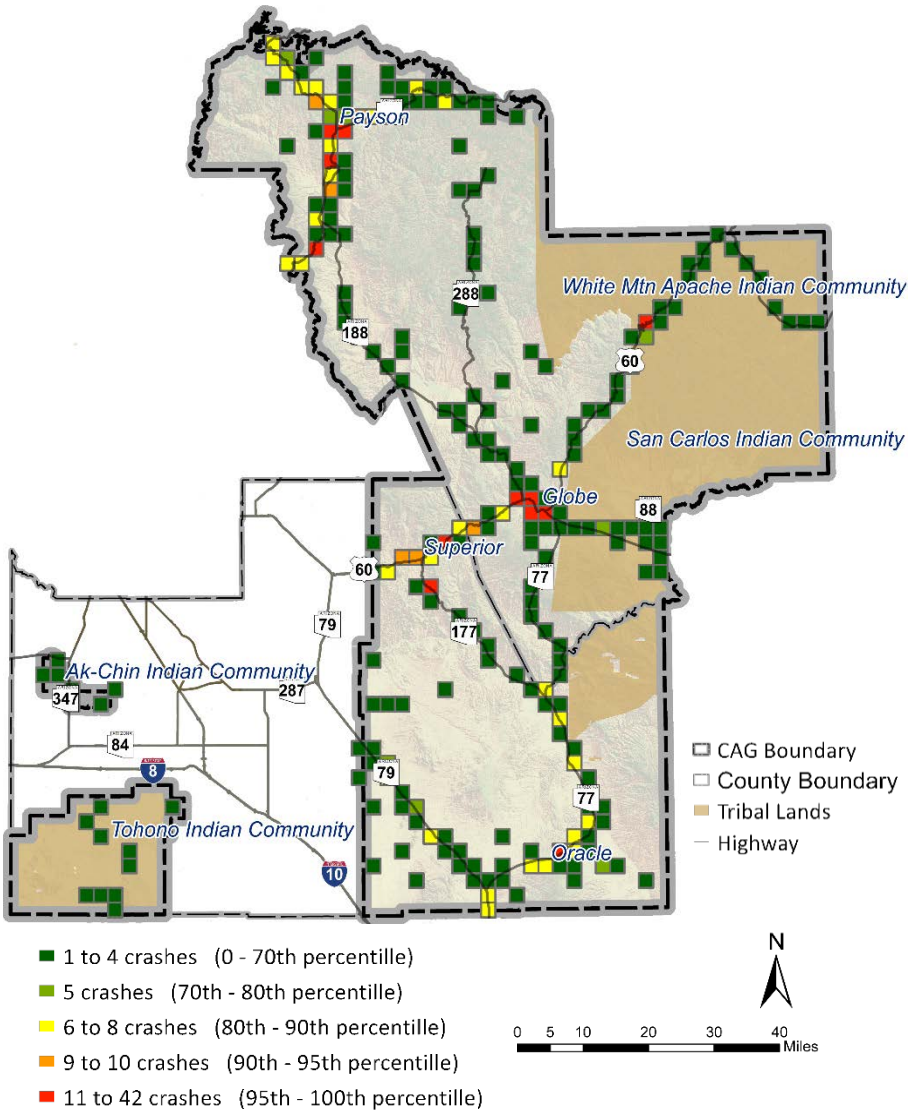
3.1 Crash Locations

Figure 4 depicts a high-level density map of severe crashes, determined by the number of fatal or serious injury crashes within a 5-square-mile area (length of each side being 2.2 miles). Each square on the map represents an area with at least one severe crash, and the color of the squares indicates the frequency of fatal or serious injury crashes within the geographies shown. These areas are ranked by the number of severe crashes in five- and ten-percentile breaks. The top five percentile is shown as red.

The worst crash locations are typically seen where traffic volumes are highest in or near urbanized areas near Payson or Globe. Four of the five highest crash areas are in and around Globe.

Other high crash locations appear to exist on mountainous rural highways, particularly on US 60 between Superior and Globe, and on SR 87, south of Payson. The high crash area on US 60 just within the White Mountain Indian Community is one such location where the roadway is mountainous and advisory speeds of 25 miles per hour are set for several curves. A closer look

Figure 4: Fatal and Serious Injury Crash Density (years 2009-2013)



at the events detailed on the crash record shows more than 20 percent of fatal or serious injury crashes involved an overturned vehicle. Additionally, more than 30 percent of fatal and serious injury crashes involved a vehicle being towed. Many of the high fatal and serious injury crash locations on mountainous roadways involved vehicles-in-tow, being overturned.

Table 2 shows the number of fatalities, serious injuries, and the total crash count by jurisdiction. Crash jurisdiction is determined by identifying crash points within the incorporated boundary for each city or town. Crashes taking place within the boundary of the four tribal areas have also been identified. Crashes identified as *Other Area* crashes include points on rural roads just outside incorporated areas or in rural areas between towns but not on roadways with tribal lands. The majority of these *Other Area* crashes have occurred just outside the incorporated city boundary, more than 12 percent of which have been within 1-mile and 37 percent within 5-miles. Color shades on this table are conditional formatting to highlight those jurisdictions and years where counts are the highest.

Globe has the highest numbers of fatalities and serious injuries and total crashes, followed by Payson. Miami, Star Valley, Superior, and Kearny have the next highest number of total crashes (in that order), but over the nine year period have low fatality numbers. After Globe and Payson, the highest numbers of serious injuries have been seen in Star Valley, Superior, and Mammoth. The 13 serious injuries seen in Mammoth are particularly alarming when the total number of all crashes for the same period was only 21.

Table 2: Total Fatalities, Total Serious Injuries, and Total Crash Count by Jurisdiction

Jurisdictions	Year									Total
	2005	2006	2007	2008	2009	2010	2011	2012	2013	
Count of Fatalities										
Globe	1	0	2	2	1	1	1	1	2	*11*
Payson	0	2	0	1	0	0	0	1	2	*6*
Miami	0	0	0	0	0	0	0	0	1	*1*
Star Valley	0	0	0	0	1	0	1	0	0	*2*
Superior	0	2	1	0	0	0	0	1	0	*4*
Kearny	0	3	0	0	0	0	0	0	0	*3*
Mammoth	0	0	0	0	0	0	0	0	0	*0*
Hayden	0	0	0	0	0	0	0	0	0	*0*
Winkelman	0	0	0	0	0	0	0	0	0	*0*
White Mtn Apache Res.	2	0	2	3	2	0	2	1	3	*15*
San Carlos Res.	4	2	3	6	2	6	2	3	2	*30*
Ak-Chin Res.	0	0	2	2	1	0	2	0	0	*7*
Tohono Res.	2	3	5	0	1	0	0	0	0	*11*
Other Areas	19	26	23	22	18	12	16	20	18	*174*
Total Fatalities	*28*	*38*	*38*	*36*	*26*	*19*	*24*	*27*	*28*	*264*

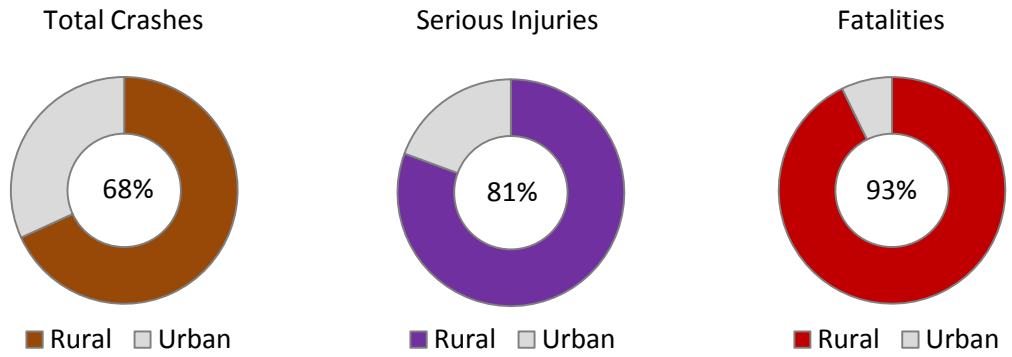
Table 2 continued:

Count of Serious Injury										
Globe	16	13	13	34	12	15	13	14	8	*138*
Payson	9	11	16	10	5	1	2	3	4	*61*

Miami	0	0	1	0	0	1	2	0	0	*4*
Star Valley	0	0	0	0	3	1	1	1	1	*7*
Superior	2	1	2	2	0	0	0	0	1	*8*
Kearny	0	1	0	0	0	0	0	1	0	*2*
Mammoth	0	2	0	1	2	8	0	0	0	*13*
Hayden	0	0	0	0	0	0	0	0	0	*0*
Winkelman	0	0	0	0	0	0	0	1	0	*1*
White Mtn Apache Res.	2	2	3	4	8	2	5	2	2	*30*
San Carlos Res.	1	0	5	11	8	2	1	1	0	*29*
Ak-Chin Res.	4	4	2	0	0	0	0	0	0	*10*
Tohono Res.	1	3	2	0	4	0	0	1	2	*13*
Other Areas	82	74	91	95	94	53	42	66	61	*658*
Total Serious Injury	*117*	*111*	*135*	*157*	*136*	*83*	*66*	*90*	*79*	*974*
Count of All Crashes										
Globe	192	178	255	219	147	163	155	141	157	*1,607*
Payson	268	214	228	191	149	130	109	114	109	*1,512*
Miami	31	30	33	18	12	12	14	9	12	*171*
Star Valley	0	0	0	0	25	33	30	25	11	*124*
Superior	18	19	25	7	3	2	0	5	4	*83*
Kearny	2	5	1	3	1	4	1	3	2	*22*
Mammoth	2	6	2	2	3	4	1	0	1	*21*
Hayden	0	3	5	5	0	1	0	0	1	*15*
Winkelman	0	2	6	3	0	0	0	1	0	*12*
White Mtn Apache Res.	19	23	32	24	33	29	30	17	25	*232*
San Carlos Res.	22	19	26	38	22	18	37	18	24	*224*
Ak-Chin Res.	20	21	16	11	5	2	9	5	5	*94*
Tohono Res.	17	15	5	11	8	2	11	3	6	*78*
Other Areas	723	826	909	823	689	577	637	613	668	*6,465*
Total Crash Count	*1,314*	*1,361*	*1,543*	*1,355*	*1,097*	*977*	*1,034*	*954*	*1,025*	*10,660*

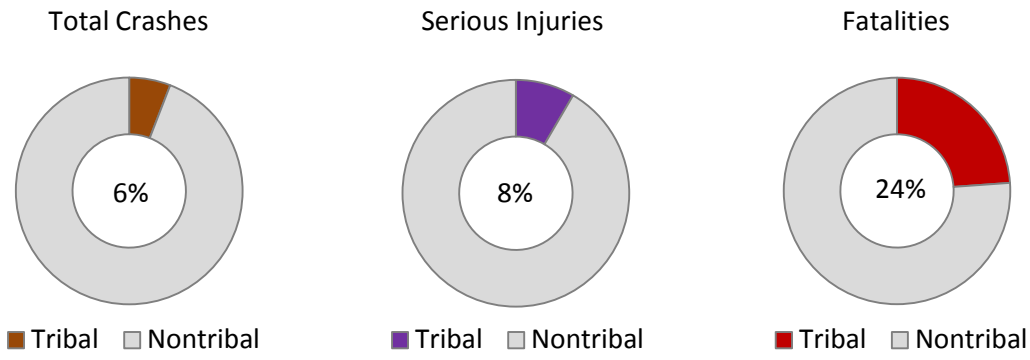
Figure 5 shows the portion of total crashes, serious injuries, and fatalities within rural vs. urban areas. The urban boundary is identified by the urbanized areas defined from the 2010 census. These boundaries do not necessarily correspond to incorporated areas for cities and towns. Within the CAG region, high severity crashes have occurred overwhelmingly in rural areas. These rural crashes are perhaps more severe as speeds are higher and emergency response and transport times are longer.

Figure 5: Rural vs. Urban Crashes



Crashes on Tribal lands account for a high portion of these severe rural crashes in the CAG region. Figure 6 shows the portion of total crashes, all serious injuries, and all fatalities that have occurred in these tribal areas. As with crashes in rural areas, these tribal areas are especially vulnerable to high severity crashes.

Figure 6: Crashes on Tribal Lands vs. Nontribal Areas

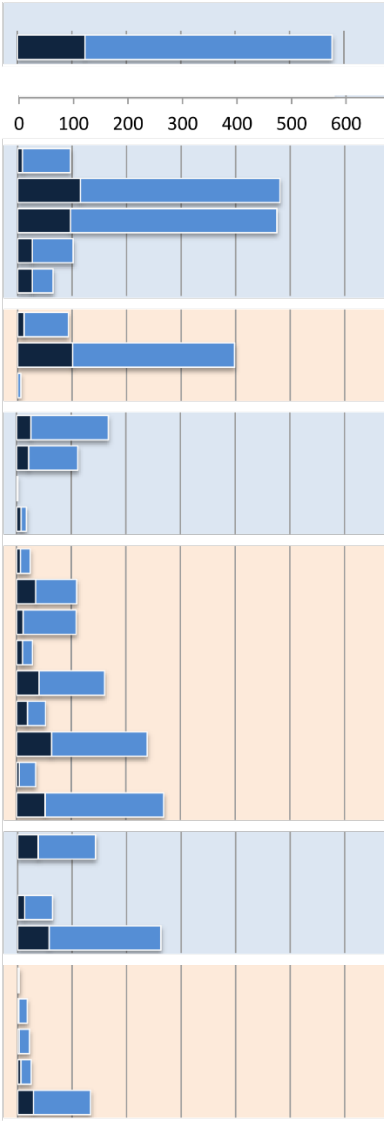


3.2 Fatality and Serious Injury Characteristics

Crash data for the most recent five available years (2009 through 2013) has been categorized to reflect 30 characteristics associated with, or potentially contributing to, fatalities and serious injuries (people). These characteristics are associated with six high level characteristic categories; (1) geographic areas, (2) roadway geometry, (3) types of persons involved, (4) behavioral characteristics of those potentially contributing to crash events, (5) vehicle information, and (6) related environmental characteristics. Table 3 summarizes the fatal and serious injury counts for these 30 characteristics. Note that most of these characteristics are not mutually exclusive and individual events will often be counted for multiple behavioral, person and vehicle types, and environmental characteristics. Indicated on the table with each characteristic is the percent of the total fatalities and serious injuries associated with each characteristic. A brief description of each of the 30 characteristics and the query definitions used in selecting these characteristics is provided as Attachment A.

Table 3: Crash Characteristic Summary Table (years 2009 through 2013)

		Fatalities		Serious Injuries		K+A Total	
CAG Total		**124**	***100.0%***	**454**	***100.0%***	**578**	***100.0%***
Characteristics		**Fatalities**		**Serious Injuries**		**K+A Total**	
		Fatality Count	**% of total**	**Injury Count**	**% of total**	**Total Count**	**% of total**
Geographic	Urban	9	*7.3%*	88	*19.4%*	97	*16.8%*
	Rural	115	*92.7%*	366	*80.6%*	481	*83.2%*
	State Highway	97	*78.2%*	379	*83.5%*	476	*82.4%*
	Other Road	27	*21.8%*	75	*16.5%*	102	*17.6%*
	Tribal Land	27	*21.8%*	38	*8.4%*	65	*11.2%*
Geometry	Intersection Related	12	*9.7%*	81	*17.8%*	93	*16.1%*
	Lane Departure	101	*81.5%*	297	*65.4%*	398	*68.9%*
	Work Zone	0	*0.0%*	6	*1.3%*	6	*1.0%*
Person Type	Young Driver (13-24)	26	*21.0%*	142	*31.3%*	168	*29.1%*
	65 and Older	22	*17.7%*	90	*19.8%*	112	*19.4%*
	Pedalcyclist Involved	0	*0.0%*	2	*0.4%*	2	*0.3%*
	Pedestrian Involved	8	*6.5%*	10	*2.2%*	18	*3.1%*
Behavior	Aggressive Driver	7	*5.6%*	18	*4.0%*	25	*4.3%*
	Alcohol Involved	35	*28.2%*	75	*16.5%*	110	*19.0%*
	Distracted Driver	12	*9.7%*	97	*21.4%*	109	*18.9%*
	Drug Involved	11	*8.9%*	18	*4.0%*	29	*5.0%*
	Impaired Driver	41	*33.1%*	120	*26.4%*	161	*27.9%*
	Unhelmeted Motorcyclist	20	*16.1%*	33	*7.3%*	53	*9.2%*
	No Restraint Used	64	*51.6%*	175	*38.5%*	239	*41.3%*
	Sleepy or Fatigued	5	*4.0%*	30	*6.6%*	35	*6.1%*
	Speeding Involved	52	*41.9%*	217	*47.8%*	269	*46.5%*
Vehicle	Motorcycle Involved	38	*30.6%*	105	*23.1%*	143	*24.7%*
	Train Involved	0	*0.0%*	0	*0.0%*	0	*0.0%*
	Truck Involved	13	*10.5%*	51	*11.2%*	64	*11.1%*
	Multiple Vehicle	58	*46.8%*	205	*45.2%*	263	*45.5%*
Environmental	Dust Related (Windy)	1	*0.8%*	2	*0.4%*	3	*0.5%*
	Wildlife/Animal Involved	2	*1.6%*	16	*3.5%*	18	*3.1%*
	Wet Weather	3	*2.4%*	19	*4.2%*	22	*3.8%*
	Dusk/ Dawn	6	*4.8%*	19	*4.2%*	25	*4.3%*
	Dark - No Light	29	*23.4%*	105	*23.1%*	134	*23.2%*



Crash characteristics identified in more than 50 percent of the fatalities or serious injuries are highlighted in red in the "% of total" columns. Crashes in rural areas of the region resulted in nearly 93 percent of the fatalities, more than 80 percent of total serious injuries, and overall contributed to 83 percent of total fatalities and serious injuries. State highways were also problematic contributing to 82 percent of the fatalities and serious injuries. Other factors in the region contributing highly to fatalities included roadway departures and unbelted drivers.

In addition to the results shown in Table 3, Attachment B contains eleven critical data tables. Nine of these show individual characteristics that are associated with the highest numbers of fatalities or serious injuries or that are meaningfully over-represented for the CAG region as compared to the rest of Arizona (PDF pages 3-11 of

Attachment B). The other two data sheets show counts for the CAG region and Arizona. The statewide data may be used for comparison with the CAG results.

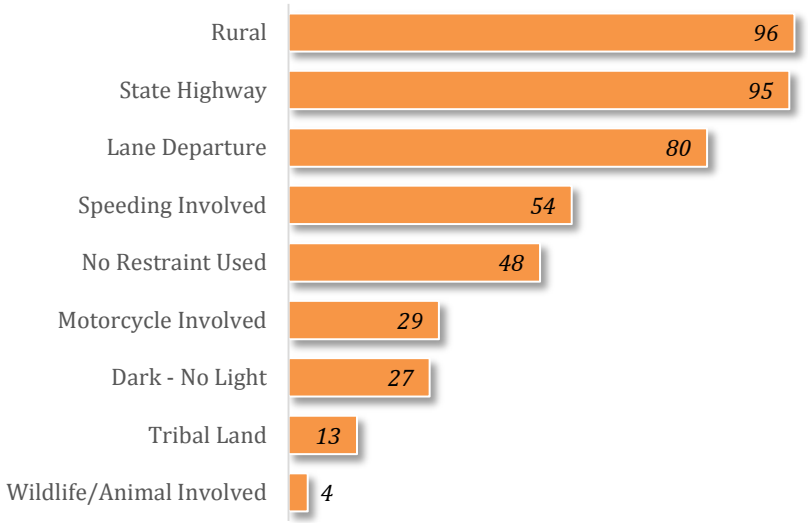
The nine data sheets include key information related to the following crash characteristics extracted from 2009 through 2013 data:

- Total CAG fatality and serious injury counts provide insight related to the specific crash characteristics that exhibit the greatest number of fatalities and serious injuries.
- Rural fatality and serious injury counts accounted for approximately 83 percent of the total. This information will provide guidance relating to common crash characteristics that can then be examined further. Key aspects of rural related crashes are crashes occurred on state highways, they typically involved lane departures, and speeding was a factor in approximately half of the counts. In examining the data further, approximately half of the fatality and serious injuries involved a towed vehicle/boat/etc. and overturning/rollover type crashes.
- State highway fatality and serious injury counts accounted for approximately 82 percent of the total. Approximately 66 percent involved a lane departure, and almost half involved speeding and/or multiple vehicles.
- Tribal land fatality and serious injury counts accounted for 11 percent of the total. Approximately 86 percent related to lane departure type crashes. Approximately 43 percent were identified as speeding involved.
- Lane departure fatality and serious injury counts accounted for almost 70 percent of the total. The most common characteristics were that speeding was involved in more than 56 percent of these instances, and no restraint was used approximately 44 percent of the time. Additionally, the driver was impaired almost 36 percent of the time.
- Approximately 41 percent of the fatality and serious injuries were instances when restraints were not used. Approximately 73 percent of the time, there was a lane departure involved. Speeding was involved in these instances almost 42 percent of the time.
- Speeding related fatalities and serious injuries accounted for approximately 46 percent of the total. Most of these instances involved lane departure (84 percent), and approximately one third of the instances included an impaired driver, or no restraint was used. Approximately 90 percent of these instances were rural, and on the state highway system 82 percent of the time.
- Motorcycle involved fatality and serious injuries account for almost a quarter of the total for the CAG region. Approximately 88 percent are in rural areas, and almost 84 percent are on state highways. Approximately 71 percent of these crashes relate to lane departures, and more than one third of the total are unhelmeted. Of the total, 42 percent involved speeding.
- Wildlife involved fatality and serious injuries account for 3.1 percent of the total. All of these are in rural areas on the state highways. A motorcycle is involved in 50 percent of these instances.
- Consistent with rural areas, fatalities and serious injuries for dark/no light areas account for approximately 23 percent of these instances. Approximately 95 percent are rural, and about 78 percent are on the state highway system. The driver was impaired in more than half of these instances, and no restraint was used more than 53 percent of the time. Additionally, speeding was documented in 56 percent of the instances.

Figure 7 shows the annual average number of fatalities plus serious injuries for the list of these characteristics that have been broken out in Attachment B. These characteristics may be areas where greater potential can be

found to effectively improve safety, and will be investigated with other data analyses and considerations in identifying key safety emphasis areas for the CAG safety plan. The sheets in Attachment B summarize in greater detail the numbers of fatalities and serious injuries for a specific characteristic.

Figure 7: Key Characteristics Average Annual Fatalities and Serious Injuries

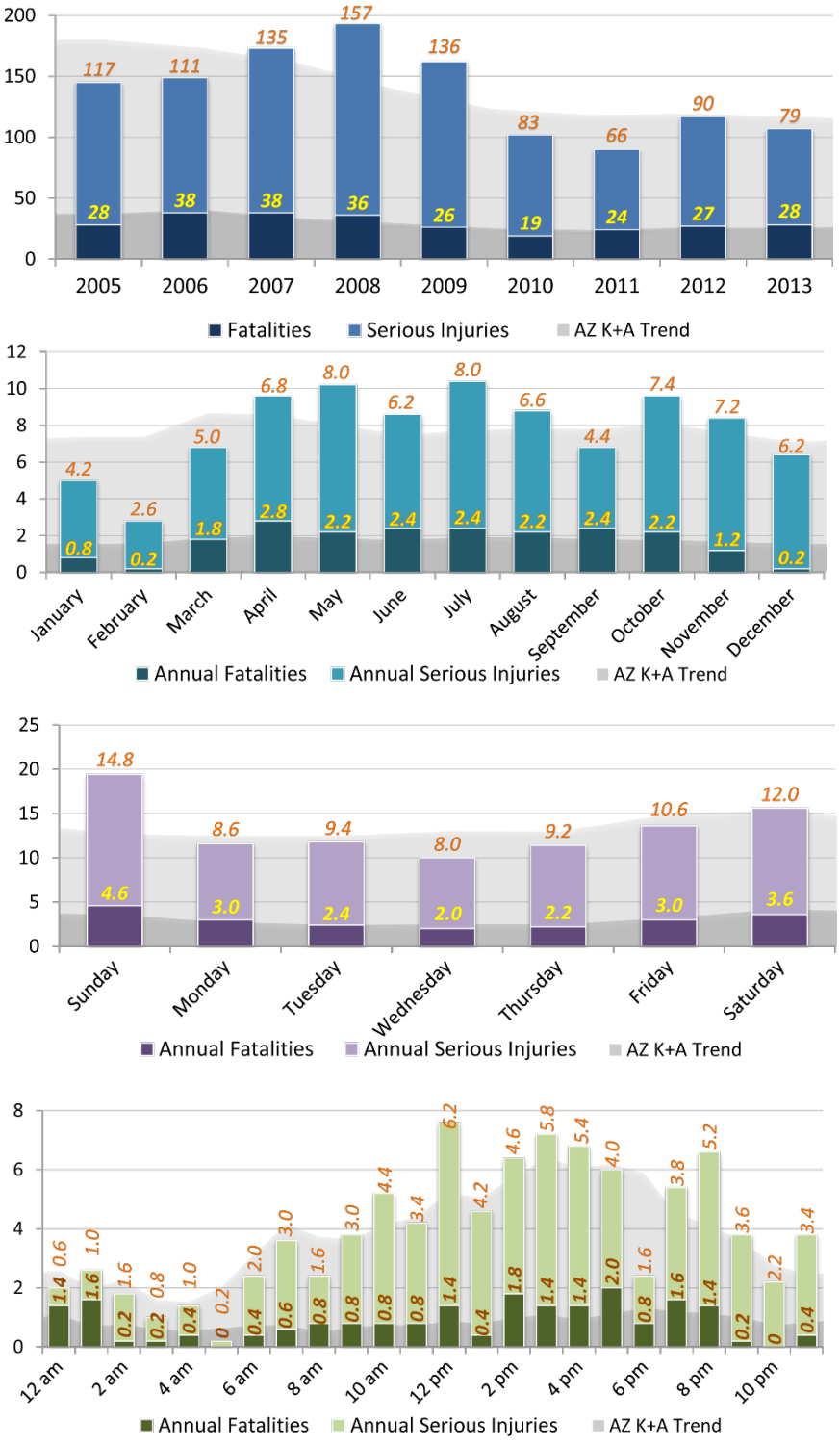


3.3 Time Series Summaries

The first figure shows the distribution of all fatalities (K) and serious injuries (A) (using the KABCO severities scale) for CAG and all of Arizona. The statewide background distributions have been proportioned to the average count for the CAG region. In this way, statewide trends can be shown for comparison with the CAG fatalities and serious injuries, thereby providing some basis for understanding how CAG trends differ from the state as a whole. The annual fatality and serious injury trend for CAG is worse than the state for some years since severe CAG crashes did not start to go down dramatically until 2009.

The next three figures show the annual, monthly, weekday, and time of day trends for fatalities and serious injuries. These temporal measures may guide strategies to improve enforcement or other behavioral interventions to reduce the risk of severe crashes. The monthly, weekday, and time of day charts show the average annual total using counts from 2009 through 2013. Each bar therefore represents an annual total, giving a sense for the number of fatalities or serious injuries that might be expected for each month, a given weekday, or hour of the day. The seasonal or monthly count figure generally reflects the statewide trend, although the variation is higher for the CAG region (i.e.

Figure 8: Temporal Trends in the CAG Area for Fatalities and Serious Injuries



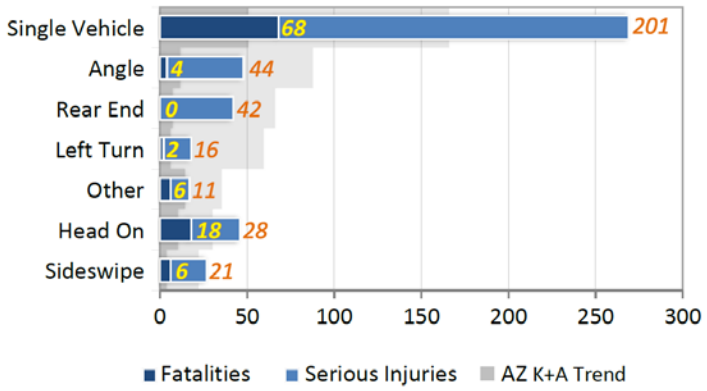
highs are higher and lows are lower). The weekly trend indicates that the highest numbers of severe crashes occur on weekends, particularly on Sunday perhaps due to weekend traffic returning to the city. The time-of-day trend again generally reflects the statewide average where the highest number of severe crashes have occurred during late afternoon peaks where traffic volume is highest. It is however notable that, for CAG, severe crashes between midnight and 2:00 am have resulted in significantly more fatalities than serious injuries.

3.4 Collision Types

In the characteristic summaries in section 3.2, more than 81% of all fatalities resulted from a lane departure crash. In these crashes a vehicle crossed the median or centerline, sideswiped a vehicle in the same or opposing traffic direction, or ran off the right side of the road to collide with a fixed object. Lane departure crashes often result in a vehicle rollover or head on collision.

Figure 9 shows the crash type distribution where the number of fatalities and serious injuries is indicated for all collision types. The statewide fatality and serious injury (AZ K+A) trend is shown in the background to allow comparison of the distribution of severe crashes in the CAG region with those for the state. Categories where the CAG crash type trend is higher than the average for the state include single vehicle crashes (which mostly consist of collisions with fixed objects), head-on crashes, and sideswipe crashes, all of which are counted as lane departure crashes. Angle and left turn crashes are not lane departure crashes and are assumed to occur mostly as intersections in urban areas and make up a much fewer portion of the most severe crashes.

Figure 9: Fatalities and Serious Injuries by Crash Type (years 2009-2013)



3.5 Fatality and Serious Injury Rates

Rates are computed by the number of fatalities or serious injuries divided by the number of 100 million vehicles miles traveled (VMT) on the transportation system. Rates are therefore influenced by both crash frequency and the amount of travel. The reported daily vehicles miles traveled (VMT) for the CAG region in 2013 was 2,376,937 (based on the ADOT Highway Performance Management System (HPMS)). The HPMS data only accounts for functionally classified routes that are reported to ADOT, and does not include counts for local roads. In examining

the statewide VMT reporting for years 2009 through 2013, there was less than a one-percent difference in the year 2013 VMT versus the average of the VMTs for years 2009 through 2013. As such, the VMT for year 2013 was used to compute the average 5-year fatality and serious injury rate for the CAG region. These rates are estimated from crashes on HPMS network roads only, which is where most of the traffic in the CAG region exists and where most of the fatalities and serious injuries have occurred. While these numbers can provide an initial summary of CAG area rates, much more detailed analyses of crash rates will take place during the network screening task using more complete traffic volume data for all roadways in the CAG region.

Table 4 illustrates the five year average fatality and serious injury rates relative to VMT by functional class, and the estimated total CAG fatality and serious injury rates. The rate by functional crash has been calculated by associating serious and fatal injury crashes with the roadway network. Highest fatality rates are seen on the minor collectors, however, the traffic volume on these roadways are relatively low and a total fatality count of four is not sufficient to draw reliable conclusions. The fatality rate on the minor arterials is substantially higher than the rates on both principal arterials and major collectors. The serious injury rate on Minor Arterials is also higher that (nearly double) the rate on other functional class roadways.

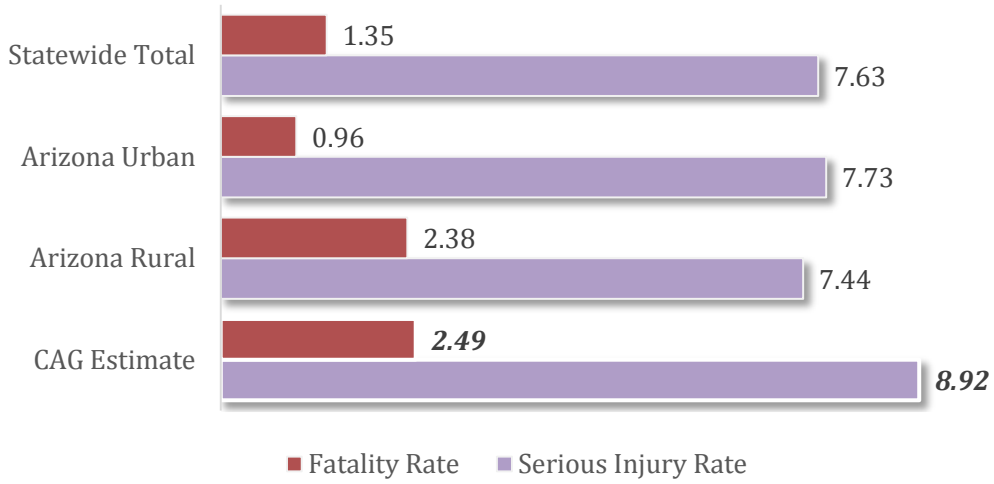
Table 4: CAG Estimated Annual Fatality and Serious Injury Rates by Functional Classification

Measure	Principal Arterial	Minor Arterial	Major Collector	Minor Collector	Local	CAG Area Estimate*
2013 Daily VMT (1,000s)	1,021,757	800,426	497,322	57,432	-	*2,376,937*
5-year Fatality Count	39	47	18	4	16	*108*
5-year Serious Injury Count	127	182	70	8	42	*387*
Average Annual Fatality Rate	*2.09*	*3.22*	*1.98*	*3.82*	-	***2.49***
Average Annual Serious Injury Rate	*6.81*	*12.46*	*7.71*	*7.63*	-	***8.92***

* CAG area estimate shown for VMT, fatalities, and serious injuries are for traffic and crashes on the functionally classified HPMS network.

For comparison, the total Arizona five-year-average fatality and serious injuries rates for statewide, urban, and rural areas are shown in Figure 10. There were 108 fatalities and 387 serious injuries that occurred on functionally classified roads in the CAG region between 2009 and 2013. Using year 2013 VMT, the 5-year average fatality and serious injury rates for CAG are 2.49 and 8.92 respectively. For a number of potential reasons, fatality rates are typically much higher in rural areas than in urban, as is the case for the Arizona fatality rates. The CAG region, which is mostly rural, still shows a fatality rate of 2.49, which is higher than the five-year average state rural fatality rate of 2.38. The CAG serious injury rate is also higher than the Arizona rural or statewide serious injury rate.

Figure 10: Comparison with Arizona Five-year Average Annual Rates



4.0 Key Findings

There are several key findings that have surfaced from the existing conditions data evaluation which include:

1. CAG region crashes are significantly rural, accounting for 92 percent of the fatalities and approximately 80 percent of the serious injuries.

2. A higher portion of crashes in the CAG region are fatal as compared to Arizona as a whole. That fact is typical of rural area crashes.

3. Approximately 22 percent of fatalities in the CAG region have occurred on tribal reservation lands, most of which involved lane departure type crashes. Looking at just the most recent five years, the percent of all fatalities in the CAG region on tribal lands is 24 percent.

4. More than 30 percent of the fatality and serious injury crashes in the CAG region are associated with towed vehicles/boats/etc., and many of those are overturning/rollover crashes on winding roads.

5. Nearly half of the wildlife related fatality and serious injuries were motorcycle involved.

6. A significant portion of fatalities and serious injuries take place at night in dark roadway environments as compared to the average severe crashes elsewhere in the state. This would be expected with the rural nature of the transportation system in the CAG region.

7. Pedestrian and bicycle involved fatalities and serious injuries are less frequent for the CAG region than for the state as a whole.

8. Higher severity crashes have generally occurred in arterial corridors with higher speeds and the highest traffic volumes.

The findings in this memorandum will serve a number of purposes; they will serve as a baseline for further investigation during the network screening effort; the data summaries will help inform the development of the multidisciplinary transportation safety team for the CAG region and the selection of emphasis areas; and the information will also be presented during the planned CAG Safety Workshop to establish a regional vision and goals, finalize emphasis areas, and identify the best set of strategies to improve safety.

5.0 Attachments

Attachment A: Description and Query Definitions for Crash Characteristics

Attachment B: Select Crash Characteristic Data Summary Sheets

CAG Region

1. Total Crashes
2. Rural
3. State Highways
4. Tribal Lands
5. Lane Departure
6. No Restraint Used
7. Speeding Involved
8. Motorcycle Involved
9. Wildlife/Animal Involved
10. Dark – No Light

Statewide (For Comparisons)

11. Total Crashes