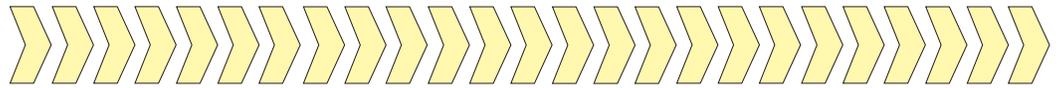


MAG STRATEGIC TRANSPORTATION SAFETY PLAN



Final Report

Prepared by:

MAG Transportation Safety Committee and
MAG Safety Stakeholders Group

October 26, 2005



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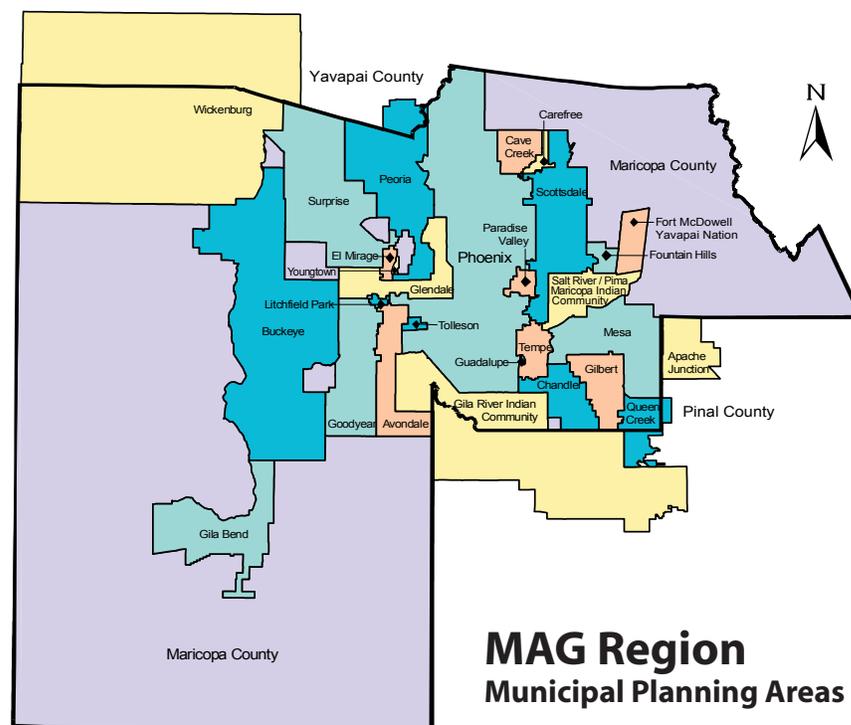
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GLOSSARY OF TERMS

AAA	American Automobile Association
AARP	American Association of Retired Persons
ACN	Automatic Collision Notification
ADA	Americans with Disabilities Act
ADOT	Arizona Department of Transportation
ALERT	Arizona Local Emergency Response Team
ALISS	Accident Location Identification Surveillance System
BRT	Bus Rapid Transit
DPS	Department of Public Safety
DUI	Driving Under the Influence
EMS	Emergency Medical Services
FHWA	Federal Highway Administration
FSP	Freeway Service Patrol
GIS	Geographic Information Systems
GOHS	Governor's Office of Highway Safety
HES	Hazard Elimination and Safety
LRT	Light Rail Transit
LTAP	Local Technical Assistance Program
MAG	Maricopa Association of Governments
MPO	Metropolitan Planning Organization
MUTCD	Manual of Uniform Traffic Control Devices
MVD	Motor Vehicle Division
NHI	National Highway Institute
NHTSA	National Highway Traffic Safety Administration
PAR	Police Accident Report
PDO	Property Damage Only
REACT	Regional Emergency Action Team
RESCU	Remote Emergency Satellite Cellular Unit
ROSS	Regional Off-Street System
RSA	Road Safety Audits
RTP	Regional Transportation Program
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act—Legacy for Users
SR2S	Safe Routes to Schools
STP	Surface Transportation Program
TADS	Traffic Accident Data System
TCN	Traffic Counts Network
TEA-21	Transportation Equity Act for 21st Century
TIP	Transportation Improvement Program
TraCS	Traffic and Criminal Software

1. INTRODUCTION

Maricopa Association of Governments (MAG) is the designated Metropolitan Planning Organization (MPO) for the Phoenix metropolitan region and provides regional planning and policy decisions in areas of transportation, air quality, water quality, regional development, and human services. Predicting growth and planning major changes for the regional transportation system are the primary responsibilities of MAG. Functions such as air quality planning are closely linked to transportation and must meet federal requirements.

1.1 Transportation Safety in the Planning Process

Although federal guidelines for transportation planning under TEA-21 included Safety and Security as key factors to be considered, guidelines are lacking on how or where to begin this journey. In 2000, MAG took a proactive step by including Transportation Safety Planning as a new planning area in the Unified Planning Work Program for FY 2001. This enabled MAG to launch the first Regional Transportation Safety Forum in March 2001. This was the first activity of the Safety Planning Program. Key stakeholder agencies that participated in the event included: FHWA, Arizona DOT, Arizona DPS, AAA, and cities and towns within and outside the MAG region. The success of this Forum led to more ambitious plans and additional resources for the Safety Planning Program.

In November 2001, MAG formed the Safety Stakeholders Group, consisting of a broad cross-section of safety stakeholders, and began a dialogue toward better planning for road safety improvements. Follow-up activities by three Safety Teams led to the identification of safety issues, goals and potential actions in the areas of: (1) Roadways, (2) 3Es—Education, Enforcement and EMS and (3) Pedestrian, Bicyclists and Transit. The results were compiled to produce the first draft of the Safety Action Plan in November 2003. In January 2004, the MAG Regional Council approved the formation of a formal committee for Transportation Safety.

The committee held the first meeting in September 2004. MAG is the first MPO in the nation to have formed a committee specifically to address transportation safety from a planning perspective. The Safety Action Plan was renamed as the MAG Strategic Transportation Safety Plan as it mainly identifies the focus areas for action. The finalization of the MAG Strategic Transportation Safety Plan was one of the first tasks undertaken by the new MAG Transportation Safety Committee.





1.2 State of Transportation Safety in the MAG Region

Much of the initial discussion on transportation safety issues and concerns in the region was based on the collective observations of participating agencies. Some of these observations were supported by agency analyses while others were based on a combination of perceived risks and intuitive reasoning. In order to observe crash trends and patterns that may provide some insights into crash occurrence in the region, an analysis of crash data was carried out for the years 1999 through 2004. The results of this analysis provide an overview of the road safety in the region and are shown in *Figures 1 through 4 and Table 1*. They provide a good overview of the distribution and magnitude of road safety issues and road risk across the MAG region. A detailed analysis was compiled using crash data for 2004, the most recent year for which crash data are available. The Draft MAG Strategic Transportation Safety Plan was reviewed and revised to ensure that safety issues that are highlighted by this analysis are addressed in the Plan. The analysis results are presented and discussed in the following sections.

1.2.1 ALISS Crash Database and Origins of Crash Data

The database of road crashes in Arizona is maintained by the Crash Data Team of the Arizona DOT. A Police Accident Report (PAR) form is filled by a local enforcement official at the crash scene. A copy of this form is sent to Arizona DOT where the data is keyed into the database named ALISS (Accident Location Identification Surveillance System). All crashes are commonly categorized as Property Damage Only (PDO), Injury or Fatal crashes, depending on whether the crash involved a fatality, injury or property only damage. Police reports are filed only for fatal or injury crashes, and crashes that exceed \$1,000 in physical damages. Bicycle and pedestrian crashes are reported and entered in the ALISS database only if they involve a motorized vehicle. As a result, crashes that involve only bicycles and pedestrians are not captured in the ALISS database. It is believed that many PDO crashes in the region are unreported as drivers involved in such crashes exchange insurance information and promptly leave the crash scene. This creates an under reporting of PDO crashes in the ALISS database. However, the extent of this under reporting is not known. Most of the crashes are geocoded or located by map coordinates by Arizona DOT. This enables spatial analyses of crash data using Geographic Information Systems (GIS) tools. However, some crash report forms do not contain sufficient details for establishing an accurate map location. As a result, based on current estimates, nearly 20 percent of all crashes cannot be accurately geocoded.

1.2.2 Annual Crash Trend for the Period 1999–2004

The crash trend for the region, shown in *Figure 1 and Table 1*, indicates that the total number of crashes in the region have initially increased by 5.6 percent from 83,622 in 1999 to a high of 88,321 in 2002, reduced by 3.7 percent to 85,082 in 2003 and again increased by 6.9 percent for the highest ever number of crashes reported in 2004. A similar trend is observed for injury and fatal crashes with a peak in 2001 and a decline until 2003. The crash numbers for 2004 indicate that total crashes, injuries and fatalities have all increased over the corresponding numbers for 2003. Reasons for this reversal of the trend are not readily apparent.

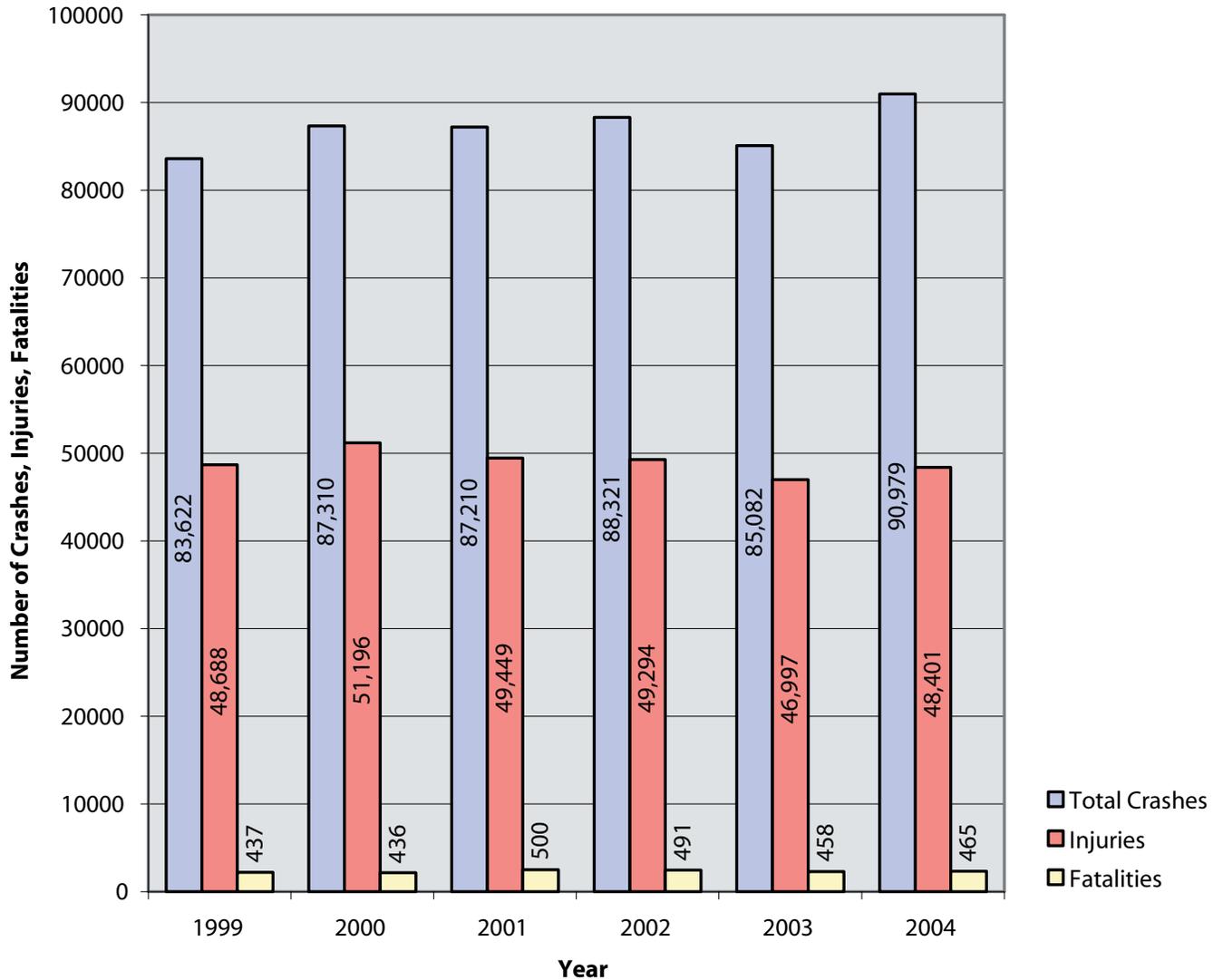


Figure 1: Crash Trend from 1999–2004

Year	Total Crashes	Injury Crashes	Fatal Crashes	Injuries	Fatalities
1999	83,622	30,714	396	48,688	437
2000	87,310	32,241	397	51,196	436
2001	87,210	31,169	450	49,449	500
2002	88,321	31,002	443	49,294	491
2003	85,082	29,811	417	46,997	458
2004	90,979	31,083	420	48,401	465

Table 1: Crash Trend from 1999-2004



1.2.3 Monthly, Daily and Hourly Crash Variation

The monthly variation of crashes during 2004, shown in **Figure 2** depicts that the number of crashes as well as injuries peaked during March-April and again in October and December.

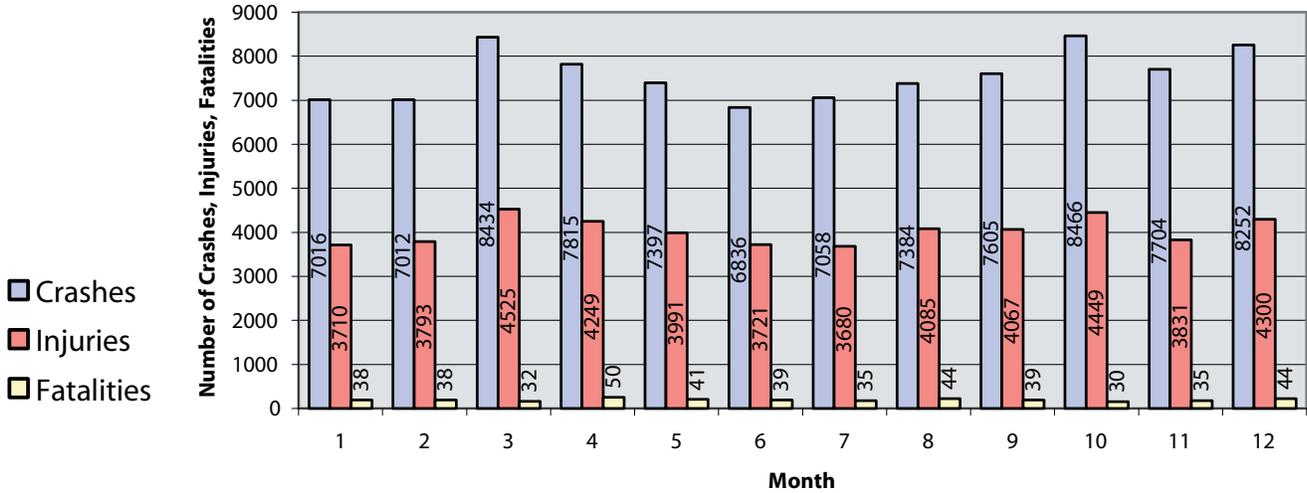


Figure 2: 2004 Number of Crashes by Month

The variation of crashes by weekday shown in **Figure 3** indicates that most crashes occur on Fridays. However, most fatal crashes seem to occur on Saturdays and Sundays.

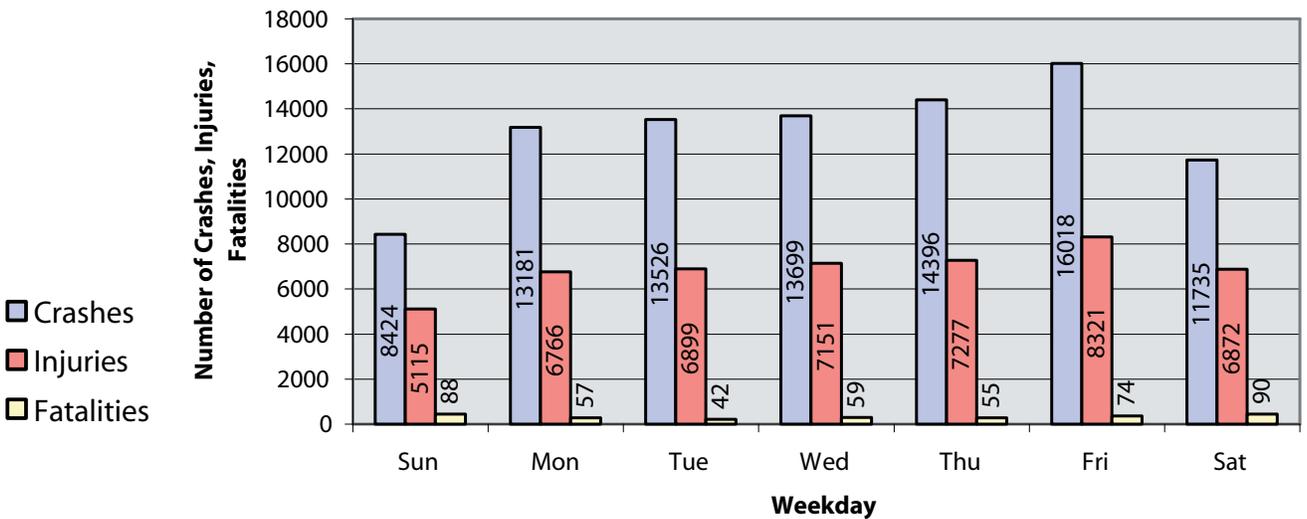


Figure 3: 2004 Number of Crashes by Day of Week



Figure 4 shows the crash variation by the hour of day. It shows that most crashes and injuries occur between 2-6 p.m.

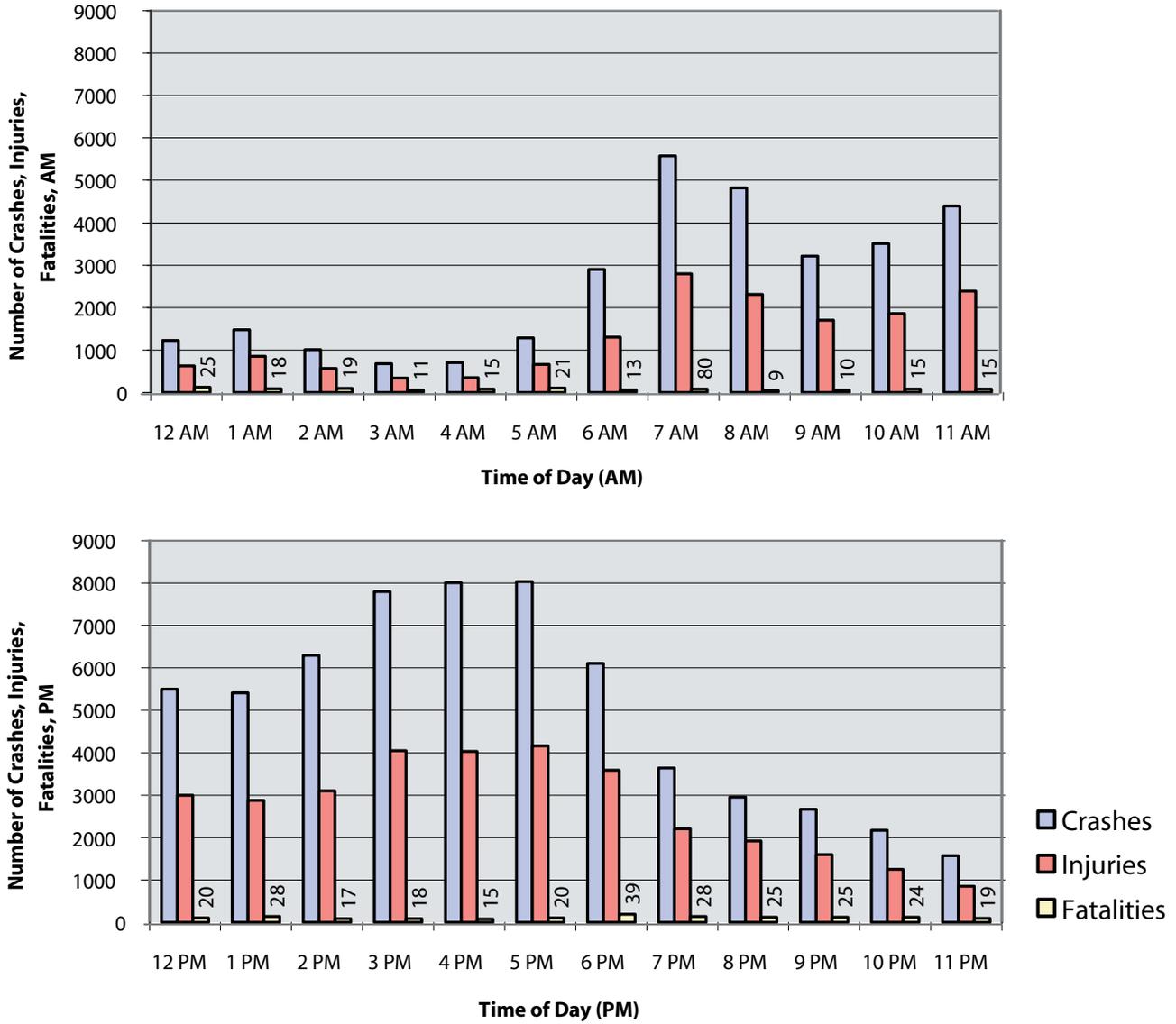


Figure 4: 2004 Number of Crashes by Hour of Day (Numbers in Figure 4 are fatalities.)



1.2.4 Crashes and Collision Manner

Figure 5 shows rear-end collisions are most common manner (38 percent) of crashes in 2004.

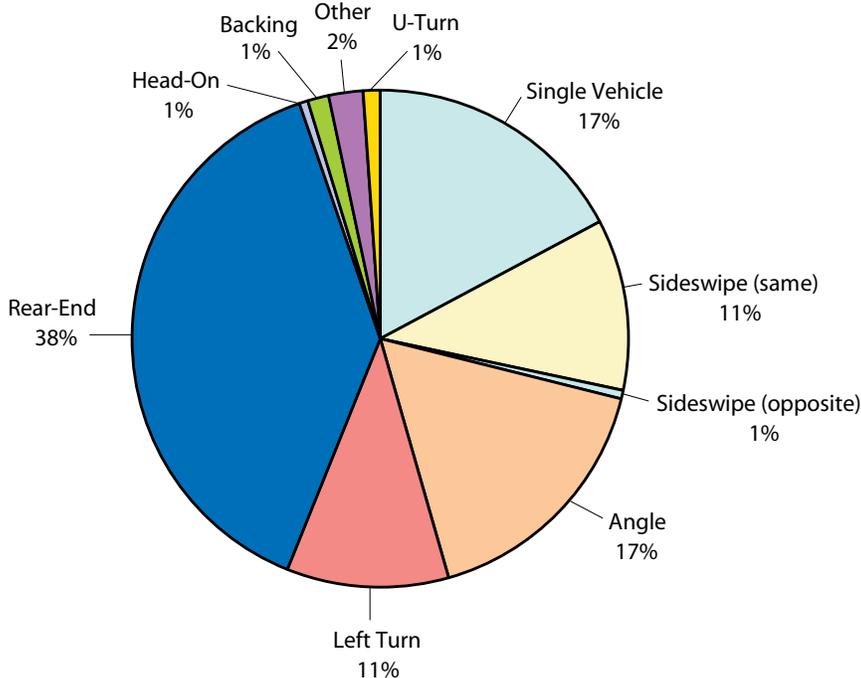


Figure 5: 2004 Crashes by Collision Manner

The results of an examination of the manner of collision in more severe crashes are shown in Figures 6 and 7. The largest single cause of injuries, shown in Figure 6, is due to rear-end crashes. Left turn and angle crashes account for nearly 37 percent of injuries and single vehicle crashes account for 14 percent.

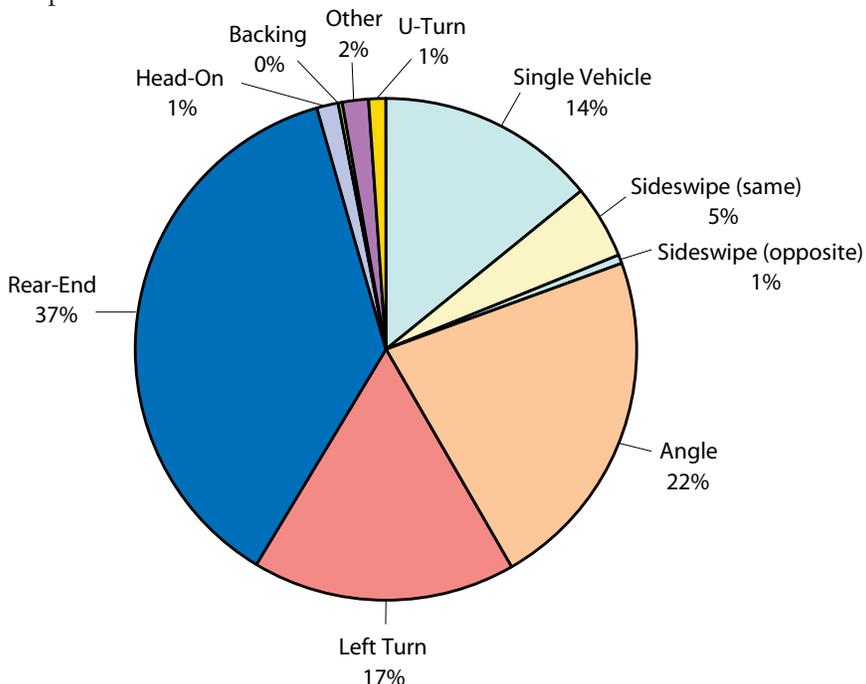


Figure 6: 2004 Injuries in Crashes by Collision Manner



Nearly half (45 percent) of all fatalities, shown in **Figure 7**, are due to single vehicle crashes. These crashes are typically due to inattention and other driver errors. The category “single vehicle crashes” also includes crashes that involve pedestrians and bicyclists. The next highest group (31 percent) consists of left turn and angle crashes, occurring mostly at intersections.

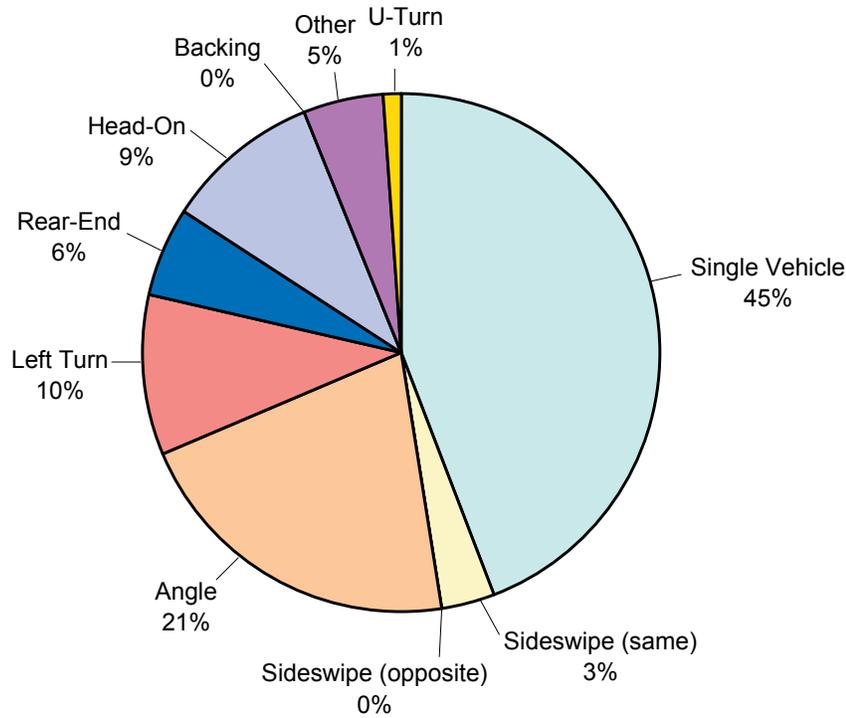


Figure 7: 2004 Fatalities in Crashes by Collision Manner



1.2.5 Pedestrian Crash Trends

An examination of pedestrian involved crashes produced the trends shown in *Figures 8 through 14 and Tables 2 and 3*. The overall 5-year trend shows a peak of all pedestrian crashes in 2000 and a slight downward trend since then. However, the number of pedestrian crashes in 2004 has increased by 6.9 percent. Fatalities peaked in 2001 and have shown a slight decrease since then.

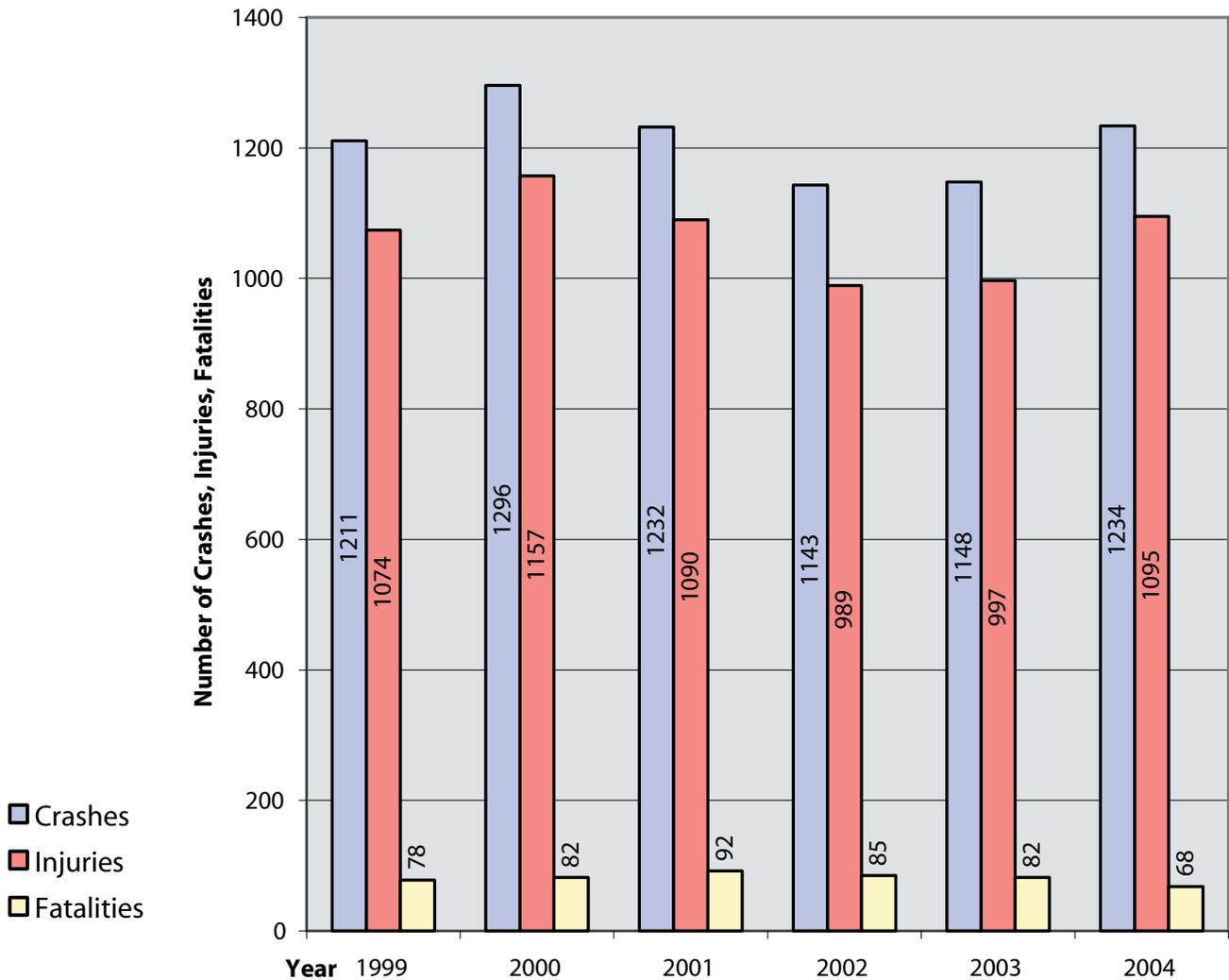


Figure 8: Pedestrian Crash Trend from 1999-2004

Year	Total Crashes	Injury Crashes	Fatal Crashes	Injuries	Fatalities
1999	1,211	1,014	78	1,074	78
2000	1,296	1,087	80	1,157	82
2001	1,232	1,015	92	1,090	92
2002	1,143	936	84	989	85
2003	1,148	935	82	997	82
2004	1,234	1,024	67	1,095	68

Table 2: Pedestrian Crash Trend from 1999–2004



More pedestrian crashes occurred during the months August to April (*Figure 9*). The peak in pedestrian crashes and injuries in March may be attributed to increased levels of pedestrian activity, and thereby exposure to risk.

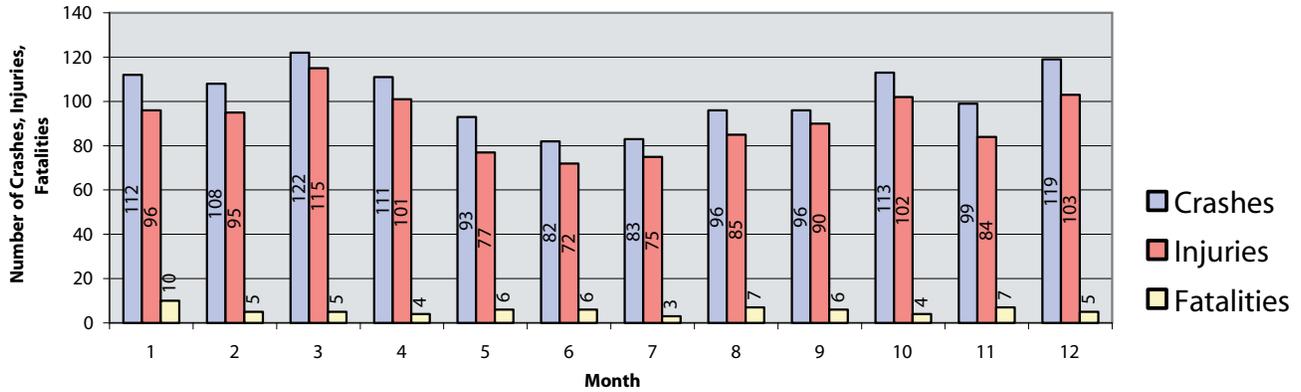


Figure 9: 2004 Number of Pedestrian Crashes by Month

The observation that the highest number of weekday pedestrian crashes and injuries occur on Fridays and highest number of fatalities on Saturdays and Sundays are consistent with high pedestrian activity associated with weekend activities (*Figure 10*).

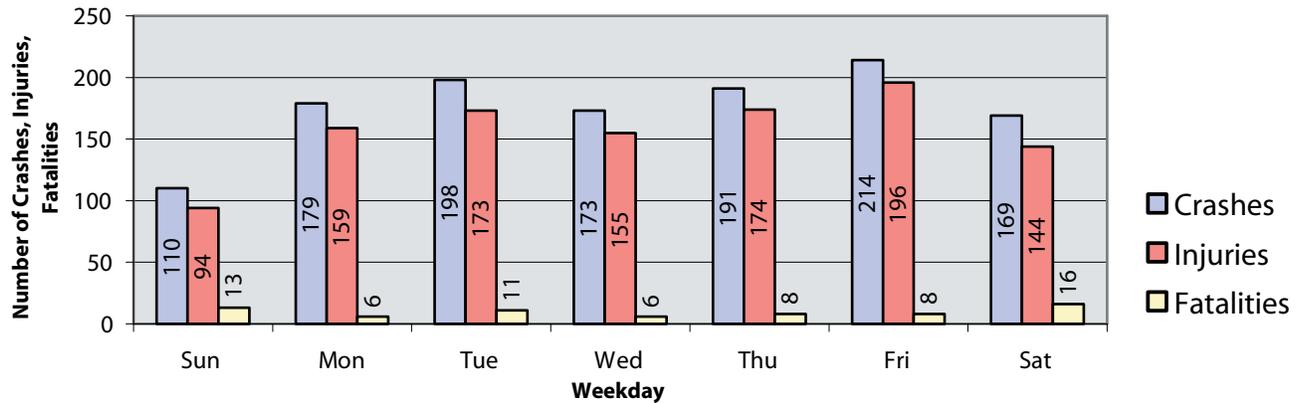


Figure 10: 2004 Number of Pedestrian Crashes by Day of Week



Crashes by hour of the day (*Figure 11*) indicate that most crashes occur between 2 p.m. and 9 p.m., with the highest during 4-7 p.m. Most of the fatalities occur from 6-9 p.m. and again from 12-2 a.m.

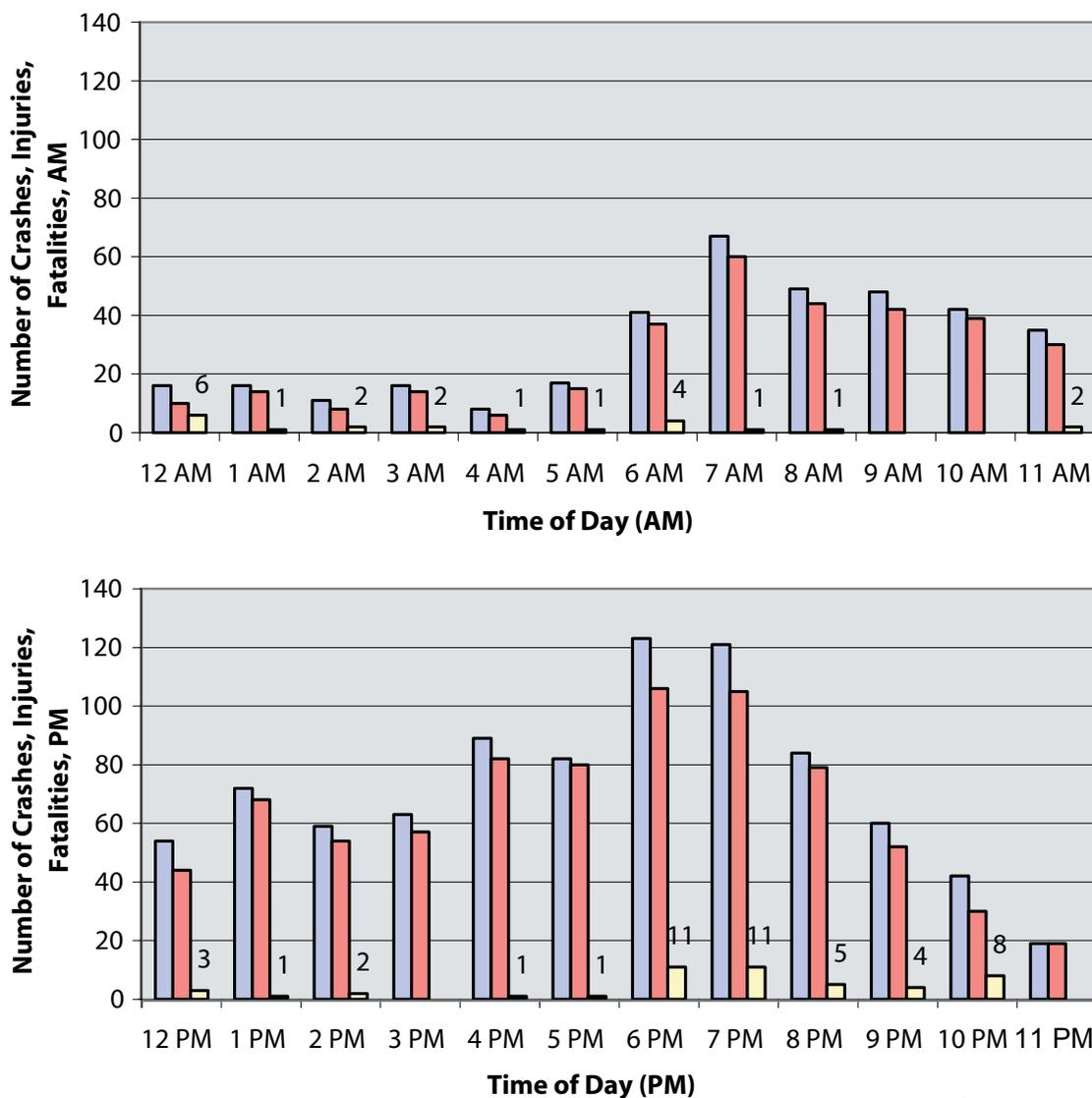


Figure 11: 2004 Number of Pedestrian Crashes by Hour of Day (Numbers in Figure 11 are fatalities.)



The age distribution of pedestrians in **Figure 12** indicates that the age group of 0-15 years of age, generally consisting of school-aged children, make up one quarter of all pedestrian crashes.

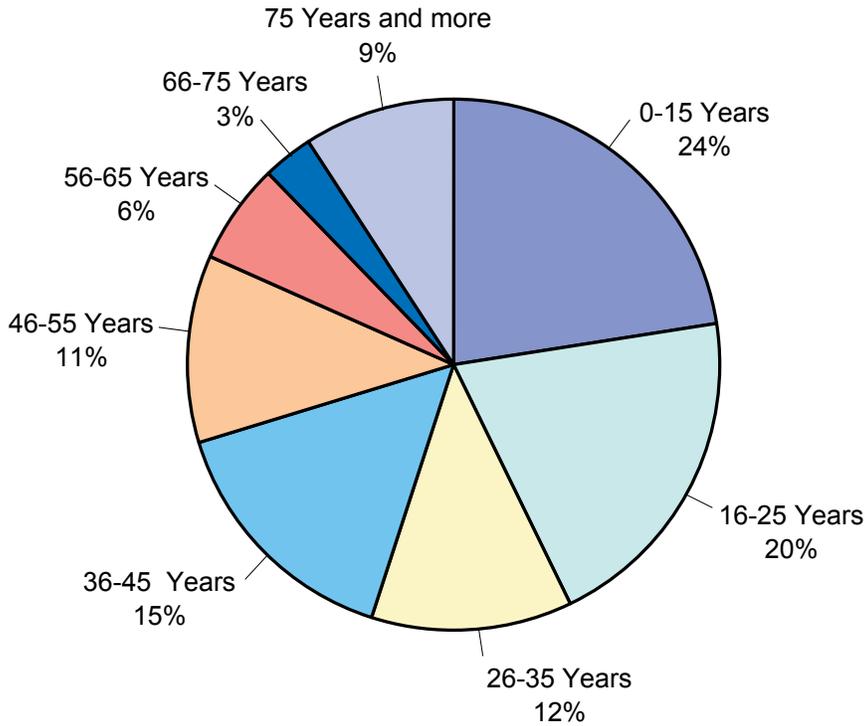


Figure 12: 2004 Number of Pedestrian Crashes by Age Group

Pedestrian Crash Statistics

An analysis of pedestrian crash data for 2004 has shown that most pedestrian fatalities (82 percent) and about two-thirds (62 percent) of pedestrian injuries did not occur near intersections. The definition used in the ADOT ALISS database states that all crashes within 150 feet of an intersection are considered intersection-related. While this definition varies among some MAG member agencies, for the purposes of this analysis the ADOT definition was used.

Year	Injuries		Fatalities	
	Int. Related	Non-Int. Related	Int. Related	Non-Int. Related
1999	397	677	25	53
2000	434	723	23	59
2001	430	660	26	66
2002	369	620	22	63
2003	420	577	14	68
2004	422	673	12	56

Table 3: Pedestrian Intersection Related Injuries and Fatalities

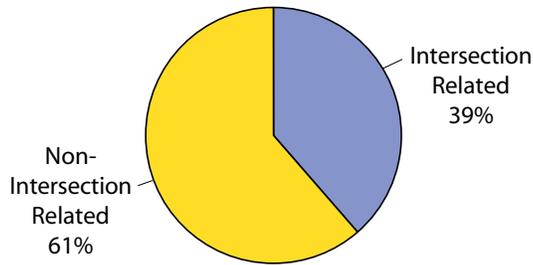


Figure 13: Pedestrian Injuries

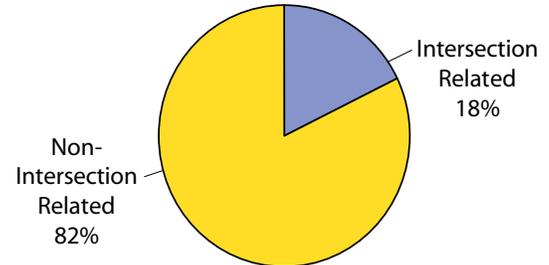


Figure 14: Pedestrian Fatalities

Pedestrian-involved crashes in the MAG region have resulted in crash rates of 1.8 fatalities and 31 injuries per 100,000 population. A comparison of population-based fatal crash rates in the region, shown in **Table 4**, indicates that the highest rate of 3.2 fatalities per 100,000 population occurred in Phoenix, followed by the Goodyear at 2.8 and Surprise at 1.6. MAG jurisdictions that experienced the highest number of pedestrian injuries are: Gila Bend with a rate of 98.5, followed by Litchfield Park with 51, and Phoenix with 47 injuries per 100,000 population.

Community	Population 2004	Pedestrian Crashes per 100K Population	
		Injuries	Fatalities
APACHE JUNCTION*	275	NA	NA
AVONDALE	60,255	16.6	0.0
BUCKEYE	14,505	0.0	0.0
CHANDLER	220,705	13.6	0.9
EL MIRAGE	28,310	3.5	0.0
FOUNTAIN HILLS	22,475	4.4	0.0
GILA BEND	2,030	98.5	0.0
GILBERT	164,685	9.1	0.0
GLENDALE	233,330	33.0	1.3
GOODYEAR	35,810	8.4	2.8
GUADALUPE	5,380	18.6	0.0
LITCHFIELD PARK	3,920	51.0	0.0
MARICOPA COUNTY	232,860	13.3	0.9
MESA	447,130	24.6	1.1
PARADISE VALLEY	14,410	6.9	0.0
PEORIA	132,300	14.4	0.0
PHOENIX	1,416,055	47.0	3.2
SCOTTSDALE	221,130	19.4	1.4
SURPRISE	63,960	6.3	1.6
TEMPE	160,820	45.4	0.6
TOLLESON	5,445	36.7	0.0
MAG REGION	3,524,175	31.0	1.8

*Apache Junction population in MAG Region only

Table 4: Pedestrian Injuries and Fatalities per 100K Population by Community



1.2.6 Bicyclist Crash Trends

An examination of bicyclist-involved crashes produced the trends shown in *Figures 15 through 21 and Tables 5 and 6*. The five-year trend indicates that all bicyclist-involved crashes and injuries declined until 2003. However, 2004 bicyclist-involved crashes show an increase by 9 percent.

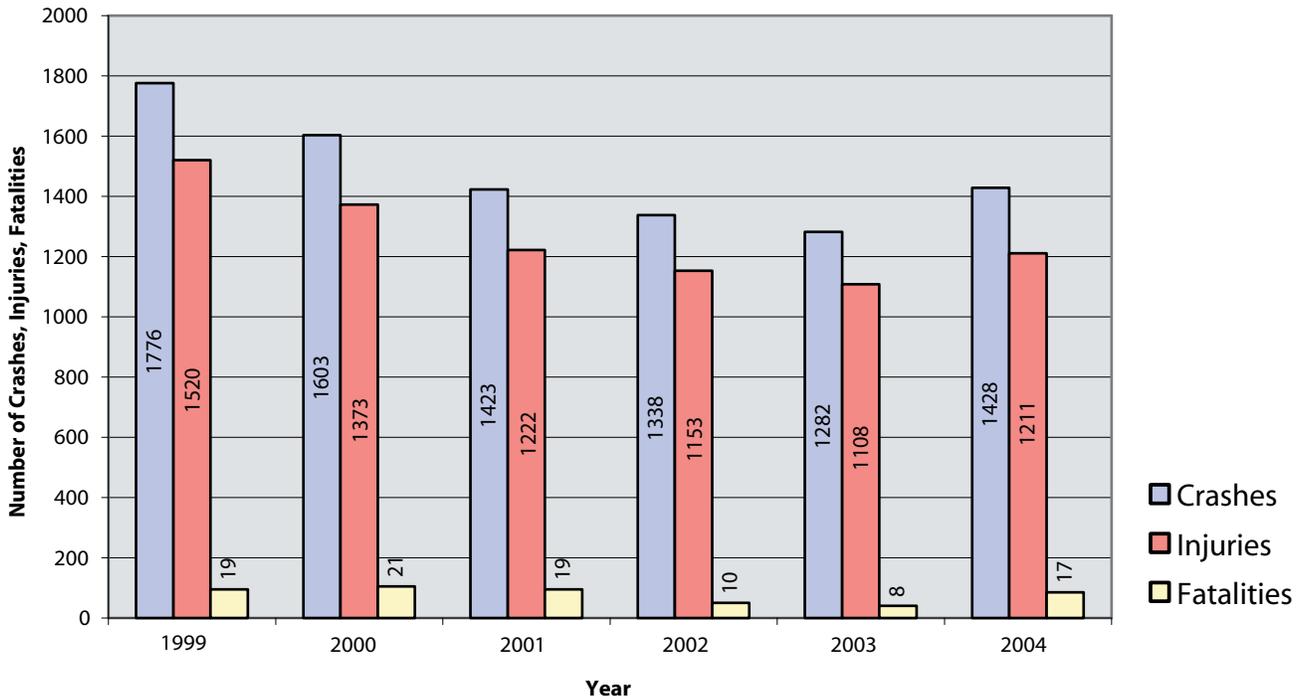


Figure 15: Bicyclist Crash Trend from 1999-2004

Year	Total Crashes	Injury Crashes	Fatal Crashes	Injuries	Fatalities
1999	1776	1511	19	1520	19
2000	1603	1364	21	1373	21
2001	1423	1214	19	1222	19
2002	1338	1148	10	1153	10
2003	1282	1101	8	1108	8
2004	1428	1204	17	1211	17

Table 5: Bicyclist Crash Trend from 1999-2004



The variation of bicyclist crashes from month to month (*Figure 16*) shows lowest crash occurrence during January, June and July. The crashes peak in March–May and again in August–October.

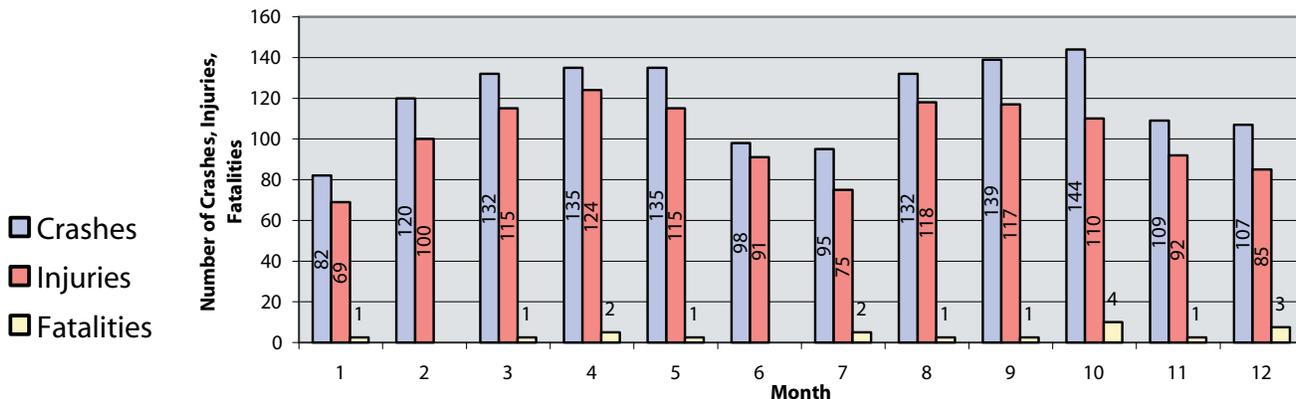


Figure 16: 2004 Number of Bicyclist Crashes by Month

The daily variation (*Figure 17*) shows a slight peak on Thursday and low crash occurrence on Saturday and Sunday. This may correlate with most work or school related trips made by bicycle.

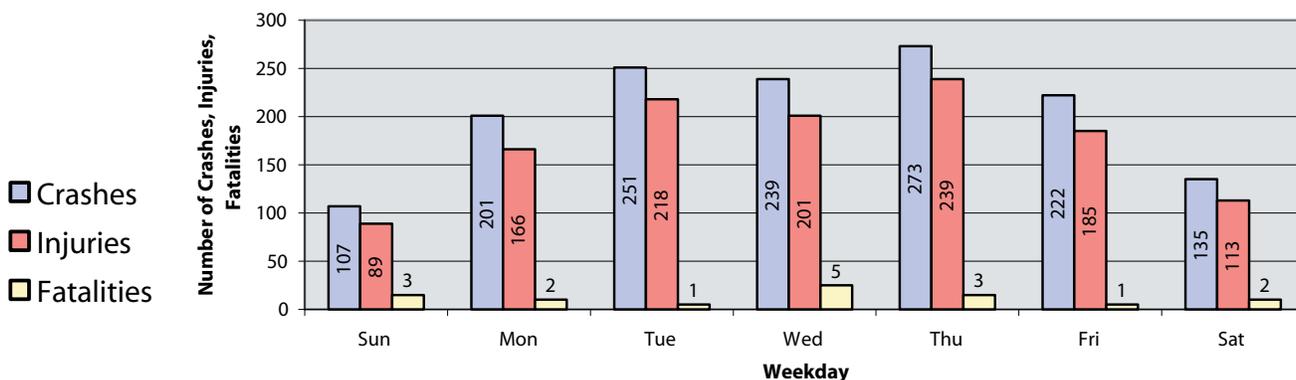


Figure 17: 2004 Number of Bicyclist Crashes by Weekday



The hourly variation shows a peak from 7-8 a.m. that coincides with work or school trips, a second peak around 2-7 p.m. also correlates with end of school, and work-related trips (*Figure 18*).

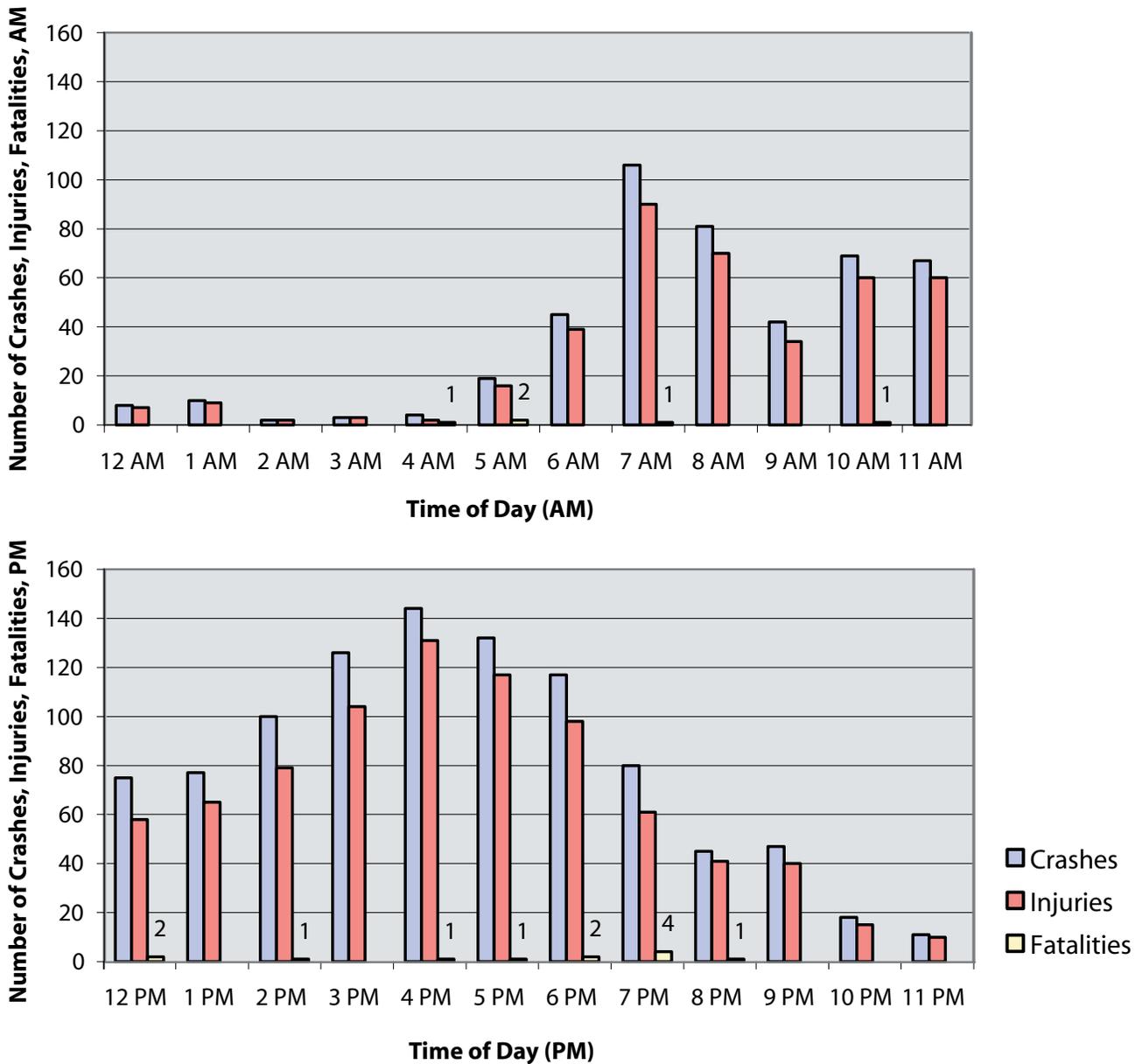


Figure 18: 2004 Number of Bicyclist Crashes by Hour of Day (Numbers in Figure 18 are fatalities.)



Very similar to pedestrian crashes, nearly one quarter of bicyclist crashes involve children less than 15 years of age. Another 23 percent involve the age group 16 to 25 years. (Figure 19)

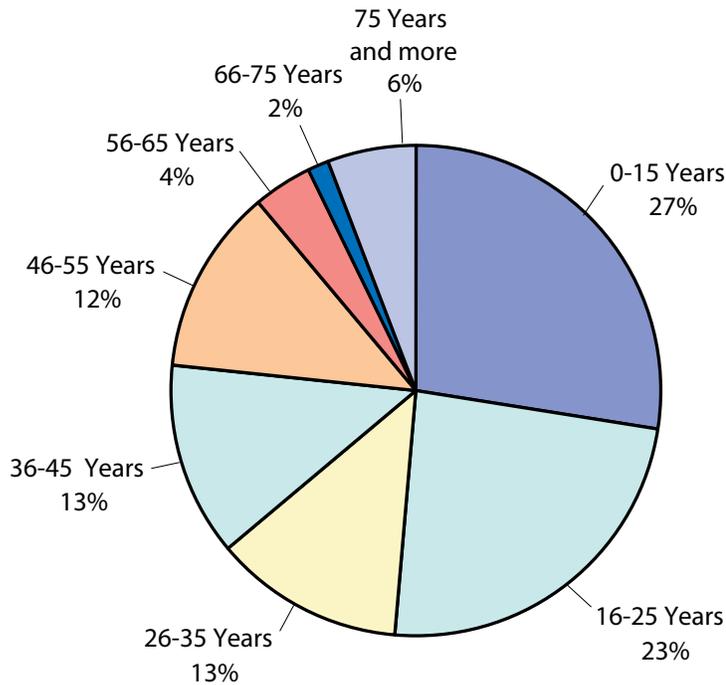


Figure 19: 2004 Number of Bicyclist Crashes by Age Group

Bicyclist Crash Statistics

An analysis of bicyclist-involved crash data for 2004 has shown that 57 percent of injury-related crashes occurred at intersections, whereas 76 percent of fatal crashes are non-intersection related.

Year	Injuries		Fatalities	
	Int. Related	Non-Int. Related	Int. Related	Non-Int. Related
1999	814	706	9	10
2000	729	644	10	11
2001	688	534	9	10
2002	618	532	3	7
2003	610	498	3	5
2004	686	525	4	13

Table 6: Bicyclist Intersection Related Injuries and Fatalities

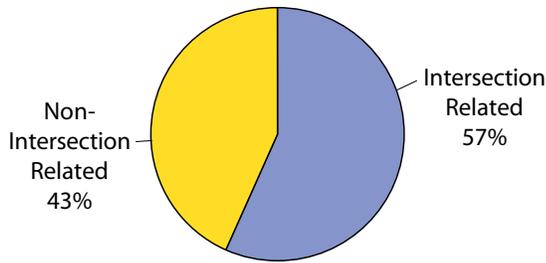


Figure 20: 2004 Bicyclist Injuries

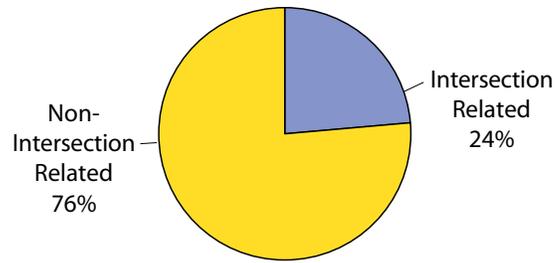


Figure 21: 2004 Bicyclist Fatalities

For bicyclist-involved crashes, the regional averages are 0.5 fatalities and 34.4 injuries per 100,000 population. The highest injury crash rate was experienced by Tempe at 107.6 injuries per 100,000 population, followed by Gila Bend at 49.3, Mesa with a rate of 45.6 and Chandler with a rate of 34.9.

Community	Population 2004	Bicyclist Crashes per 100K Population	
		Injuries	Fatalities
APACHE JUNCTION*	275	NA	NA
AVONDALE	60,255	28.2	0.0
BUCKEYE	14,505	6.9	0.0
CHANDLER	220,705	34.9	0.0
EL MIRAGE	28,310	14.1	3.5
GILA BEND	2,030	49.3	0.0
GILBERT	164,685	21.3	0.0
GLENDALE	233,330	27.4	1.3
GOODYEAR	35,810	14.0	0.0
MARICOPA COUNTY	232,860	15.5	1.3
MESA	447,130	45.6	0.4
PARADISE VALLEY	14,410	27.8	0.0
PEORIA	132,300	14.4	0.0
PHOENIX	1,416,055	34.7	0.4
QUEEN CREEK	11,245	8.9	0.0
SCOTTSDALE	221,130	28.5	0.0
SURPRISE	63,960	4.7	3.1
TEMPE	160,820	107.6	0.0
TOLLESON	5,445	18.4	0.0
WICKENBURG	5,970	16.8	0.0
MAG REGION	3,524,175	34.4	0.5

*Apache Junction population in MAG Region only.

Table 7: Bicyclist Injuries and Fatalities per 100K Population by Community



1.3 Funding Sources for Road Safety Improvements

Of the federal transportation funds, generated mainly from gasoline and diesel taxes at the pump, approximately 90 percent are returned to Arizona. The MAG region receives approximately \$70 million annually from this fund for transportation-related improvements. However, nearly all of these funds anticipated for the next 20 years have been programmed in the Regional Transportation Plan. There are a few federal funding categories that are earmarked for safety improvements. Federal funds come with detailed guidelines on project eligibility. Member agencies have access to these funds through ADOT and the Governor’s Office of Highway Safety (GOHS). Although MAG does not directly receive any federal funds earmarked for safety improvements, Surface Transportation Programming (STP) funds that are allocated to this region can be utilized for road safety improvements.



1.4 Future Funding Sources

There are several potential funding sources for safety improvements in the future: (1) Safety improvements that result from physical street improvements funded through the Transportation Improvement Program (TIP); (2) New safety programs funded through SAFETEA-LU Reauthorization; (3) Safety projects or programs developed through the MAG Unified Planning Work Program and Annual Budget.

Safety Improvements derived from Projects in the TIP

The allocation of qualifying federal funds specifically for road safety improvements in the region, through the MAG Transportation Improvement Program (TIP), would require the creation of a new project funding category for Safety Projects.

Safety Improvements from Street Projects in the RTP

The region’s freeway system is currently being built with a half-cent sales tax approved by Maricopa County residents in 1985 and extended for another 20 years in 2004. However, the rapid growth in the region will require additional resources to expand and improve the entire transportation system to keep pace with the growth. In 2003, MAG developed a comprehensive Regional Transportation Plan (RTP). This was a major planning initiative that has resulted in a broad vision for the regional transportation system to accommodate the growth expected over the next several decades. Recommendations contained in the RTP served as the basis for Proposition 400 that was approved by voters in November 2004 for extending the countywide sales tax for another 20 years. In developing the RTP, travel safety was identified as a goal and was used as one of the performance measures to compare a variety of transportation scenarios. The measures adopted in the RTP were shown to effect a three percent reduction in crashes and a seven percent reduction in crash rates when compared with the alternative of doing nothing. A safety project to help implement the Strategic Plan has been included in the RTP.



2. ROADWAY SAFETY

In 2004, there were 85,082 crashes in the MAG region. This total accounted for approximately 66 percent of crashes in the state and over-represented the population base in the County, which is less than 60 percent of the state's population. These crashes also included 394 fatal crashes. Many programs have been implemented to improve road safety in the MAG region. However, there is a need to evaluate the effectiveness of these programs and also improve both public and agency awareness of the current level of road safety in the region. Therefore, it is essential to develop a way to reliably and efficiently measure the performance of the regional road system from a safety viewpoint using definitions and techniques that are common and accepted by member agencies.





GOAL NO. 1: Develop a Reliable and Efficient Method to Assess the Safety Performance of the Regional Transportation System

Analysis of safety data can provide us valuable insights on the status of regional transportation safety; help us identify and prioritize hazardous locations; evaluate safety improvements, rank the highway treatment priority and address, quantify and minimize the crash risk factors. One of the important ways to measure the safety performance is accurate, complete and timely crash data.

General Strategies

- Improve the existing process for reporting crashes in the MAG region to ALISS.
- Improve the quality of crash data and traffic volume data.
- Develop a Regional Transportation Safety Information Management System linked to ALISS data.
- Explore road safety partnerships with the insurance industry and other private groups.
- Improve turnaround time for ALISS updates.
- Improve use of GIS technology in crash tracking.
- Establish common crash trend and rate determination system.

Potential Actions

- Develop an information and decision-support system for the regional transportation planning process based on the traffic volumes, crash records and the other important factors.
- Develop standard analysis definitions and techniques among participants.
- Assist local agencies in developing crash analysis and reporting systems like Phoenix’s TADS (Traffic Accident Data System).
- Implement the Regional Transportation Safety Information Management System based on ALISS data.
- Pilot TraCS (Traffic and Criminal Software), a customizable data collection system that can be used by law enforcement and motor vehicle agencies nationwide, in more cities. *
- Explore the possibility of building a regional Traffic Counts Network (TCN).



Reliable information on crashes can improve safety.

Lead Agencies

- ADOT
- MAG
- MAG member agencies

* TraCS is completed in the City of Phoenix. Electronic transmittal from Phoenix Police Department to ADOT is the only portion not operational as of this date. Online transmittal direct to ADOT Traffic Records database has not been scheduled.



GOAL NO.2: Promote Road Safety Audits for New and Existing Developments

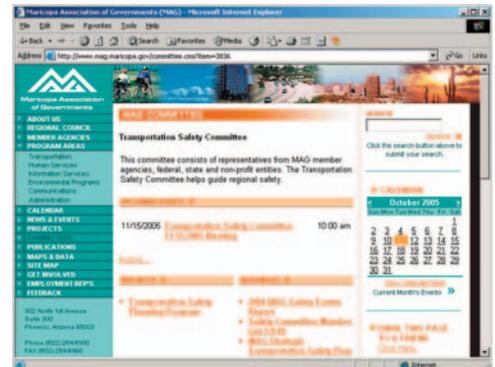
Road Safety Audits are an effective method to review roadway safety design and operational features by independent experts. After introducing safety audits, safety aspects can be incorporated during all phases of planning, design, construction, operation, and maintenance. The objectives of safety audits are to identify potential safety problems existing during the current phase or affected by the highway treatment, and consider a way to mitigate the problems. Road Safety Audits can be a highly useful and cost effective tool for reducing the risk and severity of motor vehicle crashes. The practice of Road Safety Audits is relatively new in the US. In the UK and in Australia, Road Safety Audits have been institutionalized since mid 1980s and have contributed significantly to safety improvements.

General Strategies

- Review the use of Road Safety Audits in other urban regions.
- Educate safety stakeholders on the practice of Road Safety Audits.
- Establish a pilot Road Safety Audit Program in the region.
- Address liability concerns of member agencies.
- Offer ongoing training classes on conducting Road Safety Audits and provide information packets.

Potential Actions

- Document and share best practices in the other states or regions.
- Support/Attend NHI training course being hosted by LTAP and ADOT.
- Share Road Safety Audit information via the MAG Web site.
- Provide a clearinghouse or online list of resources including downloadable audit forms and other material.
- Develop a regional RSA procedure/guidelines and checklist.
- Develop links with legal field to address liability issues.
- Develop links between RSA and available funding source such as HES Funds.



The MAG Web site could be used to share road safety audit information.

Lead Agencies

- ADOT
- MAG
- MAG member agencies



GOAL NO. 3: Better Utilize Available Road Safety Funds

The inadequacy of funds to implement all road safety improvement projects is a perennial challenge for all road safety stakeholders. The limitations placed on some categories of federal funds, which are otherwise dedicated to road safety, are other constraints within the process. Although a limited amount of funding is available for safety improvements, through ADOT’s Hazard Elimination and Safety Program (HES), the local governments in the region have not been fully utilizing this resource. The Safety Team identified this as a key safety goal. The objective of this goal is to help the region better utilize available safety funds.

General Strategies

- Review and streamline the application process for HES funds.
- Increase number of applications for HES funds.
- Explore additional funds for road safety improvements.

Potential Actions

- Share information on the HES process with safety stakeholders, utilizing the MAG Web site.
- Build linkages between the possible new road safety funding resources.
- Provide HES application workshops and training.
- Develop a Regional Safety Project Monitoring System to track the availability and timeline of the funding and funded safety projects.
- Develop an online funding opportunity Web listing.

Lead Agencies

- ADOT
- MAG
- MAG member agencies



MAG Transportation Safety Committee



GOAL NO. 4: Reduce the Crash Clearance Time

Traffic bottlenecks created by frequent occurrence of crashes on freeways and arterials can increase overall traffic congestion in the region. This could also result in the increased risk of secondary crashes. Freeway and arterial incident management can result in overall safety benefits to the region. One such program launched by MAG, the Freeway Service Patrol Program, is operated by DPS and has been making significant contributions to safety on the freeway system. The ALERT Team is another program that has been operated by Arizona DOT for many years.

The Freeway Service Patrol (FSP) provides basic assistance to motorists stranded on the freeway system. The FSP provides gas, water, battery jump start, flat tire repair, coordination with wrecker services, and assistance with clearing lanes by pushing disabled vehicles off travel lanes. Similarly, the ADOT ALERT Team assists DPS with short-term (up to 2-hours) traffic control, coordinates traffic related issues with an on-site command center, provides minimal signing for detour routes, and coordinates the use of electronic signs with the ADOT Traffic Operations Center. The ALERT Team also provides support to ADOT Maintenance during longer duration incidents such as cleaning up chemical spills and clearing crash sites. The primary goal of incident management is to remove road debris and clear the crash site as quickly as possible and restore full capacity and safety of the roadway. Maricopa County has developed an incident response program named REACT to respond to arterial incidents within unincorporated areas and in a number of jurisdictions in the West Valley.



The Freeway Service Patrol helps a stranded motorist.

General Strategies

- Assess the magnitude and trends of the crash problem on freeways.
- Assess the magnitude and trends of the crash problem on arterial roadways.
- Assess the need for increased responders to crash scenes.
- Improve emergency medical response times.

Potential Actions

- Assess the benefits of Freeway Service Patrol Program.
- Assess the benefits of the MCDOT REACT pilot project.
- Assess the need for improved operations to expedite emergency vehicle access to crash scenes and protect emergency personnel at the scene.
- Develop an EMS response time grid to identify areas within jurisdictions where response times are higher than average.

Lead Agencies

- ADOT—Freeway Incident Management
- DPS—including EMS organizations
- Maricopa County—REACT Program
- MAG member agencies—Arterial Incident Management



GOAL NO. 5: Reduce Severe Intersection Crashes

A large percentage of crashes in the MAG region, particularly severe crashes, occur at intersections. In the United States, 44 percent of all reported motor vehicle crashes and 23 percent of total fatalities, approximately 8,500 fatalities, occur at intersections. An examination of 2001 crash data indicated that, in the MAG region, 42 percent of all reported crashes and 42 percent of fatal crashes occur at intersections. The following general strategies and potential actions can be taken to improve safety at intersections.

General Strategies

- Promote safety benefits of red light camera enforcement.
- Promote the use of crash data to identify crash-prone locations for implementation of countermeasures.
- Promote and prioritize best practices for selection, design, installation, operations and maintenance of traffic control devices as they relate to safety and efficiency.
- Evaluate and promote the use of innovative traffic control devices.
- Promote increased use of countywide education and enforcement campaigns.



A busy intersection in Phoenix

Potential Actions

- Implement engineering solutions to reduce intersection crashes.
- Share information on the various implementations of red light cameras across the region and observed benefits.
- Encourage and support member agencies in using crash data.
- Improve data quality and quantity, especially for fatal or severe injury crashes at intersections.
- Develop a list of low cost safety improvement countermeasures that can be easily implemented by MAG member agencies.
- Share information on the benefits of using new technologies to reduce crash risk—such as OnStar or RESCU .
- Educate member agencies on innovative traffic control devices by showcasing innovations at the annual Safety Forum.
- Develop common definitions and measurements of red light violations.
- Evaluate degree of adherence to Arizona Traffic Accident Report Instruction Manual & Glossary (ADOT) by member agencies .

Lead Agencies

- ADOT
- MAG member agencies



GOAL NO. 6: Improve Traffic Safety in Work Zones

A significant percentage of motor vehicle crashes occur in work zones. Road construction and maintenance activities can disrupt traffic flow and pose risks to motorists, pedestrians and workers. Work zones are of particular concern to older drivers who find navigating through them at night challenging. Improvements to the legibility of signs and better delineation through work zones need to be addressed.

General Strategies

- Promote compliance with work zone signing guidelines, as specified in the MUTCD and Arizona State Supplement, and adequate maintenance of traffic control devices.
- Promote adequate enforcement of speed limits in work zones.
- Promote activities that ensure improved road safety during nighttime operations.
- Evaluate and promote the use of innovative traffic control devices for improving work zone safety.
- Promote regional work zone safety guidelines.
- Develop a countywide work zone permitting section especially relating to work on common arterial streets.
- Promote communication in work zone planning (scheduling).

Potential Actions

- Develop uniform urban guidelines for work zone and maintenance of traffic control.
- Develop a training video on work zone safety.
- Develop regional work zone inspection and management guidelines.

Lead Agencies

- ADOT
- MAG member agencies
- Construction industry and utility representatives
- Citizen action groups (ADA, AARP, etc.)



Work zone on Central Avenue in Downtown Phoenix



GOAL NO.7: Conduct Safety Reviews of Proposed LRT and BRT Operations Starting at Design

The proposed Light Rail Transit (LRT) and Bus Rapid Transit (BRT) operations in the region will introduce an additional complexity to the urban road environment. In order to ensure that the safety of pedestrians, bicyclists and other motor vehicle users is not compromised, an early safety plan/design is needed. Special design considerations should focus on safety around the LRT and BRT vehicles.

General Strategies

- Encourage safety audits during the LRT design.
- Keep the LRT related crash rate lower than national level.
- Develop educational safety programs for rail-line infrastructure and riders.

Potential Actions

- Establish a safety audit team for evaluation of LRT operation.
- Establish safety education work group.

Lead Agencies

- ADOT
- Valley METRO
- MAG member agencies



Construction of the Light Rail System is already underway.



GOAL NO. 8: Improve Lighting, Signage and Delineation for Older Road Users

The MAG Elderly Mobility Initiative has recognized the need to provide better signage and delineation. The changing demographics in the region indicate that there will be a significant number of older drivers in the MAG region by 2030. The FHWA Older Driver Highway Design Handbook provides guidance on appropriate changes to the road signs to accommodate these users. The state of Florida has adopted some of these recommendations and has included them in the state road design manual.

General Strategies

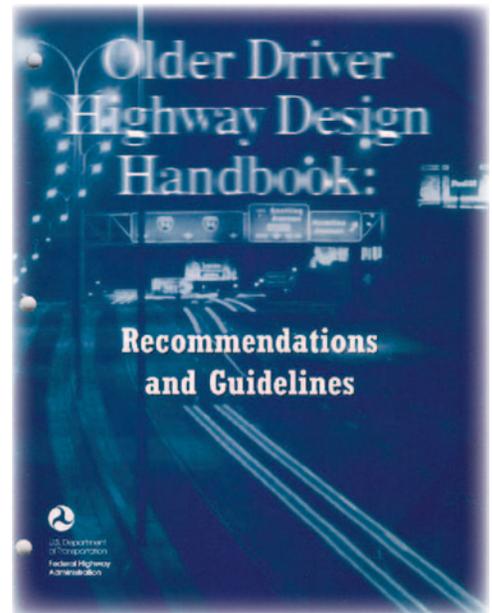
- Promote better messages, through signing, striping and design, to help older road users.
- Review state of the practice in other states.
- Develop older driver crash and injury profiles to determine how crashes are occurring and types of emergency response.

Potential Actions

- Adopt relevant recommendations from the FHWA Older Driver Highway Design Handbook.

Lead Agencies

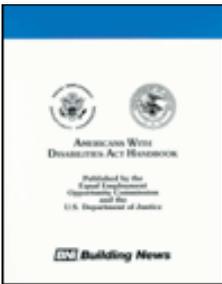
- ADOT
- Governor's Office of Highway Safety
- MAG member agencies



Older Driver Highway Design Handbook



GOAL NO. 9: Improve Lighting, Signage and Accessibility for Physically Handicapped Users



ADA Design Handbook

The increasing mobility of society and also of persons with physical disabilities indicates that there will be significant numbers of physically handicapped drivers, passengers and pedestrians in the MAG region by 2030. The ADA Design Handbook provides guidance on appropriate changes to the some roadway design features but additional guidelines may need to be developed.

General Strategies

- Review state of the practice in other states and countries.
- Evaluate and promote the use of innovative traffic control devices.

Potential Actions

- Develop guidelines (as needed) for improving access.
- Examine individual ADA needs of physically, visually and hearing impaired and develop programs as per requirement.

Lead Agencies

- Governor's Office of Highway Safety
- ADOT
- MAG member agencies

3. ENFORCEMENT/EDUCATION/EMS SAFETY

Despite improvements made to road safety through improved engineering, enforcement and safety education, a large number of crashes still occur in the MAG region. Road crash statistics in the region point to the distinct possibility that a significantly large percentage of the driving public frequently stray from good driving behavior and may even go as far as frequently violating traffic regulations and road rules. These acts may include disobeying traffic signals, exceeding the speed limit, driving while impaired, and disregarding reduced speed limit signs in construction and school zones. The key contributory factors for this unhealthy road environment are: (1) extremely low levels of road safety awareness among road users in general, and (2) dangerously high levels of disregard and disobedience of traffic laws.





GOAL NO. 1: Improve the Overall Public Awareness on Key Road Safety Issues

Road safety awareness can be improved through strategies aimed at a variety of road user groups. Combined strategies involving education and enforcement have been found to be effective at addressing disregard/disobedience of traffic laws through behavior modification. Regional initiatives should be based upon successes at the local level, i.e., Governor’s Office of Highway Safety’s Inter-Agency DUI Task Force; City of Glendale’s “Slow Down Friday” program; City of Mesa’s Child Safety Seat Program and City of Phoenix’s School Crossing Guard Training Program.

General Strategies

- Launch a media campaign targeting road safety.
- Coordinate regional road safety educational programs—avoid duplication and learn/share success stories.

Potential Actions

- Host annual MAG Regional Transportation Safety Forum—suggest bi-annual.
- Sponsor traffic safety-associated public safety announcements (PSAs) or short programs made by local celebrities.
- Identify groups or individuals interested in traffic safety, especially media personalities, and get them involved in media campaigns.
- Provide funding to MAG member agencies to develop, promote and publicize safety messages and awareness campaigns.
- Sponsor a “Traffic Safety Awareness Week” or “Traffic Safety Awareness Month”—“Prom/Grad” mock accident scene at high schools.
- Sponsor/Launch programs to repeat safety messages/slogans through TV, radio, newspaper, publication and internet.
- Launch an internet-based clearinghouse for MAG Regional Transportation Safety information; identify potential volunteers, agencies, target audiences; conduct a survey of current members to identify additional stakeholder agencies.



2005 Safety Forum

Lead Agencies

- Governor’s Office of Highway Safety
- ADOT
- AAA Arizona
- AARP
- DPS



GOAL NO.2: Reduce Crashes Related to DUI, Speeding, Red-light Running and the Illegal Passing of Stopped School Buses

All violations targeted under this goal are predominantly related to driver behavior. Strategies, therefore, should combine education and enforcement in order to modify driver behavior. Initiatives may be launched by state or local agencies, schools, law enforcement agencies and other organizations such as AAA or insurance companies. On the educational front, programs may be directed at teen, inexperienced or drivers new to Arizona. Enforcement strategies can include increased levels of enforcement, automated enforcement and stiffer fines. Since the implementation of enforcement-related strategies are beyond the transportation planning arena, any action along these lines should be coordinated with the proper authorities either at the state or local levels. Recommendations for specific actions should be directed at the appropriate agency.

General Strategies

- Reduce incidence of DUI.
- Reduce differential speeds caused by excessive speeding.
- Reduce red-light running.
- Reduce illegal passing of stopped school buses.



Mobile Incident Command and DUI Enforcement Vehicle

Potential Actions

- Recommend stricter enforcement of current laws on DUI, speeding and red-light running.
- Share information on availability of special grants for additional enforcement officers and overtime pay, etc.
- Recommend increased DUI/sobriety checkpoints, police presence during school hours.
- Prepare educational information based on crash data and benefits of specialized programs aimed at reducing DUI, speeding and red-light running.

Lead Agencies

- Governor’s Office of Highway Safety
- Arizona Department of Public Safety (DPS)
- Local Enforcement Agencies



GOAL NO. 3: Strengthen Driver Training and Licensing Standards

The quality and amount of driver training available to new drivers have been proven to have a positive influence on their behavior behind the wheel. Better driver training is an efficient and proactive measure to improve road safety. Current driver licensing standards in Arizona may not be adequate to meet current needs and future demands for improved driver safety. Statistics show that younger drivers aged 16 to 20 are more likely to be involved in crashes. Special programs should be made available to the younger drivers due to their inexperience and their tendency to be aggressive drivers.

General Strategies

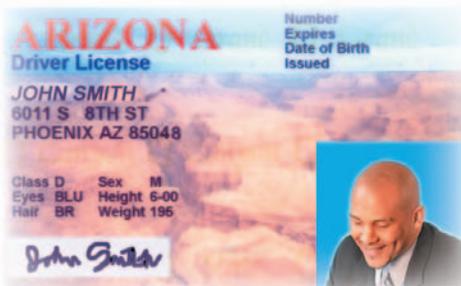
- Strengthen driver-licensing standards for teen-aged as well as older drivers.
- Partner with ADOT to update MVD testing booklets and exams.
- Improve driver training process.
- Improve high school driver training.
- Support driver intervention programs to provide assessment education and retraining to older drivers.

Potential Actions

- Introduce road safety education through videos played at ADOT Motor Vehicle Division’s Licensing and Registration locations.
- Evaluate local driver safety education programs.

Lead Agencies

- Governor’s Office of Highway Safety
- ADOT (Motor Vehicle Division)
- AAA Arizona



Strengthen driver-licensing standards.



GOAL NO. 4: Reduce Time to Respond and Clear Crash Sites

Crash scene response is a significant part of any road incident management. The responding agencies need to develop and coordinate strategies and thus reduce the response time and expedite crash scene clearance while protecting the people involved. Recently developed systems such as the Automated Collision Notification (ACN) system have clearly demonstrated their value in reducing the time to respond to serious crashes.

The addition of new urban freeway segments poses new challenges and workload on the part of DPS. Hence, more resources are needed to ensure safety and security on the freeway segments.

General Strategies

- Reduce crash response time: 4-6 minutes in 2003.
- Expedite crash scene clearance without compromising the safety of first responders.
- Increase staff available for enforcement on the urban freeway system.

Potential Actions

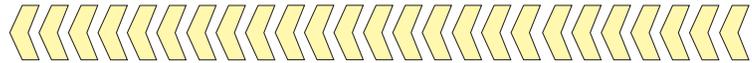
- Support efforts to reduce crash scene response times through better coordination.
- Examine the feasibility of implementing ACN in the MAG region.
- Provide field facilities for effective enforcement operations.

Lead Agencies

- DPS
- Local Law Enforcement
- Local EMS/Fire Departments



Reduce crash response time.



GOAL NO.5: Educate the Public on Safe Actions to Take at Road Crash Sites

This goal involves educating motorists on appropriate and safe actions to take when they are either involved in or encounter a traffic crash. This education content must also be included as part of driver education. A recent multiple fatal crash on a regional freeway and the ensuing public discussion uncovered a vast amount of unawareness among the general public in this area. Many motorists seem unaware of the huge risks associated with potential exposure to high speed traffic at close physical proximity.

General Strategies

- Educate motorists on how to minimize life threatening risks at crash sites.
- Educate motorists regarding what they should and should not do upon encountering a crash scene.

Potential Actions

- Develop a list of basic YES and NO actions on what to do when passing crash sites on arterials or freeways.
- Develop a list of basic YES and NO actions on what to do when involved in a crash on arterials or freeways prior to arrival of police or EMS.
- Faster notification of motorists on crashes ahead.
- Recommend including our key recommendations in the Arizona Driver's Manual.

Lead Agencies

- Governor's Office of Highway Safety
- ADOT
- DPS
- MAG
- AAA Arizona
- AARP

4. PEDESTRIAN/BICYCLE/TRANSIT SAFETY

In 2004, nearly 18 percent of all fatalities in the region were pedestrians, and nearly 2 percent bicyclists. Among all injuries caused by road crashes, nearly 2 percent involved pedestrians and bicyclists each. This goal for reducing the overall number of crashes would lead to reductions in fatalities and injuries.

Since the tragic events of September 11, 2001, security has the highest priority in all transportation modes. Transportation agencies are looking to make improvements toward a safe and secure travel environment, especially in public transit. The strategies and actions recommended call for a coordinated approach for addressing the security of the region's public transit system.





GOAL NO. 1: Reduce the Number of Crashes that Involve Bicyclists or Pedestrians

In 2004, nearly 18 percent of all fatalities in the region were pedestrians, and nearly 2 percent bicyclists. Among all injuries caused by road crashes, nearly 2 percent involved pedestrians and bicyclists each. This goal for reducing the overall number of crashes would lead to reductions in fatalities and injuries.

General Strategies

- Educate bicyclists on road safety.

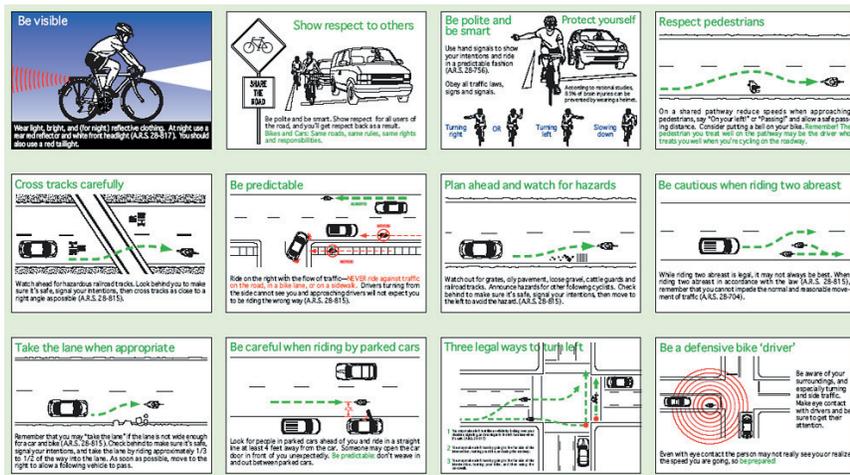
Potential Actions

- Promote bicyclist training programs for youth and adults. Utilize programs such as that provided by the League of American Bicyclists and Pedestrian & Bicycle Information Center.
- Cosponsor safety and training programs with Coalition of Arizona Bicyclists and/or other agencies.

Lead Agencies

- MAG
- ADOT
- AAA Arizona

The MAG Regional Bike Map includes bicycle safety tips on the back.





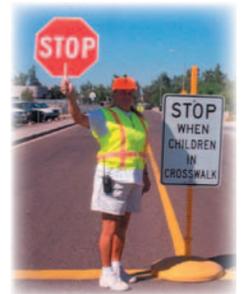
GOAL NO. 2: Improve Safety on Access Routes to Schools

Children are one of the most vulnerable of road users and are more likely to be exposed to crash risks because of their lack of street crossing experience, short attention span, immaturity and lack of physical and emotional development. Inattention and speeding by parents driving other students to schools is often a significant threat to children near schools. Walking and bicycling to school are options that can both reduce traffic demand on the streets and improve physical fitness. School crossing guards provide a valuable service to ensure the safety of students. Training for crossing guards was identified as an urgent existing need in the region. The following strategies and actions were recognized by the Pedestrian, Bicycle, Transit (PBT) Safety Team as priorities for improving overall road safety.

General Strategies

- Establish recommended walk or bike routes to school*, in areas surrounding schools, within schools and encourage and promote Safe Routes to School programs within schools.
- Include school officials, principals and teachers as vital part in promoting this program.
- Train crossing guards.
- Educate regional stakeholders on best safety practices for getting to/from school.*
- Encourage safe driving near schools* and surrounding neighborhoods.

* public schools, including charter schools



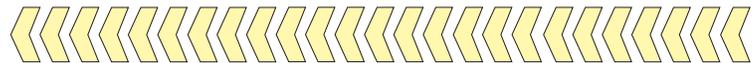
Train crossing guards.

Potential Actions

- Provide training to local agencies and schools for developing recommended walk or bike routes to school for all schools in the region and Safe Routes to School (SR2S) programs.
- Spearhead study in school areas that evaluates; investigate using latest technologies like flashing beacons, in-pavement flashers, active feedback signs, pedestrian signals, and detectors.
- Offer or support a regional training program for school crossing guards.
- Periodically sponsor pedestrian and bicycle safety audits.
- Recommend new legislation that would require all new schools to be located appropriately (i.e., no elementary schools on arterial streets), with a Traffic Impact Study to be reviewed by the city’s traffic engineers to include—pedestrian, bicycle and motor vehicle ingress and egress design; school bus or passenger car pick-up or drop-off locations; on-site circulation, off-site circulation for pedestrians, bikes and vehicles; queuing length at drop-off and pick-up locations. Such review must be carried out prior to 30 percent completion of plans. Cities and towns may need to consider revising development review process to accommodate this review step.
- Develop a guidance document on School Traffic Impact Studies.
- Develop guidelines and provide support and resources for forming a school Safety Improvement Advisory Committees (SIAC) to provide oversight for school bike and pedestrian safety issues—provide information on best practices.

Lead Agencies

- ADOT (still has ownership of the design guide for school zones)
- MAG
- School transportation officials
- Member agency traffic engineers



GOAL NO. 3: Incorporate Safety Considerations in Pedestrian and Bicycle Planning

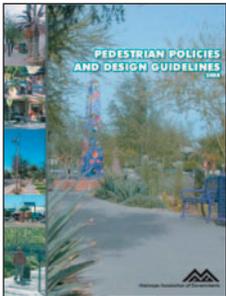
Transportation safety usually ranks very high as a priority in any planning and transportation improvement program. Planning for public infrastructure with careful consideration given to safety from the very early planning stages is the best proactive measure to improve safety. Hence, the strategies and actions below are recommended for influencing the selection of all pedestrian and bike projects launched through the regional planning process.

General Strategies

- Encourage safety conscious planning at all stages of transportation planning.
- Support or spearhead study to analyze standard safe walking speed rates and sidewalk widths under different conditions (i.e., along Safe Route to Schools, adjacent arterials to arterials or parks, where bikes may also be riding etc.).
- Stress priority of pedestrian/bike/school friendly design elements early in development process.
- Support long range transportation planning and corridor studies that incorporate safe school routes, pedestrian and bike oriented development, interconnectivity between and provision for modal options.

Potential Actions

- Develop and publish guidelines on how to consider pedestrians and bicyclists in road safety when developing new communities with emphasis on schools, also in retroactively improving existing communities.
- Promote pedestrian/bike system connectivity and continuity.
- Include explicit safety considerations in future updates of the MAG Pedestrian Area Policies and Design Guidelines, Regional Bicycle Design Guideline, and the Regional Off-Street System (ROSS) plan.
- Encourage local agencies to include safety as a criteria in evaluating alternative transportation scenarios.
- Institutionalize safety criteria in the MAG Transportation Improvement Program (TIP) process.
- Recommend methods or develop a tool box for analyzing and reducing pedestrian and bicyclist crash rates.
- Encourage and/or assist local agencies to develop their own programs to annually review pedestrian and bicycle crashes.
- Establish a clearinghouse of resources, reference materials, suggested design guidelines, links or examples of other successful safety programs from jurisdictions across the country, grant sources.
- Develop recommended Safety Tips to be posted at the MAG Web site for use by jurisdictions and the public.



MAG Pedestrian Policies and Design Guidelines

Lead Agencies

- MAG
- ADOT
- Pedestrian and bicycle facility planners and designers



GOAL NO. 4: Promote Safe Multi-Modal Access

The Maricopa region is experiencing one of the fastest travel demand growth rates in the country. Large investments are being made to expand and improve multiple travel modes, especially Light Rail Transit (LRT), Bus Rapid Transit (BRT) and metro buses. Providing safe access to these modes through walking or bicycling is critical for encouraging more people to use them. Convenient and safe access to these multi-modal transportation facilities will help reduce overall traffic pressures on the metropolitan area and reduce overall crash risks.

General Strategies

- Promote safe interaction and accommodation of buses, LRT and BRT vehicles with pedestrian and bicycles.
- Accommodate bicyclists and pedestrians within the street system.
- Promote safe access and accommodation of bicycles and pedestrians in transit vehicles.
- Incorporate requirements of the Americans with Disabilities Act (ADA).

Potential Actions

- Recommend incorporating features for safe pedestrian and bicyclist access to LRT, BRT and bus stations in MAG Pedestrian Area Policies and Design Guidelines, and any existing guidelines on bicycle facilities.
- Provide surrounding circulation paths, waiting areas, bike lockers and bike racks.
- Provide push button OR detection zone-based activation for bicyclists at signalized intersections.
- Provide bicycle activation at signalized intersections with bike lanes.
- Establish or preserve right-of-way for future bus stops and transit needs.
- Establish a program and funding sources to aid agencies in constructing or upgrading transit connections.



Planned light rail station at Indian School and Central

Lead Agencies

- MAG member agencies (traffic engineers)
- Transit planners
- LRT and BRT authority



GOAL NO. 5: Reduce Mid-Block Pedestrian Crashes

A recent technical report released by National Highway Traffic Safety Administration (NHTSA) shows the following facts about pedestrian crashes and fatalities involved in the crashes.

- More pedestrian fatalities occur at non-intersection locations (more than 75 percent) and roadways without crosswalks (more than 40 percent).
- Though most crashes occur in urban areas, 60 percent of all pedestrian crashes in urban areas do not occur at intersections. This compares to 75 percent of child pedestrian crashes, which do not occur at intersections.

Safe pedestrian access on surface roads reduces short vehicular trips and effectively reduces congestion on local streets. Hence, effective ways must be planned for movements of pedestrians and bicyclists.

General Strategies

- Educate communities on safe road crossing through public outreach.
- Legislative action to provide funding for agencies to carryout outreach and enforcement programs.
- Accommodate bicyclists and pedestrians on the street system.

Potential Actions

- Recommend increasing the lighting conditions on roads in urban areas.
- Installation of actuated mid-block pedestrian crossing signals when intersections are too far.
- Strict enforcement for jaywalking laws.



Long stretches without crosswalks makes jaywalking more likely.

Lead Agencies

- Governor’s Office of Highway Safety
- ADOT
- DPS
- MAG member agencies
- AAA Arizona
- AARP



GOAL NO. 6: Enhance Transportation Security

Since the tragic events of September 11, 2001, security has the highest priority in all transportation modes. Transportation agencies are looking to make improvements toward a safe and secure travel environment, especially in public transit. The strategies and actions recommended call for a coordinated approach for addressing the security of the region's public transit system.

General Strategies

- Provide a safe and secure environment for all users of the region's public transit system.
- Monitor system wide safety and security.

Potential Actions

- Support safety and security measures for the public transit system and facilities.
- Assist Valley Metro to collect security data in mass transit.
- Share safety and security information with the appropriate stakeholder agencies.
- Consider developing a lighting program, partner with APS and SRP.
- Establish a program to review and improve safety and security at transit terminals and stops.

Lead Agencies

- Valley Metro
- LRT and BRT authority



Promote safety measures at bus stops and other transit facilities.



5. APPENDIX

Summary of Safety Goals

Goals	Roadway Safety	Enforcement/Education/EMS Safety	Pedestrian/Bicycle/Transit Safety
1	Develop a reliable and efficient method to assess the safety performance of the regional transportation system.	Improve the overall public awareness on key road safety issues.	Reduce the number of crashes that involve bicyclists and pedestrians.
2	Promote road safety audits.	Reduce crashes related to DUI, speeding, red-light running and the illegal passing of stopped school buses.	Improve safety on access routes to schools.
3	Better utilize available road safety funds.	Strengthen driver training and licensing standards.	Incorporate safety considerations in pedestrian and bicycle planning.
4	Reduce the crash clearance time.	Reduce time to respond and clear crash sites.	Promote Safe Multi-modal Access.
5	Reduce severe intersection crashes.	Educate the public on safe actions to take at road crash sites.	Reduce Mid-block pedestrian Crashes.
6	Improve traffic safety in work zones.		Enhance Transportation Security.
7	Conduct Safety reviews of proposed LRT and BRT operations starting at design.		
8	Improved lighting, signage and delineation for older road users.		
9	Improved lighting, signage and accessibility for physically handicapped users.		

Table A- 1. Summary of Safety Goals



**MARICOPA
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302 N. 1st Avenue, Phoenix, AZ 85003
602-254-6300 www.mag.maricopa.gov

