AZTechä TRAFFIC MANAGEMENT PERFORMANCE MEASURES

Phoenix Metropolitan Region

FREEWAYS – ARTERIALS – SAFETY – INCIDENT MANAGEMENT – TRAVELER INFORMATION – TRANSIT

Jan 2012

Developed by the AZTechä Strategy Task Force

AZTech™
Moving Forward Together

PARTNERS IN INTELLIGENT TRANSPORTATION

PARTNERS / CONTRIBUTORS

The AZTech™ Regional Intelligent Transportation System Partnership wishes to thank and acknowledge the contributors of the AZTech™ Traffic Management Performance Measures Book. The following member agencies of the AZTech™ Strategy Task Force collaboratively contributed data, graphics, text and other information towards the development of this publication:

- Arizona Department of Transportation – Reza Karimvand
- Federal Highway Administration – Jennifer Brown
- Maricopa County Department of Transportation – Nicolaas Swart
- Arizona Department of Public Safety and TIM Coalition Chair – Cpt. Jeff King
- Maricopa Association of Governments – Sarath Joshua
- Valley Metro – Ratna Korepella
- METRO Light Rail – Abhishek Dayal
- Avondale, City of – Margaret Boone
- Chandler, City of – Mike Mah
- Gilbert, Town of – Michael Gillespie
- Glendale, City of – Debbie Albert
- Goodyear, City of – Luke Albert
- Mesa, City of – Alan Sanderson
- Peoria, City of – Jamal Rahimi
- Phoenix, City of – Ray Dovalina
- Scottsdale, City of (Committee Chair) – Paul Porell
- Surprise, City of – Nicholas Mascia
- Tempe, City of (Committee Vice-Chair) – Catherine Hollow
- AZTech™ Operations Committee Chair – Darrell Bingham (ADOT)
- AZTech™ ATIS Committee Chair – Faisal Saleem (MCDOT)
- AZTech™ Operators Working Group – Barbara Hauser (MCDOT)
- AZTech™ Administrative Coordinator – Cynthia Lopez (MCDOT)

FOREWORD

EXECUTIVE COMMITTEE

"What gets measured gets done, what gets measured and fed back gets done well..." – John E. Jones

This Region and the AZTech™ Partnership have made some significant traffic operations investments, and some impressive strides in advancing traffic management and operational strategies. For nearly two decades local, county and state agencies in the region have been very focused on improving the way we manage and operate the transportation network. We all strive to improve these functions within our jurisdiction, and are also focused on how decisions influence our neighboring agencies...and most importantly, the travelers.

AZTech™ and Arizona's participation as an FHWA *Operations Opportunity State* has elevated the need within our region to actively measure the performance of our transportation network. Many agencies were already closely monitoring, evaluating and enhancing their individual systems, such as transit partners. The collective effort by the partners to report on regional performance is represented within this initial Performance Measure Book for 2011. Important next steps include taking these results to improve how we do things, and take a closer look at where we need to improve.

The 2011 Performance Measure Book is a snapshot of where we are today... and it is just a starting point. Many thanks to those agencies and partners that provided the data and analysis for this inaugural regional traffic management focused performance report. There is a concerted effort at the AZTech™ Executive Committee to continue to refine those measures that are meaningful, and create a framework for ongoing measuring, reporting, and improving how we operate our transportation network.

Traffic management and operations encompasses a lot of activities, and through incremental improvements and focusing our efforts on those activities that will yield the greatest benefits, we will truly provide our travelers with a safe and seamless experience on our transportation network every day.

EXECUTIVE COMMITTEE CHAIRS

Robert Samour

Robert Samour, P.E.
ADOT Deputy State Engineer

John Hauskins, P.E.
MCDOT Director

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EXECUTIVE SUMMARY

This AZTech™ Traffic Management Performance Measures Book is the first publication combining key regional traffic management, traffic operations, and transit performance measures that are tracked and reported throughout the Phoenix metropolitan region. AZTech™ is a regional traffic management partnership in the Phoenix Metropolitan area. Led by Maricopa County Department of Transportation (MCDOT) and the Arizona Department of Transportation (ADOT), all of the major governmental transportation agencies in the region are members, along with public safety agencies and several private technology and media companies. AZTech™ began as one of four regions selected for a Federally-sponsored traffic management model deployment initiative in 1996. AZTech™ partners have collaborated to complete this Book to account for the active measurement of the success of agency investments to increase the efficiency of the freeway and arterial networks. It also provides trends on various performance elements within the management components which are described below:

Freeway Management — To improve safety and mobility, state agencies address traffic and incidents using freeway management system components such as cameras, dynamic message signs, ramp meters, and detection.

Arterial Management — To improve safety and operations of surface streets, local agencies manage the traffic and incidents at intersections and along segments of surface streets using arterial management systems.

Incident Management — To detect, respond to, and remove traffic incidents using a planned and coordinated multi-disciplinary approach so that traffic flow may be returned to normal as safely and rapidly as possible. Successful Traffic Incident Management (TIM) procedures will decreases the length and effects of traffic incidents while improving the safety of motorists, crash victims and emergency responders.

Safety — To improve safety for travelers, all agencies are focused on implementing measures to decrease the number and severity of crashes on freeways, surface streets, and through work zones.

Traveler Information — To enhance travel time predictability and reduce congestion, timely and detailed information is provided about traffic flow, traffic incidents, weather, construction activities, transit and special events.

Transit Management — To provide quality transit service to the traveling public, transit vehicles are equipped with tracking and communication technologies to provide real-time information to transit centers and to provide arrival times and other capabilities to transit users in the future.

Each section includes key measures reported by state, county, and local agencies provided in paragraph, table, or graphic format. Various measures will be collected annually and applied toward the success of achieving established regional goals.

AZTech™ PERFORMANCE DASHBOARD

This book is the first of its kind for AZTech™ and it is intended that measures will be reported at more consistent intervals of time moving forward.

For the purposes of this Performance Measures Book, the previous and current reporting periods for many of the measures reported are from different years, as noted next to each measure.

Goals identified in the dashboard have been defined by various regional planning activities and were chosen to be highlighted in this Book to relate the types of measures that have been collected in the region. Goals will be refined during the annual performance measure collection process.

Performance trending in favorable direction. | Trend is holding. | Performance is trending in an unfavorable direction.

Policy Goal/ Performance Measure	Previous Reporting Period	Current Reporting Period	Trend	Description
Freeways				
Limit the % increase in average travel time to less than the % increase in traffic volume: MAG Regional Concept of Traffic Operations (RCTO) Goal				Reduction in overall travel times means effective management of the freeways
Daily Vehicle-Miles of Travel (2005-2009)	28,370,000	29,872,000	+5.3%	
Travel Time Reliability of Inbound/Outbound Freeways (using average times) (2010-2011)	442 min	432 min		Total travel time reduction of 0.3% for inbound and 3.7% for outbound –individual freeway statistics vary widely from 29.6% reduction to 45.1% increase in travel times
Arterials				
Limit the % increase in average arterial travel time to less than the % increase in traffic volume–for arterials with ITS infrastructure only: MAG RCTO Goal				Some of the major arterials in the Phoenix region have shown actual reductions in travel time
Develop practices for after-hours monitoring of local TMC systems and devices: MAG RCTO Goal				Improve service responsibly to respond to actual needs
Daily Vehicle-Miles of Travel (2005-2009)	34,105,000	35,728,000		Increase in vehicle-miles of almost 5%
Bell Road Travel Time from 303 to 101 Aqua Fria (2008-2010)	14 min EB / 20 min WB	12 min EB / 15 min WB		-14% EB and -25% WB reduction in travel time due to ITS infrastructure deployment
City of Mesa Country Club NB Travel Time Reduction (2007-2011)	11 min 55 sec	8 min 52 sec		Reduction in travel time of 3 minutes (or 27% reduction) due to improved signal coordination along corridor
Town of Gilbert Signal Retiming % Change in Delay and % of Stops on Warner Road	0 / 0	-35% / -58%		Based on before and after study of town-wide signal retiming project
Number of TMCs with Coverage Outside of Standard Business Hours (2009-2011)	4	7		After-hours monitoring of local traffic management systems and optimization of traffic across city boundaries is becoming a more common functionality
Safety				
Vision of *Zero Fatalities* with an annual reduction goal 15% per year.: Arizona Strategic Highway Safety Plan Goal				Road fatalities have stayed consistent and other measures showing minimal improvement
% of All Road Fatalities in Arizona Concentrated in MAG Region (2006-2008)	38%	38%		While total crash related fatalities in Arizona are dropping, the % that occur in the MAG Region is staying the same
Urban Freeway System – Crash Rate on US-60 (1999-2008) (Total Crashes per Total Million Vehicle Miles Traveled)	~1.5	~1.3		I-17 experiences the highest crash rate typically each year, but US-60 matched I-17 in 2002 and has since decreased to one of the lowest crash rates in the Phoenix metropolitan region
Bicycle Crashes on Arterials and Local Roads – Total Crashes (2007-2009)	~1250	~1400		Total bicycle crashes have increased

AZTech™ PERFORMANCE DASHBOARD

Performance trending in favorable direction.

Trend is holding.

Performance is trending in an unfavorable direction.

Policy Goal/ Performance Measure	Previous Reporting Period	Current Reporting Period	Trend	Description
Incident Management — Freeways				
Reduce incident duration by 20%: MAG RCTO Goal **To be developed by TIM Coalition:** Additional Goals			⟺	The recently established Traffic Incident Management Coalition is focused on collaborating and coordinating to reduce impacts of incidents on the transportation network
DPS Average Time to Remove Blockage from Travel Lanes (2nd Qtr 2011 to 4th Qtr 2011)	49.8 min	34.2 min (-31.33%)		Quicker clearance time increases overall safety and reduces congestion
Incident Management — Arterials				
Zero secondary crashes when REACT is present: REACT Goal **To be developed by TIM Coalition:** Additional Goals			↑	There will be additional arterial incident management goals reported in upcoming years
Number of Secondary Crashes When REACT is Present (2009-2011)	0	0		Regional Emergency Action Coordination Team (REACT) presence on-scene supports public safety in traffic control and mitigation
Traveler Information				
Increase travel information usage by 200 percent: MAG RCTO Goal			↑	Progress toward this goal is positive by increased usage of 511 phone and web services
Post travel information/messages on freeway and arterial DMS: MAG RCTO Goal			⟺	There are plans to enhance the freeway travel time program in the coming years
511 Phone Service Usage (2006-2010)	750,000 calls	1,150,000 calls		Partnership of FHWA, ADOT, MCDOT and AZTech™ agencies
Total Miles of Freeway Corridors Providing Travel Times (2008–2011)	110 miles (50 inbound, 60 outbound)	110 miles (50 inbound, 60 outbound)		ADOT's travel time program in the metropolitan area is planned for expansion to more routes and more freeway dynamic message signs
Transit				
Valley Metro Goal: On-time performance of 92%.			↑	Increased passenger miles means achieving this goal benefits more passengers
METRO Light Rail Goal: On-time performance of 93%.			↑	METRO Light Rail has achieved this service goal every year in existence
Annual Passenger-Miles of Travel (2005-2009)	260 million	303 million		Passenger miles have increased
Valley Metro Fixed Route Average On-Time Performance (2007-2010)	91.55%	95.27%		Increased on-time performance from all fixed-route transit services
METRO Light Rail Average On-Time Performance (2007-2010)	93.5%	95.8%		Increased on-time performance from METRO Light Rail transit services

Why Measure Performance

- Focus attention on measures that will inform the outcome toward the goal
- Identify accomplishments, not just work that is performed
- Provide a common language for communication
- Are clearly defined in terms of owner, unit of measure, collection frequency, data quality, expected value (targets), and thresholds
- Are valid—to ensure measurement of relevant metrics relating to goals
- Are verifiable—to ensure data collection accuracy

SECTION 1

INTRODUCTION

What is AZTech™

AZTech™ is a regional traffic management partnership in the Phoenix Metropolitan area. All of the major governmental transportation agencies in the region are members, along with public safety agencies and several private technology and media companies. The coalition, led by MCDOT and ADOT, and working through several collaborating committees, guides the application of ITS technologies for managing regional traffic. The goal is to achieve more efficient mobility, less congestion, and a higher level of safety for travelers throughout the metropolitan area.

AZTech™ began as one of four regions selected for a Federally-sponsored traffic management model deployment initiative in 1996. Throughout the initial demonstration project and continuing into a permanent partnership, AZTech™ quickly evolved into a successful regional traffic management entity. The partnership has carefully integrated individual traffic management strategies and technologies for the region's benefit, yet has retained most operational control protocols important to individual units of government. Early on, AZTech™ adopted several Values, Goals, and Strategies to guide its growth from a demonstration project to what has become a full-fledged regional partnership:

Values

- Collaboration
- Leadership
- Integration

Goals

- Integrate existing ITS infrastructure into a regional system
- Establish a regional integrated traveler information system
- Expand the transportation management system for the Phoenix metropolitan area

Strategies

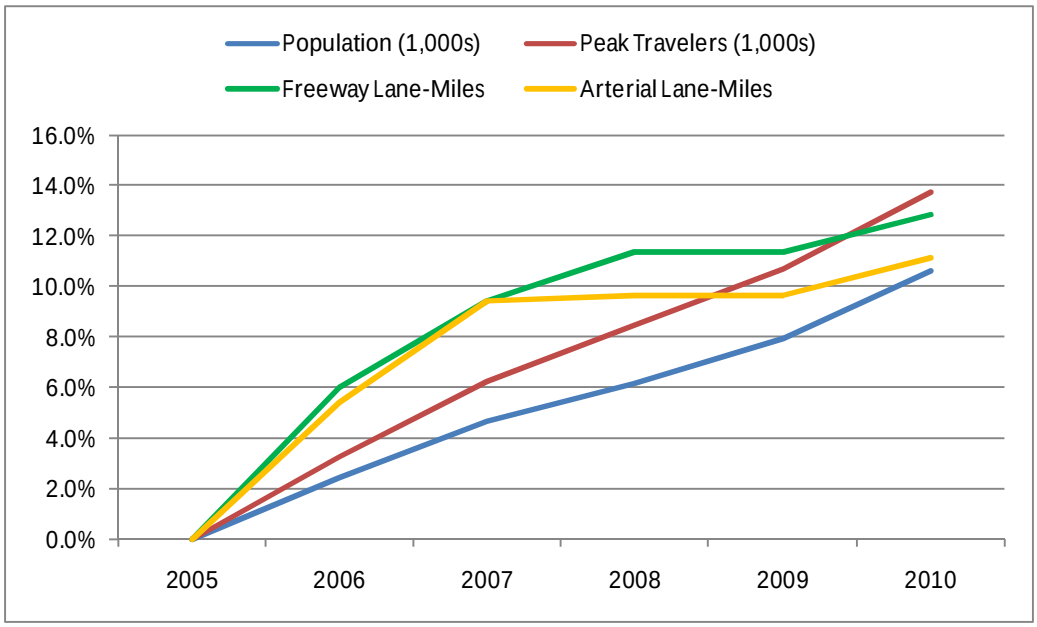
- Expand and Strengthen Partnerships
- Optimize Regional Operations and Management
- Plan, Develop, & Deploy Integrated Regional Systems
- Research and Test New Technological Opportunities
- Establish Education and Outreach Programs

IN THIS SECTION:

AZTech™ Moving Forward Together

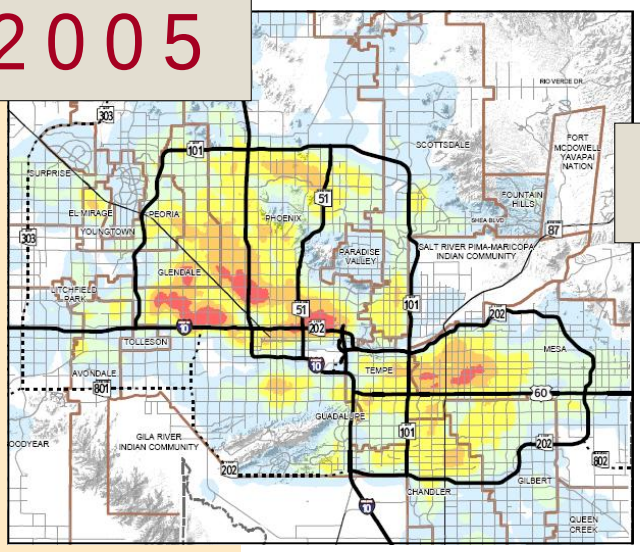
1.2 PHOENIX METROPOLITAN REGION

The population for many cities grew more than 20% between Sept 2005 and July 2009 – an average of 8.7% growth region-wide. Peak travelers shown in the graph below is growing faster than the addition of freeway and arterial lane miles. With restricted funding not readily available for infrastructure expansion, the emphasis is shifting towards more efficient management to the existing transportation system.

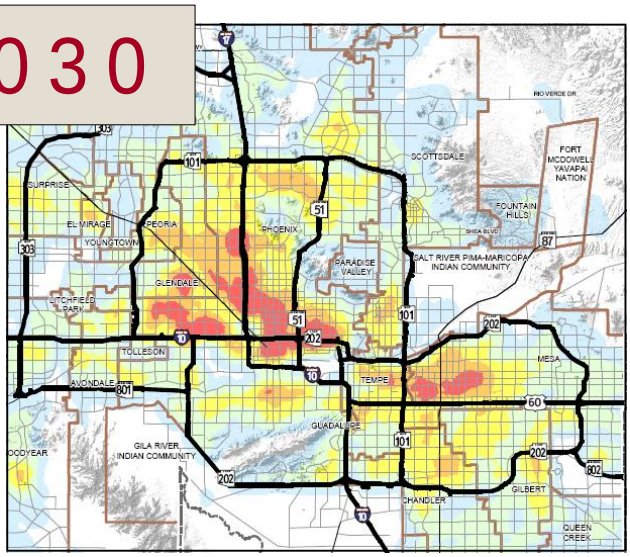


For the past several decades, the MAG Region has been one of the fastest growing metro areas in the U.S. MAG's projection from 2005 to 2030 is an increase in population of 67% to 6,135,000.

2005



2030



*Source – MAG Regional Transportation Plan Update 2010

1.3 WHY AZTech™ MEASURES PERFORMANCE

What gets measured gets improved

In support of policy and decision making, strategic performance measures monitor the implementation and effectiveness of an organization's strategies, determine the gap between actual and targeted performance, and determine organization effectiveness and operational efficiency.

Key Regional Indicators

Phoenix metropolitan region statistics in the last decade (2000-2009) which highlight the importance of measuring performance to determine the effectiveness of transportation management include (as reported by the Texas Transportation Institute [TTI] 2010 Annual Urban Mobility Report which uses Federal Highway Administration's Highway Performance Monitoring System traffic volume data by road section):

- 53% growth — Daily Freeway Vehicle Miles Traveled
- 22% growth — Daily Arterial Vehicle Miles Traveled
- 52% growth — Freeway Lane Miles Constructed
- 31% growth — Arterial Lane Miles Constructed
- 8% increase — 41% to 49% Percent of Lane Miles Congested
- 78% growth — Public Transport Annual Passenger-Miles of Travel
- 41% increase — Annual Excess Fuel Consumed
- 52% increase — Total Annual Delay
- 19% reduction — Total Number of Crashes

Good Performance Measures

- Focus attention on measures that will inform the outcome toward the goal
- Identify accomplishments, not just work that is performed
- Provide a common language for communication
- Are clearly defined in terms of owner, unit of measure, collection frequency, data quality, expected value (targets), and thresholds
- Are valid - to ensure measurement of relevant metrics relating to goals
- Are verifiable - to ensure data collection accuracy

SECTION 2

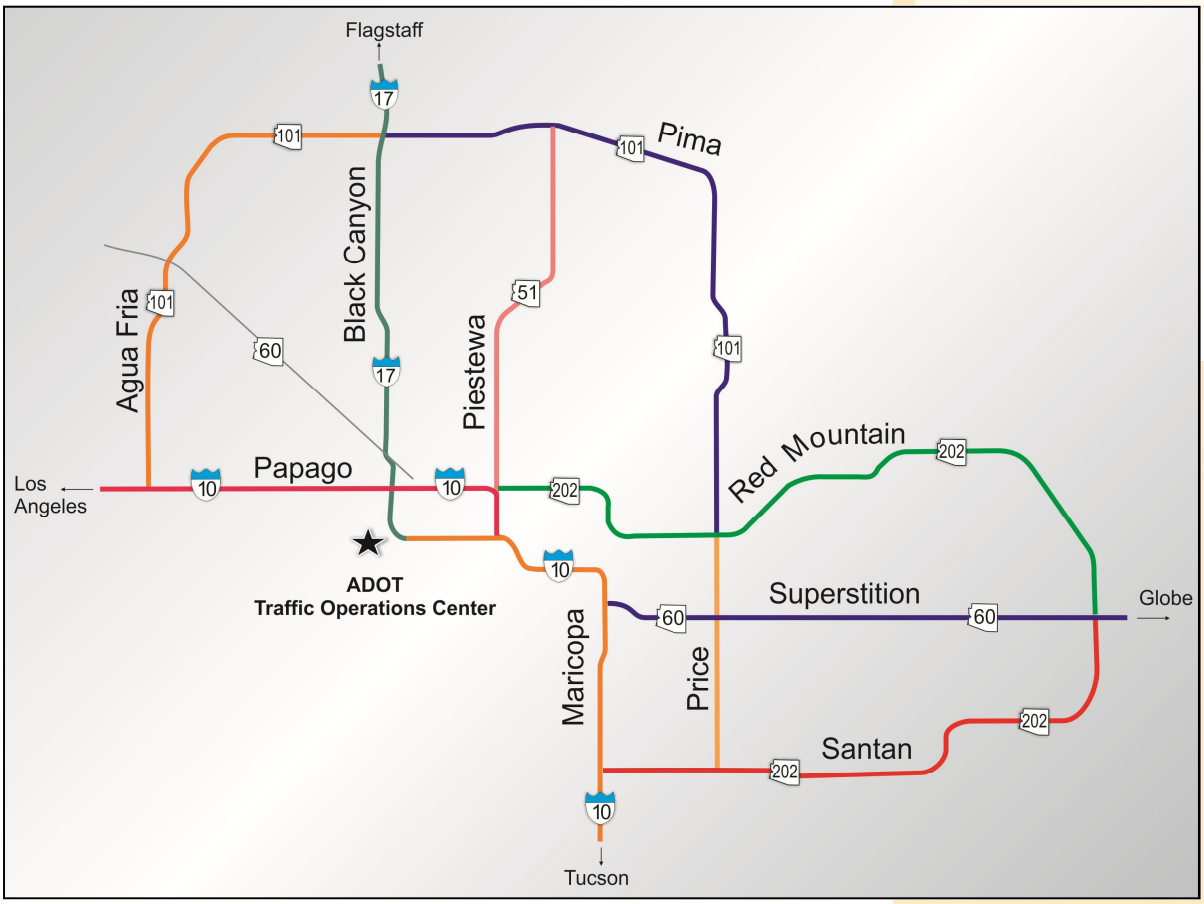
FREEWAYS

Background and Overview

Arizona Department of Transportation (ADOT) currently manages 240 miles of freeways in the greater Phoenix area. In order to accommodate the surging population, the freeway system has been expanded since early 1990's.

Today, the extensive freeway network energizes the vibrant socio-economic activities in the greater Phoenix area. The figure below shows the named freeways maintained by ADOT color-coded for clarity.

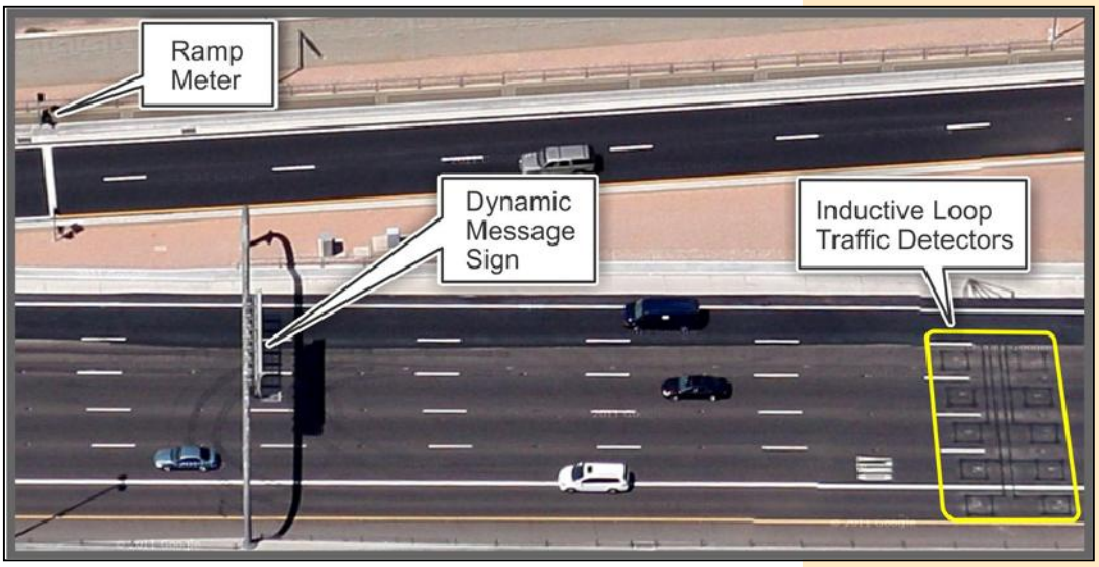
IN THIS SECTION:



2.1 FREEWAY MANAGEMENT SYSTEM

ADOT was an early adopter of the Intelligent Transportation Systems which use technologies to proactively monitor and manage traffic on the freeways. In 1993, ADOT developed a Traffic Operations Center (TOC) that houses the nerve center of the Freeway Management System (FMS). The FMS employs dedicated traffic operators who utilize Closed-Circuit Television (CCTV) cameras, vehicle sensors, Dynamic Message Signs (DMS), and ramp meters for monitoring and mitigating traffic congestion.

The communication to the FMS field devices is provided through ADOT's extensive fiber optic communication network that runs parallel to the major freeways. The figure to the right shows a typical deployment of traffic detectors, Dynamic Message Sign, and ramp meter at the freeway interchange.

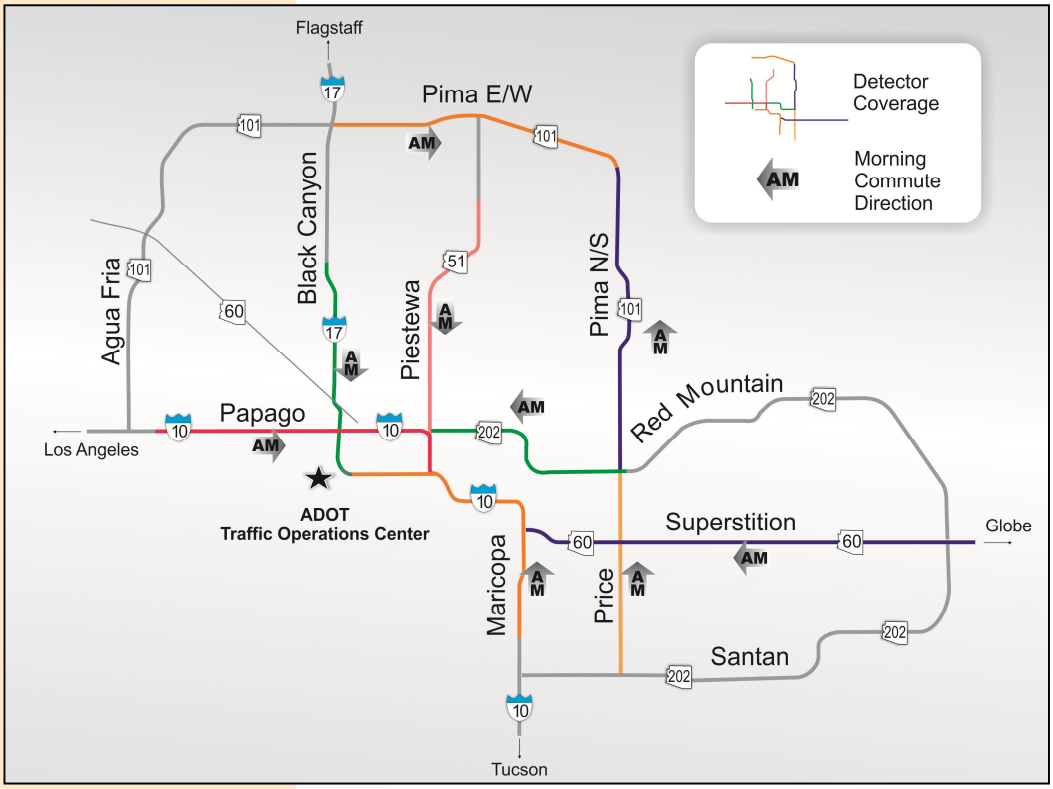


ADOT TOC operates 24 hours a day and 7 days a week. ADOT operators enter information about traffic impeding events in a database system called the Highway Condition Reporting System (HCRS) and coordinate with the Department of Public Safety (DPS) in response to incidents. HCRS allows tracking of the ongoing traffic scenarios and shares real-time traffic information through public information outlets, including regional 511 telephone service, AZ511.gov web site, and third-party information service providers.

In 2009, ADOT initiated a new public service to provide travel time information on the freeway DMS based on real-time data collected by the traffic detectors deployed along major commute corridors. Travel time to the upcoming

2.2 FREEWAY PERFORMANCE MEASURES

The data source of the freeway performance measures is the Regional Archived Data System (RADS) developed by the AZTech™. RADS permanently archives operation data produced by the region's ITS systems, including the ADOT freeway traffic detector data and incident information. These continuously collected data provide a wealth of information for assessing and monitoring the performance of the freeway system. The performance measures are presented based on the following named freeway corridors per commute direction where vehicle detectors are available. For this report, Pima is divided into east/west and north/south sections due to the distinctive traffic patterns during the morning and afternoon commute periods. The figure to the left shows the coverage of vehicle detectors (colored segments) as well as the morning commute direction of each named freeway. During 2010, the number of FMS detector stations in Pima E/W and Price nearly doubled and therefore prohibits an accurate comparison for this reporting period.



Inbound (morning commute direction):

- Black Canyon SB
- Maricopa WB
- Papago EB
- Piestewa SB
- Pima EB
- Pima NB
- Price NB
- Red Mountain WB
- Superstition WB

Outbound (evening commute direction):

- Black Canyon NB
- Maricopa EB
- Papago WB
- Piestewa NB
- Pima SB
- Pima WB
- Price SB
- Red Mountain EB

Travel Time Index

Travel Time Index (TTI) is computed by dividing the actual (measured) travel time by the free flow travel time along a freeway corridor of interest. This measure considers the peak-hour periods during the weekdays and measures separately for (morning) inbound and (evening) outbound directions of each named freeway where FMS vehicle detectors are available.

ADOT defined peak periods as 6am to 9am and 3pm to 7pm. This analysis only included Tuesday, Wednesday, and Thursday. The table below shows the comparison of Travel Time Indices of named freeways between the years 2010 and 2011. Because this measure is "normalized" by the free flow travel time, it allows comparison of freeway corridors of different lengths.

	Inbound 6am-9am					Outbound 3pm-7pm				
Named Freeways	Dir	Length	2010 TTI	2011 TTI	% Change	Dir	Length	2010 TTI	2011 TTI	% Change
Black Canyon	SB	11.6	1.07	1.03	-3.7%	NB	10.7	1.17	1.14	-2.6%
Maricopa	WB	16.1	1.21	1.17	-3.3%	EB	15.1	1.31	1.25	-4.6%
Papago	EB	14.9	1.27	1.23	-3.1%	WB	13.5	1.43	1.42	-0.7%
Piestewa	SB	12.1	0.96	0.93	-3.1%	NB	13.1	0.92	0.87	-5.4%
Pima E/W	EB	13.6	-	1.25	-	WB	11.8	-	1.27	-
Pima N/S	NB	15.7	1.13	1.10	-2.7%	SB	14.5	1.23	1.21	-1.6%
Price	NB	9.0	-	1.20	-	SB	9.3	-	1.28	-
Red Mountain	WB	9.1	1.22	1.21	-0.8%	EB	9.6	1.23	1.04	-15.4%
Superstition	WB	20.5	1.08	1.08	0.0%	EB	19.5	1.08	1.05	-2.8%

The results showed that the year 2011 travel times were unchanged or slightly decreased from the previous year. The reduction of travel times range from 0.7% (Papago WB) to 15.4% (Red Mountain EB).

2.2 FREEWAY PERFORMANCE MEASURES

Travel Time Reliability

Travel Time Reliability (TTR) is used to indicate the longest travel time of a corridor that can be expected within 95% probability–which means that drivers can expect this travel time or less 95% of the time. This measure compliments the average travel time by providing additional information on the degree of variability in the travel time measures during the period of interest. An increased TTR implies a greater degree of variability in the traffic, which generally translates into lower travel time reliability for the commuters. The degree of variation in travel time can be influenced by fluctuating demands and frequency and magnitude of recurring and the non-recurring congestion. The table below shows the comparison of travel time reliability measures during peak periods per named freeway between the years of 2010 and 2011.

	Inbound 6am-9am					Outbound 3pm-7pm				
Named Freeways	Dir	Free Flow TT (min)	2010 TTR (min)	2011 TTR (min)	% Change	Dir	Free Flow Flow TT	2010 TT (min)	2011 TTR (min)	% Change
Black Canyon	SB	12.7	19.8	22.2	12.1%	NB	11.7	22.5	22.8	1.3%
Maricopa	WB	15.7	34.4	30.6	-11.0%	EB	14.7	34.8	31.7	-8.9%
Papago	EB	13.7	28.9	29.4	1.7%	WB	12.5	30.5	30.5	0.0%
Piestewa	SB	13.2	19.3	17.8	-7.8%	NB	14.3	19.5	18.4	-5.6%
Pima E/W	EB	12.6	-	23.2	-	WB	10.9	-	22.6	-
Pima N/S	NB	14.5	21.6	22.5	4.2%	SB	13.4	25.0	26.6	6.4%
Price	NB	8.3	-	19.0	-	SB	8.6	-	20.1	-
Red Mountain	WB	8.4	17.8	18.4	3.4%	EB	8.9	10.1	14.5	43.6%
Superstition	WB	19.1	27.4	28.9	5.5%	EB	18.0	24.8	24.6	-0.8%

The TTR columns show the expected 95th percentile of travel time of a commute corridor that is influenced by recurring and non-recurring congestion. A positive number in the percentage change columns indicates that the expected 95th percentile travel time of a corridor has increased from the previous year, implying an increased degree of uncertainty in the daily commute time.

Total travel times for all freeways were 432 minutes and 424 minutes for 2010 and 2011 respectively. This equates to a total travel time reduction of 0.3% for inbound and 3.4% for outbound. Individual freeway statistics vary widely from 29.5% reduction to 43.6% increase in travel times.

Those corridors that experienced an increased degree of variability in commute time include, in order of magnitude, Red Mountain EB (43.6%), Black Canyon SB (12.1%), Pima SB (6.4%), Pima NB (4.2%), Superstition WB (5.5%), Red Mountain WB (3.4%), Papago EB (1.7%), and Black Canyon NB (1.3%).

Percentage of Corridor Miles Congested

This measure assesses the extent of recurring congestion by identifying the number of miles of a freeway corridor that was congested during the peak periods. A segment of a corridor (represented by a set of detector stations along that segment) is considered congested when the average vehicle speed drops below half of the free flow speed more than four hours a week, as defined by the Texas Transportation Institute and INRIX's 2011 Congested Corridors Report. This measure is useful for monitoring the physical dispersion of congestion along a commute corridor. The table below shows the comparison of corridor miles congested by named freeway per commute direction between the years of 2010 and 2011.

	Inbound 6am-9am					Outbound 3pm-7pm				
Named Freeways	Dir	Corridor Length (Mile)	2010 % of Miles Congested	2011 % of Miles Congested	% Change	Dir	Corridor Length (Mile)	2010 Miles Congested	2011 Miles Congested	% Change
Black Canyon	SB	11.6	35.0%	44.2%	26.3%	NB	10.7	73.5%	82.9%	12.8%
Maricopa	WB	16.1	52.9%	52.9%	0.0%	EB	15.1	46.3%	46.3%	0.0%
Papago	EB	14.9	11.7%	9.0%	-23.1%	WB	13.5	8.4%	8.4%	0.0%
Piestewa	SB	12.1	11.2%	19.9%	77.7%	NB	13.1	15.6%	15.6%	0.0%
Pima E/W	EB	13.6	-	44.6%	-	WB	11.8	-	68.5%	-
Pima N/S	NB	15.7	10.8%	17.3%	60.2%	SB	14.5	50.8%	66.9%	31.7%
Price	NB	9.0	-	71.2%	-	SB	9.3	-	42.1%	-
Red Mountain	WB	9.1	24.7%	75.8%	206.9%	EB	9.6	1.0%	12.7%	1170.0%
Superstition	WB	20.5	17.2%	17.2%	0.0%	EB	19.5	6.1%	9.2%	50.8%

Percentage of Time Congested

This measure represents the percentage of time during the peak periods a corridor is considered congested. Along with the previous measure, it allows one to gauge the extent of congestion both in space and time. The table below shows the comparison of percentage of corridor miles congested by named freeway per commute direction between the years of 2010 and 2011.

	Inbound 6am-9am					Outbound 3pm-7pm				
Named Freeways	Dir	Corridor Length (Mile)	2010 % of Time Congested	2011 % of Time Congested	% Change	Dir	Corridor Length (Mile)	2010 % of Time Congested	2011 % of Time Congested	% Change
Black Canyon	SB	11.6	3.9	7.1	82.1%	NB	10.7	9.8	10.3	5.1%
Maricopa	WB	16.1	12.5	13.8	10.4%	EB	15.1	18.4	16.6	-9.8%
Papago	EB	14.9	9.5	10.1	6.3%	WB	13.5	16.8	17.1	1.8%
Piestewa	SB	12.1	2.6	2.8	7.7%	NB	13.1	3.0	3.7	23.3%
Pima E/W	EB	13.6	-	13.7	-	WB	11.8	-	16.3	-
Pima N/S	NB	15.7	3.4	5.2	52.9%	SB	14.5	8.4	12.5	48.8%
Price	NB	9.0	-	12.8	-	SB	9.3	-	14.7	-
Red Mountain	WB	9.1	4.0	11.8	195.0%	EB	9.6	0.9	2.3	155.6%
Superstition	WB	20.5	2.8	3.7	32.1%	EB	19.5	1.2	1.4	16.7%

SECTION 3

ARTERIALS

The Phoenix Metropolitan Area has been one of the fastest growing regions in the nation over the past two decades. There are 13 traffic management centers in the region. The regional traffic management infrastructure deployed on the arterials includes approximately 3,000 signals operated by 13 different agencies 75% of which are connected to the centralized signal system. 60 Dynamic Message Signs and 475 Closed Circuit Television (CCTV) Cameras support real-time traffic management in the region.

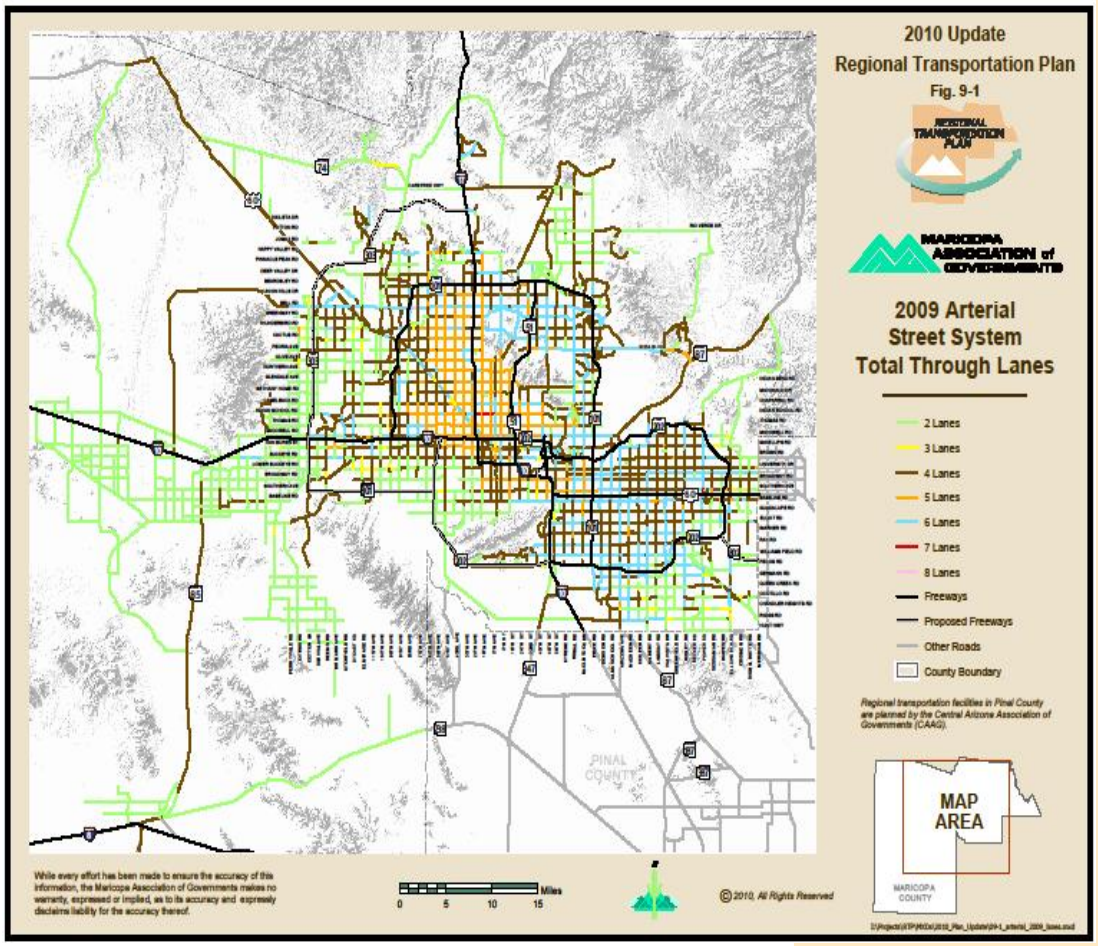
Many agencies in the region are collecting internal performance measures related to travel times along the arterials as well as changing volumes. As infrastructure (traffic signals, cameras, DMS) is added and fine-tuned to maximize benefit to the travelers, agencies are realizing benefits to overall travel times. Reduced delays, increased throughput, and reduced number of stops all account for a more seamless arterial network. Agencies are also working together along regional corridors to maximize these benefits across jurisdictions.

IN THIS SECTION:

3.1 BACKGROUND AND OVERVIEW

The arterial street system in the Phoenix Metropolitan Region is a critical element of the regional transportation network and consists primarily of roadways with four or more lanes on a mile grid. This system provides the region with a high level of accessibility and mobility, complementing the regional freeway system and serving automobile, transit, bicycle and pedestrian traffic. The arterial system carries over 67% (per MAG NRC 2010) of the total traffic in the Phoenix metropolitan region. The figure below presents the existing arterial grid system, as modeled for the year 2009.

The Phoenix Metropolitan Area has been one of the fastest growing regions in the nation over the past two decades. As a result, the arterial Vehicle Miles Traveled (VMT) has increased from 25 million in the year 1991 to 36 million in 2009. During the same period the arterial lane-miles expanded from 4,915 to 7,180 and the rate of lane mile growth has proportionally matched with the VMT growth, as shown in the 2005 and 2010 map to the right.



The 13 traffic management centers in the region utilize infrastructure on the roads such as CCTV and DMS to support real-time traffic management in the region.

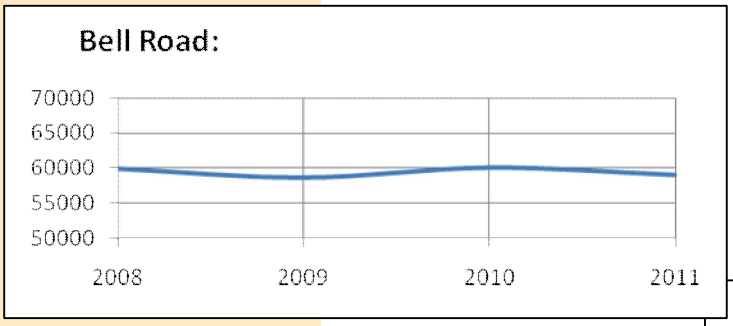
Goal

The regional goal for arterial mobility is defined by MAG Regional Concept of Transportation: Limit the percent increase in average arterial travel time to less than the percent increase in traffic volume.

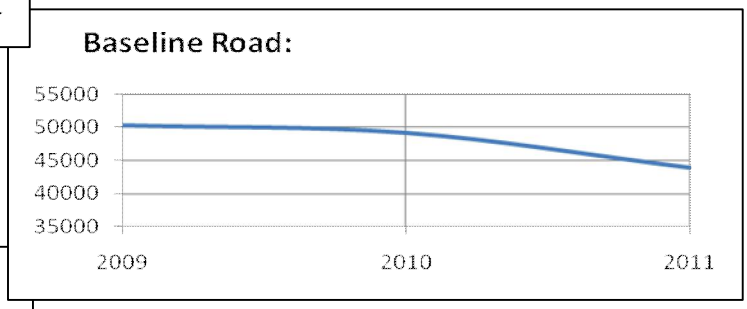
*Source – MAG Regional Transportation Plan Update 2010

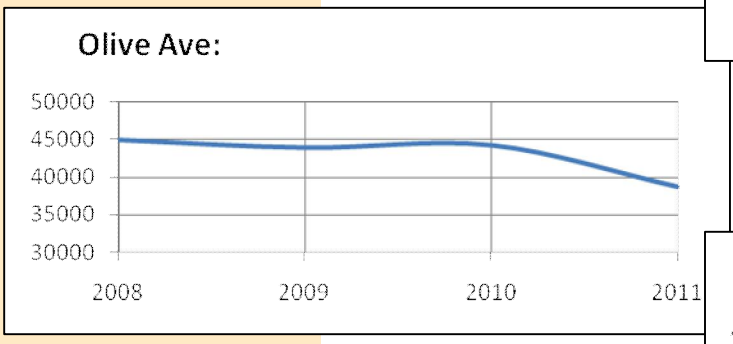
3.2 VOLUME TRENDS: ITIP CORRIDORS

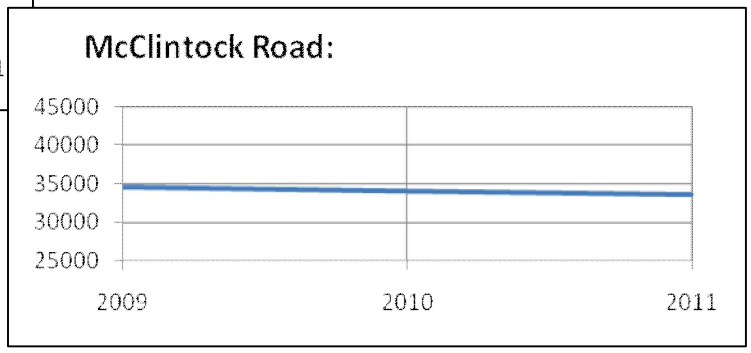
The AZTech™ partnership participates in the FHWA funded Intelligent Transportation Infrastructure Program (ITIP). Through this program mid-block traffic sensors are installed on five regional arterial corridors – Bell Road, MC85, Olive Ave, McClintock Road and Baseline Road. The sensors collect and report volume and speed data every five minutes. This data is used for day-to-day traffic management and operations activities and as well as for performance reporting purposes.



Four of the ITIP instrumented corridors - two in east valley and two in west valley were selected for reporting traffic volume trends which are illustrated in the figures to the left and below.







The volume trends for the above corridors are illustrative of overall traffic volume trend in the region. In general, the traffic volumes in the valley are trending to be flat or slightly dropping as compared to rapid increase from 1990 to 2007. This suggests that volume levels may be an important factor for travel time reduction.

3.3 TRAVEL TIMES AND VOLUMES: AGENCY TRENDS

CITY OF MESA

In the fall of 2006, the City of Mesa began performing semi-annual travel time studies. The 2010 study is the ninth semi-annual study performed. The decision to perform travel time studies was a result of a performance measurement program initiated by the City of Mesa. These performance measures were put in place to measure how well the services Mesa provides are serving its citizens. One of the original performance measures given to Traffic Engineering was to monitor travel times. To meet the City and regional goals, the City reports on the following performance measures:

- *Average speed of travel in the PM peak hours*
- *Percent change in the average travel time compared to the percent change in traffic volumes.*

In addition to providing data for the City's performance measurement program, the semi-annual travel time studies allow Staff to:

- Compare current traffic conditions to those of the past,
- Identify congested areas, and make adjustments to traffic signal timings as necessary, and
- Identify congested areas, which will provide decision makers with information that can be used to decide where to spend money intended for roadway improvements.

Twenty major arterial streets are included in the travel time study program. The table to the right presents the comparison between the growth of travel times versus the growth in traffic volumes for the AM peak, and the table at the top of the next page presents the comparison between the growth of the travel times versus the growth in traffic volumes for the PM peak.

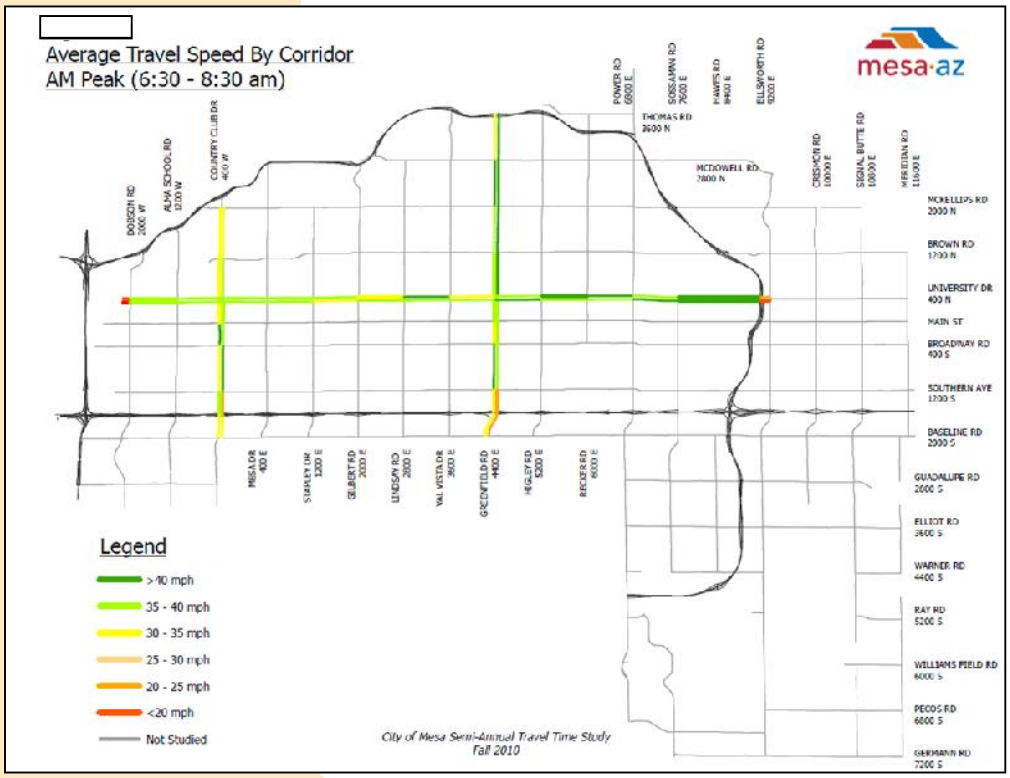
Street	AM Peak						
	Travel Time			Traffic Volumes			Is Travel Time Growth Greater Than Traffic Volume Growth?
	Previous Travel Time (seconds)	Fall 2010 Travel Time (seconds)	Annual Growth (Decline)	Previous Average Daily Traffic Volume	Most Recent Average Daily Traffic Volume	Annual Growth (Decline)	
University EB	1119 (2008)	1167.8	2.16%	24962 (2007)	21302 (2010)	-7.62%	Yes
University WB	1260 (2008)	1180.8	-3.21%	24962 (2007)	21302 (2010)	-7.62%	Yes
Country Club NB	715 (2007)	532.9	-9.33%	39348 (2006)	36350 (2010)	-2.60%	No
Country Club SB	617 (2007)	549.6	-3.76%	39348 (2006)	36350 (2010	-2.60%	No
Greenfield NB	673.4 (2009)	672.5	-0.13%	21437 (2008)	17418 (2010)	-9.86%	Yes
Greenfield SB	656.3 (2009)	705.6	7.52%	21437 (2008)	17418 (2010)	-9.86%	Yes

3.3 TRAVEL TIMES AND VOLUME: AGENCY TRENDS

CITY OF MESA

Street	PM Peak						
	Travel Time			Traffic Volumes			Is Travel Time Growth Greater Than Traffic Volume Growth?
	Previous Travel Time (seconds)	Fall 2010 Travel Time (seconds)	Annual Growth (Decline)	Previous Average Daily Traffic Volume	Most Recent Average Daily Traffic Volume	Annual Growth (Decline)	
University EB	1283.8 (2008)	1255.3	-1.12%	24962 (2007)	21302 (2010)	-7.62%	Yes
University WB	1207.5 (2008)	1166.8	-1.70%	24962 (2007)	21302 (2010)	-7.62%	Yes
Country Club NB	721 (2007)	537.5	-7.32%	39348 (2006)	36350 (2010)	-2.60%	No
Country Club SB	780.7 (2007)	664.6	-5.22%	39348 (2006)	36350 (2010	-2.60%	No
Greenfield NB	718.9 (2009)	709.8	-1.27%	21437 (2008)	17418 (2010)	-9.86%	Yes
Greenfield SB	794.6 (2009)	866.8	9.1%	21437 (2008)	17418 (2010)	-9.86%	Yes

The average travel speeds were summarized, and are displayed graphically in the figure below. The speeds were divided into six ranges, and each range was given a color code. Any segment that showed an average speed of greater than 40 mph was considered good, and is indicated by a green line. Anything below 20 mph is considered poor, and is indicated by red. Speeds in between are divided into 5 mph increments, and are indicated by lines going from shades of green to red.



Generally speaking, the slowest moving traffic during the AM peak is northbound on Country Club Drive between Baseline Road and Southern Avenue and northbound Greenfield Road between Baseline Road and Southern Avenue. The slowest moving traffic during the off peak is Greenfield Road between Baseline Road and Southern Avenue and Country Club Drive between Baseline Road and Southern Avenue in both directions. Similar analysis is performed for PM peak.

CITY OF MESA

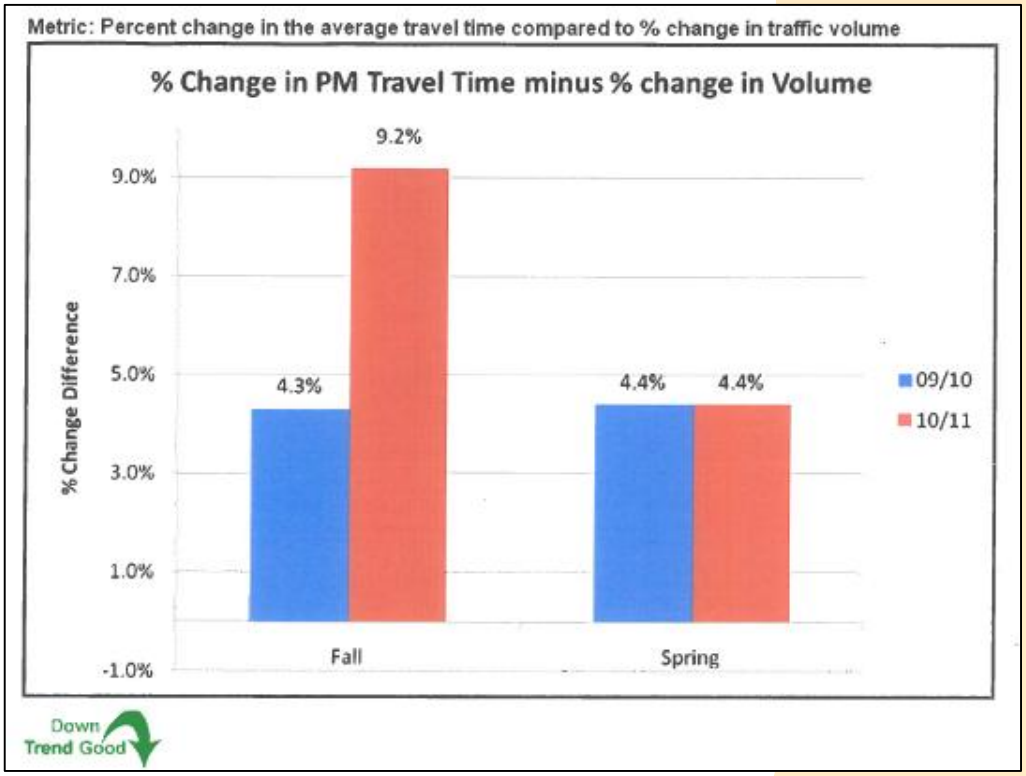
Additionally, travel time surveys are conducted on 18 arterial streets, once every 3 years. These travel time surveys are conducted on Greenfield Road and University Drive every year in the Fall. This metric calculates the average travel speed for the corridors surveyed in the current reporting period, during the PM peak period only (3:30pm-5:30pm), for both directions of travel on each currently studied corridor. Weighting is based on corridor distances.

Performance Analysis

The weighted average level of service on the three corridors studied in the Fall of 2010 is within the target of a level of service "C" (27-34 mph). A LOS of "C" means traffic conditions are stable although the ability to maneuver and change lanes midblock may be somewhat restricted.

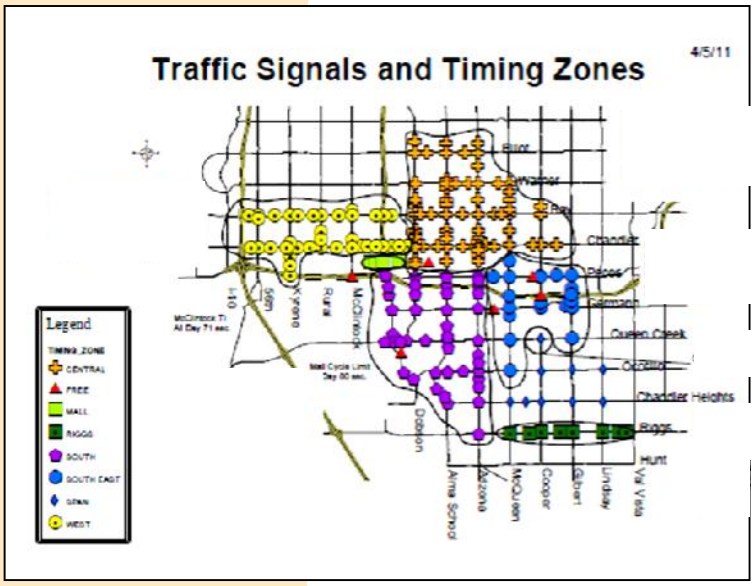
The weighted average travel speed on the three arterial corridors studied was 33.2 mph. Corridors studied were: Country Club, Greenfield, and University. Travel speeds varied between 27.1 mph (SB Country Club) and 37.2 mph (VVB University); hence, every direction on each of the corridors is operating at a LOS of "C".

The figure to the right shows the percent change in PM travel time minus the percent change in volume for the Fall and Spring of 2010 and 2011. This shows that travel time reductions outpaced volume increases in the Fall and stayed consistent in the Spring.



3.3 TRAVEL TIMES AND VOLUME: AGENCY TRENDS

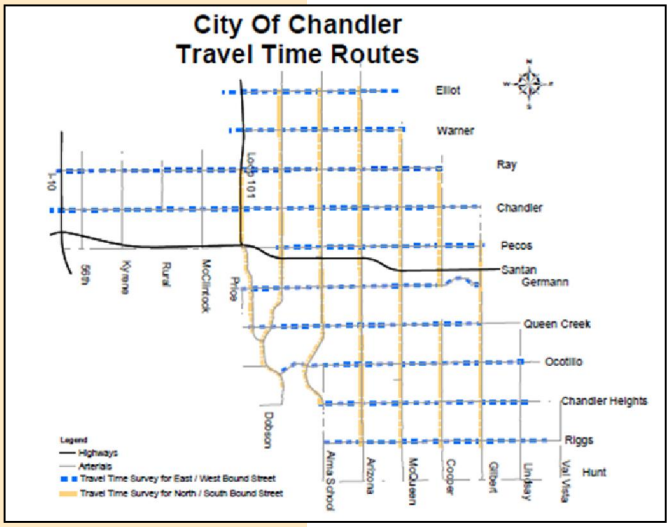
CITY OF CHANDLER

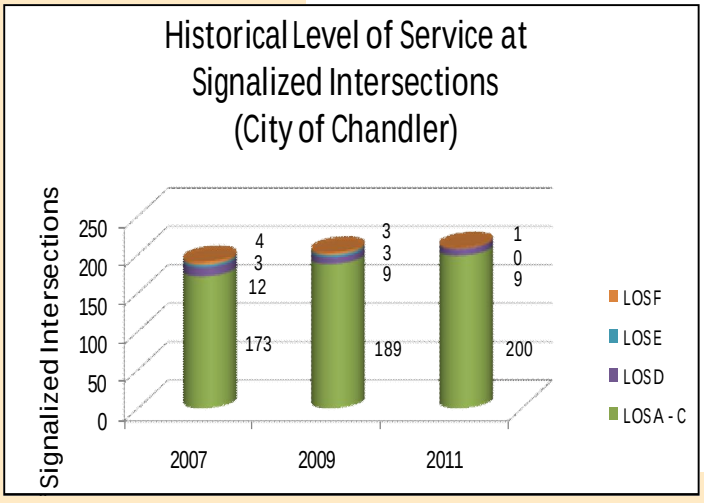


Recently, City of Chandler initiated an innovative project for measuring arterial travel time using Bluetooth readers and integrating the data with freeway travel times for dissemination through arterial DMS. The City performs routine travel time studies and its goal, in addition to the regional goal, is to:

"Develop signal optimization such that on any corridor a driver should *clear two green lights on average before catching a red light."*

Chandler currently has 209 signals that use four time-of-day plans calibrated for specific observed patterns (top left figure). In general, the City has defined traffic patterns, with commute traffic traveling north and west in the AM peak (6:00-9:00AM) and south and east in the PM peak (3:30-7:00PM). Signals are set to optimize traffic flow based on heavier directions of travel. The City performs travel time studies on selected north-south and east-west routes (middle left figure). The results of the latest study are illustrated in the table below. The proportion of LOS A-C levels have remained generally consistent since 2007, even with the addition of new traffic signals (bottom left figure).





City of Chandler: Travel Time Study

2008 Travel Time Study (City of Chandler)

Corridor	No. of Signals	No. of Stops	Chance of Stopping at a Red Light (1:X ratio)	Travel Time (min)	Stopped Delay (min)	Percentage of Time Spent Waiting at a Signal
Alma School Rd	25	6.0	4.0	16.3	4.7	29%
Chandler Blvd	31	8.5	3.5	19.5	6.3	32%
Arizona Ave	27	7.6	3.4	17.8	5.4	31%
Ray Rd	24	6.8	3.4	17.3	4.8	27%
Chandler Heights Rd	7	1.8	3.4	8.4	1.8	21%
Gilbert Rd	10	2.7	3.4	9.0	2.3	25%
McQueen Rd	17	5.5	2.9	15.1	4.4	29%
Cooper Rd	7	2.1	2.9	5.9	1.5	26%
Warner Rd	7	2.1	2.9	5.3	1.3	24%
Dobson Rd	20	7.0	2.7	15.9	5.3	33%
Price Rd	10	3.3	2.7	8.9	2.7	30%
Riggs Rd	7	2.3	2.6	8.0	1.7	21%
Elliot Rd	5	1.8	2.3	3.6	1.0	29%
Queen Creek Rd	10	4.2	2.1	11.1	3.1	28%
Pecos Rd	8	3.6	1.9	9.6	2.9	30%
Ocotillo Rd	9	4.1	1.9	11.5	3.3	29%
Germann Rd	8	4.6	1.5	11.3	3.5	31%
		Average =	2.8			28%

3.3 TRAVEL TIMES AND VOLUME: AGENCY TRENDS

TOWN OF GILBERT

Recently, as part of a town-wide signal retiming project, travel times were collected for 11 arterial segments in the Town of Gilbert before and after the retiming plans were implemented. Travel times were collected during the AM Peak Hour (7:15AM-8:15AM) and the PM Peak Hour (4:30PM-5:30PM) for each corridor. The Town will perform travel time runs on at least a bi-annual basis to assess where traffic signal retiming is most needed and to assess how Gilbert's arterials are operating. Based on these travel time runs, the following measures of effectiveness (MOEs) are reported:

- Percent Change in Travel Time
- Percent Change in Traffic Signal Delay
- Percent Change in Number of Stops
- Percent Change in Fuel Consumption
- Percent Change in CO Emissions

These MOEs were used to measure the effectiveness of the signal retiming project and were used in place of Level of Service (LOS) statistics to help policy makers and the public understand the benefits of the retiming effort. The table below displays the results from the before and after travel time studies on travel time, delay and stops.

Directional Summary of Travel Time, Delay and Stops

Corridor	Direction	From	To	Length (miles)	# of Signals	AM % Change Travel Time	AM % Change Delay	AM % of Stops	PM % Change Travel Time	PM % Change Delay	PM % of Stops
Val Vista South	NB	Queen Creek	Williams Field	3	9	0%	-1%	-39%	-4%	-13%	-20%
	SB	Williams Field	Queen Creek	3	9	-18%	-49%	-24%	-20%	-62%	-50%
Val Vista North	NB	Williams Field	Baseline	5	14	2%	7%	75%	5%	15%	-9%
	SB	Baseline	Williams Field	5	14	-6%	-18%	-30%	4%	27%	30%
McQueen	NB	Mesquite HS S	San Pedro	2.25	8	-17%	-46%	-76%	3%	7%	0%
	SB	San Pedro	Mesquite HS S	2.25	8	10%	30%	0%	-25%	-58%	-68%
Baseline	EB	Driftwood	Meadows	4	10	-1%	-3%	-11%	-10%	-32%	-67%
	WB	Meadows	Driftwood	4	10	1%	2%	-33%	14%	35%	-17%
Higley	NB	Loop 202	Baseline	3.5	8	-5%	-14%	17%	-11%	-35%	-30%
	SB	Baseline	Loop 202	3.5	8	-11%	-49%	-18%	0%	0%	14%
Lindsay	NB	Willaims Field	Houston	4.5	8	-15%	-44%	-63%	12%	45%	6%
	SB	Houston	Williams Field	4.5	8	16%	60%	40%	-20%	-46%	-46%
Gilbert	NB	Civic Center	Baseline	3.25	10	-10%	-24%	-38%	-1%	-1%	-9%
	SB	Baseline	Civic Center	3.25	10	1%	2%	-4%	-21%	-42%	-54%
Guadalupe	EB	Cooper	Val Vista	3	9	-1%	-6%	-60%	-19%	-86%	-58%
	WB	Val Vista	Cooper	3	9	4%	14%	33%	15%	81%	15%
Elliot	EB	McQueen	Val Vista	4	11	-3%	-11%	-50%	-14%	-37%	-74%
	WB	Val Vista	McQueen	4	11	-13%	-26%	-25%	17%	56%	34%
Williams Field	EB	Gilbert	Higley	4	9	-20%	-60%	-72%	-4%	-14%	35%
	WB	Higley	Gilbert	4	9	2%	8%	2%	-19%	-44%	-40%
Warner	EB	Gilbert	Greenfield	3	8	-12%	-36%	-58%	-29%	-89%	-65%
	WB	Greenfield	Gilbert	3	8	-3%	-15%	-17%	-9%	-24%	-23%

Notes:

~ Peak Direction of Travel

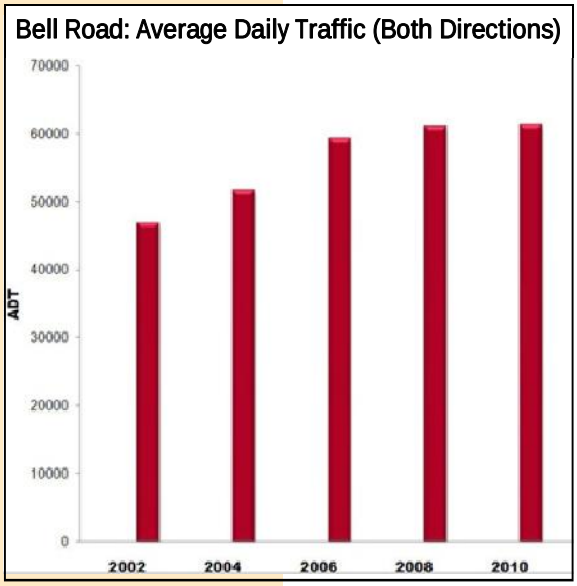
% Change Travel Time - Negative numbers represent reduction in travel time from before to after study.
% Change Delay - Negative numbers represent reduction in delay from before to after study.
% of Stops - Negative numbers represent reduction in stops along corridor from before to after study.

There is not a distinct peak direction of travel over the entire corridor for the Val Vista South and Higley corridors due to the presence of the Loop 202 freeway interchanges.

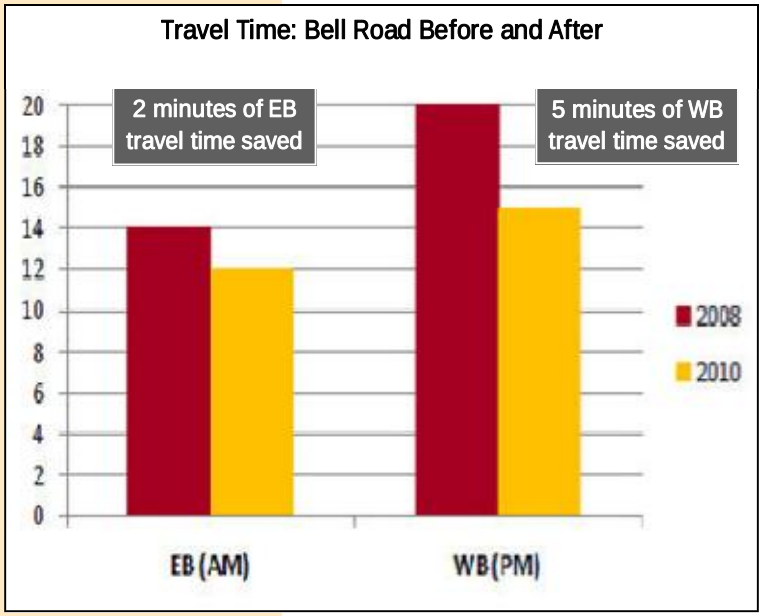
3.4 TRAVEL TIME AND VOLUME: REGIONAL CORRIDOR TRENDS

MULTI-AGENCY CORRIDOR—BELL ROAD

Bell Road is the busiest arterial corridor in the state. The section of Bell Road from Loop 101 Agua Fria west is operated by multiple agencies including ADOT, Maricopa County, City of Surprise, and City of Peoria. The corridor intersects with three freeways and several major north-south arterials. Bell Road's average volume of daily traffic is 60,000 vehicles. Bell Road between Loop 101 and Loop 303 inclusive has 28 traffic signals operated by five different agencies.



During the period from 2005-2010 the agencies have implemented several traffic management strategies and have deployed ITS infrastructure along the corridor including fiber communications, DMS, CCTV cameras. Bell Road coordination committee led by MCDOT has been established to improve inter-jurisdictional operations. Ideally travel times on arterials are collected through before and after studies of a specific improvement or for long term planning studies. Benefits shown for ITS improvements and traffic signal coordination along Bell Road from Loop 101 to US-60 (Grand Avenue) include 14% Eastbound and 25% Westbound travel time savings.



A regional project under MAG Traffic Signal Optimization Program (TSOP) is developing weekend signal coordination plans for 57 of the signals on the corridor, extending to Loop 101 in the East Valley (Pima Freeway). The travel time studies performed by MCDOT indicate reduction in travel times as shown in the figure to the left.

Engine Size	Daily	Annual		
	Gasoline Not Burned	Gasoline Not Burned	Money Not Spent	CO2 Not Emitted
Small	0.5 cups	10 gallons	$30	220 lbs
8 Cylinder	1 cup	20 gallons	$60	440 lbs

Source: Anti-Idling Primer—Every Minute Counts (Hinkle Charitable Foundation)

3.5 OPERATIONAL MEASURES: LOCAL AGENCY

CITY OF SCOTTSDALE

The City of Scottsdale ITS Group is responsible for assisting traffic flow through city arterials. The ITS Group also designs and maintains its own fiber optic network, 30 DMS, over 81 cameras and signal timing for almost 300 traffic signals. This group provides technical assistance to both the signal maintenance and construction groups and traffic engineering divisions. In fiscal year 2010-2011, the ITS group performed over 10,397 manual signal timing adjustments, posted 169 messages to overhead DMS and alerted media to 137 traffic events. Additionally, they responded to 147 phone calls.

The City has pioneered and specialized in the area of developing and implementing signal timing plans for incidents, construction, special events or random congestion. The table below illustrates the number of such timing plan adjustments implemented by the City by month.

Manual Timing Adjustments for Collisions, Construction, Special Events or Random Congestion

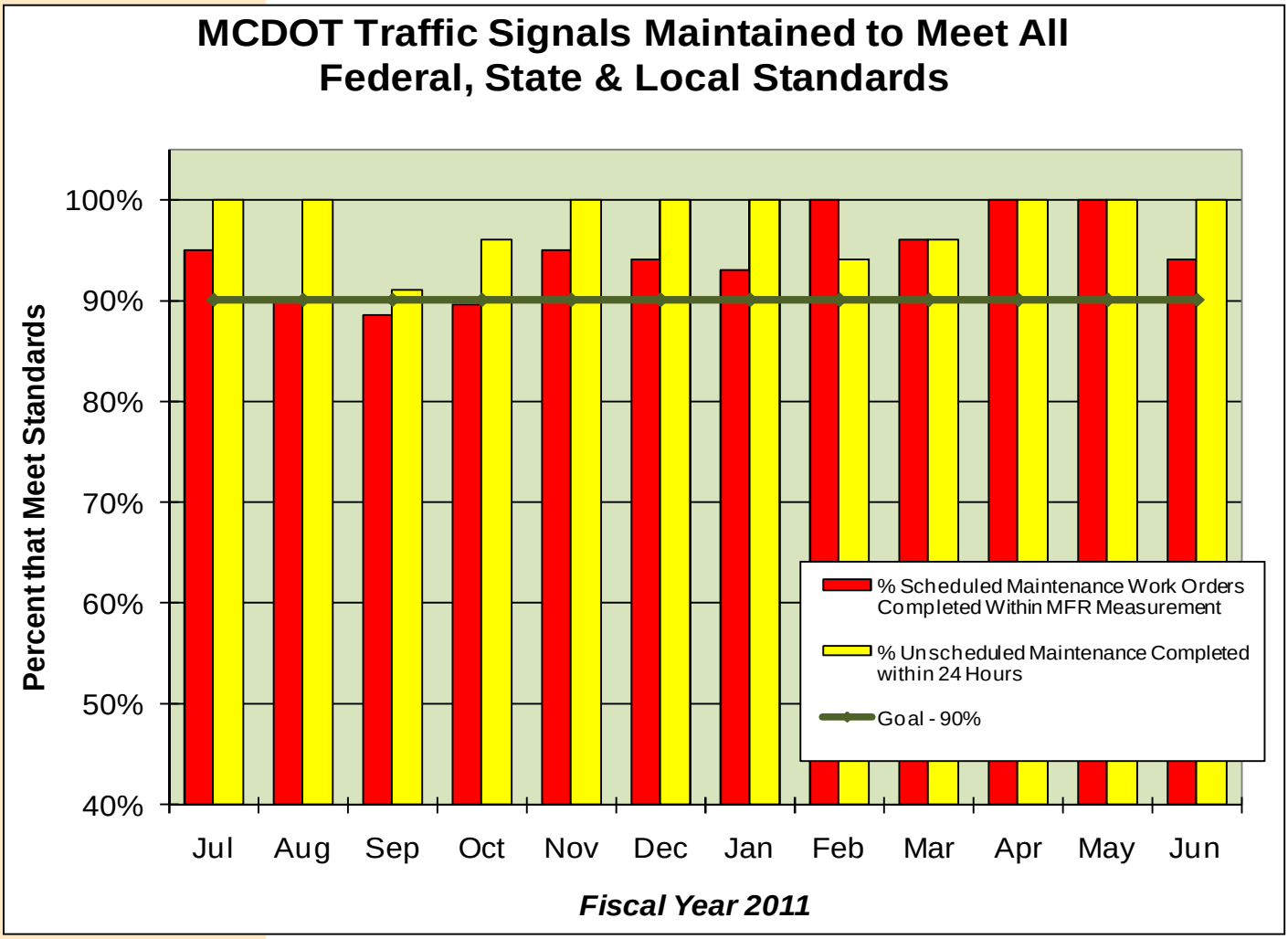
Dates	# of Plans
July '10	734
August '10	641
September '10	749
October '10	936
November '10	749
December '10	1,032
January '11	1,657
February '11	1,371
March '11	838
April '11	506
May '11	639
June '11	545
10-'11 Total	**10,397**

3.6 PRESERVATION AND MAINTENANCE

PRESERVATION AND MAINTENANCE

MCDOT keeps track of both scheduled and unscheduled maintenance of nearly 160 signalized intersections. Both include maintenance to signals to meet all Federal, State and Local Standards. Scheduled or preventative maintenance is tracked in terms of a monthly schedule. Unscheduled maintenance refers to response to equipment malfunction or damage.

The target of 90% of scheduled maintenance work orders are completed in accordance with the predetermined schedule and unscheduled maintenance completed within 24 hours. The figure below highlights the effectiveness of the MCDOT Traffic Signal Maintenance schedule in meeting that 90% target.



SECTION 4

SAFETY

Background and Overview

On average, at least two people are killed every day on Arizona's roads. In 2010, the total number of traffic-related fatalities in the state was 762, of which 362 (or 41%), occurring in the Maricopa County region including all agencies in both incorporated and unincorporated County).

Additionally, in 2010 there were over 135 persons injured in crashes every day totaling over 50,110 people. Maricopa County had 32,114 people injured, or 64% of the injuries, over-representing the population base in the region, which is 59.7% of the state's population.

Why Consider Safety in Conjunction with Transportation Operations and Management?

It is estimated that about half of the congestion experienced by freeway travelers is caused by non-recurring events (weather, construction, crashes, etc.). On the arterial system, non-recurring congestion only accounts for nine percent of total congestion. This type of congestion cannot typically be mitigated by infrastructure improvements. The integration of operations and safety has the potential to help agencies stretch limited funding, in the near term, to address safety and mobility issues.

Goal

The key regional goals for safety are defined in the *MAG Strategic Transportation Safety Plan* (October 26, 2005):

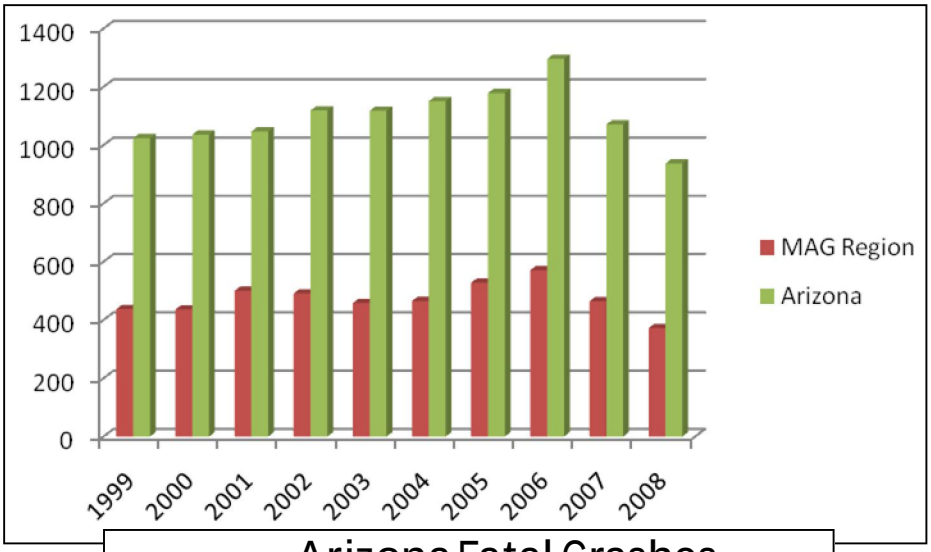
- Reduce severe intersection crashes
- Reduce crashes related to DUI, speeding, red-light running and the illegal passing of stopped school buses
- Reduce the number of crashes that involve bicyclists or pedestrians
- Reduce mid-block pedestrian crashes

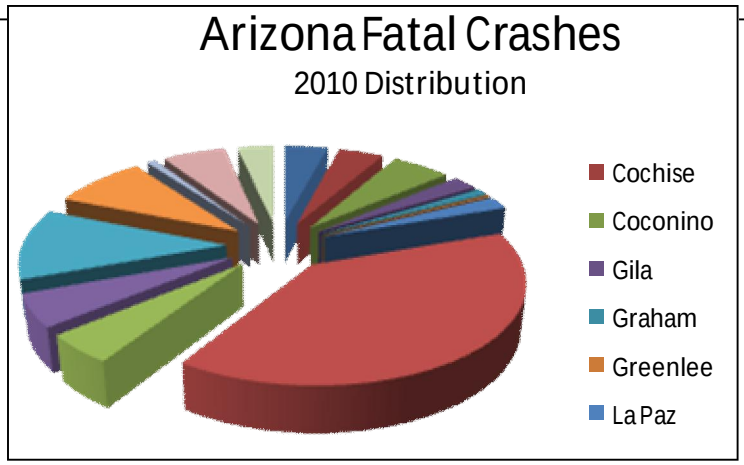
IN THIS SECTION:

4.1 BACKGROUND AND OVERVIEW

The Maricopa Country region as a whole is the largest region in the state of Arizona. It also contains the most crashes in the state. The table to the right uses a different metric: crash rate per 1,000 people—this measure allows all counties to be compared equally. As evident in the table to the right, the Maricopa County region is fourth in Arizona for crashes by population. The comparison of the MAG region to the state for crash related fatalities, as shown below, indicates that nearly 40 percent (in 2008) of all road fatalities are concentrated in the MAG urban region in comparison to rest of the crashes that are distributed across sparsely populated areas of the state.

Top 5 County Crash Rates in AZ	
Region	Rate
Coconino	28.03
La Paz	20.55
Gila	18.36
Maricopa	17.99
Pima	15.98





Arizona Crash Facts Highlights

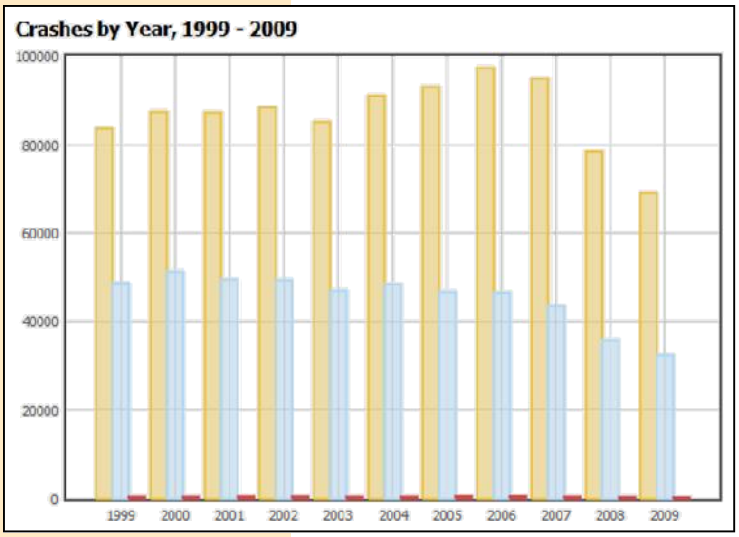
- Total economic losses from vehicular crashes for the State of Arizona totaled almost $3 billion in 2009
- One person was killed every 10.88 hours in Arizona in 2009
- Single vehicle fatal crashes comprised over 45% of the total number of fatal crashes

The Maricopa County region takes safety very seriously. MAG has a Transportation Safety Committee to tackle these problems. The committee relies on the 4E's: Engineering, Enforcement, Education, and Emergency Medical Services. For more information on the region's safety efforts, visit http://www.azmag.gov/Committees/Committee.asp?CMSID=1059.

*Source – Crash Data Analysis by MAG, Crash Data Source: ADOT ALISS Database

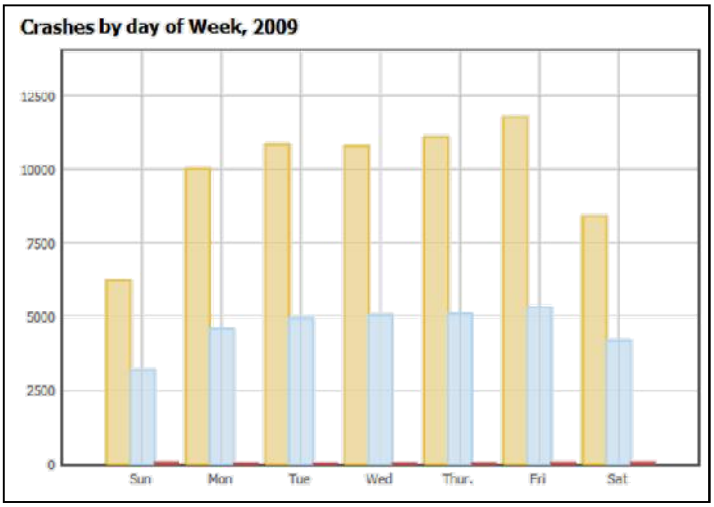
4.2 CRASH RATES BY TIMEFRAME

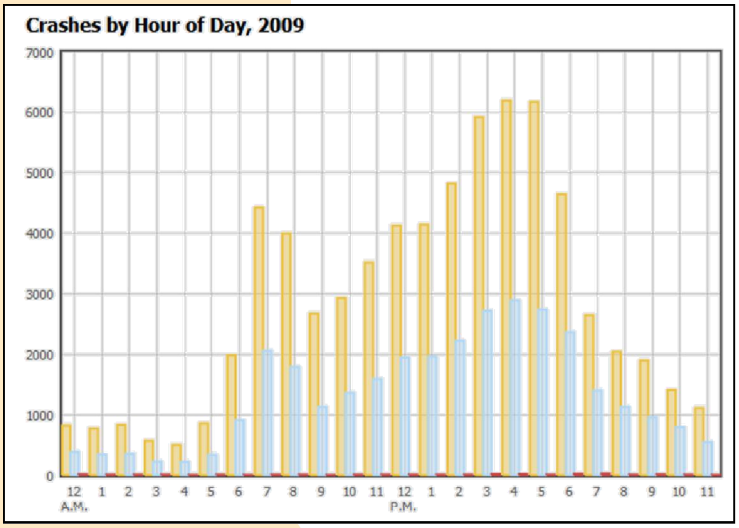
CRASH RATES BY YEAR, DAY, AND HOUR



The figure to the left shows the crashes in the Maricopa County Region (includes all agencies in both incorporated and unincorporated County). This figure shows that the annual total number of crashes (in yellow) have steadily increased since 1999. Total crashes reached a peak in 2006 and have since steeply declined. The most probable cause for the decline in crashes is the severe economic recession and resulting reduction in travel. The proportion of injury and fatal crashes appear to have remained unchanged.

The figure to the right shows the distribution of 2009 crashes by day-of-week. Most injuries occur on Tuesdays and Fridays – both days also with higher crash numbers. However, the numbers indicate that most fatalities (crash severity not shown in figure) seem to occur on Saturdays and Sundays – the days with the least number of total crashes. This is likely due to more severe crashes involving higher vehicle speeds made possible by lower weekend traffic volumes. Clearly, higher levels of traffic congestion appear to reduce the injury severity of crashes.





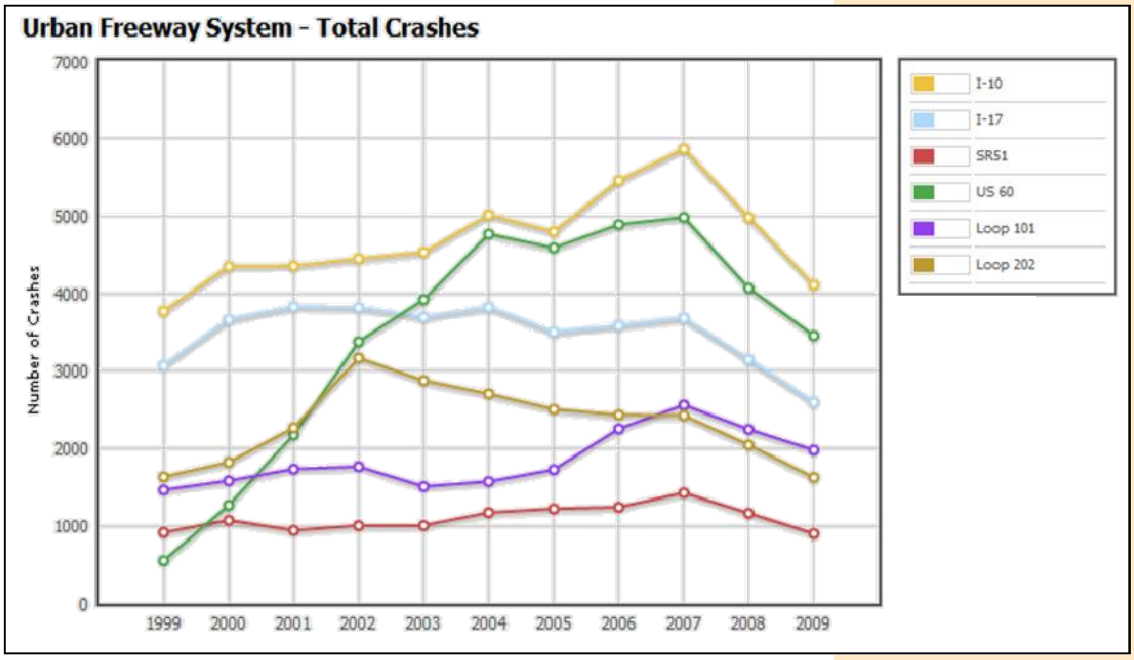
The hourly variation of crash occurrence is shown in the figure to the left. Nearly 80 percent of all crashes occur between 6AM and 6PM. However, 45 percent of all fatalities occur between 7PM and 4AM, yet again indicating that more severe crashes occur under conditions with little or no congestion.

*Source – Crash Data Analysis by MAG, Crash Data Source: ADOT ALISS Database

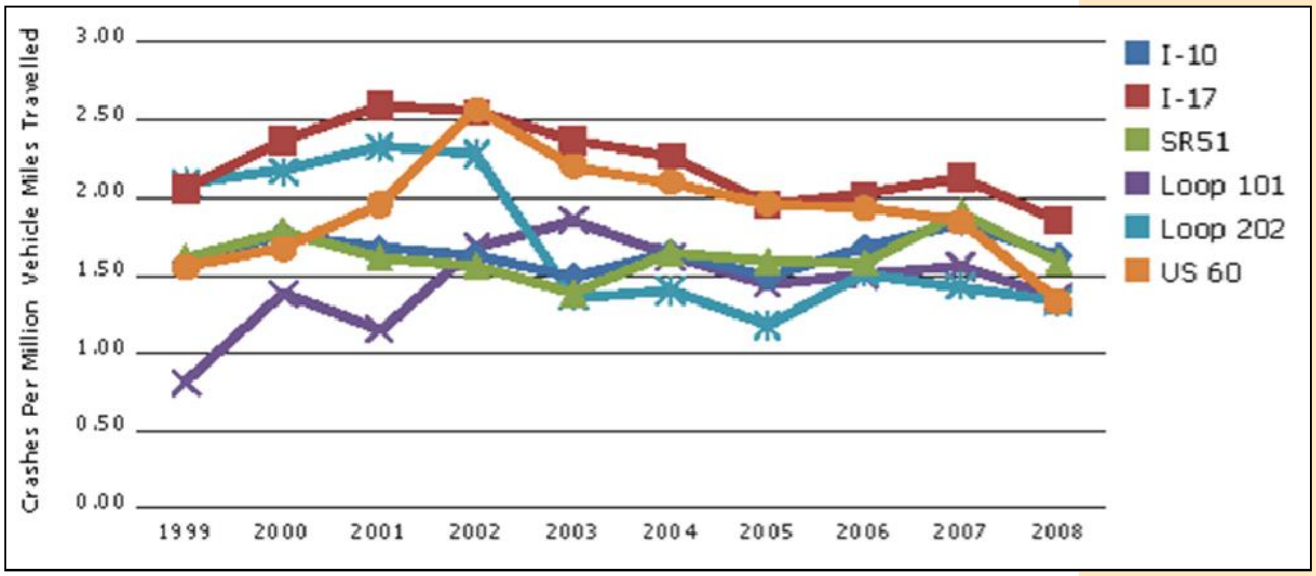
4.3 CRASH RATES BY URBAN FREEWAY SYSTEM

URBAN FREEWAY SYSTEM

The figure below shows the annual number of crashes on each freeway corridor. It should be noted that each of these freeway corridors have different mileage within the region and that two freeways, Loop 202 and Loop 101, had lane miles added during the period shown. US-60 shows a marked increase in total crashes from 1999 through 2004. The I-10 corridor experiences the highest number of crashes each year. It is also the longest of all freeway corridors and has the highest VMT. All freeways show a declining trend for crashes since 2007.



The overall crash occurrence on freeway corridor is better depicted by the variation of crash rates, as shown below, which accounts for vehicle exposure. The I-17 corridor shows the highest crash rates during the entire 10 year period.



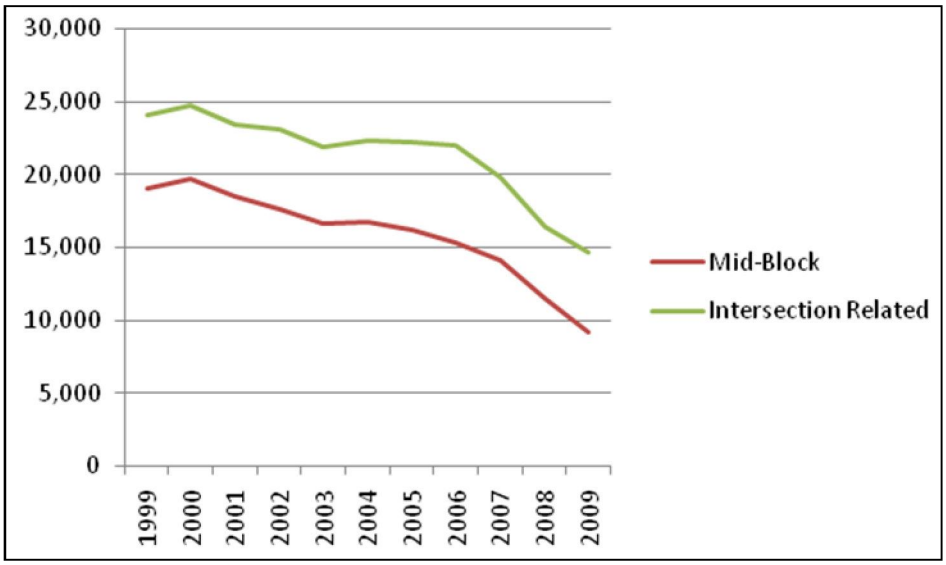
*Source – Crash Data Analysis by MAG, Crash Data Source: ADOT ALISS Database

4.4 MAG REGION STATISTICS

INTERSECTIONS, BICYCLISTS AND PEDESTRIANS

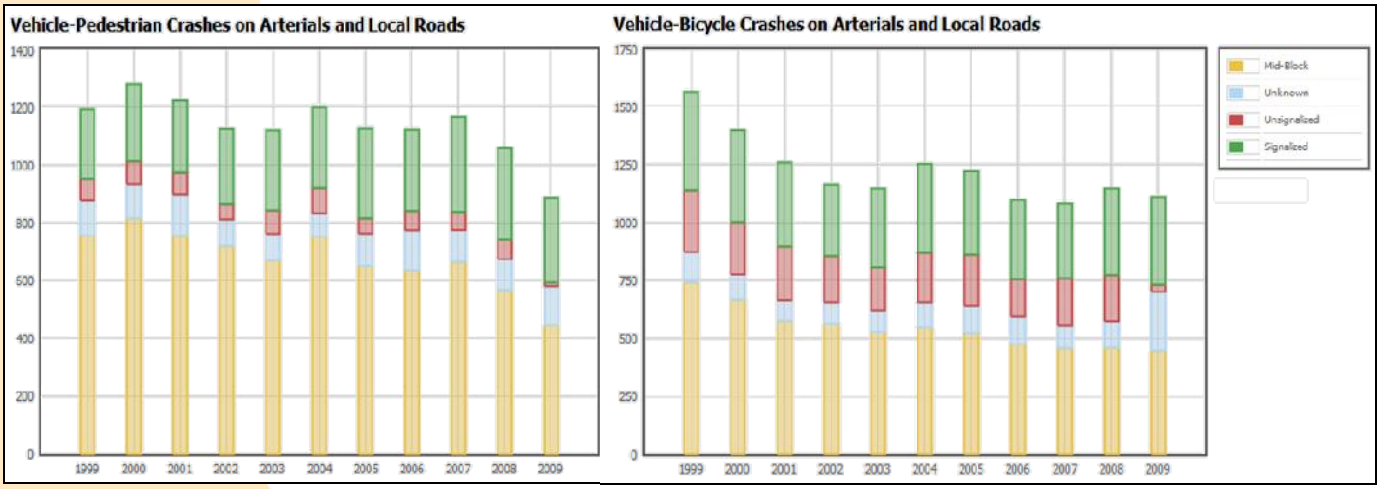
Intersections

The annual totals for injuries and fatalities due to arterial crashes show a declining trend since 2000. Most of these crashes are at intersections or are related to intersections. A high proportion of such crashes occur at mid-block locations. The figure below shows the annual injuries plus the fatalities on arterials at intersections or mid-block locations.



Bicyclists and Pedestrians

A large proportion of pedestrian crashes occur at mid-block locations as shown in the bottom figure to the left (yellow). In the bottom figure to the right, it is shown that more bicycle crashes appear to occur at or near intersections by a small margin over mid-block locations (non-yellow).



*Source – Crash Data Analysis by MAG, Crash Data Source: ADOT ALISS Database

4.4 MAG REGION STATISTICS

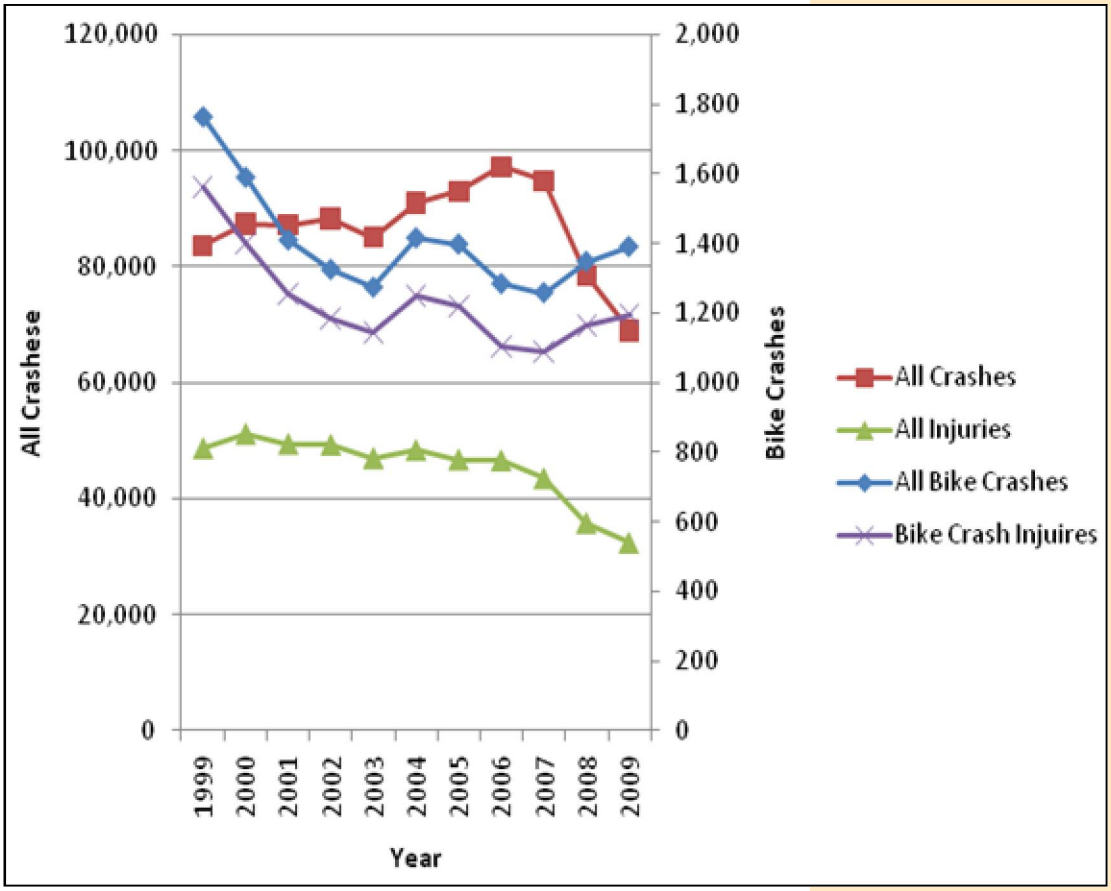
BICYCLE CRASHES

The annual count of all types of crashes reached a peak in 2006 and have been declining since then, as shown in the figure below. The annual number of persons injured due to traffic crashes have been slowly declining since 2000, but since 2006 there has been a more rapid decrease.

The reduction in total crashes and injuries since 2006 is generally attributed to reductions in travel due to the economic recession and improved vehicle design.

The annual number of bike crashes and resulting injuries have steadily dropped from 1999 to 2003 (cannot be explained). These numbers appear to have increased in 2004-2005 (during the construction reaching a low in 2007 and are now rising again.

The total annual deaths show a declining trend since 2006. Bike crashes in the region result in about 16 deaths per year on average. The annual number of bike deaths are too small to observe any trends.



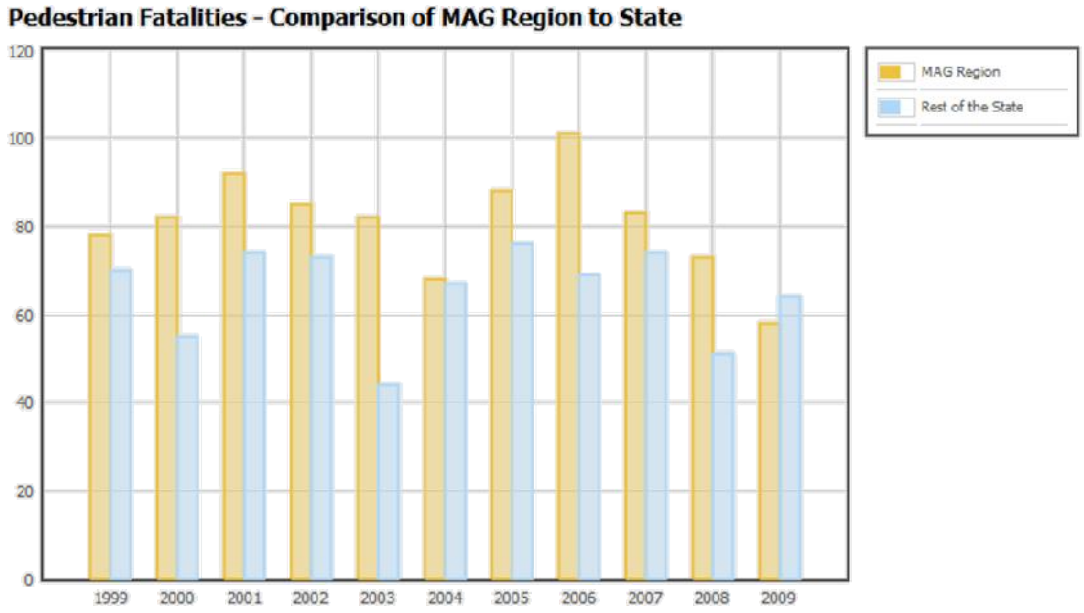
While injuries and deaths due to all motor vehicle crashes have been declining since 2007 , bike crashes and injuries have been increasing in the same period. One possible explanation, that needs to be validated, is that although the total miles of vehicles driven have generally decreased in recent years, the use of bicycles for transportation in the MAG region may have actually increased thus increasing their exposure to crash risk.

*Source – Crash Data Analysis by MAG, Crash Data Source: ADOT ALISS Database

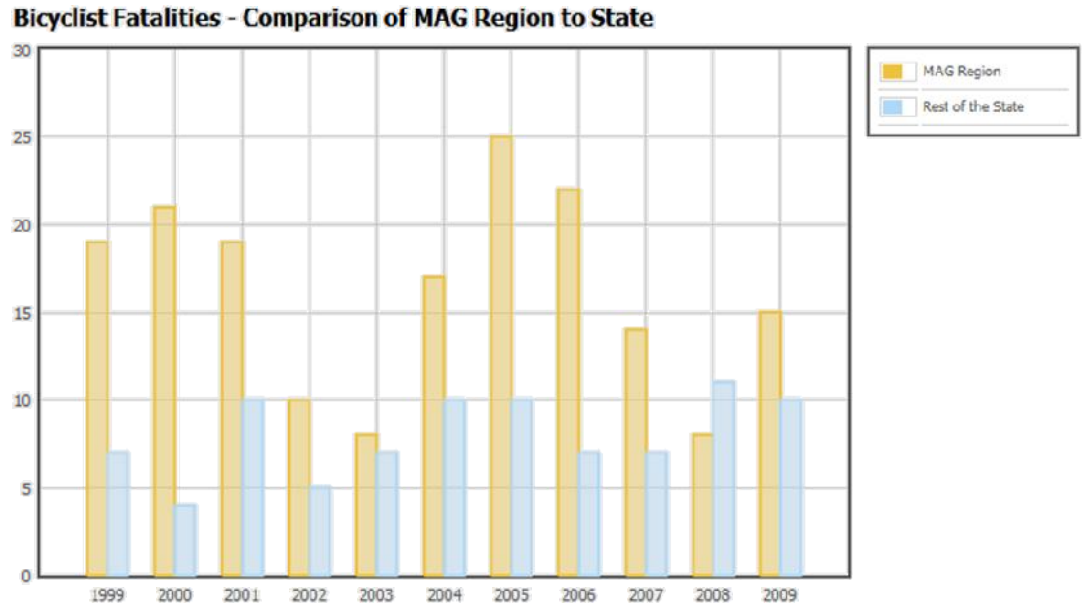
4.5 COMPARISON OF MAG REGION TO STATE

MAG TO STATE: BICYCLISTS AND PEDESTRIANS

The annual total number of pedestrians killed in crashes in the MAG region have exceeded that across rest of the state for all years except 2009. Since 2006, the annual pedestrian deaths in the region appear to be declining, as shown in the figure below.



The number of bicyclists killed in crashes in the MAG region exceeds that of rest of the state except for 2008, as shown in the figure below.



*Source – Crash Data Analysis by MAG, Crash Data Source: ADOT ALISS Database

SECTION 5

INCIDENT MANAGEMENT

Background and Overview

Incidents on the freeways and arterials cause the most delay and safety concerns to travelers and the quality of the incident response is more visible to the traveler than most other performance measures.

The AZTech™ partnership has initiated a Traffic Incident Management (TIM) Coalition to increase the effectiveness of agency partnerships in the incident response and clearance processes. In October 2010, DPS began collecting key data elements to measure TIM performance. DPS found positive results related to the time for clearing blockages and removing incidents from the roadway. The average time it took from arrival to removal of blockage from the travel lanes went down an average of 31.33% (15.6 minutes) and the average time patrolmen spent with the collision on the side of the road went down 50.68% (44.4 minutes).

There are other important measures to consider for incident management partnerships. For example, when called to an incident scene, REACT controlling the surrounding traffic through proper control results in no secondary accidents—this is a measure of increased safety that has impacts felt far beyond the incident site. Additional goals are defined in the MAG RCTO which support the goal of enhanced incident management in the region.

IN THIS SECTION:

5.1 AZTech™ TRAFFIC INCIDENT MANAGEMENT COALITION (TIM)

Traffic Incident Management National Unified Goal (NUG)

OBJECTIVE 1: RESPONDER SAFETY

- **Strategy 1.** TIM Partnerships and Programs.
- **Strategy 2.** Multidisciplinary NIMS and TIM Training.
- **Strategy 3.** Goals for Performance and Progress.
- **Strategy 4.** TIM Technology. Traffic Incident
- **Strategy 5.** Effective TIM Policies.
- **Strategy 6.** Awareness and Education Partnerships.
- **Strategy 7.** Recommended Practices for Responder Safety.
- **Strategy 8.** Move Over/Slow Down Laws.
- **Strategy 9.** Driver Training and Awareness.

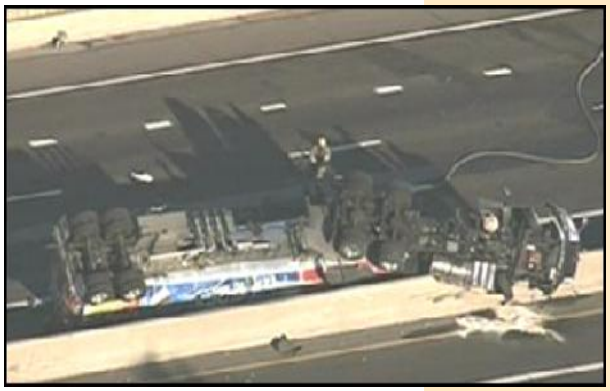
OBJECTIVE 2: SAFE, QUICK CLEARANCE

- **Strategy 10.** Multidisciplinary TIM Procedures.
- **Strategy 11.** Response and Clearance Time
- **Strategy 12.** 24/7 Availability. Traffic Incident Management responders and resources should be available 24/7.

OBJECTIVE 3: PROMPT, RELIABLE INCIDENT COMMUNICATIONS

- **Strategy 13.** Multidisciplinary Communications Practices and Procedures.
- **Strategy 14.** Prompt, Reliable Responder Notification
- **Strategy 15.** Interoperable Voice and Data Networks.
- **Strategy 16.** Broadband Emergency Communications Systems.
- **Strategy 17.** Prompt, Reliable Traveler Information

The AZTech™ Traffic Incident Management (TIM) Coalition in the Phoenix Metro Area is a collaboration of transportation and public safety agencies to coordinate in all-hazards preparedness for traffic incidents and other emergencies. The aspiration is to develop mutually supporting incident management principals in a common planning framework that integrate the coordination of protocols and communication.

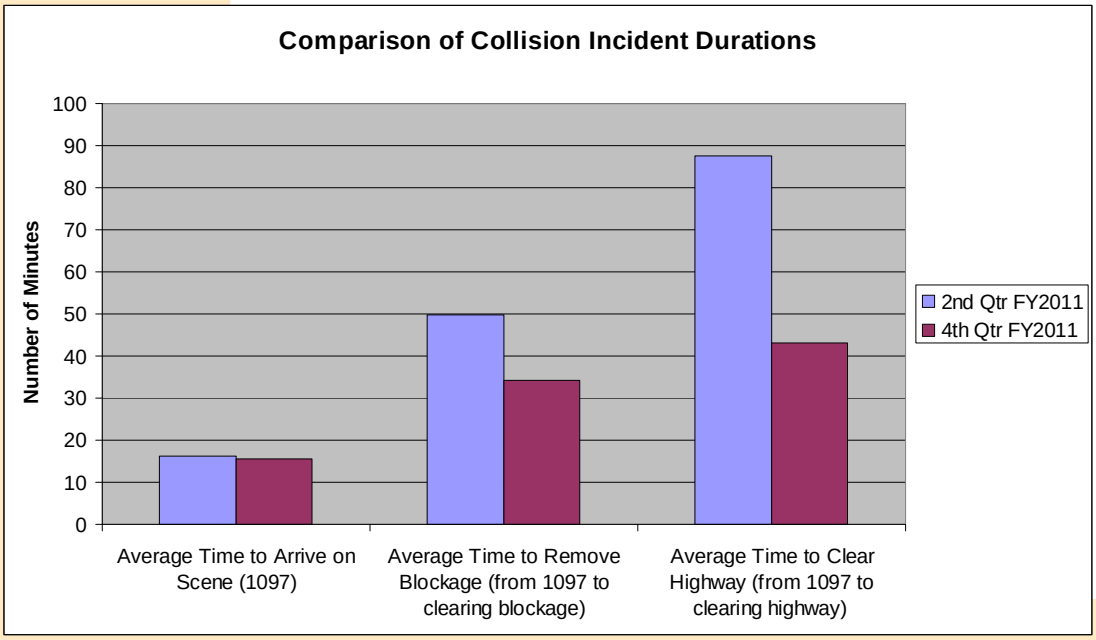


5.1 AZTech™ TRAFFIC INCIDENT MANAGEMENT COALITION (TIM)

In line with the National Traffic Incident Management (TIM) Program and the National Unified Goal, DPS led the formation of the Phoenix Metro TIM Coalition under the AZTech™ umbrella. The TIM Coalition consists of stakeholders from Law Enforcement, Fire, Emergency Medical Services, Transportation and others and focuses on a planned and coordinated multi-disciplinary process to detect, respond to, and clear traffic incidents so that traffic flow may be restored as safely and quickly as possible. Reducing the amount of time a roadway is actually blocked and the amount of time a distraction remains on the side of the roadway will not only reduce the inconvenience to the motoring public by reducing non-reoccurring congestion, but studies have shown it also reduces the likelihood of secondary crashes; many of which involve first responders including law enforcement officers.

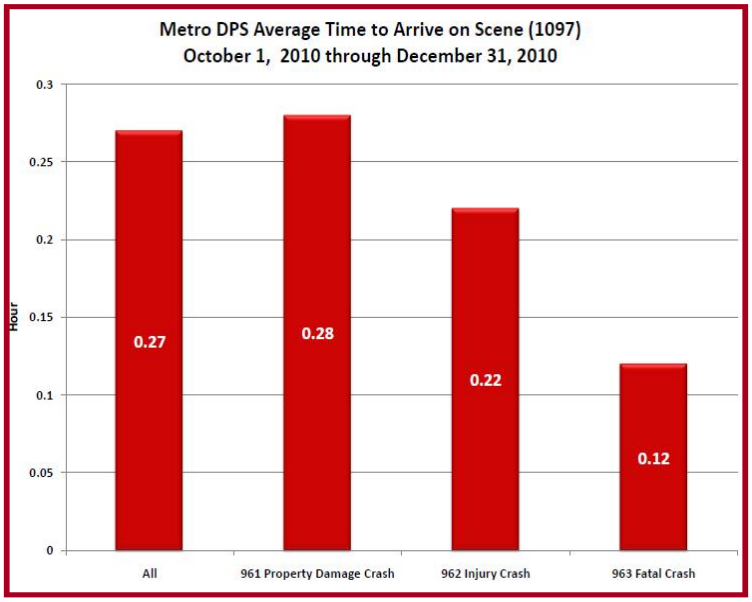
Through training and policies, DPS has increased focus and emphasis related to the TIM philosophies contained in the National Unified Goal. Division Order 2.60, relating to traffic stops and incidents, was modified to further support the cross-cutting strategies. A roll call training video related to the TIM Program was also developed and is being distributed to all the officers within the Highway Patrol Division. Through these efforts and cooperation with partnering stakeholders results appear to be positive at this early stage.

In October 2010, DPS began collecting key data elements to measure TIM performance. Several elements were evaluated including response time, lane clearing time, and incident clearing times (no longer on the roadside in view of traffic). In comparing the preliminary results of the 2nd quarter to the 4th quarter of FY2011, DPS found positive results related to the time clearing blockages and removing incidents from the roadway. The average time it took from arrival to removal of blockage from the travel lanes went down an average of 31.33% (15.6 minutes) and the average time patrolmen spent with the collision on the side of the road went down 50.68% (44.4 minutes).



5.2 TRAFFIC INCIDENT MANAGEMENT—FREEWAYS

Traffic incidents on the freeways have substantial repercussions on connecting freeways as well as the arterial network, particularly during full closures. Average time to arrive on scene (top left figure) and average time to clear and complete incident (bottom right figure) are shown. Lists of the extraordinary arterial and freeway closures incidents are provided as well.

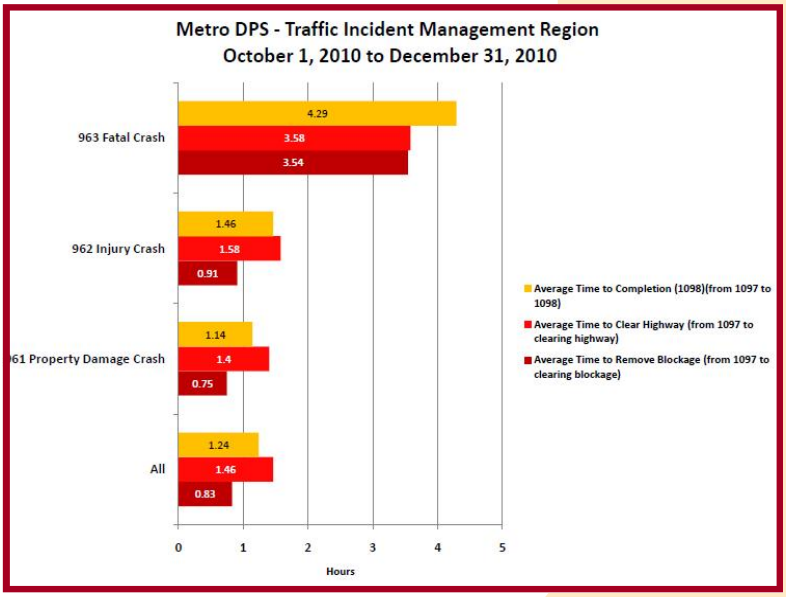


Extraordinary Arterial Road Closure Incidents

Date	Arterial	Location
4/2/2011	El Mirage Rd	Deer Valley Access Rd to Wescott Dr
4/5/2011	McDowell Rd	27th Ave to 35th Ave
4/8/2011	91st Ave	Peoria Ave to Olive
4/9/2011	Deer Valley Rd	Lake Pleasant Pkw and 95th Ave
4/14/2011	Power Rd	Ray Rd to Galvestion Rd
4/19/2011	43rd Ave	intersection with Dunlap
4/26/2011	Greenway Rd	intersection with 59th Ave
5/1/2011	Apache Trail	intersection with Meridian
5/4/2011	Hayden Rd	Chaparral Rd to Camelback
5/15/2011	Litchfield Rd	Olive Ave to Peoria Ave
5/18/2011	SR 74	Lake Pleasant Pkw and 211th Ave
5/25/2011	83rd Ave	Camelback Rd to Bethany Home Rd
5/26/2011	University Dr	intersection with Signal Butte
6/1/2011	Bell Rd	99th Ave to Del Webb
6/1/2011	Ellsworth	University to Sleepy Hallow
6/2/2011	RH Johnson	Meeker to Stardust
6/3/2011	67th Ave	Camelback Rd to Missouri
6/6/2011	Glendale Ave	99th Ave toEl Mirage Rd
6/9/2011	Northern Ave	63rd Ave to 68th Ave
6/10/2011	Buckeye Rd	83rd Ave to 91st Ave
6/11/2011	Northern Ave	intersection with 107th Ave
6/13/2011	Mesa Dr	Main to Broadway
6/16/2011	Carver Rd	43rd Ave to 51st Ave
6/18/2011	Northern Ave	83rd Ave to 91st Ave
6/22/2011	59th Ave	Northern Ave to Olive Ave
6/25/2011	Bethany Home Rd	55th Ave to 59th Ave
7/13/2011	Bush Hwy	Usery Pass Rd to SR 87
7/15/2011	Fountain Hills Blvd	Sullivan to Chama
7/16/2011	Lake Pleasant Pkwy	Deer Valley Rd to Pinnacle Peak Rd

Extraordinary Freeway Incidents

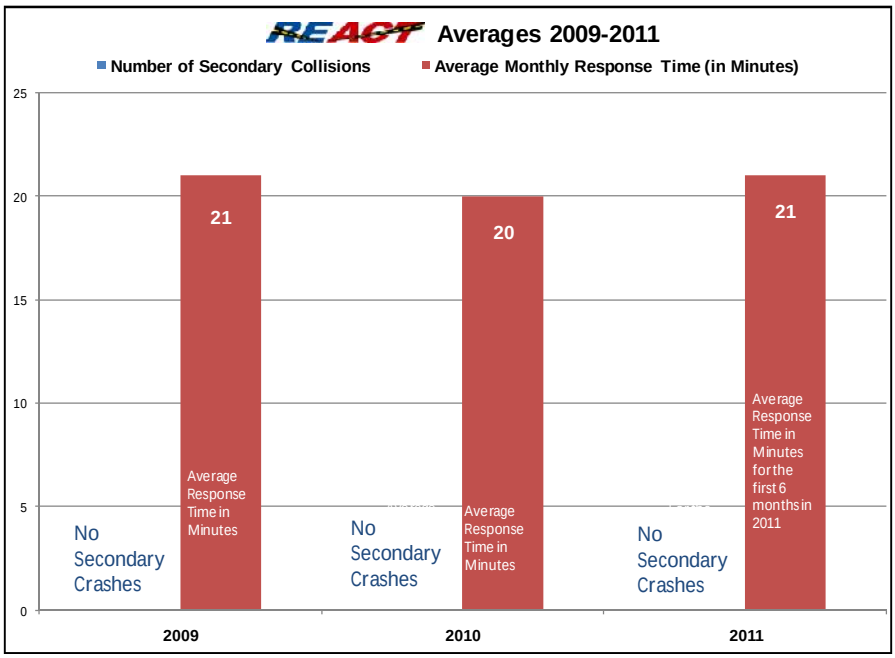
Date	Interstate	Type of Closure	Location
1/10/2011	L-303	SB full Closure	Glendale to Camelback
1/24/2011	L-101	NB full closure	Olive Ave to Peoria Ave
2/7/2011	I-17	NB full closure	Bethany Home to Rd Glendale
2/7/2011	L-303	EB Full Closure	El Mirage Rd
3/2/2011	I-17	NB full closure	I-10 to Indian Sch. Rd.
4/18/2011	I-10	EB Full Closure	51st Ave
4/18/2011	I-10	WB Full Closure	67th Ave
4/25/2011	I-10	Full Closure	L 202 and Queen Creek Rd
5/9/2011	L 303	Full Closure	Bell Road and Grand Ave
6/3/2011	L 303	Full Closure	Glendale to Northern
6/13/2011	L-303	Full Closure	Glendale to Northern
7/1/2011	I-17	Full Closure	Northern to Dunlap
7/15/2011	L 101	Full Closure	NB 90th St. to Shea
7/20/2011	L202	Full Closure	SB at US 60
7/20/2011	I-17	Full Closure	NB at Bethany Home Rd



5.3 TRAFFIC INCIDENT MANAGEMENT—ARTERIALS

"Analysis of incidents and crashes occurring along urban arterial roadways suggests that as many as 15% of crashes occurring along these roadways may have been, in part, caused by an earlier incident" according to Richard A. Raub, Northwestern University Traffic Institute, in an article titled *"Occurrence of Secondary Crashes on Urban Arterial Roadways"*.

When a secondary accident occurs the delay is prolonged increasing the exposure to damage or injury for the responders and the motoring public. One of the main benefits of implementing Traffic Incident Management is the reduction of secondary accidents. As shown in the graph for 2009-2011, there have been zero secondary accidents at incidents where REACT has responded. REACT's average monthly response time is shown in the graph below.



CASE STUDY

Impact of a Freeway Closure on a Neighboring Arterial

An example of a major incident in Phoenix on a major corridor is a closure that occurred on eastbound I-10 at 51St Ave happened about 5 AM and was open at approximately 2PM. For this study the volumes and speeds were compared on MC 85 on the Monday prior to the incident (April 11, 2011) and the day of the incident (April18, 2011). The data was taken from Traffic.com.

Approximately at 10AM on Westbound I-10 at 67th Ave there was a police officer involved injury accident. Originally the three right lanes were blocked and at approximately 10:45 AM Westbound I-10 was closed. The closure remained in place until approximately 12PM.

Incident Timeline

Incident Occurs	04:30
DPS Notified	05:00
DPS Arrives	05:02
DMS Activated	05:08
ALERT Notified	05:12
Alert Arrives	05:18
I-10 Closed	05:25
Phoenix PD Clears Scene	13:45
ALERT Opens I-10	14:00
Normal Traffic	16:00

Total Incident Clearance Time: **9.5 Hours**

Time to return to Normal Traffic Flow: **11.5 Hours**

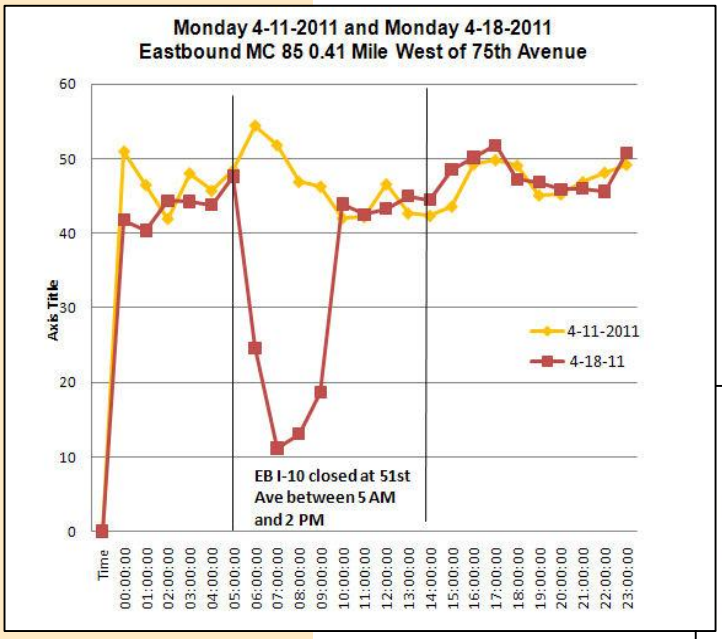
Times are educated estimates used for demonstration purposes only.

5.3 TRAFFIC INCIDENT MANAGEMENT—ARTERIALS

0.41 Mile West of 75th Avenue

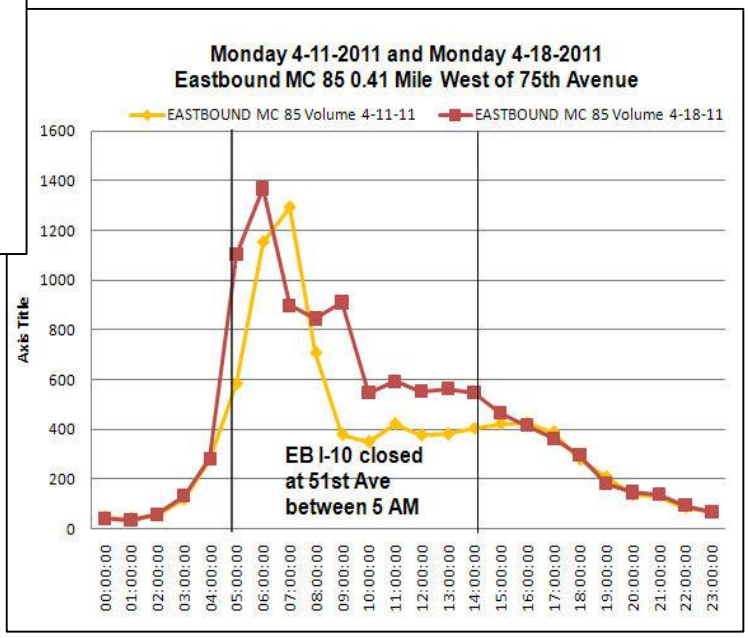
The MC85 volume and speed were impacted by the eastbound incident closure. The Westbound closure probably had minimal effect on MC85 but was a contributor to the delay already being experienced on the west side arterials.

MC85 volume appears to increase between 150 vph to 500 vph through most of the incident duration. The speed showed a marked decline between 6 AM and 10 AM, and then appeared to go back to normal levels. The 7 AM speed was 11.17 MPH which was the lowest speed.



The signal at 75th Avenue is under the control of the City of Phoenix. MCDOT right of way starts at the west side on the intersection.

MC85 was able to provide relief to travelers. Additional traveler information and responsive timing on other alternate routes could provide an even greater benefit to travelers.



SECTION 6

TRAVELER INFORMATION

Background and Overview

This region has been a national leader in innovative traveler information programs and partnerships. One of the primary goals of the original AZTech™ Metropolitan Model Deployment Initiative was to showcase unique partnerships for the delivery of real-time information. Although many of the partnerships and business models have evolved and changed over time, one thing remains constant: a regional commitment to continued enhancement of traveler information provided to the public. The AZTech™ ATIS (Advanced Traveler Information Systems) Working Group supported the implementation of regional traveler information strategies to support the enhancement of tools and collaboration for the benefit of the traveling public

ATIS Tools

- Regional Partnerships—Agency partners to provide quality traveler information
- Regional Archived Data System (RADS)—Engine for regional data
- Highway Conditions Reporting System (HCRS)—Road condition reporting system, feeds 511 systems
- Maricopa County DOT ATIS—Regional arterial traveler information resource
- AZTech™ ATIS Working Group—Agencies come together to improve the quality, accessibility, and timeliness of traveler information in the Phoenix metropolitan region

IN THIS SECTION:

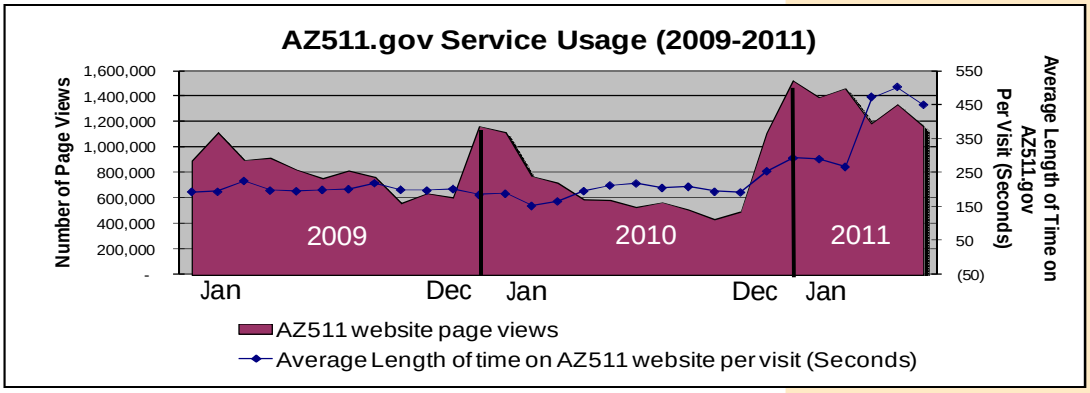
Traveler Information Achievements

- Foundation tools are in place that enable the collection and sharing of real-time data among agencies and with traveler information tools/services.
- Travel times for freeways and arterials during morning and afternoon commutes are being expanded to additional sign locations.
- Access to up-to-the minute information on 511 from phone, web and mobile.
- More camera coverage on the freeways and arterials means more real-time road condition images to share with the traveling public.
- The MAG Regional Concept of Transportation Operations identified Usage and Information Quality as the priority measures for traveler information. Performance tracking has expanded to include usage of the 511 phone and web systems, types of data shared and users of that data, and alerts that are distributed from agencies to the media, among others.
- The AZTech™ Traveler Information Working Group was established in 2006 to focus on improving traveler information in the region through collaborative efforts and reviews a wide range of monthly traveler information performance metrics to identify areas for improvement, impacts of recent system changes, and impacts of major events/storms.
- Establishing a standard freeway naming convention to support communication to travelers about freeway conditions.
- Federal funding supporting the creation of AZTech™ and new pilots/innovations has provided for institutional relationships to be able to grow through the years.
- Establishing the center-to-center protocols for DMS and CCTV usage allowed agencies to share device information.

Year	# of Freeway CCTV	# of Arterial CCTV
2007	126	95
2011	176	327

511 Web Usage

Web usage is largely influenced by weather activities throughout the state, particularly during winter months. The website was enhanced in November 2010 and is experiencing more visits in 2011 months thus far than in previous years as shown in the graph to the right. More information is available on the site and a centralized location for all mapping information is keeping users on the site more than twice as long than prior to the website enhancement.



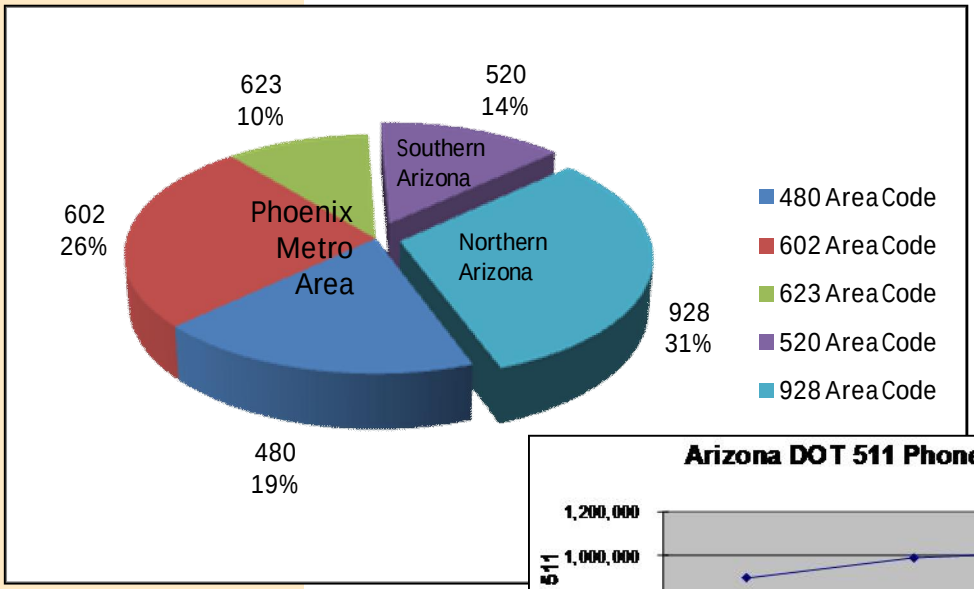
6.2 ARIZONA 511 PHONE SYSYTEM

511 Phone Usage

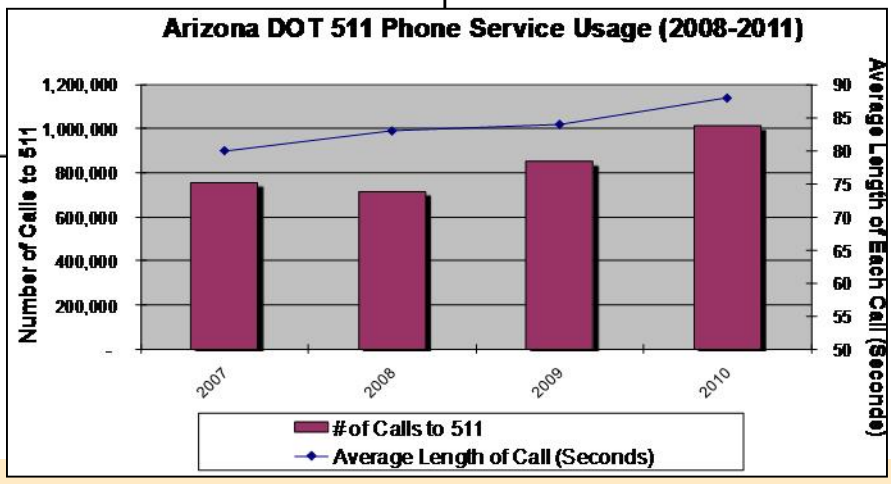
- January rainstorms and December/New Years snow storm bring lots of travelers to 511 service for the latest updates to bring the system **to over one million calls in 2010!**
- The phone system handled over 55,000 calls in two days over President's Day Weekend and the storm on Feb 27 2010 (the largest single call volume day in 511 Phone history)

511 Mobile Usage

- Mobile access available now directly from front page of AZ511.gov website
- Usage increased from 100 visits average per month to 1,000 visits in Nov 2010 after link was put on the 511 website, and have increased to over 4,000 visits per month since then



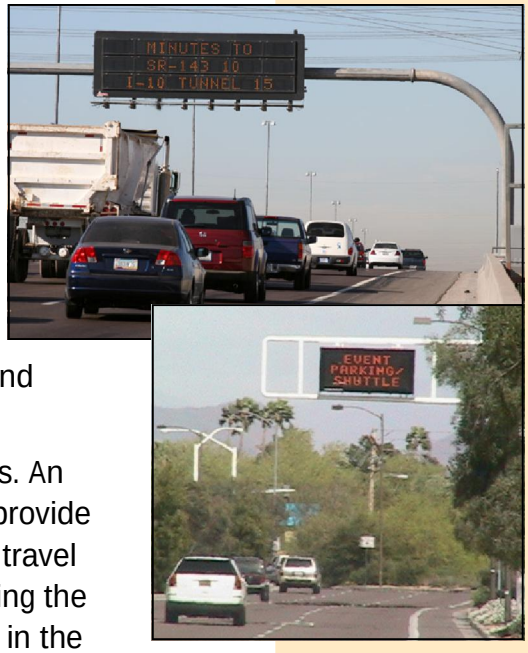
The graph to the left shows the distribution of 511 calls around the state. The majority are from the Phoenix metropolitan region, but more than 30% are from Northern Arizona.



6.3 FREEWAY AND ARTERIAL DMS

DMS USAGE ON FREEWAYS AND ARTERIALS

DMS have been installed along highways around the state and on arterials in the Phoenix metropolitan region. These DMS are being used to alert travelers of incidents ahead, construction schedules and lane closures and special events. Phoenix freeways also provide travel times during peak weekday commute periods.

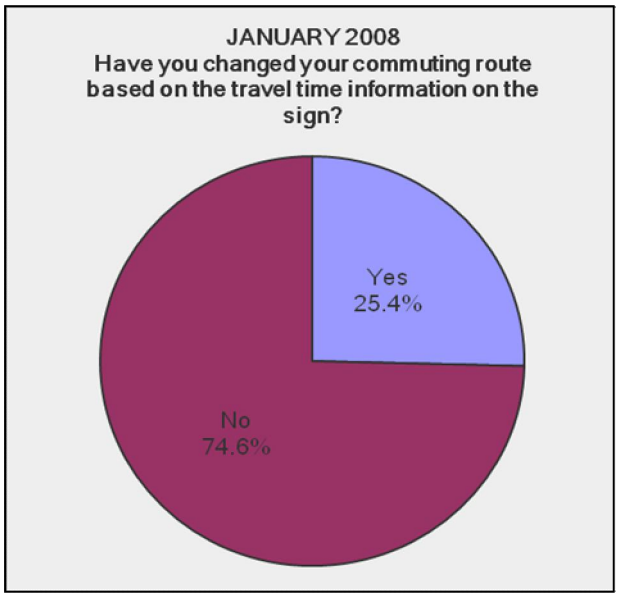


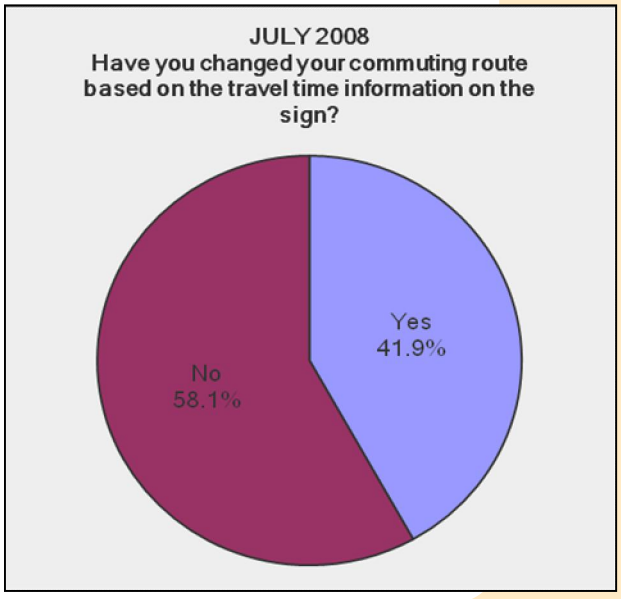
Arterial message signs were used twice as much as in 2010. Cities are making smart investments in adding signs where it makes sense to get info out to travelers better—near stadiums, major interchanges, and in advance of work zones and incidents.

Individual cities are pursuing the use of DMS in innovative ways. An example of this is the City of Chandler developing a system to provide arterial travel times on its DMS—the first application of arterial travel times in the state. Travel times can be an effective tool in helping the travelers to make better decisions about their route—as shown in the graphs below.

ADOT completed a travel time evaluation study of the effectiveness and accuracy of the travel time program in the Phoenix metropolitan area. The graphs below show how travelers began to rely on travel time information in order to make better route decisions.

Year	# of Freeway DMS	# of Arterial DMS
2007	67	71
2011	96	101



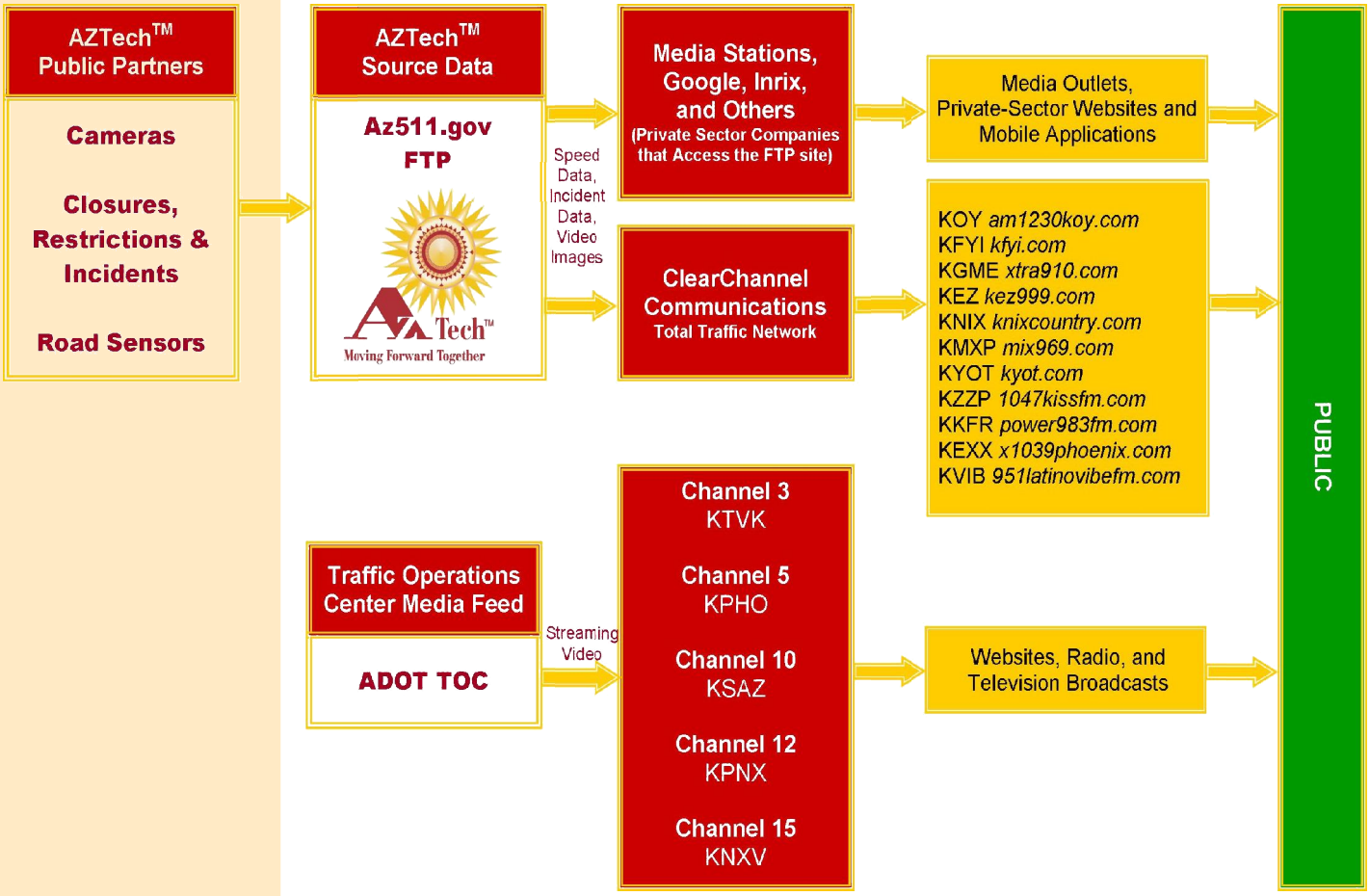


6.4 MEDIA COLLABORATION, VALLEY METRO AND FUTURE ATIS

MEDIA COLLABORATION

Media remains a key partner in the region's traveler information strategy. In fact, media was in the traffic reporting and traveler information business long before agencies began to put sensors on the roads and develop hotlines or web pages. This partnership has only gotten stronger through the AZTech™ consortium. Members of the media are part of the AZTech™ Traveler Information Working Group, and collaborate on ways to improve how to get important real-time traffic conditions and alerts to the public.

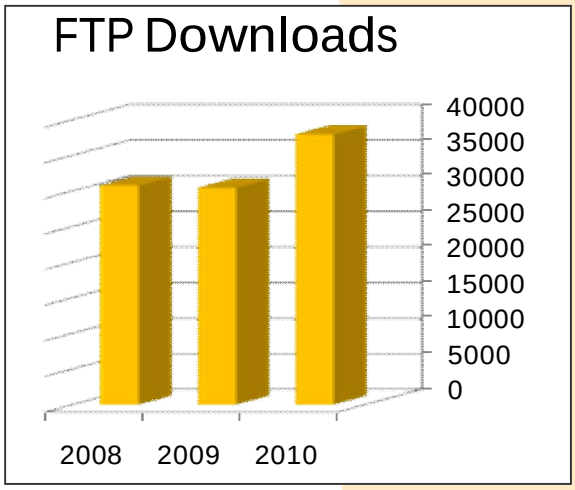
A "media summit" is convened bi-annually to bring together members of the broadcast media, traffic operations, public information officers and others for strategic discussions on how to further enhance the partnership between transportation and our media partners.



FTP Access

ADOT archives all speed and volume data collected by the detectors on the freeways into a publically accessible web-based folder called an FTP (file transfer protocol) folder. This data is free to download.

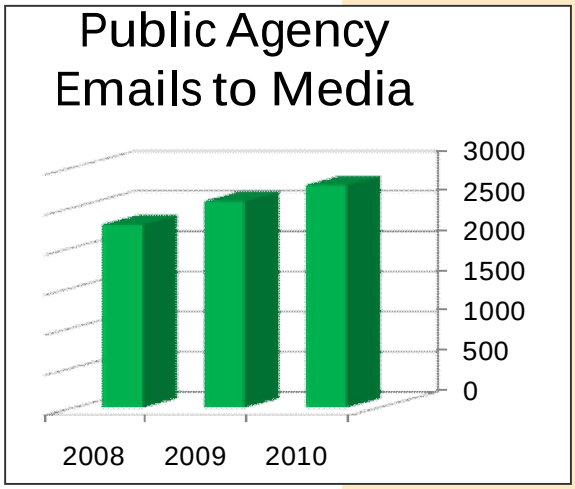
Media and private companies pull data from the Arizona DOT publically-accessible FTP folder an average of 38,000 times per day to support their mapping applications and reporting needs—up almost 25% over the last two years.



Agency Email Alerts to Media

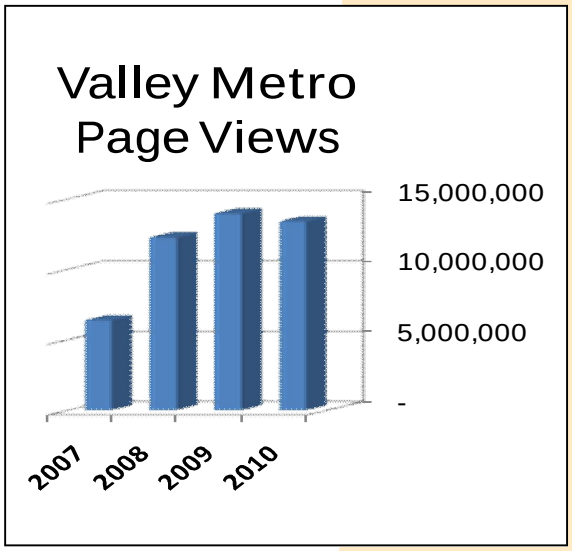
Incident reports collected by the private sector and traffic-related emails sent to the private sector by public agencies increase during stormy weather in Arizona.

The total number of media alerts sent by DPS doubled in 2010 due to the number of storms and other weather activities in 2010 that impacted state roads significantly.



Valley Metro Web Usage

METRO Light Rail service began in December 2008 which caused the two highest month-to-date page views of the Valley Metro website—1,761,915 in December 2008 and 1,732,431 in January 2009. Page views have been hovering around 1 million per month since then.



Future ATIS Tracking

Social Media—e.g. how many followers on Twitter and how many friends on Facebook. These methods can be used for more than ATIS purposes, so it will be important to filter out the non-ATIS uses.

SECTION 7

TRANSIT

Valley Metro provides public transit and public transportation alternatives for the greater Phoenix metropolitan area. Their mission is to develop and deliver an integrated regional transit system with excellence, in collaboration with member agencies and through public and private partnerships. In doing so, they improve the quality of life and the environment, and support economic development.

Valley Metro services include:

- Local, Express, and RAPID commuter bus service
- Neighborhood circulators
- Dial-a-Ride
- Vanpool service
- Online carpool matching system
- Assistance to local businesses for trip reduction alternative modes of transportation (bus, carpool, vanool, bike, telework)
- METRO Light Rail

Ridership has increased every year since 1997 and on-time performance has increased for every transit service in the past few years.

IN THIS SECTION:

Valley Metro provides public transit and public transportation alternatives for the greater Phoenix metropolitan area. Their mission is to develop and deliver an integrated regional transit system with excellence, in collaboration with member agencies and through public and private partnerships. In doing so, they improve the quality of life and the environment, and support economic development.

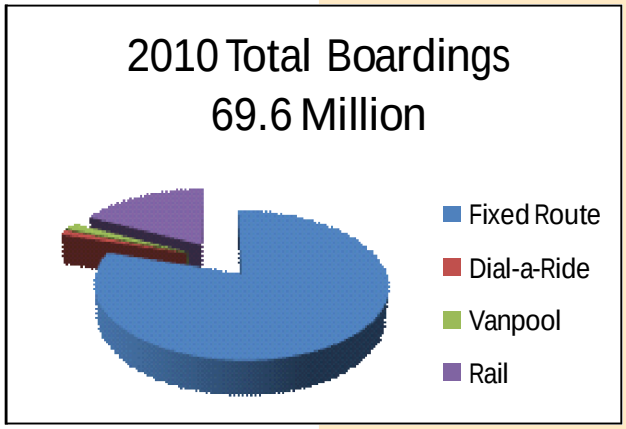
Valley Metro is the regional transit system in the Phoenix metropolitan area. Under the Valley Metro brand, local governments fund the Valley-wide transit system that the public sees on the streets today. Valley Metro Board member agencies include Avondale, Buckeye, Chandler, El Mirage, Gilbert, Glendale, Goodyear, Maricopa County, Mesa, Peoria, Phoenix, Scottsdale, Surprise, Tempe, Tolleson and Wickenburg.

Vision

Enable people in Maricopa County to travel with ease using safe, accessible, efficient, dependable, and integrated public transportation services.

Goals

- Deliver cost effective transit services
- Deliver on Proposition 400 projects and assist with city transit projects
- Integrate transit services across the region
- Increase transit visibility
- Hire/retain and develop top talent at every level
- Contribute to an enhanced quality of life in the region (air quality, congestion, services)



Infrastructure

Valley Metro services include:

- Local, Express, and RAPID commuter bus service
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- Assistance to local businesses for trip reduction alternative modes of transportation
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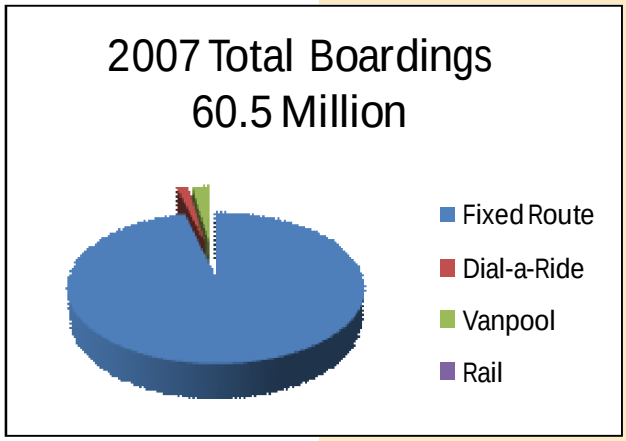
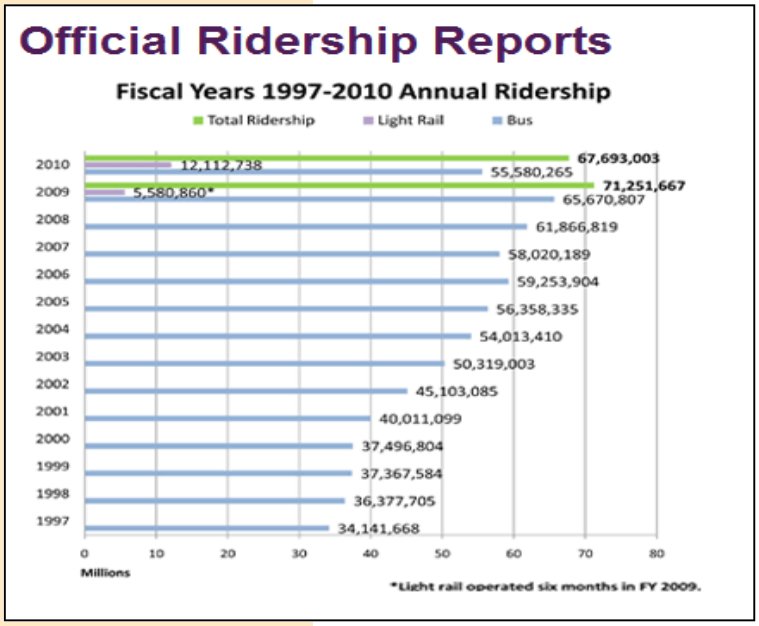


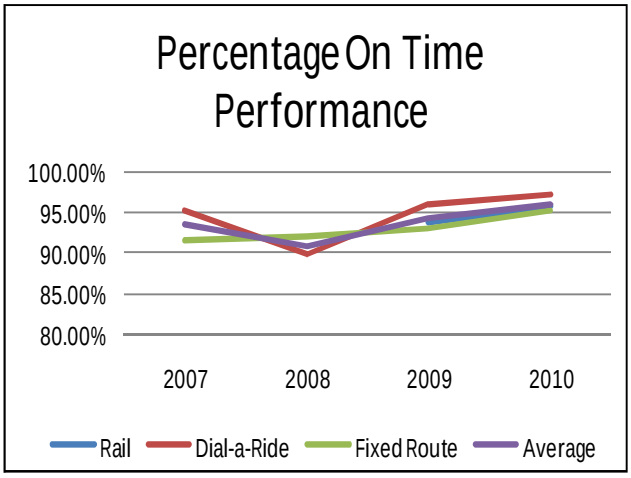
Valley Metro Highlights From FY 2009 to 2010

- System-wide ridership decreased by almost six percent or 4.3 million.
- Ridership on light rail far exceeded target by approximately 55 percent or 4.3 million.
- Subsidy (operating cost minus fare revenue) per revenue hour decreased by almost 4% for Dial-a-Ride system-wide.

7.2 SYSTEM PERFORMANCE

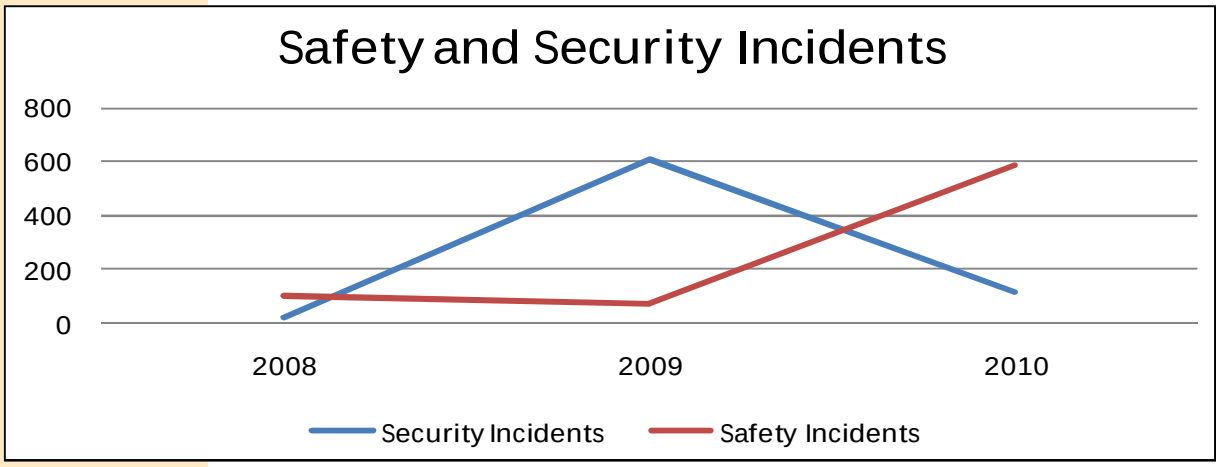
Transit operational performance can be measured and evaluated using a number of different factors, including ridership and On-Time Performance. Total revenue (service) miles increased by 65% from 2007 to 2010 largely due to the addition of METRO Light Rail to transit service.





Safety and Security

Public transit in the United States has been and continues to be a highly safe mode of transportation, as evidenced by the national statistics on incidents, injuries, and fatalities that have been reported by transit agencies for the vehicles they operate directly.



Safety Incident: Safety incidents only include major safety incidents that involve a transit vehicle or occur on transit-controlled property. Some conditions that apply to a major indecent involve property damage equal or exceeding $25,000, fatality or major injuries for two or more people.

Security Incident: Security incidents are crimes (e.g. injuries or deaths resulting from assaults, arson, homicide) and the consequences of security incidents. Security incidents only include major incidents which involve a fatality, two or more injures or property damage over $25,000.

CONCLUSION

This AZTech™ Traffic Management Performance Measures Book is the first publication of key regional traffic management, traffic operations, and transit performance measures that are tracked and reported throughout the Phoenix metropolitan region.

The AZTech™ partners have collaborated to complete this Book to account for the active measurement of the success of agency investments to increase the efficiency of the freeway and arterial networks.

For the purposes of this Performance Measure Book, the previous and current reporting periods for many of the measures reported are from different years. It is intended that measures will be reported at consistent intervals of time moving forward based on the goals established in the region.

Goals have been defined by various regional planning activities as are specifically chosen to be highlighted in this Book to reflect progress toward those goals. Goals reported in this Book will be refined during the annual performance measure collection process and are anticipated to include additional goals as developed by the TIM Coalition and other regional initiatives.

WHY MEASURE PERFORMANCE

- Focus attention on what matters most
- Measure accomplishments, not just work that is performed
- Provide a common language for communication
- Are clearly defined in terms of owner, unit of measure, collection frequency, data quality, expected value (targets), and thresholds
- Are valid—to ensure measurement of the right things
- Are verifiable—to ensure data collection accuracy

AZTech™ Partners in Intelligent Transportation

Arizona Department of Public Safety

Arizona Department of Transportation

Arizona Division of Emergency Management

Arizona State University

University of Arizona

City of Avondale

City of Chandler

City of Glendale

City of Goodyear

City of Mesa

City of Peoria

City of Phoenix

City of Scottsdale

City of Surprise

City of Tempe

Town of Fountain Hills

Town of Gilbert

Town of Paradise Valley

Town of Queen Creek

Federal Highway Administration

Maricopa Association of Governments

Maricopa County Department of Emergency Management

Maricopa County Department of Transportation

Maricopa County Sheriff's Office

Phoenix Sky Harbor International Airport

Valley Metro

Phoenix Fire Department

Regional Public Transportation Authority

Private Partners

www.aztech.org