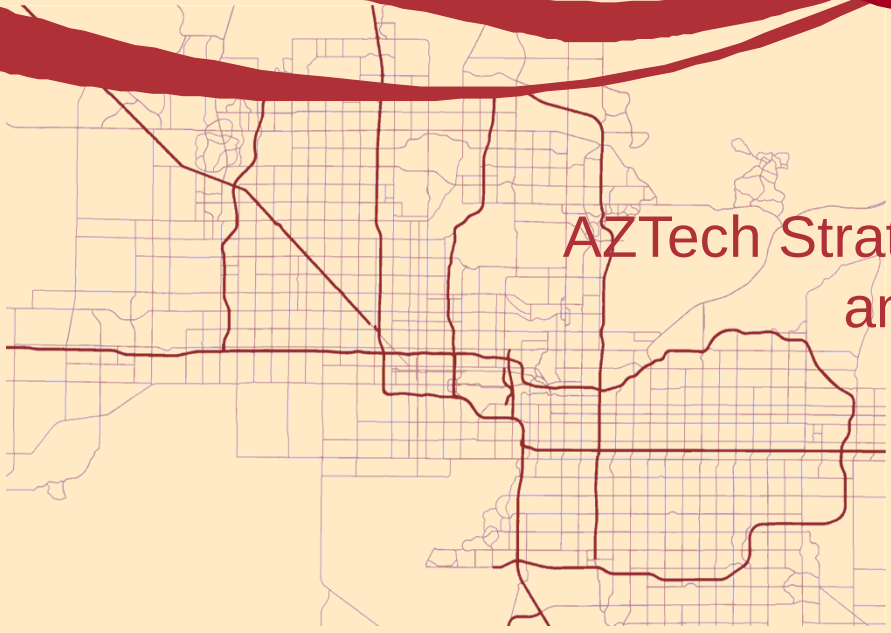
2017

AZTech TRAFFIC MANAGEMENT AND OPERATIONS PERFORMANCE INDICATORS BOOK

FREEWAYS • ARTERIALS • INTEGRATED CORRIDORS • INCIDENTS
TRAVELER INFORMATION • SPECIAL EVENTS • TRANSIT



Developed by the
AZTech Strategic Steering Committee
and Operations Committee

AZTech

REGIONAL INTELLIGENT TRANSPORTATION SYSTEMS PARTNERSHIP

PARTNERS / CONTRIBUTORS

The AZTech Regional Intelligent Transportation System Partnership wishes to thank and acknowledge the contributors of the AZTech Traffic Management and Operations Performance Indicators Book. The following member agencies of the AZTech Strategic Steering Committee and AZTech Operations Committee collaboratively contributed data, graphics, text and other information towards the development of this publication. All data reported in this book was provided by the respective agencies:

Agency	Contributors
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Maricopa County Department of Transportation	Nicolaas Swart, Faisal Saleem, Barbara Hauser, Cynthia Lopez, April Wire
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FOREWORD

EXECUTIVE COMMITTEE

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

The Phoenix metropolitan region and the AZTech Partnership have made significant traffic operations investments and 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.

Continuous evolution of connected and automated vehicle technologies is a major topic in the transportation world. A 2015 Executive Order from the Governor opened Arizona up for vehicle manufactures and technology developers to test automated vehicles on Arizona roadways. Since then, a wave of automated vehicle innovation continues to pour into Arizona and created a spark within the region's transportation agencies to understand how this new technology will impact the operations environment and the roles that local agencies have in it. The AZTech Partners have banded together to look for ways to take on this challenge and consider ways that the region will need to adapt to the next generation of transportation and mobility.

In 2017, freeway, arterial and transit agencies within the region partnered to apply for and were selected to receive a federal Advanced Transportation and Congestion Management Technologies Deployment (ATCMTD) Grant for the implementation of a model deployment for Integrated Corridor Management (ICM) and connected vehicle (CV) initiatives along the Loop 101. The successful pursuit of this grant not only highlights the Phoenix Metro area as a leader in deploying advanced technologies and strategies for operations, but it is a testament to the strong partnerships and collaboration among the region's transportation partners and the commitment to improving transportation operations at a regional level.

Driven by the AZTech Committees, the 2017 Performance Indicators Book underwent a restructuring to better align with the changing transportation environment. In this 2017 Book, you will see a heightened focus on areas such as data, the integration of multi-modal and multi-agency transportation networks and systems, and traveler information. With applications such as signal timing optimization having a benefit-cost ratio of nearly 7-to-1, freeway ramp metering at over 45:1, and adaptive signal control such as along Bell Road through the region of over 6:1, ITS and operations continue to be a solid investment of agency resources.

Many thanks to those agencies and partners that provided the data and analysis for this fourth publication of a regional traffic management and operations 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 measurement, reporting, and improvement in how we operate our transportation network.

Executive Committee Chairs

Dallas Hammit, P.E.
Deputy Director for Transportation / State Engineer
Arizona Department of Transportation

Jennifer Toth, P.E.
Transportation Director / County Engineer
Maricopa County Department of Transportation

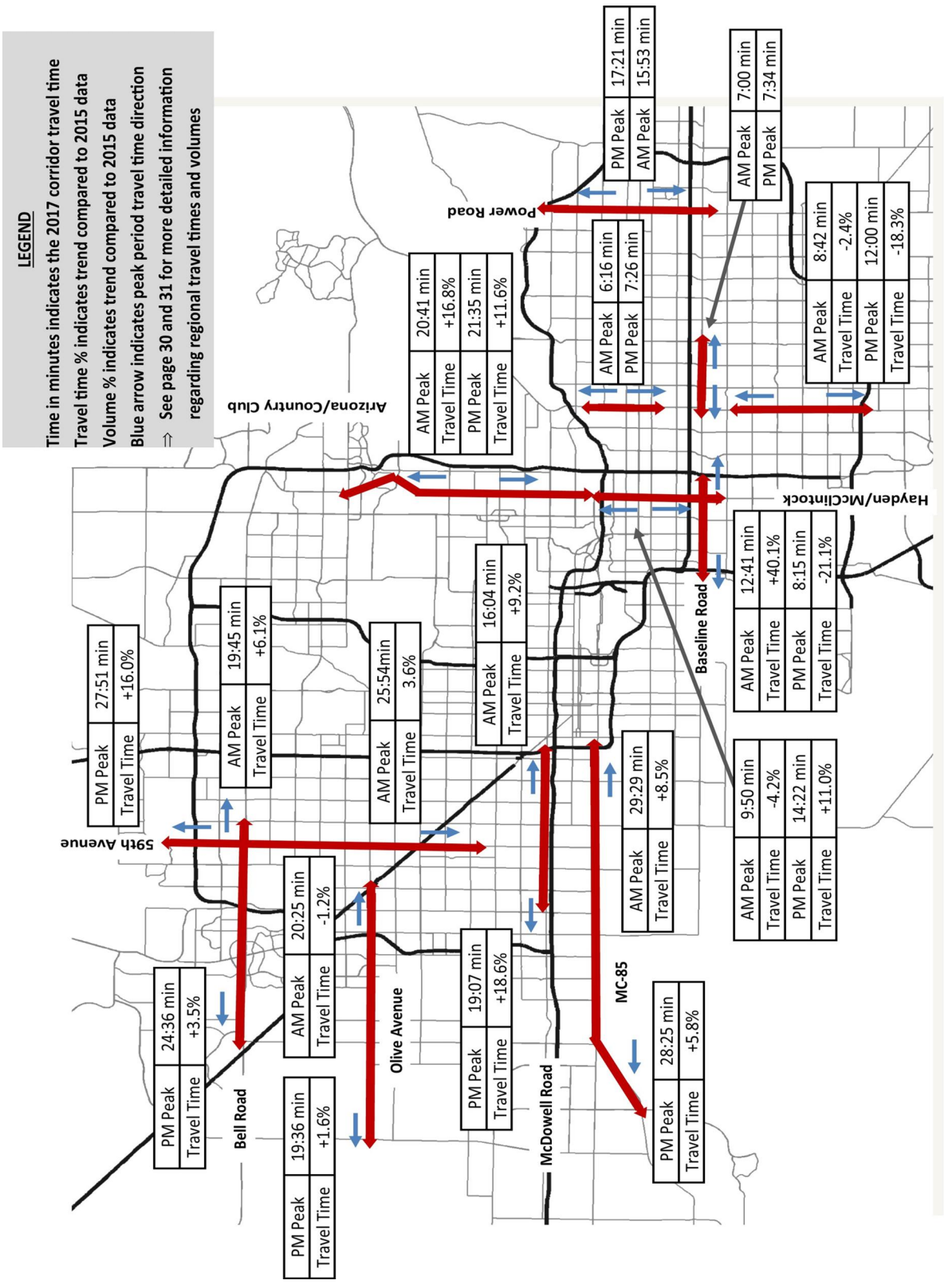
AZTECH PERFORMANCE DASHBOARD

Performance trending in favorable direction.

Performance is trending in an unfavorable direction.

Goal/ Performance Indicator	CY 2012-2013 Period	CY 2014-2015 Period	CY 2016-2017 Period		Description
Freeways					
Percent of Miles Congested (Out of Total of 422 Miles Measured as of 2017)	31.6%	36.7%	37.2%	↓	Overall freeways are experiencing more congested miles where average vehicle speeds drop below 50 mph
Percent of Time Congested Per Mile (Out of Total of 422 Miles Measured as of 2017)	25.2%	32.1%	39.6%	↓	Overall freeways are experiencing more congested time where average vehicle speeds drop below 50 mph
Arterials					
Bell Road Westbound PM Peak Travel Time—35th Avenue to US-60	22:23 min	23:46 min	23:47 min	↑	Consistent travel times from two years ago with slightly increased volumes
McDowell Road Eastbound AM Peak Travel Time—83rd Avenue to I-17	12:44 min	14:43 min	16:06 min	↓	Took over 1.5 minutes longer to travel along this corridor
Hayden Road/McClintock Drive Northbound PM Peak Travel Time—Loop 202 to Shea Boulevard	17:33 min	18:43 min	20:96 min	↓	Took over 2 minutes longer to travel along this corridor
Arizona Avenue/Country Club Drive Travel Time AM Peak—Guadalupe Road to Loop 202	11:12 min	9:00 min	9:24 min	↓	Trending in travel times has increased slightly
Average Arterial TMC Hours with Ability to Respond Per Week	44 hours	44 hours	44 hours	↑	77% of agencies also have on-call after hours support
Incident Management—Freeways and Arterials					
Percentage of Secondary Vehicular Crashes Out of Total Crashes (ADOT Motor Vehicle Division Crash Facts reported only as state values)	6% (as of 2011)	6.3% (as of 2015)	2.6% (2016)	↑	Reduction of secondary crashes well below national average
Total Crashes (ADOT Motor Vehicle Division Crash Facts reported only as state values)	103,637 (2012)	109,554 (2014)	126,987 (2016)	↓	Increase of almost 15% from two years ago
Number of Secondary Crashes when REACT is Present	0	0	0	↑	Continues to meet goal
Traveler Information					
% of Freeway DMS and % of Arterial DMS Posting Travel Times in the Metro Area	30% freeway 5% arterial	58% freeway 8% arterial	53% freeway 10% arterial	↑	DMS use for travel time purposes is consistent on the freeway and increases along arterials
Social Media Followers	68,037	232,512	500,818	↑	Increase of approximately 215% in last two years of Social Media followers of agencies
Phoenix Fire CAD and Mesa 911 to HCRS	32,199	31,199	41,131	↑	Mesa 911 for Police and Fire began sending data to HCRS in August of 2017
Transit					
Transit Schedule Adherence (Percent of Time Transit Meets Schedule)	95.0%	92.7%	90.6%	↓	Less schedule adherence for Bus, 93.3% Light Rail on-time performance
Number of Light Rail Transit Boardings Per Year	14.29 million	14.28 million	16.51 million	↑	Light Rail continues to be a well-received service for the traveling public

Arterial Corridor Travel Times



Source: Data reported as provided by respective agencies.

EXECUTIVE SUMMARY

AZTech and the Performance Indicators Book

AZTech is a regional traffic management and operations partnership in the Phoenix metropolitan area that includes transportation agencies and public safety agencies in the metropolitan area. The coalition, led by the Maricopa County Department of Transportation (MCDOT) and Arizona Department of Transportation (ADOT), supports the application of intelligent transportation systems (ITS) technologies across jurisdictional boundaries 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.

The 2017 AZTech Performance Indicator (PI) Book is a compilation of key regional transportation management and operations performance indicators that provide a snapshot of the transportation network in Maricopa County. The successes that have accompanied AZTech efforts and partner agency investments have elevated the need to actively measure the operational performance of the regional transportation network. In order to share these findings, AZTech partners have collaborated to provide data and stories to develop the book on a biannual basis. This book, along with previous publications, is also available electronically for download at: www.aztech.org/perfmeasure

The 2017 PI Book is organized into the following sections, which represent the key performance areas in the region:

- Emerging Technologies—AZTech involvement in activities that are nationally recognized
- Integrated Corridor Management—Integrated corridor management (ICM) activities related to planning or projects that connect freeway operations to arterial operations
- Using Data as an Operational Decision Making Tool —Activities that have been accomplished and things that have happened that give examples for how the AZTech partners are using their abilities to improve situational awareness of the network or of the travelers on the network
- Smarter Transportation and Mobility—Agencies are pursuing smarter technology and expanding their operational capabilities
- Traveler Information—Better traveler information being provided that starts with the right data being collected and results in multiple methods for dissemination
- Public Safety Coordination—Improved coordination with police using ITS tools
- Special Events—Agencies' activities surrounding and supporting special events in the region
- Transportation Systems Management and Operations Planning—Agencies that are undertaking a look at their agency through a TSMO lens
- Multimodal Coordination—Transit, bike, pedestrian , and rail activities in the region related to ITS

Themes in the 2017 Book

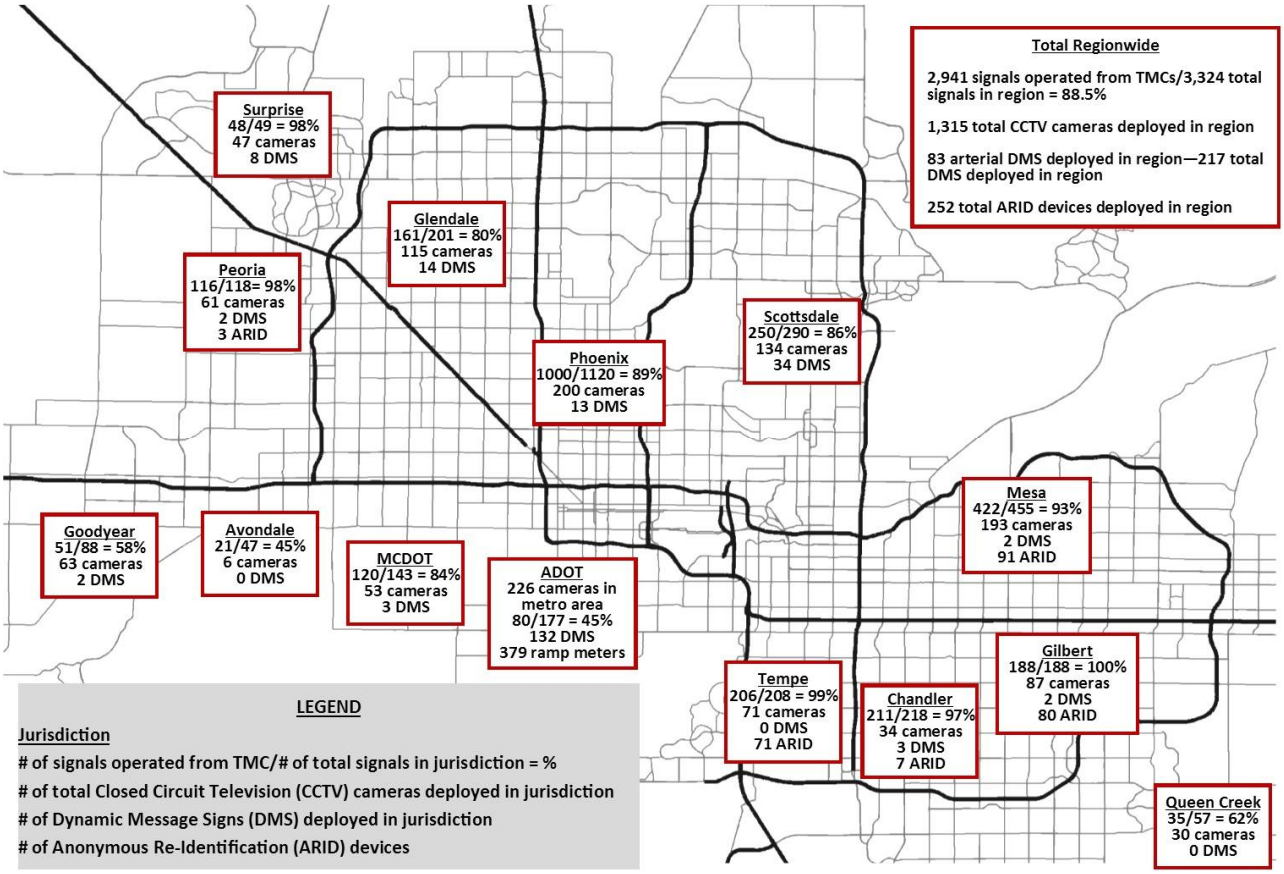
In addition to the measures reported in all Books, three themes arose during the development of the 2017 Book. These represent major regional initiatives for the 2015—2017 time period:

Emerging Technologies—This region has taken major strides in recent years to be in the spotlight nationally on numerous connected and autonomous vehicle initiatives and the receipt of major federally-funded grants for projects to plan ICM systems and deploy new technologies to assist with the integration of agencies along Loop 101.

TSMO—A number of AZTech partner agencies developed Transportation Systems Management and Operations (TSMO) plans to lay the groundwork for future operations, resource, and management investments.

Special Event Management—Major, national events have continued to choose the region as their venue of choice. These events require planning and coordination, and each year are getting finetuned to improve safety, efficiency, and mobility before, during, and after these mega-events.

Agency Intelligent Transportation Systems Infrastructure



Source: Data reported by respective agencies (as of December 2017)

AZTech Visioning Workshop

In 2016, AZTech celebrated its 20th Anniversary! AZTech took this opportunity to create an updated vision that reflects current technologies, institutional capabilities, and market/private sector influences on operations. A full-day AZTech Visioning Workshop took place on September 21, 2017 in Phoenix, Arizona. Participants included all AZTech partner agencies, several private sector representatives, transportation agencies from around the state, and Arizona academic institutions. The purpose of the workshop was to take a forward-looking approach to key influences that will shape the region's transportation system operations and provide some strategic input toward a future vision for the AZTech partnership. Some key takeaways from the workshop included:

- The private sector is looking to partner more with the public sector to understand the challenges they face.
- Public trust in automated vehicle technologies is essential for their ultimate success and penetration into the market and the private sector needs the public sector to help garner that trust.
- Host Industry Days that have a specific topic/issue focus and invite private sector representatives.
- Pursue training and resource needs at the regional level. The conversation might carry more weight coming from AZTech than individual agencies going in alone to the conversation.
- Work with universities, trade schools, high schools to educate students, teachers and professors about systems management and operations.
- Support interagency training and peer exchanges to share information on best practices.

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SECTION 1 INTRODUCTION

What is AZTech

AZTech is a regional traffic management and operations 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 Maricopa County Department of Transportation (MCDOT) and Arizona Department of Transportation (ADOT) and working through several collaborating committees, supports the application of intelligent transportation systems (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 Intelligent Transportation Systems Metropolitan 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 and operations 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. In 1997, AZTech adopted several Values, Goals, and Strategies to guide its growth from a demonstration project to what has become a full-fledged regional partnership focusing on:

Values

- Collaboration
- Leadership
- Integration
- Results

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

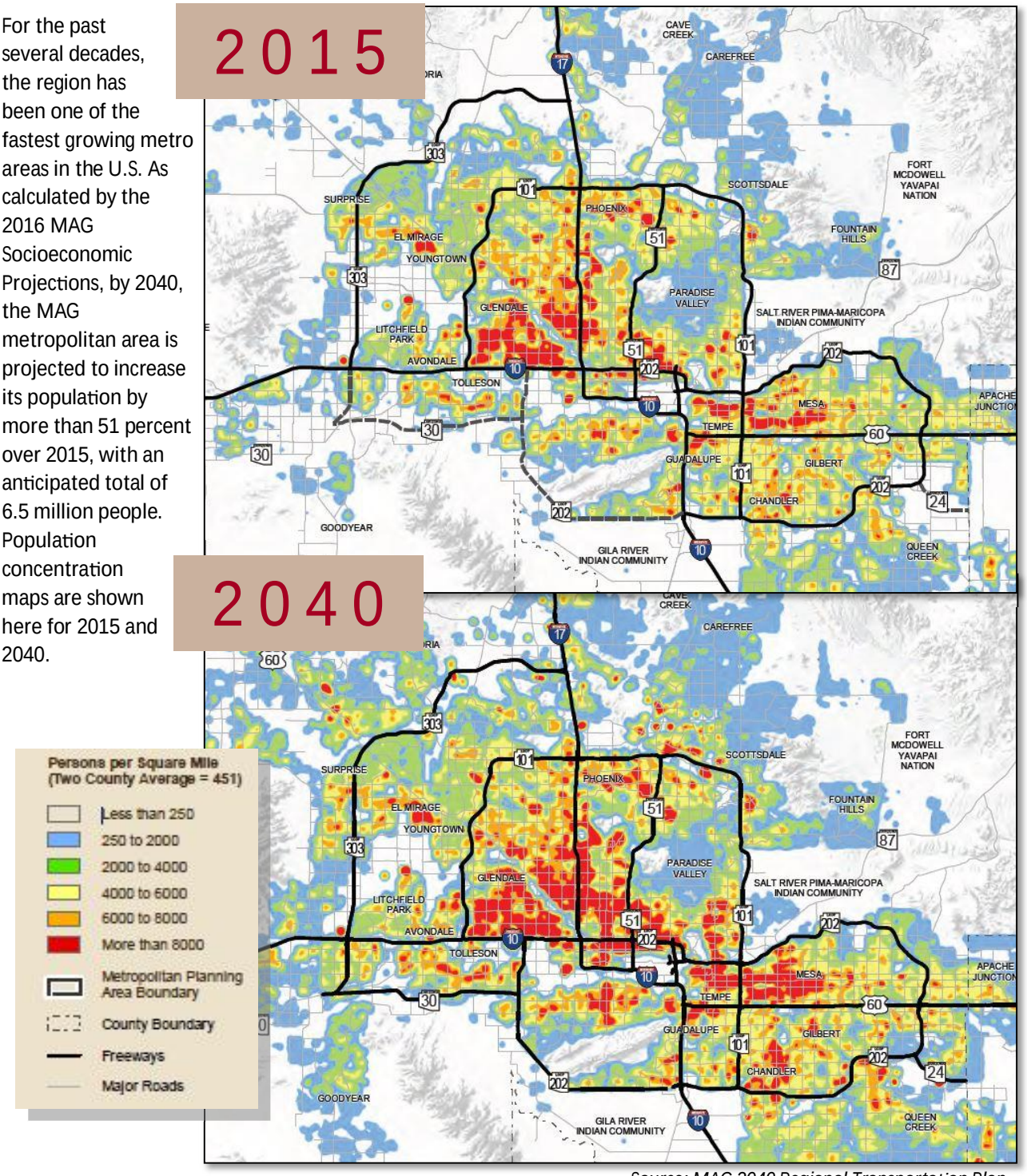
Strategies

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

PHOENIX METROPOLITAN REGION

The population for many cities grew more than 11% between 2005 and 2011 (United States Census Bureau). Peak travelers, those who begin a trip by any mode during the peak period, are growing faster than the general population growth and the growth of arterial lane miles. With funding not readily available for infrastructure expansion, the emphasis is shifting towards more efficient management and operation of the existing transportation system.

For the past several decades, the region has been one of the fastest growing metro areas in the U.S. As calculated by the 2016 MAG Socioeconomic Projections, by 2040, the MAG metropolitan area is projected to increase its population by more than 51 percent over 2015, with an anticipated total of 6.5 million people. Population concentration maps are shown here for 2015 and 2040.



Source: MAG 2040 Regional Transportation Plan

Characteristics of Performance Indicators

In support of operational 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. Performance indicator characteristics include:

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

Key Regional Indicators

There is no building our way out of congestion; instead, transportation agencies are using better technology and data analytics to relieve congestion.

The 2017 Global Traffic Scorecard published in February 2018 by Inrix revealed that urban drivers are experiencing on average nine percent of their travel time staring at the bumper in front of them. Phoenix metropolitan region is designated as a Major City in the report. Statistics from 2017 listed below highlight the importance of measuring performance to determine the effectiveness of transportation management strategies.

- 34 Hours of Yearly Delay per Auto Commuter (hours spent in congestion)—Ranked 25th (in 2015 Ranked 17th)

The Urban Congestion Report (UCR) published in 2016 using the Federal Highway Administration's Highway Performance Monitoring System provides traffic volume data by road section. The following snapshot of performance metrics cited in the report related to the Phoenix metropolitan area:

- 3 Hours and 39 Minutes of Average Daily Congestion—increase of 9 minutes from 2015
- 1.26 Travel Time Index (measure of peak period versus off-peak period travel times)— reduced from 1.27 since 2014
- 2.49 Planning Time Index (measures added planning time to take the same trip because of unreliable conditions)

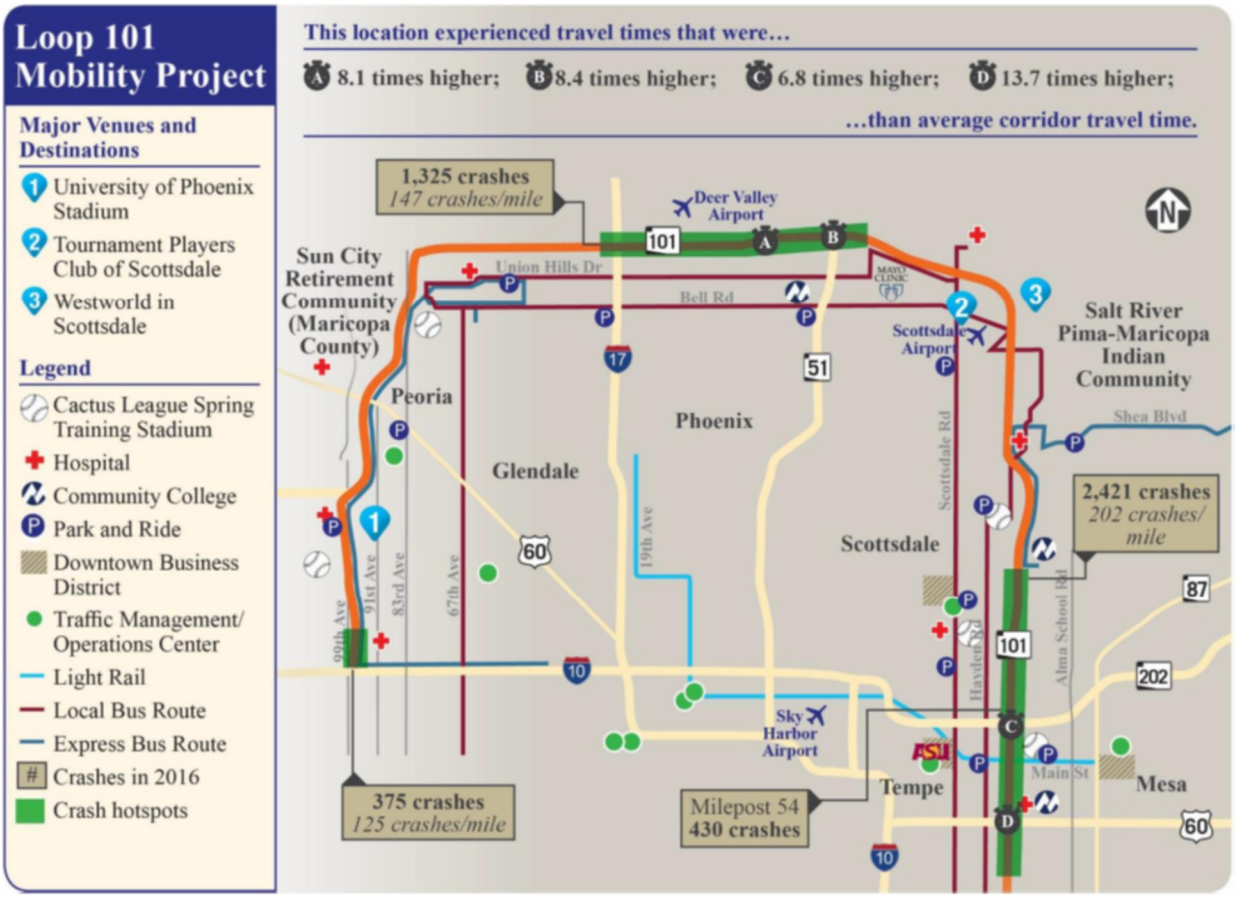
EMERGING TECHNOLOGIES

SECTION 2

This section describes AZTech involvement in nationally recognized activities related to emerging technology applications.

2017 AZTech Federal Funding Grant—Loop 101 Mobility Project

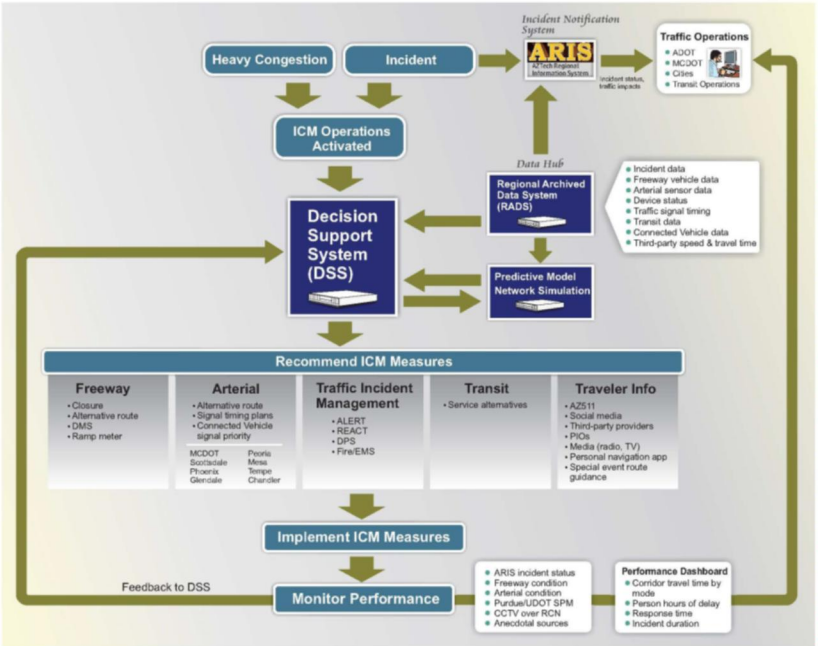
Loop 101 is a 61-mile urban beltway around the Phoenix metropolitan area that connects major cities, freeways and destinations in the region. Because of the Loop 101 corridor's importance in the region, the Loop 101 Mobility Partnership was formed to advance this corridor as a model deployment for ICM and connected vehicle (CV) initiatives. The Partnership is formalized with a charter and includes the Arizona Department of Transportation (ADOT); Maricopa County Department of Transportation (MCDOT); Maricopa Association of Governments (MAG); Valley Metro (transit and light rail); the cities of Chandler, Glendale, Mesa, Peoria, Phoenix, Scottsdale, and Tempe; the University of Arizona and Arizona State University. The corridor provides access to major event venues that are critical to the state's and region's economic development and tourism, including the University of Phoenix Stadium in Glendale, West World of Scottsdale, Tournament Players Club (TPC) Scottsdale Golf Course (home to the Waste Management Phoenix Open Golf Tournament), Arizona State University (ASU) (which has 5 campuses across the metro area with the largest campus in Tempe), Mayo Clinic and Hospital in Phoenix, and numerous Major League Baseball Spring Training Facilities throughout the metro area.



The Loop 101 Mobility Project will address the collective goals of reducing congestion, increasing travel time reliability, and improving incident and event management on the Loop 101 freeway and adjacent arterials. The Project supports regional mobility, accessibility of essential health and educational services, and economic development for the Loop 101 corridor.

The proposed technologies to be deployed, tested, and evaluated as part of the Project include:

- *A Decision Support System (DSS)* - The DSS will collect and use real-time data from agencies and private sector partners, manual inputs such as identified detour routes and signal timing plans, and predictive analytic algorithms to model, assess, and recommend the best set of ICM responses. It will also support performance measurement and evaluation of impacts of the DSS. MCDOT completed a study that identified feasible DSS options, and the Partners will select a preferred option as part of this Loop 101 Mobility Project.
- *Adaptive Signal Control Technology (ASCT) for key arterial corridors* - Enhanced signal timing technologies will improve cross-jurisdictional signal operations during ICM or other events that generate atypical volumes or flows. ASCT will adjust the signal timing on arterial corridors in response to real-time traffic patterns and congestion.
- *Connected Vehicle applications for transit and incident response vehicles* - Transit vehicles with routes along Loop 101 or the adjacent arterials, will be outfitted with connected vehicle technology to support transit priority along specific corridors. Improving the movement of transit in the area will help to serve in-need populations (including elderly) and will improve accessibility to destinations and key services. Connected Vehicle technologies will also be used for Regional Emergency Action Coordination Team (REACT) and Arizona Local Emergency Response Team (ALERT) vehicles to improve incident response and responder safety through intelligent priority for responders.
- *Adaptive ramp metering technology* - This technology will enhance the existing ramp metering system deployed on the Loop 101 to improve throughput and reduce congestion. It will use smart ramp metering technology and detection data from the mainline and ramps to adjust and coordinate the ramp metering rate based on real-time conditions.
- *Integrated Traveler Mobility Application* – This ICM mobile application suite will improve data exchange between the transportation network and the travelers that are interacting with it. The app will facilitate improved data and information exchanges between the app users and the overall ICM application and DSS in real-time and will include optimum route and travel time information based on the DSS recommendations. It will provide functionality to improve crosswalk safety for pedestrians and support people with disabilities. It will also improve transit information for passengers and support collection of real-time information from transit passengers. This app will be designed to integrate with the Regional Archived Data System (RADS), an existing open data sharing mechanism, and data will be shared with industry.



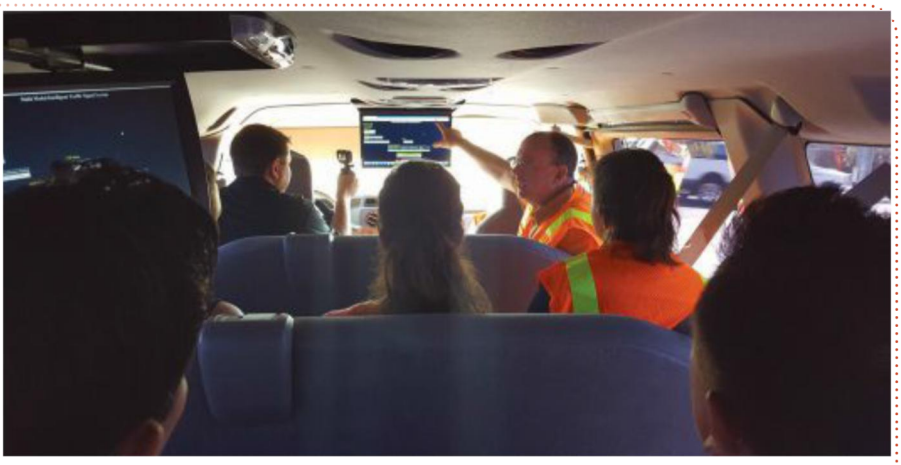
Safety and Mobility Advances through Maricopa County, Arizona's SMART*Drive* Program℠

MCDOT, ADOT, and the University of Arizona have formed the Arizona Connected Vehicle Coalition to develop, deploy, and test applications that will further advance traffic signal safety and provide efficient mobility in a multimodal environment. Through this partnership, the MCDOT SMART*Drive* Program℠ was launched. Originally created to improve emergency responder safety and mobility at intersections, the MCDOT SMART*Drive* Program℠ allows for two-way communication between vehicles and roadway infrastructure by using dedicated short range communications (DSRC), a component of the U.S. Department of Transportation (USDOT) multimodal intelligent traffic signal systems (MMITSS). MMITSS prioritizes traffic flow and pedestrian movements to improve safety and mobility.

To test MCDOT's SMARTDrive Program℠ applications, the Arizona Connected Vehicle Coalition deployed the Anthem Connected Vehicle Test Bed. The Anthem Test Bed consists of 5.3 miles of arterials and functions in a "live" operational environment so that realistic data is gathered and analyzed for greater progress.

- The first application of the MMITSS prototype developed for the Arizona test bed proved the concept of vehicle-to-vehicle and vehicle-to-infrastructure communication. The application was demonstrated using four vehicles: a Valley Metro bus, Daisy Mountain Fire truck, and two MCDOT Regional Emergency Action Coordinating Team (REACT) vehicles which were equipped with on-board equipment. Intersections with road side equipment (RSE) along the test bed recognized the approaching equipped vehicles and made the decision on how to best serve the vehicles with priority green based on the priority policy criteria. When the intersection is approached by more than one test vehicle, depending on speed, distance from the intersection, current status of the signal timing, and priority level of the vehicle, the intersection provides green to best accommodate the approaching vehicles with fire trucks and REACT vehicles receiving the highest priority, followed by the transit bus.
- The second implemented application demonstrated the use of a handheld device to assist with visually impaired and limited mobility pedestrians at intersection cross-walks. The pedestrian green and count down information currently shown on the signal head at the other side of the intersection is now also shown directly on the hand held device. The intersection recognizes the direction in which the device is pointed to tell the user whether it is safe to proceed in the requested direction.
- The third set of applications implemented at the test bed allow warning alerts to be received by the vehicle to alert the driver of work zones ahead, school zones, and incidents. Fire trucks and REACT vehicles provide an in-vehicle emergency alert using vehicle-to-vehicle communications. This application is being incorporated into the County's Smart Work Zone initiative for freight vehicles.

Adopting new connected vehicle technology requires a committed investment in upgrading signal and intersection infrastructure. To promote the progress in transportation agencies across the country, the Arizona Connected Vehicle Coalition has held more than 100 connected vehicle demonstrations, workshops, peer exchanges, and presentations to share its experience. The coalition has presented to industry professionals, students, elected officials, and the media to explain the development, deployment, and testing of this new technology. Notable demonstrations have included the Discovery Channel (Canada), the American Society of Civil Engineers, the Institute of Transportation Engineers, the semi-conductor industry, and Original Equipment Manufacturers (OEMs) such as Toyota and CAMP (Crash Avoidance Metrics Partnership). Visitors come to see the test bed and look for opportunities that they would be able to leverage for their own purposes such as to support eco-driving or red light warning applications in-vehicle.



In addition to demonstrations, the Arizona Connected Vehicle Coalition has hosted a number of workshops and peer exchanges. One of the more recent workshops was the first Signal Phase and Timing (SPaT) Challenge national workshop held on March 3, 2017 on behalf of AASHTO, ITE, and the vehicle-to-infrastructure (V2I) Deployment Coalition. The purpose of the SPaT challenge is to encourage cooperation and uniformity among the state and local public sector transportation infrastructure owners and operators in order to deploy DSRC technology along roadway corridors. The Arizona Connected Vehicle Coalition was also recently involved in a two-day peer exchange with Salt Lake City where multiple agencies demonstrated and discussed their test bed for transit priority.

Within one year of the SPaT challenge being initiated, there are roughly 2,400 traffic signals nationally that have been committed for funding DSRC infrastructure to support a connected vehicle environment. This demonstrates that public agencies are leading the way with connected vehicle deployment which will enable the growth of private system development to quickly use the technology to advance the environment. *Source: ITE Journal, October, 2017*

Maricopa Association of Governments I-10 Integrated Corridor Management Planning

Maricopa Association of Governments (MAG) was awarded a federal grant to conduct an ICM Development Planning Study along the I-10. ICM has been shown to reduce the average delay by 26 percent, reduce number of vehicle stops by 42 percent (which reduces emissions by vehicles needing to stop and improves travel times without the need to stop), and increase average speeds up to 9 percent on arterials with traffic signal control. The ICM study area includes the I-10, the adjacent arterials and associated transit facilities between Loop 101 in the West Valley and Loop 202 Red Mountain Freeway in the East Valley. The Plan will look at how non-recurring events, such as crashes, work zones and special events impact transportation operations on I-10 corridor facilities and what types of operational strategies and multi-agency coordination procedures can be put into place to help agencies best respond to and manage traffic during those times. Phase 2 of the I-10 ICM Project began in 2017 and includes the development of an ICM Concept of Operations, an Analysis, Modeling and Simulation (AMS) Plan, and Systems Requirements Specifications. The completion of Phase 2, which will occur in Fall of 2018, will set the region up to pursue implementation of the identified ICM concept along the corridor.

Autonomous Vehicle Companies Testing Throughout the Valley

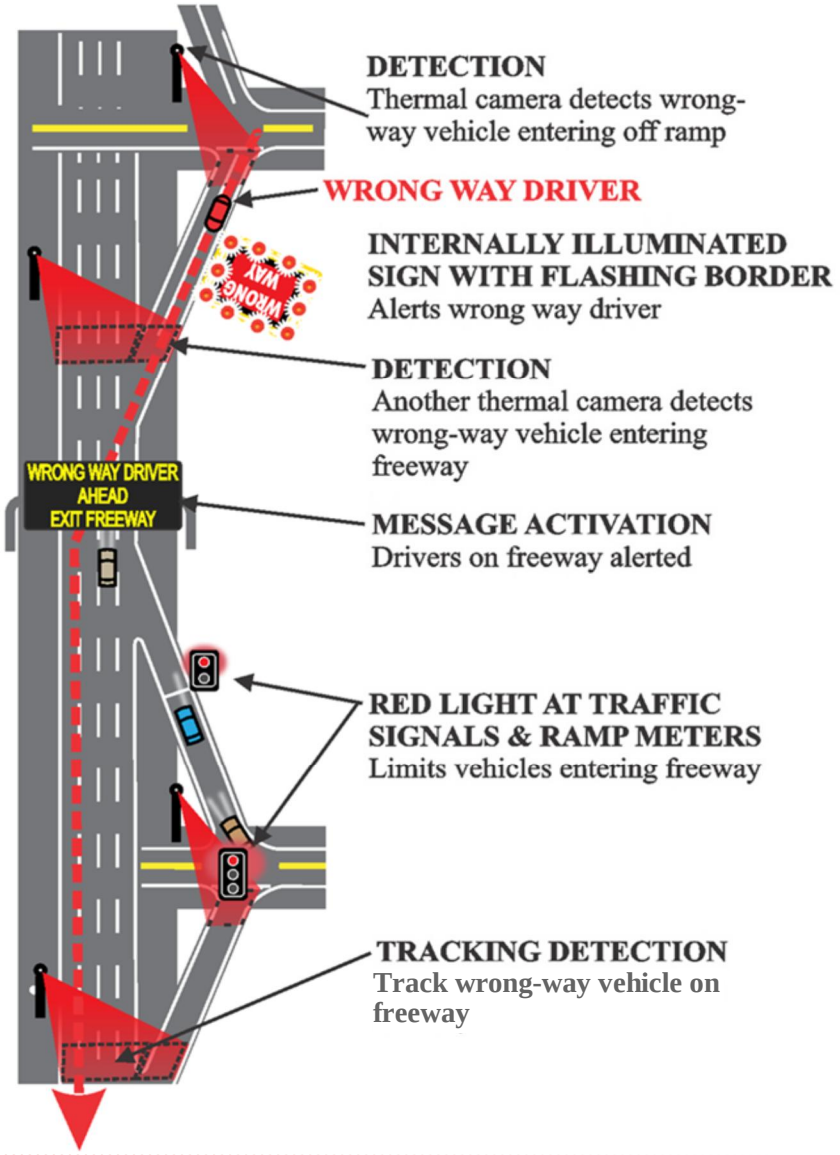
The Phoenix area has become a hot spot for autonomous vehicle testing. Automated vehicle manufacturers are testing their vehicles on public roads in the Valley, creating opportunities for future collaboration related to connected and autonomous vehicles (CAV) and ICM infrastructure. Continuous evolution of connected and automated vehicle technologies is a major topic in the transportation world. A 2015 Executive Order from the Governor opened Arizona up for vehicle manufactures and technology developers to test automated vehicles on Arizona roadways.

ADOT Wrong-Way Driver Pilot System

In late 2017, ADOT's first-in-the-nation wrong-way driver pilot system along Interstate 17 in Phoenix became operational. The 15-mile system is located on I-17 between the I-10 "Stack" interchange and Loop 101. Construction of the $3.7 million system was funded by the Maricopa Association of Governments. This section focuses on details of the components used in the ADOT wrong-way driver pilot system and findings related to the performance of the thermal cameras. At this time, more data is needed before conclusions can be drawn with confidence on effectiveness of the system to reduce the risk from wrong-way incidents. A vicinity map of the pilot system is shown in the figure below.

The pilot system's goal is to reduce the risk from wrong-way incidents. One major component to meeting this goal is getting State Troopers to wrong-way vehicles faster. While ADOT and the Arizona Department of Public Safety (DPS) respond quickly to reports of wrong-way drivers, along most freeways, law enforcement response usually begins with 911 calls from other motorists. This system automatically alerts ADOT and DPS to wrong-way drivers at the point of entry significantly improving the timeliness and accuracy of information available to law enforcement, compared to responding officers relying on information relayed by dispatchers from 911 callers.

The pilot system cannot prevent wrong-way driving. Phoenix-area freeways safely move hundreds of thousands of vehicles every day. When crashes do occur, research demonstrates that more than 90 percent of the time the collision is the result of driver behavior – like speeding, reckless or distracted driving, or driving while impaired. Because most wrong-way crashes are caused by impaired drivers, it's not surprising that 3 out of 4 wrong-way crashes occur between 6 p.m. and 6 a.m. and one-third of wrong-way crashes happen between midnight and 3 a.m. More than half of wrong-way crashes occur on weekends.



The ADOT wrong-way driver pilot system uses 90 thermal cameras positioned throughout the 15-mile I-17 freeway corridor to detect wrong-way vehicles, illuminated "WRONG WAY" signs for enhanced notification to the wrong-way driver, advisories for right-way drivers, and immediate notification to law enforcement and traffic operators.

Detection by a thermal camera of a vehicle entering an exit ramp the wrong way immediately triggers an illuminated "WRONG WAY" sign with flashing lights aimed at getting the attention of the wrong-way driver on the exit ramp before they get to the freeway to prevent a high-speed crash.

Detection by a thermal camera also immediately alerts ADOT and law enforcement about a wrong-way vehicle and plays a recorded video of the event and live video from the thermal camera, saving valuable response time. In addition, thermal camera detection immediately triggers the system to automatically focus highway cameras on the wrong-way vehicle so traffic operators can better track it, and so DPS State Troopers collocated within the ADOT TOC can quickly plan their response to intercept vehicles faster.

Decision support software allows operators in ADOT's Traffic Operations Center in Phoenix to confirm the presence of a wrong-way driver through recorded and live video and save response time by quickly activating 2 automated countermeasures:

- Warn other freeway drivers in the area though automated posting of "WRONG WAY DRIVER/AHEAD/EXIT FREEWAY" advisories on overhead dynamic message boards. Drivers who see this warning, or a similar one on another freeway, should safely move toward the nearest highway exit as soon as possible. ADOT has more "Drive Aware, Get There" safety tips dealing with wrong-way driving at azdot.gov/WrongWay.
- Limit new vehicles entering the freeway through automating pre-emption, turning traffic signals and ramp meter signals red

If the wrong-way driver continues onto the freeway, additional thermal cameras placed at one-mile intervals detect and help track the location of the wrong-way vehicle. The thermal cameras on the freeway signal when a wrong-way vehicle passes so DPS State Troopers can plan their response and get out in front of the wrong-way driver, providing a faster response.

ADOT is aware of several other transportation agencies now testing components used in this pilot system. The effectiveness of ADOT's wrong-way driver pilot system will continue to be evaluated in the coming year. ADOT is currently collecting crash and wrong-way vehicle entry data to quantify benefits. ADOT expects to see a reduction in wrong-way driver-related crashes as a result of faster interception of wrong-way drivers by law enforcement, faster alerting to right-way drivers, and enhanced alerting to wrong-way drivers. ADOT can apply this technology to any divided two-way roadway including freeways, rural highways, and arterials with a median. ADOT is also tracking wrong-way vehicle entry statistics to identify roadway improvements that can be made to deter and prevent drivers from driving the wrong way before it happens. ADOT is developing design guidelines incorporating the best practices for mounting thermal cameras and is working closely with the thermal camera manufacturer to reduce false detections from camera shaking.

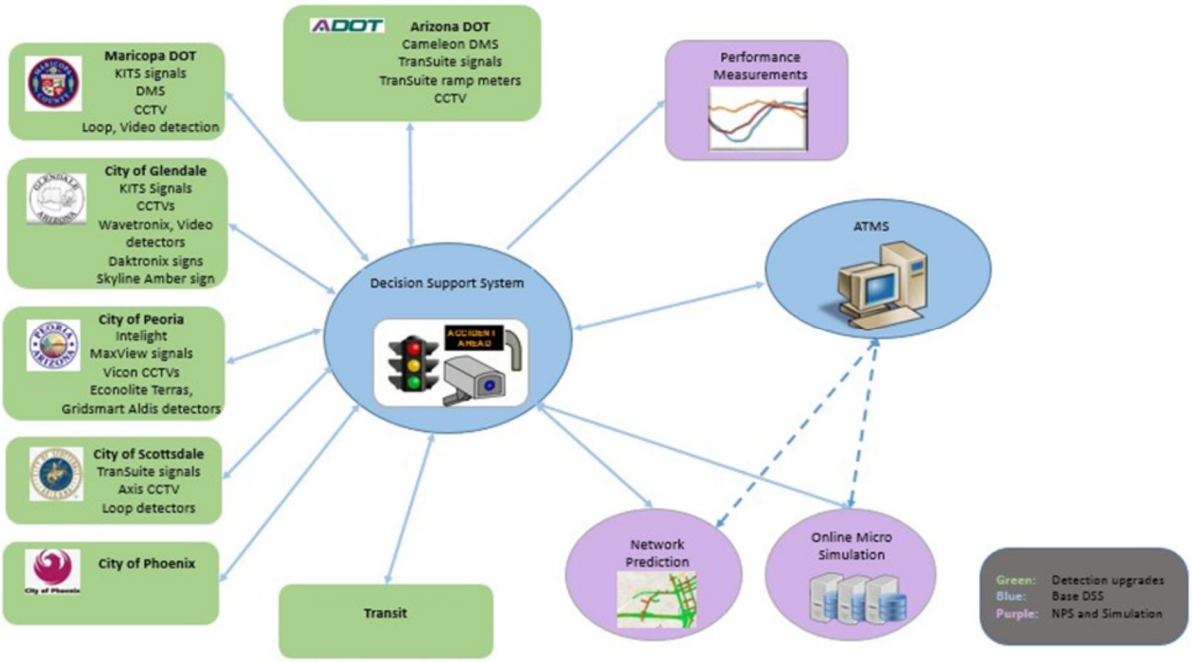
"The surest way to prevent wrong-way crashes is keeping people impaired by alcohol or drugs from getting behind the wheel," ADOT Director John Halikowski said. "When an incident occurs, this first-in-the-nation system using thermal camera technology is designed to give the Arizona Department of Public Safety an advantage in responding."

This section includes activities related to planning or projects that connect freeway operations to arterial operations.

Loop 101 Decision Support System Concept

MCDOT and ADOT completed an evaluation of what a Decision Support System (DSS) concept would look like for Loop 101. To date, ICM deployments in Arizona have involved focused coordination between agencies where response plans or incident management operations plans are enacted by each individual agency based upon a "playbook" of multiagency coordination. MCDOT, ADOT and the AZTech partner agencies explored a more automated method for ICM through an overarching Decision Support System (DSS) that would apply to Loop 101.

This concept development considered a state where all agency systems talk to each other in real-time and feed an overall DSS that then recommends how each agency may respond. Eight different types of DSS were evaluated for suitability in the region. Based on the assessment, two recommended DSS models were deemed suitable to support the Loop 101 corridor—a Hybrid Rules/Model-driven DSS or a Rules-based DSS.



The Loop 101 Mobility Project, which was selected to receive federal funding through the ATCMTD program, will include development of a formal Concept of Operations for a DSS and will further explore the DSS options. It will also consider other supporting systems, such as a predictive network simulation model, that will further enhance DSS functionality to support more automated and 'intelligent' ICM implementation.

Loop 101 Integrated Corridor Management Pilot in Scottsdale

The Loop 101 ICM Pilot has been formalized by the ADOT TOC in their Operations Manual and Operator processes when responding to incidents on the Loop 101. The notification procedures established for ICM have been fine tuned to improve how each agency will be initially notified of an incident and how agencies can support incident response. Continued partnership between agencies and departments that have jurisdiction surrounding Loop 101 through Scottsdale have been tested numerous times since the ICM plan was established. MCDOT has led a series of table top exercises to engage agency responders in continuing the operation of the Loop 101 ICM. The process heavily relies on the human connection, rather than on an automated decision support system. The ICM process for agencies to coordinate is being adjusted as events occur and as tabletop workshops help to refine the process that would be the most beneficial to the current operational capabilities of each agency.

Continuation of Loop 101 Integrated Corridor Management Pilot

In response to the preliminary success of the Loop 101 ICM Pilot through Scottsdale, ADOT and the City of Phoenix partnered to extend the Loop 101 ICM detour plans for the northern portion of the corridor through the City of Phoenix. These plans identify primary and secondary detour routes on arterials in the event of a freeway closure and also identify traveler information that needs to be sent out to alert travelers of the ICM routes. ADOT has already included these plans within TOC Operator standard procedures to improve mobility and safety during incidents.

US 60 Integrated Corridor Management Signal Optimization Project Through Mesa and Gilbert

As part of a MAG Traffic Signal Optimization Project (TSOP) project, the transportation departments at the City of Mesa and the Town of Gilbert developed signal timing plans to improve arterial detour routing in response to major incidents on the US 60. The timing plans have been implemented and tested and have already been updated to further improve conditions on the adjacent arterial to support movement and safety during freeway incidents.

I-17 Integrated Corridor Management Signal Optimization Project

The City of Phoenix and ADOT partnered to complete a signal optimization project along two of the major corridors crossing I-17: Indian School Road and Camelback Road. This was the first MAG TSOP ICM corridor project that included optimization across a freeway and included retiming of signals at the freeway intersection itself. The timing plans have been implemented in Phoenix, and while the timing plans have not been tested in real-time due to an incident, the updated timing plans have been shown to improve travel time along the corridors for normal conditions. Phoenix plans to leverage the updated timings to prepare other arterial corridors to support enhanced detouring as ICM expands in the region.

USING DATA AS AN OPERATIONAL DECISION MAKING TOOL

SECTION 4

This section includes activities that show how the AZTech partners are using their abilities to improve situational awareness of the network.

AZTech Regional Archived Data System (RADS) Upgrades

RADS is one of the data sources for the AZTech PI Book. Performance indicators such as Travel Time Index (TTI) and Travel Time Reliability (TTR) are used for monitoring and reporting the freeway and arterial corridor performance in the Phoenix area. The key to the management of non-recurring congestion is to know the traffic impeding events as they occur. Within the last two years, RADS has successfully integrated the following event data that significantly improves the situation awareness of the transportation managers in the region, including:

- Construction event data – Construction permit data was integrated from Glendale and Mesa in 2016, and Avondale, Chandler, Gilbert, Goodyear, Phoenix, Scottsdale, and Tempe in 2017. These agencies are now providing detailed road closure data for display on AZ511 to increase awareness of events that may impact roadway users. Events which reduce arterial capacity by 50% or more, or which completely close an arterial or collector street, are now updated several times per day on AZ511 to ensure the data is as accurate as possible. Cities have begun updating their street closures webpages directing users instead to AZ511 for the latest road closure information.
- Mesa 9-1-1 Computer Aided Dispatch (CAD) and Police CAD data – This data feed contains arterial incidents from Mesa police and fire departments. The Fire CAD events cover Gilbert, Apache Junction, and Queen Creek through the Mesa Fire automatic-aid agreement. The Mesa Police CAD data is the first in the region to integrate the significant police events in support of transportation management. The Mesa CAD integration project was completed in February 2017.
- Automated Traffic Signal Performance Measures (ATSPM) – Incorporating traffic signal metrics from multiple agencies is a very unique approach to using automated traffic measures and was challenging to undertake within RADS. The system is planned to continue to expand to other agencies.

The RADS event data is an important source of information to keep the traffic managers aware of the condition of the transportation network. These data are processed and stored in RADS based on national standards. The standardized event information is currently disseminated over AZ511.gov traveler information website.

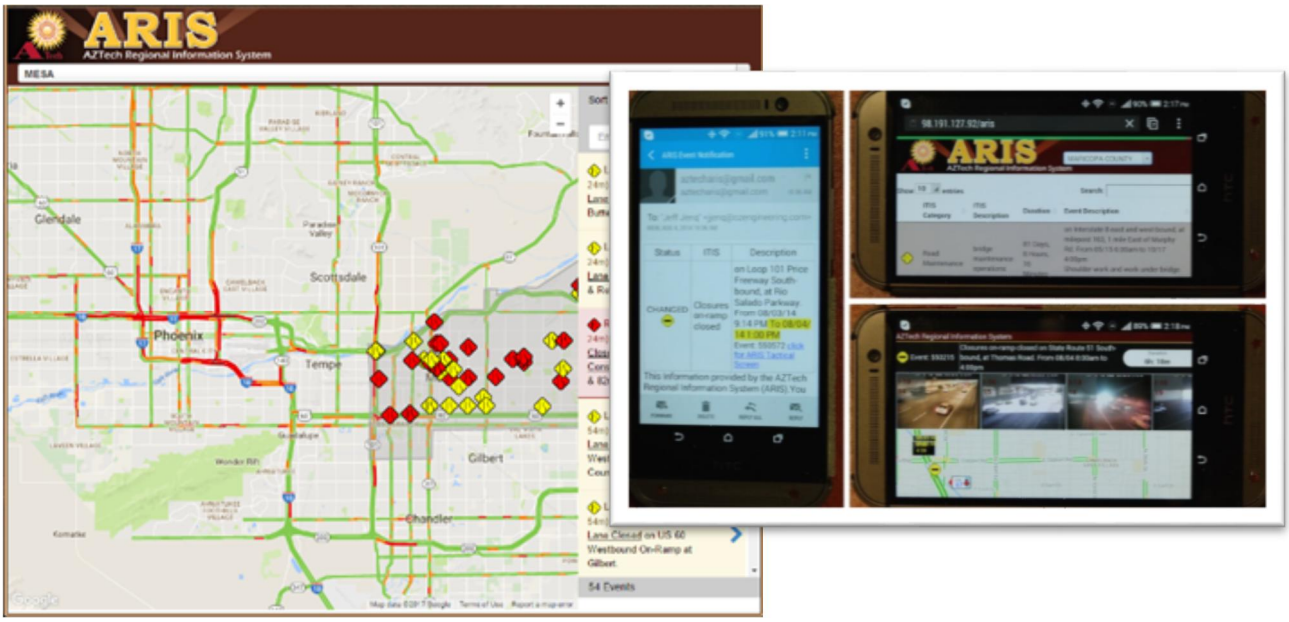
AZTech Regional Information System (ARIS) Enhancements

Leveraging the data in RADS, ARIS provides real-time incident notification in support of traffic management during an incident which allows for real-time decision making. ARIS uses geofencing technology to provide local transportation agencies real-time notification of incidents that occur in their respective jurisdictions.

The ARIS system has been designed based on the needs of local jurisdictions who demand timely notification of incidents as they occur in their respective jurisdiction. Upon notification, ARIS automatically assimilates a range of useful information related to the particular incident and presents the information in a web-based "tactical screen". Information such as event data, detection station data, anonymous re-identification (ARID) travel time data, and other data are assimilated into RADS to support ARIS notifications.

USING DATA AS AN OPERATIONAL DECISION MAKING TOOL

ARIS has been considered an important tool for the Traffic Incident Management (TIM) and Integrated Corridor Management (ICM) regional initiatives. The ARIS project received the prestigious 2015 National Institute of Transportation Engineers (ITE) Transportation System Management & Operations (TSMO) Council's Achievement Award.



RADS Services

AZ511.gov | Travel Time (DMS, flat screen displays, web) | FTP | ARIS

Freeway Management System

Detector Stn Data
- Volume
- Speed
- Occupancy
- Travel time

Ramp Meter

CCTV image

Event

Freeway: ADOT HCRS
Arterial: MCDOT RCRS

911: Phoenix Fire, Mesa Fire

Police: Mesa

Construction: 10 cities

Traffic Signal

Signal timing data sharing

ATSPM

Connected Vehicle SPaT

Arterial Data

ARID-based travel time

Third-party travel time

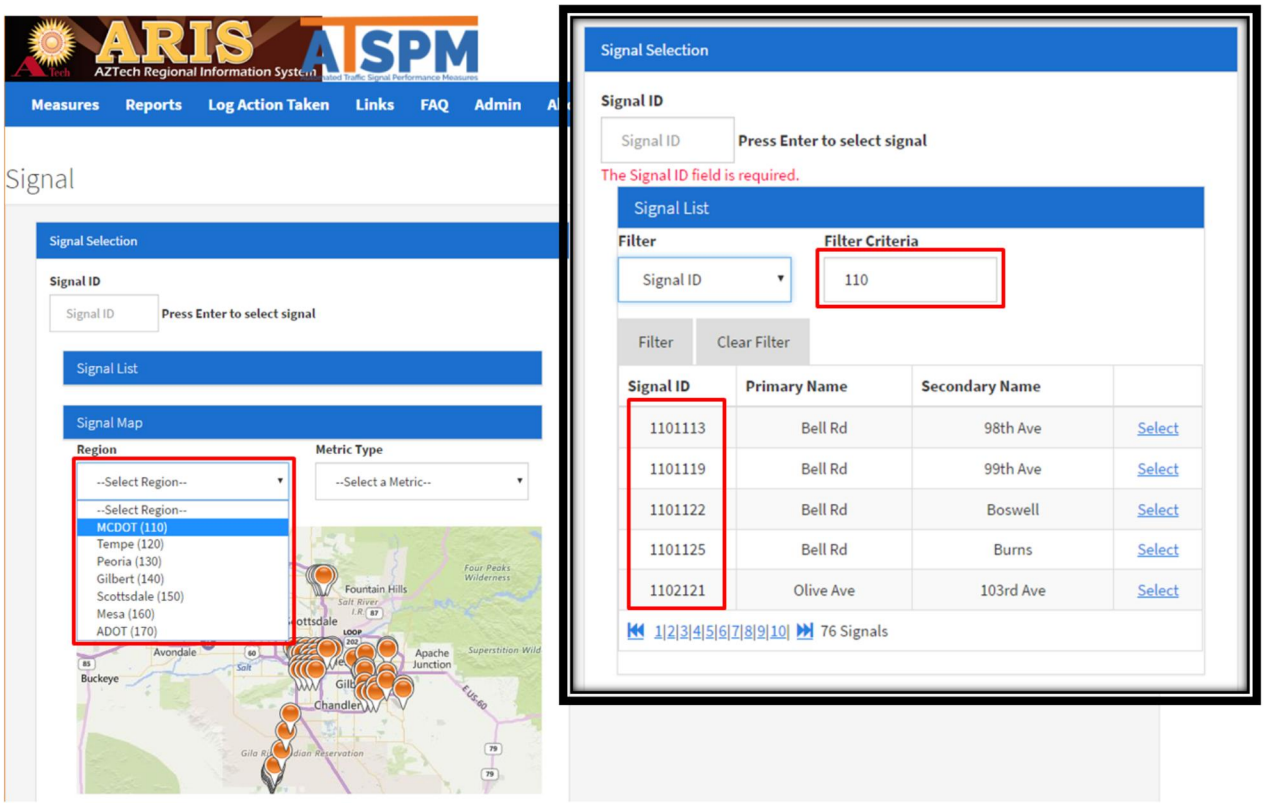
Arterial CCTV image

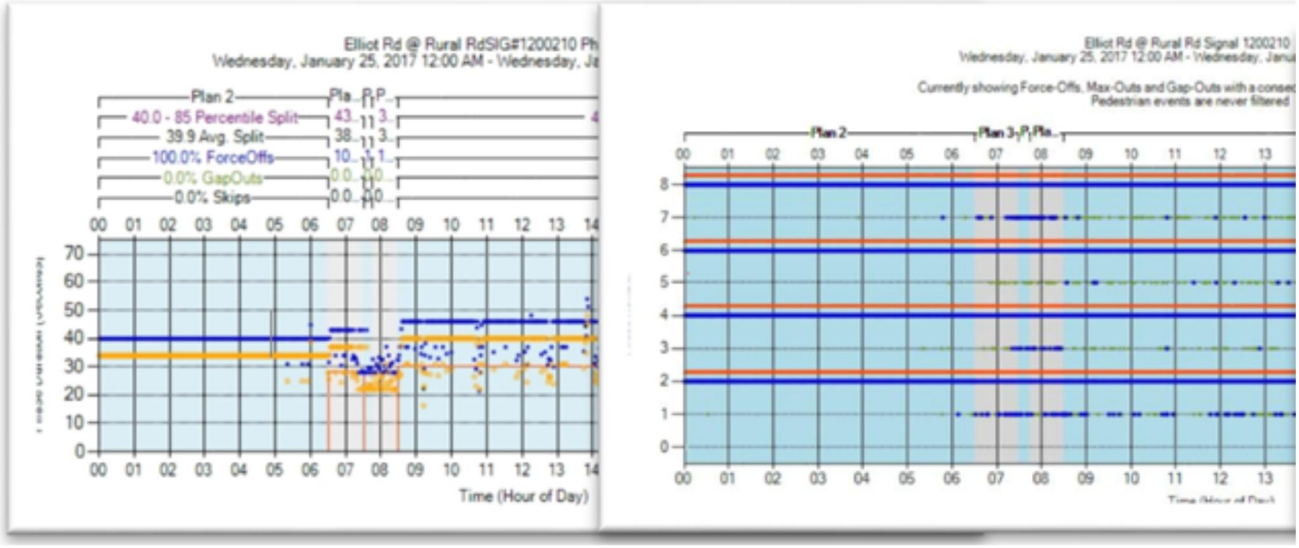
Automated Traffic Signal Performance Measures (ATSPM)

ATSPMs is a suite of performance measures, High Resolution Data (HRD) collection and data analysis tools used to support objectives and is a performance-based approach to manage traffic signal programs. ATSPM is supported by FHWA as part of the Every Day Counts initiative for innovation. Using a traffic signal controller, vehicle detection, and a means of communication to the traffic signal, ATSPM helps TMCs make real time operational decisions. HRD is captured every 1/10 of a second by the controller. The ATSPM software processes the data to produce charts that can be used to assess the performance of traffic signals. Currently, the pilot agencies have found ATSPM be helpful in identifying detection failures and aiding citizen concern analysis. MCDOT is in the process of creating a more robust set of performance monitoring email alerts to inform TMC operators of signal activities that need attention.

AZTech, in collaboration with FHWA, City of Phoenix, and ITS Arizona, hosted a workshop in June of 2017 to promote the use of ATSPM, exchange knowledge from other states and local agencies that have implemented ATSPM, and discuss how ATSPM could be expanded in this metropolitan area. The workshop not only included state and local agencies that are currently utilizing the open source Utah DOT (UDOT) ATSPM software (the version used as part of the AZTech Pilot Project), but also vendors that started incorporating ATSPM features in their off-the-shelf technologies.

The AZTech ATSPM Regional Pilot Project was kicked off in 2017. The pilot project included developing a process to extract HRD from traffic signal controllers using a single server to host the UDOT ATSPM v4 software. The first phase of the pilot project included 10 signals from each of the participating agencies. The second phase of the project expanded the number of signals to about 100 each for MCDOT and the City of Tempe. Seven agencies were included in the pilot project: MCDOT (115), Tempe (108), ADOT (10), Peoria (10), Scottsdale (10), Gilbert (10), and Mesa (10).





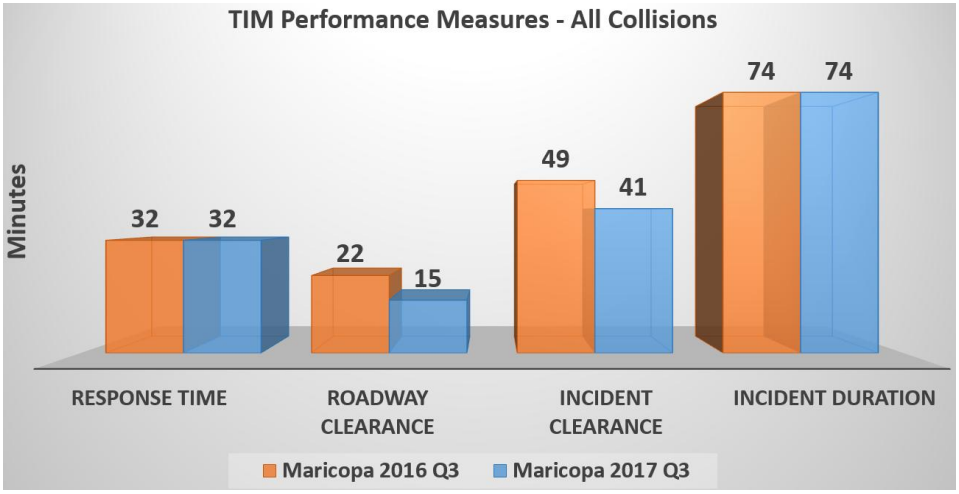
Most modern signal controller manufacturers have incorporated the collection of HRD into their platforms. A robust communications network is not necessary for the use of ATSPM. Many agencies across the country have implemented low cost solutions in lieu of installing fiber or other high cost communication networks. Some strategies include using devices, like Raspberry Pi, to manually collect the data in the field and bring it back to the TMC for incorporating into the ATSPM software.

Incorporating ATSPMs across multiple agencies with one server is a very unique approach to implementing ATSPMs. Because of this uniqueness, MCDOT has been invited to many workshops and peer exchanges hosted by FHWA to share this single server approach to implementing ATSPM. The ATSPM program is anticipated to continue adding signals from jurisdictions involved in the pilot project as well as new jurisdictions.

Traffic Incident Management Coalition Performance Measures

Arizona's public safety and transportation stakeholders have built strong partnerships to advance Traffic Incident Management (TIM) in the Phoenix Metro region. Since 2012, 5,353 law enforcement, fire/rescue, EMS, towing/recovery and transportation personal have been trained in TIM. In 2016, 80 new TIM instructors were trained as part of the Arizona TIM Coalition to provide more opportunities for TIM stakeholders to receive training.

There have been tangible improvements in key TIM performance measures for incidents In Maricopa County between 2016 and 2017 that are a likely result of TIM initiatives. The biggest reductions have been seen in roadway clearance time, which was reduced by 7 minutes, and incident clearance time, which was reduced by 8 minutes.



Freeway Travel Time Index

Travel Time Index (TTI) is computed by dividing the actual (measured) travel time by the free flow travel time along a corridor of interest. This measure considers the peak-hour periods (6am to 9am and 3pm to 7pm) during Tuesdays, Wednesdays, and Thursdays and measures separately for the general purpose lanes in the inbound (morning) and outbound (evening) directions for freeways where vehicle detectors are available. The table below shows the comparison of Travel Time Indices of named freeways between the years 2013, 2015 and 2017. This measure is "normalized" by the free flow travel time and therefore allows comparison of freeway corridors of different lengths.

Pima NB and Pima SB were excluded from 2015 data due to major construction and lack of sufficient data. The results show that the 2017 travel times have across the board increased from the previous year. The increases of travel times range from 1.5% (Black Canyon NB and Pima North) to 35.3% (Red Mountain WB).

Named Freeway	Inbound 6am-9am						Outbound 3pm-7pm					
	Dir	Lgth	2013 TTI	2015 TTI	2017 TTI	% Change (from 2015)	Dir	Lgth	2013 TTI	2014 TTI	2015 TTI	% Change (from 2015)
Agua Fria (SR101L N/S)	SB	-	-	-	1.03	-	NB	-	-	-	-	-
Agua Fria (SR101L E/W)	EB	-	-	-	1.51	-	SB	-	-	-	-	-
Black Canyon (I-17)	SB	11.6	1.16	1.34	1.38	3.0%	NB	10.7	1.26	1.30	1.32	1.5%
Maricopa (I-10 East)	WB	16.1	1.31	1.41	1.75	24.1%	EB	15.1	1.34	1.41	1.52	7.8%
Papago (I-10 West)	EB	14.9	1.36	1.74	1.83	5.2%	WB	13.5	1.47	1.54	1.77	14.9%
Piestewa (SR-51)	SB	12.1	1.09	1.15	1.35	17.4%	NB	13.1	1.08	1.10	1.16	5.5%
Pima (SR101L North)	EB	13.6	1.25	1.33	1.35	1.5%	WB	11.8	1.20	1.29	1.38	7.0%
Pima (SR101L)	NB	15.7	1.18	-	1.20	-	SB	14.5	1.26	1.31	-	-
Price (SR101L South)	NB	9.0	1.29	1.36	1.75	28.7%	SB	9.3	1.36	1.36	1.48	8.8%
Red Mountain (SR202L North)	WB	9.1	1.26	1.33	1.80	35.3%	EB	9.6	1.10	1.12	1.15	2.7%
Superstition (US-60 East)	WB	20.5	1.10	1.17	1.24	6.0%	EB	19.5	1.06	1.07	1.10	2.8%

**Data reported as provided by ADOT.*

Freeway Percentage of Corridor Miles Congested

The percentage of Corridor Miles Congested (PMC) assesses the extent of recurring congestion by identifying the number of miles on a freeway corridor that was congested during the peak periods. A segment of a corridor (corresponding to a detector station) is considered congested when the average vehicle speed drops to 50 miles per hour or less. This measure is useful for monitoring the spatial extent of congestion along a commute corridor.

The table on the top of the next page shows the comparison of corridor miles congested by named freeway per commute direction between the years 2013, 2015 and 2017. Most freeways have remained relatively steady in terms of PMC, with the exception in 2017 of the Papago portion of the freeway which is undertaking significant construction for the South Mountain freeway.

Named Freeway	Inbound 6am-9am						Outbound 3pm-7pm					
	Dir	Lgth	2013 PMC	2015 PMC	2017 PMC	% Change (from	Dir	Lgth	2013 PMC	2015 PMC	2017 PMC	% Change (from
Agua Fria (SR101L N/S)	SB	-	-	-	0.39	-	NB	-	-	-	1.34	-
Agua Fria (SR101L E/W)	EB	-	-	-	38.9	-	SB	-	-	-	37.11	-
Black Canyon (I-17)	SB	11.6	40.75	44.85	41.64	-7.2%	NB	10.7	54.59	53.66	53.30	-0.7%
Maricopa (I-10 East)	WB	16.1	38.73	41.45	48.61	17.3%	EB	15.1	37.53	44.76	65.14	45.5%
Papago (I-10 West)	EB	14.9	43.92	53.84	53.70	-0.3%	WB	13.5	41.88	46.48	49.64	6.8%
Piestewa (SR-51)	SB	12.1	26.55	26.13	29.17	11.6%	NB	13.1	20.6	23.33	23.70	1.6%
Pima (SR101L North)	EB	13.6	36.33	43.61	39.89	-8.5%	WB	11.8	41.28	53.73	46.99	12.5%
Pima (SR101L)	NB	15.7	26.86	-	13.57	-	SB	14.5	39.16	-	27.40	-
Price (SR101L South)	NB	9	37.72	41.94	43.88	4.6%	SB	9.3	38.11	42.46	39.67	6.6%
Red Mountain (SR202L North)	WB	9.1	36	36.82	39.32	6.8%	EB	9.6	21.58	29.20	20.61	29.4%
Superstition (US-60 East)	WB	20.5	19.22	21.42	18.16	-15.2%	EB	19.5	10.74	12.58	14.59	16.0%

**Data reported as provided by ADOT.*

Freeway Percentage of Time Congested

Percentage of Time Congested (PTC) represents the percentage of time a corridor is considered congested during the peak periods. Congestion is defined as when the average speed drops to 50 miles per hour or less. Along with the "percentage of corridor miles congested", it depicts the extent of congestion both in space and time. The table below shows the comparison of percentage of time congested by named freeway per commute direction.

Named Freeway	Inbound 6am-9am						Outbound 3pm-7pm					
	Dir	Length	2013 PTC	2015 PTC	2017 PTC	% Change (from	Dir	Length	2013 PTC	2015 PTC	2017 PTC	% Change (from
Agua Fria (SR101L N/S)	SB	-	-	-	0.5	-	NB	-	-	-	1.3	-
Agua Fria (SR101L E/W)	EB	-	-	-	37.1	-	SB	-	-	-	39.3	-
Black Canyon (I-17)	SB	11.6	33.1	38.9	41.8	7.5%	NB	10.7	42.8	43.1	52.4	21.5%
Maricopa (I-10 East)	WB	16.1	32.2	37.1	48.4	30.5%	EB	15.1	35	44.4	65.6	47.8%
Papago (I-10 West)	EB	14.9	36.7	47.6	54.9	15.3%	WB	13.5	35.2	43.8	47.2	7.9%
Piestewa (SR-51)	SB	12.1	18.8	20.3	28.4	39.7%	NB	13.1	13	20.0	21.8	9.0%
Pima (SR101L North)	EB	13.6	31.6	41.9	38.9	-4.8%	WB	11.8	27.7	47.2	48.1	2.0%
Pima (SR101L)	NB	15.7	20.8	-	13.5	-	SB	14.5	31.3	-	26.2	-
Price (SR101L South)	NB	9	32.2	35.5	42.3	19.0%	SB	9.3	40	48.0	46.8	-2.5%
Red Mountain (SR202L North)	WB	9.1	26.8	28.0	36.9	31.8%	EB	9.6	9.9	15.7	25.7	63.4%
Superstition (US-60 East)	WB	20.5	13.8	17.2	20.8	21.1%	EB	19.5	4.9	9.7	13.9	43.0%

**Data reported as provided by ADOT.*

SMARTER TRANSPORTATION & MOBILITY

SECTION 5

This section describes how agencies are pursuing smarter technology and expanding their operational capabilities.

State Route 51 Smart Ramp Metering

ADOT has piloted an important improvement to traffic mobility in the region through the use of smart ramp metering along SR-51. ADOT anticipates this concept to be applicable throughout the urban metropolitan region to improve the responsiveness of the freeway management system to support mobility and safety.

With a goal of improving rush-hour traffic flow, ADOT is testing changes in the timing of ramp-meter signals along State Route 51 (Piestewa Freeway).

The first phase, started the week of Oct. 3, 2017, involved on-ramps along northbound State Route 51.

The red lights at the northbound State Route 51 ramp meters may hold vehicles for several more seconds, but detectors along the entrance ramps also will assess if ramp traffic is backing up. The system also is designed to adjust the red and green light timing to limit the amount of traffic waiting to enter the northbound freeway.

ADOT will also study another system of ramp meter programming along southbound SR-51 in the near future. That additional programming system is designed to allow individual ramp meters to respond to traffic conditions even several miles away and adjusts ramp meter signal timing to help improve traffic flow along with larger stretch of freeway. *Source: ADOT website*

Avondale Intelligent Transportation Systems Is Expanding

The City of Avondale has been busy expanding their fiber infrastructure in recent years. The Dysart Road fiber project added fiber along the corridor connecting traffic signals to the Avondale TOC. A new project along McDowell Road beginning in 2018 will connect additional miles of the corridor and traffic signals to the City's TOC. This decreases the requirement on the wireless system and provides a solid and reliable foundation of communications throughout the City.

Bell Road Adaptive Signal Control Deployment Through Valley

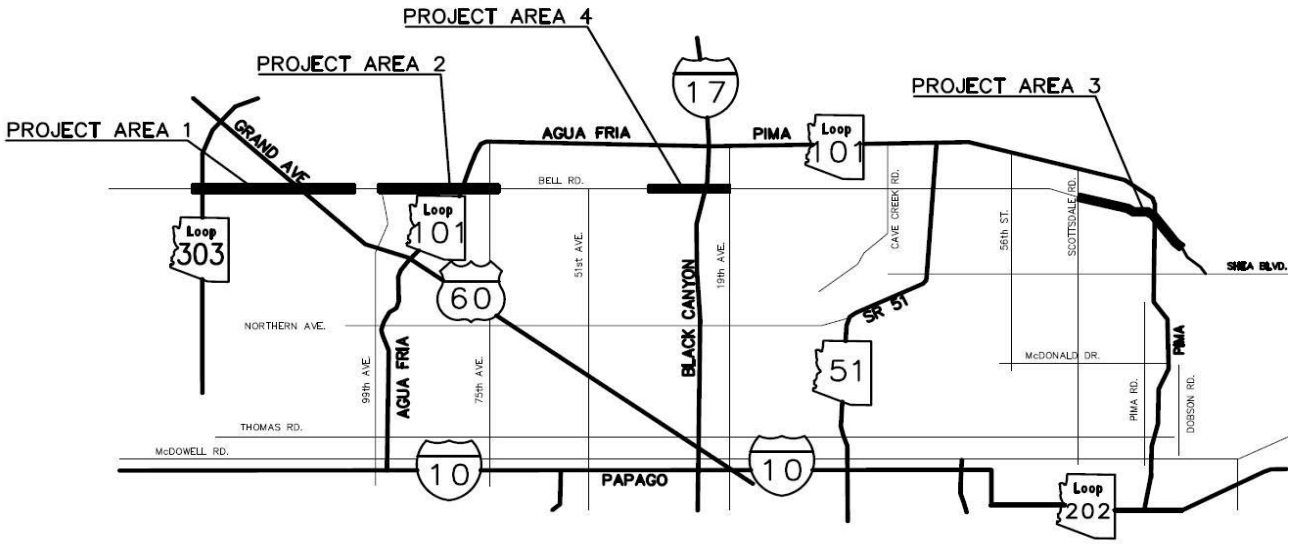
The Bell Road Adaptive Signal Control Technology (ASCT) Pilot Project is broken up into four project areas with each area focused around the freeway interchanges. The vision of an ASCT system is to provide a traffic control system that automatically responds to changing traffic conditions, reduces delays and improves corridor travel times while managing queues. The Bell Road ASCT Pilot Project was funded by MAG.

Two of the project areas have been installed and are active. Three different ASCT systems were procured for the four project areas.

ASCT is an operations strategy with great potential to provide smooth traffic progression, manage queues, and improve safety. An ASCT system is one in which the signal timing sequencing is optimized and green times modified in response to changes in the real-time traffic conditions. The purpose of providing ASCT in these areas is to overcome variable traffic patterns, improve multi-agency operations, and to minimize queues during periods of congestion. The ASCT system can prolong the effectiveness of the signal timing without having to make manual changes to the signal timings.

The Bell Road ASCT Pilot Project has installed vehicle detection, ASCT system hardware and software along 15.6 miles (50 signalized intersections) of Bell Road to improve traffic operations in the Cities of Surprise, Peoria, Glendale, Phoenix, Scottsdale, MCDOT, and ADOT.

Anonymous Reidentification (ARID) sensors will also be installed. The ARID data will be used as a performance measure tool to help monitor travel time and areas of congestion along the corridor.



Maricopa Association of Governments Regional Community Network (RCN) Developments

Expansions to the center-to-center physical communications connection between agencies throughout the metropolitan area have been robust in recent years. Network updates have included the following:

- A redundant connection was established to City of Surprise in preparation for the Bell Road and Grand Avenue construction project. This involved coordination with City of Surprise, City of Peoria, and MCDOT and was funded by MAG.
- Wireless connections were established with the Town of Queen Creek and Salt River Pima-Maricopa Indian Community which involved coordination with City of Mesa and Maricopa Region 911.

MAG staff has been coordinating efforts related to the RCN use for many years. There is ongoing support for Luxriot that has been the video management system for RCN users. There is also event-specific support provided such as working with ADOT on the I-10 construction project from 83rd Avenue to Loop 303 which also involved coordination with the City of Goodyear, City of Avondale, and City of Tolleson, as well as the 911 Dispatch Center.

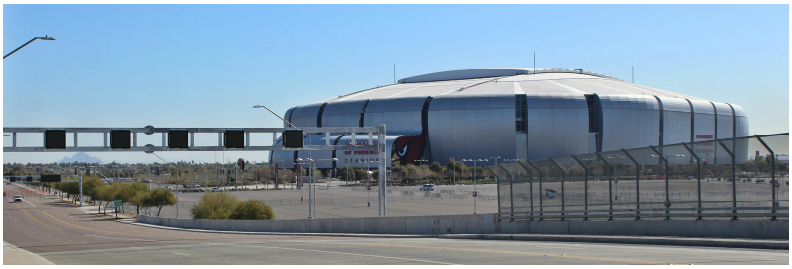
Bell/Grand Intersection Close Down Coordination

To improve congestion at the busy Bell Road intersection, ADOT constructed a new Bell Road bridge over US 60 (Grand Avenue) and the adjacent railroad tracks in 2017. The bridge replaced the current ground-level intersection. With this new interchange, through traffic on Grand Avenue will no longer stop at Bell Road. Instead, the two roadways connect via new on- and off-ramps constructed within the Grand Avenue median. A full closure of Bell Road was in place for a duration of 8 months.

The City of Surprise, City of Peoria, MCDOT, and MAG worked together to provide redundant communications for sharing traffic signal timing plans and CCTV camera images during the interchange work. This provided an alternate path for the RCN access to continue operations for transportation purposes as well as serving as the backup to 911 communications. This kept critical intersections running east of the Bell/Grand intersection during a challenging traffic control environment. By all accounts, the construction process went smooth largely due to the quality traffic control diversions coordinated by the agencies. This project was funded by MAG.

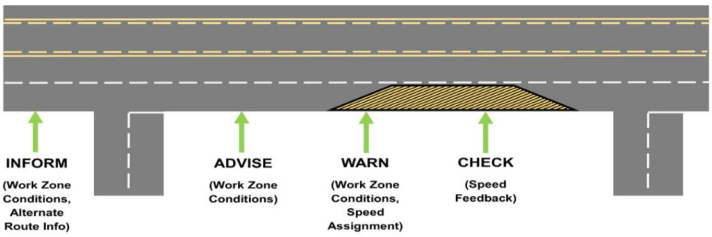
Glendale Completing Reversible Lanes on Maryland Avenue

For years, the City of Glendale has been putting up temporary barricades to create reversible lanes to support heavy traffic for events at the University of Phoenix Stadium. Typically, reversible lanes are used during ingress and egress traffic for an event. The City is now making a temporary traffic control measure permanent. In 2017, the City completed the design and began construction of lane control signals along Maryland Avenue to allow reversible lanes. This project is located on Maryland Avenue west between 95th Avenue and 91st Avenue.



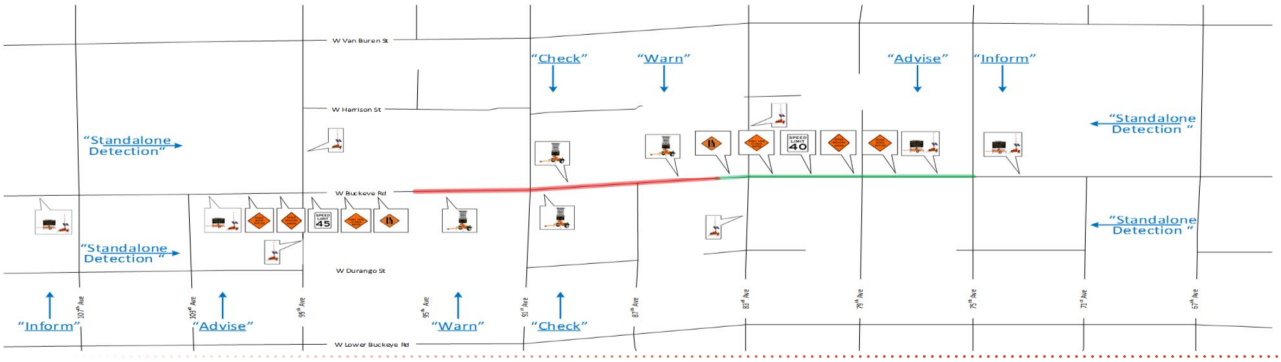
The City considers the area encompassed by 99th Avenue on the west, Northern Avenue on the north, 83rd Avenue on the east, and Indian School Road on the south to be the footprint of the traffic control boundaries related to the stadium and Westgate area. All freeways in the metropolitan area are included in the traffic control planning area as freeway message signs display event traffic information on all freeways for travelers on their way to the area.

AZTech Arterial Smarter Work Zones



As part of AZTech and the Federal Highway Administration's Every Day Counts (EDC3) initiative, MCDOT developed a concept for the deployment of Smarter Work Zone (SWZ) technology at work zone sites in 2016 and completed the design and construction documents associated with implementing the technology for the MC-85 work zone in 2017. The MC-85 project will begin construction in the Fall of 2018 from 107th Avenue to 75th Avenue. While the concept will be piloted during the MC-85 project, it is intended that this concept would be adaptable to all AZTech partner work zones. Nationally, there are a limited number of examples of arterial SWZ applications. AZTech is leading the way in SWZ innovation for arterials. MCDOT is also deploying a connected vehicle SWZ application for freight to test during construction and will report on findings.

A process was established to provide traceability between the equipment and the systems deployed to track the results that are attributable to the SWZ. A matrix was also developed to assist in selecting the appropriate SWZ components for different work zone needs.



TRAVELER INFORMATION SECTION 6

This section includes agency activities that support better traveler information which starts with the right data being collected and results in multiple methods for dissemination.

Anonymous Re-Identification Device Use in Chandler, Gilbert, Glendale, Mesa, Maricopa County, Phoenix, and Tempe

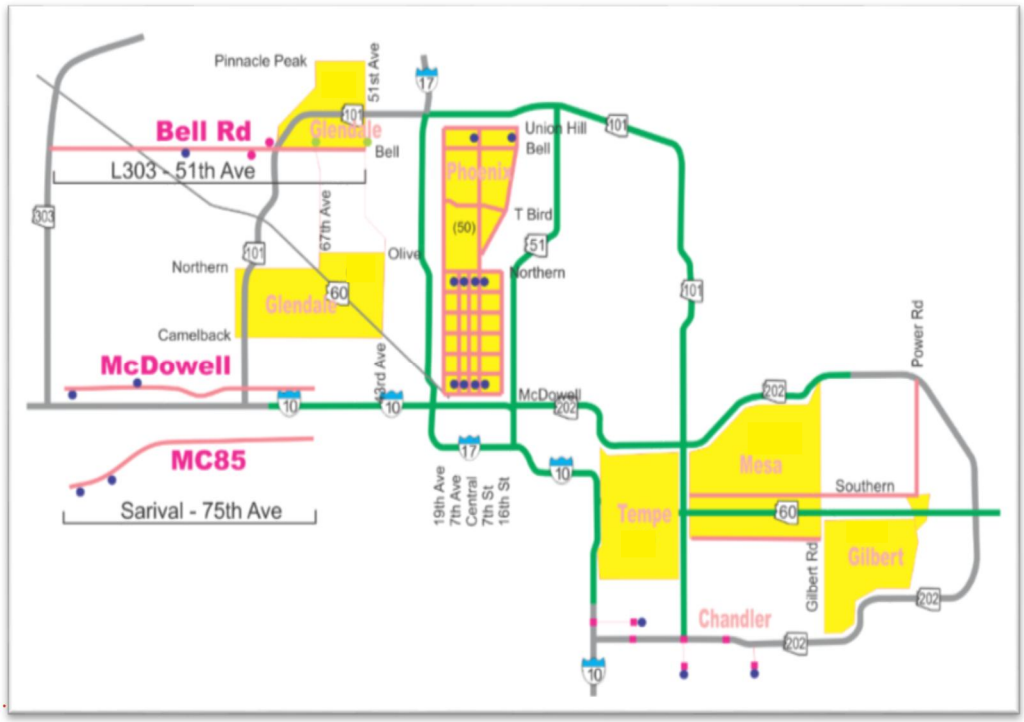
Local jurisdictions have started deploying Bluetooth and Wi-Fi-based Anonymous Re-Identification (ARID) sensors to provide continuous monitoring of the travel time on arterial streets. The resulting arterial travel time data of this implementation are contributed to RADS for regional applications (e.g., AZ511.gov).

The jurisdictions that currently operate ARID-based travel time monitoring system include Mesa, MCDOT, Gilbert, and Tempe. The cities of Chandler, Glendale and Phoenix all plan to deploy ARID devices in the near-term. The City of Tempe's ARID system is used to actively manage the City's arterials, monitor the state of their transportation network in real-time and compare the current state to historical congestion levels. It is a valuable tool that enables the City to provide safe and efficient operations of arterials. In addition to public access via AZ511, the cities of Tempe and Mesa have incorporated the ARID travel time information into their respective Open Data Portals as part of their commitments to transparency and providing accurate and easy access to data .

Gilbert, Mesa, and Tempe partnered on a regional project to gather and share ARID data across much of the east valley through the East Valley Travel Time Map project. In addition to sharing data between these three agencies, data is shared with RADS and displayed on AZ511, marking the first time that non-freeway congestion data has been displayed.

The EVTTM received the 2018 American Public Works Association Technical Innovation Award in recognition of this forward-thinking project that has pioneered the addition of arterial travel time data on the AZ511 statewide map.

This regional system has set a standard for inter-agency communication.



Exchange of ARID data is being used as a model for the West Valley in the near future, providing full arterial coverage available to the public on AZ511. This type of regional cooperation is possible through investments made by MAG, MCDOT, ADOT and local agencies on the RCN, RADS and other systems. It demonstrates how jurisdictional boundaries are opportunities for cooperation instead of barriers. The value of regional committees, councils and other partnerships cannot be overstated as the regular exchange of ideas and information is critical as public transportation agencies all work toward a common goal of improved mobility for our citizens.

Glendale Invests in Real-Time Condition Information

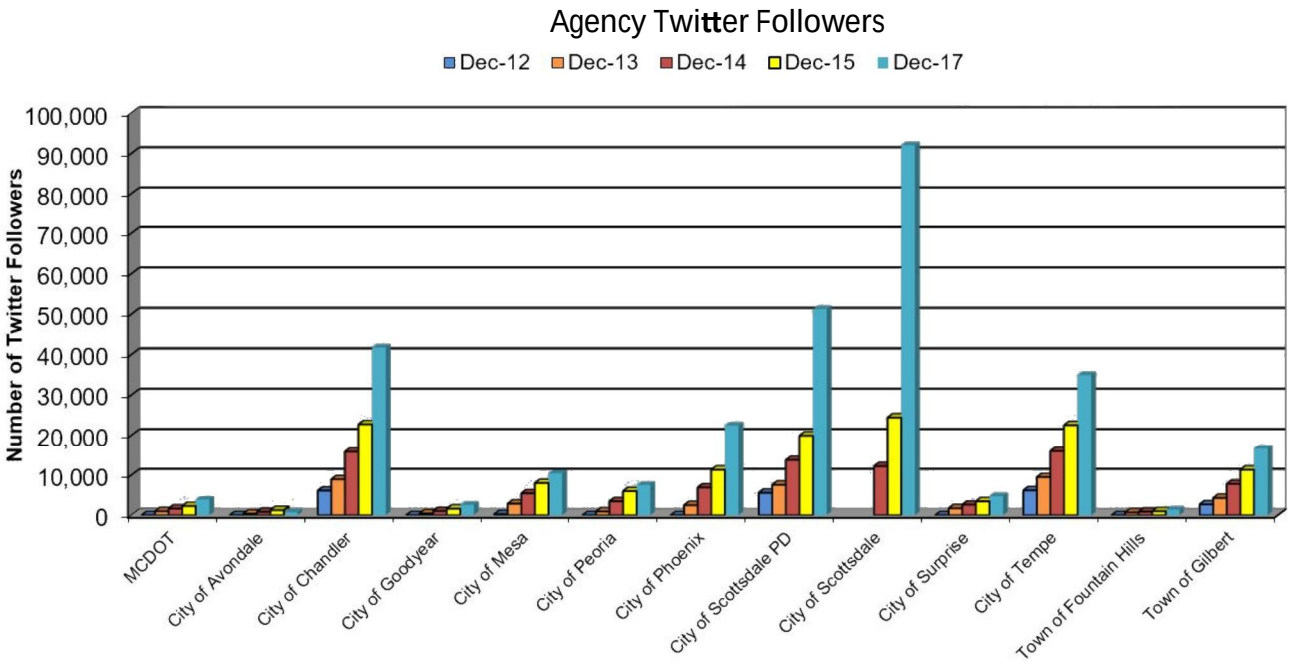
The City of Glendale is planning to install 50 WiFi devices at major intersections in the City as well as 17 mid-block sensors for speed detection. This will be used for real-time decision making for traffic signal management.

Travel times will provide real-time condition information that can be shared with the traveling public. In addition, this information coupled with speeds at mid-block locations along key corridors will be used by TMC operators to make adjustments to signal timing based on conditions.

Social Media Notifications

Transportation Departments and Public Safety Departments are using more email alerts and various social media outlets to provide traveler information to the public. The number of Twitter postings are rising on a week-to-week basis and the number of Twitter followers are concurrently rising.

Since 2012, ADOT public information officers located at the TOC have communicated daily with the media and the public via Twitter (@ArizonaDOT). The Twitter account allows ADOT to have immediate communications to the media and the public about such issues as road closures, crashes and recommended alternate routes. Over the past two years, ADOT increased the number of followers by about 117 percent (from 96,500 in December of 2015 to 211,000 in December of 2017). This is equivalent to more than 313 new followers per day. ADOT has more than four times the number of followers (not shown in the graph below) than any other agency in the region. ADOT has the second-largest number of followers among state DOTs with single Twitter accounts, behind only Washington state.



Regional Corridor Travel Times

Arterial data collection corridors have been identified by AZTech Committees to facilitate consistency in measuring and reporting the operational performance each year in collaboration with AZTech partner agencies. Travel time data for AM and PM peak hours is collected and percentage change in travel time is reported, as shown in the graphic.

	Dir	2013 TT (min)	2015 TT (mins)	2017 TT (mins)	% Change
AM	EB	10:08	10:22	10:37	+2.4
	WB	6:56	6:53	7:18	+6.1
PM	EB	11:16	11:56	12:52	+7.8
	WB	7:34	8:19	8:14	-1.0

	Dir	2013 TT (min)	2015 TT (min)	2017 TT (min)	% Change
AM	EB	17:32	18:37	19:45	+6.1
	WB	18:28	19:22	19:41	+1.6
PM	EB	20:15	21:34	23:29	+8.9
	WB	22:23	23:46	24:36	+3.5

Bell Road

	Dir	2013 TT (min)	2015 TT (min)	2017 TT (min)	% Change
AM	NB	26:10	25:00	25:54	+3.6
	SB	25:00	25:00	22:06	-13.1
PM	NB	23:00	24:00	27:51	+16.0
	SB	26:30	26:00	26:38	+2.4

59th Avenue

35th Avenue

Olive Avenue

	Dir	2013 TT (min)	2015 TT (min)	2017 TT (min)	% Change
AM	EB	19:21	20:39	20:25	-1.2
	WB	19:30	19:24	20:00	+3.1
PM	EB	19:38	21:14	20:55	-1.5
	WB	19:25	19:18	19:36	+1.6

McDowell Road

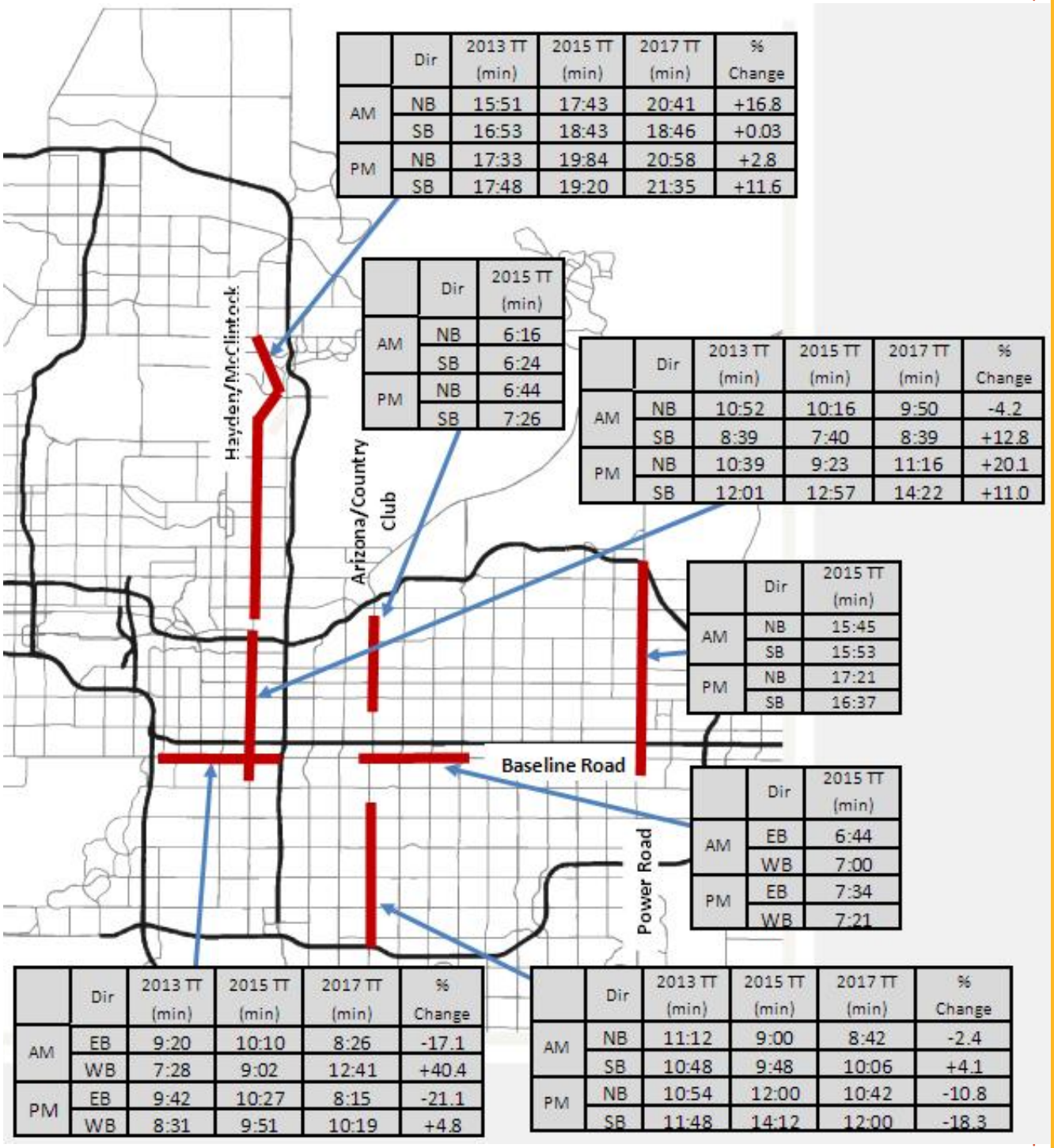
MC-85

	Dir	2013 TT (min)	2015 TT (min)	2017 TT (min)	% Change
AM	EB	24:17	27:10	29:29	+8.5
	WB	26:07	30:46	37:13	+21.0
PM	EB	26:56	30:43	34:28	+12.2
	WB	24:56	26:52	28:25	+5.8

	Dir	2013 TT (min)	2015 TT (min)	2017 TT (min)	% Change
AM	EB	12:44	14:43	16:04	+9.2
	WB	14:28	19:15	22:38	+17.6
PM	EB	14:26	16:46	19:53	+18.6
	WB	15:08	16:07	19:07	+18.6

	Dir	2013 TT (min)	2015 TT (min)	2017 TT (min)	% Change
AM	EB	8:08	8:50	9:41	+9.6
	WB	9:38	10:43	12:12	+13.8
PM	EB	8:45	9:53	12:16	+24.1
	WB	10:32	11:56	12:58	+8.7

Regional Corridor Travel Times



	Dir	2013 TT (min)	2015 TT (min)	2017 TT (min)	% Change
AM	NB	15:51	17:43	20:41	+16.8
	SB	16:53	18:43	18:46	+0.03
PM	NB	17:33	19:84	20:58	+2.8
	SB	17:48	19:20	21:35	+11.6

	Dir	2015 TT (min)
AM	NB	6:16
	SB	6:24
PM	NB	6:44
	SB	7:26

	Dir	2013 TT (min)	2015 TT (min)	2017 TT (min)	% Change
AM	NB	10:52	10:16	9:50	-4.2
	SB	8:39	7:40	8:39	+12.8
PM	NB	10:39	9:23	11:16	+20.1
	SB	12:01	12:57	14:22	+11.0

	Dir	2015 TT (min)
AM	NB	15:45
	SB	15:53
PM	NB	17:21
	SB	16:37

	Dir	2015 TT (min)
AM	EB	6:44
	WB	7:00
PM	EB	7:34
	WB	7:21

	Dir	2013 TT (min)	2015 TT (min)	2017 TT (min)	% Change
AM	EB	9:20	10:10	8:26	-17.1
	WB	7:28	9:02	12:41	+40.4
PM	EB	9:42	10:27	8:15	-21.1
	WB	8:31	9:51	10:19	+4.8

	Dir	2013 TT (min)	2015 TT (min)	2017 TT (min)	% Change
AM	NB	11:12	9:00	8:42	-2.4
	SB	10:48	9:48	10:06	+4.1
PM	NB	10:54	12:00	10:42	-10.8
	SB	11:48	14:12	12:00	-18.3

**Data reported as provided by respective agencies.*

This section describes improved coordination with police using ITS tools.

Peoria Police Use New Crime fighting Tool on the Roads

Whether police need to find a suspect who passed through an intersection or want to see the moments leading up to a serious crash, now they can hit the rewind button in Peoria's TMC.

Fifty cameras are set up at intersections around the city and while some have been there for some time, traffic engineers say the camera and fiber-optic technology has finally caught up so they can record.

Video is on a 72-hour loop before it gets dubbed over so if something potentially criminal happens police can pull the footage. Thanks to a formal partnership between the transportation department and the police department, there's no red tape to cut through before accessing the video.

"There's already been about 30 incidents on the police side that it's helped us investigate and look into, from a missing person, hit-and-run accident, major accidents where somebody could've died, criminal investigations...so it really is helpful," said police spokesman Officer Brandon Sheffert.

Policy has outlined that only police can use the footage within specific parameters -- it's not for the general public to review fender-benders for insurance purposes.

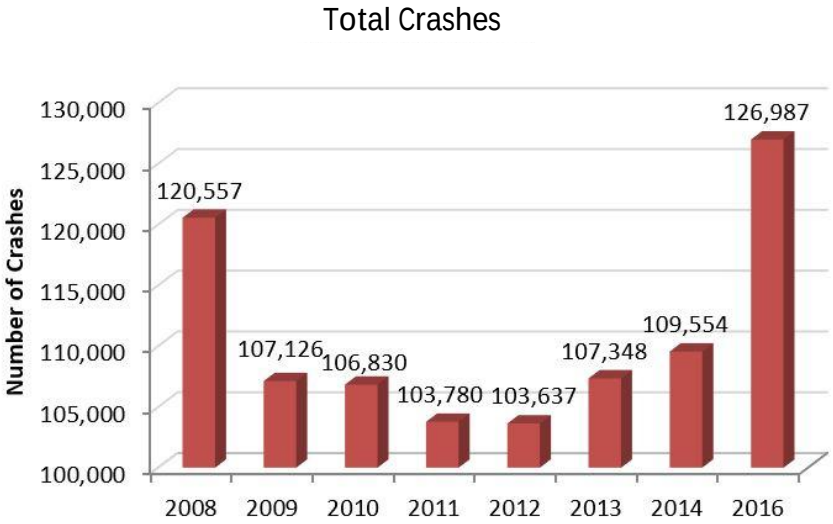
There is a broader benefit as the new system is also helping control the flow of the daily commute. Traffic cameras have already been used to watch and remedy backups in real time but by having a continuous recording, now engineers can also see if traffic patterns change throughout the day, even when the office isn't manned, as new schools or apartments are built and make improvements.

The City of Peoria gained national recognition in 2017 for their vision and innovation receiving Institute of Transportation Engineer's (ITE) Traffic Engineering Council Technical Achievement Award for their video archive project.

Source: ABC15 on Sept 22, 2017

Statewide Crashes

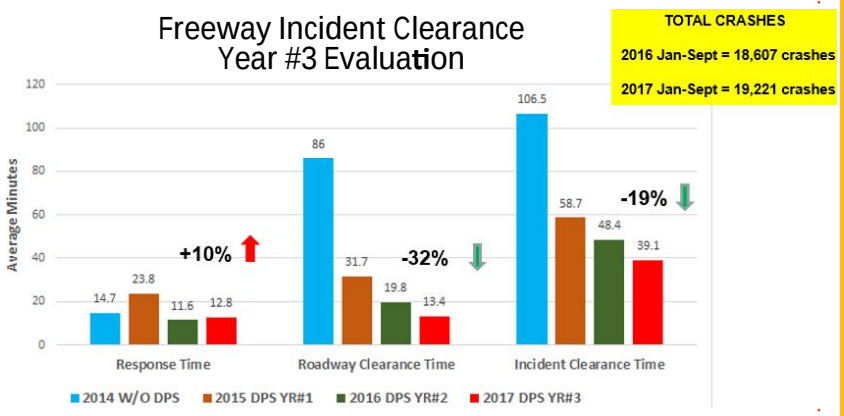
The ADOT Motor Vehicle Division (MVD) tracks statewide crash rates on a yearly basis and publishes this information within the annual Arizona Crash Facts report. Since 2014 the annual crash rates have increased statewide by almost 15%.



Arizona Department of Public Safety Collocation at the ADOT Statewide Traffic Operations Center

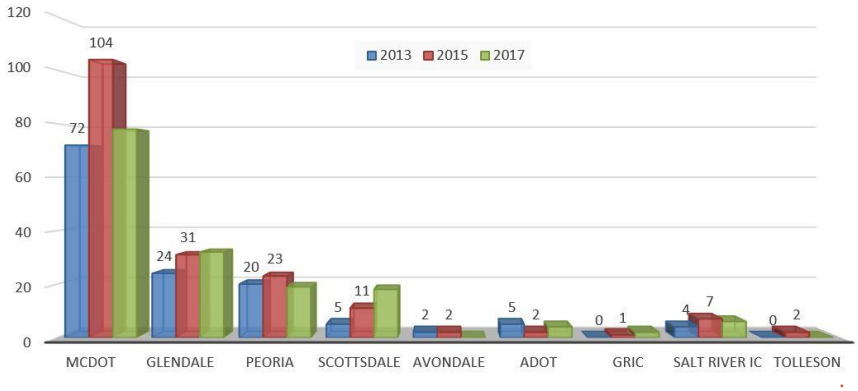
A three-year pilot project to co-locate DPS officers at the ADOT Traffic Operations Center commenced in October 2014. The purpose of the project was to help improve Traffic Incident Management (TIM) coordination on freeways. The pilot project was jointly funded by MAG and ADOT, and ended in September 2017.

Evaluation of the second and third years of the pilot project has been completed and the results show that, despite continuing increases in the number of crashes year-over-year, the average time to clear freeway crashes was reduced each year. Due to the success of this pilot project, ADOT has permanently funded DPS colocation and expanded coverage to include the entire state. DPS now has five (5) troopers and one (1) sergeant assigned to the TOC 24/7. Consoles for DPS officers have also been upgraded with higher capacity computers. The ADOT TOC also now has 24/7 Public Information Officer presence which allows for real-time media and social media information from the ADOT TOC in coordination with DPS.



Maricopa County Regional Emergency Action Coordination Team (REACT) Called for Assistance

The various agencies in the region that utilize MCDOT's Regional Emergency Action Coordination Team (REACT) have shown consistency in their request for assistance during traffic incidents that require traffic control support. However, in recent years, there has also been an increase in the use of MCDOT REACT to support other road closures.



In 2016, a threat at a local public school in the City of Glendale forced the lockdown of the school. Leveraging their relationships and knowledge of assistance capabilities, the City of Glendale Police Department coordinated with the MCDOT REACT team to assist in traffic control closing the intersections from 75th Avenue/Glendale Avenue to 75th Avenue/Bethany Home Road to keep vehicles from entering the area. The creativity of traffic management resources that could support anything that would impact the traveling public was employed. This shows that the extent of services can go well beyond just day-to-day or incident traffic management purposes.

MCDOT REACT was called by both the Maricopa County Sheriff's Office and the Scottsdale Police Department to close Shea Boulevard at two different locations in response to public crowds gathering for a dignitary visit in the area. There are many factors that may close roadways and warrant the use of traffic control assistance, and local agencies are continuing to see the benefit of MCDOT REACT coordination to support their needs.

SPECIAL EVENTS

SECTION 8

This section describes agency activities supporting large special events.

2016 College Football Playoff National Championship

The Valley hosted college football's second national championship game to culminate the 2015-2016 season on January 11th, 2016 at the University of Phoenix Stadium in Glendale. ADOT TOC personnel were at the Glendale TMC and MCDOT REACT teams monitored traffic ingress and egress for the game. The City of Glendale partnered with ADOT to provide real-time traffic information to update 511 for travelers. There were many lessons learned from the previous Super Bowl that were applied to help the preparations and management of this event.

2017 NCAA Final Four Men's Basketball Tournament

The 2017 NCAA Final Four came to town from March 31 through April 3 and held numerous events at the University of Phoenix Stadium, as well as downtown Phoenix. There have been numerous lessons learned over the years that have improved special event management, including:

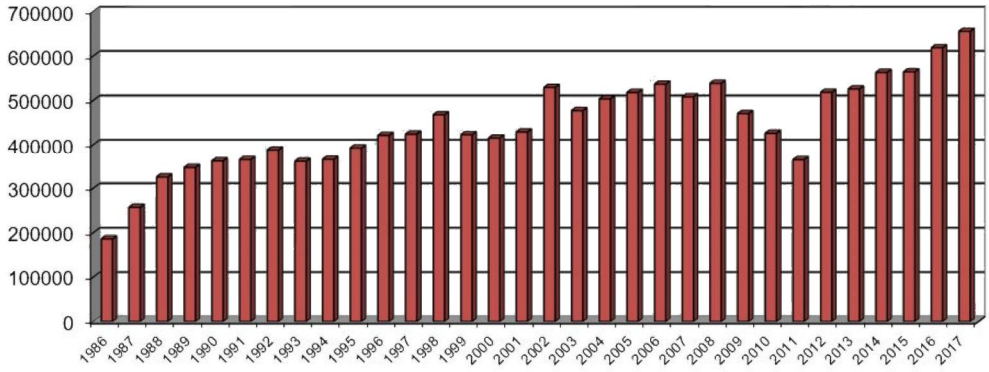
- *Multiple personnel operating from the Glendale TMC*—this time, the City of Glendale hosted not only ADOT TOC personnel, but also AZDPS (for quick clearance support), Parking Management for the Stadium (for stadium parking lot management), and Westgate Entertainment District (for Westgate parking lot management) personnel as well.

- *Coordination with neighboring jurisdictions for event signal timing support*—MCDOT and the City of Phoenix both supported this event that spanned multiple days with special event signal timing.
- *Event helicopter helped to manage traffic and operations before and after events*—Use of the helicopter allowed the Glendale Police to radio to their Dispatch and the TMC with what issues were being seen quicker and helped manage unplanned issues. The helicopter flew during the heaviest hours for ingress and egress, which is the 90 minutes before the start of the event and the first hour after the end of the event.
- *The exponential use of rideshare will change planning each year*—In 2017, the City developed a plan on how to manage rideshare. A partnership with the Stadium and the event planner used a private lot on Bethany Home Road as a "depot" lot that can hold 1,500 vehicles to help rideshare companies identify a specific location for drop off and pick up of event-goers. The City managed the traffic control for the rideshare lot and the event planner provided personnel for managing the lot. In 2017, they averaged 1,000 drop offs and 1,500 pick ups. Because of the "depot" planning, this did not disrupt traffic on other roads, but there was a significant wait time for both cars and the people waiting to access the cars. The City anticipates rideshare use to continue to rise in coming years and currently is planning to develop updated strategies.

The metropolitan region continues to show growth in experience and capabilities to support large special events.

Scottsdale Golf Tournament

Attendance at Phoenix Open (1986-2017)



The Phoenix Open has been held in Scottsdale for 24 years. More people attend each day of the tournament than attends a Super Bowl. Records continue to be broken each year for attendance, with 2017 topping out at more than 655,000 attendees during the week-long event.

Scottsdale launched its ITS in 1993 to help alleviate congestion during the Phoenix Open. The cameras implemented in 1993 reduced the manpower and time required to control traffic at special events and set the foundation for today's system. In 2014, the TMC was expanded, upgraded and relocated to the North Corporate Yard. Viewing access to the pan-tilt-zoom cameras is provided to the Scottsdale Police Department and Arizona DOT's and neighboring communities' traffic operations centers.

The City TMC has been instrumental in helping move traffic and event goers to and from the event location at the TPC Scottsdale Golf Course. The City of Scottsdale has robust traffic signal timing plans for ingress and egress traffic to support mobility around and to the event. The City has trained some of their Police force to be able to operate out of the TMC, even if normal business hour Operators are not present.

Because the City does so well in managing the event year to year, regional coordination for this annual event is not necessary. The other agencies do, however, leverage the City of Scottsdale's tactics and lessons learned to support other larger events in the region.

TRANSPORTATION SYSTEMS MANAGEMENT AND OPERATIONS PLANNING

SECTION 9

This section includes agencies that are undertaking a look at their transportation management using a new perspective.

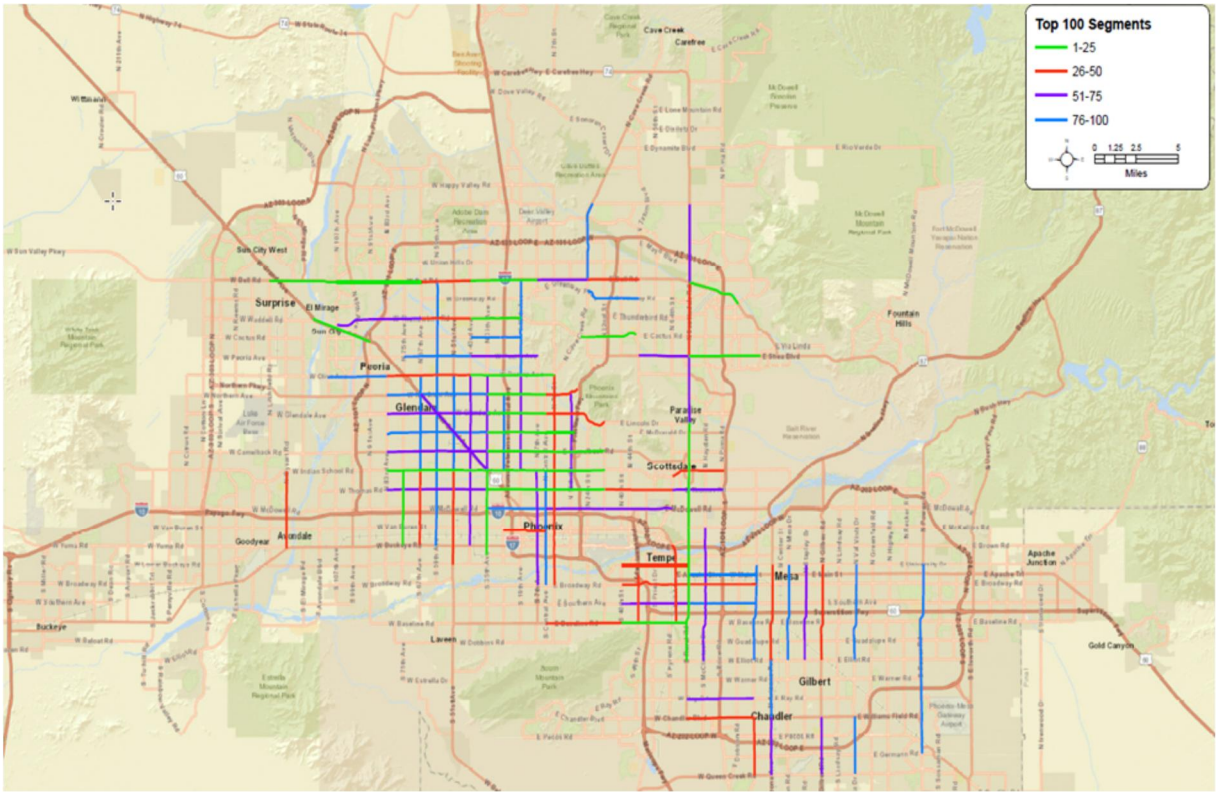
Transportation Systems Management and Operations (TSMO) includes a wide range of functions aimed at reducing delay and improving mobility – clearing traffic incidents, providing real-time information to travelers, actively managing congestion using devices and systems, and proactively developing traffic management plans for work zones and special events, among others. To accomplish this, an effective TSMO program needs enabling business processes, organizational support, and the appropriate resource allocation for operations and maintenance functions. TSMO touches all aspects of a DOT's business, including training, partnering, procurement, planning, budgeting, and strategic planning. With fewer funds available for agencies to "build their way out of congestion," improving and optimizing the current and planned transportation network is critical. Throughout the country, agencies at all levels (federal to local) are using a TSMO lens to identify a wide range of functions.

Maricopa Association of Governments Systems Management and Operations Plan

System Management and Operations (SMO) is a coordinated approach to cost-effectively manage the transportation network. SMO goes beyond a single strategy, and instead, represents a holistic approach to planning, operating and sustaining a robust suite of operational capabilities. SMO needs institutional support to integrate innovative technologies, develop new business models and partnerships, improve system reliability, and enable performance-based planning and prioritization. In the MAG region, SMO builds on current agency operations partnerships, current resources to operate and maintain critical systems, existing ITS infrastructure and operations capabilities, and sets forth a vision for a regional operations strategy that will grow with the region.

The MAG region has benefitted from multiple funding sources to build a transportation network to keep pace with growth. Proposition 400 has provided an integral level of local sales tax funding that supports freeway, arterial roads and transit infrastructure in the region. Proposition 400 will sunset in 2025, and there is a desire to pursue future sales tax funding to continue to expand and sustain the region's transportation infrastructure. Agencies in the MAG region recognize that continuing to focus on building and expanding roads is not a sustainable solution.

In 2016, MAG initiated the SMO Plan for the region. The SMO Plan looks at the needs of the MAG regional transportation system through 2030, factoring in current investments and programmed projects through the end of Proposition 400, new priorities identified through the freeway funding rebalancing, and several important changes that will influence mobility in the MAG region. The map to the right shows the top 100 segments of roadway through the region that were evaluated using a number of metrics important for improving operations. The SMO Plan was largely developed in 2016 and 2017 and will be finalized in 2018.



Buckeye Intelligent Transportation Systems Strategic Plan

The ITS Strategic Plan for the City of Buckeye was funded and managed by MAG. The current Buckeye transportation network does not experience significant challenges related to congestion or delay, and the road system is able to operate effectively without real-time management of traffic signals and other ITS devices. This ITS Strategic Plan identifies the traffic management functions that can be supported when active management of the transportation network is needed and desired by the City.

Buckeye's population is projected to increase by more than 400% by 2040. During this 20-year timeframe, Buckeye is likely to reach a "tipping point" when some combination of the following factors would warrant the implementation of a TMC for Buckeye's ITS Program. At the tipping point when ITS is needed to support traffic management, the City will need to assemble staff and resources to activate a TMC.

A major step in establishing the Buckeye ITS Program is procurement of a City-owned central traffic management system to establish a real-time operational connection to traffic signals and other ITS devices on the roadway. It will also involve establishing a TMC at the City Public Works Department. All traffic signals and devices will be connected to the Buckeye TMC via fiber optic communications to provide City operations staff with the ability to manage traffic and operate ITS devices in real time. Leading up to the tipping point, the City will be working toward establishing a robust ITS program that includes adequate staffing, training, and ongoing funding for operations and maintenance (O&M) of ITS infrastructure so that the City can independently own and operate their ITS network in-house.

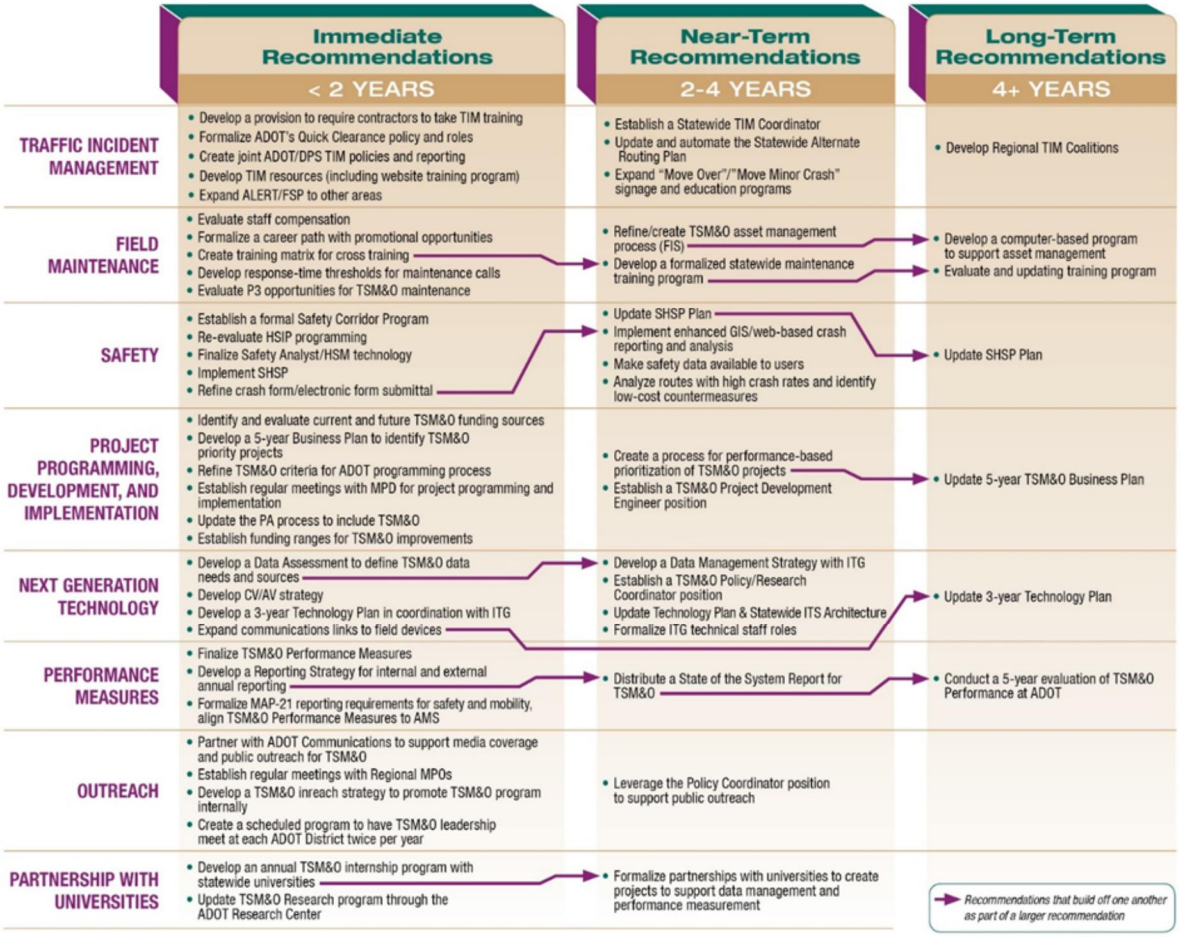
TRANSPORTATION SYSTEMS MANAGEMENT AND OPERATIONS PLANNING

ADOT Transportation Systems Management and Operations Plan

In 2017, support from top management at ADOT has helped to elevate the priority of TSMO to focus and energize around the collective, performance-driven approach to managing congestion, improving highway operations and improving safety.

In October 2015, ADOT formally established a TSMO Division. This resulted in a significant reorganization to bring together key operations, maintenance and safety functions, as well as elevate the focus on TSMO within the ADOT organization. The TSMO reorganization brought together Traffic Operations, Traffic Safety, Incident Management, Signal Operations and Signal Systems, Signing and Striping, Traffic Maintenance, Permitting (for over-dimension commercial vehicles), and the TOC into one Division. While the reorganization is structurally complete, ADOT recognizes that important processes and functions also need to be refined. Bringing key groups together is just the first step.

The purpose of ADOT's TSMO Plan is to focus on priority recommendations and strategies for improving planning for TSMO, establishing new lines of communication among key TSM&O functions within ADOT, integrating ADOT's priorities into regional planning, and elevating the understanding and awareness of ADOT's TSMO efforts within the department and throughout the state. The TSMO Plan identifies priority implementation strategies that will better align traffic, safety, maintenance and operations functions. Recommended strategies are identified within three timeframes: immediate, near-term (2-4 years), and long-term (4+ years).



Surprise Intelligent Transportation Systems Strategic Plan

The City of Surprise completed an ITS Strategic Plan. The City received federal funding through MAG and worked with ADOT project management to develop the Plan. The City had already invested in ITS communications and traffic management devices along major arterial corridors throughout the City. This Plan intended to support the City in implementing the next level of individual ITS strategies and the comprehensive ITS Program that is envisioned for the City.

Today, the City of Surprise has a comprehensive ITS network that facilitates real-time management of traffic in the City and creates connectivity between the City and the rest of the region. Surprise is in a unique position to act on this ITS Plan to maximize the use of current ITS infrastructure and focus on key areas to grow and maintain the ITS Program and technology resources.

The two main purposes for the plan is to:

- Guide the enhancement and expansion of the current ITS Program
- Help the City better leverage ITS investments for broader use for the City and travelers

A set of ITS strategies are identified in the ITS Plan that are guided by the dual purposes and driven by the needs, goals, and the opportunities for ITS that were identified by City staff from multiple departments. The set of strategies identified in the Plan are meant to provide an action-oriented roadmap that the City can pursue over time and as opportunities arise.

A set of four strategy goals were used to organize ITS strategies that align with the two purposes of the Plan. The four strategy goals are: enhance and expand ITS assets to support current and future operations, provide ITS communications structure that supports multiple City services, use ITS to provide traveler information and performance tracking, and use ITS to improve incident management and response. Further, the set of individual strategies associated with a specific goal are described in the form of 'master plans', where each master plan addresses a different aspect of the larger ITS Program, including Infrastructure, Communications, Data and Public Safety. Each of the individual Master Plans provide guidance and considerations related to the actions that the City can take to achieve the ITS plan goals. The master plans include detailed information on specific projects that can be undertaken, key programs or processes that can be put in place, and suggested updates or improvements to existing activities that may already be in place in the City.

The City has become energized around the TSMO approach to their ITS Plan that helps create a more sustainable operating environment from which to use the ITS Program. This includes such improvements that have already been realized such as ITS assets being included in their City's asset management replacement program and staffing acquisition to support TMC operations.

MULTIMODAL COORDINATION

SECTION 10

This section describes transit, bicycle, pedestrian, and rail activities in the region related to ITS and operations.

Bikeshare Use and Expansion

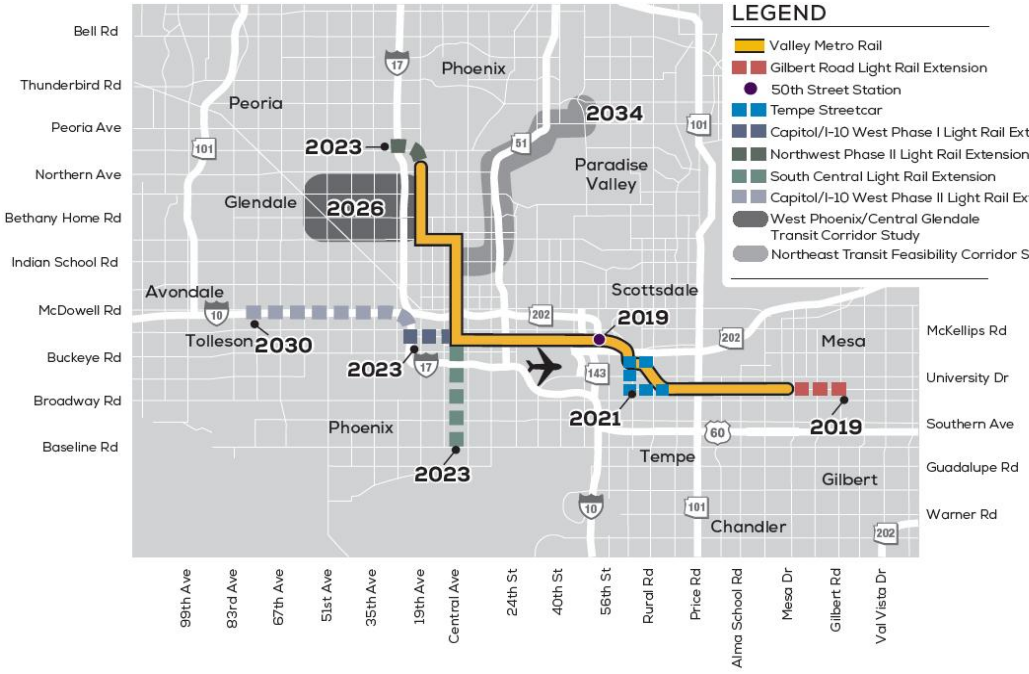
Grid Bike Share is operating a docking station bikeshare program in three jurisdictions that also are Light Rail jurisdictions: Phoenix, Mesa, and Tempe. Tempe turned on their program in May of 2017 with 300 bicycles and Phoenix's program which expanded within the last year to 700 bicycles with 49 stations and 11 payment kiosks. The Tempe BikeShare system provided over 21,000 rides in 2017 and ridership continues to grow each month. Three dockless bike share companies (Spin, Lime and Ofo) recently began operating in the City of Tempe and offer additional opportunities to shift modes. Scottsdale implemented its LimeBike program in late 2017 which is a dockless bike share that allows a user to pick up or park a bicycle around their specific trip rather than the locations of docking stations. In Phoenix during 2016, there were 47,826 trips taken by 9,927 riders for a total of 81,095 miles; this represents a 29 percent increase in trips and 30 percent increase in total miles from year prior. These bikeshare programs are anticipated to continue to expand across the Valley as more modes of transportation become more accessible beyond the single occupancy vehicle.

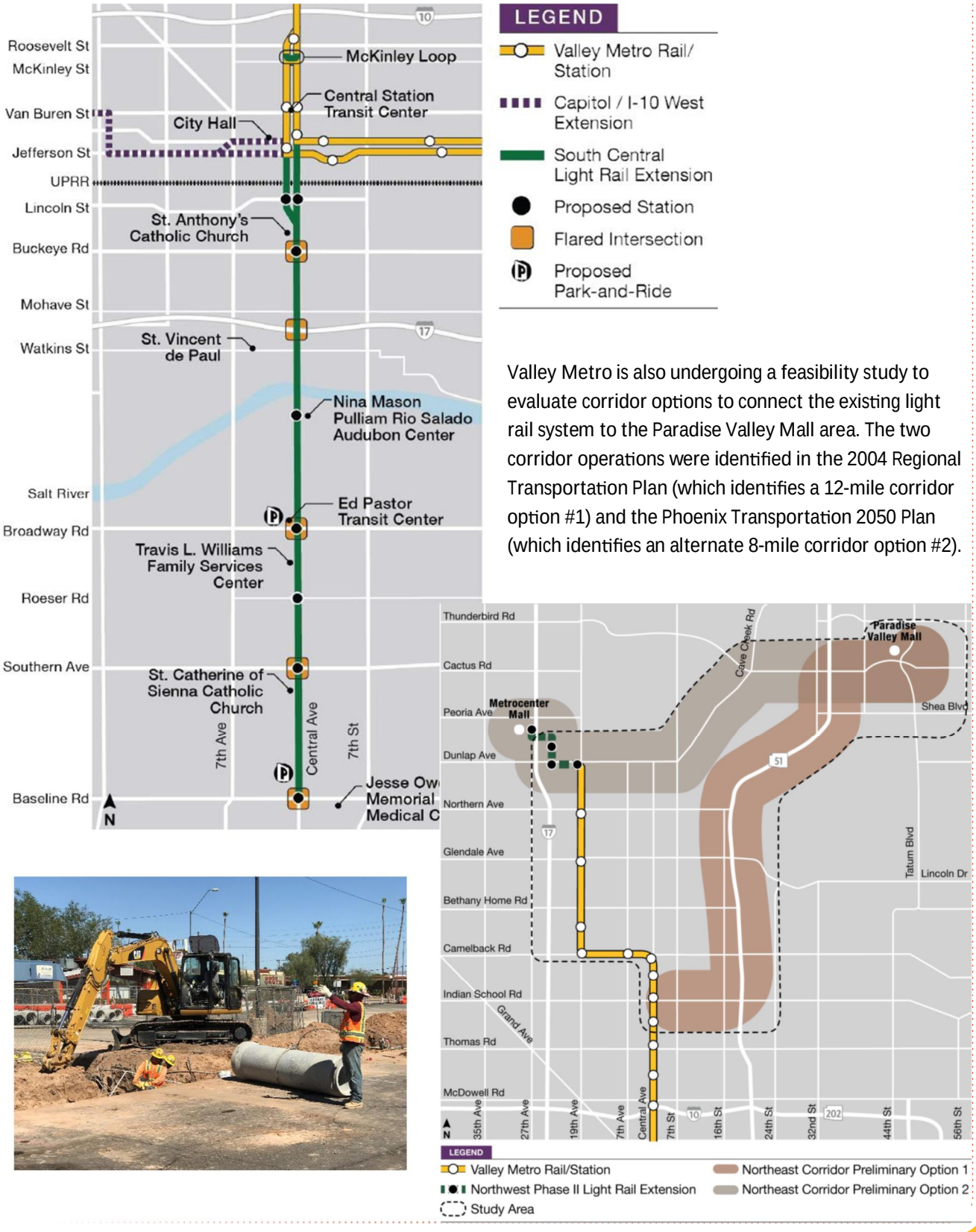
Metro Light Rail Expansions

Valley Metro continues to extend the light rail lines throughout the valley, with multiple projects currently under design or construction.

The Gilbert Road Extension will extend light rail on Main Street in Mesa from Mesa Drive to Gilbert Road. The first track is anticipated to be laid in spring 2018.

The Northwest Phase II Extension is advancing to the next phase of design while the South Central Extension is in the initial design phase.

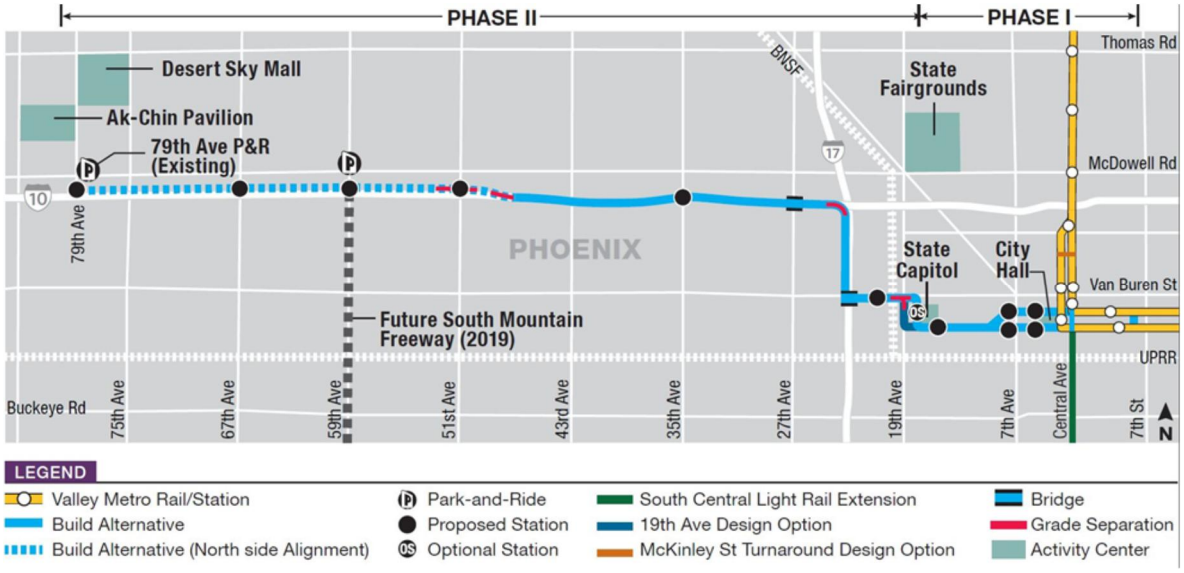




Valley Metro is also undergoing a feasibility study to evaluate corridor options to connect the existing light rail system to the Paradise Valley Mall area. The two corridor operations were identified in the 2004 Regional Transportation Plan (which identifies a 12-mile corridor option #1) and the Phoenix Transportation 2050 Plan (which identifies an alternate 8-mile corridor option #2).

MULTIMODAL COORDINATION

The environmental assessment is being drafted for the 11-mile Capitol/I-10 West light rail extension that will connect the existing light rail system in downtown Phoenix to the 79th Avenue park-and-ride along I-10.



Tempe Street Car

Tempe Streetcar utility evaluation is underway for the Valley's first modern streetcar line, where design will be completed in 2018 and open for service in 2021. It will serve one of the highest transit ridership centers in the region and connect to neighborhoods, major business centers, and regional events and destinations.

Valley Metro and Phoenix Public Transit Bus Service Improvements

In the past year, Valley Metro has expanded the bus transit system to include a new route on Ray Road (Route 140), extended Route 83 to provide new transit service on 83rd Avenue from Camelback Road to Arrowhead Transit Center, and extended Route 51 to provide a one-seat transit ride from Thunderbird Road to Pecos Road. Phoenix T2050 has funded several bus service span and headway service enhancements as well. Additionally, the City of Phoenix hired a Bus Rapid Transit (BRT) administrator and awarded multi-year planning and engineering contracts to design a multi-corridor BRT system that is slated to begin operations in 2023. These are all very positive investments that enhance transit operations, performance and attractiveness of the regional transit system.

SECTION 11 WHAT'S NEXT?

Glendale Safety Message Campaign

In response to an increasing annual fatality rate, the City of Glendale Police Department began working with other city departments to reduce traffic collisions. In 2017, the Glendale TMC began posting safety messages on their arterial dynamic message signs, such as IT'S OUR TOWN PLEASE SLOW DOWN. Partnering with enforcement on critical safety corridors, this was the only change to traffic management during the year. As a result of the campaign, reduced fatality rate and lower number of tickets are anticipated due to speed compliance by the end of 2018.

Peoria Intelligent Transportation Systems Strategic Plan Being Completed in Early 2018

The City of Peoria is in the process of completing their updated ITS Strategic Plan which will guide the city's investments in technologies into the future. The City is already leading the way in innovative uses of TMC capabilities and this Plan will outline the next steps and initiatives the City will use to partner with additional departments and agencies for traffic mobility and incident response support.

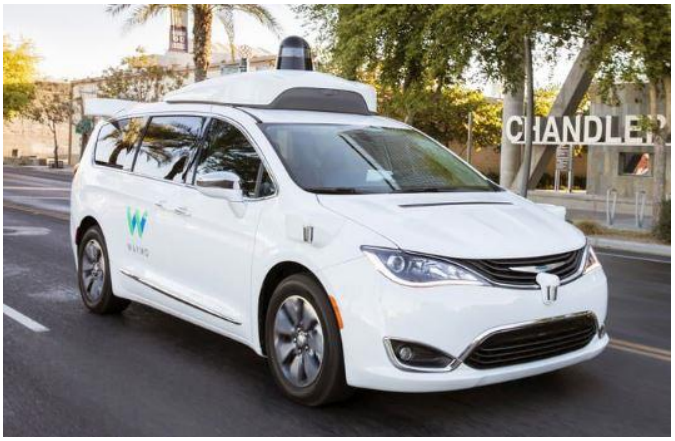
Tempe Becomes the first Arizona City to Adopt Vision Zero Resolution

Vision Zero is a traffic safety policy towards achieving safety for all road users. The goal is to achieve a reduction in the number of fatal and serious injury crashes to zero in Tempe, because no loss of life is acceptable. In early 2018, the City of Tempe adopted a Vision Zero framework resolution, becoming the first City in the state to do so. The Tempe Transportation Division is developing a comprehensive framework with the goal to have it completed in the next 12 to 18 months.

VISION ZERO TEMPE

Chandler Pursing Amending City Zoning for Driverless Cars

In early 2018, Chandler proposed to include autonomous vehicles in its zoning code. City planners introduced the proposal that looks to a future in which less parking is needed because of self-driving cars and ride-sharing. The proposal would encourage new developments to include drop-off and pick-up areas for people using autonomous vehicles or ride-sharing. In exchange, the city could reduce up to 40 percent of the project's required parking. *Source: Digital Trends*



AZTECH PARTNER AGENCIES

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