



Arizona Department of Transportation

Transportation Systems Management and Operations (TSM&O) Plan

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Prepared for:



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In association with:



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ACRONYM LIST

ADOA – Arizona Department of Administration	JOPS – Joint Operations Policy Statement
ADOT – Arizona Department of Transportation	LPA – Local Public Agency
ALERT – Arizona Local Emergency Response Team	LRTP – Long Range Transportation Plan
ATDM – Active Transportation and Demand Management	MAG – Maricopa Association of Governments
ATM – Active Traffic Management	MAP-21 – Moving Ahead for Progress in the 21 st Century
AV – Automated Vehicles	MCS – Maintenance Contract Services
BqAZ – Building a Quality Arizona	MDOT – Michigan Department of Transportation
CAD – Computer Aided Dispatch	MPD – Multi Modal Planning Division
CATT – Center for Advanced Transportation Technology	OCI – Office of Continuous Improvement
CCTV – Closed Circuit Television	P2P – Planning to Programming
CDOT – Colorado Department of Transportation	P3 – Public Private Partnership
CHART – Coordinated Highways Action Response Team	PA – Project Assessment
CMAQ – Congestion Mitigation and Air Quality	PAG – Pima Association of Governments
CV – Connected Vehicles	PeMS – Performance Management System
DCR – Design Concept Report	PSA – Public Service Announcement
DMS – Dynamic Message Sign	RADS – Regional Archived Data System
DOT – Department of Transportation	RCN – Regional Community Network
DPS – Arizona Department of Public Safety	RPF – Request for Proposals
DSRC – Dedicated Short Range Communications	RSA – Road Safety Assessment
ECD – Enforcement and Compliance Division	RWIS – Road Weather Information System
FHWA – Federal Highways Administration	SHA – State Highway Administration
FMPO – Flagstaff Metropolitan Planning Organization	SHSP – Strategic Highway Safety Plan
FMS – Freeway Management System	STIP – State Transportation Improvement Program
FTE – Full Time Employee	TIM – Traffic Incident Management
FTP – File Transfer Protocol	TIP – Transportation Improvement Program
HCRS – Highway Conditions Reporting System	TRAC – Transportation Research Center
HSIP – Highway Safety Improvement Program	TOC – Traffic Operations Center
HURF – Highway User Revenue Fund	TRCC – Traffic Records Coordinating Council
ICM – Integrated Corridor Management	TSM&O – Transportation Systems Management and Operations
IDO – Infrastructure Delivery and Operations	TTG – Transportation Technology Group
IFB – Invitation for Bid	VSL – Variable Speed Limits
IGA – Intergovernmental Agreement	WSDOT – Washington State Department of Transportation
ITD – Intermodal Transportation Division	YMPO – Yuma Metropolitan Planning Organization
ITS – Intelligent Transportation Systems	
JOC – Job-Order-Contracting	

1 INTRODUCTION AND OVERVIEW

The Arizona Department of Transportation (ADOT) is in an exciting stage of transition. Support from top management levels at the Department has helped to elevate the priority of Transportation Systems Management and Operations (TSM&O), which is the collective, performance-driven approach to managing congestion, improving highway operations and improving safety. TSM&O 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, proactively developing traffic management plans for work zones and special events, among others.

To accomplish this, an effective TSM&O program needs enabling business processes, organizational support, and the appropriate resource allocation for operations and maintenance functions. TSM&O touches all aspects of a DOT's business, including training, partnering, procurement, planning, budgeting, and strategic planning.

1.1 Need for Transportation Systems Management and Operations Approach

Arizona DOT has accepted the challenge from Arizona Governor Doug Ducey to strive for improvement and efficiency within every state agency, every day. Recognizing the important ways that Arizona's transportation system supports the economy and livability of Arizona's communities, ADOT is seeking innovative ways to address some of the transportation system's biggest challenges:

- Expanding capacity cannot be the only option to address congestion on the state system – cost effective solutions need to be added to the congestion toolbox;
- Reducing the number of fatalities on public roads, and specifically on the state roadway system, is a top priority;
- Actively manage and minimize recurring congestion;
- Actively manage non-recurring congestion, like incidents that block lanes or severe weather patterns that make driving hazardous and cause unpredictable delays for travelers;
- Reducing the impact of planned events (like a work zone or large-scale special event) to minimize delay and keep traffic moving; and
- Increasing the implementation and use of technology to manage congestion, as well as keeping technology investments up to date and functioning properly.

A TSM&O focus will help ADOT continue to identify innovative ways of operating, managing and maintaining the state's transportation network.

1.2 Elevating TSM&O at ADOT

In October 2015, ADOT formally established a TSM&O Division. This resulted in a significant reorganization to bring together key operations, maintenance and safety functions, as well as elevate the focus on TSM&O within the ADOT organization. The TSM&O reorganization brought together Traffic Operations, Traffic Safety, Incident Management, Signal Operations and Signal Systems, Signing and Striping, Traffic Maintenance, Permitting (for over-dimensional commercial vehicles), and the Traffic Operations Center (TOC) into one Division.

ADOT TSM&O Division Vision:

To operate our transportation system for safe, reliable, efficient, and cost-effective means of transporting people, commerce and data.

Mission:

Integrated program to optimize the performance of existing infrastructure through implementation of systems, services, and projects to preserve capacity and improve reliability and safety of our transportation system.

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.

Prior to the reorganization, ADOT participated in an FHWA-sponsored Capability Maturity Assessment and TSM&O Implementation Planning effort. This assessment consisted of a one-day facilitated workshop examining internal processes across the following key dimensions of organizational capabilities:

- *Business Processes (planning and programming)* – budgeting, strategic planning, long-range planning
- *Systems and Technology* – using standards, effective procurement processes for technology, ITS architecture
- *Performance Measures* – gathering and analyzing data, reporting on trends, integrating performance data into operations
- *Culture* – leadership support for TSM&O, understanding of TSM&O throughout the department
- *Organization and Staffing* – trained staff, adequate staff resource allocation to TSM&O functions, career path, recruiting and retention
- *Collaboration* – internal partnering across agency groups and divisions, external partnering with key TSM&O stakeholders

ADOT identified the capability levels for each of these dimensions. Several priorities resulted from this assessment, including the need to develop a TSM&O Program Plan to help guide future efforts related to TSM&O within the organization.

1.3 TSM&O Plan Structure

The purpose of this TSM&O Plan is to focus on priority recommendations and strategies for improving planning for TSM&O, 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 TSM&O efforts within the department and throughout the state.

The TSM&O 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).

Key sections in this document include:

- **ADOT Current TSM&O Capabilities**– provides an overview of current ADOT operations, programs and processes, partnerships and infrastructure and systems related to TSM&O. The section also identifies some key gaps and challenges that exist.
- **National Experiences and Practices** – provides a summary of experiences from other state DOTs who are early adopters of TSM&O programs and strategies and provide some exemplary processes in areas such as planning, staffing, culture and collaboration, that ADOT can consider adapting for its TSM&O program.

- **ADOT TSM&O Program and Strategies** – describes specific recommendations within eight priority categories, including discussion about key steps and inputs for each recommendation as well as identification of a timeline for implementation of the strategy and anticipated outputs that look to address needs, goals and gaps identified in the Current TSM&O Capabilities section.
- **TSM&O Implementation** – identifies key elements for successful implementation of this TSM&O Plan including partnering priorities, implementation priorities, and key resources and funding requirements. In addition, it identifies various challenges and potential barriers that ADOT might encounter when implementing the recommendations in the Plan as well as some potential solutions to consider.
- **Updating the Plan** – identifies the ways that this TSM&O Plan will be used and a plan for periodically updating it to make sure that it remains current and relevant.

2 ADOT CURRENT CAPABILITIES

2.1 ADOT TSM&O Structure and Organization

ADOT has undergone a substantial agency-wide reorganization to optimize performance of existing transportation infrastructure, preserve capacity, and improve the safety and reliability of the transportation system. The TSM&O Division brought together existing traffic engineering, operations, safety, and traffic maintenance groups as part of the reorganization. With some roles created and others redefined, the intent behind the reorganization was to better and more efficiently coordinate among these groups and provide for a common mission toward an operations-focused culture. The TSM&O Division organization structure is shown in Figure 1.

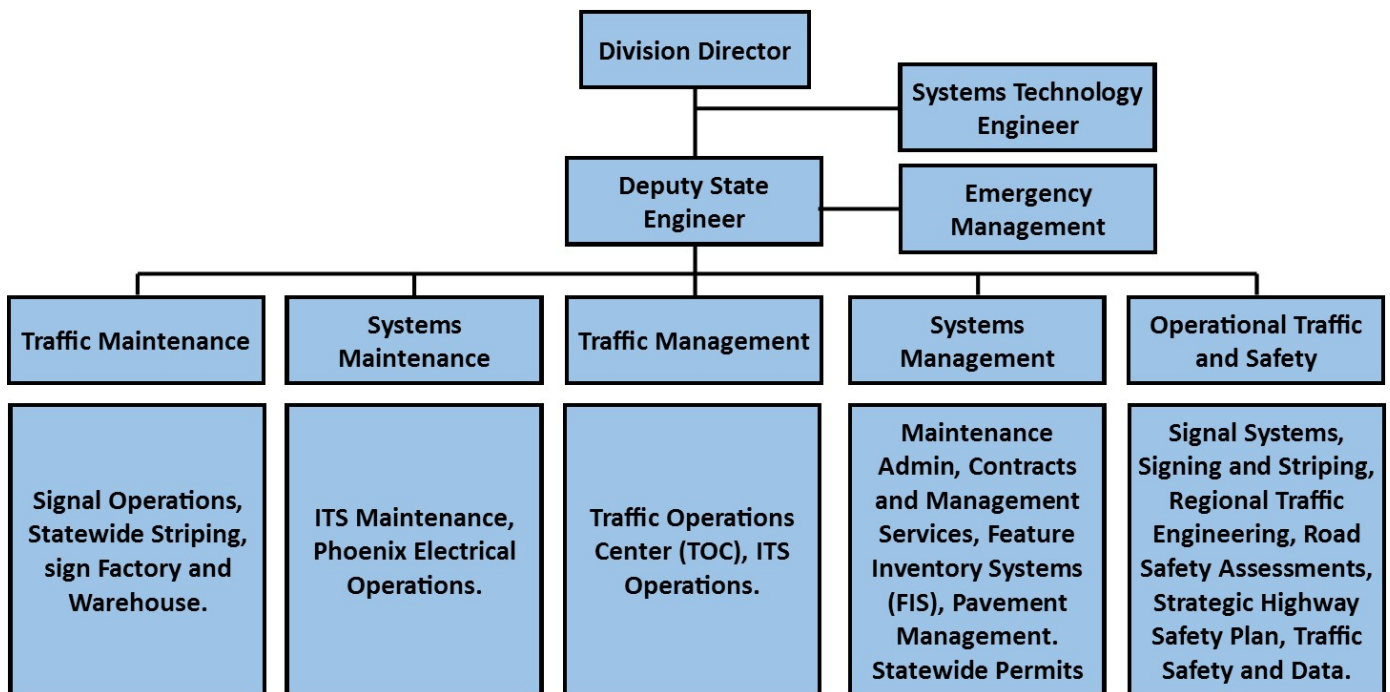


Figure 1 – ADOT TSM&O Divisional Organization Chart (2016)

2.2 ADOT Project Development Processes

The ADOT project development process includes the steps to identify, plan, program and construct projects that help preserve and expand the ADOT transportation network. The Long-Range Transportation Plan (LRTP) provides a strategic vision as well as specific direction for system investment decisions based on four categories. These categories, as well as the recommended funding allocation breakdown for the 2035 planning horizon includes (source: ADOT 2035 LRTP):

- *Modernization* (29% of funds) – highway improvements that upgrade efficiency, improve functionality, and improve safety without adding capacity;
- *Expansion* (27% of funds) – improvements that add transportation capacity through the addition of new facilities and/or services;
- *Preservation* (34% of funds) – activities that preserve transportation infrastructure by sustaining asset condition or extending asset service life; and

- *Non-Highway Modes* (10% of funds).

TSM&O strategies would largely fall into the ‘modernization’ category; however, TSM&O-based improvements can be included in larger projects that fall within the ‘expansion’ and ‘preservation’ categories.

Based on the LRTP, the ADOT Five-Year Program identifies those projects that are funded for construction within the five-year time horizon. This work program is adopted by the State Transportation Board and is revised annually. ADOT’s process for prioritizing and funding projects that are submitted for inclusion in the Five-Year Program is called “Planning to Programming” (P2P). The P2P process is a performance-based process for linking transportation planning to capital improvement programming and project delivery. Within P2P, evaluation criteria are identified for each investment category (preservation, modernization, expansion and non-highway) which correlate to the performance measurements anticipated by Moving Ahead for Progress in the 21st Century (MAP-21) as well as a set of universal criteria, or System Planning Criteria, that each project is evaluated against.

In its current form, the P2P criteria does not consider many TSM&O-specific measures, such as travel time reliability. As part of the planning process, the TSM&O Division is coordinating closely with the Multimodal Planning Division (MPD) to provide input on TSM&O criteria. That way, TSM&O strategies and needs can be evaluated against traditional expansion projects. **Figure 2** provides details about the evaluation criteria for each project category and the general system criteria.

<u>Preservation</u>	<u>Modernization</u>	<u>Expansion</u>
Bridge		
Sufficiency Ratings	Delay Reduction	Travel Time Savings
Conditions Ratings	Traffic Flow Improvement	Future Traffic Volume
Detour Length	Total Crashes	Future Freight Flow
Scour Criticality	Expected Crash Reduction	
Fracture Criticality		
Pavement		
Ride Quality		
Structural Integrity		
<u>System Planning Criteria</u>		
Freight Flow		Multimodal Enhancement
Strategic Corridor		Supports Statewide Plans
Cost Effectiveness		Local Input

Figure 2 – Current P2P Evaluation Criteria

Currently, ADOT does not have a TSM&O planning or programming process in place to supplement the ADOT 5-Year Program. However, ADOT does have planning documents related to some specific ITS infrastructure and functions that are included within TSM&O. These documents include:

- Statewide Dynamic Message Sign (DMS) Master Plan (August 2010);
- Arizona Statewide ITS Architecture (2013); and
- Freeway Management System (FMS) Communications Master Plan (2010).

2.3 TSM&O Systems and Functions

2.3.1 Statewide Traffic Operations

ADOT operates a robust Freeway Management System (FMS) in the Phoenix and Tucson metropolitan areas consisting of closed circuit television (CCTV) cameras, large overhead DMS, ramp meters, mainline detectors, and fiber communications.

ADOT owns 574 **traffic signals** along state-owned facilities and at freeway interchanges. There are additional traffic signals within ADOT right-of-way that are operated and maintained by local agencies through an intergovernmental agreement (IGA). Over 100 of the 574 ADOT-maintained signals in the Phoenix urban area are connected to TOC where signal operations can be monitored and changed. A similar program for Signal Communications Centralization is also deployed and evolving in Tucson. ADOT signals throughout the state that are not connected to communications infrastructure operate on independent signal timing plans.

The TOC operates, views and manages statewide ITS infrastructure. The TOC is centrally located in downtown Phoenix and is staffed 24x7x365. Staff includes operators, public information/communications staff, and an AZDPS officer. The ADOT TOC first launched in 1995, and was upgraded in 2013 to newer technology and to accommodate additional staffing positions on the operations floor. **Figure 3** show the video wall and operator workstations at the ADOT TOC.



Figure 3 – ADOT TOC Operations Room

CCTV cameras are used for congestion management and incident detection and confirmation. Streaming images are shared with other local transportation departments in the Phoenix valley through the Regional Community Network (RCN) of fiber communications. CCTV images are provided to the media (through direct feed) as requested for use in broadcasts or news coverage. In Tucson, the City of Tucson has direct feed to freeway CCTV.

Dynamic message signs display a wide range of information, including roadway closures, incident or weather warning/alerting, evacuation notices, AMBER/Silver/Blue Alerts, travel times, planned special event traffic information, pre-warning of construction or restrictions, Public Service Announcements (PSAs) and high pollution

advisories. Although the complete FMS does not extend to rural areas, ADOT has numerous DMS located on I-10, I-40, I-17, and other major travel routes throughout the state. All ADOT's DMS are connected to the TOC and can be accessed by operators.

Ramp meters are at most on-ramps in the Phoenix metro area, and they are activated by time-of-day scheduling (operational hours) and based on mainline traffic flows. ADOT is currently testing a system for smart ramp metering that will initially be implemented in the Phoenix metropolitan area and provide dynamic operations for ramp meters based on real-time conditions.

Detectors are installed as part of the FMS in Phoenix and Tucson, and are used to detect the presence of vehicles on both the freeway mainline and ramps. They collect various types of real-time data, including volume, speed, and vehicle occupancy. Weigh-in-motion systems measure vehicle loading, but these systems are not usually linked for live viewing.

Road Weather Information System (RWIS) sensors detect specific weather/pavement/atmospheric conditions that could impact roadways. ADOT has a statewide network of 17 RWIS that provide information on precipitation levels, pavement temperature, humidity, visibility, and wind speeds. Winter weather seasonally impacts the northern part of the state each year along I-40, I-17, and US 93. Dust storms and wind impact parts of I-10 (primarily the segment between Phoenix and Tucson) and the southern part of the state. In both cases, RWIS are imperative to determining appropriate operational response to road weather conditions.

ADOT is investigating innovative technologies as part of planning projects around the state to improve information dissemination and response to localized and recurring road conditions. One example is variable speed limit signs and detection devices to provide dust detection and warnings along I-10. This system will warn drivers to slow down ahead of a dust blowing area on I-10. While there is static signage that currently provides a warning, the variable speed system would display a recommended speed for the driving conditions.

2.3.2 Traffic Incident Management

ADOT is a key partner in Traffic Incident Management (TIM) activities throughout the state, particularly in coordination with the Arizona Department of Public Safety (AZDPS). Starting in 2015, an AZDPS trooper has been co-located in the ADOT TOC 20 hours per day, 5 days a week, and is a liaison and incident manager during freeway incidents. ADOT coordinates with local jurisdictions regarding freeway detours or anticipated impacts where there is an established agreement in place to do so, such as along Loop 101 in Scottsdale. Additional agreements for incident management and response coordination are also in progress.

The AZTech TIM Coalition in the Phoenix metropolitan area brings together several incident response partners to coordinate on incident debriefings and after-action reviews, TIM response performance, and specific TIM training. Many ADOT personnel throughout the state have participated in the formal TIM responder training program, and ADOT has several certified trainers who can facilitate the TIM training.

ADOT's Arizona Local Emergency Response Team (ALERT) supports freeway incident response and clearance. ALERT is comprised of two teams of ADOT maintenance volunteers that support traffic control and end of queue warning during freeway incident response and clearance. Volunteers are ADOT staff members who are on-call 24/7/365 to respond to any emergency call. Rural incident detection and response relies largely on dedicated AZDPS patrol, local law enforcement in the area, and ADOT District staff.

2.3.3 Traveler Information

ADOT operates the AZ511.gov website and 511 phone service that provides traveler information statewide. AZ511 leverages the investments that ADOT has made in statewide devices, weather sensors, freeway

management systems, incident data from the Highway Condition Reporting System (HCRS). HCRS is a statewide incident and event tracking database that provides information to 511 phone, web and external partners.

Dynamic message signs are an important tool that ADOT uses throughout the state to warn of closures, restrictions, upcoming construction, delays, and hazardous weather conditions impacting travel. ADOT also uses the DMS to provide freeway travel time estimates in the urban areas. Travel times are provided on nearly all urban area DMS.

ADOT Communications is active with social media including Twitter, Facebook and an online Blog. They also complete a high volume of one-on-one phone calls with drivers and commercial operators and coordinate with media outlets throughout the state. Communications staff is on-site at the ADOT TOC and actively post updates about closures, weather events, crashes and other impacts to Arizona's highway system.

Although ADOT has capitalized on traveler information infrastructure and modern methods to communicate with the traveling public, many of the forms of communication require internet or cell phone accessibility, which may be limited in rural parts of the state, and not all travelers use smart phones or the internet to determine their travel route. ADOT is not currently promoting its mobile-optimized web page developed as part of the AZ511.gov web site, other than a link from the AZ511.gov home page.

2.3.4 TSM&O Maintenance

Within the TSM&O Division, there are three maintenance groups that support the maintenance and upkeep of specific aspects of the state highway system. The **Striping** crews are regional teams who implement and maintain necessary striping on the roadway and associated components. The striping group conducts annual inspections of the roadways in their region to identify areas that need to be re-striped. The **Signing** maintenance staff make sure that proper signage is deployed and that it is compliant with federal and state regulations. Staff in signing will do annual visual inspection of signage at night in their designated area to make sure that it is adequately visible and properly installed. Finally, the **Signal** maintenance crews are responsible for any signal maintenance that arises within a designated region. The signal crews are highly specialized positions, as the staff must be trained to work with high voltage and specialized signal equipment. All three maintenance crews rotate the responsibility for being on-call for emergency repair. When a traffic signal is reported to be malfunctioning or damaged in an incident, the on-call maintenance crew is responsible for responding to and fixing the issue.

2.4 Internal and External Coordination for TSM&O

The hub of much of the operations activity, especially with respect to operations, is the TOC in Phoenix. ADOT's activities related to incident response, notifications, traveler information dissemination or work zone coordination is handled at the TOC. For incidents, the TOC coordinates with ALERT and ADOT Roadway Maintenance crews, who support incidents with local staff. The TOC staff is in direct communication with District staff throughout the state.

In the Phoenix area, there is strong momentum to improve coordination among ADOT and local agencies regarding operations and activities that involve a freeway and parallel arterial routes. These include Integrated Corridor Management (ICM) activities, signal optimization (optimizing the timing of an ADOT signal at an interchange with the local signals along a corridor), and special events planning and execution, such as sports games or other large events. Scottsdale and Phoenix have developed detour routing plans in coordination with ADOT as part of an ICM Plan. These plans identify the routes and processes to detour freeway traffic to a local, parallel arterial in the event of a freeway closure. ADOT partners with local cities and Maricopa County DOT in the metropolitan area to develop these alternate routing plans.

In the Phoenix and Tucson metropolitan areas, there many interchange ramp signals that are owned by the State but operated and maintained by the local agencies via an IGA. Outside of the metropolitan areas, there is less formal coordination between ADOT and local agencies in relation to signal timing.

The ADOT TOC and State Emergency Management coordinate with adjacent state DOTs to provide information and operational support during incidents or inclement weather events that impact the interstate freeway. Additionally, ADOT recently signed an agreement with adjacent states to develop I-10 into a “Connected Corridor” from California to Texas. The focus of this initiative is to address freight mobility and provide seamless connectivity for freight along this key interstate route.

2.5 Data and Performance Management

The performance of the ADOT transportation system and its assets are reflected in performance measures. ADOT’s ability to sustain TSM&O and articulate a business case for investing in TSM&O is going to be dependent on ADOT’s ability to articulate performance outcomes and benefits, both of which support the need for a robust and comprehensive data and performance management strategy. ADOT has several data sources, but few ways to integrate data, and even fewer ways to automate the analysis and reporting. Some data is provided by existing infrastructure technology (ex: traffic volume data is collected by detectors embedded in some ADOT roadways); other data is collected from or calculated based on multiple data sets (level of service of roadways).

Table 1 provides an overview of the databases and data management tools for data collection, tracking and management.

Table 1 – Existing ADOT Databases and Data Management Tools

Name of Tool	Description
Feature Inventory System (FIS)	Online asset management system used to track roadway infrastructure.
ITS Device Log	Log of ITS devices in the field, such as FMS, statewide DMS, and RWIS, and the communications status of the device.
Arizona Transportation Asset Management System (AZTAMS)	Geographical Information Systems (GIS) Data Clearinghouse for authoritative data.
Safety Data Mart (SDM) [Accident Location Identification and Surveillance System (ALISS)]	Record of all reported motor vehicle crashes in Arizona as reported annually by cities, counties and other local law enforcement entities.
Highway Conditions Reporting System (HCRS-2)	Statewide closure and restriction information that is used to populate the 511 website and phone system. Supports tracking incident response and clearance measures.
Highway Performance Monitoring System (HPMS)	National database of highway information that is required of each state. Data is collected by and for the states and submitted to the FHWA on an annual basis.
Average Annual Daily Traffic (AADT)	ADOT collects traffic volume data for interstates, US Routes and State Routes throughout Arizona on an annual basis.
Transportation Data Management System (TDMS)	Online tool that collects and generate reports based on traffic count data from detection stations throughout the state and provides count data and speed analysis.
State Highway System Log	Route-by-route highway inventory for all State Highway System facilities.
Loop Speed Data	Database that collects and stores data from loop detectors and archives them for future use and analysis
Regional Archived Data System	Database that collects data from ADOT and regional and local partners

Name of Tool	Description
(RADS)	in the MAG planning area.

From a TSM&O perspective, ADOT tracks incidents, response and clearance times, traveler information system metrics (usage of 511 and social media) and system device operations. There are plans to expand the TSM&O performance tracking and management both in response to the MAP-21 requirements and to support the TSM&O program and outreach.

ADOT’s MPD is responsible for much of the external reporting on various performance metrics for ADOT. The State Highway System Performance Report, last completed for 2014, includes metrics for infrastructure health (pavement and bridges), safety, freight, and congestion (highway peak travel time index). <http://azdot.gov/performance-report/index.asp> ADOT MPD is updating its performance reporting strategy in response the Map-21 Performance Management Measures. **Figure 4** shows ADOT’s approach to linking Planning to Programming (P2P). The P2P will elevate the role of performance-based planning, as well as work toward meaningful measures that will help to inform investment priorities.

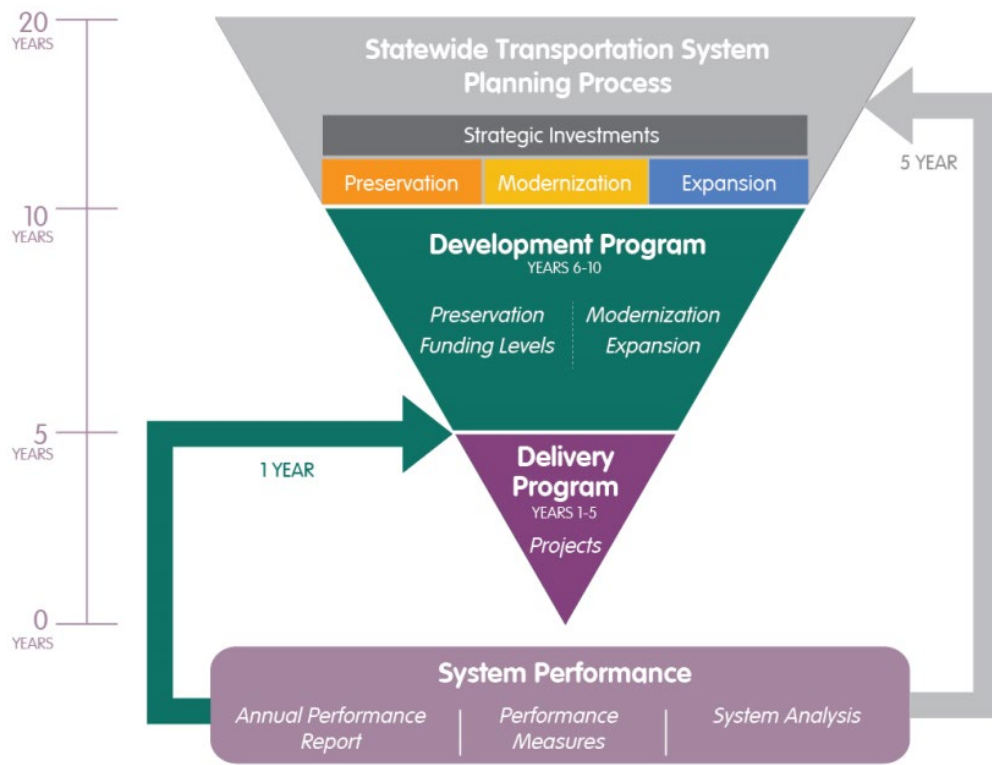


Figure 4 – ADOT Planning to Programming (P2P) Process and Timeframes

Under MAP-21, the FHWA established a set of performance measures for State DOTs to use. DOTs are required to report on these measures to assess the performance of the Interstate and non-Interstate National Highway System. Performance measures are identified for three categories: Safety, Infrastructure and System Performance. For the TSM&O Division, the Safety and System Performance measures, are the most relevant because the Infrastructure measures consider condition/performance of pavement and bridges only.

Table 2 – MAP-21 Performance Management Measures for Safety and System Performance

Performance Measure	Measure Applicability
Safety	
Number of fatalities	All public roads
Rate of fatalities	All public roads
Number of serious injuries	All public roads
Rate of serious injuries	All public roads
Number of non-motorized fatalities and non-motorized serious injuries	All public roads
System Performance	
Percent of the Interstate System providing for reliable travel	The Interstate System
Percent of the non-Interstate NHS providing for reliable travel	The non-Interstate NHS
Percent of the Interstate System where peak hour travel times meet expectations	The Interstate System in urbanized areas with a population over 1 million.
Percent of the non-Interstate NHS where peak hour travel times meet expectations	The non-Interstate NHS in urbanized areas with a population over 1 million.
Percent of the Interstate System mileage providing for reliable truck travel time	The Interstate System.
Percent of the Interstate System mileage uncongested	The Interstate System.
Annual hours of excessive delay per capita	Projects financed with CMAQ funds in all nonattainment and maintenance areas for one or more of the criteria pollutants under the CMAQ program.
Total tons of emissions reduced from CMAQ projects for applicable criteria pollutants and precursors	Projects financed with CMAQ funds in all nonattainment and maintenance areas for one or more of the criteria pollutants under the CMAQ program.

Source: National Performance Management Measures: Assessing Performance of the National Highway System, Freight Movement on the Interstate System, and Congestion Mitigation and Air Quality Improvement Program. Table 2 (<https://www.regulations.gov/document?D=FHWA-2013-0054-0092>)

3 NATIONAL EXPERIENCES AND PRACTICES

Several states are in the process of formalizing TSM&O as a program. A review of national case studies and best practices of agency TSM&O programs and structures was conducted to provide a context for other states’ initiatives and lessons learned. This review included research and interviews with other state DOTs to provide lessons learned and guidance on facets of a TSM&O program that ADOT could consider as part of new or changing TSM&O strategies. Research for the best practices focused on states that have new or emerging TSM&O programs, as well as states with established TSM&O programs and success stories.

Peer states included those that were initiating TSM&O reorganizing activities as well as those that already have established TSM&O programs. Several key practices emerged from the discussions, and those are detailed in this section. **Table 3** below contains a summary of states interviewed and researched.

Table 3 – Summary of National Experiences and Practices

Capability Dimension	Specific Interest Area	Peer State
Business Processes (planning and programming)	<ul style="list-style-type: none"> Integrating TSM&O into long-range planning Project development Budgeting for TSM&O HQ vs. District/Regional responsibilities 	<ul style="list-style-type: none"> Caltrans Connected Corridors Florida DOT (FDOT) TSM&O Planning Maryland Coordinated Highways Action Response Team (CHART) Planning Iowa DOT TSM&O Plan and program
Systems and Technology	<ul style="list-style-type: none"> Technology planning Future technology initiatives Procurement 	<ul style="list-style-type: none"> Michigan AV/CV Strategic Plan, Active Traffic Management, and test beds Colorado DOT (CDOT) designated staff for Connected/ Autonomous Vehicle (CV/AV) and program branding (RoadX)
Performance Measures	<ul style="list-style-type: none"> Data collection, data sources Performance reporting Integrating performance data into operations and planning Aligning agency performance metrics (safety, asset mgmt., mobility) 	<ul style="list-style-type: none"> Washington DOT (WSDOT) Gray Notebook Caltrans Annual Bottleneck report Michigan DOT Congestion and Mobility Performance Measure Report CDOT Performance Plan
Culture	<ul style="list-style-type: none"> Leadership support Department-wide understanding Policy 	<ul style="list-style-type: none"> Caltrans (Director Policy) WSDOT integrating TSMO into multiple disciplines Florida DOT TSMO Leadership team Maryland TSM&O Steering Committee
Organization and Staffing	<ul style="list-style-type: none"> Staff/resource allocation TSM&O job descriptions Specific TSM&O staffing needs In-house vs. outsourced Partnering with Universities 	<ul style="list-style-type: none"> Caltrans Connected Corridors CDOT staff realignment – new positions Maryland DOT, WSDOT, FDOT, and Michigan DOT partnerships with universities Iowa District TSM&O Engineer positions Wisconsin DOT and Georgia DOT staff support contracts
Collaboration	<ul style="list-style-type: none"> Internal and external partnerships Key operations initiatives (ATM, ICM, TIM) 	<ul style="list-style-type: none"> WSDOT TIM and Joint Operations Policy Statement Maryland TIM CDOT Corridor partnerships Georgia DOT Highway Emergency Response Operators (HERO) partnership

Research and interviews with states that have emerging and established TSM&O programs yielded common themes and practices that ADOT can consider:

- Focusing on Traffic Incident Management can build momentum for other TSM&O strategies;
- Realigning functions to better support TSM&O objectives;
- Modifying or creating TSM&O staff roles and descriptions to meet specific TSM&O needs;
- Corridor focus can improve stakeholder collaboration and operations; and
- Elevate performance management to articulate the impact of TSM&O.

This section describes these common themes and identifies specific applicability for ADOT's TSM&O program.

1. Focusing on Traffic Incident Management can build momentum for other TSM&O strategies.

A focused TIM program can help to build momentum for other TSM&O strategies by bringing key stakeholders together to address incident management goals and objectives. This kind of collaboration can translate into improved lines of communication, exchanging data, and a noticeable, positive impact on overall system safety and reliability. In Maryland, the TIM focus became a catalyst for a host of other improvements, including multi-agency collaboration, freeway management technologies, and traveler information. Policies, such as the Washington State's Joint Operations Policy Statement (JOPS), help to elevate TIM within partner organizations and establish consistent goals. The JOPS is a joint policy among Washington State DOT, Washington State Police, Washington Fire Chiefs. It outlines roles and responsibilities for traffic incident management, goals (timeframes) for incident clearance, coordinated performance reporting, and it has served as an important foundation for a wide range of TIM-related program enhancements. It has also served as a model for similar collaborative TIM policies in Nevada, Nebraska, and Illinois focused on multi-agency responses and time targets for incident clearance (90-minute incident clearance times).

Applicability to ADOT TSM&O Strategies:

Continue to expand and formalize ADOT's role for TIM statewide, including partnerships with law enforcement, emergency responders, tow operators and other local stakeholders. Clarify ADOT's role for incident response and establish a consistent interpretation statewide. Consider formalizing policies to support TIM, including roles and responsibilities, processes for incident debriefings, and performance metrics. Expand TIM program statewide in partnership with Arizona DPS and local responders throughout the ADOT Districts. Identify key resources, equipment, and processes to formalize ADOT's TIM role statewide.

2. Realigning key functions to better support TSM&O objectives.

Like Arizona DOT's TSM&O reorganization, Colorado and Tennessee brought together specific functional areas to increase synergies and coordination. Tennessee DOT's Traffic Operations Division was established in 2013, and shifted Traffic Engineering from the Maintenance Division and ITS from the Design Division. The Traffic Operations group includes Traffic Engineering, Operations & Safety, TMCs and TIM and traveler information. In Colorado, the ITS, Safety, and Traffic Engineering Branches were brought under the TSM&O Division. New positions were established, including a TSM&O Director, Corridor Operations Managers and a Planning, Performance & Transportation Demand Manager were established. Most of the organizational changes with Colorado's TSM&O program occurred with the headquarters group, but there are efforts to foster increased coordination with the Regional Traffic Engineers. CDOT is piloting a regional TSM&O Deputy Director in one region (Denver). This position will serve as a champion and manager of key TSM&O activities, including traffic engineering, operations assessments, integrated corridor management planning and implementation, work zone reviews, TIM coordination and other functions. This Regional position liaises with the CDOT TSM&O Division Director. There could be opportunities to establish similar roles in other CDOT Regions.

Applicability to ADOT TSM&O Strategies:

ADOT's reorganization has already brought together key groups to support TSM&O, and was recently expanded to include the Safety group. ADOT's TSM&O Division can coordinate resources and budget needs across the different groups in the Division to help maximize available funding for TSM&O priority functions and activities. There also is an opportunity to create champions for TSM&O outside of the central TSM&O group in Phoenix.

3. Modifying or creating TSM&O staff roles and descriptions to meet specific TSM&O needs.

In states where reorganizations have happened (or are in progress), leadership has had to designate staff to support TSM&O, as well as update job descriptions to reflect specific TSM&O needs. Colorado DOT designated new positions for Corridor Operations Managers and Highway Incident Commanders, Planning and Performance, as well as staff positions to support specific technology initiatives. Through the Caltrans Connected Corridors, the agency is piloting some revised staff roles to better support corridor operations and partnerships. Iowa is looking to designate a TSM&O Engineer in each District to support district-level TSM&O initiatives.

Applicability to ADOT TSM&O Strategies:

Through the reorganization that established TSM&O, ADOT created new groups and staff leadership descriptions. With potential focus areas of Traffic Incident Management, additional technologies (such as Connected and Autonomous Vehicles), and large-scale corridor coordination efforts, ADOT can consider designating additional specific roles/staff positions to meet these needs. Similarly, staff job descriptions for traffic engineering and traffic maintenance should be periodically reviewed to be sure that roles are aligning with any expanded priorities or responsibilities.

4. Corridor focus can improve stakeholder collaboration and operations.

Corridors provide a good opportunity around which to organize. Tackling specific issues, a consistent set of stakeholders, and a common goal among partners has helped to elevate the TSM&O focus on such corridors as I-40 in Tennessee, I-70 and I-25 in Colorado, pilot corridors in California, and I-90/I-5 in Washington. Multi-state corridors, such as the new I-10 Corridor Coalition, the I-95 Corridor Coalition, and the I-15 Mobility Alliance expand the TSM&O focus across state lines.

Applicability to ADOT TSM&O Strategies:

ADOT is a partner with the Maricopa Association of Governments (MAG) and other local partners for the I-10 Integrated Corridor Management planning effort, and is leading some near-term improvements for the I-17 and I-10 corridors in the Phoenix metropolitan area. ADOT is a partner for the multi-state I-10 Corridor Coalition, with Caltrans, New Mexico DOT and the Texas DOT. There is an opportunity for ADOT to lead or participate in corridor coordination efforts for additional corridors throughout the state, for example, pilot expanded TIM programs on key corridors, or implement connected/autonomous vehicle pilots on specific highways (such as key commerce corridors).

5. Elevate performance management to articulate impact of TSM&O.

Agencies such as Washington, Tennessee and Florida have established performance management programs for operations, and publish performance data online as well as in reports. Performance management takes performance measures a step further and integrates performance information into operations strategies, such as informing agencies about key needs and gaps to be addressed. Performance data can be used to establish the

business case for TSM&O, support future TSM&O initiatives, and help to communicate, internally and externally, the benefits of the TSM&O program.

Applicability to ADOT TSM&O Strategies:

ADOT’s TSM&O staff currently report on specific safety and congestion metrics to the ADOT Director. ADOT also contributes freeway-related performance data to regional performance reporting processes, including the MAG MPO Performance Dashboard (www.performance.azmag.gov) and the AZTech Operations Performance Indicators Book. With the MAP-21 requirements, ADOT has initiated some of the required performance reporting. The Multimodal Planning Division has a leadership role for the current MAP-21 reporting, and with the System Performance Measures proposed rulemaking will provide a set of measures that will need to be addressed. These measures require ADOT to explore data needs and options for acquiring statewide data. ADOT has identified several potential performance measures for TSM&O, and will need to develop a plan to initiate roll-out of those measures, secure data (potentially real-time probe data), and develop reporting formats. In addition to the MAP-21 measures, additional performance measures should be developed for internal management of field devices.

3.1 Business Processes (Planning and Programming)

Having the ability to identify, plan and program TSM&O program elements and projects is often a challenge due to the non-traditional nature of TSM&O projects and timelines. Business processes refer to internal process for planning, coordinating project priorities, project approvals, and overall business rules within an agency. States that are most successful use foundational planning documents and/or overarching agency initiatives to provide support for TSM&O programs and initiatives.

- **Project Programming:** Few states have specific TSM&O line items in the Statewide Transportation Improvement Program, although budgets for TSM&O functions are accounted for through operations, maintenance, signals, traffic, incident response, and other related budgets. Florida DOT has an Operations budget as part of the Five-Year Work Program that covers traffic signals and signal systems, safety programs, TOC operations, TIM, traveler information, weather monitoring, and non-Turnpike toll operations. Although the term TSM&O is not specifically articulated in any of the project line items, they are part of the TSM&O program and staff responsibilities. The Maryland CHART program projects are identified and accounted for in the Maryland Five-Year Consolidated Transportation Program for the State Highway Administration. Projects are reviewed and approved for inclusion, and each project includes potential funding sources (special state funding, federal funding or other) and a line item. These are primarily equipment projects (CCTV, DMS, various ITS devices), and do not need to be programmed as part of other capital improvements.
- **Planning: Iowa DOT’s** TSM&O Program aligns with the Iowa DOT Strategic Plan has three components: (1) the TSM&O Strategic Plan, (2) the TSM&O Program Plan, and (3) the TSM&O Service Layers Plan. The purpose of the Strategic Plan is to facilitate and advance systems management and operations integration into the mission of Iowa DOT. The Program Plan develops a business case for TSM&O, organization and administration frameworks, roadmap and performance measures. The eight service layers (or TSM&O tools) that are included in the Service Layers Plan are: traffic management center; ITS and communications; traveler information; traffic incident management; emergency transportation operations; work zone management; active transportation and demand management; and connected and autonomous vehicles.
- **Planning: Caltrans** recently established a Connected Corridors program that provides a statewide framework for implementing enhancements focused on ICM and multimodal operations to key corridors throughout the state. District 7 (Los Angeles) was the first to establish a pilot corridor through this program. Operations planning focuses on key ICM principles including data/information sharing among partners, addressing multimodal needs, and elevating operational processes to better respond to incident and balance corridor capacity (freeway and arterial networks). This District 7 effort resulted in a reorganization of District

operations staff. At the District level in Caltrans, most major projects are programmed through local MPO Transportation Improvement Programs, and are funded through a combination of state and local sales tax funding.

- The **Maryland CHART** Program is well established. In 2013, CHART developed a Long-Range Strategic Deployment Plan, which references the MD State Highway Administration (SHA) Business Plan. The CHART Plan identifies typical costs for ‘traditional’ functions (incident management, traffic and roadway monitoring, emergency weather operations), and presents bundled costs by program area for ‘expanded’ functions (ICM, signal timing) to meet the plan’s objectives. CHART also factors in 20 years of operations and maintenance costs into its total program estimates.

3.2 Systems and Technology

Several state DOTs operate freeway management systems, TOCs and other core technologies for system operations. A few states are focusing on next-generation technologies and preparing their organizations for the unique challenges and opportunities.

- The **Michigan DOT** developed a CV/AV Strategic Plan in 2013. This plan has helped to elevate interest and leadership support for technology initiatives and has helped MDOT be recognized as an innovator and early adopter of new and emerging technologies. For more than 10 years, MDOT has had a partnership with the automotive industry, and has helped to demonstrate and test connected and autonomous vehicles, and has expanded its research program to include crowd-sourced data and technology and innovative ways other units within the DOT could use these new data sources. The Strategic Plan helped to focus on several key areas that would guide MDOT’s overall program: Leadership, Safety, Customer Service, Partnerships, System Linkages and Efficiency. These categories align with the overall Department strategic goals.
- Following its reorganization in 2014, the **Colorado DOT** established the RoadX program. RoadX establishes a vision for leveraging technology and innovative partnerships to advance system operations, better manage Colorado’s road networks to make Colorado a leader in system reliability and road safety. Colorado is piloting connected vehicle technologies on the I-70 mountain corridor, which is prone to seasonal traffic volumes to and from the Denver metropolitan area and nearby ski resorts. As part of the RoadX program, a dedicated manager for CV/AV was established who is responsible for identifying research needs opportunities, establishing key partnerships, and coordinating with local agencies and peer states.

3.3 Performance Measures

There has been a growing focus at state DOTs on performance monitoring, reporting and overall performance management. Performance monitoring and reporting can help to demonstrate effectiveness of TSM&O strategies, identify gaps in strategies, evaluate corridor operations under different types of conditions, and help agencies focus their TSM&O resources (staff, equipment, and systems) toward high-impact TSM&O activities. Key to performance monitoring is the availability of data. Instrumenting a statewide highway network with detectors and communications infrastructure is not feasible. Many states are using statewide speed data from private sector vendors to support both operations as well as performance monitoring. The following provide brief summaries of three state DOTs and how they use performance data.

- The **Washington State DOT** has had a long-standing program to report system performance measures called “The Gray Notebook”, which is published quarterly and available on the DOT website. From a TSM&O perspective, the Gray Notebook tracks and reports on delay on key corridors, incident response times and multimodal measures (ferry on-time departures and rail schedule adherence). The report shows goals and performance against goals, trends from the last reporting period as well as annual and five year trends. WSDOT also issues an annual Corridor Capacity Report to provide performance data on the state’s highway system.

- **Caltrans** has a Mobility Performance Reporting and Analysis Program that reports on congestion and mobility metrics statewide and by District. Key metrics include: vehicle miles of travel, vehicle hours of delay/bottleneck locations, lost lane miles (lost productivity), and system detector health. These are quarterly reports that compare to the prior quarter and the prior year. Districts are responsible for reporting for their corridors and detectors to Caltrans headquarters. Caltrans is in the process of updating its approach to publishing annual reports, but does report the quarterly District reports on the Caltrans site. Caltrans also maintains a statewide performance data tool to support performance analysis, the Performance Measurement System (PeMS). This database includes traffic detectors, incidents, toll tag data and lane closure data. Several MPOs in California also track and publish regional performance metrics. In the San Francisco Bay Area, the MPO has acquired probe data from a vendor to support bottleneck analysis and corridor performance reports.
- **Michigan DOT's** Congestion and Mobility Performance Measure Report provides User Delay Costs, Speed Profiles and reliability information on all freeway routes within the State of Michigan using probe data. MDOT is using this data to help identify congested areas, when congestion occurs and how often, corridor rankings, causes of delay, and more. Before and after studies of signal optimization projects or road improvements can be made to verify if proposed improvements to congestion have been realized. Probe data has also been used to help calibrate traffic models.

Michigan DOT was among the first states outside of the I-95 Corridor Coalition to procure statewide real-time data from a probe data vendor. This data supports travel time displays on highways throughout the state, and helps to inform performance monitoring. Michigan DOT contracts with the University of Maryland to use the Regional Integrated Traffic Information System (RITIS) for performance monitoring and reporting. Congestion performance monitoring is accomplished almost exclusively through probe data, and the probe data also is used for before-and-after studies.

3.4 Culture

Leadership and commitment to TSM&O from the top-levels of management helps provide support for TSM&O programs through resources, policies and staff. Many foundational TSM&O programs emerged because of management directives which helps command a shift in culture towards TSM&O at an agency.

- **Colorado DOT's** TSM&O program was established through a Director's Directive in 2013. The reorganization to establish the TSM&O Division included establishing the role of a Division Director, and this position was included among the core operating units. Strong support from the Executive Director enabled a series of changes aimed at mainstreaming TSM&O throughout the Department. Some of these changes included new processes, including an operations review for construction projects, as well as the ability to create needed positions (such as the RoadX program manager, highway incident commanders and corridor managers) to advance specific TSM&O objectives.
- With the recent finalization of the **Maryland** TSM&O Strategic Implementation Plan, the SHA and partner agencies are placing emphasis on developing and implementing a sustainable TSM&O Program at MDOT/SHA. This began with the creation of a new TSM&O Program Manager position to facilitate institutional and programmatic TSM&O strategy integration within existing SHA offices. The TSM&O Program Manager reports to the TSM&O Executive Committee. The TSM&O Executive Committee and Steering Committee promote a supportive culture for TSM&O both inside and outside of SHA and raise overall TSM&O awareness. The development of a TSM&O Program is consistent with MDOT/SHA's Mission, Business Plan, Long-Range Plan, and Excellerator performance management system.
- The **Florida DOT** has embraced TSM&O at the headquarters and District levels and has had a formal TSM&O program in place since 2010. There is a TSM&O Leadership Team that includes Headquarters TSM&O leadership and TSM&O program leads from each of the FDOT Districts. This Leadership team is responsible

for updating the Strategic Plan and reviewing the District Business Plan progress. Each District must prepare a plan for TSM&O deployment, integration, operations and maintenance and report on progress as part of scheduled leadership team meetings.

3.5 Organization and Staffing

The commitment to TSM&O implementation and advancement is evidenced at several agencies that have made changes to staff allocation and focus:

- **CDOT** does not have a cap or limit on staff numbers, but rather has a budget allocation. This gives TSM&O some flexibility in defining roles and specific staff responsibilities that can support key TSM&O objectives. New positions include Corridor Managers for the I-70 and I-25 corridors; these positions report directly to the TSM&O Director, and will coordinate with multiple CDOT regions and partner agencies. Each of these corridors also has a Highway Incident Commander focused on improving planning and response to incidents. CDOT also established a Planner/Performance Manager/Modeling position to focus on those specific needs for the TSM&O division and improve alignment with CDOT planning activities.
- The **Caltrans** Connected Corridors program has put a key focus on advancing integrated corridor management strategies for the state's most congested corridors. To enable this, changes at the Caltrans District organizations have happened to assign corridor managers and key staff responsible for performance management, partnerships and maintenance. At the headquarters level, staff positions have been created and modified to better support aligning planning and operations.

To address staff and resource needs for TSM&O, several states contract out maintenance for ITS devices.

- **Wisconsin DOT** began contracting out maintenance of ITS hardware to vendors in 2007. As part of an RFP, WisDOT requires the following services out of their contracted maintenance vendor: field device troubleshooting and diagnosing; communications troubleshooting and diagnosing; reinstalling damaged traffic ramp meter signal poles, controllers, and cabinets; repairing damaged cable and conduit, including fiber optic cable; traffic signal and ramp meter LED lamp repair or replacement; electronic sign repair or replacement; verification of communication system integrity; repair of equipment; concrete base installation or repair; and field device system integration.
- In March 2012, the **Louisiana DOT** awarded a \$6 million contract for a vendor to provide maintenance of the state's ITS and operations infrastructure and systems (including the TMC and traveler information website) for a three-year period. The Contractor is responsible for maintaining: CCTV cameras; DMS; radar and video vehicle detector technologies; Highway Advisory Radios; fiber optic and wireless communications; Traffic Management Centers; communications equipment/network; telephone systems; traveler information web site; ramp meters; portable changeable message signs; weigh-in-motion; toll facilities; and traffic signal systems.

There are multiple examples of states that have used contractors to operate their traffic management centers. One example is in Georgia when the **Georgia DOT** contracted out their TMC operations in 2010 for the original price of \$21 million over six years. As part of this contract, contractors were responsible for project management, system performance and benefits reporting, incident time line process improvement, updating the Georgia Regional ITS Architecture Benefit/Cost Analysis for NaviGator System, as well as TMC staffing and training.

There are numerous states who actively partner with universities to support key operations tasks and objectives. Although not a new development because of the focus on TSM&O, these partnerships serve several purposes: support research for new technologies and approaches; support agency and project tasks, and; develop the future workforce.

- The **Washington State DOT** has a long-standing partnership with the University of Washington (UW) and Washington State University (WSU). The Washington State Transportation Center (TRAC) was formed initially

to coordinate research efforts for WSDOT across the two universities. Staff at UW are actively engaged in WSDOT projects and research, and students help to support data analysis, performance reporting and projects.

- The **Florida DOT** actively engages universities to conduct research and advance the Department's research program. FDOT also offers internships for university students as part of District TSM&O Divisions.
- The University of **Maryland** Center for Advanced Transportation Technology (CATT) is integrally involved in projects for the Maryland SHA, Federal Highway Administration, and the I-95 Corridor Coalition. Students also are involved in projects for the Washington DC metropolitan area.

3.6 Collaboration

Partnerships are an integral component of agency TSM&O programs. Among the most visible are those partnerships for traffic incident management.

- **WSDOT** participates in a formal policy with the Washington State Patrol and the Washington Fire Chiefs to provide coordinated incident response and management. The Joint Operations Policy Statement (JOPS) is a governance document that outlines roles and responsibilities for incident management and response, enforcement, support resources (tow and major tow services, motorist assist), and using technology for incident investigations. The JOPS also outlines requirements and standards for data sharing and performance reporting for WSDOT and WSP. The JOPS has been in place since 1999, and is reviewed and updated approximately every two years.
- Traffic incident management was a foundational element in the **Maryland** CHART program. CHART is a partnership among Maryland SHA, Maryland DOT, the Maryland State Police, and the Maryland Transportation Authority. In 2011, the SHA partnered with State Farm to sponsor the response vehicles and provide the resources to be able to expand the program (addition of two vehicles). CHART includes both incident response and motorist assist.
- **Colorado** has established corridor partnerships for major interstate corridors in the state. The I-70 Corridor is an important route through the Denver metropolitan area and connects tourists and recreational travelers to the mountain ski areas. To address the mobility and safety needs of this corridor, CDOT, the Colorado State Police and numerous local agencies have aligned as part of the I-70 Mountain Corridor. CDOT and partners have focused on building stakeholder relationships, coordinating with local businesses, improving traveler information, and deploying systems to improve safety and mobility.

There are many examples of DOT's that have partnered with third party companies to provide sponsorships for various programs. The most prominent type of service derived from these sponsorships are freeway service patrol programs. Many states participate in such programs. One example is the **Georgia DOT** HERO program. HERO is a freeway service patrol program where HEROs are dispatched to traffic-related incidents with the primary duty to clear roads so that normal traffic flow is restored. In 2009, GDOT entered a five-year agreement with State Farm, which was renewed in 2014, to increase funding for the HERO program. As part of the agreement, State Farm provided annual funding for the HERO program and, in exchange, GDOT put State Farm logos on patrol vehicles, operator uniforms, and various service signs throughout the service area.

4 ADOT TSM&O PRIORITIES

This section includes critical gaps and opportunity areas for TSM&O at ADOT which were identified and explored in greater detail during a full-day long workshop held on June 28th, 2016 in Phoenix, Arizona. The following section identifies and describes a set of strategies and projects that address some prominent challenges faced by the TSM&O Division at ADOT and take advantage of opportunities that will be most impactful to ADOT operations as well as the organizational success of the TSM&O Division.

The strategies are divided into eight categories that represent TSM&O priorities:

- Traffic Incident Management;
- Field Maintenance;
- Safety;
- Project Programming, Development and Implementation;
- Next Generation Technology;
- Performance Measures;
- Outreach; and
- Partnerships with Universities.

4.1 Recommendation Timeframes

For each of the priority categories, a set of strategies has been identified based on the gaps, needs and priorities of that category. Some of the strategies are stand-alone projects, while other strategies are composed of several projects that should occur in succession over multiple timeframes. The strategies are categorized into timeframes: immediate (<2 year), near-term (2-4 year) and long-term (4+ year) and are shown in **Figure 5**.

Immediate Strategies

Immediate strategies are those that are ongoing or should be pursued within two years of this Plan's development. There are several strategies that are categorized as Immediate. Some strategies are those that ADOT has already started in 2016 and in early 2017. Completion of these strategies will give ADOT an 'early win', and the results can help create a foundation and momentum for other projects. Other strategies that are categorized as Immediate are those that are critical first steps of larger projects and those that are a high priority for the current or near-term day-to-day operations of ADOT.

Near-Term Strategies

Strategies that were categorized for Near-Term implementation are those that are high priority and high impact, but require additional time, effort or funding to implement. Near-Term projects involve external coordination with partners or research prior to being able to initiate them. Some projects are also a second step or follow up project to a strategy that will be undertaken in the Immediate timeframe.

Long-Term Strategies

The Long-Term (4+ year) timeframe is largely made up of projects that involve updating or evaluating plans, programs or processes that are developed in the first four years of the TSMO Program. In addition to the updates identified, this timeframe should include a project to update the TSMO Program Strategies that are identified in this section. As new priorities and opportunities arise, a new list of strategies and projects should be identified and documented.

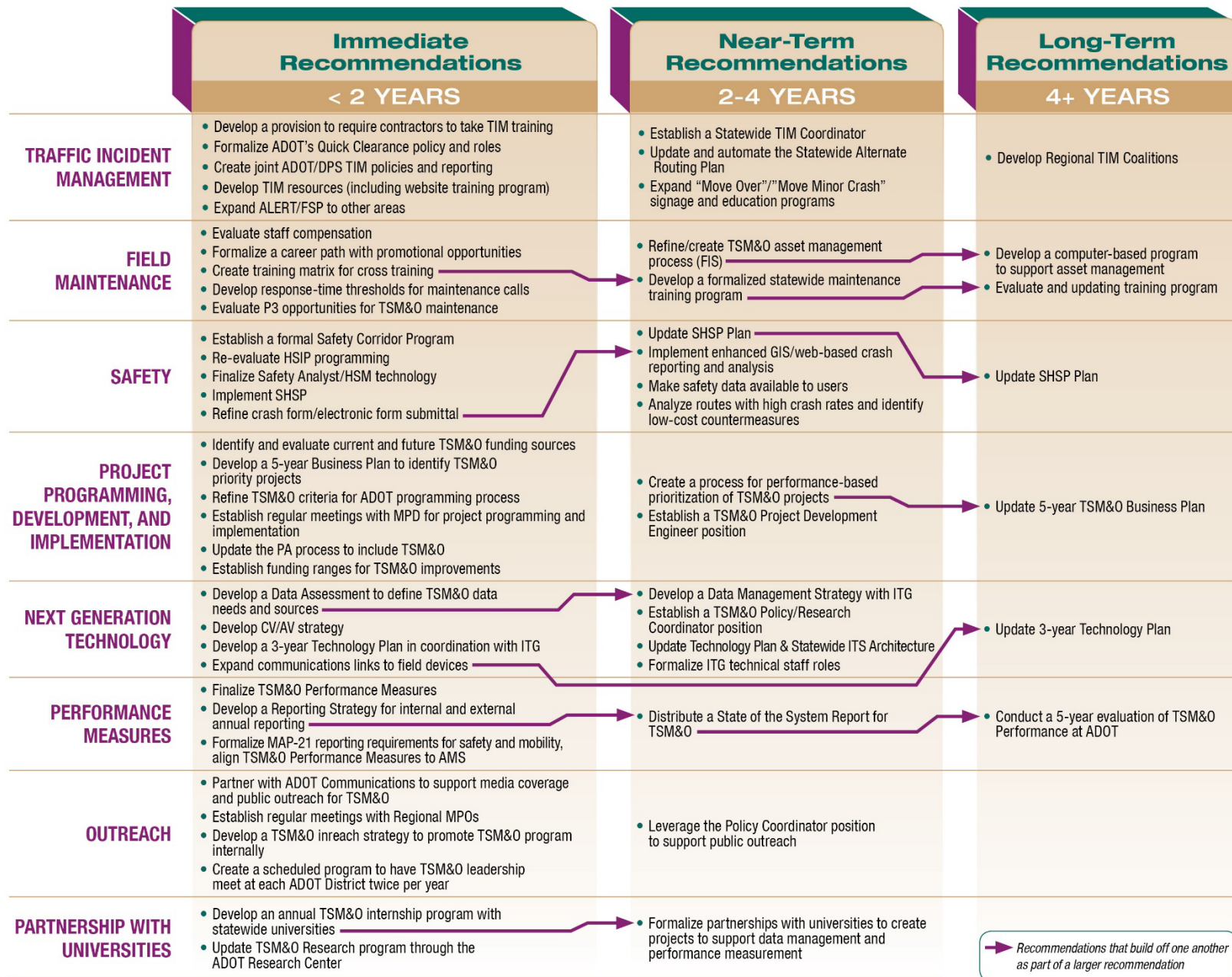


Figure 5 – ADOT TSM&O Implementation Priorities

4.2 Recommended Strategies

Figure 5 provides an overview of the recommended TSM&O strategies for this ADOT TSM&O Plan. Strategies are organized by category and timeframe. The following section provides an overview of the eight priority categories and the strategies that have been identified for each. **Appendix A** provides greater detail for each strategy including a description of the strategy, a list of the step-by-step actions that should be taken to complete the strategy, the anticipated strategy timeframe, any required inputs for the strategy, and the strategy's anticipated outcomes.

4.2.1 Traffic Incident Management

Traffic Incident Management plays a pivotal role in ensuring safety and reducing congestion on ADOT roadways. The FHWA estimates that approximately 50% of all delay is non-recurring congestion, and that drivers across the United States burn over 2.8 billion gallons of gasoline and spend 4.2 billion hours in traffic delays each year because of traffic incidents.

DPS is currently leading AZTech TIM Coalition in the Phoenix metropolitan area, and has been a leader with ADOT statewide in helping to advance TIM training. Many agencies in Arizona play a role in incident response. There is a need for greater coordination and leadership related to consistency in policies, availability of programs to help improve incident response and management, and improving clearance.

Recommended strategies related to traffic incident management are found in the list below and are described in greater detail in Appendix A.

- Develop a provision to require contractors to take TIM training, and include this requirement in future contracts. Build on language that AZDPS has developed for the tow contractor TIM training requirements.
- Develop an MOU for incident management between Infrastructure Delivery and Operations (IDO) and TSM&O.
- Formalize ADOT's Quick Clearance Policy and roles.
- Create joint ADOT/DPS TIM policies and reporting, including incident debriefings. This also will include a consistent platform for monitoring and tracking incidents for TIM and Emergency Management.
- Establish a central resource for ADOT (web site) for information on TIM, available TIM resources, policies, and links to external TIM resources and best practices.
- Establish a statewide TIM Manager who can serve as a lead for ADOT's TIM coordination and program, and coordinate ADOT's incident response across the state.
- Update and automate ADOT's statewide alternate routing plan.
- Expand response and assistance program to include incident response vehicles in all ADOT districts.
- Develop regional TIM Coalitions throughout the state.

4.2.2 Field Maintenance

Maintaining the State roadway network in a state of good repair is a key component of ADOT's core mission and is important for the safety of travelers and customer satisfaction. Limited staff numbers and high staff turnover have been identified as issues that have had significant impacts on the maintenance units' ability to complete their work effectively and efficiently. High staff turnover is largely attributed to non-competitive compensation packages and unpredictable work hours and workloads. In addition, ADOT personnel have identified insufficient training resources as a hindrance in the progress of new hires.

Recommended strategies related to field maintenance are found in the list below.

- Evaluate field maintenance staff compensation to identify opportunities to be more competitive.

- Formalize a maintenance career path with promotional opportunities.
- Develop a maintenance staff training and continuing education program and have training resources available to maintenance staff in all Districts.
- Measure the Division's goal to network ADOT signals (urban and rural) which will allow signal operations and timing changes from the TOC.
- Develop response-time thresholds for maintenance calls to help staff prioritize call-outs, as well as promote understanding of response times with partner agencies.
- Develop a formal asset management program for TSM&O.

4.2.3 Safety

Safety of State roadways is the highest priority to ADOT. There are a variety of programs, processes and systems used to help maintain safe roadways, but many of these programs need upgrades and improved delivery. The recommended strategies in this section look to improve the efficiency and robustness of safety data collection and analysis, and improve project identification for safety throughout the State.

- Establish a formal Safety Corridor program.
- Analyze routes with high crash rates and identify low-cost countermeasures.
- Re-evaluate HSIP programming.
- Finalize Safety Analyst/Highway Safety Manual technology.
- Update crash reporting to implement enhanced GIS/web-based reporting and analysis. Make data more accessible to ADOT Divisions and groups.
- Implement and update the 2014 Strategic Highway Safety Plan.

4.2.4 Project Programming, Development and Implementation

A challenge with TSM&O projects is that they often do not fit into the traditional categories for DOT projects which usually are either large capital projects, such as constructing or re-constructing new facilities, or routine maintenance. Because of this, there are no standardize procedures within ADOT to identify or program/fund many types of TSM&O projects. TSM&O enhancements might need to be addressed in a shorter timeframe than traditional capital construction projects. The five-year programming cycles are challenging in a rapidly changing technology environment.

This set of strategies looks to put into place mechanisms to identify, prioritize and program TSM&O projects within the large ADOT programming process as well as internally within the TSM&O Division so that TSM&O projects can be implemented. There are opportunities to embed TSM&O into the project development and design phases.

- Identify and evaluate current and future TSM&O funding sources and assure that they are being maximized.
- Develop a 5-year TSM&O Business Plan and identify priority projects.
- Refine TSM&O criteria for ADOT programming process in coordination with MPD.
- Update Project Assessment (PA) process to identify where TSM&O considerations need to be included/addressed, and which processes TSM&O should own (such as Transportation Management Plans).
- Establish regular meetings with MPD for project programming and implementation.
- Establish a TSM&O project development engineer position that can help to coordinate among multiple districts, identify opportunities to address TSM&O needs within other projects, identify funding sources/opportunities, and champion TSM&O projects through the programming process.

4.2.5 Next Generation Technology

The emergence of new transportation technologies has forced transportation agencies and organizations to begin preparing for the potential opportunities and impacts. It is important that ADOT take a proactive approach in identifying the steps and measures necessary to accommodate the deployment of these technologies. As an early adopter of systems and technologies, ADOT has gone through both equipment and TOC upgrades to replace old or obsolete equipment. Wireless communications can offset some of the needs for expensive fiber construction. There are partnership models available to be able to supplement ADOT detector data with probe speed data for traveler information, performance monitoring and other statewide functions.

Arizona's Governor issued an Executive Order (2015-09) that allows self-driving vehicles to test in Arizona, and the Order also established a Self-Driving Vehicle Oversight Committee. ADOT will need to prepare for the vast amount of data that will be generated. This will require the proper personnel in place to integrate, operate, and maintain new systems and work with new data sources.

Recommended strategies related to ADOT's preparation for next-generation technologies are found in the list below.

- Complete a data assessment to define TSM&O data needs and sources, including probe data.
- Develop a Data Management Strategy that includes current and emerging forms of data that can support key TSM&O functions.
- Develop a 3-year TSM&O Technology Plan to plan for technology needs for ICM, in support of connected and autonomous vehicles, signal phase and timing (SPaT), and other initiatives.
- Expand communications links to field devices to allow for real-time control and monitoring.
- Establish a TSM&O policy/research coordinator position.
- Update the Statewide ITS Architecture and include the Connected Vehicle Reference Implementation Architecture.
- Develop a smart work zone framework that will be used for all Department projects.
- Formalize ITG technical staff roles and how those roles might need to change to support the future TSM&O technology environment.

4.2.6 Performance Measures

In addition to the required MAP-21 performance measures that are found in Table 2 in Section 2.5, ADOT currently collects and reports on other measures related to the performance of the roadway network, crashes, freeway management system and ITS devices, travel times, 511 and 511.gov usage, and incidents through the Highway Condition Reporting System (HCRS). Data analysis is largely a manual task for the information collected. The strategies in this section look to help identify the critical performance measures that should be collected and reported and establish a process that will streamline performance measurement and reporting for TSM&O. Performance measures should fall under three main categories: Safety, Mobility, and Infrastructure Health. In 2016, ADOT established an Office of Continuous Improvement (OCI) that focuses on finding ways to improve efficiency and effectiveness at all levels and in all dimensions of the organization. The OCI uses principles of Lean management – tools and practices aimed at solving problems with incremental improvements. This increase focus on continuous improvement is driven by Governor Ducey's focus on improving performance and results throughout state government as part of the Arizona Management System. There also is an opportunity to coordinate with MPD's performance-based planning processes, as well as with metropolitan planning organizations, who also have responsibility for performance reporting on a regional level.

- Finalize ADOT’s TSM&O performance measures. ADOT has already developed a comprehensive list of potential measures, data sources and strategies for how to measure that can be used as a starting point. Measures will support the ADOT’s Executive Leadership focus on Safety, Mobility, and Infrastructure Health.
- Develop a TSM&O performance reporting program that includes frequency of performance reporting, format of reporting, responsibility for reporting, and potential distribution.

4.2.7 TSM&O Outreach and Awareness

With the ADOT TSM&O Division being relatively new, it is important to educate internal and external partners about the TSM&O Division’s focus areas, key initiatives and successes. Outreach can improve the overall knowledge and understanding of agency activities, and can increase the level of public interest in agency activities. Creating trust with the public is also critical for the success of ADOT TSM&O projects.

Understanding of TSM&O is growing within ADOT, an ongoing internal ADOT outreach (“InReach”) is necessary to establish a unified front for all TSM&O staff and an understanding of the Division’s goals and mission. It will also create understanding and support among non-TSM&O staff about the TSM&O Division and the work they do with respect to the larger ADOT mission.

- Public Outreach for TSM&O that can leverage performance outcomes, efficiencies and benefits of TSM&O for the traveling public. These strategies should leverage ADOT communications tools and media partnerships to promote TSM&O program elements and success stories.
- Focused outreach to partner agencies (including MPOs, TIM stakeholders, counties, AZTech) to keep them engaged in ADOT TSM&O activities and accomplishments.
- “InReach” to consistently promote priority TSM&O Division initiatives, important milestones, and the range of TSM&O responsibilities within ADOT. This can include a TSM&O web site or intranet site, and regular performance reports and updates to internal departments.

4.2.8 Partnerships

There are some partnerships between ADOT and the universities and educational institutions throughout the State, including large universities such as ASU, U of A, or NAU. Establishing strategic partnerships with these entities can provide ADOT with additional staff, knowledge and resources to tackle current issues, improve process efficiencies and stay up to date with research and innovation in the research community. An added benefit is helping to develop the next generation pipeline of talent coming out of university programs. The strategies in this section are recommendations to help ADOT establish similar relationships and derive similar benefits.

- Expand partnerships with statewide universities to help advance TSM&O initiatives.
- Update TSM&O research program through the ADOT Research Center.

5 IMPLEMENTING ADOT’S TSM&O PROGRAM

This section discusses additional considerations and priorities required to implement the ADOT TSM&O Plan. Items include key partnerships and agreements, resources and funding needs, and potential challenges and barriers that could prevent the recommendations outlined in Section 4 from being implemented.

5.1 Key Partnerships and Agreements

Table 4 summarizes the Divisions and Groups within ADOT that have a role in the TSM&O Division priorities.

Table 4 – Internal Agency Coordination for TSM&O Priorities

ADOT Division/Group	Required Input/Contribution							
	TIM	Field Maintenance	Safety	Project Programming, & Development, & Implementation	Performance Measures	Next Generation Technology	Outreach and “InReach”	Partnerships with Universities
TSM&O	X	X	X	X	X	X	X	X
IDO	X	X	X	X				
ITG	X	X			X	X		
Communications	X		X		X	X	X	
ECD	X		X		X	X	X	
HR	X	X				X		X
MPD			X	X	X	X	X	X
Districts	X	X	X	X	X	X	X	X
Contracts	X	X	X	X		X		X

5.2 Resources and Funding Needs

In addition to the above partnerships, there are resources and funding needs that will be required to implement the TSM&O Plan. A primary resource for implementing the plan is staff to champion the implementation of recommendations, and to coordinate with ADOT MPD and Finance to identify strategies for including TSM&O needs with current programming processes.

In addition to time, funding will be required to implement many of the recommendations. A description of key funding sources for ADOT are listed below and will be important to pursue for some of the TSM&O Plan recommendations:

- *State Highway User Revenue Fund (HURF)* - The State of Arizona taxes motor fuels and collects a variety of fees and charges relating to the registration and operation of motor vehicles on the public highways of the state. These collections include gasoline and use-fuel taxes, motor-carrier taxes, vehicle-license taxes, motor vehicle registration fees and other miscellaneous fees. The revenues collected are deposited in the Arizona HURF and supplement the ADOT State Highway Fund which is used to for highway construction, improvements and other related expenses.
- *Highway Safety Improvement Program (HSIP) Funding*

Table 5 – ADOT Public Funding Sources

HURF ¹	FY 2015-2016: \$634 million
HSIP ²	2015: \$23 million (infrastructure) \$2.5 million (non-infrastructure)
Prop 400 ³	FY 2015: \$382 million
PAG RTA ⁴	FY 2014-15: \$74,263

¹<https://www.azdot.gov/docs/default-source/businesslibraries/hurf16city.pdf?sfvrsn=4>

²<http://safety.fhwa.dot.gov/hsip/reports/pdf/2015/az.pdf>

³https://www.azmag.gov/Documents/MAG_2016-01-19_2015-Annual-Report-on-the-Status-of-the-Implementation-of-Proposition-400.pdf

⁴<http://www.rtamobility.com/documents/RTAARFY2015.pdf>

- The HSIP program provides states with funding to help achieve a significant reduction in traffic fatalities and serious injuries on all public roads, including non-State-owned public roads and roads on tribal lands. HSIP funding is provided to ADOT but is required to be used for safety projects on all roadways within the state based on data-driven measures and the SHSP.

- *Proposition 400 Funds* – Proposition (Prop) 400 is a half-cent transportation sales tax that was approved in November 2004 (Maricopa County) and was approved for 20 years (through 2025). These funds have been used to construct new freeways, widen existing roads and freeways, improve the arterial street system, and expand transit services such as light rail, bus rapid transit and express buses. All projects funded from the sales tax are specified in the MAG Regional Transportation Plan. Prop 400 funds are allocated to specific projects; however, current rebalancing efforts at MAG are identifying what could potentially be accelerated or expanded through cost savings on specific projects (or projects that did not advance). These rebalancing efforts do not occur frequently. Within the next five years, a new RTP and sales tax proposition is likely to be issued to voters in Maricopa County, and the RTP will include the next generation of project and program priorities. It will be important for ADOT TSM&O needs to be reflected in that RTP.
- *PAG Regional Transportation Authority (RTA) Sales Tax* – In 2006, Pima County voters approved a countywide half-cent sales tax to fund the PAG RTA plan through fiscal year 2026. The sales tax is collected by the State of Arizona is then transferred to regional transportation account. These funds are used to fund the RTA plan, which includes \$2.1 billion of improvement projects for roadway, transit, safety, environmental and economic vitality.
- *Congestion Mitigation and Air Quality (CMAQ) Funding* – The CMAQ program provides a flexible funding source to State and local governments for transportation projects and programs to help meet the requirements of the Clean Air Act. Funding is available to reduce congestion and improve air quality in areas where air quality standards are not met. It is also available to help areas maintenance compliance if they have previously been out of compliance. ADOT distributes CMAQ funding to regional MPOs, such as MAG and PAG, for their administration in their respective regions. In areas without an MPO, ADOT will administer the CMAQ program.
- *Federal Grant Funding* – The Fixing America’s Surface Transportation Act (FAST Act), enacted in 2015, is the federal legislation that funds surface transportation programs through 2020. The FAST Act established funding for competitive grants, including FASTLANE, the Advanced Transportation and Congestion Management Technologies Deployment Initiative (ATCMTD), both of which are integral to TSM&O. ADOT successfully secured a FASTLANE grant for I-10 that is helping to implement several improvements, including dust warning systems. ADOT also partnered with county and local agencies to submit a grant for the ATCMTD. Although not initially selected, the ATCMTD process will allow for future submittals. ADOT and partners will need to provide a local match (typically a minimum of 20% of project costs).
- *Public Private Partnerships (P3)* – A public-private partnerships is a contractual agreement formed between a public agency and a private sector entity where the private sector has participation in the delivery and financing of transportation projects. P3s can be used for construction of new facilities as well as maintenance and operation of existing facilities and programs. Examples of P3s include design-build projects, sponsorships (such as that for a freeway service patrol program), and contracted operations and maintenance for equipment and facilities. These types of partnerships can provide ADOT with additional funding outside of those that are publicly available and can free up those public funds to undertake other critical projects.
- *Maintenance Funds (special line item)* – ADOT can utilize some maintenance funds for smaller projects that are completed in-house. These funds provide a level of flexibility to be able to address needs quickly, but will need to be balanced with recurring maintenance costs to be sure those core functions are addressed.

5.3 Potential Challenges and Barriers

The following section describes potential barriers that have been identified that could pose challenges to implementing components of this Plan. It will be important for ADOT to recognize and take steps towards addressing or avoiding these challenges while planning for implementation of the TSM&O Plan.

Additional Staff Positions

The recommendations propose establishing some new positions (or redefining existing positions) within ADOT as champions of important TSM&O processes and projects. The current FTE cap that is in place at ADOT will make it critical for the TSM&O Division to develop a strong business case for the development of these new positions and show that they are critical for the bottom line mission of ADOT and TSM&O. TSM&O should prioritize the importance of these positions in relation to Division and agency needs and, in some cases, consider redefining existing positions to take on or include key functions and responsibilities of these proposed positions.

Coordination with External Agencies

Many of the recommendations rely on the input and on partnerships with ADOT's external partners. While ADOT will be the leader and champion for these recommendations, it will be important to engage and coordinate with these agencies early on and often to make sure that the mutual interests of both parties are being addressed. These include federal agencies (FHWA, Department of Homeland Security, US Border Patrol, US Forest Service); Tribal governments; state agencies (Governor's Office of Highway Safety, DPS, Department of Emergency Management); neighboring states (California, Nevada, Utah New Mexico); counties; regional councils of governments; metropolitan planning organizations; and local cities and towns. In addition to proactive and cooperative relationship-building, one way that ADOT can generate interest and support for TSM&O projects is by broadcasting the benefits and successes that ADOT has experienced from past or current TSM&O projects. This should be a key focus of the outreach strategies.

Non-Traditional Timeframe for TSM&O Projects

The 5-year programming process is not suitable for many TSM&O projects that are not large-scale capital projects. Some TSM&O projects, such as operations projects, should be implemented in the near-term to provide maximum efficiency gains. TSM&O projects might also involve deployment of technologies that are continually evolving and could be obsolete in a 5-year programming process. As such, TSM&O projects occupy a "mid-term" timeframe as opposed to the long-term timeframe for capital project programming and the near-term timeframe for maintenance budgeting. It will be a challenge to establish this mid-term budgeting philosophy. ADOT could partition a 'subprogram' of discretionary funding at the TSM&O subprogram level that can be used to address high-priority, near-term needs that arise. These funds could be spent on procurement-type projects that involve little to no upfront design or environmental clearance.

Changing or Updating ADOT Processes

Some of the recommendations suggest changes or updates to processes that ADOT staff use regularly and that are not changed or updated frequently. The inclusion of newer measures, such as reliability, forces ADOT to change the way that it goes through the project development and programming processes. This is also true for changes internal to the TSM&O Division, such as maintenance processes that may change based on this TSM&O Plan, and established performance measures. For these examples, it is critical to garner support from the top levels of each Group or Division to mitigate this challenge.

Changing ADOT Priorities

Support from ADOT leadership is the driving force for implementation of initiatives and changes at ADOT. Recently, TSM&O has risen to the top as a priority, which has resulted in the TSM&O Division and the development of this Plan. Continued support from ADOT leadership will be critical to allocating the resources and support needed to implement many of the recommendations in this TSM&O Plan. It is critical that the TSM&O Division demonstrate the benefits of the program, through performance tracking and reporting, to support the TSM&O business case. Developing and benefiting from critical partnerships for operations and maintenance is another way to highlight the importance of the TSM&O program. The more involved and engaged ADOT leadership is in the TSM&O Program and its successes, the more likely that support will remain.

6 TSM&O PLAN UPDATES

This section describes the intended use of this TSM&O Plan as well as considerations and processes for updating the Plan.

6.1 Using the TSM&O Plan

This TSM&O Plan was developed as a guide for the TSM&O Division to address some of the major needs and gaps related to the Division and ADOT TSM&O program. For each of the recommendations provided in **Figure 5**, a detailed description of the Recommendation, including step-by-step procedures and required inputs, is provided within **Appendix A**. As TSM&O staff implement recommendations, they should refer to the expanded discussion located in the Appendix. It is likely that these steps will require some modification but they do highlight some important considerations that should be acknowledged.

As discussed in Section 4 – ADOT TSM&O Program and Strategies, the recommendations within each timeframe were identified based on a variety of factors such as priority level, reliance on other recommendations, cost, effort required, presence of a strategic opportunity and others. However, the timeframes of these recommendations are dynamic and may be altered based on future conditions.

Actions will have different ‘owners’, and there will need to be a process implemented to track the different activities. A regularly scheduled forum, such as weekly, biweekly or monthly meetings will allow the action owners to provide updates and coordinate on strategy activities with peers.

6.2 Updating the TSM&O Plan

It will be important to use the TSM&O Plan as a dynamic document that should be maintained and updated as necessary. It is recommended that this Plan be updated as recommendations are implemented. The Plan may also require updates based on the following conditions:

- *Changes to ADOT priorities or initiatives* – the recommendations were developed based on current conditions and ADOT priorities. If priorities at the leadership level change, the implementation timeframes for some priorities may need to be altered and new priority recommendations may need to be added.
- *Availability of Funding Opportunities* – if a strategic funding opportunity arises which allows or requires the TSM&O Division to complete a Near-Term recommendation within the Immediate timeframe, ADOT should adjust the timeframe accordingly and consider the implications of this change on the timeframes of the other recommendations.
- *Change to federal priorities or programs* – changes to federal priorities or programs may necessitate changes to TSM&O priorities, which could accelerate recommendations initiatives at ADOT. One example of this is related to next generation technologies, such as Smart Cities or CVV/AV. These programs are in these early stages and they are rapidly evolving.

6.2.1 Full Plan Review

It is recommended that the ADOT TSM&O Plan be reviewed annually just prior to the end of the fiscal year. This may help identify a recommendation that can be implemented using remaining funds that must be used prior to the end of the fiscal year. The Plan should also be reviewed after key milestones, such as the completion of the ADOT 5-Year Programming process.

6.2.2 Full Plan Update

The ADOT TSM&O Division is still relatively new at the time that this document was developed, so it is likely that there are changes to the organizational and programs at ADOT that will affect this document and its recommendations. As such, it is recommended that this entire document be updated in the 4 to 5-year timeframe, which corresponds to the Long-Term implementation timeframe for the Recommendations. During this update, the items in Figure 5 as well as the individual descriptions should be revisited and updated accordingly. All projects that might have been implemented should be removed, projects that have not been implemented should be re-prioritized and new projects should be identified for each timeframe.

Prior to updating the plan, ADOT should consider undergoing a Capability Maturity Model (CMM) self-assessment to assess the performance and effectiveness of TSM&O programs and processes. A CMM workshop will allow ADOT to assess the progress that has been made since the last CMM assessment identify areas that still need improvement. The outcomes from this self-assessment should be used to identify areas for improvement and develop projects or recommendations that should be included in the updated version of the Plan.

APPENDIX A – STRATEGY DESCRIPTIONS

The following appendix provides details about each strategy that was introduced in Section 4. This Appendix is intended to provide ADOT staff with step-by-step guidance and key considerations for implementing the various strategies included in this plan.

Traffic Incident Management Recommendations

Develop a Provision to Require Contractors to take TIM Training

Description: Update contract language for construction projects to require all contractors to have TIM training prior to being on site in work zones.

- Review the contract language that DPS prepared that modified the statewide towing contract that now requires towers to have TIM training as a condition for being included on the towing rotation. This is to serve as one point of reference for potential language.
- Meet with representatives from IDO to discuss the proposed update and what would need to be updated in ADOT's contracts.
- Work with the relevant ADOT Contracts group(s) to update the current language in ADOT construction contracts.

Timeframe: Immediate

Required Inputs: DPS Towing Contract example; input from IDO, construction staff, contracts/specs

Anticipated Outcomes: Work zones often result in irregular traffic patterns and flow, so they pose a higher risk for incidents. Requiring work zone personnel to have a basic understanding of TIM and strategies to respond to and manage incidents that might occur would improve both the safety of the contractors and the safety of drivers on the roadway.

Formalize ADOT's Quick Clearance Policy and Roles

Description: Establish a single, clear definition and directive for roles and responsibilities of ADOT staff with respect to incident response and clearance in a variety of situations, including crashes involving commercial vehicles, hazardous materials, and various other scenarios that require different actions on the part of ADOT staff who are on scene.

- Review ADOT's current quick clearance processes and compare it to the model language found in the 2008 FHWA publication titled "Traffic Incident Management Quick Clearance Laws: A National Review of Best Practices".
- Work with ADOT leadership and ADOT Risk Management to develop an updated policy that it is comprehensive and provides a clear and direct policy for ADOT staff to follow.
- Work with ADOT Communications staff to distribute and publicize the policy to all ADOT staff in a form that is accessible and easily retrievable.
- Include the policy document as part of the upfront documentation and training that is provided to all new staff who have a role in incident response and management, including adding this policy to the new staff matrices.
- Establish an MOU with IDO to improve consistency of TIM understanding of clearance roles.
- Hold a meeting in each District to present and discuss the policy and make sure that it is understood.

Timeframe: Immediate

Required Inputs: Example language from best practices document or other states; input and agreement from ADOT leadership, coordination with Risk Management

Anticipated Outcomes: Providing a clear and consistent policy and set of procedures for ADOT staff to follow will increase the likelihood of staff compliance with procedures, minimize ADOT's liability, and reduce the delay associated with crashes by facilitating faster incident clearance. Reducing clearance time will help reduce congestion impacts and the likelihood of secondary crashes. Having clear roles and procedures for ADOT staff and having legal basis for ADOT's actions will minimize liability for ADOT during all crashes, but particularly high profile crashes, such as those involving hazardous materials, injuries or fatalities.

Create Joint ADOT/DPS TIM Policies and Reporting

Description: Develop a written agreement between ADOT and DPS related to response and reporting for traffic management in Arizona. This statement should acknowledge the joint responsibilities for TIM on the statewide transportation system and delineate responsibilities, identify policies for areas such as data sharing and contractor requirements, and identify a comprehensive and joint performance reporting strategy for TIM.

- Review the Joint Operations Policy Statement (JOPS) between WSDOT, WSP and WFC as an example for an agreement related to TIM, TIM reporting and data sharing.
- Meet with representatives from DPS to present the Washington example and propose a similar agreement and gauge their interest.
- Coordinate with DPS to develop a document that covers the areas listed above. The final document should have signatures from leadership at both agencies.
- Develop and formalize debrief procedures for all TIM stakeholders (i.e., ADOT, DPS, towing, counties, local law enforcement, medical examiners and other key stakeholders).
- Distribute the agreement to both agencies and make it available.
- Establish a training program for ADOT staff.
- Work with ADOT Communications to publicize and make it available to the public.

Timeframe: Immediate

Required Inputs: Example policy document from WSDOT; input from ADOT leadership and ADOT ECD; input and support from DPS

Anticipated Outcomes: This document will help formalize a partnership between ADOT and DPS in terms of roles and responsibilities for incident management as well as for TIM reporting. With respect to performance reporting, this agreement will help ADOT leverage what DPS is already doing in terms of data collection and reporting. It will facilitate sharing of data between agencies so that more comprehensive and robust reporting can be accomplished without redundant efforts. This formal document will also help support other ADOT TIM goals that are included in this plan, such as expanding the TIM Coalition efforts statewide, since DPS is a key player in the success of the TIM Coalition.

Establish a Central Resource for TIM

Description: ADOT wants to increase awareness of TIM, improve consistency of TIM collaboration and response processes, and establish TIM as a key TSM&O priority. An important tool that can help to provide staff with a centralized place for information on ADOT's TIM processes, emerging policies, formal documents, templates (for debriefings), training materials, training schedules, and other resources would be a TIM web site – either internal or externally available. If it is external, ADOT and partner agencies could access it and it could serve as a statewide resource. This is a tool for which ADOT can take a leadership role, and it is one that will help to provide a centralized resource that can be updated with current materials, contacts, and links to other TIM resources around the country.

- Coordinate with DPS and the AZTech TIM Coalition to identify partners to help identify TIM resource needs. Determine if this will be an internal or external resource.
- Review examples of TIM sites from other states or regions with active TIM coalition programs.
- Partner with ITG and Communications to establish a core team to develop a web-based resource.
- Establish a process to maintain content and links. Identify appropriate security measures needed if there are policy, procedure, process or other sensitive information located on the site.

Timeframe: Immediate

Required Inputs: Collaboration from current partners (DPS, AZTech) to provide materials; internal collaboration for site ownership and maintenance; FHWA to provide authorization to link to national documents.

Anticipated Outputs: Create a centralized resource that can provide TIM partners in Arizona with up to date information on TIM response processes, training materials, training schedule, policies, and links to external TIM resources.

Establish a Statewide TIM Manager

Description: Create a position that will provide leadership for statewide TIM activities, in partnership with the statewide Emergency Management coordinator. This person will make decisions on a statewide level so there is a unified directive for TIM policies and processes. This person will receive performance reports and be responsible for making sure the results are provided to ADOT leadership and are used to inform changes to the TIM program as needed.

- Consult with Colorado DOT on their position descriptions for their Corridor Incident Managers as an example, and develop a proposed job description to present to ADOT leadership
- Meet with ADOT leadership to discuss the position, including the department and level the position would have.
- Work with ADOT Human Resources staff to initiate the process for creating a new position.

Timeframe: Near-Term or when full-time employee (FTE) positions become available

Required Inputs: Example position descriptions from CDOT; input from ECD; Input from ADOT leadership; input from ADOT HR

Anticipated Outputs: Creating a statewide TIM manager position would provide two key benefits. The first is that it would provide a single voice for ADOT with respect to TIM policies, processes and initiatives, which would help create consistency in information and processes throughout the ADOT Districts. Standardizing processes and policies can facilitate safety and efficiency in terms of incident response and clearance time. Second, creating this position within the ranks of ADOT leadership would foster accountability for the TIM program throughout ADOT, which shows an important commitment from ADOT for the safety and efficiency of their roadways.

Update and Automate the Statewide Alternate Routing Plan

Description: Update the prior Plan to identify preferred alternate routes, including HAZMAT considerations, and alternate route notification processes and procedures for implementing detours along state routes. The routes should be identified in coordination with ADOT Districts, local agencies, Counties and neighboring state DOTs and should be formalized through an IGA or other agreement where possible. The Plan should be distributed and made available electronically and should be included as part of training for maintenance staff and TIM training.

- Review current alternate routing plan and identify jurisdictions that should be contacted related to updating the routes.

- Schedule meetings with representatives at each of the ADOT Districts to discuss the routes and identify those that will need to be updated, including those that might have a different route for passenger cars versus freight vehicles.
- Meet with representatives from local agencies and counties, as well as with DPS, who have a stake in the routes that need to be updated and work with them to identify the best route to be established as the formal alternate route. Additionally, work with them to establish notification procedures for implementing these routes as well as coordination procedures that should be followed while the route is in place.
- Work with these agencies to develop a formal agreement on the alternate route and procedures, such as an IGA, that is signed by leadership at both ADOT and the other agency/agencies.
- When the Plan is finalized, distribute it to all ADOT Districts as well as all agencies who were involved in the process.
- Work with ADOT Communications to make the plan available on the ADOT internal network as well as the public website.
- When the Plan is completed and distributed, work with the ADOT GIS group to convert the plan into a GIS shapefile format that includes both the routes as well as the associated notification and coordination procedures that were identified for each route so that they can be queried and updated, if necessary, in real-time. These files should be available to all ADOT staff.
- After using the updating plan an GIS format, consider automating the process for identifying alternate routes and notifying relevant jurisdictions. This might include developing software to provide decision support capabilities.

Timeframe: Near-term for updating and automating

Required Inputs: Input from ADOT Districts, input from local agencies, counties and DPS on routing as well as notification and coordination procedures, input on desirability for full automation

Anticipated Outcomes: An updated Alternate Routing Plan that is clear, agreed upon by agency partners (DPS, counties and municipalities through which traffic is being diverted) and readily available will reduce likelihood of confusion when a detour is necessary. It will also provide traffic management entities, including the ADOT TOC, with the ability to develop predetermined settings for various equipment, such as traffic signals, ramp meters, DMS, etc. to support the detour, such as predetermined DMS messages or different signal timing plans along the route. These can help provide improved traveler information about the detour and provide improved traffic operation to support the detour. In addition, ADOT maintenance staff can be prepared to provide equipment to a specific detour route location, which will reduce the time it takes to implement a detour and thus reduce the time that traffic is stopped at a closure.

Expand Incident Response and Assistance Program

Description: Expand freeway services such as ADOT's Arizona Local Emergency Response Team (ALERT) or Freeway Service Patrol (FSP) to serve other areas in the State. These programs are currently used in the Phoenix metropolitan area and have proven to be very beneficial. This project should involve developing a program or programs that will be implemented in strategic areas throughout the state to provide similar services to incident responders and drivers. ADOT could consider combining both functions in to one program for a statewide service.

- Identify the program requirements for the current ALERT and FSP programs, including operating costs, equipment requirements and staffing requirements.
- Identify areas within Arizona that may benefit from one or more of the support functions and which types of services would be most beneficial (there may be an opportunity to provide both services in a single program).
- Consider funding options for the program extension (currently, FSP is jointly funded by MAG and AZDPS in the Phoenix area). This might include discussions with local MPOs, private agencies/sponsorship

opportunities, such as those involving insurance companies or similar arrangements, or internal ADOT sources.

- Consider equipping response vehicles with Dedicated Short-Range Communications (DSRC) to support future connected vehicle initiatives.

Timeframe: Near-Term

Required Inputs: Current operating budget and program requirements for ALERT and FSP in the Phoenix area; input from ADOT Districts, Counties and local agencies on what areas would benefit from the response/assistance services; research/input on funding mechanisms for service patrol or incident assistance programs.

Anticipated Outputs: This project will result in new freeway assistance programs in areas outside of the Phoenix metropolitan area. FSP services provide some of the highest benefit-cost ratios when deployed on a freeway, since they help remove distressed vehicles from the side of the roadway which reduce hazards on the roadway, improve safety of drivers and is a highly visible and well-received public service. An incident response program such as ALERT is important in improving closures and detouring and reducing the amount of time it takes to clear a crash. Implementing similar services in other areas throughout the state will help improve safety of drivers as well as improved roadway conditions in response to a crash or disabled vehicle.

Develop Regional TIM Coalitions

Description: Partner with DPS to organize TIM Coalitions in other urban areas throughout the state based on the successes and lessons learned of the TIM Coalition in the Phoenix metropolitan area.

- Identify an ADOT and DPS champion in different regions/areas (Tucson, Kingman, Yuma, Flagstaff) to formalize regional TIM Coalitions.
- Reach out to local incident responders (fire, EMS, police), MPOs and towing companies and provide a business case for why improved TIM coordination and response are priorities.
- Formalizing the Coalition will require some of the following steps
 - Identifying certified TIM trainers who can train local responders in the area,
 - Developing a TIM Coalition charter or shared agreement amongst partners,
 - Conducting periodic meeting to share information and best practices amongst responders and conduct after-action debriefs on high impact incidents.

Anticipated Outcomes: TIM Coalitions provide training on best practices in incident management, provide a forum for identification of shared policies related to TIM and provide a forum for after action discussions and sharing of process improvements and lessons learned. Collaboration between state, county and local emergency responders can improve the safety and efficiency of incident notification and response, and improve strategic use of time by mobilizing equipment when it is needed. Faster notification and response results in faster incident clearance, which reduces delay and the likelihood of secondary crashes.

Field Maintenance Recommendations

Evaluate Field Maintenance Staff Compensation

Description: Review the current compensation packages for maintenance staff and consider changes so that they are competitive with industry standards, reflect the caliber of existing staff and attract high-caliber staff.

- Research the compensation and benefits for comparable maintenance staff positions at other agencies within Arizona.
- Compare and evaluate current ADOT compensation packages and work with ADOT TSMO leadership to propose updates to maintenance staff salary, benefits, and/or other incentives to ensure that compensation packages are competitive.

- Work with ADOT Human Resources to finalize compensation decisions, update compensation packages of existing staff and update job postings accordingly.
- Establish a schedule to regularly reevaluate compensation packages for maintenance and other technical staff at ADOT.

Timeframe: Immediate

Required Inputs: Research on local agency, county and other relevant agency compensation packages; input from ADOT maintenance staff supervisors, input from ADOT TSMO leadership; input from ADOT HR

Anticipated Outcomes: Improved compensation packages will improve retention of existing staff, which is important for ensuring the safety and quality of ADOT infrastructure. It will also help attract high caliber applicants that are seeking career opportunities at ADOT as opposed to more temporary positions, which will further strengthen the ADOT work force, reduce issues related to staff turnover and experience, and improve the efficiency of the ADOT maintenance program.

Formalize a Maintenance Career Path with Promotional Opportunities

Description: Develop a plan to formalize a career path for maintenance staff that provides the opportunity for career growth and advancement. This plan should clearly define and outline the potential for near-term and long-term career development for maintenance staff by defining procedures for salary increases and promotions. It should also outline a process for providing recognition for individual accomplishments to staff members.

- Research maintenance staff position descriptions and organizational structures for comparable maintenance staff positions at other agencies within Arizona and at other state DOTs.
- Review the existing maintenance department structure and organization and identify or create opportunities for maintenance staff to continue to progress and move up in rank.
- Establish a process for bi-annual individual performance reviews for all staff, which should include a process for identifying career goals, tracking their achievement, and rewarding/recognizing those who achieving these goals.
- Work with HR to update maintenance staff job descriptions to demonstrate the opportunity for upward mobility.

Timeframe: Immediate

Required Inputs: Research on other agencies or other state DOTs job descriptions or career paths; input from ADOT maintenance staff supervisors and District leadership, input from ADOT HR.

Anticipated Outcomes: Creating and defining a career path for the maintenance staff will improve staff retention and sustain staff motivation. Updating job descriptions to demonstrate the opportunity for upward mobility will provide incentive for maintenance staff to perform at a high level and remain at ADOT. It will also provide leverage for ADOT to attract high-caliber staff who are looking for careers as opposed to more temporary positions.

Develop a Maintenance Staff Training and Continuing Education Program

Description: Develop a standardized training program for maintenance staff that includes training for new hires as well as continuing education for existing staff. One key goal of this training program is to provide opportunities for maintenance staff members to expand their roles and receive training in areas in which had previously not been trained through cross training. It is also necessary to define the specific functions for which cross-training might be applicable.

- Work with maintenance supervisors and District leadership to review the job descriptions and responsibilities of each type of maintenance personnel. Identify any overlapping responsibilities or areas where there is a

good justification or opportunity to provide cross-training between maintenance staff. Recognize that there are several skill sets that might be unique and not easily transferable to other functions.

- Work with maintenance supervisors and other relevant ADOT staff and conduct research on training materials from other agencies to develop and/or compile materials related to the areas identified for cross training.
- Develop processes and identify opportunities to provide cross training between existing maintenance staff in all groups (signals, signing and striping); this should include printed, web-based and in-person training formats and materials.
 - Consider a model that provides annual or bi-annual continuing education training for existing staff.
- Conduct a cross training session as a pilot at one of the Districts and use experiences and feedback to adjust materials and format.
- Update maintenance job descriptions so that all positions have responsibilities outside of their primary responsibility. For example, ITS and signals staff have some overlapping responsibilities and cross training.
- Using cross training materials as a foundation, work with maintenance supervisors and District leadership to identify the necessary components for a comprehensive new hire training program.
- Develop and compile information that was identified, including information on ADOT policies (such as Quick Clearance or TIM), procedures (such as alternate routing processes) and other available resources for ADOT staff.
 - Make sure there is a combination of print, web-based and on the job training and consider some in-person training.
 - The web-based and printed materials should be available to all staff at maintenance offices and via the ADOT intranet.
- Gather input on the effectiveness of the training program.
 - Develop a process for gathering information from training participants about the content and format of the training program as part of a post-training evaluation.
 - Gather input from existing and senior maintenance staff on the effectiveness of the training program related to performance of new hires after they go through the program.
- Adjust training program content and format as necessary based on feedback; review training program annually to make sure all materials are still relevant and up to date and to make sure there is nothing missing.

Timeframe: Immediate (cross training), Near-Term (development of training program), Long-Term (evaluate and update program)

Required Inputs: Input from ADOT senior/supervising maintenance staff and District leadership; input from ADOT HR; existing training materials for all ADOT employees; existing training materials for maintenance staff

Anticipated Outcomes: Facilitating cross training between maintenance staff can promote improved response times to maintenance needs and a balance of staff hours, since any staff member can be used for multiple types of jobs. This will help avoid situations where one staff member is underutilized while another is overworked, which often results in high staff turnover. Promoting employee versatility can help address limitations in staff availability and could create opportunities to improve staff schedule consistency, such as implementing a standardized on-call schedule, and avoid issues related to unpredictable work hours and work load.

Developing a standardized new hire training program that combines online modules, printed materials (training binder) and on-the-job training, will help new staff get up to speed quickly and will reduce the amount of time required of existing staff to train new hires. The continual evaluation of the statewide maintenance training program will allow ADOT to determine which training approaches are effective and allow them to update the training materials or format appropriately.

Develop Response-Time Thresholds for Maintenance Calls

Description: It is important for ADOT's maintenance department to continue to perform at a high level. Developing reasonable response time thresholds for maintenance calls will establish expectations for the completion of various tasks.

- Work with senior maintenance staff and District leadership to identify and prioritize the types of maintenance calls that ADOT receives; maintenance needs that pose safety risks to the public should receive a high priority while tasks that often do not require immediate attention should receive a lower priority.
- Based on its priority level of each type of maintenance call, identify reasonable time thresholds within which ADOT maintenance staff should be able to respond to a call, taking into consideration response times for calls that come in overnight.
- Work with maintenance supervisors and District leadership to identify opportunities to partner with local agencies or counties for certain maintenance responsibilities, including trouble shooting.
- Work with ADOT Communications to disseminate the maintenance response-time policy to ADOT partners (including DPS, local agencies/counties, local law enforcement, etc.) as well as to the public.
- Reach out to agencies that are identified as potential partners and discuss partnership opportunities for maintenance tasks; discussing the response time thresholds could help incentives partnerships.
 - The goal of these discussions is to develop a formal inter-agency agreement (IGA, MOU, other type of agreement) between ADOT and the agency for maintenance support on ADOT roadways.

Timeframe: Immediate

Required Inputs: Input from ADOT maintenance staff and District leadership, input from local agencies, counties and local law enforcement, input from ADOT Communications.

Anticipated Outcomes: By establishing response-time thresholds for maintenance calls, the maintenance units will be able to provide more reliable maintenance support throughout the State for priority maintenance issues. It will create more reasonable expectations for ADOT maintenance staff, which will help improve the perceived responsiveness of ADOT to local agencies. This will allow ADOT maintenance units to develop more consistent work-schedules or rotations for maintenance staff to improve staff work-life balance and schedule consistency. In addition, established thresholds will allow ADOT to measure and track the performance of maintenance staff and make it easier to identify issues or situations where resources are lacking so that they can be addressed.

Develop a Formal Asset Management Program for TSM&O

Description: Develop an asset management program for TSM&O that includes tracking of infrastructure such as signing, striping, signals, and ITS equipment and assets. The goal of this project is to develop a computer-based asset management system that the TSM&O Division can use to proactively track and manage its infrastructure. ADOT uses the Feature Inventory System (FIS), which is a robust, GIS-based asset management system used Departmentwide to maintain an inventory of assets, asset condition, location, etc. Upgrades will be needed for the FIS to adequately handle technology and TSM&O assets. Currently, infrastructure such as traffic signals, poles, controllers and other elements are included in FIS. Most asset management programs are challenged with capturing assets like communications networks and software systems.

With the continual emergence of new technologies that will be increasingly dependent upon field assets, it will be important for the TSM&O division to develop a process that takes a proactive approach in managing and maintaining this equipment. In addition, recording the information produced through the asset management program will require the support of a computer-based program. The development of this program will coincide with the procedures established by the asset management plan and will store information regarding the condition of signals, striping, signing, and ITS equipment.

- Review the FIS and identify gaps for TSM&O assets. There might need to be some coordination with the TOC to align with the Highway Condition Reporting System.
- Work with TSM&O staff to identify the types of information that should be collected for TSM&O assets; example information includes install date; manufacture; model; tracking of preventive maintenance completed; tracking of maintenance work orders; etc.
- Develop procedural guidelines and templates for keeping inventory and tracking the information identified in the previous task. Part of the guidelines should include accounting for relative costs of equipment and maintenance to help with budgeting/programming.
- Implement the asset management program as a standard procedure for staff; this should include inputting all known information about existing assets and working to fill in gaps that might exist.
- Work with ITG and internal TSM&O staff to develop a concept for updating the existing computer-based asset management program or developing a new tool to provide more automated and sophisticated asset management.

Timeframe: Near-Term (create asset management process for all TSM&O assets) and Long-Term (enhance computer-based asset management program)

Required Inputs: Review of existing ADOT asset management systems for bridge, pavement, etc.; compilation of existing asset information for TSM&O infrastructure and devices; input from ADOT maintenance and other District staff, input from ADOT ITG.

Anticipated Outcomes: Using an asset management system to track infrastructure maintained by the maintenance staff will support proactive, as opposed to reactive, maintenance for infrastructure. Proactive maintenance can help reduce emergency maintenance calls and allow maintenance staff to identify and replace/preserve the infrastructure that is approaching end of life prior to it failing or malfunctioning. This strategy will also contribute to better planning for equipment needs so that equipment is being budgeted prior to end of life. A computer-based asset management system will provide ADOT with a better ability to keep track of the condition of their infrastructure and equipment and could provide some automation that would reduce the amount of work for staff related to maintenance tracking (for example, if the management system was integrated so that work orders for devices/infrastructure are automatically populated). The program should support data storage and provide information that will enable ADOT to proactively manage assets critical to TSM&O.

Safety Recommendations

Establish a Safety Corridor Program

Description: Establish a Safety Corridor program that identifies and looks to address high crash or high risk corridors in the State. The first ADOT Safety Corridor that was implemented was over Memorial Day weekend in 2013 when I-17 was the focus of a safe-driving campaign involving increased DPS, Compliance and Enforcement and FSP presence, use of DMS messages for public safety announcements and local “Safe Driving Fairs”. ADOT also had incident response equipment ready to providing faster response to incidents along the corridor. ADOT also recently launched two additional phases of safety corridors, focusing on I-10 and US 60 in the Phoenix area and I-40 in northern Arizona.

- Develop criteria for identifying additional candidate Safety Corridors, including both urban and rural roadways.
- Use existing crash data and input from DPS to identify candidate Safety Corridors where increased focus and resources will be provided.
- Identify low-cost countermeasures for corridors with a history of high crash rates.

- Work with DPS, the Department of Health Services, local agencies and local first responders to develop a plan for improved safety awareness and incident response on the corridor.
 - Develop a set of safety goals for the corridor that can be measured.
 - Develop a set of standard operating procedures and roles and responsibilities for safety and incident response on this corridor and have a final document signed by all agencies involved.
 - Develop a way to identify safety projects that could be implemented to improve the safety of a corridor – this might include changes to roadway configuration, addition of signage, addition of rumble strips, etc.
- Regularly review safety data and adjust plan to achieve safety goals. Evaluate the effectiveness of the Safety Corridors and identify if other adjustments need to be implemented.
- Work with ADOT Communications to provide a public education campaign on Safety Corridors and the results of the program when available.

Timeframe: Immediate

Required Inputs: Crash data to identify candidate Safety Corridors; input from DPS, local agencies and counties and other relevant agencies/organizations, ADOT Communications related to media material.

Anticipated Outcomes: The ADOT Safety Corridors Program should provide a way to comprehensively address corridors with a history of safety issues. It will provide public visibility to the work of ADOT and its partners and will help develop relationships and partnerships between ADOT and local agencies related to roadway operations and safety. The establishment and measurement towards safety goals will provide empirical evidence of the program's successes that can be reported and, if successful, can be used to leverage further support for the program.

Re-evaluate HSIP Programming

Description: Since ADOT is responsible for allocating Highway Safety Improvement Program (HSIP) funds for the whole state, funding for safety improvement projects needs to be balanced between safety needs on the ADOT system and local safety needs. Currently, a larger portion of fatalities are occurring on local (non-ADOT) roadways, so ADOT will need to re-evaluate how HSIP funds are being programmed so that safety issues on local roadways are addressed.

- Establish a set of prioritization criteria for safety improvement projects that accounts for both local and ADOT projects; use that to develop a list of priority safety improvement projects for the State.
- Based on the top priorities, evaluate funding available each year and allocate appropriately with the goal of programming the highest priority projects first.
- Consider alternative funding for ADOT safety improvement projects if deemed necessary.
- Reevaluate priority list annually to account for changes in priority status, and adjust priorities as the plan, expectations and resources change.

Timeframe: Immediate

Required Inputs: Input from ADOT and local agencies on prioritization criteria for HSIP funding; input from ADOT and local agencies on top safety improvement project needs; research on other funding mechanisms for safety improvement projects (if deemed necessary)

Anticipated Outcomes: With growing local safety needs, the proportion of HSIP money going to ADOT projects may decrease. This makes it especially important for ADOT to keep their priority list up to date and make sure that projects are re-evaluated each year that HSIP funding becomes available. A more robust programming will ultimately aid ADOT in meeting MAP-21 and Fixing America's Surface Transportation (FAST) requirements.

Finalize Safety Analyst/Highway Safety Manual Technology

Description: The AASHTO Safety Analyst tool helps aggregate and analyze crash data to identify problem areas on highways. ADOT has invested in this tool to analyze areas with high potential for crash reduction. This project recommends the use of Safety Analyst as part of ADOT's safety assessments and project identification process.

- Finalize data mapping efforts using Safety Analyst.
- Determine the process for integrating Safety Analyst into the HSIP, Road Safety Assessment (RSA) and P2P processes.
- Coordinate with ITG and MPD to establish long-term resources and support for the program.

Timeframe: Immediate

Required Inputs: Input from ITG and MPD.

Anticipated Outcomes: Safety Analyst will allow ADOT to take a more proactive approach in identifying roadway segments, ramps, and intersections that are more susceptible to safety risks. The program, which is very data intensive, will allow ADOT to assess the safety of roadway segments, ramps, intersections based on their physical condition, geometric configuration, average daily traffic, and crash frequency and severity. The use of the network screening and analytical tools will better focus the limited resources, such as HSIP and RSA funds) to the highest need.

Update Crash Reporting to Implement Enhanced GIS/Web-Based Reporting and Analysis

Description: Work with DPS to update the current crash form to streamline the information that is most useful for reporting internally and per federal requirements. The goal is to provide a GIS/web-based forum for crash reporting.

- Work with relevant TSM&O staff to identify the information and format that is critical and/or required for crash reporting.
- Meet with DPS to discuss proposed changes to reporting information and ideas for improved processes for electronic form submittal.
- Work with ADOT Traffic Records and Districts to evaluate in Traffic and Criminal Software (TRACS) software will support the needs of Districts. There is an important need for quick access to crash data and crash diagrams. Explore alternatives if TRACS will not meet future needs.
- Develop a short training document to provide training to ADOT staff.
- Work with ITG and ADOT GIS staff to implement a GIS-based crash database that is linked to the crash database and automatically populates a map with associated information and can provide crash diagrams.
- Provide internal communications about the availability of the GIS-based data.
- Develop a process for using web-based portal for crash data analysis and reporting.

Timeframe: Immediate (assess District needs for crash data – availability, diagrams and timeliness); Near-Term (GIS/web-based reporting and analysis)

Required Inputs: Input from ADOT staff involved in crash/safety reporting; input from DPS; input from ADOT GIS staff, input from TRCC.

Anticipated Outputs: This project will leverage the current crash reporting process and provide ADOT with improved capability to analyze crash information and provide data in a more organized manner. Providing electronic submittal allows ADOT to more easily keep track of data and creates an electronic copy for improved document backup and storage. Eventually developing a system that provides a link to a GIS database and interface will help reduce the amount of time and effort it takes ADOT to conduct the crash queries and analysis.

Implement and Update the Strategic Highway Safety Plan (SHSP)

Description: Every five years, ADOT is required to update the SHSP that provides a comprehensive framework for reducing crashes on public roadways. The plan is updated by the cooperative efforts of ADOT, the Governor's Office of Highway Safety, DPS, the Department of Health Services, the FHWA, the Federal Motor Carrier Safety Administration and the National Highway Traffic Safety Administration, amongst other local safety stakeholders and partners. It is essential that ADOT implement the current SHSP, and provide leadership for the implementation process.

- Evaluate candidates for an ADOT lead for the SHSP implementation.
- Work with TSM&O leadership to recommend a process for implementation, including support for overseeing roles and responsibilities of other SHSP partners.
- Develop a scope of work for implementing, and later updating the Plan; identify funding available for the project.
- Work with ADOT Contracting/Procurement to advertise and award the project.
- Work with external group undertake the process to update the Plan.
- Work with ADOT Communications to advertise the new Plan and make the approved Plan publicly available on the ADOT website.
- Develop an annual evaluation and process tracking mechanism for interim progress.

Timeframe: Immediate (implementation) Near-Term (2019 SHSP) and Long-Term (2024 SHSP)

Required Inputs: Input from relevant ADOT and external staff on consultant scope of work for plan update; input from relevant ADOT and external staff on consultant selection process; input from relevant stakeholders (ADOT and external) regarding Plan contents; input from Executive Leadership group for Plan approval.

Anticipated Outcomes: An updated SHSP will be developed conforming to the federal requirements and provide ADOT and other state agencies with a set of focus areas and strategies to help improve safety of all public roads in Arizona. Between updates, ADOT staff will track progress and evaluate the program on an annual basis.

Project Programming, Development and Implementation Recommendations

Identify and Evaluate Current and Future TSM&O Funding Sources

Description: Develop a document that outlines the current and future budgets and funding streams that are used by groups in the TSM&O Division (ex: safety, maintenance, TOC, etc.). This document will also identify known operating and project costs that are incurred by groups in TSM&O. Together, this document will provide a starting point for developing a consolidated TSM&O Division budget.

- Work with staff in each of the groups within TSM&O to identify the annual budgets as well as the sources of funding used to cover these budgets.
- Identify the funding sources that are available for projects within the TSM&O Division as well as the requirements and restrictions of that funding (ex: are there limitations on what HSIP funds can be used for?).
- Work with staff to establish types of TSM&O improvements that can be accomplished within various funding ranges (ex: for \$1 million, we can accomplish this project/these projects).

Timeframe: Near-Term

Required Inputs: input from staff on operating/program costs for TSM&O groups; input from staff on funding sources and any requirements/restrictions of the source; input from staff on estimates of funding requirements for various types of TSM&O projects.

Anticipated Outputs: This will allow the TSM&O Division to understand their current financial status in terms of budgets, costs and funding sources. The TSM&O Division does not currently have a single, consolidated budget, but there are a variety of funding streams that are used by different groups within the Division, such as safety, maintenance and operations. By identifying these funding streams and identifying the regular funding requirements for TSM&O, ADOT can prioritize and budget projects through the most accessible and effective channels.

Develop a 5-Year TSM&O Business Plan to Identify Priority Projects

Description: Develop a TSM&O Business Plan that outlines the key priorities and projects for the TSM&O Division over the subsequent 5-year period as well as a prioritization process that will be used to rank projects for internal programming or for submittal to the larger ADOT 5-year programming process.

- Work with TSM&O staff, including all District, to identify key projects that should be accomplished by the TSM&O Division over the next 5-years. These projects can relate to all facets of TSM&O as they are defined by ADOT, including safety, operations, maintenance, technology or others.
- Work with TSM&O staff to categorize and prioritize the projects.
 - Categorization might consider funding opportunities for the project as well as the type of project.
 - An initial set of prioritization criteria should be developed as part of this process.
 - Look to integrate projects that target specific bottlenecks.
- Based on the categorization and prioritization, identify the projects that will be included in each year of the 5-year Plan and identify a champion(s) for each project.
- Use the performance measures that are identified in the TSM&O Performance Measures project (found in the Performance Measures Recommendation section) to formalize a performance-based prioritization process for future project programming after the initial process is in place.
- Revise Business Plan each year to make updates and, after the initial 5-year planning period, develop a new 5-Year TSM&O Business Plan.

Timeframe: Immediate (development of Plan), Near-Term (finalization of prioritization process), Long-Term (update Plan).

Required Inputs: Input from TSM&O staff; inputs from TSM&O Performance Measures project (found in the Performance Measures Recommendation section).

Anticipated Outputs: This Plan will be the initial step in the development of a regular TSM&O project development and programming process. The resulting Business Plan should act as a guiding document for the development of the TSM&O program at ADOT by providing a list of scheduled projects that should be programmed when funding becomes available. With the addition of a formalized process for prioritizing TSM&O projects, the TSM&O Division can make sure that the most effective TSM&O projects are being programmed and implemented for each 5-year planning period.

Refine TSM&O Criteria for ADOT Programming Process

Description: ADOT's current P2P process has not been fully vetted for TSM&O projects, since the prioritization criteria that have been developed thus far do not fully account for key TSM&O performance measures, such as reliability, safety and mobility. Refine the criteria for the ADOT programming process to ensure that TSM&O projects are receiving consideration for programming and can compete with more traditional projects.

- Use the list of TSM&O Performance Measures (developed as part of a recommendation in the Performance Measures Recommendation section) to identify performance measures that should be included in the larger ADOT P2P process.

- Discuss the TSM&O performance measures with MPD, refine as necessary and continue to support their inclusion into the evaluation criteria for the P2P process.

Timeframe: Immediate

Required Inputs: Inputs from TSM&O Performance Measures project (found in the Performance Measures Recommendation section); input from ADOT MPD.

Anticipated Outputs: Refining TSM&O criteria for ADOT’s programming process will increase the competitiveness of TSM&O projects within the statewide programming process. The current prioritization criteria generally do not take a performance-based approach, and instead largely considers existing conditions such as traffic volumes. By encouraging the use of more performance-based criteria, TSM&O strategies and TSM&O projects can be better represented within the ADOT 5-year Program going forward.

Establish Regular Meetings with MPD for Project Programming and Implementation

Description: Establish regular communication and coordination with MPD staff TSM&O project programming and implementation.

- Work with MPD and Districts to identify key priorities.
- Schedule regular check-in meetings between ADOT TSM&O and MPD staff to review status, identify new opportunities, and identify specific coordination needs with Districts.
- Identify changes to current programming processes that need to be made to enable TSM&O to be considered at different steps in the process. For example, the Project Assessment review process can include a TSM&O checklist to provide TSM&O alternatives to traditional project methods.
- Identify where TSM&O staff should be involved in reviewing projects, for example, reviewing Traffic Management Plans for construction projects could be a TSM&O responsibility.

Timeframe: Immediate

Required Inputs: Development of the 5-Year TSM&O Business Plan; input from Districts and MPD

Anticipated Outputs: Regular and consistent coordination between TSM&O and MPD will help to assure that TSM&O is being included in ADOT programming processes, and that project development processes consider TSM&O alternatives at various stages.

Establish a TSM&O Project Development Engineer Position

Description: Develop a position in the TSM&O Division to lead the process for identifying and developing TSM&O projects and the annual TSM&O programming process. The position would also be responsible for playing a role in the broader ADOT planning process to champion TSM&O projects through the P2P process and to work with ADOT IDO and project managers to support the inclusion of ITS components within larger construction projects.

- Obtain the position description of the Planner/Performance Manager position at Colorado DOT to use as an example. This position was developed to focus on the specific needs for the TSM&O division and improve alignment with CDOT planning activities.
- Work with TSM&O leadership to develop a position description and roles and responsibilities for a TSM&O Project Development Engineer as well as identify the location of the position within the current organizational chart.
- Work with ADOT HR to initiate the process for creating a new position.

Timeframe: Near-Term or when FTE positions are available

Required Inputs: CDOT Planner/Performance Manager position description; input from TSM&O leadership; input from ADOT HR

Anticipated Outputs: Establishing a TSM&O project development engineer position will help formalize and improve the efficiency of the TSM&O project development and programming processes both internally within the Division as well as within the larger ADOT process. This person will champion the development of the 5-Year TSM&O Business Plan and the submittal of TSM&O projects into the P2P process. He or she will also work with IDO to develop a process for including ITS components into larger construction projects, which is one of the most efficient ways to deploy ITS infrastructure into existing roadways.

Next Generation Technology Recommendations

Assess Data Needs and Develop a Data Management Strategy

Description: Assess TSM&O data availability, data gaps, current data processing capabilities and future data needs and establish a plan for how future data needs are going to be met. The first step of this project is a Data Assessment that identifies the current data sources and types for TSM&O at ADOT, and identifies future data needs related to emerging technologies. This assessment will then be used to develop a Data Management Strategy.

- Work with ITG to identify and document the following items in a Data Assessment:
 - The types of data that are currently collected by ADOT related to TSM&O, how they are collected and the types of information that are derived from each type of data.
 - Anticipated data needs related to emerging technologies that are being considered by ADOT (especially connected/autonomous vehicles); data needed for operations, performance reporting (both internal and federal), project planning and other key ADOT processes and responsibilities.
- Use the Data Assessment, and update as necessary, to develop a Data Management Strategy in coordination with ITG. This document should provide:
 - Anticipated data needs related to emerging technologies with respect to operations, performance reporting (both internal and federal), project planning and other key ADOT processes and responsibilities.
 - For each type of data, identify the ways in which ADOT can obtain the data (collect it internally, get it from another accessibility/shared database, purchase probe data from the private sector, partner with a university, etc.).
 - For each type of data, identify whether it is cost effective for ADOT to deploy technology and provide systems to collect, process and store the data or if it is in ADOT's interest to obtain the data from a different source.
 - Develop a list of data that will likely require partnership with a third-party provider for its collection and/or processing. Make sure there is justification documented for the data need as well as for why ADOT should not collect the data internally.
- Based on the Data Management Strategy, develop a business case for having an annual line-item budget for purchasing data for operations; meeting with MPD to present business case.

Timeframe: Immediate (Data Assessment); Near-Term (Data Management Plan)

Required inputs: Input from ITG

Anticipated Outputs: A Data Management Plan is critical to prepare ADOT for the data requirements associated with next generation technologies, such as connected and autonomous vehicles. The documentation of current and future data will allow ADOT to begin planning for future data collection and processing needs and could also uncover some current inefficiencies or issues related to data collection and processing that could be addressed. The Plan will force ADOT to consider the opportunities and challenges related to collecting, processing and storing data and allow them to be proactive in planning for technology and systems updates required for these

future needs. Finally, the Plan provides TSM&O with a business case for purchasing data from third party providers in the future to make sure that there is a funding available.

Develop a 3-Year TSM&O Technology Plan

Description: Develop a Technology Plan that identifies technologies required to support the deployment of next generation technologies and provides ADOT TSM&O and ITG with a plan for procuring and deploying technologies and systems related to connected and autonomous vehicles, decision support systems, smart work zones, variable speed limits, integrated corridor management (ICM) and other advanced technologies.

- Research the most current information related to next generation technologies and the status of infrastructure and systems that will need to be deployed to support them. Because of the speed of technology advancements, only critical and required technologies should be identified.
- Based on this research and internal knowledge, work with TSM&O and ITG staff to provide a list of technologies and systems that will need to be replaced or procured by ADOT in the next 5-years in relation to these technologies and systems.
- Identify the sources and costs for the technologies and systems identified (where possible) and use that to develop a procurement and deployment plan where items are prioritized by need.
- Work with MPD and regional MPOs through their project programming processes to submit projects related to procurement of technology and systems within the prioritized list.
- Integrate technology requirements into project development processes (for example, a smart work zone requirement for traffic management in work zones).
- Update the Statewide ITS Architecture to account for new technologies and systems, as well as incorporate the Connected Vehicle Reference Implementation Architecture.
- After each project programming cycle, update the Technology Plan to reflect any progress made and make any necessary changes to technologies or systems that were originally identified in the Plan that might have changed.

Timeframe: Immediate (developing Plan); Long-Term (updating Plan)

Required Inputs: Research on connected/autonomous vehicle technology and system needs; input from ITG; input from TSM&O staff;

Anticipated Outputs: A Technology Plan will provide ADOT TSM&O and ITG with a documented road map for the types of technologies and systems that will be required and a plan for how ADOT will proactively pursue their procurement and deployment. One challenge that ADOT will face with this recommendation is the constant evolution of technology, so it will be important to stay informed of the most up to date technology prior to procuring any technologies or submitting projects for programming.

Expand Communications Links to Field Devices

Description: Deploy communications infrastructure to provide communication between all ADOT ITS field devices and the ADOT TOC.

- Identify the field devices that do not have a communications connection to the ADOT TOC; these could include traffic signals, DMS, portable DMS for work zones, etc.)
- Through the 5-Year TSM&O Business Plan process (see Project Programming, Development and Implementation Recommendations), identify a list of projects that are required to provide communications connections to the identified devices.
- Identify funding opportunities for the projects, including regional MPO funding cycles, the ADOT 5-Year Program, opportunities to deploy infrastructure as part of programmed construction projects at ADOT, or opportunities to deploy infrastructure as part of local agency or county projects.
- Based on each project's funding source/opportunity, work with relevant partners (local agencies, MPOs, counties, other ADOT groups) to procure and deploy communications infrastructure.

- Work with ITG to make sure that the communications infrastructure and systems in the field and at the TOC are working properly.

Timeframe: Immediate (project development); Near-Term and Long-Term (infrastructure deployment)

Required Inputs: Input from the TOC and ITG on required communications connections; input into the TSM&O 5-Year Plan; knowledge of ADOT and local agency projects that provide opportunity to deploy communications infrastructure.

Anticipated Outputs: This project will result in complete communications connectivity between the ADOT TOC and field devices. This will allow the TOC to see and control all devices, which will help with situational awareness of operations throughout the state as well as ability to support real-time operations and management of the ADOT roadway network.

Establish a TSM&O Policy/Research Coordinator Position

Description: Develop a new position that will act as a technical resource for the public-facing side of TSM&O, with an emphasis on emerging technologies. Responsibilities of this position might include providing information on TSM&O or ADOT's status on emerging technologies to ADOT PIOs as requested; working with policy makers and providing information related to emerging technologies and their effects on ADOT; identifying funding opportunities for TSM&O projects and research; and making sure that ADOT is apprised of the current state of research and policy related to TSM&O and emerging technologies.

- Develop a proposed job description for a TSM&O Policy/Research Coordinator Position that will reside in the TSM&O Division
- Work with TSM&O leadership to identify the location of this position within the TSM&O organizational chart.
- Work with ADOT HR to initiate the process for creating a new position.

Timeframe: Near-Term or as FTE positions become available

Required Inputs: Input from TSM&O leadership; input from ADOT HR

Anticipated Outcomes: This position will be the primary ADOT resource for information related to next generation technologies, including as active transportation and demand management (ATDM), variable speed limits (VSL), and connected and autonomous vehicles. As these technologies become a reality at ADOT, ADOT will benefit from having someone equipped with the necessary knowledge and expertise of TSM&O activities and responsibilities. This person will be able to articulate the information to the public as well as bodies that have influence over policies related to ADOT and emerging technologies, such as legislative bodies or the governor's office.

Formalize ITG Technical Staff Roles

Description: Identify existing ITG staff who are currently supporting the TOC hardware and software and develop a dedicated resource for the TSM&O as technologies and systems continue to evolve and emerge within ADOT.

- Work with ITG leadership to establish staff position(s) that provide dedicated ITG staffing to TSM&O. This position should be someone already largely familiar with the TOC systems and software.
- Work with the TOC and other TSM&O staff to develop a plan to integrate the ITG staff into the day to day functions of the TOC, such as discussions related to TSM&O goals and processes.
- Work with ADOT HR to undergo any processes required to formally dedicate an ITG position to TSM&O.

Timeframe: Near-Term

Required Inputs: Input from ITG leadership; input from ADOT HR

Anticipated Outputs: As technology continues to evolve and systems continue to become more sophisticated, it will be important for ADOT to ensure that they have the personnel to operate and maintain the equipment necessary for daily operations. System malfunctions have the potential to jeopardize the transportation system, putting drivers in danger. Therefore, it will be important to have a dedicated staff position, provided by ITG, in the TOC to ensure that there is a staff member that has a complete understanding of the systems and equipment and their relationship to TSM&O's goals and operations.

Performance Measures Recommendations

Finalize Recommended and Required TSM&O Performance Measures

Description: Develop a relevant and agreed-upon set of performance measures for evaluating TSM&O projects and the performance of the TSM&O program at ADOT. Performance measures will focus on Safety, Mobility, and Infrastructure Health.

Review MAP-21 reporting requirements for safety and system performance and select associated performance measures (see Table 2 in Section 2.5).

- Review performance measures for TSM&O projects and operations established by peer agencies and identified as best practices.
- Develop measures that support the Department's Executive Leadership's desired outcomes.
- Evaluate existing performance measures that have been compiled to determine which measures are most relevant to ADOT and support the categories of Safety, Mobility and Infrastructure Health. Criteria to determine relevancy should be determined; some examples of criteria include ADOT's ability to measure them, the audiences for which they will be reported (including measures needed for required federal and/or state reporting), and the significance of the measure to the larger mission of ADOT and the TSM&O Division.
- Work with MPD staff to integrate a set of TSM&O performance measures that should be included during the prioritization process for annual P2P process at ADOT.
- Identify a set of agreed upon performance measures that will be used internal to the TSM&O Division to prioritize projects and measure the performance of operations, including maintenance.
- Identify strategies for automating performance reporting.

Timeframe: Immediate

Required Inputs: Research TSM&O performance measure best practices and other agency examples; input from all groups within TSM&O; input from MPD.

Anticipated Outcomes: Performance measures will enable ADOT to evaluate the effectiveness of the TSM&O Division and determine the extent to which various projects and efforts have achieved their intended purposes. Having clear identification of a set of performance measures that will be collected and analyzed will improve federal reporting as well as internal reporting. This is important to have on both an ADOT-level for the 5-year planning process, as well as a Division-level for annual planning and project development. Performance measures will also allow the TSM&O Division to evaluate the effectiveness of various operational aspects and internal processes, which can assist in identifying operational strengths and areas for improvement.

Develop a TSM&O Performance Reporting Program

Description: Develop a performance reporting program for TSM&O that outlines the various types of measures that the TSM&O Division will provide on a periodic basis. This should include identification and formalization of required reporting that ADOT must do as well as the development of a 'State of the System' report that is updated annually and distributed internally within ADOT and externally.

- Identify all federal required reporting that ADOT must do in relation to TSM&O; this should start with identifying and finalizing all MAP-21 reporting requirements for safety and system performance (See Table 2 in Section 2.5 of this document).
- Based on finalized list of TSM&O performance measures, determine the measures that should be reported internally to TSM&O, within ADOT and externally to audiences such as FHWA and the public (included federally required reporting).
- Work with TSM&O staff to develop a plan for an annual ‘State of the System’ report that would be developed each year and provide a comprehensive, but high-level overview of ADOT’s performance related to TSM&O. It should include status and performance of infrastructure and devices (number of traffic signals controlled by the TOC, number of traffic signals replaced that year, etc.), performance of operations, including safety, congestion and mobility, and a variety of other measures that provide an overview of the TSM&O Division.
- Develop a spreadsheet that identifies key information related to the collection of various reporting; timeline and frequency of reporting (ex: annually every December); performance measures and data that are required; the champion for that report (individual or group, if applicable); and other relevant information.
- Identify a group that will champion the TSM&O Division Reporting Program to make sure that all required reporting is completed and to hold the group accountable.
- After the Reporting Program is in place for 5-years, conduct a 5-year evaluation of the ADOT TSM&O program that provides information related to TSM&O functions within ADOT as well as the TSM&O Division’s progress towards completing the recommendations provided in this ADOT TSM&O Plan.

Timeframe: Immediate (finalize MAP-21 reporting requirements and develop internal/external reporting strategy); Near-Term (develop and distribute ‘State of the System’ Report); Long-Term (5-year Evaluation).

Required Inputs: MAP-21 safety and system performance requirements; final list of ADOT TSM&O performance measures; input from TSM&O staff on required and recommended reporting; availability of data required for performance measures; capacity and capability of staff to complete reporting.

Anticipated Outcomes: Developing a performance reporting strategy will keep ADOT TSM&O aware and accountable for required reporting, which is a critical requirement for ADOT as a state agency. It will also allow the TSM&O Division to internally evaluate their program and projects; it creates a systematic process for identifying issues or concerns through a performance-driven process. Further, it creates a mechanism for ADOT TSM&O to highlight their successes internally within ADOT as well as to the public.

Outreach Recommendations

Public Outreach for TSM&O at ADOT

Description: Develop a plan for public and external agency outreach to provide information about the status of TSM&O at ADOT. This should include information about TSM&O initiatives or projects that are being implemented (changes to incident response, information dissemination), success stories related to TSM&O (improvements to safety, mobility, congestion, etc.) and information that the public should know regarding technologies or systems, as they become available.

- Meet with representatives from ADOT Communications/Public Information Office to discuss a plan for providing period notifications about relevant TSM&O initiatives, successes and important information.
 - Develop a process for TSM&O to provide ADOT PIOs with important information and for the PIOs to disseminate the information through a variety of methods, including new articles, social media and blogs and other forms of public information.
- Reach out to regional MPOs throughout the State to establish regular meetings throughout the year where ADOT TSM&O and the MPO can share relevant information and updates regarding TSM&O and operations.

- Leverage the information from the State of the System Report that will be developed (see Performance Measures Recommendations section for more information) to inform public information dissemination.
- Leverage the Policy Coordinator position to support public outreach in the near-term.

Timeframe: Immediate

Required Inputs: Inputs from ADOT Communications; input from performance measure strategy and State of the System Report; input from the Policy Coordinator

Anticipated Outputs: Public information and public education are often critical components for the success of TSM&O strategies, since the goal of many TSM&O strategies is to improve information dissemination to the public to allow them to make informed decisions about their trip. The more familiar that the public is with various technologies and strategies that might be deployed, the more likely that the strategy will be successful for its intended purpose.

Another important component of public outreach is having partnerships and open communication with regional MPOs who are often leaders when it comes to the operations landscape of a region. For example, MAG in the Phoenix metropolitan area has significant influence over operations because they program and distribute federal money to the local agencies, including ADOT. It is critical that MPOs are aware and supportive of ADOT's mission related to TSM&O so that TSM&O projects are consistent and compatible with regional priorities and so that there is the opportunity for financial support from these agencies.

Internal ADOT Outreach (“InReach”)

Description: Develop a program to provide information to other ADOT employees about the TSM&O Division, what it does and its activities, successes, and major programs/initiatives. This project should also target InReach within the TSM&O Division to make sure that the Division's goals, mission and successes are aligned and shared amongst TSM&O staff.

- Work with TSM&O staff as well as ADOT Communications staff to develop and distribute a TSM&O newsletter to highlight TSM&O initiatives and successes. This newsletter should be distributed periodically throughout the year and should be provided to all ADOT employees.
- Work with ADOT communications to create a place within ADOT's Intranet for a TSM&O page that provides updates on projects, performance metrics, etc.
- Establish a formalized, scheduled program to have TSM&O leadership meet at each ADOT District for an in-person meeting at least twice per year.

Timeframe: Immediate

Required Inputs: Input from TSM&O staff on initiatives, successes and outreach items; input from ADOT Communications; input from Districts regarding scheduling and planning for in-person meetings

Anticipated Outputs: As a relatively new Division within ADOT, providing communications and information to other ADOT groups will help establish the Division and its role within ADOT. Additionally, the TSM&O Division needs to create unity within their own Division, given the dispersed nature of the various groups within TSM&O. Establishing periodic staff meetings with leadership help provide staff with a unified understanding of the role and mission of TSM&O at ADOT. It also helps keep them informed of the successes and challenges that the Division is experiencing. For staff that are not located in Phoenix it is important for those staff members to get face time with their leadership to clearly communicate these ideas.

Partnership Recommendations

Formalize Partnerships with Statewide Universities

Description: Develop a formal partnership with local universities that can lead to the development of projects and cooperative agreements related to day-to-day operations and management at ADOT, including support for data management and/or performance management. One type of partnership involves development of an internship program where students in engineering, computer science/data management and other relevant fields can have an internship with ADOT that exposes them to TSM&O jobs and opportunities while providing ADOT with assistance related regular operations and management functions.

- ADOT has partnered with local universities (ASU, University of Arizona, and Northern Arizona University) to complete and apply for the FHWA University Transportation Center (UTC) Program. If awarded, this will provide local universities with federal funding to provide educational and research opportunities, training an internship opportunities related to transportation careers.
- If selected for UTC program, work with university career staff and ADOT TSM&O staff to identify internship opportunities with ADOT TSM&O groups throughout the state.
- Use lessons learned from other State DOT experiences to work with University leadership within certain departments to formalize partnerships where university staff and students are provided with ongoing projects that will support TSM&Os day-to-day operations, such as data management (especially in relation to emerging technologies) and performance management and reporting.

Timeframe: Immediate (internship program); Neat-Term (formalized partnerships for projects)

Required Inputs: A university must submit the UTC application to the FHWA, so input and support from the universities is required; input from TSM&O staff regarding internship and project opportunities for students and university staff; research on other successful DOT/University partnerships such in Maryland, Washington State and Florida; input from TSM&O staff and university staff regarding ongoing projects to support ADOT through research and data analysis.

Anticipated Outputs: There is a limited amount of ITS/TSM&O curriculum at universities, so a stronger partnership with universities and with students though an internship program will raise awareness of TSM&O amongst engineering and technology students who represent the next generation of workforce. It will also provide ADOT with an outlet for partnering in relation to research or analysis needs that ADOT may not have internal capacity to undertake.

Update TSM&O Research Program through the ADOT Research Center

Description: Work with the research center to initiate an ongoing research program related to TSM&O and operational needs at ADOT. There have been a handful of TSM&O-related research projects over the past few years, but a more developed and ongoing program would provide an outlet for ADOT TSM&O to stay at the forefront of TSM&O research and provide additional capacity for research and analysis through contracts and partnerships that the TSM&O Division may not have currently.

- Meet with TSM&O staff to discuss research projects that could be undertaken to support ADOT TSM&O and day-to-day operations at ADOT.
- Meet with the ADOT Research Center to discuss development of a continuous research program for TSM&O.
- Designate a group within TSM&O who will champion the research program in partnership with the research center.
- Identify research projects and work with either internal ADOT staff, university partners (through the UTC) or other contractors such as consultants, to assign and complete the projects.

Timeframe: Immediate

Required Inputs: Input from TSM&O staff on research topics; input from ADOT Research Center; input from ADOT Contracts

Anticipated Outputs: An ongoing research program will provide ADOT with the additional capacity and expertise related to TSM&O that will help them stay at the forefront of technology, operations and data analysis. Throughout this TSM&O Plan, there are many instances where it was clear that ADOT does not currently have the capacity (staff or infrastructure/systems) or the expertise to undertake all the operational needs related to future operations and technologies, so developing an ongoing research program through the UTC or other contracted mechanisms can help fill some of those gaps and provide the information that TSM&O needs to support current and future operations.