

Active Transportation Demand Management

The intent of System Layers is to define in further detail recommendations that would serve toward the goals of how ADOT should be operating and managing their network. This System Layer Plan is focused on:

- **Active Transportation Demand Management** – Active transportation demand management (ATDM) is used to analyze, predict, and manage congestion issues. Active management optimizes the performance of TSMO/ITS strategies by monitoring the strategies, assessing their performance, generating and selecting ways to improve performance, and then implementing the performance.

Context of Existing Capabilities

ADOT has a robust network of ITS devices in the Phoenix urban area that allows for data collection, device connectivity, and monitoring. Similar capability is present in other urban and rural areas of the State but at a lower density. These features provide the foundation for ATDM and serve as the basis for responding to and managing congestion and other operational issues.

While there is a solid foundation of Active Transportation Demand Management in place, there are challenges and gaps in the deployment, maintenance, and sustainability of ATDM capabilities that drive the recommendations outlined in this System Layer Plan.

Current Issues

Through a variety of meetings, workshops, and review of existing conditions and applications utilized by the state, current issues were uncovered that provide insight into the direction that ADOT should focus on addressing. The following are some of the current issues identified as related to ATDM:

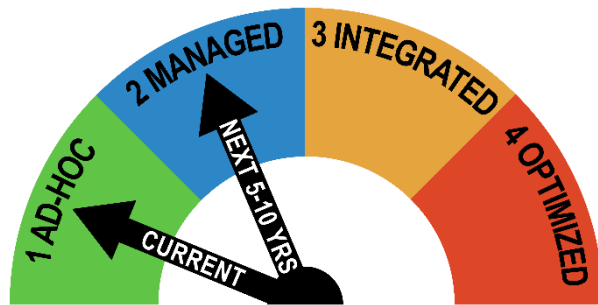
- Big data sets are not currently connected, processed, and readily accessible for real-time decision making to manage congestion/incidents.
- Existing agency-wide data governance process is not well known.
- Need ability to evaluate performance metrics in an automated fashion for day to day operation on a weekly/monthly basis.

Future Direction

The project team conducted a series of individual workshops with ADOT for each System Layer Plan to identify the perceived existing readiness and future direction within the functional areas. The workshops included an interactive, online (JamBoard) activity in which ADOT staff provided specific feedback following a similar structure to the TSMO Capability Maturity Model (CMM) Framework. For Active Traffic Demand Management, the workshop was held on April 8, 2022.

CMM levels for consideration of ADOT staff for their current capabilities, where they see progress in the next 5 years, and where there is desire to move toward in the next 10 years.

- **Level 1 – Ad-Hoc** – Activities are ad-hoc, informal, champion-driven
- **Level 2 – Managed** – Basic strategy application is understood with limited internal accountability or coordination
- **Level 3 – Integrated** – Standardized strategy applications that are managed for performance and aligned
- **Level 4 – Optimized** – Full and sustainable program based on prioritized data-driven process of continuous improvement



A summary of the feedback for the state is that the current capabilities are at the ad-hoc Level 1 state and in the future can be moved toward the Level 2 managed state.

The ADOT TSMO Division operates and maintains a wide range of ITS systems and devices related to a number of functions statewide. While these strategies are deployed for specific issues, they are often not consistently applied and used across the State and are often implemented standalone and may not be integrated with other strategies. ADOT should increase options for continuously monitoring systems to make them more effective. Performance measures need to be defined to support justification in staffing, processes, and infrastructure recommendations. The ADOT Traffic Operations center is currently only focused on traffic incident management and should move toward supporting ATDM from the Traffic Operations Center functions including the staff and resources to support proactive management of transportation operations.

Recommendations

This section provides a summary of important steps that will be used as building blocks for achieving the ultimate vision that extends to the five- to ten-year horizon. Since ADOT is looking at the three- to five-year horizon for implementation, these recommendations will focus on investments that are foundational technologies needed to support ADOT's future. The remaining gaps between what ADOT has today and where ADOT needs to be in the future becomes the recommended changes/additions that are needed.

ADOT's initial request for the ITS Master Plan included a number of specific areas in which potential recommendations were anticipated. For each area, the team has provided a summary of the current direction based on the research, interviews, and evaluation conducted during this study.

- Integrated Corridor Management (ICM), Decision Support System (DSS)
- Event Management
- Adaptive Ramp Metering
- Variable/Dynamic Speed Limits
- Lane Management
- Advanced Traffic Signal Systems
- Signal Control Strategies

Table 1 provides recommendations that can assist ADOT in improving their readiness level to move toward Level 2 capabilities for ATDM on a statewide basis. While many of the recommendations are independent and can be accomplished in a short timeframe, ADOT should focus on a few key recommended activities (denoted in bold) to ensure adequate resources are available and generate the greatest benefits in progressing their readiness level.

Table 1 – ATDM System Layer Plan Recommendation Summary (STIP level information)

PROCESS Recommendation Title	Description	Steps and Outcomes	Context for Recommendation	Recommended Champion	Recommended Stakeholder Involvement in Implementation	Total Funding Required	Annual Funding Required	Contracting Mechanism
DATA MANAGEMENT								
Enhance Real-Time Data Repository	Create a central data repository for real-time data that can be used in decision making. Data can also be used for performance management and analysis for those who need this information.	<i>Steps and Outcomes have been incorporated in the Develop and Utilize TSMO Performance Measure Platform action item in the Data and Performance Management System Layer Plan</i>	ADOT field devices collect a number of data elements that can support traffic management systems. ATDM is most effective when it is based on real-time or near real-time data such as: detection data, signal controller data (and other traffic management systems, such as ramp meters), construction and closure information, weather data, etc. A centralized repository can provide enhanced access.	ADOT TSMO Director and Operational Traffic & Safety Manager	ADOT ITG to assist in database/software development, all TSMO Group managers to contribute	\$400K for developing platform and dashboards with the various groups that will utilize the platform	\$50K per year of maintenance (if any is needed once it is initially established)	Out-source – either RFP or TSMO On-Call assignment
Develop TSMO Data Governance and Management Plan	Develop data management plan (including data governance) for all TSMO related data in ADOT.	<i>Steps and Outcomes have been incorporated in the Develop TSMO Data Governance and Management Plan action item in the Data and Performance Management System Layer Plan</i>	TSMO has several data repositories - FMS loop detection, crash data, TOC incidents, etc. Each has a separate environment and additional sources are being added without integration such as INRIX and RITIS. There is a need to focus on TSMO data management to be able to incorporate TSMO data into ADOT data governance sets as a whole.	ADOT TSMO Director	Coordinate with ITG for inclusion into their Data Governance and Management Planning efforts, Assistant State Engineer TSMO, TSMO Systems Technology Manager, TSMO Group Managers	\$250K for implementing data governance	None	Out-source – either RFP or TSMO On-Call assignment

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PERFORMANCE MEASURES								
Develop and Utilize TSMO Performance Measures Platform	Develop a performance measure platform (i.e., ATSPM) across all TSMO elements that includes dashboards to easily communicate TSMO performance. Include automatic performance report generation to identify recurring issues and systems performance issues.	<i>Steps and Outcomes have been incorporated in the Automatic Performance System Monitoring and Reporting System action item in the Data and Performance Management System Layer Plan</i>	ATDM requires real-time knowledge of field conditions and traffic operations. Data should include ADOT-owned data and not rely fully on vendor (3 rd -party) data. As dedicated staff may not always be monitoring, an automated process is needed to identify areas of concern that exceed given thresholds.	ADOT TSMO Director and Operational Traffic & Safety Manager	ADOT ITG to assist in database/software development, all TSMO Group managers to contribute	\$400K for developing platform and dashboards with the various groups that will utilize the platform	\$50K per year of maintenance (if any is needed once it is initially established)	Out-source – either RFP or TSMO On-Call assignment
Develop ATSPM Dashboard	Develop and deploy an ATSPM system to provide needed measures for traffic signal operations. This will include dashboards at the intersection, corridor, and area levels. This will require updating the controllers and detection of the signals to communicate with the system.	Steps: 1. Determine what level of urban intersection SPMs we need to make a positive impact on signal timing 2. Determine level of effort to configure and deploy detection data, if necessary 3. Procure CotS software (SaaS) and hardware needed 4. Update signal controller and detection as needed (lane by lane) Outcomes: Dashboard to tell if intersection is functioning properly.	SPMs such as arrival on green, approach volume, and detector health help signal engineers to optimize the performance of signalized intersections thereby reducing travel time delays and number of stops.	TSMO Maintenance Manager	Operational Traffic & Safety	\$200K	\$50K	Out-source

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Develop Performance Measure Thresholds for ATDM Response in Real-Time	Develop performance measure thresholds that can be used to determine the need for ATDM responses in real-time.	<p>Steps: Select key performance measures to monitor that reflect real-time traffic operations and align with TSMO goals. Quantify thresholds by facility type, location, time, rural/urban, or other characteristic. Identify the duration or level of severity that relates to specific ATDM responses. Focus on scaling the ATDM response framework within a realistic implementation methodology based on staff resources. Develop process to support prioritization of responses needed.</p> <p>Outcomes: Clear guidelines for staff on when to deploy ATDM strategies.</p>	<p>The application of ATDM activities / responses relies on real-time knowledge of field conditions and whether those conditions are abnormal or exceed a threshold/target. These thresholds may vary by roadway characteristics and location.</p> <p>(For example – this road always has 5 miles of queuing being detected, but right now it has 10 miles of queuing. We need to act.)</p>	TSMO Operational Traffic & Safety Group Manager	All TSMO Group Managers	\$0	Anticipate needing to review and update as needed annually	In-House

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STAFFING STRUCTURE								
Establish Corridor Operations Managers for Key Corridors	Assign dedicated staff to monitor and manage/adjust operations under a "Corridor Operations Manager" for specific routes. These activities would include coordination of freeway management systems, traffic signal systems, road weather management when activated, traveler information, work zone traffic management, etc.	<p>Steps: Identify key corridors that require increased coordination and oversight. Allocate and train a staff person to serve as the manager for all traffic operations activities on a particular corridor. Focus will include planning, traffic signal operations, construction, and coordination with TOC. Staff augmentation may be one full-time person or a firm with a team of staff dedicating a portion of their time during the year to provide a capped contractual number of resources. Implementation would be physically located at the current ADOT TOC to coordinate with TOC Operators but could ultimately be housed in regional TOCs.</p> <p>Outcomes: Increased coordination along key corridors.</p>	RTEs are currently responding to day-to-day operations but do not have adequate senior staff to manage and focus on specific corridors. The TOC is not currently providing non-incident issues/response. Urban areas have higher volume routes that require special attention relative to ATDM. These large regional routes play a key role in mobility and would benefit from a dedicated "Corridor Operations Manager" that can provide a coordinated management of the various systems/activities across the TSMO Groups.	TSMO Operational Traffic & Safety Group Manager	TSMO RTEs, Signal Superintendents, ADOT TOC personnel	\$300K per year for one FTE staff position in a staff augmentation contract	\$300K per year for one FTE staff position in a staff augmentation contract	Out-source – either RFP or TSMO On-Call assignment for traffic management dedicated staff augmentation for 100% of one FTE staff position

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STAFFING STRUCTURE								
Provide Dedicated Rural Regional ITS/Signal Operations Staff	Provide dedicated ITS & traffic signal operations staff for rural TSMO Regions (up to 3 total).	<p>Steps: Allocate and train a staff person to serve as the traffic signal operations liaison for the rural TSMO regions. Positions need to have the local knowledge of the area to know how mitigation efforts will impact the local traffic movement and ability to prepare timing plans in Synchro. Start with 1 dedicated staff with the potential to increase to 3 at a ratio of 1 staff: 2 rural regions. The staff augmentation may be one person or a firm with a team of staff dedicating a portion of their time during the year to provide a capped contractual number of resources.</p> <p>Outcomes: Increased coordination along key corridors.</p>	Rural regions within TSMO have limited staffing capability in terms of traffic signal operations and TSMO Systems Maintenance is largely focused on Central Region. Dedicated staff with technical signal knowledge, local familiarity, and availability are needed to assist in ATDM efforts. ADOT has been working on staffing efforts both with Systems Maintenance and Operational Traffic & Safety to potentially serve this role.	TSMO Operational Traffic & Safety Group Manager and TSMO Systems Maintenance Group Manager	TSMO RTEs; future Corridor Operations Managers	\$300K per year for one FTE staff position in a staff augmentation contract	\$300K per year for one FTE staff position in a staff augmentation contract	Out-source – either RFP or TSMO On-Call assignment for traffic management dedicated staff augmentation for 100% of one FTE staff position
Increase TOC Staffing Resources	Increase staffing at the TOC to support ATDM activities statewide.	<p><i>Steps and Outcomes have been incorporated in the Dedicated Traffic Management Staffing action item in the Traffic Management System Layer Plan</i></p>	ATDM activities require dedicated personnel with access to the field devices to monitor and activate countermeasures. With the desire for additional ATDM processes, there is a need to identify additional staff to support adoption and integration statewide (all Regions).	TSMO Traffic Management Group Manager	ADOT TOC personnel, AZDPS personnel	\$300K per year for one FTE staff position in a staff augmentation contract	\$300K per year for one FTE staff position in a staff augmentation contract	Out-source – either RFP or TSMO On-Call assignment for traffic management dedicated staff augmentation for 100% of one FTE staff position to serve as liaison to complete SLP needs

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PROCESS STRUCTURE								
Formalize Integrated Corridor Management (ICM) Roles	Formalize the internal and external ICM roles and responsibilities for ADOT staff along with ICM strategies.	<p>Steps: Identify ADOT roles within regional freeway ICM efforts. Formalize agreements with partner agencies. Assign internal roles within TSMO for ICM activities. Determine data needs, performance measures, and associated aspects of ICM implementation.</p> <p>Outcomes: Increased efficiency and coordination in ICM deployments.</p>	ADOT has entered into the L101 ICM with various agency partners and additional corridors have been identified. Once L101 ICM has been finalized, a strategy for future roles, responsibilities, and coordination efforts needs to be formalized.	TSMO Systems Technology Group Manager	TSMO Traffic Management Group Manager and TSMO RTEs	\$0	\$0	In-House

INFRASTRUCTURE DEPLOYMENT Recommendation Title	Description	Steps and Outcomes	Context for Recommendation	Recommended Champion	Recommended Stakeholder Involvement in Implementation	Quantity	Cost Per Unit	Total Capital Cost	Total O&M Cost	Contracting Mechanism
LIFECYCLE REPLACEMENT										
Recommendations incorporated into "Formalize ADOT ITS Committee Across All TSMO Groups" under Traffic Management.										
EXPANSION OF ADOT TECHNOLOGY DEPLOYMENT										
Expand Traffic Signal Control Strategies	Expand the deployment of advanced traffic signal control strategies to key urban corridors and remote rural highways.	<p>Steps: Identify key urban and rural locations that would benefit from advanced strategies. Scope the appropriate treatment and identify required effort (planning, hardware). Advertise for consultant support through the TSMO On-call. Manage the consultant through installation. Evaluate and adjust system once operational.</p> <p>Outcomes: Increased efficiency in traffic signal operations.</p>	Traffic signal operations can result in significant delay if not properly timed and/or coordinated. The use of advanced control strategies can improve operational efficiency, reduce user delay, and reduce staff workload.	TSMO Operational Traffic & Safety Group Manager and TSMO Signal Manager	None	120	\$40K	\$4.8M	\$480K	In-house & Out-source - TSMO on-call

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EXPANSION OF ADOT TECHNOLOGY DEPLOYMENT										
Fix Detection Locations	Upgrade and/or install roadway detection near ramp meter locations to support more advanced operations such as corridor adaptive ramp metering.	<i>Steps and Outcomes have been incorporated in the Develop ITS Upgrade / Maintenance Program action item in the Traffic Management System Layer Plan</i>	Ramp metering is a significant portion of active freeway management and requires detection to provide supporting data. Adaptive algorithms require increased data and associated detection across mainline lanes.	TSMO Systems Maintenance Engineering Manager	TSMO Traffic Signal Timing Manager, TSMO RTEs, District Maintenance personnel	Until a thorough inventory is complete it is unknown how many devices require upgrade or replacing	Cost for new capital upgrade or replacing is reflected in the Funding Pools	Cost for new capital upgrade or replacing is reflected in the Funding Pools	Cost for new capital upgrade or replacing is reflected in the Funding Pools	Out-source – either RFP or TSMO On-Call assignment for signal inventory and plan
Enhance Rural Operations and Management	Add communication, detection and CCTV at key rural locations on freeways (I-17, I-10) and POE. Add cameras to verify queuing at key rural locations (such as railroad crossing) to be able to inform travelers of conditions.	<i>Steps and Outcomes have been incorporated in the Real-Time Roadway Condition Enhancements - Detection and Real-Time Roadway Condition Enhancements – DMS and CCTV action items in the Traffic Management System Layer Plan</i>	Monitoring and responding to congestion can be aided through both data and visual confirmation. This is even more important in rural areas where it may take significant time to get staff out to observe the conditions. It will also facilitate timely and accurate information disseminated about queuing conditions. Adding detection and CCTV coverage in locations that are subject to congestion issues in rural areas will benefit ATDM.	TSMO RTEs	District Maintenance Managers, one representative from each TSMO group	Refer to Tool for DMS and CCTV – quantity will depend on specific location where deployed	\$150K for mini DMS \$400K for full DMS \$35K for each CCTV and pole	Refer to Tool for DMS and CCTV – cost will depend on quantities included at specific locations where deployed	\$15K per DMS \$1.5K per CCTV	Out-source – either RFP or TSMO On-Call assignment

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DEMONSTRATED TECHNOLOGIES FOR ADOT DEPLOYMENT										
Expand VSL to Address Urban Congestion	Apply VSL (dynamic speed advisories) for congestion (ADOT only uses for weather currently).	<p>Steps: Define the scope of the project with District. Write request for proposals for advertising design through ECS. Manage consultant throughout the project design to achieve goals. Coordinate with IDO to advertise construction through C&S and manage installation.</p> <p>Outcomes: Infrastructure.</p>	Rear-end, side swipe and improper lane change are the most prevalent crash types on urban freeways. These are predominantly congestion related. Posting appropriate speeds for conditions have proven to be effective at reducing these types of crashes.	TSMO Operational Traffic & Safety Group Manager	ADOT Districts	2	\$4M	\$8M	\$200K	Out-source – ECS (design) C&S (construction)
Real-Time Rail Crossing Information	Rail crossing wait time estimates to support alternate routing, queue management, etc.	<p>Steps: Identify key rail crossings that are prone to long and/or frequent queuing. Prioritize based on severity and frequency of queuing and traffic volumes. Scope the type of detection and advanced warning needed and identify required effort (planning, hardware). Advertise for consultant support through the TSMO On-call. Manage the consultant through installation. Evaluate and adjust system once operational.</p> <p>Outcomes: Providing accurate wait times and alternate routing options will reduce delay and driver frustration.</p>	Monitoring and queuing and estimate wait times at rail crossings facilitate timely and accurate traveler information rail crossing conditions. This can reduce overall delay in the system and reduce driver frustration.	TSMO Systems Maintenance Group	TSMO RTEs, U&RR	Varies, Study to Evaluate	Varies, Study to Evaluate	Varies, Study to Evaluate	Varies, Study to Evaluate	Out-source - TSMO on-call

Performance Measures

The ADOT TSMO Plan defines performance measures using three categories, safety, mobility, and infrastructure/system health. The following performance measures were developed to track the progress of the above recommendations associated with the ATDM SLP.

Performance Measurement Topic	Performance Measure	Measure Applicability
Congestion mitigation	Increased detection of congestion issues	Number of CCTV cameras accessible to the TOC Number of TOC dispatches to operations staff (IRU, RTEs) Frequency and location of targeted speed threshold
Intersection operations	Improved signal timing	Number of intersections with CCTV