Traveler Information Systems

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:

- **Traveler Information Systems** – Traveler information systems include the utilization and management of a dynamic network consisting of software and hardware to alert the traveling public in a real-time manner to affect driver routing decisions.

Context of Existing Capabilities

Since the inception of ITS capabilities at ADOT in the early 1990's, ADOT has integrated capabilities for traveler alerts and information dissemination as a cornerstone of the DOT's ITS and operations programs. Dynamic Message Signs (DMS) were among the early technologies installed as part of the ADOT Freeway Management System in Phoenix, and these have now expanded to corridors statewide. ADOT was an early adopter of both AZ511 and social media for information alerts to travelers and key stakeholders. Many of ADOT's other ITS and operations initiatives intersect with this System Layer. For example, improvements to incident management and enhanced data for incidents results in more accurate alerts to travelers, using crowdsourced data allows ADOT to provide travel time estimates on corridors throughout the state on its DMS. ADOT has also been testing innovations such as pushing notifications to cell phones. During high-profile events in the urban areas, coordination is smooth for traveler information.

Recognizing the importance of up-to-the-minute information and alert dissemination, ADOT co-located several members of the communications team into the TOC to provide increased coordination between operators coordinating incidents and closures and the teams that could quickly get information out to the public. Multiple workgroups maintain AZ511 including ADOT's technical, data, communications and TOC staff.

Traveler information and messages are an integral part of ADOT's ITS and TSMO priorities. It will be important for ADOT to continue to explore opportunities to improve information it provides to stakeholders and partner agencies, as well as to travelers. The dynamic technology environment for sharing data, as well as getting alerts and information directly to vehicles and mobile technologies will provide more opportunities to get information directly to travelers. Several recommendations in this System Layer Plan support these future needs.

Challenges and Gaps

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 Traveler Information Systems:

- Limited third party data use
- Limited information delivered in small, discrete offerings, non-real-time.
- Limited alternate routing in rural areas.
- Drivers rely on third party traveler app; lack of using the AZ511 app which contains accurate information/warning.
- Multiple stakeholders involved in weather alerts which lead to delayed messaging.

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 workshop 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 Traveler Information Systems, the workshop was held on April 6, 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
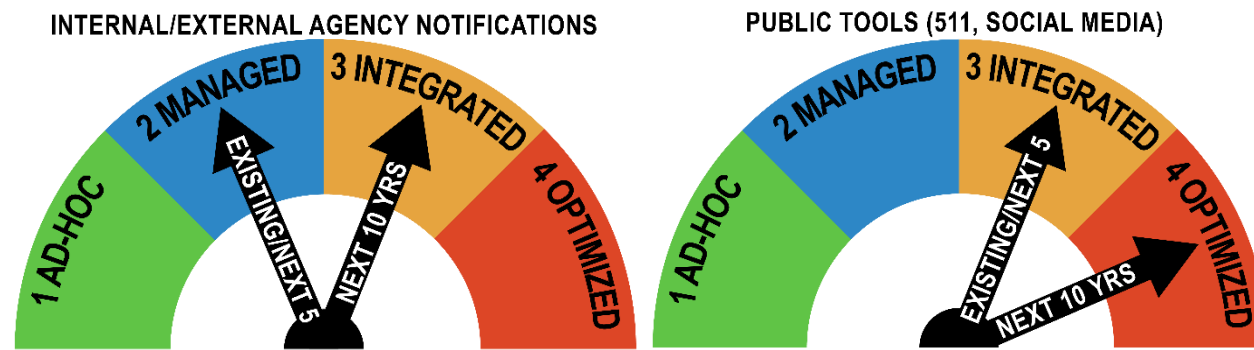
A summary of the feedback for internal/external agency notifications as well as public tools is shown in the graphics to the left. Public tools (such as AZ511 and social media) are evaluated separately from internal and external agency notifications. At the current state, public tools are robust and well executed, but there is an opportunity in the next ten years to improve to an optimized state. The current state of internal and external agency notifications is at the Level 2 managed state and can be improved to the Level 3 state in the next 10 years with some focused attention on utilizing private sector data feeds and private sector partnerships.

Public tools such as AZ511 and social media are robust and well executed. ADOT is in a position to move toward an optimized state by providing more opportunities to give information to the traveling public. The current state of internal and external agency notifications is at the managed state and can be improved to the integrated state in the future. Setting up automated systems to provide traveler information as well as utilizing different sets of data to provide insights for traveler information dissemination. Integration can be accomplished with focused attention on utilizing private sector data feeds to provide more robust information for various traveler information systems that ADOT manages.

Recommendations

This section provides a summary of important steps that can be used as building blocks for achieving the ultimate vision that extends to the five- to 10-year horizon. Because 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 desires to look at potential recommendations in the following areas:

- Truck Parking Availability – The state is undertaking a freight plan update that will largely drive the recommendations for truck parking availability. It is recommended that ADOT TSMO stay close to the effort to effectively guide the infrastructure and links to the traveler information services effectively.
- Travel Time Displays – There are no changes in how ADOT is currently displaying travel times statewide recommended. ADOT is already utilizing two panel messages per the DMS level of importance guidelines effectively and the travel time messages are valuable information statewide.
- AZ511 – Bolstering AZ511 with additional information and marketing the service as the main traveler information tool in the state of Arizona are where the recommendations in this system layer plan are guided.
- Mobile Apps – as ADOT is moving away from its My511 mobile application, any ability to implement any new mobile application capability to duplicate or replace a traveler's ability to access reliable third party systems such as Google or Waze is less realistic. The recommendations built in this system layer plan as related to mobile applications are leveraging existing platforms such as AZ511 and the ADOT website. Creating more consistency in information and bolstering already reliable information to have additional information provided to the traveler through these existing services is the direction forward.

Table 1 provides a summary of recommendations that ADOT should undertake to move toward Level 4 or Level 3 capabilities for Traveler Information Systems 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 – Traveler Information 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								
Maintain and Enhance AZ511 Public Data Feed to External Users	Improve processes for pushing critical alerts / closures / incidents / planned events to broaden information sharing (through APIs) with third-party providers to get ADOT data (events, work zones) onto publicly available apps and platforms (in-vehicle nav systems, commercially available mobile apps, mobile devices).	*Steps and Outcomes have been incorporated in the **Maintain and Enhance AZ511 Public Data Feed to External Users** action item in the **Data and Performance Management System Layer Plan***	ADOT makes some information captured with AZ511 available to third party providers such as Google/Waze. There is a current initiative underway to develop a Work Zone Data Exchange feed from ERS will help to standardize work zone information that will be consumed by private sector/third-party mobile providers. There will be a growing need to partner with the private sector to get data to travelers through a broad range of mobile and in-vehicle apps. There is limited DOT data available to AZ511 today and therefore limited data made available through the AZ511 API. Making quality, relevant and accurate data available to data aggregators and suppliers will help to expand the reach of ADOT's data. Several agencies have implemented open data portals, and ADOT can learn from these experiences.	TSMO Traffic Management Group Manager	ADOT ITG, Arcadis (AZ511 contractor)	$160K - $200K	$25K best practices synthesis $80K - $125K develop data portal $15K annual update / maintenance	On-call support for synthesis Use AZ511 contract to develop data portal
PERFORMANCE MEASURES								
Measure Public Input and Report	Track and measure public feedback on ADOT tools and information.	**Steps:** Develop feedback mechanism to get input from the public on value and use of ADOT traveler information tools. Attach survey to AZ511.gov, tailor questions for phone, web, mobile apps. Identify where future investments should be prioritized – tools that should be kept and enhanced, tools that should be considered for sunsetting, tools that are obsolete. Hosting an interactive focus group to get input from a variety of users to guide investment priorities. **Outcomes:** Quantitative feedback on user experiences, preferences and input to ADOT traveler information tools to inform updates.	ADOT is currently working with the University of Arizona on a natural language process for Twitter to mine for messages for potential reposting. ADOT currently tracks ad-hoc feedback from comments left on AZ511 and through social media. ADOT does not have the resources to conduct a worthwhile focus group in-house. This task will provide succinct and intentional quantitative feedback on current tools to help ADOT prioritize future investments.	Assistant Communications Director	ADOT TOC personnel	$150K if out-sourced	Replicate process every 5 years as communication preferences and methods change over time	Out-source – either RFP or TSMO On-Call assignment

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
STAFFING STRUCTURE								
None								
PROCESS STRUCTURE								
Updated ERS Processes for Data Entry and Verification	Collect any available local data that can support a more robust AZ511 platform with automated information from the ERS system for information dissemination (incidents, work zones, weather conditions, etc.).	**Steps:** ADOT needs to evaluate and update this process to improve accuracy and reliability of this information – which includes planned events, work zones, incidents, restrictions, among others. For example, a closure could automatically inform Google/Waze by an automatic entry into ERS which pushes to AZ511 without the need for manual intervention. Need to improve consistency of using ERS for planned events. Need to identify how that data would be entered or integrate with ERS to go into AZ511. Assess how the ERS system itself can help monitor timeliness of information and flag/alert potentially old or outdated information. More comprehensive outreach is needed to train users, provide periodic training updates and promote use of this system statewide. ADOT needs to evaluate what resources are needed to support better monitoring and outreach of this information, and what system updates may be needed to help automate monitoring, duplicate/incomplete entries, etc. **Outcomes:** Updated ERS processes.	ADOT's Event Reporting System is a key data source for traveler information and agency situational awareness. Multiple entities (within ADOT and agencies outside of ADOT) can enter data into this system, although data entry, review, updating, etc. is somewhat inconsistent outside of the ADOT TOC. ERS has entries from different people, with different approaches. This creates an inconsistent usage of ERS as traveler information reporting tool. ERS is linked to a number of software platforms to provide valuable information across agencies in Arizona. Although it is difficult to maintain software-to-software connections, it is a worthwhile investment to maintain the connections.	Traffic Management Group Manager	TOC personnel, District Contacts, up to five local agencies for pilot project, ADOT representative in charge of AZ511 data	$100K for update to ERS system for AZ511 additional data integration	$10K maintenance per year to maintain software-to-software connection required	Out-source to ERS provider
ADOT TOC Standard Operating Procedures for Local Agency Coordination	Standardize TOC operator communication requirements with local affected jurisdictions statewide when freeway capacity is nearly or fully closed.	**Steps:** Update contact list for ADOT TOC standard operating procedures. Get feedback from ADOT Districts on appropriate contacts for their respective district. Develop process to require operators to notify contact at affected jurisdiction of full freeway closure and integrate into TOC SOP. Distribute process to agencies statewide. Need to consider where jurisdictional boundaries begin/end. Utilize CAD potentially to automatically notify agencies statewide. Investigate potentially developing an ARIS for statewide, not just Maricopa County. **Outcomes:** SOP for TOC operators.	This recommendation builds on the practice currently happening in the metro areas but expands to statewide. ADOT is currently working on internal communication function where CAD can automatically notify agencies when needed. This will provide an additional step to alert local agencies when closures could send traffic to county or local roads. More consistent notifications to affected agencies when there is a full closure that might impact traffic volumes diverting to county or local roads.	ADOT TOC Dispatch Manager	ADOT District Engineers Regional Traffic Engineers County Public Works	-	No funding required – although this information should be updated and verified annually for accuracy	In-house (this can be out-sourced as well, although in-house staff should initiate the process)

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
PROCESS STRUCTURE								
Administer AZ511 Public Awareness Campaign	Expand advertising and awareness of ADOT traveler alerting tools for the public, including freight.	**Steps:** Develop consistent branding for tools within ADOT's suite of traveler information resources for the public. AZ511.gov currently provides links to the AZ511 mobile app and project-specific apps. Consider making app access more prominent from the home page. Consider adding a link from AZ511 to showcase information valuable for freight: closures, rest areas, future truck parking, etc. **Outcomes:** Improve overall awareness and use of ADOT tools by travelers, including freight.	Today, information can be found in a variety of locations, that all are linked because of the ADOT logo, but not linked otherwise. There is not a centralized public awareness campaign other than spot deployments of website updates, 511 updates, or other individual activities. ADOT requires a thorough and standardized message to make it known where information can be obtained and relied upon rather than an ad hoc approach that exists today. Standardizing messaging and branding will create a one-stop-shop mentality when travelers are looking where to go for reliable traveler information. As ADOT is going through a website redesign, this is being taken into consideration. As people move throughout the state, their information should be reliable and supported by one entity on behalf of the state system and that message needs to be carefully crafted to support.	Assistant Communications Director	ADOT Government Relations, ADOT TSMO, ADOT TOC	$150K	-	Out-source – either RFP or TSMO On-Call assignment
Establish DMS Message Automation	Create automated processes for DMS messages statewide to support planned events at minimum and potentially unplanned events such as for weather and incidents.	**Steps:** Update or replace the DMS scheduling software that requires manual procedures for messages to be released. Create DMS programming for planned events statewide and potentially unplanned events (if carefully developed) can be timelined for implementation in an automated manner. Make sure DMS messaging is automatically pushed into the ERS system for AZ511 posting to be able to be pulled by Google/Waze. **Outcomes:** Updated DMS scheduling software with predetermined messages for automatic posting.	For planned activities such as construction or special events, DMS messaging could be utilized more effectively, and more automatically. Currently FLIR is updating the scheduling software offered in DCAM. Standardized messages are predetermined prior to planned activities and can be automated for more streamlined functionality and use of the DMS for more than just planned activities. This programming is an overwhelming job statewide for one FTE.	Planned Event DMS Coordinator	Traffic Management Group Manager, TSMO Systems Maintenance Engineering Manager, Assistant State Engineer TSMO	$50K	-	Out-source – either RFP or TSMO On-Call assignment

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										
Real-Time Roadway Condition Enhancements – DMS and CCTV	Deploy or replace existing equipment supports real-time road condition technologies. This includes recommendations to deploy CCTV for monitoring roadway conditions / situational awareness in real-time and to deploy messages in key areas.	*Steps and Outcomes have been incorporated in the **Real-Time Roadway Condition Enhancements – DMS and CCTV** action item in the **Traffic Management System Layer Plan***	There is a broad set of existing DMS and CCTV throughout the state. Although there are a number of gaps around the state in real-time condition collection and reporting that would be valuable and cost effective to have physical infrastructure located. Priorities likely need to be for traffic management detouring purposes as well as road weather purposes.	TSMO RTEs	District Maintenance Managers, one representative from each TSMO group	Refer to Tool for DMS and CCTV	$150K for mini DMS $400K for full DMS $35K for each CCTV and pole	Refer to Tool for DMS and CCTV	$15K per DMS $1.5K per CCTV	Out-source – either RFP or TSMO On-Call assignment
EXPANSION OF ADOT TECHNOLOGY DEPLOYMENT										
Expand Availability of Additional Portable ITS Equipment (Rural Areas)	Equip districts with additional portable DMS for planned closures/restrictions.	*Steps and Outcomes have been incorporated in the **Expand Availability of Additional Portable ITS Equipment (Rural Areas)** action item in the **Traffic Incident Management System Layer Plan***	The permanently installed ITS infrastructure may not be always located in the exact area of a weather, incident, or event needed for monitoring real-time conditions. Portable equipment deployment allows the District flexibility to address an immediate need for real-time condition collection without the long-term requirements.	TSMO RTEs	District Maintenance Managers	See *Expand Availability of Additional Portable ITS Equipment (Rural Areas)* for detail	$15K for portable CCTV with trailer $20K for portable DMS with trailer $10K for portable comm. (radio)	See *Procure Additional Portable ITS Equipment* for detail	No O&M cost anticipated – although replacement may occur in advance of traditional lifecycle due to wear and tear	Out-source through RFP to vendor for procurement

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
DEMONSTRATED TECHNOLOGIES FOR ADOT DEPLOYMENT										
Broaden Implementation of Third Party Data in AZ511	TOC should use third-party data for incident detection/notifications to have TOC verify and get information to traveling public sooner than they learn about it in the road.	*Steps and Outcomes have been incorporated in the* **Continue Evaluating Third Party Data Use** *action item in the* **Data and Performance Management System Layer Plan**	ADOT has limited real-time detection capabilities outside of the metro area freeways. The existing ADOT RITIS procurement process is limited in its use and needs to be expanded to TOC operators, TSMO personnel, and Regions for real-time and decision-making use. Third party providers can generate data to show atypical conditions (such as bottlenecks, slowdowns, decreases in travel time) to alert ADOT of potential crashes or incidents on the state highway system. Other state DOTs have found this incredibly valuable for incident notifications and awareness of potential incidents in areas where ADOT currently does not have detectors, cameras, or other real-time monitoring infrastructure.	TSMO Systems Technology Group Manager	Traffic Management Group Manager, ADOT TOC operators, TSMO RTEs, District TEs, other TSMO staff as needed	-	Unique cost for each third party data source	Third party data has already been acquired by the state

$80K for Arcadis | $650K per year for each third party data agreement statewide | In-house (this can be out-sourced as well, although in-house staff should initiate the process) |

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
DEMONSTRATED TECHNOLOGIES FOR ADOT DEPLOYMENT										
Real-Time Truck Parking Availability	Implement real-time truck parking availability information at key areas (already underway through TPAS project); include real-time information on AZ511.gov and ADOT alerting app.	**Steps:** Leverage the TPAS pilot along I-10 to expand statewide. Steps should be available through the TPAS project, including locations where pilot technologies will be deployed. Identify ways to make information available through ADOT's existing suite of traveler information tools, in addition to physical infrastructure near the parking areas. Leverage the interface between TPAS and AZ511 to get parking availability information on to the AZ511.gov and AZ511 alerting apps from the I-10 Connected Corridor Project. Coordinate with MPD closely with relation to the freight plan. Establish operating parameters for displaying info on AZ511 (ADOT may elect to not have specific space availability shown since that information is too dynamic). Get feedback from truckers as to accuracy and value of the information for their route planning. **Outcomes:** Implemented real-time truck parking availability information system statewide.	Build on the project already underway through the I-10 Connected Corridor project. There is a total of eight sites along four locations of I-10 at existing rest areas. IT point-of-contact is being identified for the project. Freight plan update is underway with MPD which should include real-time truck parking at key areas. Additional truck parking would need to be an output from the freight plan, along with funding to support. Currently, that is not available; so ADOT will monitor the I-10 TPAS to assess ability and application.	Senior ITS Project Development Manager	ADOT MPD Freight Plan personnel, TSMO RTEs	To be identified by the freight plan, TSMO personnel to coordinate to support	To be identified by the freight plan, TSMO personnel to coordinate to support	To be identified by the freight plan, TSMO personnel to coordinate to support	To be identified by the freight plan, TSMO personnel to coordinate to support	Out-source – either RFP or TSMO On-Call assignment
EMERGING TECHNOLOGY FOR ADOT PILOTING										
None										

Performance Measures

The ADOT TSMO Plan defines performance measures using three categories, safety, mobility, and infrastructure/system health. The ADOT Communications group tracks several activity measures such as number of unique users to the website, daily/monthly/annual users), trends and usage during weather events. The following performance measures are recommended to be tracked in order to support the recommendations listed in this System Layer Plan:

Performance Measurement Topic	Performance Measure	Measure Applicability
Timely and accurate road closure information	Use established DMS messages for planned events / incidents / unplanned closures	Focus on increasing consistency of DMS messages for planned and unplanned events on all state roads # of ADOT TOC dispatcher-created messages % of ADOT-created messages that follow the standard format
	Expand partnerships with counties and cities to increase data in AZ511 statewide (get to 100% of counties getting closure info to AZ511 systems)	# of incidents entered into AZ511 by other jurisdictions
Get more alerts to more users	Increase # of partnerships with data aggregators and data providers	Track and document activity of specific data aggregators accessing AZ511 APIs
Improve awareness of ADOT's traveler information tools	Increase usage of ADOT's AZ511.gov website by unique visitors and frequent visitors	# of unique users for web site and specific web pages # of repeat web users
Improve safety and mobility*	Expand technologies to provide en-route information on key corridors	% of priority locations (based on incidents, congestion, weather, etc.) that are covered by each type of device

* The ADOT Communications group also actively tracks social media, including retweets, reposting and responses to get a gauge of user engagement. ADOT averages 450,000 calls annually since launching the updated system. Daily call averages over the past three years are 1,376. 1.56M unique users have visited AZ511.gov in the past 12 months; approximately 66% of users access az511.gov from a mobile device.