2024 Arizona Statewide ITS Architecture Update

Contract No. CTR060470
Task Order MPD0232-23 / A1002

Final Plan of the Arizona Statewide ITS Architecture Update

May 2024

Prepared for:
Arizona Department of Transportation
Multimodal Planning Division

Prepared by:

DOCUMENT VERSION CONTROL

DOCUMENT NAME	SUBMITTAL DATE	VERSION NO.
Initial Internal Draft	March 27, 2024	0.5
Revised Internal Draft	April 2, 2024	0.8
Internal Draft for QC Review	April 7, 2024	0.9
Draft submittal to ADOT	April 12, 2024	1.0
Revised Draft for Internal QC Review	May 15, 2024	1.9
Final submittal to ADOT	May 20, 2024	2.0

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ACRONYMS

Acronym	Description
AASHTO	American Association of State Highway and Transportation Officials
ACE	Automated Commercial Environment
ADEM	Arizona Division of Emergency Management
ADEQ	Arizona Department of Environmental Quality
ADMS	Archived Data Management Subsystem
ADOT	Arizona Department of Transportation
ALERT	Arizona Local Emergency Response Team
ALISS	Accident Location Identification Surveillance System
ANSI	American National Standards Institute
AOC	Administrative Office of the Courts
APTA	American Public Transportation Association
ARC-IT	Architecture Reference for Cooperative and Intelligent Transportation
ARIS	AZTech Regional Info System
ARS	Arizona Revised Statutes
ASU	Arizona State University

Acronym	Description
ATMS	Advanced Transportation Management System
ATSPT	Arizona Tribal Strategic Partnering Team
AVI	Automated Vehicle Identification
AVL	Automatic Vehicle Location
AWC	Arizona Western College
BIA	Bureau of Indian Affairs
BRT	Bus Rapid Transit
CAD	Computer-Aided Dispatch
CAG	Central Arizona Governments
Caltrans	California Department of Transportation
CBP	US Customs and Border Protection
CCTV	Closed Circuit Television
CDL	Commercial Driver License
CDLIS	Commercial Driver's License Information System
CFR	Code of Federal Regulations
COG	Council of Government
CRIS	Crash Reporting Information System
CRT	Certified Response Team
CV	Connected Vehicle
CVA	Connected and Automated Vehicles
CVO	Commercial Vehicle Operations
CVRIA	Connected Vehicle Reference ITS Architecture
CYMPO	Central Yavapai Metropolitan Planning Organization
DEMA	Arizona Division of Emergency and Military Affairs
DEOC	ADOT's Departmental Emergency Operations Center
DMS	Dynamic Message Sign
DPS	Department of Public Safety
DTMF	Dual-tone Multi-frequency
ECD	Enforcement Compliance Division
EM	Emergency Management
EMS	Emergency Medical Services
EOC	Emergency Operations Center
EV-ChART	Electric Vehicle Charging Analytics and Reporting Tool
EVP	Emergency Vehicle Preemption
FAST	Freeway & Arterial System of Transportation
FHWA	Federal Highway Administration
FMS	Freeway Management System
FMSCA	Federal Motor Carrier Safety Administration
FSP	Freeway Service Patrol
FTA	Federal Transit Administration
GOHS	Arizona Governor's Office of Highway Safety
HAR	Highway Advisory Radio
HAZMAT (HazMat)	Hazardous Materials
HCRS	Highway Condition Reporting System
HPMS	Highway Performance Monitoring System

Acronym	Description
IC	Incident Command
ICE	Immigration and Customs Enforcement
ICM	Integrated Corridor Management
IEEE	Institute of Electrical and Electronics Engineers
IFTA	International Fuel Tax Agreement
IP	Internet Protocol
IPAWS	Integrated Public Alert Warning System (International Registration Plan)
IRP	International Registration Plan
IRU	Incident Response Unit
ISP	Information Service Provider
IT	Information Technology
ITG	Information Technology Group
ITD	Innovative Technology Deployment
ITE	Institute of Transportation Engineers
ITS	Intelligent Transportation Systems
IVR	Interactive Voice Response
KART	Kingman Area Regional Transit
LHMPO	Lake Havasu Metropolitan Planning Organization
LRTP	Long Range Transportation Plan
MAG	Maricopa Association of Governments
MAP-21	Moving Ahead for Progress in the 21st Century Act of 2012
MC	Maintenance & Construction
MCDOT	Maricopa County Department of Transportation
MCO	Maintenance and Construction Operations
MOU	Memorandum of Understanding
MPD	Multimodal Planning Division
MPO	Metropolitan Planning Organization
MVD	Motor Vehicle Division
NACOG	Northern Arizona Council of Governments
NAIPTA	Northern Arizona Intergovernmental Public Transportation Authority (doing business as Mountain Line)
NAU	Northern Arizona University
NDOT	Nevada Department of Transportation
NEMA	National Electrical Manufacturers Association
NMDOT	New Mexico Department of Transportation
NOAA	National Oceanic and Atmospheric Administration
NOC	Network Operations Center
NTCIP	National Transportation Communications for ITS Protocol
O&M	Operations and Maintenance
OBE	On-board Equipment
P2P	Planning to Programming
PAG	Pima Association of Governments
PD	Police Department
PDPS	Problem Driver Pointer System
PIO	Public Information Officer

Acronym	Description
PMT	Project Management Team
POE	Port of Entry
PS	Public Safety
PSAP	Public Safety Answering Point
PT	Public Transportation
RAD-IT	Regional Architecture Development for Intelligent Transportation
RADS	Regional Archived Data System
RCRS	Road Condition Reporting System
RFP	Request for Proposal
RFS	Radar Feedback Sign
RMS	Records Management System
RSE	Roadside Equipment
RTDN	Regional Transportation Data Network
RTP	Regional Transportation Plan
RWIS	Road Weather Information System
S2S	State to State Verification Service
SAE	Society of Automotive Engineers
SAFER	Safety Fitness Electronic Record
SCMPO	Sun Corridor Metropolitan Planning Organization
SDO	Standards Development Organization
SENTRI	Secure Electronic Network for Travelers Rapid Inspection
SET-IT	Systems Engineering Tool for Intelligent Transportation
SHL	State Highway Log
SLP	System Layer Plan
SPaT	Signal Phasing and Timing
STIP	State Transportation Improvement Plan
SVMPO	Sierra Vista Metropolitan Planning Organization
TEA-21	Transportation Equity Act for the 21st Century ~
TEU	Twenty–foot Equivalent Unit
TI	Traveler Information
TIC	Traveler Information Center
TIP	Transportation Improvement Program
TM	Traffic Management
TMC	Transportation Management Center
TOC	Traffic Operations Center
TPAS	Truck Parking Availability System
TSMO	Transportation Systems Management and Operations
TSP	Transit Signal Priority
TTTR	Truck Travel Time Reliability
U of A	University of Arizona
UDOT	Utah Department of Transportation
USDOT	United States Department of Transportation
V2I	Vehicle to Infrastructure
V2X	Vehicle to Everything
VMS	Variable Message Signs

Acronym	Description
VSL	Variable Speed Limit
WACOG	Western Arizona Council of Governments
WIM	Weigh in Motion
WWD	Wrong Way Driver
YCAT	Yuma County Area Transit
YCIPTA	Yuma Country Intergovernmental Public Transportation Authority
YMPO	Yuma Metropolitan Planning Organization

1. INTRODUCTION

Intelligent Transportation Systems (ITS) is loosely defined as the use of electronics, communications technologies, and computers in an integrated manner to improve the efficiency and safety of roadways. ITS offers non-traditional solutions to transportation problems and provides an alternative to new infrastructure.

ITS architecture is a framework for deployment and integration of ITS. An ITS architecture provides an understanding of "what" needs to be integrated and what information to be exchanged between, or among systems. An ITS architecture consists of Physical Objects, Information Exchanges, and Services. It functionally defines what pieces of transportation management systems are linked to others and what information is exchanged between and among them.

In 2023, the Arizona Department of Transportation (ADOT) initiated an update to the 2018 Arizona Statewide ITS Architecture. The primary purpose of the Statewide ITS Architecture Update is as follows:

- Bring the Arizona Statewide ITS Architecture up to date with the current version of the Architecture Reference for Cooperative and Intelligent Transportation (ARC-IT), formerly known more simply as the National ITS Architecture
- Provide a foundation for Arizona agencies to plan, design, and implement ITS that is consistent with the Statewide ITS Architecture Update
- Incorporate all Arizona ITS within the Statewide ITS Architecture that is not included in the Maricopa Association of Governments (MAG) or Pima Association of Governments (PAG) ITS Architectures
- Align the Statewide ITS Architecture with the state's planning goals and operations objectives
- Recommend ITS projects from the Statewide ITS Architecture Update to be implemented in the planning to programming processes

1.1 Background

In 2013, ADOT developed the Arizona Statewide Intelligent Transportation Systems (ITS) Architecture to provide a roadmap for transportation systems integration. The architecture was developed through a cooperative effort by the State's transportation and emergency management agencies, covering all modes of transportation. It represented a shared vision of how each agency's systems would work together and share information and resources to provide safer, more efficient, and more effective transportation systems for travelers in the State of Arizona. The architecture provided an overarching framework that spanned all the State's transportation organizations, emergency response, and individual transportation projects. The 2013 Statewide ITS Architecture was developed based on the National ITS Architecture Version 7.0.

After the 2013 Arizona Statewide ITS Architecture Update, the United States Department of Transportation (USDOT) initiated a major update to the National ITS Architecture that covered all the scope and contents from the National ITS Architecture and integrated the then recently completed Connected Vehicle Reference ITS Architecture (CVRIA) into a single reference architecture. The merging of these two products was then referred to as the Architecture Reference for Cooperative and

Intelligent Transportation (ARC-IT). ARC-IT reflects the contributions of a broad cross-section of the ITS community including transportation practitioners, systems engineers, system developers, technology specialists and consultants.

In 2018, the Arizona Statewide ITS Architecture was updated, to be consistent with ARC-IT version 8.2. That update to the Statewide ITS Architecture covered all Arizona ITS within the state that was not included in the Maricopa Association of Governments (MAG) or Pima Association of Governments (PAG) ITS Architectures. The 2018 Update followed a process that was substantially like this 2024 Update, which resulted in a Statewide ITS Architecture that is consistent with federal guidance for ITS architecture development and documentation.

1.2 2024 Arizona Statewide ITS Architecture Update

The intent of the 2024 Update is to maintain up to date inventories of ITS elements, ITS services, ITS needs, ITS projects, and ITS stakeholders from around the state. The 2024 Update is based on the currently available version of ARC-IT, version 9.2, which was released in October 2023. The Architecture is documented in the companion software tool called Regional Architecture Development for Intelligent Transportation (RAD-IT), also version 9.2.

1.3 Project Management Team

This ITS Architecture update was led by an ADOT Project Management Team (PMT). The role of the PMT was to provide technical guidance, support, advice, suggestions, recommendations, and to perform document reviews throughout the update process. PMT members included the ADOT Project Manager, from the ADOT Multimodal Planning Division (MPD) and select members of the ADOT Transportation Systems Management and Operations (TSMO) Division, in conjunction with the Consultant Team.

1.4 Purpose of this Document

The main purpose of the Final Plan of the Arizona Statewide ITS Architecture Update is to present consolidated documentation of interim deliverables and update activities, which included the following:

- Establishment of a Stakeholder Group
- Data Collection
    - Documentation of an ITS Inventory
    - Identification of Service Packages and User Needs
    - Development of an Operational Concept
- Identification of System Interfaces and Information Flows in the architecture
- Identification of Project Sequencing
- Documentation of a List of Agency Agreements
- Identification of pertinent ITS Standards
- Development of an ITS Architecture Maintenance Plan
- Comprehensive updates to the RAD-IT software database

1.5 ITS Architecture Components

Federal guidance for the development of regional ITS architectures directs that, at a minimum, a regional ITS architecture shall include the following:

1. Architecture Scope and Region Description
2. Stakeholder Identification
3. System Inventory
4. Needs and Services
5. Operational Concept
6. Functional Requirements
7. Interfaces/ Information Flows
8. Project Sequencing
9. Agreements
10. Standards Identification
11. Using the Regional ITS Architecture
12. Maintenance Plan

The material presented in this Final Plan is consistent federal guidance for ITS architecture development and documentation. It is also consistent with standard practice for regional and statewide architecture across the country.

2. STATEWIDE ITS ARCHITECTURE PURPOSE AND NEED, TIMEFRAME, AND LOCALE

The Arizona Statewide ITS Architecture was developed and is maintained by ADOT. There are three existing ITS architectures within the State of Arizona.

1. The Arizona Statewide ITS Architecture (2018 Update)
2. The Maricopa Association of Governments (MAG) Regional ITS Architecture (2019 Update)
3. Pima Association of Governments (PAG) Tucson Metropolitan Region Intelligent Transportation Systems Strategic Deployment Plan for the 21st Century

The Arizona Statewide ITS Architecture is separate but aligned with the two regional architectures. It focuses on statewide ITS services, ADOT-owned ITS Elements, and all other ITS Elements outside of the two regional architectures. Some of the MAG and PAG regional architecture Elements are included in the Arizona Statewide ITS Architecture, as required.

2.1 Purpose and Need

The Transportation Equity Act for the 21st Century (TEA-21), enacted in 1998, authorized the federal surface transportation programs for highways, highway safety, and transit for the 6-year period from 1998 to 2003. In 2001, USDOT published the Code of Federal Regulations 23 (23CFR) Part 940, which implements section 5206(e) of TEA-21. 23CFR Part 940 is the Federal Highway Administration (FHWA) Final Rule and Federal Transit Administration (FTA) Policy pertaining to conformance with the National Intelligent Transportation Systems Architecture and Standards. It is also known informally as "The Architecture Rule."

23CFR Part 940 requires that federally funded projects conform to the National ITS Architecture and standards, be guided by a regional architecture of geographic boundaries defined by stakeholder needs and use a system engineering analysis that considers the total project life cycle. The National ITS Architecture has evolved since 2001 and is now known as ARC-IT.

ADOT has determined that development and use of a Statewide ITS Architecture achieves coordinated and orderly ITS planning and deployment, as envisioned in the Architecture Rule. The Statewide ITS Architecture also achieves coordination of multimodal and rural ITS planning and deployment outside of the MAG and PAG metropolitan regions. The Arizona Statewide ITS Architecture enables the state of Arizona and the Statewide ITS Architecture stakeholders to be eligible for federal funding for ITS projects.

2.2 Timeframe

An ITS architecture planning horizon should project far enough into the future to guide the efficient integration of ITS over time. While there is no required minimum, the planning horizon used for the Arizona Statewide ITS Architecture Region is 10 years. Making the timeframe too short reduces the value of the regional ITS architecture as a planning tool. Making the timeframe too long increases the effort involved since long-range forecasts are difficult to make and require reevaluation. Historically, ADOT has updated the Arizona Statewide ITS Architecture approximately every five years. A ten-year planning horizon supports the evolving nature of ITS with the opportunity for refinement of the architecture content every five years to address the five- to ten-year ITS plans as they get closer.

2.3 Description of the Region

The study area for the Arizona Statewide ITS Architecture is defined by the boundaries of the state of Arizona – outside of the MAG and PAG metropolitan planning areas. The MAG metropolitan planning area encompasses the entirety of Maricopa County; and the PAG metropolitan planning area encompasses the entirety of Pima County. The Arizona Statewide ITS Architecture captures interstate ITS interfaces and supporting ITS services with the neighboring states of California, Colorado, Nevada, New Mexico, and Utah.

2.4 Related Architectures

In addition to the MAG and PAG ITS Regional Architectures, ADOT will share operations and data with surrounding states to varying degrees. Therefore, the statewide ITS architectures listed below are included in the Arizona Statewide ITS Architecture and reflect connectivity to elements in those ITS architectures, where appropriate.

1. California Statewide ITS Architecture (Caltrans 2017)
2. 2019 New Mexico Statewide ITS Architecture Update (2019)
3. 2019 Southern Nevada Regional ITS Architecture (NDOT 2019)
4. Mountainland Association of Governments (MAG) and Wasatch Front Regional Council (WFRC) Metropolitan Planning Organizations ITS Architecture (Utah Department of Transportation – 2018)

3. PARTICIPATING AGENCIES AND OTHER STAKEHOLDERS

In consultation with the ADOT Project Manager, the consultant team took the lead in assembling a Stakeholder Group that would be engaged to assist with the Statewide ITS Architecture Update. The goal was to establish a Stakeholder Group that would provide input and feedback to the Statewide ITS Architecture Update process, the interim deliverables, and the Final Plan of the Arizona Statewide ITS Architecture Update, from a broad perspective. This meant identifying a Stakeholder Group that was geographically diverse, as well as representative of multiple transportation modes and multiple transportation interests.

The consultant team was provided with multiple stakeholder lists from recent ADOT planning efforts that were thought to have some overlapping interest in the ITS Architecture Update. One of those stakeholder lists came from a recently completed National Electric Vehicle Infrastructure (NEVI) planning effort led by ADOT. Another stakeholder list provided by ADOT included contacts from Councils of Governments (COGs), Metropolitan Planning Organizations (MPOs), cities, and towns from around Arizona. Several additional potential contacts from several Native American tribal entities and transit operators from around the state were also provided by various modal representatives from within ADOT.

The stakeholder lists were reviewed with the ADOT Project Manager and some general direction was agreed upon regarding which stakeholders would be the most likely to participate in the Statewide ITS Architecture Update. A specific set of ADOT staff were included, primarily ADOT's Transportation Systems Management and Operations (TSMO) group. Other modal staff from ADOT were also identified, including transit representatives and commercial vehicle enforcement personnel from the Enforcement and Compliance Division (ECD). Outside of ADOT, individual stakeholders were generally identified by their role in their respective agencies. Broadly speaking, traffic engineers, agency engineers, transit planners, transportation planners, and transit managers were readily identified as logical participants to engage. In some cases, city managers and public works directors were identified. Other stakeholders that were identified to be engaged included Arizona Department of Public Safety (DPS) personnel, Customs and Border Protection (CBP) personnel, and the Arizona Department of Environmental Quality (ADEQ) personnel.

The Arizona Statewide ITS Architecture Update generally excludes ITS from within the MAG and PAG MPO planning areas, unless the ITS is providing a statewide service, or is connected to a statewide service. The reason for this exclusion is, both of these metropolitan planning areas have their own regional ITS architecture. However, MAG and PAG staff were engaged in the Statewide ITS Architecture Update process to ensure proper coordination between the Statewide ITS Architecture Update and the MAG and PAG Regional ITS Architecture documents.

The stakeholder list and individual stakeholder names were combined into a single database and saved on a shared folder. ADOT staff and the consultant team collaborated on the stakeholder contact list and this simplified and expedited stakeholder changes and updates.

ADOT knew the specific agencies/organizations that should be included on the Statewide ITS Architecture Update Stakeholder Group but did not know in all cases the individuals from those agencies/organizations to invite. Members of the consultant team and ADOT staff reviewed agency websites and other sources to identify potential stakeholders who were contacted and asked to participate in the Statewide ITS Architecture Update Stakeholder Group.

Table 3-1 is a listing of agencies engaged in the 2024 Statewide ITS Architecture Update. Table 3-1 is organized alphabetically, by stakeholder agency name. The table covers parts of five pages of this document, with the two left-hand columns listing agencies alphabetically A through P; and the right-hand columns continuing P through Z. The gray column is intended to create visual separation of the left-hand columns from the right-hand columns.

Table 3-1: Agencies Engaged in the 2024 Statewide ITS Architecture Update

Stakeholder Agency (A through P)	Job Title		Stakeholder Agency (P (cont'd) through Z)	Job Title
ADOT ECD	Innovative Technology Deployment (ITD) Manager		Pima County	Engineer III
ADOT ECD `	ITD - Finance		Pima County Department of Transportation	Deputy Director
ADOT ECD	Quality Management Administrator/Spillman Flex & TraCS		Pinal County	Senior Planner/Public Works
ADOT Broadband Office	Program Administrator		Pinal County	Traffic Engineer
ADOT Emergency Management	Traffic Engineer - Emergency Management		Pinetop-Lakeside	Public Works Director
ADOT IT	IT Contract Manager		Prescott	Town Engineer
ADOT ITG	TOC ITS Support		Prescott Valley	Public Works Director
ADOT Multimodal Planning Division	Regional Planning Manager		Quartzsite	Public Works Director
ADOT Transit	ADOT Transit Group Manager		Quartzsite Camel Express	Transit Manager
ADOT TSMO	Systems Technology Group Manager		Safford	City Engineer
ADOT TSMO	Traffic Management Group , Manager		Safford	Public Works Director/City Engineer
ADOT TSMO	Systems Maintenance Engineer, Manager		Sahuarita	Traffic Signal Operation Manager
ADOT TSMO	Regional Traffic Engineer, Southern Region		San Luis	Director of Public Works
ADOT TSMO	Systems Technology Team Lead		Santa Cruz County	County Engineer / Public Works Director
ADOT TSMO	Systems Management Group, Manager		Sedona	Assistant City Manager/Director of Public Works

Stakeholder Agency (A through P)	Job Title		Stakeholder Agency (P (cont'd) through Z)	Job Title
ADOT TSMO	Systems Technology Transportation Engineering Specialist		Sedona	Public Works Director
ADOT TSMO	ITS Project Manager		Show Low	Public Works Director
ADOT TSMO	Operational Traffic and Safety Group, Manager		Sierra Vista	CIP Development Manager
Apache County	County Engineer		Snowflake	Public Works Director
Arizona State University (ASU), School of Sustainable Engineering	Associate Professor of Transportation Systems		Springerville	Public Works Director
Arizona Department of Public Safety (DPS)	Sgt. Highway Patrol Division		Springerville	Town Manager
Benson	Public Works Superintendent		Springerville	Town Manager
Benson	Public Works Director - City Engineer		Star Valley	Finance Director
BIA Navajo Regional Office	Western Navajo Agency Road Engineer		Transit - City of Benson	Benson Area Transit
BIA Navajo Regional Office	Regional Maintenance Engineer		Transit - City of Bisbee	City of Bisbee
BIA Navajo Regional Office	Chinle Agency Road Engineer		Transit - City of Bullhead City	City of Bullhead City
BIA Navajo Regional Office	Regional Director		Transit - City of Coolidge	City of Coolidge
BIA Navajo Regional Office	Acting Regional Road Engineer		Transit - City of Cottonwood	City of Cottonwood
BIA Navajo Regional Office	Fort Defiance Agency Road Engineer		Transit - City of Douglas	City of Douglas
BIADOT	Engineer		Transit - City of Kingman	City of Kingman
BIADOT	Supervisory Highway Engineer		Transit - City of Maricopa	City of Maricopa
BIA Western Regional Office	ROW Highway Engineer		Transit - City of Sedona	City of Sedona
Bullhead City	Public Works Director		Transit - City of Show Low	City of Show Low
Caltrans District 8	Transportation Engineer Electrical		Transit - City of Willcox	City of Willcox
Chino Valley	Public Works Director		Transit - City of Winslow	City of Winslow
City of Casa Grande	City Traffic Engineer		Transit - Helping Hands Agency	Helping Hands Agency
Cochise	Director, Engineering & Natural Resources		Transit - Hopi Tribe	Hopi Tribe
Coconino County	Director of Public Works		Transit - Hualapai Indian Tribe	Hualapai Indian Tribe (FTA Direct)

Stakeholder Agency (A through P)	Job Title		Stakeholder Agency (P (cont'd) through Z)	Job Title
Coconino County	Director of Public Works		Transit - Hualapai Indian Tribe	Hualapai Indian Tribe (FTA Direct)
COG - CAG	Transportation Planning Manager		Transit - Navajo Transit System	Navajo Transit System (FTA Direct)
COG - NACOG	Senior Mobility Management Planner		Transit - Northern Arizona Intergovernmental Public Transportation Authority	IT Manager
COG - SEAGO	Transportation Program Administrator		Transit - Regional Public Transportation Authority	Valley Metro Regional Public Transportation Authority
COG - WACOG	Transportation Program Manager		Transit - Regional Transportation Authority of Pima County	RTA of Pima County
Colorado Department of Transportation (CDOT)	ITS Project Development Manager		Transit - Salt River Pima-Maricopa Indian Community	Salt River Pima-Maricopa
Colorado Department of Transportation (CDOT)	ITS Asset Manager		Transit - San Carlos Apache Tribe	Nnee Bich'o Nii Services (FTA Direct)
Cottonwood	City Engineer		Transit - Town of Miami	Town of Miami
Customs/BP	Assistant Director, Trade and Cargo Security		Transit - Town of Payson	Town of Payson
Customs/BP	Assistant Director for Mission Support		Transit - Yavapai Regional Transit, Inc	Yavapai Regional Transit*
Customs/BP	Director of Field Operations		Transit - Yuma County Intergovernmental Public Transportation Authority	Transit Director
Douglas	Public Works Director/City Engineer		Tribe - Ak-Chin Indian Community	Director - Planning and Development Department
Eloy	Public Works Director		Tribe - Cocopah Indian Tribe	Planning Director
FHWA - Arizona Division	Operations Engineer		Tribe - Colorado River Indian Tribes	Planning Manager
Flagstaff	Senior Transportation Engineer		Tribe - Fort McDowell Yavapai Nation	Planning & Project Manager
Federal Motor Carrier Safety Administration (FMCSA) - AZ	Division Administrator		Tribe - Fort Mojave Indian Tribe	Tribal Planner - Roads Department
Forest Service Southwestern Region	Transportation Program Manager		Tribe - Fort Yuma Quechan Tribe	Director - Economic Development Administration
Gila Bend	Town Manager		Tribe - Gila River Indian Community	Director - Department of Transportation

Stakeholder Agency (A through P)	Job Title		Stakeholder Agency (P (cont'd) through Z)	Job Title
Gila County	Director		Tribe - Hopi Tribe	Director - Department of Transportation
Globe	City Engineer		Tribe - Hopi Tribe	HDOT Engineer
Graham County	General Planning & Zoning		Tribe - Hualapai Tribe	Transportation Planner
Greenlee	Environmental Health Specialist		Tribe - Hualapai Tribe	Director - Public Services Department
Greyhound Lines, Inc.	Greyhound Lines, Inc.		Tribe - Kaibab Band of Paiute Indians	Vice-Chairwoman - Tribal Council/Transportation Committee
GSA	Arizona-California (Region 9) LPOE		Tribe - Navajo Nation	Planning Department Manager, Division of Transportation
Holbrook	Interim Town Manager		Tribe - Pascua Yaqui Tribe	Transportation/Construction Manager - Facilities Management Department
City of Kingman	Assistant City Engineer		Tribe - Pascua Yaqui Tribe	Division Director
La Paz County	Public Works Director		Tribe - Pueblo of Zuni	Program Manager - Tribal Roads Department
Maricopa County	Transportation Systems Planning Branch Manager		Tribe - Salt River Pima-Maricopa Indian Community	Roads Section Manager - Public Works Department
Maricopa County - TSMO	Data Systems Engineer		Tribe - San Carlos Apache Tribe	Executive Director - Transportation Department
Maricopa County - TSMO	Traffic Technology Branch Manager		Tribe - San Juan Southern Paiute Tribe	Tribal Administrator/Planner - Tribal Administration/Planning Department
Maricopa County - TSMO	Traffic Operations Branch Manager		Tribe - Tohono O'odham Nation	Interim Executive Director - Office of Planning and Economic Development
Mohave County	Director		Tribe - Tohono O'odham Nation	Planning & Economic Development Dept.
MPO - CYMPO	Executive Director		Tribe - Tohono O'odham Nation	Planner
MPO - LHMPO	Executive Director		Tribe - Tonto Apache Indian Tribe	Roads and Streets Coordinator
MPO - MAG	TSMO Program Manager		Tribe - Tonto Apache Indian Tribe	Grant Manager - Tribal Gaming Office
MPO - METROPLAN	Planning Manager		Tribe - White Mountain Apache Tribe	Director - Division of Transportation

Stakeholder Agency (A through P)	Job Title		Stakeholder Agency (P (cont'd) through Z)	Job Title
MPO - PAG	Director of Transportation Services		Tribe - White Mountain Apache Tribe	Director - Division of Transportation
MPO - SCMPO	Deputy Director		Tribe - Yavapai-Apache Nation	Public Works Manager
MPO - SCMPO	Executive Director		Tribe - Yavapai-Prescott Indian Tribe	Tribal Planner - Planning Department
MPO - SVMPO	Executive Director		University of Arizona (U of A)	Associate Professor (Transportation Engineering)
MPO - YMPO	Principal Engineer		Utah Department of Transportation	ITS Program Manager, Traffic Management Division
NAIPTA	Executive Director		Utah Department of Transportation	Planning Director
NAIPTA	Mobility Planner		Welton	Public Works Director
National Parks	Operations Research Analyst		Wilcox	City Manager
Navajo County	Assistant County Engineer		Wilcox	Public Works Director
Nevada Department of Transportation	Assistant Chief Traffic Operations Engineer		Williams	Public Works Director
New Mexico Department of Transportation	ITS Manager		Yavapai County	County Engineer
Nogales	Public Works Director		Yuma	City Traffic Engineer
Northern Arizona University (NAU)	Director of AZTrans: The Arizona Laboratory for Applied Transportation Research		Yuma	Director of Public Works
Page	Public Works Director		Yuma County	Interim Director
Parker	Community Development Director		Yuma County	Director
Payson	Town of Payson		Winslow	Transit Manager
Pima County	Principal Planner			

Source: Excerpted from the 2024 Statewide ITS Architecture Update Stakeholder Contact List

3.1 Stakeholders in the RAD-IT Database

Separate from the agencies engaged to participate in the 2024 Statewide ITS Architecture Update, is the list of stakeholders represented in the RAD-IT database. Not every stakeholder engaged in the ITS architecture update process is reflected explicitly in the RAD-IT database. In many cases, when several agencies have similar ITS inventory characteristics and capabilities, those individual stakeholder agencies are grouped together into a single generic stakeholder related to a generic ITS element. For example, the stakeholder in the RAD-IT database called Arizona Cities and Towns represents several smaller cities and towns around the state that have similar characteristics from a transportation operation and ITS perspective. This simplifies the RAD-IT database, as well as the documentation for stakeholder review. It also promotes the establishment of standard interfaces for each instance of the generic inventory elements which makes interfacing with each element instance easier to establish. This is common practice in most ITS architectures developed around the country.

While the individual agencies within a group are substantially like one another, they are not all the same. In some cases, an ITS inventory element may be shown as Planned for the overall group, when in fact it may exist within some of the agencies in the group. Similarly, an ITS inventory element may be shown as Existing for the overall group, when it may not exist in all the agencies in the group. The Planned versus Existing designation is a judgement call typically made by the ITS architect, based on input and feedback received for the overall stakeholder group, and in consultation with the agency leading the architecture development. Though the grouping of stakeholders may lead to some ambiguity in some aspects of the architecture documentation, the benefits of simplifying the overall architecture outweigh a small number of ambiguities brought about by the grouping of some stakeholders in the architecture.

As agencies in a grouping of stakeholders in the RAD-IT database begin to deploy more ITS than the other stakeholders in the group, those advancing agencies can step apart from the group and be named individually in the RAD-IT database. There would be a companion effort to also itemize the ITS inventory and functions of the advancing agencies. The additional effort to identify the ITS inventory elements would also bring clarity to the status – Planned or Existing – of the agency's ITS inventory elements.

Appendix A contains the Stakeholder List and their respective descriptions as contained in the RAD-IT database.

4. SYSTEM INVENTORY

As defined in FHWA's Architecture Rule, an ITS inventory is a list of systems, referred to as elements in the Statewide ITS Architecture. An element is identified using the name or title used by stakeholders to describe the system, or piece of a system.

The systems described in the ITS Inventory are not limited to ITS facilities but include elements representing collections of functionality. For instance, the inventory includes software, hardware, and functions that provide control, monitoring, or data processing functions. The scope of an ITS inventory element can also depend on a stakeholder's viewpoint and may not include details on functionality internal to an agency that are not available for external purposes.

The focus of this section is on identifying ITS and the related elements, existing and planned, within the Arizona Statewide ITS Architecture. In association with the ITS inventory, it is important to identify the ITS owners and/or operators, the presence of operations centers, and the connections (communication links and data flows) between various ITS elements and other systems. Because the architecture is generally technology neutral, identifying technological aspects of the ITS inventory, such as equipment make and/or model, is not necessary and is discouraged. It is most important to assess and describe the functionality and capabilities of the various ITS elements. Furthermore, the total quantity of various ITS devices (such as traffic signals, closed circuit television (CCTV) cameras, buses with automatic vehicle location, etc.) that exist, and the location of all these elements, is not critical with respect to developing an ITS architecture.

The ITS inventory is entered into the RAD-IT software tool. RAD-IT is then used to identify the interconnections and information flows among the ITS elements.

4.1 Collection Methodology

The methodology used to compile the ITS inventory for the 2024 Arizona Statewide ITS Architecture Update included document review, surveys, and email-based approaches. The varying methods promoted a more accurate and complete survey process. Stakeholders were provided with an ITS Inventory Survey, which is a comprehensive tool aimed at capturing essential details about the stakeholders current and planned ITS elements.

The survey primarily focused on various transportation management centers, seeking information about system inventories, stakeholders, core functionalities, field elements and external data exchange interfaces associated with these systems.

The Microsoft Excel-based survey included multiple tabs (worksheets) representing various ITS service categories. Stakeholders were instructed to complete only the tabs relevant to their agency or agency function. The ITS Inventory Survey included tabs for Freeway Management, Arterial Management, Emergency Management, Public Transportation, Traveler Information, Construction & Maintenance, Commercial Vehicles, and Archive Data, ensuring a comprehensive exploration of the ITS landscape with each of the stakeholders surveyed.

The complete ITS inventory contained in the RAD-IT database, which is based on the inventory surveys, can be found in **Appendix B**. The inventory in Appendix B is sorted by stakeholder name, and provides a name of the inventory element, the description, the status (Existing or Planned), and the associated physical object for each inventory element.

5. NEEDS AND SERVICES

The next step in the process of updating the Arizona Statewide ITS Architecture was determining stakeholder ITS needs. The needs were then compared to the services to determine which needs are currently being met with existing ITS, will be met in the near future with planned ITS, or are not being met. This comparison was used to select and/or determine the status of Service Packages and to develop projects in the project sequencing portion of the Statewide ITS Architecture update. It was also used to determine interconnections and information exchange between systems and agencies.

5.1 Collection Methodology

The methodology used to compile Arizona's ITS needs consisted of a variety of mechanisms including document review, surveys, and emails. Since Arizona is large and diverse, different methods served to verify and improve the survey responses, along with stakeholder feedback. Stakeholder input is key to the ITS needs evaluation. Stakeholders were contacted primarily via email to provide input and feedback. The ITS Needs Survey was emailed to stakeholders to capture essential details about agency ITS needs.

The ITS Needs Survey provided a list of candidate ITS needs for ITS development. Stakeholders were asked to assign a priority of High, Medium, or Low to each applicable ITS need contained in the survey. This prioritization helped generate an objective overall scoring of the stakeholder-identified priorities.

The ITS needs were divided into categories, consistent with the main ARC-IT service areas:

- Traffic Management (Arterial)
- Traffic Management (Freeway)
- Public Transportation
- Public Safety (Emergency Management)
- Maintenance & Construction Operations
- Traveler Information
- Commercial Vehicle Operations
- Vehicle & Infrastructure Safety

To generate an objective starting place to prioritize Arizona ITS needs, a non-scientific scoring system was used to rank the ITS needs, based on stakeholder input and feedback. Needs were ranked and scored as follows:
High (H): 3 points
Medium (M): 2 points
Low (L): 1 point

Once the numerical rankings were assigned, the numbers for each ITS need were summed and averaged to convert the subjective High/Medium/Low rankings to more objective numerical values. In many cases, an obvious gap in the average scores appeared, indicating a change from High priority to Medium priority; or from Medium priority to Low priority. The resulting numerical scores were converted back into High, Medium, and Low rankings to make the presentation of results back to the stakeholder group consistent with the way stakeholder input was initially requested.

After this objective scoring was performed, some manual adjustment of ranking a handful of needs was performed, primarily in the Vehicle & Infrastructure Safety service area. Revised Technical Memorandum #3 (Data Collection) also provides a description of the ITS needs survey and evaluation process, along with results.

Tables 5-1 through 5-8 provide the aggregated prioritization results of the ITS Needs Assessment, after the manual adjustments. The ITS Needs are prioritized as High (H), Medium (M), and Low (L).

Table 5-1: ITS Needs Assessment Results – Traffic Management (TM) – Arterial

Need #	Needs Traffic Management (TM) – Arterial	Priority Rating	Service Package(s)
1	Improve arterial roadway visual traffic surveillance	H	TM01
2	Enhance communication and coordination between traffic management centers and emergency response agencies for efficient incident management	H	TM08
3	Improve system operation monitoring (i.e., traffic flow, field equipment status and operation, etc.)	H	TM01 DM02
4	Provide systemwide arterial management strategies to improve traffic congestion mitigation	M	TM03 TM06 TM07 TM08 TM09
5	Improve traffic flow monitoring	M	TM01
6	Remote monitoring of signal system status / operations by traffic operations staff	M	TM03 SU14
7	Improve/implement ability to remotely modify signal timing	M	TM03 SU14
8	Reduce emergency vehicle delays at signals and provide additional emergency vehicle preemption	M	PS03
9	Implement or improve signal coordination	M	TM03
10	Upgrade signal hardware	M	TM03
11	Provide quality real-time travel time and congestion related information	M	TM06
12	Remote monitoring of signal system status / operations by public safety agencies	M	SU14
13	Provide more widespread centralized computer control	M	TM03 SU07 SU14
14	Improve hardware issues in interconnecting signal systems between agencies	M	TM03 TM07
15	Improve inter-jurisdictional continuity	M	TM07

Need #	Needs Traffic Management (TM) – Arterial	Priority Rating	Service Package(s)
16	Deploy network vs. Corridor-based signal coordination	M	TM03 TM07
17	Reduce vehicle entrapment, incidents, and traffic delays at rail grade crossings	M	TM13 TM14
18	Reduce detector failures	M	TM01
19	Better coordinate rail grade crossing operations with signals	M	TM15
20	Reduce transit vehicle delays at signals	L	PT09
21	Share traffic signal system data and information with other Centers	L	TM07 DM01
22	Receive traffic signal system data and information from other Centers	L	TM07 DM01
23	Monitor emissions and environmental conditions	L	ST01
24	Expansion of private signal interconnect / ITS communications network(s)	L	TM03 SU07

Table 5-2: ITS Needs Assessment Results – Traffic Management (TM) – Freeway

Need #	Needs Traffic Management (TM) – Freeway	Priority Rating	Service Package(s)
1	Improve inter-agency coordination for effective traffic management and incident response	H	TM07 TM08
2	Reduce delay related to incidents or construction	M	TM08
3	Identify specific strategies for freeway management during recurring and non-recurring congestion	M	TM08 TM09
4	Improve incident detection and verification technologies and improve response procedures for quicker incident clearance and reduced impact on traffic flow	M	TM01 TM02 TM06 TM08 TM09
5	Provide quality real time congestion related information	M	TM06 TI02
6	Better information dissemination regarding traffic diversion	M	TI01 TI03 TI04
7	Improve speeding detection and implement alert systems	M	TM01 TM17
8	Implement ramp metering to regulate traffic flow and improve merging operations at freeway ramps	M	TM05
9	Improve information exchange between ADOT and other agencies	M	TM07 DM02
10	More timely incident information dissemination (traveler information)	M	TM06 TI01

Need #	Needs Traffic Management (TM) – Freeway	Priority Rating	Service Package(s)
11	Implement variable speed limits and queue warning systems	M	TM20 TM21
12	Improve incident response and clearance times	L	TM08 TM09
13	Monitor emissions and environmental conditions	L	ST01
14	Deploy additional vehicle detection coverage to provide comprehensive data on traffic conditions	L	TM01 DM02
15	Improve freeway traffic surveillance	L	TM01
16	Implement hard shoulder running	L	TM22

Table 5-3: ITS Needs Assessment Results – Public Transportation (PT)

Need #	Needs Public Transportation (PT)	Priority Rating	Service Package(s)
1	Improve on-time performance and efficiency of operations	H	PT02 PT03
2	Improve patron safety and security (in-vehicle and at stations / waypoints)	H	PT05
3	Improved transit fare payment systems	H	PT04
4	Enable emergency information dissemination to transit operators	H	PT05 PT14
5	Improve service planning (scheduling and runcutting)	H	PT02 PT03
6	Enhanced security and privacy measures	H	PT05 SU08
7	Improve information exchange between transit agencies and freeway / arterial management centers	M	PT14
8	Improve regional and interregional trip planning	M	PT14
9	Utilize a mobile application or electronic display/audio output at stops to provide real-time transit information to passengers	M	PT08
10	Enable transit agencies to locate bus fleet (AVI/AVL)	M	PT01
11	Support for multiple payment methods	M	TM10
12	Provide transit priority at signals	M	PT09
13	Improve transit transfers within and between systems and modes to improve service delivery	M	PT14
14	Improve efficiency of social service transportation providers	M	PT02
15	Improve information exchange between/among transit agencies	M	PT14
16	Improved information exchange between modes (rail and bus arrival and departure times – connectivity issues)	M	PT14

Need #	Needs Public Transportation (PT)	Priority Rating	Service Package(s)
17	Deploy universal fare payment system(s)	M	PT18
18	Improve maintenance system for transit fleets	M	PT06
19	Remote monitoring of mechanical condition of transit vehicles	L	PT06
20	Improve "back-office" systems (interface between personnel scheduling systems and payroll systems, etc.)	L	SU10
21	Deploy universal fare payment system(s) for parking payment	L	PM03 PT18
22	Implement bus queue jump lanes	L	PT09

Table 5-4: ITS Needs Assessment Results – Public Safety/Emergency Management (PS)

Need #	Needs Public Safety ((PS) Emergency Management)	Priority Rating	Service Package(s)
1	Improve incident response coordination between agencies	H	PS02 TM07 TM08
2	Better information dissemination regarding traffic diversion and detours	H	TM06
3	Improve incident detection and data collection	H	PS01 TM08
4	Improve incident response times	H	PS02 PS08 TM08
5	Provide most efficient route for emergency vehicle drivers during an incident	M	PS03 TM09
6	Improve detour development during incidents for drivers	M	TM08
7	Improve response to hazardous materials spills / incidents (better manage resulting traffic congestion, improve clean-up time)	M	PS12 CVO12 CVO13
8	Enhance incident data collection and analysis to identify areas for improvement and optimize emergency response strategies	M	DM02
9	Reduce emergency response delays at traffic signals	M	PS03
10	More timely incident information dissemination (traveler information) to notify public of emergency situations	M	TI01 TM06
11	Increase use of portable traffic control equipment (DMS, HAR, etc.)	L	TM06
12	Provide tracking of emergency vehicles	L	PS01

Need #	Needs Public Safety ((PS) Emergency Management)	Priority Rating	Service Package(s)
13	Integrate multi-modal emergency response to ensure a seamless and coordinated emergency response across all transportation systems	L	PS02 TM08 PT14

Table 5-5: ITS Needs Assessment Results – Maintenance & Construction (MC)

Need #	Needs Maintenance & Construction (MC)	Priority Rating	Service Package(s)
1	Improve temporary maintenance work zone safety for staff and drivers	H	MC07
2	Enhance work zone information dissemination	H	MC06 MC08 TI01
3	Reduce delay due to maintenance work zones	H	MC06 MC08
4	Improve work zone safety monitoring	H	MC07
5	Optimize maintenance and construction scheduling	M	MC08
6	Improve / enhance work zone traffic handling plans	M	MC06 MC08
7	Improve coordination on construction notification and information distribution	M	MC08 MC05
8	Provide automated real-time vehicle location systems for maintenance and construction operations vehicles	M	MC01
9	Improve fleet information / management (maintenance schedules, mileage accumulations, etc.)	M	MC02
10	Deploy mobile / portable traffic management field equipment (mobile surveillance eqpt, mobile ramp metering, portable DMS, etc.)	M	PS02 TM06
11	Improve remote vehicle diagnostic capabilities	L	MC01 MC02
12	Provide more data source locations for the National Weather Service	L	WX01 WX02

Table 5-6: ITS Needs Assessment Results – Traveler Information (TI)

Need #	Needs Traveler Information (TI)	Priority Rating	Service Package(s)
1	Provide quality real-time congestion related information (i.e. travel times, delays, incident/special event information, road closure/lane restriction information, weather conditions, etc.) on freeways and arterials	H	TI01 TI02 TM06
2	Improve method of disseminating delay and incident data	H	TI01 TM06
3	Improve quality and timeliness of communications	H	TI01
4	Enhance integration with mobile devices and apps	H	TI01 TI02
5	Provide better road construction information and notification	H	TI01 MC08
6	Collect data and transportation information for performance-based planning	M	DM02
7	Expand traveler information delivery methods	M	TI01 TM06
8	Improve data storage and management capabilities	M	DM01
9	Enhance multimodal traveler information	M	PT14
10	Improve targeted traveler information for tourists and recreation travelers at visitor information areas, etc.	M	TI05
11	Develop interstate / inter-region traveler information covering a wide area (targeted to CVO)	L	TM07 TI01 PS10
12	Provide personalized traveler information	L	TI02
13	Share archived data between agencies	L	DM01
14	Integration with traveler information systems to provide users with real-time information on fares, parking availability, toll rates, and payment options	L	TI02 TM10

Table 5-7: ITS Needs Assessment Results – Commercial Vehicle Ops (CVO)

Need #	Needs Commercial Vehicle Ops (CVO)	Priority Rating	Service Package(s)
1	Provide tracking of hazmat vehicles	H	CVO12
2	Provide interstate / inter-region traveler information covering a wide area (targeted to CVO)	M	CVO01
3	Improve real-time truck storage / parking information	M	CVO05
4	Deploy weigh-in-motion technologies	M	CVO03 CVO08
5	Deploy automated clearance systems	M	CVO03 CVO08

Need #	Needs Commercial Vehicle Ops (CVO)	Priority Rating	Service Package(s)
6	Deploy mobile credentialing and/or enforcement systems / technologies	L	CVO17 CVO18

Table 5-8: ITS Needs Assessment Results – Vehicle & Infrastructure Safety

Need #	Needs Vehicle & Infrastructure Safety	Priority Rating	Service Package(s)
1	Improve monitoring of transportation infrastructure conditions for maintenance	H	MC09
2	Automated warning signs for excess speed, etc.	H	TM17
3	Improve monitoring of transportation infrastructure for security	H	MC09 SU08
4	Deploy / support Connected Vehicle Applications (infrastructure based): - automated collision avoidance systems	H	VS13
5	Deploy / support Connected Vehicle Applications (infrastructure based): - Vehicle count and classification systems	H	TM01
6	Deploy / support Connected Vehicle Applications (infrastructure based): - Emergency management systems	H	VS02 VS03 PS02
7	Deploy / support Connected Vehicle Applications (infrastructure based): - Non-motorized safety systems	H	VS12
8	Deploy / support Connected Vehicle Applications (infrastructure based): - Speed warnings	H	VS09
9	Deploy / support Connected Vehicle Applications (infrastructure based): - Traveler information systems	H	TI01
10	Deploy / support Connected Vehicle Applications (infrastructure based): - Weather warnings	H	VS07
11	Deploy / support Connected Vehicle Applications (infrastructure based): - Traffic data collection systems	M	SU01 DM01 TM01 TM02
12	Deploy / support Connected Vehicle Applications (infrastructure based): - Transit operations systems	M	PT02 PT03
13	Deploy / support Connected Vehicle Applications (infrastructure based): - Pavement data collection systems	M	MC09

Need #	Needs Vehicle & Infrastructure Safety	Priority Rating	Service Package(s)
14	Support automated vehicle operations (infrastructure based)	M	VS16
15	Deploy / support Connected Vehicle Applications (infrastructure based): - Eco-driving applications	L	ST09
16	Deploy / support Connected Vehicle Applications (infrastructure based): - Network traffic flow optimization	L	TM09
17	Deploy / support Connected Vehicle Applications (infrastructure based): - Freight signal priority	L	CVO06
18	Deploy red light running enforcement systems	L	TM26

5.2 ITS Services in the Arizona Statewide ITS Architecture

Service Packages are a concept taken from ARC-IT. Service Packages provide an accessible, service-oriented perspective to ARC-IT. They are tailored to fit, separately or in combination, real world transportation problems and needs. Service Packages assemble one or more functions that must work together to deliver a given ITS service and the information flows that connect them and other important external systems. Service Packages are implemented through projects (or groups of projects).

The term "instance" is used in relation to Service Packages. The concept of a Service Package instance in a regional or statewide ITS architecture may include multiple agencies (stakeholders) that perform a similar function, like traffic signal control. For example, there is an ARC-IT Service Package named TM03 Traffic Signal Control. For each stakeholder, a separate TM03 Traffic Signal Control Service Package instance is created by selecting and configuring the TM03 Traffic Signal Control Service for each of those agencies performing traffic signal control. Each appearance of the TM03 Traffic Signal Control Service Package is considered a separate instance of the Service Package. This approach allows the Service Package to be tailored for each agency (stakeholder), and it allows each instance to be named with a unique Service Package name that is uniquely identified with its stakeholder owner/operator. Using Service Package instances in this manner allows creation of simpler Service Package diagrams that are a standard output from the RAD-IT software tool. Another benefit of tailoring Service Package instances is the clarification of architecture documentation when various agencies performing the same (or substantially similar) functions may have differing internal and external interfaces to their systems. Tailoring enables the clarification of those interface differences (and others) between those agencies.

Appendix C contains a listing of the Service Packages contained in the Updated 2024 Arizona Statewide ITS Architecture RAD-IT database. The updated Service Packages in the current RAD-IT database were identified in part because of the ITS Inventory and the ITS Needs Survey results.

6. OPERATIONAL CONCEPT

The operational concept identifies the roles and responsibilities (RR) of participating agencies and stakeholders in the operation and implementation of the systems included in the statewide ITS architecture. It considers the ITS services the individual stakeholders provide and a big picture view of how those services will be performed. The roles and responsibilities are stated in high-level statements of the individual stakeholders' general responsibilities in providing ITS services.

ARC-IT includes an Enterprise Viewpoint, addressing the relationships between organizations and users, and the roles those entities play in the delivery and consumption of ITS services. Relationships between entities are dependent on the roles those entities have in the delivery of ITS user services.

Table 6-1 presents a brief example of stakeholder roles and responsibilities. The complete updated listing of stakeholder roles and responsibilities contained in the updated RAD-IT database is contained in **Appendix D.**

Table 6-1: Operational Concept Example – Stakeholder Roles and Responsibilities

Role/Responsibility (RR) Area Name	Role/Responsibility (RR) Area Description	Stakeholder	RR Status
Surface Street Management for Arizona	Service Street Management includes traffic detectors, other surveillance equipment, the supporting field equipment, and fixed-point to fixed-point communications to transmit the collected data back to the Traffic Management Subsystem. The derived data can be used locally such as when traffic detectors are connected directly to a signal control system or remotely (e.g., when a CCTV system sends data back to the Traffic Management Subsystem). The data generated enables traffic managers to monitor traffic and road conditions, identify and verify incidents, detect faults in indicator operations, and collect census data for traffic strategy development and long-range planning. The collected data can also be analyzed and made available to users and the Information Service Provider Subsystem	Travelers	Existing
Surface Street Management for Arizona	Service Street Management includes traffic detectors, other surveillance equipment, the supporting field equipment, and fixed-point to fixed-point communications to transmit the collected data back to the Traffic Management Subsystem. The derived data can be used locally such as when traffic detectors are connected directly to a signal control system or remotely (e.g., when a CCTV system sends data back to the Traffic Management Subsystem). The data generated enables traffic managers to monitor traffic and road conditions, identify and verify incidents, detect faults in indicator operations, and collect census data for traffic strategy development and long-range planning. The collected data can also be analyzed and made available to users and the Information Service Provider Subsystem	Tribal Governments - Statewide	Planned
Traffic Management for Arizona	Traffic Management for Arizona monitors and controls traffic and the road network. It includes centers that manage a broad range of transportation facilities including freeway systems, rural and suburban highway systems, and urban and suburban traffic control systems. This subsystem communicates with the Roadway Subsystem to monitor and manage traffic flow and monitor the condition of the roadway, surrounding environmental conditions, and field equipment status.	ADOT	Existing
Traffic Management for Arizona	Traffic Management for Arizona monitors and controls traffic and the road network. It includes centers that manage a broad range of transportation facilities including freeway systems, rural and suburban highway systems, and urban and suburban traffic control systems. This subsystem communicates with the Roadway Subsystem to monitor and manage traffic flow and monitor the condition of the roadway, surrounding environmental conditions, and field equipment status.	ADOT	Planned
Traffic Management for Arizona	Traffic Management for Arizona monitors and controls traffic and the road network. It includes centers that manage a broad range of transportation facilities including freeway systems, rural and suburban highway systems, and urban and suburban traffic control systems. This subsystem communicates with the Roadway Subsystem to monitor and manage traffic flow and monitor the condition of the roadway, surrounding environmental conditions, and field equipment status.	Arizona Department of Public Safety (DPS)	Existing
Traffic Management for Arizona	Traffic Management for Arizona monitors and controls traffic and the road network. It includes centers that manage a broad range of transportation facilities including freeway systems, rural and suburban highway systems, and urban and suburban traffic control systems. This subsystem communicates with the Roadway Subsystem to monitor and manage traffic flow and monitor the condition of the roadway, surrounding environmental conditions, and field equipment status.	Arizona Department of Public Safety (DPS)	Planned

Source: 2024 Statewide ITS Architecture RAD-IT database

7. INTERCONNECTS AND INFORMATION FLOWS

Interconnects and Information Flows are architecture concepts that describe and define how systems are interconnected, and what kind of information is exchanged across those Interconnects. This section describes Interconnects and Information Flows in more detail, then provides the Interconnects and Information Flows currently contained in the 2024 Arizona Statewide ITS Architecture Update.

An individual agency that is part of a stakeholder group may see a Planned or Existing Interconnect or Information Flow designation that may not necessarily be accurate for their own agency but is generally accurate for the overall stakeholder group. The Planned versus Existing designation is a judgement call typically made by the ITS architect, based on input and feedback received from stakeholders, and in consultation with the agency leading the architecture development.

7.1 The Regional Architecture Development for Intelligent Transportation Software Tool

The RAD-IT software tool is an application aimed at facilitating the creation of regional, statewide, and project-specific ITS architectures. It provides functionality to tailor the ARC-IT content to meet the needs of the stakeholder community.

RAD-IT produces a selection of standard reports and diagrams to describe and depict regional and statewide ITS architectures. Specific to Interconnects, RAD-IT produces a configurable tabular report listing the Interconnects present in an architecture. RAD-IT also produces configurable Interconnect diagrams that allow stakeholders to visualize how their agency and/or systems are interconnected with other Elements in the architecture. Specific to Information Flows, RAD-IT produces similar tabular reports and diagrams depicting Information Flows present in the architecture. The tabular and diagrammatic outputs from RAD-IT are utilized in this Technical Memorandum to facilitate stakeholder review of Interconnects and Information Flows currently contained in the 2024 Statewide ITS Architecture RAD-IT database.

Another standard RAD-IT output is a set of preformatted hyperlinked web pages that can be used to build a website conveying ITS architecture content. This hyperlinked set of web pages includes pages for each aspect of the ITS architecture that is defined in the RAD-IT database, including stakeholder information, an inventory of transportation systems, services, functional objects, interfaces, communications solutions information, and ITS project information. When hosted on a website, these pages make the ITS architecture definition available to stakeholders and agencies in an interactive, user-friendly format to review.

7.2 Interconnects

An Interconnect is defined in ARC-IT as follows: “Communications paths that carry information between Physical Objects (subsystems and terminators) in the physical view of ARC-IT. Several different types of interconnects are defined in ARC-IT to reflect the range of interface requirements in ITS. Most of the interconnects are various types of communications links that are defined in the communications view…". This formal definition goes on to cite several examples of communications links and communications media. In short, an Interconnect is a connection between systems and agencies in the architecture, without regard to the communications type, or the type of information being exchanged between systems.

7.2.1 2024 Arizona Statewide ITS Architecture Interconnects in Tabular Format

Table 7-1 is an example of the tabular listing of Interconnects that is generated by RAD-IT. The Elements in the table are sorted alphabetically by Element 1, then by Element 2. Many of the Elements in the Arizona Statewide ITS Architecture start with a stakeholder name in the Element title. This makes it easier for the stakeholders to find the Elements of direct interest in the Interconnect table(s) to review the accuracy of what is contained in the RAD-IT database.

Table 7-1: Example (Abbreviated) Tabular Interconnect Listing (from the 2024 Arizona Statewide ITS Architecture)

Element 1	Element 2	Status
ADEQ Arizona Emissions Management	ADOT HPMS Data Archive	Planned
ADEQ Arizona Emissions Management	ADOT Motor Vehicle Division (MVD) Database	Planned
ADEQ Arizona Emissions Management	ADOT TOC Traffic Information Center	Planned
ADEQ Arizona Emissions Management	MPO-COG Planning Traffic Database	Planned
ADOT 511 IVR	ADOT 511 Website	Existing
ADOT 511 IVR	ADOT Communications PIO	Existing
ADOT 511 IVR	ADOT Incident Response Unit (IRU)	Existing
ADOT 511 IVR	ADOT TOC and EMC	Existing
ADOT 511 IVR	Cities and Towns Transit Dispatch	Planned
ADOT 511 Website	ADOT 511 IVR	Existing
ADOT 511 Website	ADOT AZ 511 App	Existing
ADOT 511 Website	NOAA _National Weather Service	Planned
ADOT 511 Website	Personal Information Devices for Travelers	Existing
ADOT Asset Management Systems	ADOT DEOC-Dept EM Ops Center	Existing
ADOT Asset Management Systems	ADOT Engineering Districts	Existing
ADOT Asset Management Systems	ADOT Regional Traffic Operations	Existing
ADOT Asset Management Systems	ADOT Systems Maintenance	Existing
ADOT AZ 511 App	ADOT 511 Website	Existing
ADOT AZ 511 App	ADOT Communications PIO	Existing
ADOT DEOC-Dept EM Ops Center	DEMA CRT - HazMat Response Team	Existing

Source: 2024 Statewide ITS Architecture RAD-IT database

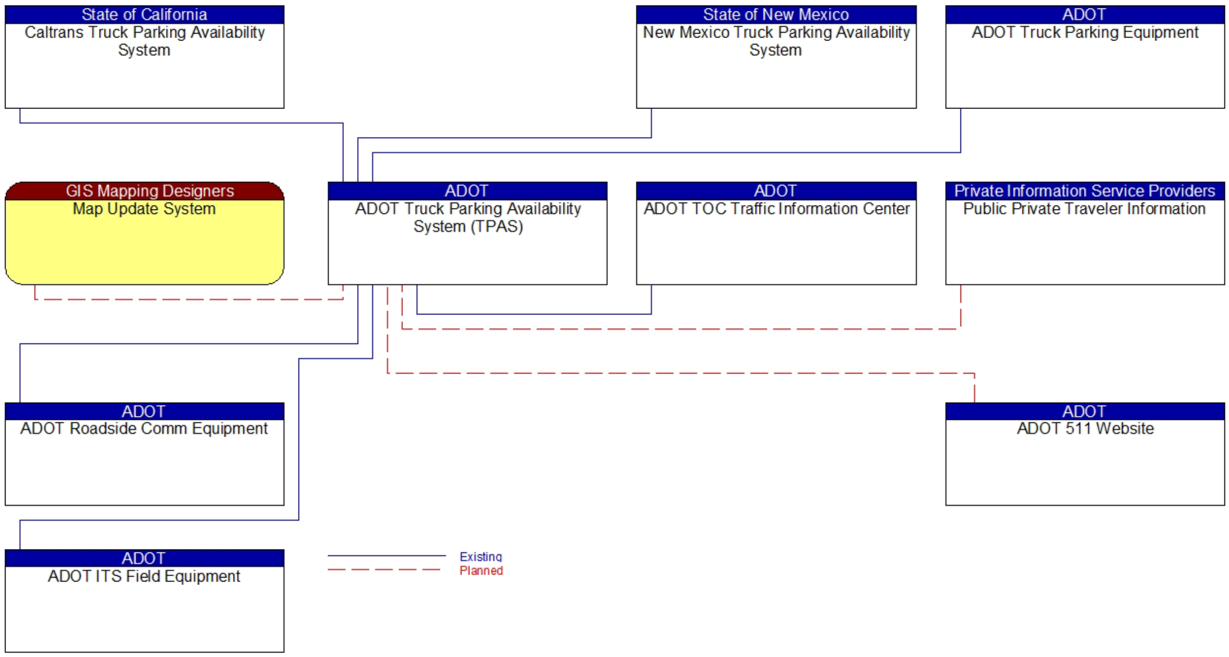
The full tabular listing of Interconnects currently contained in the 2024 Arizona Statewide ITS Architecture is contained in **Appendix E**.

7.2.2 2024 Arizona Statewide ITS Architecture Interconnect Diagrams

Each Element in an ITS architecture is represented with two types of diagrams, an Interconnect diagram and an Information Flow diagram. An Interconnect diagram shows a particular Element and all other Elements with which that particular Element shares information. Interconnects between Elements are represented as single lines and indicate information sharing without specifying the type or quantity of information being shared or the direction of the information movement.

Figure 7-1 is an example of an Interconnect diagram that is generated by RAD-IT. It is also called a context diagram as a diagram is generated from the perspective of each Element in the RAD-IT database. Where a particular Element is interconnected to more than three other Elements, that particular stakeholder's Element is shown in the "center" of the diagram, with the other interconnected Elements surrounding it. In diagrams where there are only two or three Elements interconnected, the "center" of the diagram is not as visually well defined. The single lines between Elements in an Interconnect Diagram are either blue, denoting an Existing interconnection or red, denoting a Planned interconnection.

Figure 7-1: Example Interconnect Diagram (from the 2024 Arizona Statewide ITS Architecture)



Source: 2024 Statewide ITS Architecture RAD-IT database

Legend:

Stakeholder Transportation Element with defined functions	Subsystem Box Subsystems are individual pieces of the Intelligent Transportation System defined by ARC-IT. Subsystems are defined at three levels of hierarchy: ITS Objects, Classes, and Functional Subsystems. They are the principle structural element of the physical view of ARC-IT.
Stakeholder Transportation Element with no defined functions	Terminator Box Terminators define the boundary of an architecture. ARC-IT terminators represent the people, systems, and general environment that interface to ITS. The interfaces between terminators and the subsystems and processes within ARC-IT are defined, but no functional requirements are allocated to terminators. The functional and physical view of ARC-IT both contain the same set of terminators.
Communications Element	Communications Box Some of the physical objects defined in ARC-IT primarily provide a communications capability that enables other physical objects to share information.

The Interconnect diagrams from the 2024 Arizona Statewide ITS Architecture are presented in **Appendix F**.

7.3 Information Flows

An Information Flow is defined in ARC-IT as follows: "The provision of information from one Physical Object to another in the physical view of ARC-IT. An Information Flow may include one or more other Information Flows (i.e., one flow is a sub-flow of another). An Information Flow may include message exchanges used to control the flow of information. An Information Flow may be unidirectional or bidirectional. Regardless, the informative description defines the information provided by the source…" Information Flows have a "directional" characteristic. Therefore, when presented in a tabular format, Information Flows are associated with a "Source Element" and a "Destination Element," with information flowing from the source to the destination. When presented in diagram format, there is always an arrow at one or both ends of the Information Flow line in the diagram that indicates the direction information is flowing.

Information Flows represent ITS architecture interfaces. The Information Flows and associated communications requirements define the interfaces and form the basis for much of the ongoing standards development work in the national ITS program.

The following ARC-IT webpage link provides an alphabetical, interactive listing of all the Information Flows (Data Flows) contained in ARC-IT, with descriptions.
https://www.arc-it.net/html/dataflows/dataflows.html

7.3.1 2024 Arizona Statewide ITS Architecture Information Flows in Tabular Format

Table 7-2 is an example of the tabular listing of Information Flows that is generated by RAD-IT. The tabular listing is sorted alphabetically by a Source Element, then by a Destination Element. Since the Information Flows are directional, a Destination Element can also be a Source Element; and a Source Element can also be a Destination Element. Many of the Elements in the Arizona Statewide ITS Architecture begin with a stakeholder name in the Element title. This eases the stakeholder review process to find the Elements of direct interest in the Information Flows table(s) contained in the RAD-IT database.

Table 7-2: Example (Abbreviated) Tabular Information Flow Listing (from the 2024 Arizona Statewide ITS Architecture)

Source Element	Destination Element	Flow Name	Flow Status	Flow Description
ADOT Incident Response Unit (IRU)	ADOT 511 IVR	incident information for public	Existing	Report of current desensitized incident information prepared for public dissemination.
ADOT Incident Response Unit (IRU)	ADOT 511 IVR	transportation system status	Existing	Current status and condition of transportation infrastructure (e.g., tunnels, bridges, interchanges, TMC offices, maintenance facilities). In case of disaster or major incident, this flow provides an assessment of damage sustained by the surface transportation system including location and extent of the damage, estimate of remaining capacity and necessary restrictions, and time frame for repair and recovery.
ADOT Incident Response Unit (IRU)	ADOT 511 Website	incident information for public	Existing	Report of current desensitized incident information prepared for public dissemination.

Source Element	Destination Element	Flow Name	Flow Status	Flow Description
ADOT Incident Response Unit (IRU)	ADOT 511 Website	transportation system status	Existing	Current status and condition of transportation infrastructure (e.g., tunnels, bridges, interchanges, TMC offices, maintenance facilities). In case of disaster or major incident, this flow provides an assessment of damage sustained by the surface transportation system including location and extent of the damage, estimate of remaining capacity and necessary restrictions, and time frame for repair and recovery.
ADOT Incident Response Unit (IRU)	ADOT AZ 511 App	incident information for media	Existing	Report of current desensitized incident information prepared for public dissemination through the media.
ADOT Incident Response Unit (IRU)	ADOT Communications PIO	incident information	Existing	Notification of existence of incident and expected severity, location, time, and nature of incident. As additional information is gathered and the incident evolves, updated incident information is provided. Incidents include any event that impacts transportation system operation ranging from routine incidents (e.g., disabled vehicle at the side of the road) through large-scale natural or human-caused disasters that involve loss of life, injuries, extensive property damage, and multi-jurisdictional response. This also includes special events, closures, and other planned events that may impact the transportation system.

Source: 2024 Statewide ITS Architecture RAD-IT database

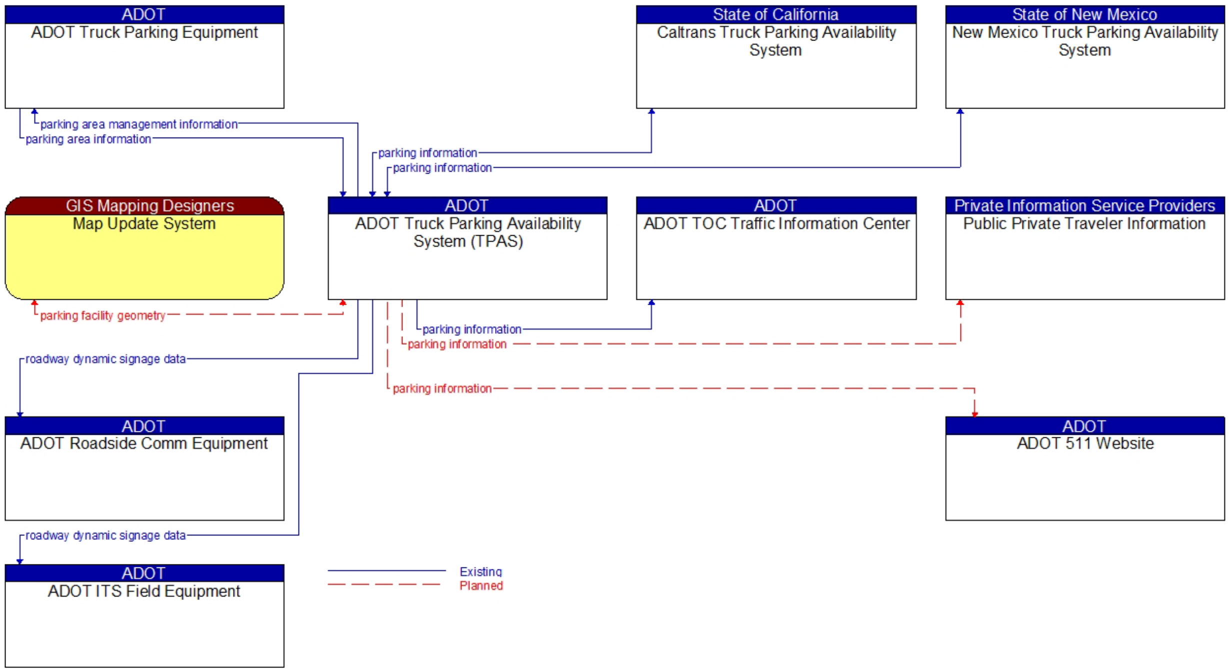
The full tabular listing of Information Flows currently contained in the 2024 Arizona Statewide ITS Architecture is contained in **Appendix G**.

7.3.2 2024 Arizona Statewide ITS Architecture Information Flows Diagrams

Each Element in an ITS architecture is represented with two types of diagrams, an Interconnect diagram and an Information Flow diagram. An Information Flow diagram shows a particular Element and all other Elements with which that particular Element shares information. There may be one or several lines between any pair of Elements in an Information Flow diagram. Each line in an Information Flow diagram represents a specific type of information that is being exchanged between Elements.

Figure 7-2 is an example of an Information Flow diagram that is generated by RAD-IT. Like the Interconnect diagrams, Information Flow diagrams are configured in a “context” orientation, in that the diagram is generated from the perspective of a particular Element in the RAD-IT database. Where a particular Element is interconnected to more than three other Elements, that particular Element is shown in the “center” of the diagram, with the other interconnected Elements surrounding it. In diagrams where there are only two or three Elements interconnected, the “center” of the diagram is not as visually well defined. Like the Interconnect diagrams, the lines between Elements in an Information Flow diagram are either blue, denoting an Existing Information Flow or red denoting a Planned Information Flow. Additionally, each Information Flow line has an arrow at one or both ends, denoting the directional flow of information.

Figure 7-2: Example Information Flow Diagram (from the 2024 Arizona Statewide ITS Architecture)



Source: 2024 Statewide ITS Architecture RAD-IT database

Legend:

Stakeholder Transportation Element with defined functions	Subsystem Box Subsystems are individual pieces of the Intelligent Transportation System defined by ARC-IT. Subsystems are defined at three levels of hierarchy: ITS Objects, Classes, and Functional Subsystems. They are the principle structural element of the physical view of ARC-IT.
Stakeholder Transportation Element with no defined functions	Terminator Box Terminators define the boundary of an architecture. ARC-IT terminators represent the people, systems, and general environment that interface to ITS. The interfaces between terminators and the subsystems and processes within ARC-IT are defined, but no functional requirements are allocated to terminators. The functional and physical view of ARC-IT both contain the same set of terminators.
Communications Element	Communications Box Some of the physical objects defined in ARC-IT primarily provide a communications capability that enables other physical objects to share information.

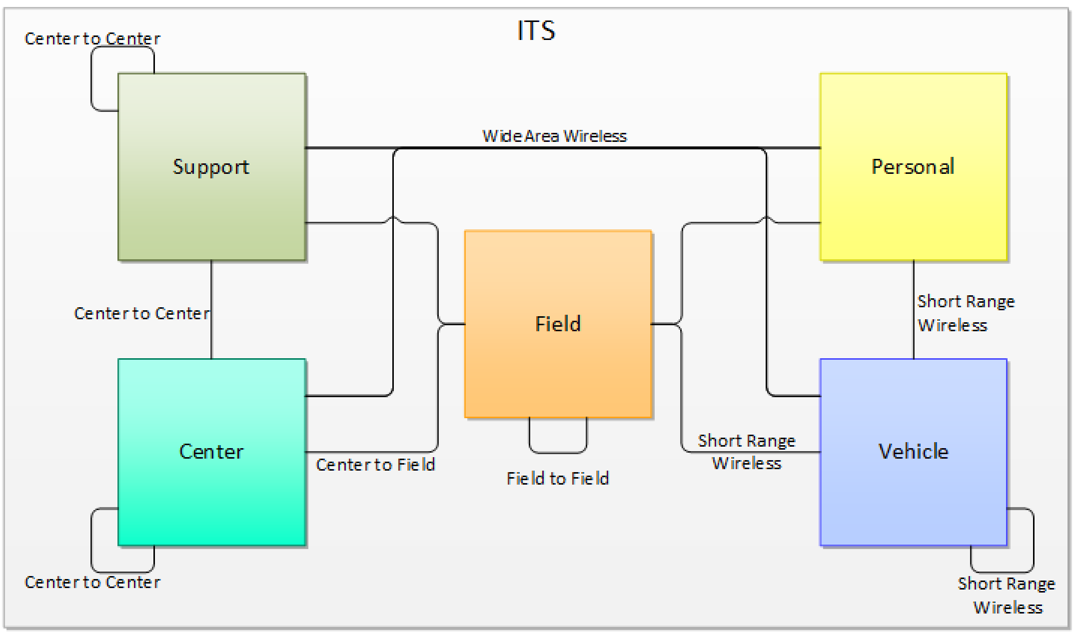
The Information Flow diagrams from the 2024 Arizona Statewide ITS Architecture are contained in **Appendix H**.

7.4 Physical View of the Arizona Statewide ITS Architecture

ARC-IT was used as the basis for the development of the Arizona Statewide ITS Architecture. ARC-IT provides a standard framework from which state, regional and project architectures are tailored to suit the needs of the geography, agencies, and systems represented in the architecture. The physical view of the Arizona Statewide ITS Architecture depicts the transportation systems and the information exchanges that support ITS in the Arizona Statewide ITS Architecture. In the physical view, the architecture is depicted as a set of integrated physical objects that interact and exchange information to support the architecture Service Packages. Physical objects are defined in the physical view to represent the major physical components of the ITS architecture.

At the heart of the physical view, the physical objects are organized into six classes that define ITS at the highest level of abstraction. The specific classes are referred to as Center, Support, Field, Vehicle, and Personal. The classes are used to group physical objects based on where they reside in the ITS architecture and fundamentally how they behave and interact with other physical objects. Generically, each of the classes, and their typical communications mediums are shown in **Figure 7-3**.

Figure 7-3: Classes of Physical Objects in ARC-IT

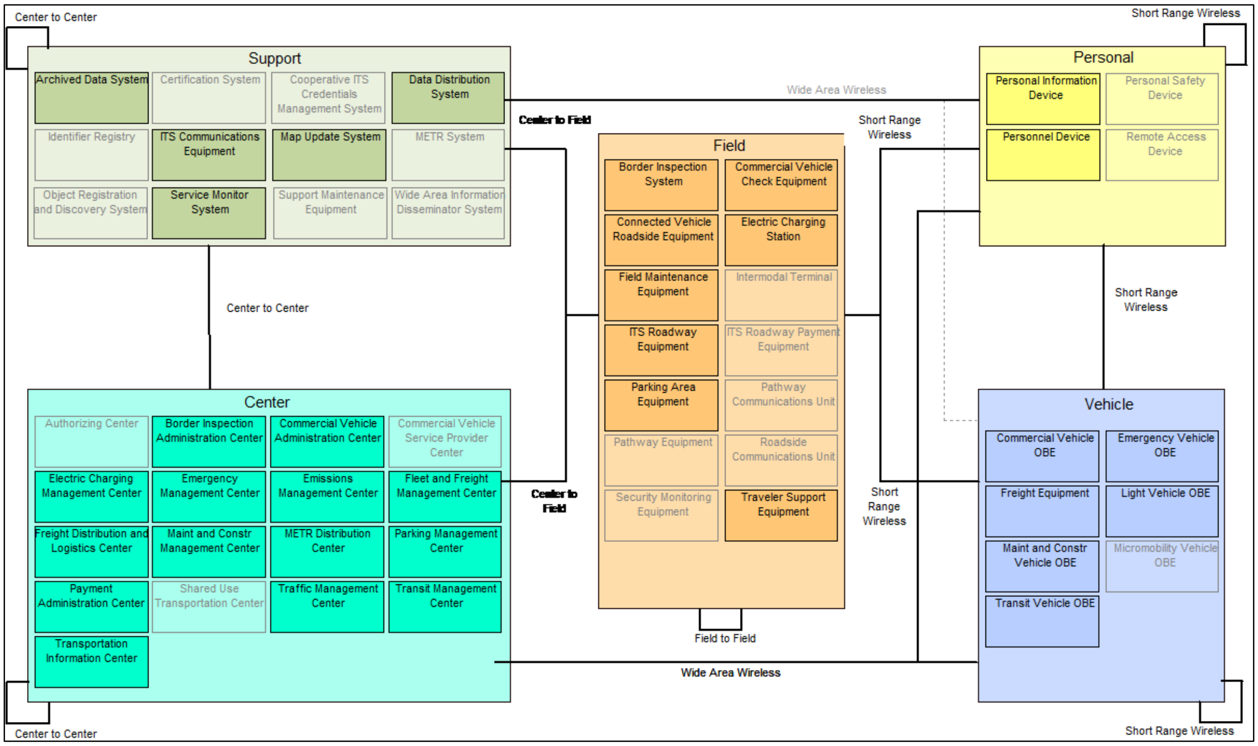


Source: ARC-IT website: https://www.arc-it.net/html/viewpoints/physical.html

Each of these classes include one or more subsystems (individual pieces of the ITS defined by ARC-IT) that are revealed at the next level of detail in the physical view of ARC-IT. As shown, if we know the class of a subsystem (e.g., Center), then we know generally how it interacts with other subsystems (e.g., a Center interacts with other Centers using 'Center to Center' Communications).

Figure 7-4 shows the physical view of the Arizona Statewide ITS Architecture. It shows how the various classes of subsystems interconnect with one another in the Arizona Statewide ITS Architecture, and how they would typically communicate between classes. Subsystems within Figure 7-4 that are light in color (grayed-out) are not applied in the Arizona Statewide ITS Architecture.

Figure 7-4: Physical View of the Arizona Statewide ITS Architecture



7.5 Functional Requirements

As conveyed in Section 5, services are made up of selected inventory elements that, together, provide transportation services that benefit travelers and operators to address their safety, mobility, and efficiency needs. To address each service identified, an included inventory element will perform functions needed to deliver the service. The inventory element's functions are represented as Functional Objects. Functional requirements are high-level descriptions of the share of work or the tasks that a functional object fulfills in order for the inventory element to contribute its part of an ITS service. When used in a set of specifications for a project, functional requirements inform agencies as they procure, obtain, and contract with solution-providers to develop and implement the services that meet their agency needs. Functional requirements are not product-specific, technology-specific, or communication media-specific. In ARC-IT, functional requirements have been defined for each Functional Object that focus on the high-level requirements that support regional integration.

Specific functional requirements found in the Arizona Statewide ITS Architecture are intended to be helpful in producing specifications for Arizona agencies during ITS project development. **Table 7-3** presents a brief example of functional requirements found in the Arizona Statewide ITS Architecture RAD-IT database. The complete listing of functional requirements can be found in the Arizona Statewide ITS Architecture RAD-IT database.

Table 7-3: Functional Requirements Example

Element Name	Functional Object	Functional Object Description	Requirement
ADEQ Arizona Emissions Management	Emissions Data Collection	'Emissions Data Collection' collects and stores air quality and emissions management information that is collected during Emissions Management Center operations. This data can be used directly by operations personnel, or it can be made available to other data users and archives in the region.	The center shall collect air quality and emissions management data from various sources, including emissions sensors distributed along the roadside and wide-area sensors detecting pollution over a larger geographical area.
ADEQ Arizona Emissions Management	Emissions Data Collection	'Emissions Data Collection' collects and stores air quality and emissions management information that is collected during Emissions Management Center operations. This data can be used directly by operations personnel, or it can be made available to other data users and archives in the region.	The emissions management center shall assign quality control metrics and meta-data to be stored along with the data. Meta-data may include attributes that describe the source and quality of the data and the conditions surrounding the collection of the data.
ADEQ Arizona Emissions Management	Emissions Data Collection	'Emissions Data Collection' collects and stores air quality and emissions management information that is collected during Emissions Management Center operations. This data can be used directly by operations personnel, or it can be made available to other data users and archives in the region.	The center shall receive and respond to requests from ITS Archives for either a catalog of the emissions management data or for the data itself.
ADEQ Arizona Emissions Management	Emissions Data Collection	'Emissions Data Collection' collects and stores air quality and emissions management information that is collected during Emissions Management Center operations. This data can be used directly by operations personnel, or it can be made available to other data users and archives in the region.	The emissions management center shall produce sample products of the data available.
ADOT 511 IVR	TIC Traveler Telephone Information	'TIC Traveler Telephone Information' services voice-based traveler requests for information that supports traveler telephone information systems like 511. It takes requests for traveler information, which could be voice-formatted traveler requests, dual-tone multi-frequency (DTMF)-based requests, or a simple traveler information request, and returns the requested traveler information in the proper format. In addition to servicing requests for traveler information, it also collects and forwards alerts and advisories to traveler telephone information systems.	The center shall provide information on traffic conditions in the requested voice format and for the requested location.
ADOT 511 IVR	TIC Traveler Telephone Information	'TIC Traveler Telephone Information' services voice-based traveler requests for information that supports traveler telephone information systems like 511. It takes requests for traveler information, which could be voice-formatted traveler requests, dual-tone multi-frequency (DTMF)-based requests, or a simple traveler information request, and returns the requested traveler information in the proper format. In addition to servicing requests for traveler information, it also collects and forwards alerts and advisories to traveler telephone information systems.	The center shall provide information on traffic conditions in the requested voice format and for the requested location.

Source: 2024 Statewide ITS Architecture RAD-IT database

8. PROJECT SEQUENCING

The "Architecture Rule" requires that regional ITS architectures define a Project Sequencing that allows ITS stakeholders to see how the regional ITS architecture will be "built out." Project sequencing is defined in the Regional ITS Architecture Guide as "any relevant ordering of the projects in order to contribute to the integrated regional transportation system depicted in the regional ITS architecture."[1] The project sequence provides a path to regional and statewide ITS implementation. The project sequence should be factored into existing traditional transportation planning processes.

The development of the Project Sequence for the Arizona Statewide ITS Architecture Update was performed in an iterative manner. Development of the project sequence for the Arizona Statewide ITS Architecture Update began with an examination and evaluation of the existing project list from the 2018 Update. Stakeholders with projects on that list were asked to review and provide feedback on those projects with the main goals of:

- Removing projects that have been completed
- Removing projects not completed and no longer being considered
- Updating project descriptions, timeframe, priority, and services where appropriate
- Combining / consolidating projects where appropriate

The intent is to remove completed or no longer relevant projects, while keeping projects on the list that are still relevant, and making room for new projects on the list.

Those stakeholders with projects on the 2018 project list were asked to update the relative priorities for those projects they wanted kept on the list. Those stakeholders were then asked if they had new projects to add to the list, and to indicate the relative priorities of those new projects.

At a subsequent virtual stakeholder meeting, that draft project list was presented to the larger stakeholder group. The larger stakeholder group was asked to review the project list and to provide any input or feedback on new projects they would like to see added to the project list. As an example, ADOT partnered with the Sun Corridor Metropolitan Planning Organization (SCMPO) in determining and prioritizing projects for Dynamic Message Signs (DMS) implementation in the region concurrently, which provided project recommendations to this ITS Architecture Update. After the virtual stakeholder meeting the draft project list was included in Draft and Revised Technical Memorandum #5 (Implementation Plan (Project Sequencing, Agency Agreements, and ITS Standards)) for further review by the larger stakeholder group and ADOT. The project list was revised based on stakeholder comments in Technical Memorandum #5, with the revised project list being inserted into the Draft Final Plan for another round of review by the larger stakeholder group in advance of distributing the Final Plan.

[1] Regional ITS Architecture Guide; prepared by the National ITS Architecture Team; prepared for the Intelligent Transportation Systems Joint Program Office (ITS JPO), US Department of Transportation; November 5, 2020

Additionally, review of existing local and regional plans, programs, and studies was performed to gather any additional ITS projects that were already planned and/or programmed to ensure that they are included in this plan.

To move forward in the sequencing of projects, each of the projects identified were assigned a relative priority, designated as Short, Medium, and Long, equating to High, Medium, and Low priorities, respectively. The project sequence does not establish a specific decreasing priority ranking for all identified projects. This approach is desirable in that it does not discretely identify "Project A" as being a higher priority than "Project B," thus potentially pitting one project or agency against another when competing for funding. This method of prioritizing projects brings structure to the planning process and gives focus to eventual project selection and deployment without establishing a "pre-defined" funding priority for specific projects. It also provides flexibility during the project development and deployment processes.

A primary factor in project sequencing is a logical ordering of projects. For example, in order for a complex Automated Incident Detection and Management System to be implemented it is typical that a more basic Advanced Transportation Management System (ATMS) is in place. An ATMS would be a foundational system, that would be leveraged by the Automated Incident Detection and Management System for deployment and operation. Therefore, an ATMS project for a given agency would be a higher priority than an Automated Incident Detection system for that same agency – if said agency did not already have an ATMS in place.

The prioritization of projects should be used as a guide and not a prescription. Some projects may be considered long-term efforts because near-term deployment may represent an unacceptable risk. Or other near-term projects need to be in place prior to deployment of a medium- or long-term project. The short, medium, and long term timeframes identified for the projects can be translated into "near-term" (typically, 1 to 3 years), "medium-term" (typically, 4 to 6 years) and "long-term" (typically, 7 to 10 years) deployments.

In some cases, an early opportunity to deploy a medium- or long-term project in the state, with relatively low risk, may present itself. Or perhaps a technology or system may advance more quickly than was originally anticipated in the development of this ITS Architecture Update. Neither of these scenarios should preclude implementation of a medium- or long-term project before a short-term project, if it makes sense in the context of the local setting and changing local priorities and needs. This plan should provide flexibility to the state in project deployment and not necessarily cause restrictions.

The actual deployment of ITS projects could also be dependent on other factors including the data or policy decisions that support the projects. For example, transit signal priority (TSP) or emergency vehicle preemption (EVP) projects may benefit by waiting for the development of a regional standard. Certain project deployments may benefit by the needed results from a cost-benefits analysis. Other system integration projects may require a ratified national standard. These types of dependencies should be recognized not just in the prioritization and sequencing of projects, but also the selection and planning of projects.

Appendix I contains the ITS Project List for the Arizona Statewide ITS Architecture Update (the Project Sequence) grouped into short, medium and long term timeframes based on stakeholder needs and discussions and the other factors as described.

9. AGENCY AGREEMENTS

Agreements governing ITS deployment and operations among the various stakeholder agencies and organizations in the state of Arizona are required to fully achieve the ITS integration proposed in the statewide ITS architecture. Each interconnection between systems in the regional ITS architecture represents cooperation between stakeholders and a potential requirement for an agreement, whether it is a simple handshake or a more formal agreement.

The Architecture Rule requires that a list of potential agreements needed to implement a regional ITS architecture be kept by the region and considered during deployment and implementation of ITS projects.

Typically, existing stakeholder agreements that support information sharing, funding, or specific ITS projects are reviewed regularly and assessed to determine if they can be extended. The review should include evaluation of the potential for the existing agreement to be used to support cooperative implementation and operation of ITS in the region or state. Arizona ITS stakeholders have provided information on some agreements that are already in place that support effective ITS deployment and integration.

Documented agreements aid Arizona ITS stakeholders in planning their operational costs, understanding their respective roles and responsibilities, and in building trust for future projects. Formal agreements are necessary where funding or financial arrangements are defined or participation in large regionally significant projects is required. The list of ITS-related agreements for this 2024 Arizona Statewide ITS Architecture Update was developed based primarily on the list of agreements contained in the 2018 update to the statewide ITS architecture.

9.1 Types of Agreements

There is considerable variation between regions and states and among stakeholders regarding the types of agreements that are created to support ITS integration. The types of agreements used are determined by the "lead agency" for a given project. The lead agency is the organization that is overseeing / managing the implementation of a specific service or project in the region or state. That agency's policies and procedures will usually dictate the types of agreements used for implementing various projects. At the time of development of this list of agreements, lead agencies for projects identified in this document have not all been determined. In future updates and during the maintenance of the statewide ITS architecture, this is an item that will likely be considered and updated.

The Regional ITS Architecture Guide[2] presents some common types of agreements, as noted in **Table 9-1.**

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[2] Regional ITS Architecture Guide; prepared by the National ITS Architecture Team; prepared for the Intelligent Transportation Systems Joint Program Office (ITS JPO), US Department of Transportation; November 5, 2020

Table 9-1: Common Agreement Types

Type of Agreement	Description
Handshake Agreement	• Early agreement between one or more partners. • Not recommended for long term operations.
Memorandum of Understanding (MOU)	• Initial agreement used to provide minimal detail and usually demonstrating a general consensus. • Used to expand a more detailed agreement like an Interagency Agreement which may be broad in scope but contains all the standard contract clauses required by a specific agency. • May serve to modify a much broader Master Funding Agreement, allowing the master agreement to cover various ITS projects throughout the region and the MOUs to specify the scope and differences between the projects.
Interagency Agreement	• Between public agencies (e.g., transit authorities, cities, counties, etc.) for operations, services, or funding. • Documents responsibility, functions, and liability, at a minimum.
Operational Agreement	• Between any agency involved in funding, operating, maintaining, or using the right-of-way of another public or private agency. • Identifies respective responsibilities for all activities associated with shared systems being operated and / or maintained.
Funding Agreement	• Documents the funding arrangements for ITS projects (and other projects). • Includes at a minimum standard funding clauses, detailed scope, services to be performed, detailed project budgets, etc.
Master Agreements	• Standard contract and / or legal verbiage for a specific agency and serving as a master agreement by which all business is done. These agreements can be found in the legal department of many public agencies. • Allows states, cities, transit agencies, and other public agencies that do business with the same agencies multiple times (e.g., cities and counties) to have one Master Agreement that uses smaller agreements (e.g., MOUs, Scope-of-Work and Budget Modifications, Funding Agreements, Project Agreements, etc.) to modify or expand the boundaries of the larger agreement to include more specific language.

Source: Regional ITS Architecture Guide; Intelligent Transportation Systems Joint Program Office (ITS JPO), US Department of Transportation; November 2020

9.2 Existing Agreements

There were a number of existing agreements documented in the 2018 Statewide ITS Architecture. All but two of them involve ADOT. Most were related to specific projects and systems, with a few being programmatic, relating to more general agency cooperation and coordination, rather than a specific project or system.

Appendix J contains a list of agreements that emanated from the 2018 Statewide ITS architecture Update. Earlier in the 2024 Update process, stakeholders were asked to review this list of agreements to determine if any agreements should be removed from the list, or if any agreements need to be added to the list.

10. STANDARDS IDENTIFICATION

A list of recommended ITS standards needed to implement a regional ITS architecture is a required element of the Architecture Rule. The resulting list of ITS standards is to be considered during deployment and implementation of ITS projects in the region.

ITS standards are fundamental to the establishment of an open ITS environment, a goal originally envisioned by USDOT. ITS standards are an important component of the information flows in an ITS architecture. National ITS standards are attached to each information flow (Architecture Flow in National ITS Architecture terms) and as such, this is how they are identified throughout the ITS architecture for Arizona.

Use of non-proprietary ITS standards facilitates interoperability within a system and between systems at local, regional, and national levels without impeding innovation as technology advances and new approaches evolve. ARC-IT is "technology neutral;" and ITS standards for information flows between systems ensure consistency and compatibility between and among systems.

Establishing national and regional ITS standards for exchanging information among ITS deployments is important not only from an interoperability point of view, but it also reduces risk and cost since a region or state can select among multiple vendors for products and applications. ITS standards help create competition, better products, and potentially lower prices.

ARC-IT currently identifies over 500 ITS standards, many of which have overlapping technical goals and objectives. Those standards can be found at the following web page address: https://www.arc-it.net/html/standards/standards.html. The standards identified there are in various stages of development.

Not all standards are used in most regions. To conform to the Architecture Rule, the ITS architecture is required to reference those standards that are applicable to the region based on the types of information exchanged between Elements in the architecture. The types of information exchanged are based on the selected information flows between ITS Elements.

The standards that are most widely applicable to ITS deployments are the National Transportation Communications for ITS Protocol (NTCIP) family of standards. NTCIP is a joint product of the National Electronic Manufacturers Association (NEMA), the American Association of State Highway and Transportation Officials (AASHTO), and the Institute of Transportation Engineers (ITE).

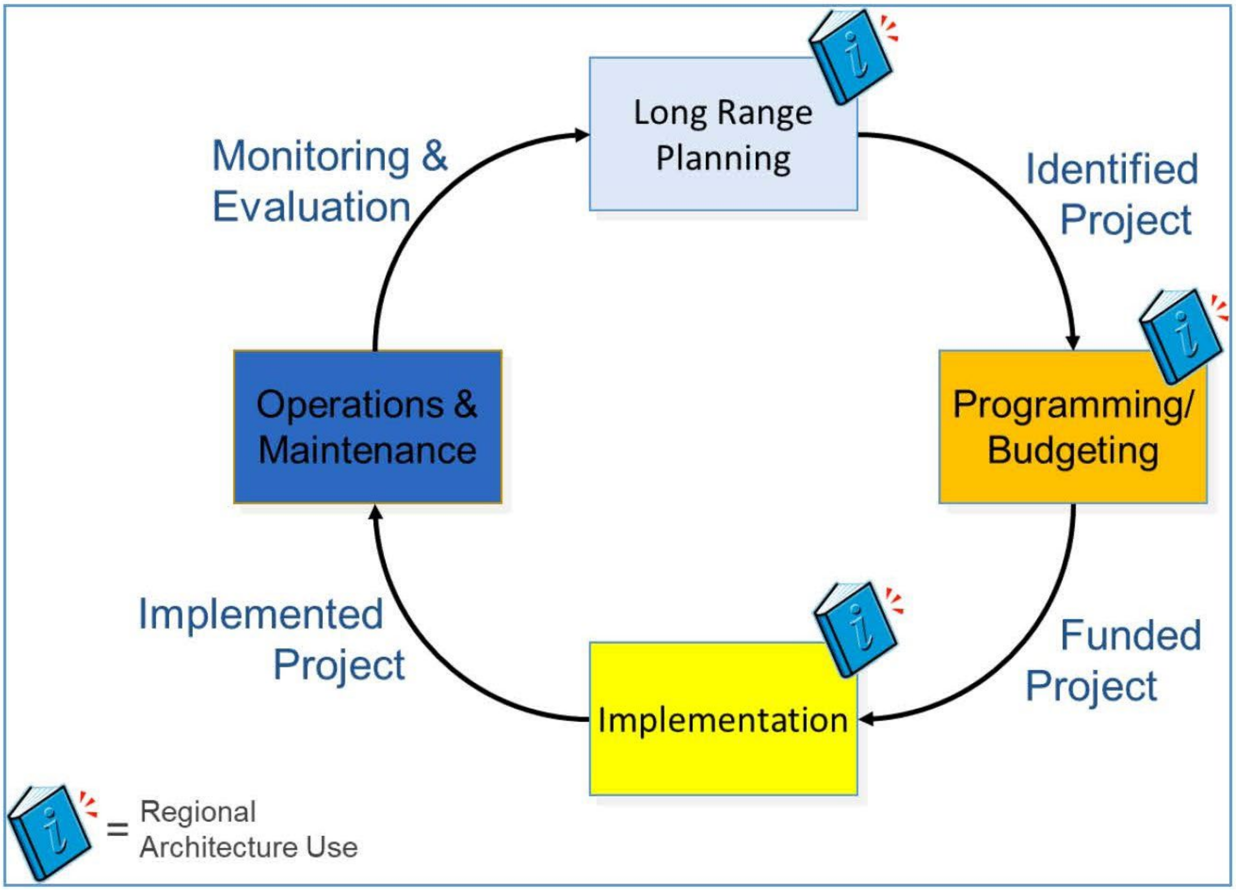
NTCIP is a family of communication protocols and data definition standards that have been designed for use in all types of systems dealing with the transportation environment, including those for freeways, traffic signals, transit, emergency management, traveler information, and data archiving. It has been adopted by FHWA to meet the needs and requirements for ITS communication and to ensure that inter-network connectivity is done through industry standard interfaces.

Appendix K contains a listing of ITS standards that are pertinent to the Arizona Statewide ITS Architecture. The pertinent standards are sorted by Element name, followed by the Standard Title, the Standard Number, and the SDO name.

11. USING THE STATEWIDE ITS ARCHITECTURE

The implementation of transportation projects is depicted diagrammatically as a lifecycle as shown in **Figure 11-1**. A regional or statewide ITS architecture can be used to support the planning, programming, and implementation of projects, as described in this diagram.

Figure 11-1: Transportation Project Lifecycle



Source: Regional ITS Architecture Guide; Intelligent Transportation Systems Joint Program Office (ITS JPO), US Department of Transportation; November 2020

Figure 11-1 shows the transportation project lifecycle at the highest level. From the top of the diagram, goals and objectives of the transportation system are identified in long-range planning, such as the Arizona 2050 Long-Range Transportation Plan (LRTP), or a Regional Transportation Plan (RTP) in a metropolitan planning area. To meet the goals and objectives, policies, strategies, and projects are identified in long-range planning activities. To deploy the projects, funding must be secured via the federal transportation programming and/or agency budgeting processes. Once funding has been secured for a project, it can be implemented. Once implemented, it is operated and maintained (O&M). During O&M, ideas for improvement or replacement are identified and fed into the long-range planning process to begin the cycle again.

A regional or statewide ITS architecture supports three of these major steps – planning, programming, and implementation.

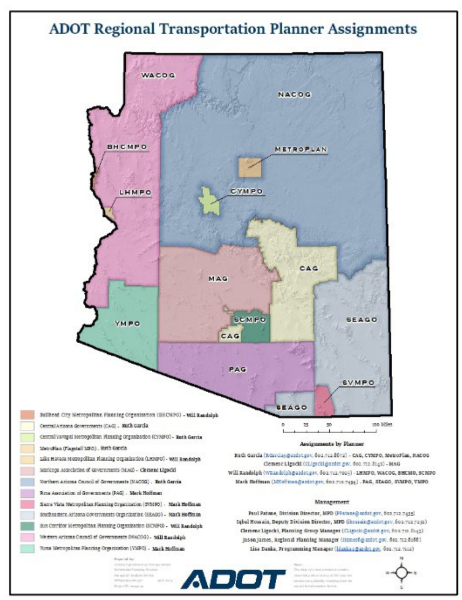
Use in Long Range Transportation Planning: A regional or statewide ITS architecture can be used to support metropolitan and statewide long-range transportation planning. A regional or statewide ITS architecture provides a means by which peer agencies can jointly define their vision for ITS development based on regional and statewide goals and objectives. Using the ITS architecture, a region or state can plan for technology application and integration to support more effective planning for operations.

Use in Programming/Budgeting: A regional or statewide ITS architecture can be used to support the programming/budgeting of projects in metropolitan and statewide regions. The ITS architecture provides a high-level description of ITS projects, which can serve as an input to the definition and prioritization that occurs during programming/budgeting processes.

Use in Project Development: By starting with an ITS architecture, the steps taken by each project will be on the path to fulfilling the broader objectives set forth in the long-range transportation plan. A well-maintained regional or statewide ITS architecture that is created and maintained using RAD-IT provides context for ITS projects and the initial input for the systems engineering processes for a project. Once a project has been articulated in RAD-IT, the systems engineer can use another software tool called the Systems Engineering Tool for Intelligent Transportation (SET-IT) to develop project specific documentation. Project-relevant information from RAD-IT can be used within SET-IT to support not only the development of a project architecture, but also the systems engineering documentation such as a Concept of Operations and a System Architecture Document.

11.1 Use Cases for the Arizona Statewide ITS Architecture

There are three key use cases for the Statewide ITS Architecture:



1. **Planning** – The Architecture should be used to assist in the traditional transportation planning process for ADOT, as well as local and regional agencies outside of the MAG and PAG metropolitan planning areas.

- The planning process defines projects that include ITS
- The Architecture can be used to determine the sequence of ITS deployment and to also complement state and local transportation planning efforts

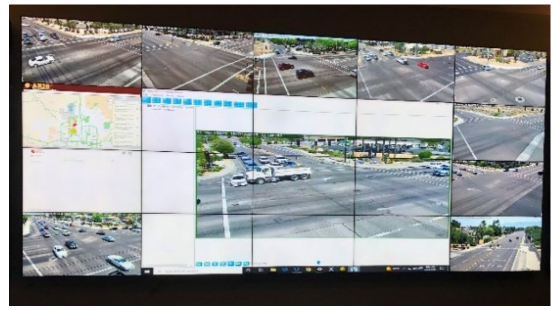
2. **Design** – The Architecture should be followed during the design of ITS projects.

- Use of the Architecture enhances the possibility of ITS elements being interoperable and able to communicate with other systems

- Use of the Architecture helps to verify that the desired functions will be provided by the project's ITS elements

3. **Implementation** – During implementation, the Architecture can provide information to support procurement and testing of ITS.

- Development and verification of functional requirements
- Planning and implementing information exchange standards



In Transportation Planning, ITS Architecture has its greatest impact on institutional integration.

- A structure around which discussions can take place among state, regional, and local stakeholders to gain consensus on the direction of ITS
- Identify opportunities for making ITS investments in a more cost-effective manner
- Plans and assigns roles and responsibilities

11.2 Arizona Statewide Transportation Planning and Project Programming

Specific transportation planning and programming activities related to the Statewide ITS Architecture Update are the Arizona LRTP and ADOT's Planning to Programming (P2P) process. The most recently completed Arizona LRTP is known as 2050 LRTP, released in September 2023. The 2050 LRTP can be reviewed on ADOT's website at this link: https://www.adot2050plan.com/. The 2050 LRTP is a policy document that provides a current "roadmap" for the state transportation system over the next 25 years. The 2050 LRTP vision, goals, and objectives are incorporated into the Statewide ITS Architecture Update and influence ITS user needs, as well as the identification of projects in the updated ITS architecture.

ADOT's P2P process is used to prioritize projects on the state highway system. P2P connects ADOT's LRTP to the Five-Year Construction Program through performance, as required by Arizona Revised Statutes (ARS). P2P categorizes projects into 4 categories: 1) Pavement Preservation Projects, 2) Bridge Preservation Projects, 3) Modernization Projects, and 4) Expansion Projects. Stand-alone ITS projects will generally be found in the Modernization Projects category. Other ITS included in larger projects may generally be found in the Expansion Projects category. Projects and other ITS initiatives coming out of the Statewide ITS Architecture Update will be incorporated into the P2P process for construction programming. The most current Five-Year Construction Program was approved by the State Transportation Board in June 2023 for the five-year period from 2024 to 2028.

11.3 Transportation Systems Management and Operations and ITS Architecture

Transportation Systems Management and Operations (TSMO) is an integrated approach to optimize the performance of existing infrastructure by implementing multi-modal, intermodal, and often cross-jurisdictional systems, services, and projects. This includes regional operations collaboration and coordination activities among transportation and public safety agencies. TSMO is not routine road maintenance like resurfacing or guardrail replacement. TSMO strategies improve system efficiency, enhance public safety and security, reduce traffic delays of road users, and improve access to information for travelers. The emphasis of TSMO is an outcome driven, performance-based system. It is critical that regional operations objectives can be measured since they have importance on a regional level. TSMO strategies include but are not limited to traffic safety, traffic incident management, travel information services, roadway weather information, freeway management, connected and automated vehicles, traffic signal systems coordination, work zone management, managed lanes, emergency response, homeland security, freight management, active traffic management, and new technologies that are rapidly occurring.

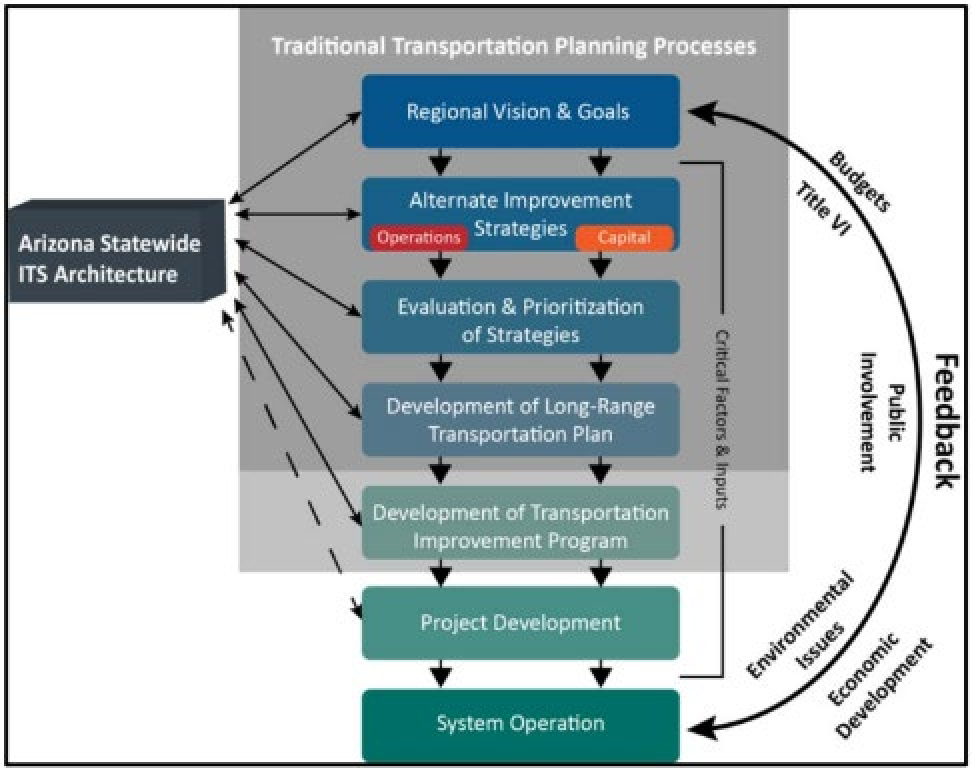
ITS is a primary tool for the implementation and practice of TSMO strategies. ITS Architecture provides a common framework for planning, defining, and integrating ITS on a regionwide or statewide basis. Similarly, TSMO promotes a collaborative and coordinated approach to traffic operations investments and practices, with an emphasis on institutional coordination and integration. With the overlap in collaboration concepts between TSMO and ITS Architecture, the ITS Architecture is used to support both the technical and institutional aspects of TSMO.

11.4 ITS Planning for Operations

The traditional transportation planning process includes the development of goals and objectives, identification of alternative improvement strategies, evaluation and prioritization of strategies, development of the transportation plan and transportation improvement programs. ADOT recently completed the Arizona 2050 LRTP to provide a current “roadmap” for the state transportation system over the next 25 years (2026-2050).

Planning for technology-based operations activities is in some ways fundamentally different than planning for traditional capital improvement projects. However, the Arizona Statewide ITS Architecture is compatible with ADOT’s 2050 LRTP and transportation improvement program and is aligned with the 2050 LRTP vision, goals, and objectives. **Figure 11-2** provides a view of the statewide planning processes and how the Arizona Statewide ITS Architecture aligns with those processes.

Figure 11-2: Arizona Statewide ITS Architecture Use in Planning for Operations



Source: 2018 Arizona Statewide ITS Architecture

11.5 Performance Based Planning

"Over the past two decades, transportation agencies have increasingly been applying 'performance management' – a strategic approach that uses performance data to support decisions to help achieve desired performance outcomes. Performance management is credited with improving project and program delivery, informing investment decision-making, focusing staff on leadership priorities, and providing greater transparency and accountability to the public.

Performance-based planning and programming (PBPP) refers to the application of performance management within the planning and programming processes of transportation agencies to achieve desired performance outcomes for the multimodal transportation system. This includes a range of activities and products undertaken by a transportation agency together with other agencies, stakeholders, and the public as part of a 3C (cooperative, continuing, and comprehensive) process. It includes development of: long range transportation plans (LRTPs), other plans and processes (including those Federally-required, such as Strategic Highway Safety Plans, Asset Management Plans, the Congestion Management Process, Transit Agency Asset Management Plans, and Transit Agency Safety

Plans, as well as others that are not required), and programming documents, including State and metropolitan Transportation Improvement Programs (STIPs and TIPs)."[3]

The initial step in the objectives-driven, performance-based approach to statewide ITS architecture is to establish statewide goals and operations objectives. Goals and objectives that focus on the operational performance of the transportation system in the planning process were included in the 2018 Statewide ITS Architecture Update, based on the then current State LRTP. The 2024 Statewide ITS Architecture Update also incorporates goals, objectives, and performance measures from the 2050 LRTP. They may be formed in response to input from ITS and operations staff, elected or appointed officials, or a significant event such as a dust storm, or major traffic incident that draws public attention to needed operational improvements.

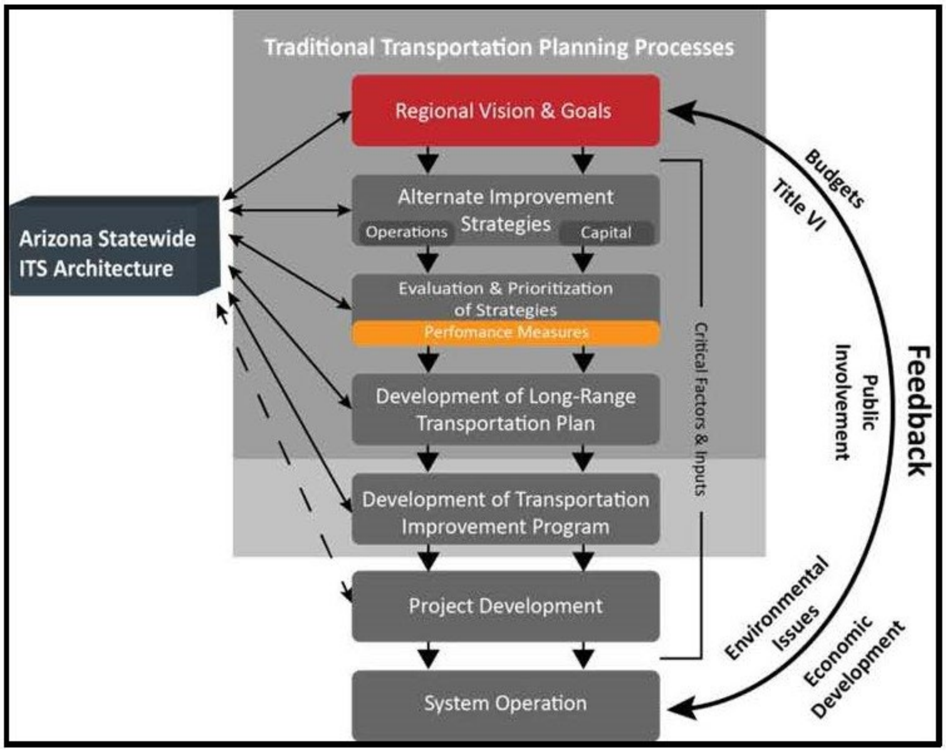
Performance measures track the achievement of operations objectives and are identified during the development of the objectives and are typically embedded in operations objectives. For example: the operations objective - improve average travel time during peak periods by 5% by the year 2025 on regionally significant arterials - is tracked by the performance measure of - average travel time. The ITS elements from the stakeholder inventory show several archive databases that support this task and track travel times. That information is shared statewide through the statewide performance measures captured in the Highway Performance Monitoring System (HPMS).

Figure 11-3 illustrates the introduction of Performance Measures in the transportation planning process with the addition of Performance Measures in the evaluation and prioritization of strategies leading into the LRTP development. In this way, operations and operational concerns can be introduced into the planning process in the form of operations-oriented performance measures. When this is done in the earlier stages of the planning process, it facilitates operations and operational concerns being carried into the latter stages of the process as mature concepts and not as an afterthought.

Using the performance-based federal requirements, ADOT developed the vision goals, objectives, and performance measures during the development of the 2050 LRTP. The Statewide ITS Architecture can help stakeholders meet the 2050 LRTP vision, goals, and objectives by using them to organize supportive ITS capabilities and select service packages, functional requirements, and project concepts that address the 2050 LRTP objectives. Conversely, architectures and regional ITS strategic plans can help planning organizations define operations objectives that reflect available data and the expertise of operations staff for metropolitan or statewide transportation plans.

[3] Performance-Based Planning and Programming Guidebook; United States Department of Transportation Federal Highway Administration; September 2013.

Figure 11-3: Arizona Planning Process with Performance Measures



Source: 2018 Arizona Statewide ITS Architecture

11.6 ADOT 2050 Long-Range Transportation Plan

To align the 2024 Statewide ITS Architecture with the state's long range transportation planning processes, the goals and objectives, and some performance measures from the 2050 LRTP have been incorporated into the 2024 Statewide ITS Architecture Update. Incorporating the goals and objectives has influenced the identification of ITS user needs, as well as the identification of projects in the updated ITS architecture.

The 2050 LRTP provides a vision and roadmap for how the state will address the growing demands on Arizona's transportation system for the next 25 years. The reality is that Arizona's transportation needs greatly outweigh the state's projected future funding. The 2050 LRTP recommends a "Preserve and Upgrade" investment scenario, which commits a higher level of funding priority to preserving existing infrastructure through activities like operational improvements and asset management, rather than system expansion. In this scenario, ITS plays a significant role in improving system management and operations.

The 2050 LRTP defined seven goals to support the overall vision of the LRTP and provide strategic priorities on how to implement the LRTP. The goals establish the path to achieve the vision and were formulated in consideration of Department, stakeholder, and public priorities. Four of the goals address the state transportation system, while three of the goals address processes. The 2050 goals provide a guide for implementing existing and future decision-making and policies to support the vision.

Table 11-1 contains the goals and objectives from the 2050 LRTP that are incorporated into the Statewide ITS Architecture. Table 11-1 also shows the performance measures that support the goals and objectives and provide the operations and operational foresight into the early stages of the planning processes to better integrate the two planning efforts (the 2050 LRTP and the Statewide ITS Architecture). Some performance measures come directly from the 2050 LRTP, while others have been carried into the ITS architecture from other ITS architecture developments, as well as from the recently completed ADOT ITS Master Plan.

Table 11-1: 2050 LRTP Goals, Objectives, and Performance Measures

Goals	Objectives	Performance Measures
1. Preserve and Maintain the System	• Achieve and maintain a state of good repair of transportation assets within available resources • Cost-effectively maintain, operate, and upgrade assets to maximize useful life • Incorporate resiliency, adaptability, and redundancy in the transportation network, systems management, and operation	• Resources available for State Highway maintenance • Mitigate congestion • Focus on implementation policies • Increased ITS infrastructure health • Reduction in weather-related maintenance and incident response
2. Enhance Safety and Security	• Reduce the number of lives lost and injuries sustained on Arizona's transportation network, striving for zero • Foster a community and workplace culture of safety first • Reduce vulnerability from various threats; protect physical assets, cyber assets, and transportation systems • Prepare for and implement efficient coordinated response and recovery to emergency and disaster events	• Increase and measure shared access • Decrease travel delay • Mitigate congestion • Decrease in fatalities and serious injuries • Quick Clearance – time it takes to clear roadway incidents • Focus on implementation policies • Status of traffic conditions throughout year • Increased detection of congestion issues • Improved safety at intersections • Improved speed compliance in work zones • Reduce secondary crashes

Goals	Objectives	Performance Measures
3. Improve Mobility, Reliability and Accessibility	• Advance access and connectivity between modes • Support accessible and equitable modal options for the movement of people • Mitigate travel delays and alleviate congestion to provide predictable, reliable travel times • Leverage technology, communications, and management strategies to maximize safety and operational efficiency of existing systems and keep up with of major travel trends • Identify and close redundancy gaps in the network to support continued mobility in the event of disasters or other disruptions	• Increase and measure shared access • Households with access to transit service • Resources available for state highway maintenance • Access to destinations by mode • Annual hours of peak–hour excessive delay per capita • Average on–time performance for transit and intercity rail • Decrease travel delay • Improve speed of vehicles • Mitigate congestion • Percent of person–miles traveled on the Interstate Highway System that are reliable • Percent of person–miles traveled on the non–Interstate NHS that are reliable • Improved signal timing • Quick Clearance – measure time it takes to clear roadway incidents
4. Promote Environmental and Health Stewardship	• Create opportunities for safe physical activity, equitable transportation choice, and community engagement • Support flexible and adaptable measures to the transportation system to accommodate anticipated climatic changes and potentially severe climatic events over time • Plan, develop, and maintain transportation facilities in a manner that protects the natural, historic, and cultural environment and avoids or minimizes adverse impacts • Pursue community-supportive transportation outcomes • Strive for cleaner, more efficient, and sustainable energy sources for transportation operations and facilities	• Air quality in low income and disadvantaged communities • Changes in transportation related carbon monoxide emissions • Changes in transportation related Nitrogen Oxides emissions • Changes in transportation related Particulate Matter (< 10 microns) entrained into the air • Changes in transportation related Particulate Matter (< 2.5 microns) into the air • Changes in transportation related volatile organic compounds emissions • Change in vehicle–related emissions, level of environmental certification

Goals	Objectives	Performance Measures
5. Support Equitable Access to the State Highway System	• Improve access and choices for all Arizona residents by supporting transportation system access to job opportunity and training, health care, food availability, and recreation • Support transportation system accessibility to underprivileged populations without damaging community culture or neighborhood integrity • Identify and mitigate transportation burdens for low-income communities, communities of color, people with disabilities, and other disadvantaged groups	• Access to active modes in low income and disadvantaged communities • Access to destinations by income quantile and race • Number of communities and community–based organizations (CBO) meaningfully engaged in development of plans and projects • Transportation and housing cost burden by income quintile and race
6. Strengthen Partnerships	• Look for opportunities to partner with the private sector to stretch public funds through public-private partnerships or coordinated program development • Work with appropriate specialists/experts during project development, design, and construction to optimize safety, community health, and climate responsiveness	• Increase and measure shared access • Resources available for State Highway maintenance • Focus on implementation policies • Number of meetings and agreements signed • Resources available for economic initiatives • Expand partnerships with counties and cities to increase data in AZ511 statewide (get to 100% of counties getting closure info to AZ511 systems)

Goals	Objectives	Performance Measures
7. Support Economic Vitality	• Pursue transportation assets and operational improvements that will expand access to economic opportunities, jobs, and core services. • Improve transportation connectivity to established and emerging activity centers and tourist destinations • Strengthen partnerships throughout the State to encourage and support existing and new opportunities as the demographic base expands • Create and enlarge competitive advantage for Arizona supply chains through higher productivity and reliability in the state freight system, supporting economic growth, and strengthening economic resilience • Coordinate transportation systems with land use for efficient and sustainable use of resources	• Resources available for State Highway maintenance • Decrease travel delay • Mitigate congestion • Focus on implementation policies • Annual employment growth of high–quality jobs • Annual twenty–foot equivalent units (TEUs) imported & exported through Arizona ports of entry • Resources available for economic initiatives • Truck Travel Time Reliability (TTTR) Index • Expand technologies to provide enroute information on key corridors • Improved traveler information • Resources available for economic initiatives

ITS supports the 2050 LRTP goals and objectives to varying degrees. ITS plays a more direct role in preserving and maintaining the system and in improving mobility, reliability, and accessibility than it does in supporting equitable access to the state highway system. Similarly, ITS directly supports enhancement of transportation safety and security, and indirectly supports environmental and health stewardship. Multijurisdictional ITS deployments and regional ITS efforts directly strengthen partnerships among agencies deploying ITS. ITS can support economic vitality through improved traveler information and travel conditions reporting. Overall, ITS can directly and indirectly be used as a tool to measure system performance.

11.7 The ADOT Intelligent Transportation Systems Master Plan

The ADOT TSMO Division recently completed development of an ITS Master Plan to guide activities and investments that relieve congestion, optimize infrastructure operations, and promote a safe and reliable transportation system. The Statewide ITS Architecture is a high-level framework for ITS deployment throughout the state and includes coordination with agency stakeholders outside of ADOT. The ITS Master Plan is much more ADOT-centric and delves into a greater level of detail on system capabilities, system-level planning, and project recommendations. Project recommendations contained in the ITS Master Plan have been carried into the Statewide ITS Architecture project list.

The ITS Master Plan synthesizes a large number of efforts to address different issues spread across the various TSMO groups and functions through the aid of ITS. The evaluation of the ITS needs and the development of recommendations were organized into individual System Layer Plans (SLP). While there is significant interaction and some overlap, the SLPs were developed focusing on particular areas of need and the ITS strategies that could support them. Eight SLPs focused on primary functional areas while two SLPs provide support areas common to the other eight areas. The eight SLPs focused on primary functional areas are:

- Traffic Management
- Road Weather Management
- Active Transportation Demand Management
- Traffic Incident Management
- Work Zone Management
- Safety Applications
- Connected/Autonomous Vehicles and Smart Cities
- Traveler Information Message Systems

The two SLPs that serve as support areas common to the other eight areas are:

- ITS Communications Structure
- Data and Performance Management

Challenges and gaps identified in each SLP provided a basis for developing future implementation steps. Each SLP includes specific, purpose-driven recommendations, organized as process and infrastructure improvements, to progress the associated function independent of the other functions. The ten SLPs are standalone reports but are summarized in the Appendix of the ITS Master Plan Executive Summary.

The ITS Master Plan observes that there is a solid foundation of ITS infrastructure, data use cases, and a variety of staff working in many different areas within the ITS field demonstrating and deploying technology that has broad uses for ADOT personnel and for the constituents in the state. While there are many successes to note, there are opportunities to improve ADOT's capabilities in some specific areas to further enhance collaboration and capabilities to support a future environment. In particular, there is a desire for more active management and operations of the transportation network, a transition from a reactive and incident management perspective to a proactive and mobility management perspective.

The individual SLP reports contain recommendations within each functional area based on the challenges and gaps uncovered through the stakeholder coordination process. Areas of concern include roadway coverage, congestion, crash history, weather events, system improvements, utilization of resources, and others. Recommendations are generally categorized between process and infrastructure improvements with further subdivision based on the nature of the improvement.

Stakeholder input resulted in over 100 recommendations, so an initial screening was conducted to identify the more manageable solutions based on funding, resources, and timelines. A prioritization process was developed with ADOT leadership to rank each recommendation as "high", "medium", or "low" based on the relative merit considering the following factors:

- Effectiveness of the ITS strategy/technology
- Incident hot spots
- Compatibility with existing systems/projects

- Rate of return on investment
- Staffing levels of support

The most applicable and feasible recommendations, along with those already underway, across all SLPs with a "high" priority rating are summarized in the ITS Master Plan Executive Summary. Specific device/system locations were prioritized and mapped on an ArcGIS Portal. The detailed plan will be updated periodically as the various needs of the various projects change.

12. MAINTENANCE PLAN

An ITS architecture maintenance plan was developed as part of this 2024 Arizona Statewide ITS Architecture Update. ADOT has been solely responsible for maintenance of the Arizona Statewide ITS Architecture. Because ADOT will remain solely responsible for maintenance of the Arizona Statewide ITS Architecture moving forward, the maintenance plan was not circulated to the stakeholder group at large. ITS architecture maintenance responsibility will largely be with the Transportation Systems Management and Operations (TSMO) group, with some support from the Multimodal Planning Division (MPD). A summary of the maintenance plan is outlined here.

The ITS Architecture will be updated periodically to reflect changes resulting from project implementation or resulting from changes during the on-going planning process. Events that may influence an ITS Architecture update may include one or more of the following:

- Changes in project definition
- Changes resulting from project addition/deletion
- Changes in project status
- Changes in project sequencing
- Stakeholder changes
- Changes in regional needs
- Changes in other architectures

ADOT or any of the stakeholders can identify a needed change in the Arizona Statewide ITS Architecture and request a change to the ITS architecture. ADOT will evaluate the change request to determine what impact it has upon the current ITS architecture. If the request impacts other stakeholders, ADOT will provide the names of impacted stakeholders to the stakeholder requesting the change. The requester will be responsible for confirming consensus agreement among impacted stakeholders with the requested modification. In the case of a full baseline architecture update, the change evaluation happens through overall stakeholder consensus as part of the ITS Architecture update.

Outside of a full baseline update, ADOT approves, defers, or rejects the change request. This will be handled through email, conference call and/or through periodic face-to-face meetings. The result of the approval step, including rejection or deferment, will be communicated to the requester. If warranted, the result of the approval step could be communicated to the ITS architecture stakeholder group, if deemed appropriate and/or necessary.

If a change request is approved and it warrants an update to the ITS architecture baseline, the Arizona Statewide ITS Architecture RAD-IT database and companion documentation will be updated by ADOT, or ADOT's designee. The final part of the maintenance process is to notify stakeholders of the changes or updates to the ITS architecture. This is accomplished via email to the stakeholders that the ITS architecture has changed and a request for review of the revised information on the updated architecture website.

At the discretion of ADOT, very minor changes, such as to stakeholder descriptions or names, or those that impact only a single project may be made at the time they are identified. Alternatively, ADOT may choose to document the change request and defer making the change to the ITS architecture until the next major ITS Architecture update.

ADOT will initiate a comprehensive revision/update of the ITS architecture every 5 years or as needed. At the discretion of ADOT, the ITS architecture can be modified more frequently, depending on the level and impact of ITS planning and deployment activities.