MARICOPA ASSOCIATION of GOVERNMENTS

MAG Regional ITS Architecture

DRAFT

Technical Memorandum #1
Region Definition and Inventory

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Note – Appendix A, Regional ITS Inventory, will be included with the final version once the inventory is complete.

1. INTRODUCTION

The purpose of this project is to develop a Regional ITS Architecture for the Maricopa Association of Governments (MAG) Region. An ITS architecture is a useful tool for planning and implementing ITS within the MAG Region. From a planning perspective, the regional ITS architecture defines the ITS that the stakeholders wish to realize over a given timeframe. The ITS architecture properly and efficiently define projects so that they build upon one another to be able to achieve the goals and objectives of the Region. The MAG ITS Architecture can identify opportunities for making ITS investments in a more cost-effective fashion, by utilizing inter-agency cooperation during planning, implementation, and operation of these ITS projects.

MAG developed a Regional ITS Architecture (RIA) as part of an ITS Strategic Plan in 2001 which summarized the existing and planned ITS infrastructure as well as the ITS "roadmap" that intended to guide ITS projects and programs in the MAG region for the next 20 years. Since the completion of that project, the amount of ITS infrastructure and level of communications in the MAG Region has increased significantly, as has the integration among agency systems. Furthermore, the National ITS Architecture has been updated to include new services (including expanded emergency management, traffic management and maintenance and construction operations focused services) which need to be reviewed for applicability to the MAG Region. The Federal Highway Administration (FHWA) Final Rule 23 CFR 940 (Rule 940) was adopted which requires that ITS projects, for highways/streets as well as transit, conform to the Rule 940 to be able to receive federal funding.

Along with the ITS infrastructure and communications developing in the Region, the transportation system as a whole has seen significant growth, including an expanded freeway network, additional arterials, and transit services expanding to meet the demands of the Region's growing population and geographic expansion of the metropolitan area. Section 2 of this technical memorandum describes the multimodal transportation network in the MAG Region. MAG is taking this opportunity to capture the expanded deployment and integration of ITS in the Region, and provide a valuable tool for continued project deployment and integration among the MAG member agencies.

The ITS Architecture is intended to serve as a planning tool that is technology-neutral, explains the use of the system from the perspective of various stakeholders, and helps to set goals and expectations of an ITS project. MAG's vision for this RIA update is to go beyond identifying functionality within the ITS architecture, but to also link the RIA to existing, under-construction, programmed and planned systems and ITS infrastructure in the Region. In doing so, the architecture will become a much more tangible and valuable tool for stakeholders as they develop projects, and establish their project requirements through Systems Engineering processes. By linking the RIA more closely to ITS infrastructure (and status of ITS infrastructure), it will provide for a more complete picture of deployment and integration within the MAG Region.

A list of requirements for an ITS architecture to be compliant with the FHWA Final Rule/FTA Policy compared to the tasks identified for this project are provided in **Table 1**. This table shows that through the scope of work for this project, the end result will be a compliant Regional ITS Architecture for the MAG Region. This architecture will also provide a link to more details about ITS elements for each agency for MAG regional planning purposes as well as federal reporting of systems in Arizona.

Table 1 – ITS Architecture Requirements

Rule 940 Requirement	Analysis to Address Requirement	ITS Strategic Plan Technical Memorandum (TM)
Description of region, participating agencies, and other stakeholders.	Textual description in tech memo.	Task 2 – Region Definition and Inventory
Identification of participating agencies' roles and responsibilities.	The listing of stakeholders is one of the aspects of the Turbo Architecture database and defined within the tech memo.	Task 2 – Region Definition and Inventory
An operational concept that identifies the roles and responsibilities of stakeholders in the implementation and operation the systems.	This discussion of the roles and responsibilities can be input to the Turbo Architecture database, or expressed as a table in the Architecture tech memo.	Task 2 – Region Definition and Inventory
Agreements, procedures, and resources necessary for operations and maintenance of the system.	The listing of existing or planned agreements which will be defined within the tech memo.	Will identify in Task 5 – Organization of Regional ITS Architecture
Functional requirements definitions for ITS system.	These functional requirements, based upon the equipment packages selected for each element in the inventory.	Task 4 – Develop Physical Architecture
Interface requirements and information exchanges with planned and existing systems and subsystems.	The detailed description of stakeholder physical elements, at the level of subsystems and terminators, and information flows between these elements is held in Turbo Architecture. Customized outputs to reflect specific agency and system names within the data flow diagrams are included in the tech memo.	Task 4 – Develop Physical Architecture
Identification of applicable ITS standards supporting regional and national interoperability.	This identification is contained in the Turbo Architecture database and can be further defined and discussed in the tech memo.	Task 4 – Develop Physical Architecture
The sequence of projects required for implementation.	The listing of projects is usually done in a tabular format, providing a brief description, lead/supporting agencies, timeframe, and status.	Addressed as existing or planned. Strategic Plan will define potential future projects
Develop and implement procedures and responsibilities for maintaining the architecture as needs evolve within the region.	Defines what elements of the architecture are maintained, who maintains it, and identifies a timeframe and process for updating and maintaining the architecture.	Task 5 – Organization of the Regional ITS Architecture

1.1 Overview of Tasks

Key tasks of this project for developing the MAG Regional ITS Architecture include:

Task 1 – Project Management/Communications

- Provide project updates to the MAG Project Manager and MAG ITS Committee

Task 2 – Region Definition and Inventory

- Identify stakeholders, existing systems and infrastructure, and planned projects
- Establish operational framework in the region
- Develop a glossary to define terms within the Regional ITS Architecture

Task 3 – Develop Logical Architecture

- Establish user needs and user requirements

- Develop logical architecture for the MAG Region

Task 4 – Develop Physical Architecture

- Develop physical architecture for the MAG Region and provide traceability between logical and physical architecture
- Customize functional elements within the architecture, including market packages and equipment packages, to reflect local functionality desired by stakeholders
- Provide a link between local agency ITS infrastructure and the ITS architectures
- Conduct an ITS Architecture Review Workshop with stakeholders in the Region

Task 5 – Organization of the Regional ITS Architecture

- Provide MAG and its members with a Regional ITS Architecture that complies with the Rule 940 requirements

1.2 Input to the Architecture Development

For the MAG RIA, stakeholders from state, regional, county, city and transit operations agencies will be actively involved in the architecture development and review. In order to accurately capture the breadth of deployment and integration in the Region since the last ITS Architecture was developed, the consultant team will obtain input directly from MAG member agencies through an inventory survey as well as follow-up discussions with some stakeholders for more specific information. The consultant team will also make periodic updates to the MAG ITS Committee as well as make all project deliverables available via a project web site and e-mail. A stakeholder workshop will serve as a comment discussion/resolution forum with the ITS architecture development team and key stakeholders so that physical architecture elements and connectivity can be discussed among participating agencies.

MAG will be developing an ITS Strategic Plan for the Region in the near future, which will update the previous ITS Strategic Plan completed in 2001. In order to capture key functional priorities and needs to support the RIA development, the team will draw upon the wide range of ITS plans that have been developed by various agencies in the Region over the last several years. Many of these plans identify priority functions and services, connectivity needs, strategic priorities that ITS can help to address, as well as map out deployment and integration scenarios. Goals and priorities will be extracted from these plans and incorporated into the architecture development process. These plans and projects being reviewed by the team are included in Section 3 of this document.

Projects that are already planned and programmed for implementation are identified in MAG's Transportation Improvement Program (TIP), and they are another key component of the methodology and process to develop this architecture. The current MAG TIP includes ITS projects that are programmed through 2013, and these projects are shown later in this document in Table 8. Projects include local agency ITS deployments as well as connections between multiple agency systems to provide for broader connectivity to support operations beyond the local level.

Another important input to the RIA development is the MAG Regional Transportation Plan (RTP), which is a comprehensive multi-modal plan to prioritize transportation system enhancements and guide investment in the Region's transportation network through FY 2028 (the July 2007 Update expanded the RTP to FY2028 to maintain a 20-year planning horizon for the Regional Transportation Plan). The RTP covers freeway, arterial and public transportation systems, and lays out a detailed sequence of projects that will expand the current transportation networks as well as provide for the needed enhancements to existing transportation facilities throughout the Region. Also included in the RTP is a chapter on Systems Operations and

Management, which identifies ITS as a critical component in member agencies being able to effectively monitor, manage and operate transportation networks (freeway, arterial and transit) to promote safe and efficient travel throughout the Region.

In addition to those ITS projects that are included in the TIP, important regional initiatives, including the Regional Community Network (RCN) and Center-to-Center (C2C) System, will also be reflected in the architecture concepts. Stakeholders will have opportunities to review and update elements within the architecture during the development process.

1.3 Methodology to Develop the MAG ITS Architecture

Figure 1 shows the process of developing the architecture and the many inputs and review sessions that are required to establish a consensus-based regional ITS architecture. The process of developing the RIA for the MAG Region has a foundation in stakeholder involvement and information gathering. Stakeholder needs and regional focus areas will be combined with local knowledge of existing systems to develop a comprehensive inventory of existing, under-construction, programmed and future ITS infrastructure. The regional inventory will be captured in the architecture databases, as well as an associated and expanded inventory database that MAG will use as part of a future effort to map the specific locations and extent of coverage of ITS in the Region.

Using this information, a logical ITS architecture will be developed which defines what ITS systems and devices should do from the user's (public) perspective rather than the operations perspective. The logical architecture will be represented in terms of user requirements and processes that would be required to implement those requirements.

The next step in the RIA development process is to develop the physical view of the ITS architecture. This is where stakeholders, subsystems, information and data flows, connectivity among subsystems and infrastructure will be documented and diagrammed. The physical architecture will define how ITS systems and devices are currently being operated and which agencies are currently coordinating operations to provide those user services defined in the logical architecture. The physical architecture gives a detailed and comprehensive picture of what agencies are doing in the MAG Region with ITS, and uses Market Packages and Equipment Packages to illustrate functionality and connectivity. The National ITS Architecture version 6.0 is being used as the basis to develop the physical architecture for the MAG RIA. Elements within the MAG Region are being customized to reflect actual agency and system names, as well as to clearly identify the status of various elements and connectivity. This customization may also extend to expanding what is currently available within the National ITS Architecture to more accurately depict system operations and connectivity within the MAG Region.

Turbo Architecture is a software application used to develop a Regional ITS Architecture based on the National ITS Architecture, and it will be used to build the MAG RIA Update. Turbo Architecture focuses on the physical view of the RIA and will store the information about stakeholders, the regional ITS inventory, services (market packages), requirements and allow the team to assign information/data flows among the entities and infrastructure within the architecture. This will be the first time that the MAG RIA will be developed using Turbo Architecture, and it will provide for a solid foundation for future reviews and updates.

Stakeholder workshops held during the project will be used to review developed material and provide feedback to more accurately depict each agency and the communications they have within the RIA.

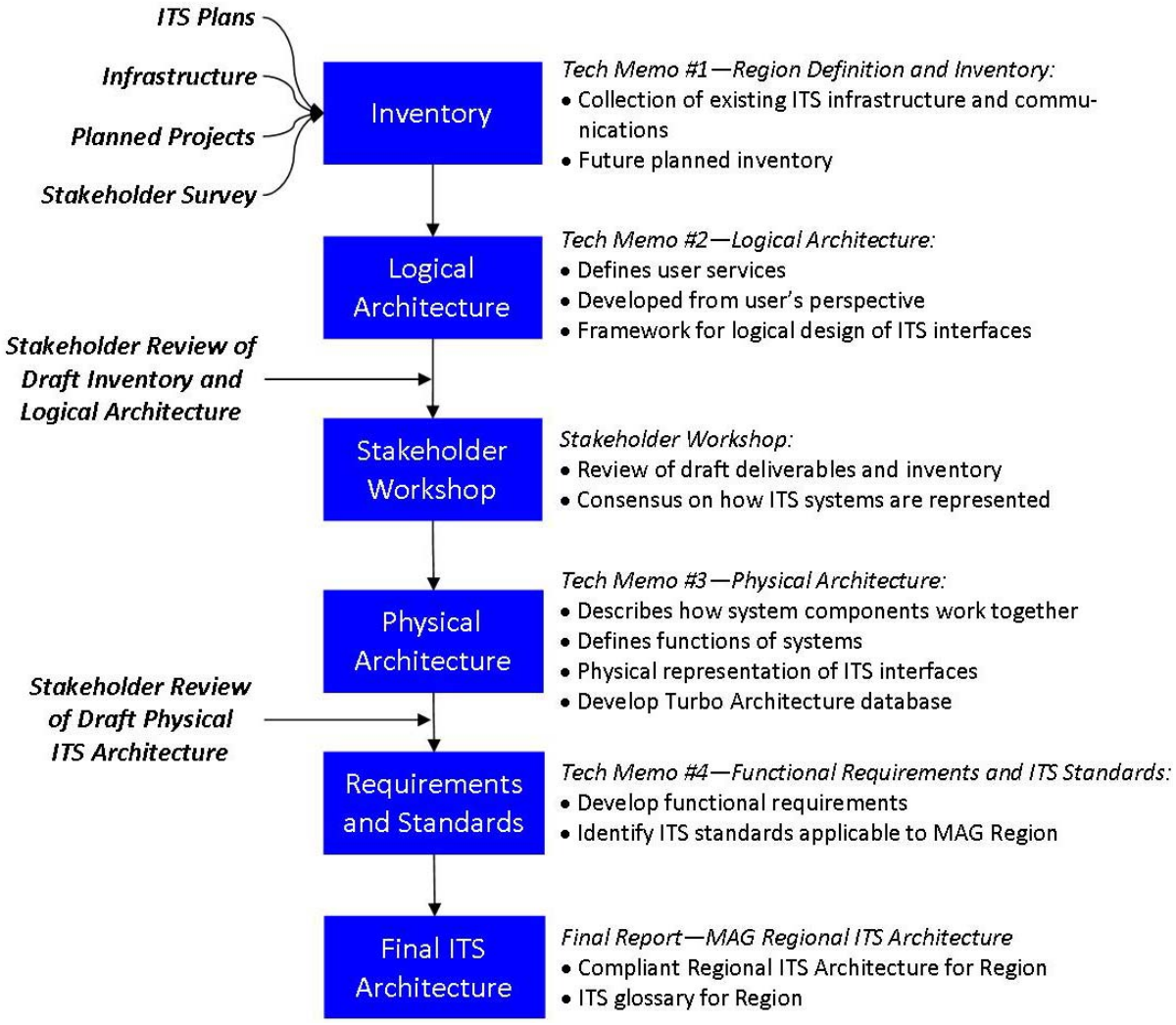

Figure 1 – ITS Architecture Development Process

2. OVERVIEW OF THE MAG REGION AND STAKEHOLDERS

In 2004, Maricopa County contained approximately 60 percent of the population in Arizona, as well as eight of the nine cities in Arizona with populations greater than 100,000 people. A 2005 Special Census Survey indicated that in September of 2005, the population for Maricopa County exceeded 3,700,000 people. This represents an increase of 20.5% since 2000. For the past several decades, the MAG Region has been one of the fastest growing regions in the country. By 2030, the region is projected to nearly double in population.

MAG member agencies proactively plan for the growing population and its effects on the transportation network. More than 20 years ago, Proposition 300 implemented a half-cent sales tax in Maricopa County over 20 years specifically for transportation. That funding enabled the build-out of the freeway network within the Region, including the Loop System, State Route 51, and provided for expansion of the existing freeway corridors to better meet the needs of regional growth. A major funding source to be able to expand the current transportation network to respond to the growing population was the passing of Proposition 400 in 2004, which authorized the continuation of the half-cent sales tax for transportation in the region (Maricopa County Transportation Excise Tax). This action provided a 20-year extension of the half-cent sales tax through 2025 to implement projects and programs identified in the MAG RTP. Proposition 300 in 1985 was focused on expanding the Regional Freeway System, and revenues collected from the Proposition 400 half-cent sales tax extension are now allocated among freeway/highway, arterial street projects, and public transit programs and projects. These monies must be applied to projects and programs consistent with the MAG RTP.

There are plans to expand the current transportation network to be able to accommodate more travelers. The following summarizes the planned growth of the network:

- **MAG RTP –** The MAG Regional Transportation Plan (RTP) is the comprehensive, performance based, multi-modal, and coordinated regional plan that addresses all major modes of transportation and key transportation related activities through fiscal year 2028. The RTP is funded through various federal, state, and local revenue streams, including the half-cent sales tax extension provided by Proposition 400. Regional funding is allocated in the RTP as follows: 57% identified for freeway/highway programs; 32% for transit; 9% for arterial street improvements; and 2% for other programs (including safety planning, non-motorized transportation projects, and other regional programs)
- **Freeway/Highway System –** The freeway/highway system is a focus of transportation planning and implementation in the MAG Region. The RTP calls for new freeway/highway corridors, added travel lanes on existing facilities (including HOV and general purpose lanes), new interchanges with arterial streets on existing freeways, and direct connections between HOV lanes at freeway-to-freeway interchanges. A total of 615 centerline miles are in the freeway/highway network in the MAG Region and an additional 98 miles are planned for future development as identified in the current RTP.
- **Arterial Street System –** The current arterial street system consists primarily of roadways on a one-mile grid system which provides a high level of accessibility and mobility to the regional freeway system serving multi-modal transportation facilities. Expansion of the arterial network in the Region includes widening existing arterials, construction of new arterials following the one-mile grid pattern, arterial capacity improvements through intersection redesign, and closing gaps in the arterial network in both developed and developing areas. The current RTP identifies $9.8 billion in arterial projects and enhancements.

- **Public Transportation System –** Fixed route bus service in the MAG Region represents an increasingly important component of the regional transportation network. New routes will be added to the existing transit system, METRO Light Rail will open December 2008 and expansion plans will be the next phase of the project, and bus services including vanpool, ride share, and dial-a-ride services will be expanded.
- **Intelligent Transportation Systems –** Over the last decade, the state, Maricopa County, cities, transit and public safety have been actively deploying systems and infrastructure which have significantly enhanced the capability of agencies in the Region to operate and manage the transportation network. The RTP allocates funding to assist in the implementation of projects identified in the regional ITS Plan. The MAG Region is a relatively robust area in terms of ITS deployment and integration. There has been a concerted effort to direct funding and resources toward instrumenting urban freeway corridors as well as major arterials with detection, CCTV monitoring, traveler information capabilities, as well as transit technology enhancements. Furthermore, state, county, transit and cities have made significant investments in establishing and enhancing their operations and management centers to provide centralized hubs for traffic management and operations coordination.MAG has helped to guide these efforts through collaborative development of the ITS Strategic Plan, Regional Concept of Transportation Operations, and now with the Regional ITS Architecture update and the future ITS Strategic Plan update.

Considering the planned expansion of the transportation network, it is the responsibility of MAG member agencies to be able to monitor and manage the network that is expanding in their jurisdiction to provide the public with safe and efficient travel. The two primary components of planning for this expansion are 1) document existing conditions and 2) plan for future deployment and interactions necessary to respond to changing conditions. Developing this ITS Architecture for the MAG Region will address the first component of planning for this growth in the MAG Region in regards to ITS development. The ITS Architecture will identify what is currently available on the transportation network to monitor and manage traffic as well as the coordination between agencies that facilitates faster incident management and real-time traffic management. The ITS Strategic Plan developed as a separate project will address the second component will guide the future planning of ITS in the Region to be able to respond to the changing conditions of the roadways.

This section will discuss the stakeholder agencies in the MAG Region that have either directly or indirectly provided input to this project, the coordination teams established to facilitate communication between agencies on a regional level, and the operational roles and responsibilities of the MAG member agencies. **Figure 2** shows the various stakeholder agencies and their jurisdictions in the MAG Region.

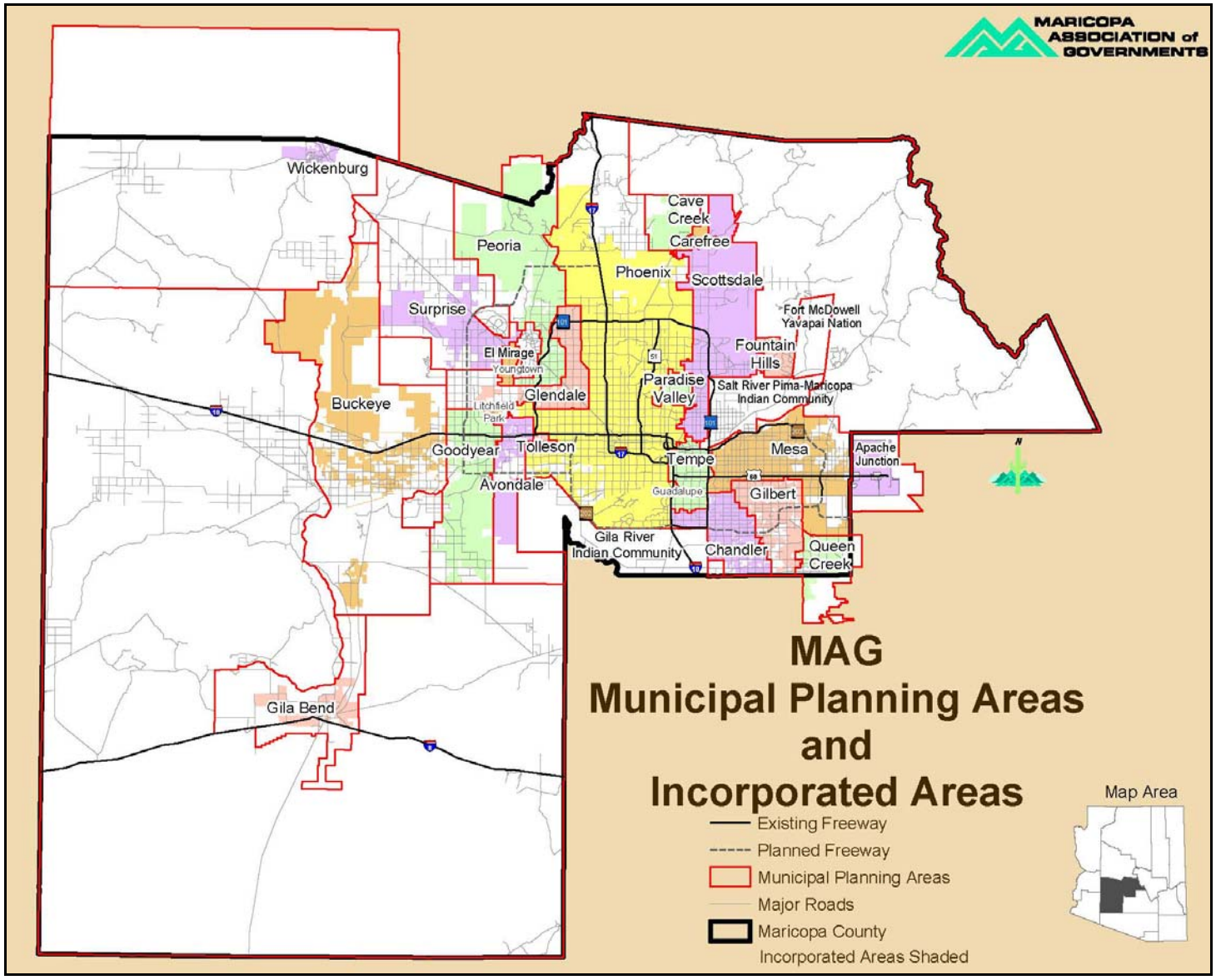

Figure 2 – MAG Member Agency Jurisdictions Map

2.1 Current Regional Operations

The MAG region is comprised of state, county, city, transit and emergency services, each with its own operational system, operational procedures, and operational priorities. This section provides an overview of the various transportation networks and modes within the Region, as well as summarizes some of the agency stakeholders that have an active role in managing and operating transportation systems within those networks.

2.1.1 Regional Freeway Network

The Arizona Department of Transportation (ADOT) operates and maintains the regional freeway network. Freeway construction and enhancements throughout the Region has been accelerated in order to meet the demands of the region's growing population, and was funded through revenues generated from the Proposition 300 sales tax. Widening of existing freeways, including I-10 in the West Valley, Loop 101 from Chandler to Scottsdale, and I-17 in north Phoenix are helping to increase capacity on these vital corridors. High-occupancy vehicle lanes are being extended on SR51 and I-17, and HOV lanes are being built with the I-10 widening in the West Valley and Loop 202 in the East Valley. The RTP identifies HOV lane construction on additional segments of Loop 101, 202 and US 60 as part of future projects.

ADOT operates a Freeway Management System (FMS) on approximately 130 miles of the Phoenix metropolitan area freeway system that travels through many local jurisdictions. Primary components of the FMS include vehicle detectors, CCTV surveillance, DMS for traveler information, and ramp meters. Fiber telecommunications provides the communications and control infrastructure for ADOT staff to monitor and implement management and control strategies from the ADOT Traffic Operations Center (TOC), which is staffed 24/7/365. Another 37 miles of FMS is in design and will be constructed in the near-term, and the RTP identifies funding needs for FMS through FY2025. For many local jurisdictions, the ADOT FMS ITS devices and fiber communications is important for their local operations whether it be viewing ADOT's cameras or utilizing ADOT fiber/conduit space to communicate with another department or agency. Ramp metering capability is provided at many on-ramps to the freeway network and is a time-based operated system. ADOT utilizes data from system detectors to monitor freeway speeds, and this data is also used to calculate travel times for DMS posting and to support other traveler information programs. ADOT has recently begun providing travel times on DMS on a limited number of signs during the weekday AM and PM commute periods.

The Arizona Department of Public Safety (DPS) is responsible for incident management on freeways and highways throughout the state. In the metro area, two key services provide for enhanced incident management, response and clearance: ADOT's Arizona Local Emergency Response Teams (ALERT) are dispatched from ADOT's TOC to respond to freeway incidents to support traffic control and detours; and the Freeway Service Patrol (operated by DPS) provides assistance to motorists on freeways who require support or help with stalled vehicles, minor collisions or other impact.

2.1.2 Arterial Street Network and Operations

The metropolitan area is characterized by a network of four-lane (or more) arterials on a one-mile grid system, supplemented with local and collector streets. Travelers in the Region are very dependent on the region's arterial roadway system, and it is estimated that the

Region's arterial network carries over half of the total vehicle-miles traveled in the Region (MAG Regional Transportation Plan 2007 Update, page 9-1). The Region has several key east-west and north-south arterial corridors that traverse multiple jurisdictions, and these cross-jurisdictional arterial corridors can include two, three or even four different traffic signal systems operated by different cities in the Region, and in some cases include two or more interchanges with freeways.

Local agencies recognize that improved traffic signal operations are a significant factor in overall regional mobility. Each jurisdiction in the Region operates independent traffic signal systems, which pose several challenges to the vision of a 'seamless' arterial network. MAG's Traffic Signal Optimization Program (TSOP) provides funding for coordinating signals on arterials, and encourages partnerships among agencies to address these multi-jurisdictional corridors. Traffic Signal Groups in the East Valley and West Valley (meets as needed), and the Valley Area Traffic Engineers Committee (meets one to two times a year) provide ad-hoc forums for local traffic operations personnel and managers to discuss traffic signal operations and management issues in a multijurisdictional context. However, these groups are not firmly linked to any formal decision making or planning process.

To meet the growing demands of arterial management and mobility, agencies in the MAG Region have been actively implementing ITS technologies to support their arterial traffic and incident management, travel information, day-to-day operations and maintenance of their systems. Traffic Management Centers (TMCs) are becoming an integral part of Street or Transportation Departments in cities in the MAG Region. At present, TMCs are operational in several jurisdictions, including the Cities of Glendale, Goodyear, Phoenix, Scottsdale, Peoria, Mesa, Chandler and Maricopa County DOT. The City of Peoria is nearing completion of a new city TMC that will also serve as a back-up ADOT TOC, and the City of Surprise will have its TMC in place in early 2009. Avondale also plans to implement a TMC in the next few years. These TMCs provide a central location for cities to manage their traffic signal systems, monitor arterial devices (including detection, CCTV and arterial DMS) and coordinate with other agencies for traffic and incident management, as well as for managing traffic during planned special events.

Arterial ITS infrastructure will continue to expand in the near term (through 2013), and the RTP identified $83M in arterial ITS programs through 2028 (including local funding share and contributions). Arterial ITS projects within the MAG TIP including expanding fiber and wireless telecommunications, upgrading and expanding detection and monitoring equipment (including CCTV), expanding traveler information on arterials with additional dynamic message signs, and constructing or enhancing local TMCs.

Incident management on arterials is provided largely through local agency police and fire/EMS, as well as Maricopa County Sheriff. City TMCs are able to support incident management on those corridors where traffic signals are connected to the TMC as well as on corridors that are instrumented with CCTV monitoring.

2.1.3 Public Transportation Systems

Transit services have grown and expanded significantly in the last decade, and approximately one-third of the Proposition 400 revenues from the half-cent sales tax for transportation are being focused on mass transit. Transit service is a cooperative effort through contracted arrangements among the Regional Public Transportation Authority (RPTA), local cities and transit operators, and it is provided under the 'brand' of Valley Metro. The RTP identifies transit funding for expanded local service, as well as for

expanded Bus RAPID Transit service on both freeways and arterials. There is envisioned to be substantial growth in geographic area covered by fixed-route public transportation over the next two decades. It is important to note that several local tax initiatives also fund transit service within their respective jurisdictions.

Fixed-route transit services in the Region include local bus service, express bus service, and circulator/shuttle services. The majority of existing routes (local and express) primarily serve arterials; RAPID Commuter service is currently provided on freeway routes in the metropolitan area, and there are plans to implement a Bus RAPID Transit on key arterial corridors. The Transit Operations and Control Center (OCC) manages the regional transit system, including vehicle management system, and voice communications with each transit vehicle. Regional fixed-route vehicles are equipped with GPS AVL systems. The region also includes several park-and-ride facilities and transit centers.

In December 2008, the first METRO Light Rail will commence operations of the first 20-mile segment of LRT service in the Valley, which will include a line through Phoenix, Tempe and Mesa. 50 trains will be part of the initial LRT fleet. Each LRT train will be equipped with automated vehicle location, passenger counting systems, and on-board vehicle diagnostics/monitoring as well as security systems. METRO Light Rail is also looking at future extensions of service routes to include potential expansion into Glendale and west on I-10, as well as expanding the initial line in Phoenix, Tempe and Mesa.

Table 2 describes the ITS operations and communications between the various stakeholder agencies in the MAG Region at a very high level. Later tasks in the RIA will further define the operational roles of stakeholders in the Region.

Table 2 – Operational Roles and Responsibilities of Agencies in the MAG Region

Agency / Organization Type		Roles and Responsibilities
Regional	Maricopa Association of Governments	MAG serves as the MPO for the Phoenix metropolitan area. The MAG Committee structure includes an ITS Committee that is comprised of traffic and transportation professionals from MAG member agencies. MAG is responsible for all planning decisions for regional transportation based on a Regional Transportation Plan, which includes ITS as one of many components.
Freeway Management	Arizona Department of Transportation	Operates and maintains the freeway network. Responsible for freeway management system devices/communications, including the 24/7 Traffic Operations Center. Supports the Arizona Local Emergency Response Team (ALERT) to assist with traffic incidents on the freeway network. There are freeways in the east and northeast portions of the Valley that are located on Tribal lands, which requires consultation with the respective Tribal governments for operations.
	Arizona Department of Public Safety	Public safety and law enforcement on state highways and freeways. Operates the Freeway Service Patrol (FSP) which assists stranded motorists and disabled vehicles. An interface was established between DPS and ADOT and MCDOT to share information about incidents on freeways.
Arterial Management	City TMC/Transportation Department	Operates and maintains the arterial network within their city/town jurisdiction including the traffic signal system and network of arterial DMS, CCTV. Many signals at freeway interchanges are operated/maintained by the local jurisdiction. Incident management on arterials are coordinated with the local public safety agencies. Cities have been actively establishing traffic operations and management centers to better operate their own infrastructure, as well as support incident management and special event traffic operations, and coordinate with neighboring agencies on incidents and events that impact multi-jurisdictional corridors.

Table 2 – Operational Roles and Responsibilities of Agencies in the MAG Region (continued)

Agency/Organization Type		Roles and Responsibilities
Arterial Management	City Fire Department	The City of Phoenix Fire Department dispatches for 18 local city fire department jurisdictions. They are first responders to arterial and freeway incidents. Phoenix Fire department has established a link to the Maricopa County TMC. Local Fire Departments typically do have established links to the local police department, but does not necessarily have established links to their local traffic operations center for traffic management support during incident operations.
	City Police Department	Local Police Departments are typically responsible for public safety on arterial streets within their jurisdiction. Local police and emergency services respond to traffic incidents on roadways within their jurisdiction, although there is a high degree of cooperation among emergency responders as part of current mutual aid agreements.
	Maricopa County Department of Transportation	Maricopa County operates and manages arterials in unincorporated areas of the Region including CCTV, DMS, and traffic signals as well as having shared control of ITS devices in two cities for multi-jurisdictional corridor management. Maricopa County operates and manages a Regional Emergency Action Coordination Team (REACT) which is an arterial incident responder service provided primarily within the West Valley.
	Maricopa County Sheriff's Office	Public safety and law enforcement on arterials within unincorporated Maricopa County and agencies for which it is contracted including City of Litchfield Park.
Transit	Valley Metro	Responsible for regional transit planning, transit public information, the management and operation of regional bus (local, Express and RAPID) and dial-a-ride services, the Regional Ridesharing program, and a regional vanpool program.
	Phoenix Public Transit	The regional transit system is managed through the Transit Operations and Control Center, including a vehicle management system for automated vehicle location.
	METRO Light Rail	METRO is the brand name for Valley Metro Rail Inc., a non-profit, public corporation charged with the design, construction and operation of the Valley's light rail system.

2.2 Stakeholder Agencies

MAG member agencies include 25 incorporated cities and towns, three Native American Indian communities, and Maricopa County. ADOT serves as an ex-officio member for transportation-related issues. Many of these MAG member agencies provide traffic management operations and serve in key roles for helping to plan for traffic and transportation programs at the local and regional levels. Emergency management agencies and transit agencies utilize the transportation network to perform their operations. Each one of these agencies have key needs in the operation and use of ITS equipment and communications between agencies that will support the development of the Regional ITS Architecture.

A survey was distributed to all MAG member agencies to gather ITS and agency coordination data as well as document the ITS deployment and integration in the MAG Region. This survey included questions for each agency regarding the number of devices, types of information sharing, and locations of devices where it is feasible to gather that information. There are many regional initiatives and plans that have been developed within the last few years which provide a substantial foundation for existing coordination and ITS infrastructure. **Table 2** summarizes the types of stakeholders whose communications and device-ownership is represented in various plans and/or have participated in the survey for inventory to help build this Regional ITS Architecture. Relevant local public safety/law enforcement elements will be identified from existing documents and planned projects and included in this ITS architecture to show interaction with other elements and other agencies.

Table 3 – Summary of Stakeholder Agencies

Category	Agency	Surveyed	TMC / Central Dispatch?	Owns ITS Devices?
MAG Member Agencies	Arizona Department of Transportation	Yes	Yes	Yes
	City of Avondale	Yes	Yes	Yes
	City of Chandler	Yes	Yes	Yes
	Town of Gilbert	Yes	Yes	Yes
	City of Glendale	Yes	Yes	Yes
	City of Goodyear	Yes	Yes	Yes
	Maricopa County	Yes	Yes	Yes
	City of Mesa	Yes	Yes	Yes
	City of Peoria	Yes	Yes	Yes
	City of Phoenix	Yes	Yes	Yes
	City of Scottsdale	Yes	Yes	Yes
	City of Surprise	Yes	Yes	Yes
	City of Tempe	Yes	Yes	Yes
	City of Apache Junction	Yes	No	Yes
	Town of Buckeye	Yes	No	No
	Town of Carefree	Yes	No	No
	City of El Mirage	Yes	No	No
	Town of Fountain Hills	Yes	No	Yes
	Town of Gila Bend	Yes	No	No
	Gila River Indian Community	Yes	No	No
	Town of Guadalupe	Yes	No	No
	City of Litchfield Park	Yes	No	Yes
	Town of Paradise Valley	Yes	No	Yes
	Town of Queen Creek	Yes	No	Yes
	Salt River Pima-Maricopa Indian Community	Yes	No	No
	City of Tolleson	Yes	No	Yes
	Town of Wickenburg	Yes	No	No
	Town of Youngtown	Yes	No	No
*State/Regional Emergency Management/ Public Safety	Arizona Department of Public Safety	No	Yes	Yes
	Maricopa County Sheriff	No	Yes	No
	Phoenix Fire	No	Yes	No
Transit Management	Valley Metro/RPTA	Yes	Yes	Yes
	METRO Light Rail	Yes	Yes	Yes
	Phoenix Public Transit	Yes	Yes	Yes

* The emergency management technologies/systems inventory information have been coordinated through the respective traffic management/operations contacts at State, County and City agencies surveyed.

2.3 Regional Stakeholder Coordination

State, regional and local agencies in the Phoenix metropolitan area have been moving toward more coordinated and integrated transportation operations for several years. There is strong support for continued physical integration and connectivity among transportation management, transit, public safety, and other key agencies to better share information, in real time, to support key traffic, transit, and incident management strategies. This move encompasses both localized projects as well as regional integration projects. Cities and towns are focusing on integrating their localized transportation and ITS network, and in parallel the Region is working toward combining those efforts into a regional cooperative strategy. The cooperative partnerships and systems described in this section facilitate multi-agency coordination for traffic, transit, and incident management.

2.3.1 MAG Regional Council

The MAG Regional Council is the final decision-making body of MAG and is composed of elected officials appointed by each MAG member agency. For the majority of members, the city or town Mayor serves as the Regional Council member. Regional Council meetings are open to the public and discuss regional initiatives that move beyond just transportation into public policy related topics such as land use, census, schools, and homeless assistance programs. The Executive Committee consists of at least three Regional Council members who are elected at the annual meeting to serve for one year (until the next annual meeting). The Executive Committee is required to include the Chair, Vice Chair and Treasurer of the Regional Council as ex-officio members. In June 2002, the Executive Committee was expanded to seven members to allow for additional participation by the member agencies. The MAG By-Laws indicate that the business that arises between meetings of the Regional Council can be conducted by the Executive Committee. The Executive Committee also serves as the Finance Committee.

The Regional Council approves the Regional Transportation Plan, MAG TIP, and makes decisions on the recommendations from the TRC and TPC each year. Recommendations for the RTP and TIP come from other groups and committees within MAG; however, the final approval on funding priorities is with the MAG Regional Council.

2.3.2 Transportation Policy Committee (TPC)

Members of this committee include elected officials and private sector representatives from the Region, appointed by the MAG Regional Council, to help develop policy recommendations for Regional Council consideration on transportation issues, including the Regional Transportation Plan and MAG TIP. This Committee hears consent items on any proposed updates or modifications to the MAG TIP and RTP, and has responsibility for overseeing the implementation of Proposition 400.

2.3.3 Transportation Review Committee (TRC)

This group was formed by the Regional Council to encourage the development of the telecommunication infrastructure and applications in the MAG Region. The members of the TRC include one representative from each MAG member agency that could be from various departments within each agency. This committee also discusses transportation initiatives, major regional projects, funding allocation for MAG Federally Funded Program, federal propositions for taxes and projects, and transit initiatives, among other high profile topic areas.

2.3.4 MAG ITS Committee

The MAG ITS Committee one of several Technical Advisory Committees at MAG. The ITS Committee is made up of federal, state, and local transportation agencies in the Phoenix metropolitan region, and includes representation from DPS, the Federal Highway Administration (FHWA), and Arizona State University (ASU) in addition to local, county, transit and state transportation operations representatives from MAG member agencies. The primary role of the MAG ITS Committee is to plan all regional ITS infrastructure and recommend regional investments in ITS for consideration by the Transportation Review Committee, Transportation Policy Committee and Regional Council. The meetings of the ITS Committee, which occur every month, also provide a formal avenue for interagency cooperation and coordination on matters pertaining to ITS and regional traffic management.

Under the leadership of MAG, a Regional Concept of Transportation Operations was developed in 2003. MAG will continue to have a long-term role in planning for operations. The MAG ITS Committee includes a strong multimodal focus, and is responsible for making recommendations on regional ITS infrastructure investments for the Phoenix metropolitan region.

MAG also leads working groups that support various projects and regional coordination activities. The MAG Telecommunications Advisory Group (TAG) was formed to encourage the development of telecommunication infrastructure and applications which increase multiagency cooperation and improves access to public information by travelers. The Regional Communications Network (RCN) Working Group was formed as a venue for stakeholders of the RCN program to discuss the status and the evolution of the program in the Phoenix metropolitan area. The RCN Working Group is comprised of members from the MAG TAG and MAG ITS Committee.

2.3.5 AZTech™

AZTech™ is primarily a voluntary regional forum for discussing issues related to transportation operations. 'AZTech™' is often used as the generic name, adopted by regional ITS stakeholders, for all ITS applications in the Region. For example, the traffic management system in the City of Scottsdale and ADOT's Freeway Management System are both referred to as part of the regional AZTech™ system, yet they are owned and operated by separate agencies. The AZTech™ forum includes state and county traffic management and operations, regional transit operations, regional planning, municipal traffic and transportation agencies, state and regional law enforcement and public safety, emergency services, and private partners. This forum is led by the AZTech™ Executive Committee that has been co-chaired by ADOT and Maricopa County since inception. Working groups address specific focus areas, including Traffic Operations, Traveler Information, and Incident Management. These groups meet periodically to address specific areas of concern and collaboration, as well as identify where key decisions should be made by the Executive Committee. Recommendations generated at the AZTech™ forum can feed into the regional ITS planning process at MAG, provided they are sponsored by a MAG member agency, and meet regional planning criteria. While AZTech™ has an indirect link to the regional planning process, there is no direct role in the formal decision making process for regional ITS planning.

3. SUMMARY OF CURRENT REGIONAL TRANSPORTATION GOALS AND OBJECTIVES

Substantial planning has occurred in the MAG Region for goals and objectives of the roadway and ITS networks. MAG's 2001 ITS Strategic Plan Update and the 2003 Regional Concept of Transportation Operations provide an important foundation for establishing a regional benchmark for goals and strategic priorities developed by partner agencies as part of these processes. Also important are the more localized ITS plans that have been developed by MAG member agencies over the last five or more years, as these provide a basis for specific agency objectives that must be captured within the regional ITS Architecture.

As a means of establishing the operational framework for the Region, the study team has reviewed and summarized these plans in terms of key ITS goals or services that would need to be incorporated into the updated Regional ITS Architecture. This section contains a summary of those findings from both regional ITS planning and more localized planning documents.

It is envisioned that broader regional strategic ITS goals for the future planning and implementation of ITS infrastructure will be addressed as part of MAG's ITS Strategic Plan update, which is to be completed as part of a separate, near-term project.

3.1 MAG Regional ITS Plans

Goals and objectives are summarized in **Table 4** that were developed for the *MAG ITS Strategic Plan Update* and the *MAG Regional Transportation Concept of Operations*. Both of these efforts brought together stakeholders from throughout the Region to establish priorities for ITS deployment, integration and operations, and to define key needs that ITS could support or address. MAG will be updating the Region's ITS Strategic Plan in 2009, and as part of that process, it is envisioned that regional goals will be updated and established to guide the next several years of ITS deployment in the Region.

As a starting point for the RIA update, the study team reviewed the goals established for these prior plans for applicability to the current state of ITS in the Region, as well as to factor in how priorities may have changed or accelerated since those efforts. The goals and objectives that were included in this table apply to today's current operations and strategic planning for ITS, and represent a summary of the applicable goals and objectives that were developed as part of the previous efforts. For example, in the ITS Strategic Plan, call boxes along freeways were identified as a priority; however, the Region is not pursuing this as a strategy for implementation. To help consolidate goals into functional categories that could be translated into the RIA, **Table 4** includes categories for freeway and arterial operations, incident management, transit mobility, traveler information, and multi-agency coordination. In some instances, associated objectives were also identified to support the goal or strategy identified in the previous plans, and these have been identified where applicable. Specific performance measures were identified in the *Regional Transportation Concept of Operations* that define how the agencies in the Phoenix metro area will achieve their goals. The goals and objectives from this planning effort document the purpose of the focused performance measures, rather than the performance measure itself. These are categorized in the same manner as those from the MAG ITS Strategic Plan Update for a comprehensive view of regional goals in each service area. Stakeholders will be asked to review this table for consistency in current operational planning and objectives of regional initiatives.

Table 4 – Consolidated Goals and Objectives for MAG Region

Operational Categories	Source	Goals and Objectives	Associated Objectives (if applicable)
Freeway Operations	MAG ITS Strategic Plan Update	Increase use of VMS for more types of traffic and incident information	• None identified
		Increase automated traffic data collection and archiving ability	• Develop and facilitate ITS education and marketing efforts to public • Increase use of detector data/travel time data
	Regional Concept of Transportation Operations	Establish integrated freeway-arterial corridor operations for major arterial corridors	• Utilize traffic responsive ramp metering capabilities and coordination with traffic signals systems for on-ramps
		Coordinate ALERT services on freeway network throughout the Region	• Increase coordination between ALERT, public safety agency responders, and supporting traffic management agencies through incident clearance on freeways
		Develop traffic responsive ramp metering	• Improve freeway incident clearance times
Arterial Operations	MAG ITS Strategic Plan	Coordinate signal systems across jurisdictional boundaries	• Integrate signal systems with freeway management systems • Enhance regional signal coordination/improve progression • Increase inter- and intra-agency coordination • Increase use of computerized traffic signals • Increase use of detector data/travel time data
		Increase use of VMS for more types of traffic and incident information	• None identified
		Enhance traffic management capabilities for special events	• None identified
		Provide advanced warning at railroad/street crossings	• More advanced warning at railroad/street crossings • Increase use of detector data/travel time data
		Increase automated traffic data collection and archiving ability	• Develop and facilitate ITS education and marketing efforts to public • Increase use of detector data/travel time data
	Regional Concept of Transportation Operations	Coordinate signal systems within jurisdiction along key arterial corridors	• Integrate signal system communications along key arterial corridors for real-time traffic signal management from a TMC or Traffic department workstation
		Enhance traffic management capabilities for special events	• Increase use of portable traffic management devices such as DMS, CCTV, speed management trailers, and wireless communications
		Coordinate signal systems across jurisdictional boundaries and improve progression	• Integrate signal system communications along key multi-jurisdictional arterial corridors for real-time traffic signal management between multiple TMCs
		Increase ITS device shared operation partnerships along key arterial corridors	• Increase shared operations and use of CCTV cameras, DMS, and view of traffic signal timing plans between multiple jurisdictions along key arterial corridors

Table 4 – Consolidated Goals and Objectives for MAG Region (continued)

Operational Categories	Source	Goals and Objectives	Associated Objectives (if applicable)
Freeway and Arterial Incident Management	MAG ITS Strategic Plan Update	Improve incident detection capabilities and reduce incident clearance times	• Improve incident clearance at freeway interchanges • Reduce incident clearance times • Improve incident detection and notification to motorists • Increase use of detector data/travel time data
		Provide PSAP managers with access to real-time traffic information	• PSAPS need access to real-time traffic information
	Regional Concept of Transportation Operations	Increase incident information sharing between traffic management and public safety agencies for cooperative freeway and arterial incident management	• None identified
		Increase arterial incident response services throughout the Region	• Increase coordination between arterial incident response services, public safety agency responders, and supporting traffic management agencies through incident clearance
		Improved coordination with transit agencies for incident notification	• Increase interagency coordination between transit agencies and traffic management agencies
Transit Mobility	MAG ITS Strategic Plan Update	Improve bus progression using traffic signal priority	• Bus priority at traffic signals
		Enhanced transit service (routes, frequency, hours)	• None identified
		Regional light rail system	• None identified
		Enhanced information at transit centers	• None identified
	Regional Concept of Transportation Operations	Improve bus progression using traffic signal priority	• Increase arterial traffic signal transit priority devices along transit route significant corridors • Utilize transit priority devices on freeway on-ramps
		Coordinate roadway closure/construction information with transit agencies	• Utilize transit AVL for traveler information purposes at bus stops or light rail stations • Increase usage of incident information from public safety agencies for conflicts in bus routes or light rail lines due to incidents
		Establish a mass transit service that will coordinate with agencies and other modal services	• None identified

Table 4 – Consolidated Goals and Objectives for MAG Region (continued)

Operational Categories	Source	Goals and Objectives	Associated Objectives (if applicable)
Multi-Agency Coordination	MAG ITS Strategic Plan Update	Increase inter-agency and intra-agency coordination	• Integrate signal systems with freeway management systems • Enhance traffic management capabilities for special events • Increase use of computerized traffic signals
		Coordinate signal systems across jurisdictional boundaries and improve progression	• Integrate signal systems with freeway management systems • Enhance regional signal coordination/improve progression • Increase inter- and intra-agency coordination • Increase use of computerized traffic signals • Increase use of detector data/travel time data
	Regional Concept of Transportation Operations	Establish center-to-center communications between traffic management agencies in the region	• Implement physical fiber connectivity between key traffic management agencies in the region
		Establish communications between traffic management agencies and public safety agencies in the region	• Increase sharing of CAD data with traffic management agencies • Implement physical fiber connectivity between key traffic management agencies and public safety agencies in the region • Implement Public Agency Video Distribution System for sharing of CCTV camera images with public safety agencies
		Collect and store data from implemented transportation systems	• Increase data provided to HCRS for 511 traveler information dissemination, including arterial corridor information • Utilize RADS network for ATIS travel times, DMS travel times and other regionally significant projects
Traveler Information	MAG ITS Strategic Plan Update	Improve accuracy, timeliness, and availability of real-time traveler information to the public	• Improve accuracy and timeliness of traffic information to public • Real-time transit schedule information • More accurate information about road construction/closures and alternate routes • In-vehicle traffic information • Integrate transit information with arterial and freeway management systems • AVL for transit • PSAPS need access to real-time traffic information • Enhanced information at transit centers • Increase use of detector data/travel time data

Table 4 – Consolidated Goals and Objectives for MAG Region (continued)

Operational Categories	Source	Goals and Objectives	Associated Objectives (if applicable)
Traveler Information (continued)	Regional Concept of Transportation Operations	Increase the use of DMS for more types of traffic and incident information	• Increase DMS travel time display usage • Increase use of detector data/travel time data
		Improve accuracy, timeliness, and availability of real-time traveler information to the public	• Improve accuracy and timeliness of traffic information to public via DMS and 511 services • Increase real-time transit schedule information available to public • More accurate information about road construction/closures and alternate routes • Integrate transit information with arterial and freeway management systems • Collect and track AVL data for transit
		Make available work zone and incident information to HCRS	• Increase data provided to HCRS for 511 traveler information dissemination, including arterial corridor information via RCRS
		Integrate transit information with traveler information services	• Provide transit AVL data to 511 traveler information service

3.2 Local Agency ITS Plans

Several of MAG's member agencies have developed or are in the process of developing plans to guide ITS deployment and integration within their jurisdiction. **Table 5** provides a brief overview of existing plans developed by agencies in the Region, as well as pivotal goals or outcomes from these efforts that may be factored in to the Regional ITS Architecture development.

These plans are important for several reasons. First, they represent localized ITS planning processes that have identified specific issues, and corridor-specific deployment priorities within jurisdictions in the Region. Second, many of these localized plans also identify where connectivity to external or regional programs will provide benefits to the agency as well as travelers on a broader scale. They help to map out funding priorities within these agencies for ITS deployment, and can provide valuable input to priorities that should be captured and identified within the RIA.

Table 5 – Summary of Local ITS Plans

Agency Plan/Date	Key Goals and Objectives
Avondale ATMS Plan	• Identifies strategies that allow the City to maximize traffic operation, use and safety through design and implementation of ITS • Establish a Traffic Operations Center to centrally control Avondale's ITS devices, and maps out a preliminary concept for telecommunications communications and devices. Avondale's telecommunications strategy includes both fiber and wireless communications systems • Recognizes need for more detailed ITS Strategic Plan to plan funding and implementation for the City's ITS program
Mesa ITS Strategic Plan	• Efficient and reliable traffic management tools that support real-time management through central control of all field devices and regional and interdepartmental connectivity • Fast, informed, coordinated incident management and emergency response through shared CAD information, traffic data sharing with public agencies, and sharing CCTV camera images • Highway quality and quantity of information available to travelers via arterial DMS, incident reporting, and regional traveler information communications • Effective, multi-modal transit management through sharing information with transit
Mesa ITS Deployment Plan	• Plan for key ITS infrastructure projects to add to existing and implement new ITS deployments in Mesa to address goals defined in Mesa ITS Strategic Plan • Streamline ITS planning with planned capital improvement projects • Prioritization and implementation strategy for ITS projects
Glendale ITS Master Plan	• Strategies for using permanent and portable ITS devices (CCTV cameras, DMS, communications) during special event management in the University of Phoenix stadium area
Goodyear ITS Strategic Plan	• Focus on citywide ITS priorities and functional areas to deploy ITS devices, communications to devices, communications with other departments within the City, and communications with other agencies • Identified priority ITS deployment projects to utilize existing MAG programmed funding for Goodyear and plan for future MAG TIP project requests • Established feasible timeline for projects based on comprehensive funding and implementation plan
Scottsdale ITS Strategic Plan	• Create reliable travel times and reduce traffic incident delay on arterials through signal coordination and incident detection capabilities • Communicate traveler information rapidly to vehicle drivers via arterial DMS and other traveler information services such as 511 • Communicate with other departments within Scottsdale and other partner agencies such as Police, Emergency Services, ADOT, and Fire
MCDOT ITS Strategic Plan	• Advance regional traveler information systems by enhancing RCRS connection and information to the 511 telephone service • Continue ITS infrastructure deployment of CCTV, DMS, detection as well as TMC operation of those devices • Expand TMC operations to operate devices from other jurisdictions, facilitate regional traveler information and reporting systems, coordinate with public safety and emergency management agencies • Expand REACT program to increase presence in cities and reduce response time
Surprise TMC Concept of Operations	• Developed to guide the Surprise TMC functional and physical design, and integration of key systems between Surprise and other agencies • Defines needs for TMC operations as well as staffing requirements and agreements and policies needed to implement the communications defined by the needs
Queen Creek Town Center ITS Design Concept Report	• Ellsworth Loop Road Improvement District project is significantly modifying eleven traffic signals and installing miles of communications conduit • This project intends to build on that infrastructure and establish a central traffic signal system for the Town and to provide for the fiber interconnection of those eleven traffic signals • Installation of CCTVs at six key intersections in the town center area and establishment of a central video monitoring point

3.3 Multi-Agency ITS Plans and Current Planning Efforts

In addition to local plans, there have been several key initiatives whereby multiple agencies in the Region have collaborated on specific ITS planning efforts to address very specific corridors or sub-regions. These typically involve two or more arterial traffic management agencies, and potentially County DOT and ADOT partners. These represent efforts by partners to address specific deployment, integration and operations requirements, and the major impact of these efforts on the RIA are envisioned to be agency and system connectivity strategies. **Table 6** provides an overview of multi-agency ITS plans and planning efforts, as well as collaborative efforts to address agency information sharing and provision of information to travelers. These projects/systems in this section will be captured in the RIA either as a comprehensive stand-alone service area or identified within other service areas for which it is being used.

Table 6 – Multi-Agency Collaborative Planning Efforts

Planning Effort	Description
I-10 Integrated Corridor Management System	• Integrated plan to manage and reduce congestion in the I-10 corridor in the West Valley, with a focus on the near-term construction improvements • Comprehensive system of urban interstate freeway facilities, local urban arterial streets, and express and local transit routes • Project consisted of recommended strategies for integrating ITS projects and system operations to help transportation coordination along the I-10 corridor through the I-10 widening project and other key growth considerations • Coordination with MAG, City of Goodyear, ADOT, City of Avondale, Town of Buckeye, City of Phoenix, MCDOT, and Valley Metro
Bell Road ITS Concept of Operations and ITS Operations Plan	• Bell Road ITS Phase I design project installed fiber, arterial DMS, and CCTV cameras along Bell Road between Loop 101 and Grand Avenue and the project area fell within the jurisdiction of three different agencies: City of Surprise, Maricopa County, and City of Peoria • Concept of Operations was developed to provide roles and responsibilities in the operation of the system for each of the services that the ITS equipment will provide • Describes roles or agencies coordinating during specific scenarios • Bell Road ITS Operations Plan was developed to document the agreed-upon procedure and prioritization for ITS device operations and management during these scenarios from the perspective from the three jurisdictions involved
Phoenix International Raceway (PIR) Major Event Traffic Management Plan	• Agencies have collaborated on a comprehensive traffic management plan for pre-event coordination, event day traffic and incident management, ingress/egress monitoring and management, and public information for major events at PIR • Information is distributed to local media and to the public, through the az511.gov website and 511 phone service, and the Sky Harbor Airport traveler information screens • Effort requires months of pre-planning every year and actively involves PIOs from traffic, law enforcement, ADOT, MCDOT, cities in the area, DPS, MCSO, PIR, and the media
Regional Community Network (RCN)	• In 2004, ADOT proceeded with the design of the the MAG Regional Connectivity Network (RCN) concept which would establish a fiber communications network through a topology of three sub-rings (West of I-17 Region, Northeast Region, and Southeast Region). The first phase of the project has been funded by MAG and is under implementation. • The RCN links multiple agencies throughout the MAG Region to facilitate the sharing of traffic management information and video conferencing capabilities between all linked agencies • The RCN network will consist of the conduit, fiber optic cable, routers, switches, and other communications hardware necessary to provide a path between network nodes • The first phase of fiber deployment and physical connection of 15 agencies utilizing mostly existing agency-owned fiber is planned to be completed by December of 2008 and the hardware/software to share information will be installed shortly thereafter • This program will expand to include fiber connectivity to other agencies in the future based on funding availability

Table 6 – Multi-Agency Collaborative Planning Efforts (continued)

Planning Effort	Description
AZTech™ Center-to-Center (C2C) Information System	• The AZTech™ Transportation and Public Safety C2C Needs Assessment and Concept of Operations project developed the system configuration, concept of operations, and functional requirements for the system that will make use of the RCN infrastructure, as well as other communications means such as leased lines or the Internet • C2C System does not provide any physical links between centers or agencies, but instead establishes the protocols that the various software platforms within each of the centers will use to exchange information over the RCN or other networks • C2C system will facilitate the sharing of traffic signal timing (initially) and in the future is planned to support DMS, CCTV and potentially other information sharing in the MAG Region • Currently the software protocol has been developed to view the i2TMS and TranSuite traffic signal software, and may be expanded to other types of traffic signal software in the future • Once the Regional Communications Network is put into place, the C2C system will function on direct fiber paths between agencies rather than the web-based program
ADOT Highway Conditions Reporting System (HCRS)	• HCRS is ADOT's closure and restriction information central server which consolidates planned event, construction, and incident information for the statewide highway system on scheduled and unscheduled state roadway closures • HCRS is essentially an internal multi-agency information sharing system, but the information input to HCRS is used to populate the public website (www.az511.com) and the 511 system • ADOT primarily populates the HCRS with roadway condition/closure information; however, there are numerous other agencies that are authorized users to the HCRS to post local arterial information • AZTech™ created a version of this system (RCRS introduced below) for local arterial roadways
Regional Archived Data Server (RADS)	• RADS provides and maintains valid, classified ITS-derived data for use in transportation system planning, modeling, and real-time operation applications • RADS will collect and store data from the various systems in Maricopa County, Arizona, including the ADOT freeway management system, ADOT HCRS, AZTech™ SMART Corridors, RCRS, C2C, and transit operations • The main system design goal for the system is to take ITS data from systems throughout the Phoenix metropolitan area, store the data in a centralized archive data server, and then make the data available for a variety of data users through a common Web interface • Data stored includes traffic volumes, speeds, closures, incidents, public transit operations, and other data collected by AZTech™ partner agencies
MCDOT Public Agency Video Distribution System	• This program will facilitate the sharing of CCTV camera images managed by transportation management agencies throughout the Phoenix metro area with public safety agencies (Department of Public Safety, Maricopa County Sheriff, Phoenix Fire Dispatch, and local public safety agencies) • Program is currently in the planning stages
Traveler Information Programs	• Local television channels and radio provide local traffic alerts and construction/work zone information, as well as special event traffic information • Information about incidents, closures, delays, or other real-time traffic condition information are shared with the traveling public via the 511 telephone service or az511.gov website as well as public-agency owned DMS (freeway and arterial) • MAG and ADOT collaborated on a mobile traffic information portal that makes freeway speed and travel time information accessible via internet-enabled cellular phones and PDAs • ADOT's HCRS is populated with road condition and traveler information from state and local agencies that are disseminated via the 511 telephone and az511.gov web site services; and • Travel times are displayed on select ADOT DMS as part of a pilot program that provides travelers with an estimation of freeway travel times during AM and PM peak commute hours • Information about public transportation services is available from www.valleymetro.org as well as Valley Metro's customer service center

4. ITS INVENTORY

ITS infrastructure is not only the physical devices and telecommunications networks that are deployed throughout the transportation network – it is the communications and coordination that occurs as a result of that infrastructure. This initial task of the ITS Architecture focuses on the physical ITS infrastructure that is deployed and used by each agency to operate their respective freeway or arterial transportation networks. The later tasks of this project will define the communications and coordination that occurs in the MAG Region currently and moving forward into the future.

4.1 Inventory Data Collection

The process of creating an inventory of ITS devices, communications, and future developments starts with collecting existing inventory information from existing plans, studies, and project documentation as well as stakeholder input. An inventory of existing and planned 'ITS elements' supports development of interface requirements and information exchanges with these ITS elements. A variety of resources were used to support the data collection efforts, as described in Section 3, included local agency ITS planning documents, regional multi-agency coordinated projects, and regional concept of operations plans.

A survey was prepared and distributed MAG member agencies to be able to gather ITS and agency coordination data to develop the MAG Regional ITS Architecture, as well as document the ITS deployment and integration in the MAG region. The survey included questions for each agency regarding the number of devices, types of information sharing, and locations of devices where it is feasible to gather that information. Status of various devices and systems throughout the MAG region was also requested from agencies in the following categories:

- **Existing** - infrastructure/devices that are already installed, or will be in place by February 2009;
- **Programmed (Through 2013)** - infrastructure/devices that will be installed or deployed and have funding identified or already allocated; and
- **Planned (Not Programmed)** - infrastructure, devices or systems that agencies envisions implementing in the future, but funding is not yet identified or secured

The ITS inventory is a valuable list for several reasons. First, it provides a baseline of existing and planned ITS projects and systems in the MAG Region. Second, it outlines which agencies are currently deploying and operating ITS as well as those planning to implement ITS programs. Third, it provides a foundation for identifying potential connectivity to develop the ITS architecture. Status of ITS deployments and communications in the survey is important to differentiate because the MAG ITS Strategic Plan that will be developed in a later project will evaluate the existing capabilities and the plans for the future for each agency against capabilities that support that regional growth in the future. Multi-agency projects such as the RCN and C2C support agency cooperation across jurisdictional lines, but it will be important for the ITS Strategic Plan to assess other cooperative efforts on the arterial network and from an interdepartmental standpoint as well.

4.2 Existing ITS Infrastructure

This section includes a summary description of the types of ITS infrastructure that currently exists in the MAG Region. **Table 7** provides an overview of the agency-owned infrastructure and communications that was captured as part of the survey that was given to each agency. **Appendix A** provides a sample of the survey that was distributed to each of the MAG member agencies.

Table 7 – Summary ITS Inventory by Agency (Freeway/Arterial)

	Centers	Devices						Communications		
Agency	TMC/TOC	CCTV	DMS	Traffic Signals	Traffic Signal System	VID	Other Detection	Fiber	Wireless	Leased Lines
ADOT	■	■	■	■			■	■		
Avondale	■	■	■	■	■	■	■	■	■	
Buckeye										
Chandler	■	■	■	■	■	■	■	■	■	
El Mirage										
Fountain Hills			■	■		■	■			
Gilbert	■	■	■	■	■		■	■	■	
Glendale	■	■	■	■	■	■	■	■	■	
Goodyear	■	■	■	■	■	■	■	■		
MCDOT	■	■	■	■	■		■	■	■	■
Mesa	■	■	■	■	■	■	■	■	■	■
Paradise Valley										
Peoria	■	■	■	■	■	■	■	■	■	■
Phoenix	■	■	■	■	■	■	■	■	■	
Queen Creek	■	■		■	■	■	■			
Scottsdale	■	■	■	■	■	■	■	■	■	■
Surprise	■	■	■	■	■	■	■	■	■	
Tempe	■	■	■	■	■	■	■	■	■	

■ Existing capability - could be expanded in future

■ Future capability – currently programmed or planned for future

4.3 Planned ITS Infrastructure

Existing infrastructure is a key focus area for this ITS Architecture because it is the foundation for ITS development and communications for the MAG Region moving forward. There are improvements to ITS infrastructure development and regional communications planned for the various agencies in the Region. These future improvements are collected as part of this project to assess the progress of implementation toward those goals as well as to identify any potential streamlining of agency planning efforts to minimize funding impacts and capital improvement requirements. This assessment of existing versus planned infrastructure will largely be done as part of the ITS Strategic Plan effort.

This section will review both programmed projects from the MAG TIP as well as planned projects that agencies have identified as future in the survey.

4.3.1 MAG TIP Programmed Projects

Planned infrastructure and deployment projects from the MAG TIP (2008-2013) are provided in **Table 8** by their respective timeframes. The purpose of summarizing these projects is to highlight key areas of the application of ITS that are focus areas for many jurisdictions.

One of the key themes as shown by **Table 8** is the corridor planning being developed on a citywide basis. These corridors typically span multiple jurisdictions such as Bell Road, McDowell Road, Greenway Road, Olive Avenue, Rural Road/Scottsdale Road and Arizona Avenue, among others. Infrastructure that is existing along those corridors and the ITS plans shown in the table are tremendous additions to the traffic monitoring, incident management, traffic operations, and traveler information capabilities for each jurisdiction. However, it is important to understand the benefits of not only sharing that monitoring information with other agencies, but also coordinating operations across jurisdictional boundaries. Understanding what types of infrastructure each agency currently operates combined with the future plans for neighboring jurisdictions along that same corridor will help facilitate coordination of projects to establish connections between the two or more agencies.

Another key theme is that many agencies are expanding their traffic management centers (either capabilities or physical space expansion) to support additional services and personnel in the facility. As each centralized point of ITS operations in each jurisdiction grows to become capable of collecting important information along corridors that may affect other areas, it becomes important for those agencies to share that information with other agencies. This process will largely become a reality through the RCN and C2C projects, but are also a priority for corridors that span two or three agencies that requires closer coordination on that particular asset.

Table 8 – MAG TIP (2008-2013) Programmed ITS Projects

Agency	Year	Project
ADOT	**2008**	202: Loop 101 to Gilbert Road – Design FMS
	2008	101: I-17 to SR-51 – Design and construct FMS
	2009	202: Loop 101 to Gilbert Road – Construct FMS
	2009	101: SR-51 Princess Drive – Design and construct FMS
	2011	I-17: Loop 101 to SR-74 – Design FMS, SR-51: Bell Road to Loop 101 – Design FMS, 101: I-17 to SR-51 – Design FMS, I-17: Arizona Canal to Loop 101 – Design FMS, 101: SR-51 to Princess Drive – Design FMS, 202: Dobson Rd to I-10 – Design FMS
	2012	I-17: Arizona Canal to Happy Valley Road – Construct FMS
	2012	MAG regionwide – FMS projects (2012)
Avondale	**2008**	Avondale City Hall – Develop strategic plan for the Avondale traffic management system and design operations center
	2013	Furnish and install 2 1/8 miles of fiber optic cable, conduit, and innerduct, and associated equipment at 9 traffic signals and one CCTV camera
Buckeye	**2010**	Miller Rd: Hazen Rd to I-10 and Monroe Rd (MC-85): Miller Rd to Apache Rd – Interconnect traffic signals
Chandler	**2008**	Citywide – Install Chandler Fire/Police Department signal system integration and variable message signs
	2009	Chandler Blvd: Delaware St to Gilbert Rd – Install fiber optic cable traffic signal interconnection
	2010	Buffalo St at Colorado St – Upgrade, retrofit, and integrate TMC equipment
	2011	Arizona Ave: Pecos Rd to Riggs Rd – Install fiber optic cable for interconnecting traffic signals (4 out of 5 miles)
Gilbert	**2008**	Gilbert Rd: US-60 to Guadalupe Rd and US-60: Dobson Rd to Gilbert Rd – Install fiber and conduit along Gilbert Road, fiber only along US-60 (joint with Mesa to link ATMS)
	2009	Gilbert ATMS Fiber East Ring Project – Phase I (Design) – Design for a fiber ring to connect to existing fiber to link out-lying traffic signals to the Gilbert Traffic Operations Center via fiber connection
	2009	Gilbert ATMS Fiber East Ring Project – Phase II (Design) – Design for fiber branch connections to link traffic signals to the future East Fiber Ring (Phase I)
	2013	Install five miles of fiber optic cable and associated communications hardware to complete a high-bandwidth, non-leased interconnection between the TOCs in Gilbert and Queen Creek
Glendale	**2008**	Various locations – Install CCTV cameras
	2009	Olive Ave: 67th Ave to 59th Ave – ITS fiber and one CCTV camera – Glendale and Peoria Joint Project
	2012	Various locations – Deployment of ITS
	2013	Variable message signs; ITS conduit and fiber

Table 8 – MAG TIP (2008-2013) Programmed ITS Projects (continued)

Agency	Year	Project
Goodyear	**2009**	Various locations – Purchase dynamic message signs
	2011	Citywide – Implement traffic signal system, including installation of ITS backbone and communications equipment
	2012	McDowell Rd: Sarival Rd to Litchfield Rd – Design and construct fiber-optic interconnection for traffic signals and video
	2013	Design and construct fiber optic interconnect in existing conduit for traffic management through video surveillance and data collection
Guadalupe	**2008**	8413 S Avenida Del Yaqui – Install emergency signal device at fire station
MAG	**2009**	Regionwide – Traffic signal optimization program
	2010	Regionwide – Traffic signal optimization program
	2012	Regionwide – Traffic signal optimization program
Maricopa County	**2008**	Regionwide – System enhancements to expand arterial traveler information systems, including 511 and az511.gov
	2009	Glendale, Peoria and Scottsdale City Limits – Establish REACT arterial incident response teams in Glendale, Peoria, and Scottsdale
	2009	Bell Rd: Loop 303 to Loop 101 – Construct ITS improvements
	2010	99th Ave: Olive Ave to Bell Rd – Install conduit and fiber optic cable to connect existing and planned ITS field devices
	2010	MCDOT Traffic Management Center – Design and construct TMC upgrade
	2011	Bell Rd: Loop 303 to 75th Ave – Construct dynamic message signs and fiber optic cable and conduit
	2011	5 different locations – Upgrade traffic signals, including CCTV facilities
	2012	Regionwide – Upgrade regional archived data server (RADS) equipment
	2012	Olive Ave: Litchfield Rd to Loop 101 – Construct and install new conduit and fiber-optic cable to connect existing and planned ITS field devices
	2013	Develop and implement arterial ATIS enhancements, building on the previous Phase I efforts, 511 enhancements, and other key projects
	2013	Develop a multi-agency Operations Plan that will support coordinated arterial operations, freeway/arterial coordination, incident management and traveler information
	2013	Install arterial DMS and associated conduit, pull boxes, fiber optic cable, communication equipment, and electrical service equipment – joint project with Avondale and Goodyear
Mesa	**2008**	Mesa St: Mesa Dr to Mill Ave – Construct non-intrusive detection systems, cameras, dynamic message signs and one mile of fiber optic cable
	2008	Loop 202 – Design and install fiber optic cable and end devices and complete connections at network hubs
	2008	ITS Signal Conversions – Phase 3 – Expand fiber optic network and link 11 traffic signals to the Mesa TMC
	2009	Various locations – Upgrade TMC equipment and purchase central components, field cameras and VMS
	2009	Along sections of Broadway, Dobson, Alma School and Baseline Rds – Establish fiber optic link on Broadway Rd and connect to west ITS loop

Table 8 – MAG TIP (2008-2013) Programmed ITS Projects (continued)

Agency	Year	Project
Mesa (continued)	**2009**	Country Club Dr: 8th Ave to Baseline Rd (including US-60 TI) – Install real-time adaptive signal system
	2010	Baseline Rd, Southern Ave, Dobson and Alma School Rds – Establish fiber optic link with arterial streets near US-60
	2011	Various locations – Install fiber optic communications and upgrade traffic signal controllers
	2012	ITS Signal Conversions – Phase 5 – Improve existing fiber optic communications systems and install communications network and ITS devices
	2013	Implement video and acoustic sensors in the field with communications facilitated using existing traffic controller cabinets to automatically detect and alert traffic operations staff of suspected crash or traffic impeding events
	2013	Upgrade central traffic control system software to accommodate a lite version of adaptive control
Paradise Valley	**2009**	Various locations (12 intersections) – Install video detection systems
Peoria	**2008**	Traffic Management Center – Construct Traffic Management Center
	2009	Citywide – Connect existing traffic signals to the central system using a hybrid wireless-fiber system (35 additional signals will be connected with this project)
	2011	Various locations – Design and construct extension to fiber optic backbone and install CCTV cameras
	2013	Installation of conduit, pull boxes, fiber, and CCTV cameras to connect signals to Central, and monitor traffic and provide real-time traffic management on this segment of 83rd Avenue
Phoenix	**2008**	Downtown Phoenix – Design parking management system (phase 3)
	2008	Various locations – Construct Phoenix regional ITS fiber optic backbone, Phase B
	2009	Various locations – Construct regional ITS fiber optic backbone, Phase B-1
	2010	Various locations – Construct regional ITS fiber optic backbone, Phase B-2
	2011	Various locations – Construct regional ITS telecommunications expansion
Queen Creek	**2008**	Queen Creek Town Center – Construct ITS infrastructure and traffic management system
	2011	Townwide – Design and construct/implement ITS hardware and software
	2012	Ellsworth Rd: Sierra Park Blvd to Empire Blvd – Construct traffic signal/CCTV system
	2012	Rittenhouse Rd: Sossaman Rd to 204th St alignment – Construct traffic signal/CCTV system
	2013	Establish ten wireless traffic signal connections

Table 8 – MAG TIP (2008-2013) Programmed ITS Projects (continued)

Agency	Year	Project
Scottsdale	**2008**	Scottsdale Rd: Pima Fwy to Indian School Rd – Construct smart corridor traffic control system
	2008	Area enclosed by McKellips Rd to Indian School Rd and 64th St to Pima Rd – Replace traffic signals controllers and cabinets
	2009	Scottsdale Rd: Frank Lloyd Wright Blvd to Thompson Peak Pkwy – Construct smart corridor traffic control system
	2009	South Scottsdale – Controller and cabinet replacement
	2010	McDowell Rd: Scottsdale Rd to Pima Rd – Construct smart corridor traffic control system
	2011	Scottsdale and Hayden Rds: Shea Blvd to McDowell Rd – Install detection equipment, variable message signs and software
	2012	Area enclosing Shea Blvd to Carefree Hwy and 56th St to 136th St – Install dynamic message signs
	2012	South Scottsdale – Replace traffic signal controllers and cabinets
	2013	Establish last-mile connections from city fiber network
Surprise	**2008**	Surprise Center Parkway at Statler Blvd – Supply and install TMC equipment (phase 1
	2008	Bell Rd at Coyote Lakes, Dysart Rd and 134th Ave – Equipment (CCTV cameras) and installation
	2010	Bell Rd: US-60 to Surprise Traffic Management Center – Construt fiber optic interconnection of traffic signals, cameras and VMS
	2010	Greenway Rd: US-60 to Cotton Ln – Construct fiber optic interconnection of traffic signals, cameras and VMS
	2011	Peoria Ave: Litchfield Rd to Jackrabbit Rd – Design and construct fiber optic cable interconnection of existing and future ITS facilities
	2012	Bell Rd: Loop 303 to Jackrabbit Trail (195th Ave) – Design and connect traffic signals, CCTV cameras and changeable message signs
	2013	Optical fiber interconnect of signals, CCTV cameras, dynamic message signs, and connection to ITS fiber backbone
Tempe	**2008**	Citywide – Engineering services for ITS network components
	2009	Citywide – Purchase and install malfunction management units in all traffic control cabinets
	2009	Citywide – Develop ITS and communications strategic plan
	2010	Citywide – Install video detection system
	2011	Various locations – Install fiber optic connection between ADOT FMS backbone and signal cabinets at 22 interchanges
	2011	Various locations – Install wireless communications and CCTV monitoring at 26 intersections
	2012	Citywide – Design and construct fiber optic cable installations
	2012	Light Rail Transit Corridor in Tempe – Install CCTV monitoring stations
	2013	Procure and install traffic control cabinets and hardware – Phase 1 of 3

4.3.2 Other Planned Infrastructure

This section includes a brief description of the types of planned infrastructure that has been captured as part of the survey that was distributed to stakeholders. These projects are not specifically identified in the MAG TIP table above because they are either funded through local agency funds or are in the conceptual stages of planning at this time.

- Many agencies in the MAG Region are expanding their current ITS program by adding CCTV cameras, DMS, portable ITS devices, fiber optic cable, and traffic detection capabilities to their jurisdiction's transportation network. Some of this planned infrastructure is shown in the MAG TIP projects table. There are additional infrastructure projects funded by local agency sources to support adding ITS and communications to their local transportation network;
- Agency coordination between Gilbert, Mesa, Chandler, and Queen Creek for operations of ITS devices such as CCTV and DMS are in the planning stages primarily to coordinate management along corridors that cross into multiple jurisdictions;
- Goodyear and Avondale are planning in the future to share monitoring and detection information regarding arterial corridors that span both jurisdictions;
- Initial agency connections to the RCN are planned to be deployed in the near-term timeframe and additional agencies will connect to the network in subsequent phases of the RCN program;
- The C2C project currently communicates to the traffic signal system of i2TMS. Additional traffic signal systems will be added to the protocol development for sharing of traffic signal timing plan information between agencies;
- Surprise has plans to implement video detection and preemption devices along key corridors in their jurisdiction which will support incident management and emergency operations; and
- Phoenix Public Transit is evaluating many technologies and services that will enhance their ability to share transit information with the public as well as coordinate with their operators on real-time conditions. Of particular note is planning to upgrade their web trip planning software to provide real time data and to display a map when customers use the web trip planner.

5. NEXT STEPS

The foundation of information that this task has provided will guide the subsequent tasks on this project. To capture the overall function of ITS in the MAG Region, a logical architecture will be developed next for the MAG Region.

Following the logical architecture, this inventory will be used to provide the detail that is necessary to develop the physical architecture. The ITS Architecture and database will be the functional tool that agencies will be able to use in planning for the future of ITS projects/programs in their jurisdictions and in coordination with other jurisdictions.