ITS Planning Guidelines for Smaller Jurisdictions

April 2012

Prepared By:

JACOBS

Prepared For:

MARICOPA ASSOCIATION of GOVERNMENTS

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Sponsored by the MAG ITS Committee

Prepared for:

MARICOPA ASSOCIATION of GOVERNMENTS
301 North First Avenue, Suite 300
Phoenix, Arizona 85003
Phone: (602) 254-6300
Fax: (602) 254-6490

Prepared by:

JACOBS®
101 North First Avenue, Suite 3100
Phoenix, Arizona 85003
Phone: (602) 253-1200
Fax: (602) 253-1202

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Disclaimer: If you are using this document offline or if links are broken, contact MAG for updates.

List of Acronyms

ADOT	Arizona Department of Transportation
APS	Arizona Public Service
ASU	Arizona State University
BR	Bridge replacement
CCTV	Closed-Circuit Television
CIP	Capital Improvement Program
CMAQ	Congestion Mitigation and Air Quality
DMS	Dynamic Message Sign
DOT	Department of Transportation
DPS	Department of Public Safety
EVP	Emergency Vehicle Preemption
FHWA	Federal Highway Administration
FMS	Freeway Management System
GIS	Geographic Information Systems
HES	Hazard Elimination Program
HRI	Highway-Rail Intersection
HSIP	Highway Safety Improvement Program
HURF	Highway User Revenue Fund
IGA	Intergovernmental Agreements
IMSA	International Municipal Signal Association
IT	Information Technology
ITE	Institute of Transportation Engineers
ITS	Intelligent Transportation Systems
ITS AZ	Intelligent Transportation Society of Arizona
LTAF	Local Transportation Assistance Fund
MAG	Maricopa Association of Governments
MCDOT	Maricopa County Department of Transportation
MCSO	Maricopa County Sheriff's Office
MPH	Miles per hour
MPO	Metropolitan Planning Organization
MTBF	Mean time between failures
MUTCD	Manual on Uniform Traffic Control Devices
NCHRP	National Cooperative Highway Research Program
NIA	National ITS Architecture
O&M	Operations and maintenance
OSHA	Occupational Safety and Health Administration
RCN	Regional Community Network

List of Acronyms (Continued)

RCTO	Regional Concept of Transportation Operations
RIA	Regional ITS Architecture
RPTA	Regional Public Transit Authority
RR	Rail road
RTP	Regional Transportation Plan
RWIS	Road Weather Information System
SMFO	Single Mode Fiber Optic
SOP	Standard Operational Procedures
SRP	Salt River Project
SRTS	Safe Routes to School
SSR	Spread Spectrum Radio
STP	Surface Transportation Program
TAG	Technical Advisory Group
TIP	Transportation Improvement Program
TMC	Traffic Management Center
TTG	Transportation Technology Group
TTI	Texas Transportation Institute
USDOT	United States Department of Transportation
VMS	Variable Message Sign
WAN	Wide Area Network

1. INTRODUCTION

The Phoenix metropolitan region consists of 25 incorporated cities and towns, 3 native Indian communities, and rest of the unincorporated areas of Maricopa County. Out of these there are seventeen (17) jurisdictions in the Maricopa Association of Governments (MAG) region that can be classified as smaller jurisdictions with 2010 census population less than 50,000. This project was initiated by MAG as part of its efforts to meet a growing need for technical guidance for Intelligent Transportation Systems (ITS) planning faced by many of the smaller MAG jurisdictions in the region.

The purpose of this document is to serve as a guideline and a template that could be readily utilized by a smaller jurisdiction in the MAG region to plan and implement ITS.

1.1 Background Information

As the population of the nation, currently near 300 million, keeps increasing so does the number of towns and cities where nearly 75 percent of this population live and work. In regions of the nation that are experiencing rapid growth, new or rapidly growing jurisdictions are struggling to keep up with infrastructure needs. Many examples can be found in former small rural jurisdictions located not too far from large urban centers. These new or rapidly growing suburban jurisdictions have to plan and build roads, water, sewer systems, schools etc. all at the same time and must also be able to meet the needs of residents who are likely to have high expectations from their transportation system. Jurisdictions could take some early steps to ensure that they build safe and efficient transportation systems that would serve their jurisdiction well into the future. Making ITS an integral part of the jurisdiction's infrastructure plan would be such a step. Implementation of such a step could include, adopting a policy for requiring a standard conduit configuration with all new road construction OR requiring that property developers pay for the conduit. Other steps could include the co-location of enforcement and traffic operations in a shared facility and the sharing of communications infrastructure. This project is consistent with MAG's vision and mission to plan, implement and evaluate ITS technologies that address regional goals and objectives of the transportation users.

As they grow, the smaller local agencies within the MAG region look ahead to plan and build upon their existing infrastructure and systems to accommodate future transportation needs within their jurisdiction and region. The MAG ITS committee serves as the champion in helping plan and implement the regional ITS program.

1.2 Project Kickoff Meeting

The first task of this project was to prepare and conduct a project kickoff meeting in conjunction with a monthly MAG ITS committee meeting. MAG has a total of 31 member agencies. Using the recent 2010 Census population data, agencies with population less than 50,000 were identified and designated as smaller jurisdictions for the purposes of this study. Table 1.1 summarizes MAG's member agencies and the smaller jurisdictions.

At the May 4, 2011 MAG ITS Committee meeting, a brief presentation was made to the member agencies in attendance providing an overview of the project, the various tasks involved and the

schedule for completion. A one-page summary of the project and the scope was provided as hand-outs at this meeting. The one-page summary is provided in *Appendix A*. At this presentation all member agencies were invited to attend the 3-hour workshop scheduled for May 18, 2011.

Table 1.1: MAG Member Agencies

#	Agency	2010 Census Population Data	#	Agency	2010 Census Population Data
1	Avondale	76,238	17	Litchfield Park	5,476
2	Apache Junction	35,840	18	Mesa	439,041
3	ADOT*	N/A	19	Maricopa County	N/A
4	Buckeye	50,876	20	Paradise Valley	12,820
5	Carefree	3,363	21	Peoria	154,065
6	Cave Creek	5,015	22	Phoenix	1,445,632
7	Chandler	236,123	23	Queen Creek	26,361
8	El Mirage	31,797	24	Scottsdale	217,385
9	Fountain Hills	22,489	25	Surprise	117,517
10	Fort McDowell Yavapai Nation	971	26	Salt River Pima-Maricopa Indian Community	6,289
11	Gila Bend	1,922	27	Tempe	161,719
12	Gilbert	208,453	28	Tolleson	6,545
13	Glendale	226,721	29	Wickenburg	6,363
14	Goodyear	65,275	30	Youngtown	6,156
15	Guadalupe	5,523	31	Citizens Transportation Oversight Committee*	N/A
16	Gila River Indian Community	11,712			

Note: Shaded cells indicate agencies with population < 51,000
* indicates ex-officio members

1.3 Gather Background Information

The purpose of this task was to gather information about the smaller jurisdictions such as:

- Agency's mission, how the agency is organized, and where ITS might fit in current plans
- Agency's current infrastructure planning process
- Agency staff involved in the planning process
- Existing infrastructure and planned new infrastructure within the jurisdiction (including infrastructure shared across jurisdictions)
- Adjacent jurisdictions with whom the agency may wish to share infrastructure, operations and maintenance (O&M) support

To accomplish gathering the background information the following tasks were conducted:

- Contact information of all key personnel from the 17 smaller jurisdictions was obtained.
- A 3-hour workshop was conducted on May 18th, 2011 for the key personnel from the identified smaller jurisdictions and other MAG member agencies shown in Table 1.1, providing an overview of transportation technology and ITS solutions, national and regional ITS initiatives and plans.
- A questionnaire was developed to help identify overall agency organization, needs and priorities related to traffic operations, safety, and, ITS infrastructure within their jurisdiction.
- A follow-up was conducted via telephone and e-mail to obtain the requested information in the questionnaire.

1.3.1 ITS Workshop for Smaller Jurisdictions

On Wednesday, May 18, 2011 a workshop was held at the MAG facilities. The workshop was scheduled from 9:00 AM to 11:30 AM. Table 1.2 lists those in attendance.

Table 1.2: ITS Workshop for Smaller Jurisdictions – Attendees

Attendee	Agency	Title	Email Address	Telephone Number
Ron Reimer	Salt River Pima Maricopa Indian Community	Project Manager	ronald.reimer@srpmic-nsn.gov	480-362-7773
Jim Michalak	Town of Fountain Hills	Signal Tech. II	jmichalak@fh.az.gov	602-721-5639
Mark Hannah	Town of Youngtown	PPG Manager	mhannah@youngtownaz.org	623-933-8286
Jorge Gastelum	City of El Mirage	CIP Engineer	jgastelum@cityofelmirage.org	623-876-2976
Margaret Boone-Pixley	City of Avondale	Asst. Traffic Engineer	mboone-pixley@avondale.org	623-333-4200
Hafiz Noor	City of Apache Junction	Project Engineer	honor@ajcity.net	480-474-8547
Sarath Joshua	MAG	ITS & Safety Program Manager	SJoshua@azmag.gov	602-254-6300
Leo Luo	MAG	ITS & Safety Engineer	LLuo@azmag.gov	602-452-5072
Kiran Guntupalli	MAG	ITS & Safety Engineer	KGuntupalli@azmag.gov	602-254-6300

A PowerPoint Presentation, found in *Appendix B*, was presented to provide an overview of transportation technology solutions provided by ITS, national and regional ITS initiatives and plans. The ITS Planning Guidelines for Small Jurisdictions Questionnaire, found in *Appendix C*, was also prepared and handed out to the workshop participants. The questionnaire contained questions related to the following areas:

- Agency's mission, how the agency is organized, and where ITS might fit in current plans
- Current infrastructure planning process
- Staff involved in the planning process
- Existing infrastructure and planned new infrastructure (including infrastructure shared across jurisdictions)
- Adjacent jurisdictions with whom the agency may wish to share infrastructure and O&M support

As part of the workshop the agency representatives participated in a breakout session to identify their individual agency's needs and priorities in the area of ITS and Traffic Management. The following highlights the information shared by each agency:

Apache Junction

- Develop intergovernmental agreements (IGA) for signal preemption (Mutual Aid Agreements exist now among many agencies).
- Conduct a study to evaluate traffic signals within the community and specific locations to determine if certain traffic signals can be eliminated.
- Standardize practices for traffic signal and closed-circuit television (CCTV)
- Need a centralized control system to monitor signals.

Avondale

- There is a need to market the value of ITS programs to upper management. Identifying an ITS Champion may help in obtaining funds for ITS programs within the community and adjacent communities.
- Develop a communications mechanism (whether it be fiber optic communications or microwave communications) at three main arterials, Dysart Road, Avondale, and McDowell.
- Install dynamic message signs (DMS) at main decision points within the community to advise motorists about roadway conditions.
- Develop a working partnership with surrounding communities, Maricopa County Department of Transportation (MCDOT), Arizona Department of Transportation (ADOT), and Goodyear for better operation and control of signal systems.
- Develop communications infrastructure for the signal systems.
- Work with surrounding communities and agencies to develop funding strategies for ITS projects.

El Mirage

- No needs at this time however, did mention
    - They are in the planning stage to develop Olive Ave.
    - Signals are operated by the City, but working with City of Peoria for shared control.
    - Also working on developing signal interconnects.

Fountain Hills

- Complete a communications link between two groups of existing signals
- Need to coordinate traffic signals along Shea Blvd, (the main corridor between Fountain Hills and Scottsdale).
- Need to coordinate control of traffic signals between Fountain Hills and Scottsdale.
- Need to provide motorists with traveler information for the main corridor between Fountain Hills and Scottsdale.
- Need to bring back system information locally to eliminate the need for unnecessary travel to a site to investigate problems.
- The addition of CCTV at certain locations/intersections to assist in monitoring traffic.
- Develop IGSs between fountain Hills, Scottsdale, and ADOT.

Salt River Pima – Maricopa Indian Community

- Would like to take control of traffic signals along Pima Road. Currently ADOT controls the signals. Scottsdale also controls some signals and other ITS devices.

Youngtown

- Would like to install CCTV along Grand Avenue and Olive Avenue
- Would like to tie into (share control) of other existing CCTV
- Would like to provide traveler information on the City's website

A few responses were obtained from the smaller jurisdictions on the ITS Planning questionnaire that was provided at the May 18th, 2011 workshop. The responses from the agencies are provided in *Appendix D*.

2. ITS PLANNING: STAKEHOLDERS

The involvement of stakeholders is key for successful planning and implementation of ITS infrastructure. This chapter will focus on developing guidelines that describe the very important first task of establishing an agency's key stakeholders group for developing their ITS plans.

2.1 Establishing an Agency Stakeholders Group for ITS Planning

The internal stakeholders at a typical small jurisdiction usually include various municipal departments performing several functions including planning, design, operation, and maintenance. The identification, prioritization and implementation of a project will need input from the various departments that may be impacted by the project decisions. The lead person responsible for coordinating all agency activities related to ITS planning is identified as the agency's ITS Champion. Ideally, the ITS Champion should be a qualified professional with experience in traffic engineering and operations. If an agency lacks such a professional within the organization, it may be necessary to hire someone for this position. This section will discuss the various items that an ITS Champion within a smaller agency will need to consider while trying to engage the various project stakeholders in the process to effectively and efficiently execute a project.

2.1.1 Internal Stakeholders for a Small Jurisdiction

The internal stakeholders at a typical small jurisdiction within the MAG region will include municipal departments of the agency performing several functions as described below:

- Public Works
  Public Works is responsible for planning, contracting, operating and maintaining all infrastructure, traffic control systems, streetlights and signs, the purchase and maintenance of vehicles for the agency, and the maintenance of the agency buildings.

- Engineering
  The Engineering and Construction Services function in a small jurisdiction is usually part of Public Works and provides technical expertise like plan review and inspection on public works projects. This department also provides project management services in the implementation of the Agency's Master Plan for public infrastructure.

- Planning and Zoning
  The Planning and Zoning Department implements planning related goals, policies, and programs, as approved by the City/Town Council. The department processes amendments to the Town's regulations, Zoning Ordinance, Subdivision Ordinance, and Town Code, in addition to process sign applications for changes of zoning, signs and amendments to the General Plan and Area Specific Plans.

- Economic/Community Development
  This department is typically responsible for planning for future growth, improving the image of the community, and, service resulting in opportunities for economic and community development.

- Information Technology
  The Information Technology Department is responsible for coordinating the use of computer technology across the various departments of a City/Town to ensure that accurate and timely information is provided to citizens, elected officials, management and staff. They support large multi-user systems including criminal justice system, financial system, GIS system etc.

- Public Safety – Police
  The Police Department provides the law enforcement staff to enforce state laws, deter criminal activity, protect life and property, maintain order, and operate a safe, constitutional jail system. For some of the towns in the MAG region Police Services are provided by the Maricopa County Sheriff's Office (MCSO) through an IGA.

- Public Safety – Fire
  The Fire Department provides the residents, businesses, and visitors of a jurisdiction with the highest level of protection against loss of life and property. They provide emergency services in all aspects of rescue, emergency medical service, fire prevention and suppression and control the control of hazardous situations.

- Transit
  The Transit Section is usually under the Transportation Operations Department of an agency, specially a smaller jurisdiction. This department coordinates the local and commuter buses, dial-a-ride services and coordination with the major transit providers in the area.

2.1.2 External Stakeholders for a Small Jurisdiction

The external stakeholders at a typical small jurisdiction, within the MAG region, will include larger regional and statewide agencies including the following:

- Maricopa Association of Governments
  MAG is the Metropolitan Planning Organization (MPO) for Maricopa County and programs future ITS projects in the Transportation Improvement Program (TIP) and also maintains the regional ITS architecture.

- Arizona Department of Transportation
  ADOT is the contracting agency for federal funding. ADOT is also a key stakeholder on any projects involving freeways and other state owned roadways.

- Federal Highway Administration
  FHWA is the federal agency that provides oversight for the obligation of federal funds for qualifying ITS projects.

- Major Traffic Generators
  Most jurisdictions also have various activity centers that need to be considered in all ITS projects such as:
  - Major Employers
  - Schools

- Retail Centers
- Cultural/Religious Centers
- Sports facilities
- Center of the Arts

2.2 Strategies for Engaging Stakeholders in Consensus Building

Stakeholders are persons or groups who are directly or indirectly affected by a project, as well as those who may have interests in a project and/or the ability to influence its outcome, either positively or negatively.

Consensus-building processes allow stakeholders to provide input into decision-making processes. Each stakeholder possesses a wide range of understanding or perceptions of a project. The consensus-building process helps them to establish a common understanding and framework for developing a solution that works for everyone. The process also fosters the exploration of mutual gains and integrative solutions and permits stakeholders to deal with interrelated issues in a single forum. This also allows stakeholders to make trade-offs between different issues, and allows the development of solutions that meet more peoples' needs more completely than decisions that are made without such widespread participation.

A structured process to go about engaging the stakeholders to garner consensus on projects will include the following steps:

- Identify those stakeholders directly and indirectly affected by the project
  - Internal Stakeholder or External Stakeholders based on your project
  - Engage stakeholders at the early stages of the project
- Define the project
  - Develop an outline for the scope of work
  - Identify the geographic limits of the projects
  - Frame the key goals of the project
  - Collect and evaluate data relevant to the project
- Convene the stakeholders to meeting(s) to discuss the project
  - Prepare an agenda for the meeting
  - Prepare handouts and/or plans to explain the project
  - Provide information that will assist stakeholders in understanding issues and problems
  - Listen to stakeholders and learn about their plans, views, issues, concerns and expectations.

- Identify and evaluate alternative solutions
    - Brainstorm alternatives and/or solutions with the stakeholder group
    - Consult with technical experts if necessary
    - Develop advantages and disadvantages of the alternatives
- Consult with stakeholders to obtain feedback
    - Ensure their input is considered and incorporated to the maximum extent possible
    - Collaborate and partner with the stakeholders in the decision making process
- Develop a formal structure for the project to take it to the next stage of implementation

A sample questionnaire, found in *Appendix E*, can be used to help identify the needs and priorities of the various departments during the process of engaging stakeholders.

A sample agenda, found in *Appendix F*, can be used to conduct an internal workshop within the jurisdiction to discuss the various issues associated with the project.

2.3 Local, Regional, and National ITS Resources

There are a large number of ITS resources available for the jurisdictions located in the Metropolitan Phoenix region. *Appendix G* provides a comprehensive listing of the various local, regional and national ITS resource websites.

2.4 List of Speakers

The MAG region is nationally known for innovations in planning and implementing ITS solutions. Many ITS applications are already at work in the MAG region on area freeways, arterials, and the transit system. The MAG ITS Committee is a technical committee that consists of representatives from FHWA, ADOT, Arizona Department of Public Safety (DPS), Regional Public Transit Authority (RPTA), METRO Rail, ASU, and fifteen MAG member agencies. The committee provides oversight to the development of regional plans, such as the ITS Strategic Plan, the Regional ITS Architecture and studies to support Planning. These plans serve as the overall roadmap for investments in regional ITS infrastructure and in the application of technology-based solutions for managing and operating the regional multimodal transportation system. The committee also recommends ITS applications on the arterial and freeway systems through projects that are programmed in the TIP.

There is a wealth of ITS expertise and ITS Professionals in the MAG ITS Committee that can speak on the various ITS topics of interest. Table 2.1 provides a list of potential ITS speakers and their contact information:

Table 2.1: ITS Speakers – Contact Information

Agency	Name	Title	Phone Number	Email
ADOT	Reza Karimvand	Assistant State Engineer - ADOT TTG	602-712-7640	RKarimvand@azdot.gov
Chandler	Mike Mah	City Traffic Engineer	480-782-3470	mike.mah@chandleraz.gov
Glendale	Debbie Albert	Principal ITS Engineer	623-847-7524	dalbert@glendaleaz.com
MCDOT	Nicolaas Swaart	Traffic Engineering Manager	602-506-0599	nicolaasswart@mail.maricopa.gov
MCDOT	Faisal Saleem	ITS Manager	602-506-0599	faisalsaleem@mail.maricopa.gov
Scottsdale	Bruce Dressel	ITS Manager	480-312-2358	bdressel@scottsdaleaz.gov
MAG	Leo Luo	ITS and Safety Engineer	602-254-6300	LLuo@azmag.gov Area of Expertise: ITS Architecture
MAG	Sarath Joshua	ITS and Safety Program Manager	602-254-6300	sjoshua@azmag.gov Area of Expertise: ITS Planning and Funding

3. INVENTORY OF ITS-RELATED INFRASTRUCTURE

An inventory of traffic control infrastructure like traffic signals, signs, markings, and ITS equipment is very important for effective governmental transportation management practices. The investment in traffic control infrastructure is significant when considering all the assets of a government agency. The ideal inventory system would track all traffic control infrastructure from initial installation, through inspections and maintenance, and until removal from the system.

This chapter gives an overview of the background for this task, the need for an inventory, the data to be collected during the inventory, the criteria for selecting an inventory system, the stakeholders involved, and the process for conducting an inventory.

3.1 Background

To build a foundation for the ITS planning process, it is important for jurisdictions to first develop an inventory by identifying all existing and planned infrastructure that are either part of, or could be leveraged for, ITS deployments. Such an inventory of existing, under construction, and planned infrastructure that can be a part of or could be leveraged for ITS deployments is recommended as one of the first steps for a small jurisdiction. The inventory will help chart out a roadmap for ITS deployment that optimizes available resources that are located within the jurisdiction or in adjacent jurisdiction, and state or regional facilities such as fiber paths along freeways and the RCN.

The Regional Community Network (RCN) is a program initiated by MAG. It is a regional fiber optic network that is available to agencies for transportation related needs. The RCN increases the information sharing capabilities between the various public sector agencies and across jurisdictional boundaries and enhances the level of service that these agencies provide to the communities they serve. Smaller jurisdictions could utilize nearby RCN nodes and communication links by submitting applications to MAG Technical Advisory Group (TAG) and MAG ITS Committee. To understand the structure of the RCN and how your agency might tie-in, a schematic of the RCN topology can be found in *Appendix H*.

3.2 Why conduct an inventory?

An inventory of existing, under construction and planned ITS related infrastructure is beneficial to the community as it helps with the following:

1. Maintain a record of the agency's assets related to Traffic Control and ITS infrastructure.
2. Proactive Operations and Maintenance
3. Maintain Regulatory Compliance (MUTCD standards etc.)
4. Planning and Budgeting (personnel and work orders)
5. Improve service to the public by tracking responses to complaints and requests.
6. Prepare applications for Funding (HSIP etc.)

3.3 Who would be the agency's stakeholders in developing an inventory system?

Development of the system should involve key personnel, including Management representatives, Traffic department staff, Maintenance and Operations staff, Information Technology (IT) department, Planning Department and other affected departments within the agency. The development of an inventory system should also take into consideration some of the following:

- collecting initial data
- daily operations, and reporting procedures
- ancillary tasks such as enforcement and risk management
- selecting and purchasing software

3.4 How do you choose an inventory system?

Many transportation agencies use an automated or computerized inventory system. Each agency should consider the following factors before making a selection between one of the many automated systems available:

- agency requirements
- computer capabilities
- availability of trained staff to support the system and keep it current
- improved accuracy and production with use of laptop computers/portable devices for field operations

When selecting an inventory system, the following issues should be addressed:

- Does the system match the selected data elements? Are all data elements recorded?
- Is there an understanding of the basic features of a software program as compared to data elements?
- Do the hardware and software requirements of computer programs match the existing computer system?
- Have user support and references been reviewed?
- What does the initial cost include?
- Are there maintenance costs with the program?

Software that provides basic inventory features has been developed and is available at minimal cost to local agencies. These programs can be effectively used as a low-cost supplement to a sign management system. There are a number of 'off-the-shelf' Asset Management Software programs used by agencies to track the inventory. These programs provide a reliable, easy-to-use and comprehensive inventory management software tool. A brief description and outline of these programs are provided in *Appendix I*.

3.5 What data would be included in a typical inventory of ITS related infrastructure?

Inventory systems range from very basic to quite sophisticated, depending on the resources available to and the needs of an agency. A very basic inventory system might consist of manual records, such as paper files of activities or a card system, to maintain the system and keep it current.

Related to ITS, the typical inventory would include existing, under construction and planned ITS related infrastructure for your agency. The types of ITS related infrastructure that would typically be included, but not limited to, are:

- Traffic Control System (traffic signals, pedestrian signals, battery backup, detection, controllers, interconnect fiber, flashers etc.)
- Dynamic Message Signs
- CCTV Monitoring System
- Speed Feedback Systems
- Emergency Vehicle Preemption Systems
- Railroad Preemption Systems
- Bus Priority Systems

The following are some of the details that would be beneficial in obtaining during the traffic signal inventory:

- *Existing System Hardware and Software*
  This would include the details of the field and office hardware and software components of each of the infrastructure elements listed above. Digital or photographic images of each of the components can be taken and included as part of the inventory documentation
- *Existing System Communications Facilities, System Computer Control Facilities, Vehicle Detection Systems and Video Monitoring Systems*
  Some of the relevant details included would be the location and routing of conduits, identification of termination points, communication cable type, number of used and spare conductors, interface equipment and routing, review of all existing computer hardware and software components associated with the remote monitoring and control functions of the system and detailed inventory of existing vehicle detection systems including all inductive loop assemblies, ultrasonic units and other types in place.
- *Future System Needs Assessment*
  Some of the details related to existing and future traffic signal control system goals/objectives based on requirements such as traffic flow, agency O&M resources, reuse of existing system facilities, compliance of equipment along a corridor, compliance of equipment of adjacent jurisdictions etc.

3.6 What is the process to conduct an inventory?

The inventory can be simple or elaborate. A simple inventory of traffic control and ITS infrastructure could easily be conducted by field personnel or a department intern using simple Microsoft Excel spreadsheets. This is a low-cost method to obtain field data for a small agency.

Depending on the staffing at any agency and the computing capabilities they may have, a more elaborate inventory can be conducted by using off-the-shelf asset management or inventory software.

3.6.1 Simple Process (Spreadsheets)

A simple inventory can be a conducted on a low-cost basis by following the steps outlined below:

1. Obtain a map including the jurisdictional boundary of your agency and its neighboring agencies.
2. Develop a checklist of the traffic and ITS related infrastructure that you would like to include in your inventory. An inventory checklist (MS Excel spreadsheet) is provided in *Appendix J* for your reference.
3. Using 'Google Earth' review the locations where the inventory needs to be conducted and note the relevant information prior to field review.
4. Conduct field reviews at these locations and note the relevant details in the spreadsheet.
5. Take photographs of locations, devices, signs etc. to add to the spreadsheet inventory.
6. Enter the data into MS Excel (separate the locations by tabs).
7. Add relevant PDFs of the plans, roadway projects etc. to the spreadsheet as 'hyperlinks'.
8. Identify major roadway corridors within your jurisdiction. Obtain information of the Traffic and ITS related infrastructure along those corridors from the adjacent jurisdictions. Add these as notes to your spreadsheet.
9. Meet with your internal departments (Planning, Engineering, Development Services etc.) to obtain information on future projects and associated traffic improvements planned for your jurisdiction. Add this information to the map.
10. Update the inventory periodically.

3.6.2 Detailed Process (Software)

The inventory can also be conducted by field review and entering the data into a management software, such as those listed in *Appendix I*. The inventory can be a conducted by following the steps outlined below:

1. Obtain a map including the jurisdictional boundary of your agency and its neighboring agencies.

2. Develop a checklist of the traffic and ITS related infrastructure that you would like to include in your inventory. An inventory checklist (MS Excel spreadsheet) is provided in *Appendix J* for your reference.
3. Using 'Google Earth' review the locations where the inventory needs to be conducted and note the relevant information prior to field review.
4. Conduct field reviews at these locations and note the relevant details in the spreadsheet.
5. Take photographs of locations, devices, signs etc. to add to the spreadsheet inventory.
6. Add the collected field data into the various fields in the inventory software program. Coordinate with your agency's Geographic Information Systems (GIS) Department to tie the inventory into their database, should they have this capability.
7. Identify major roadway corridors within your jurisdiction. Obtain information of the Traffic and ITS related infrastructure along those corridors from the adjacent jurisdictions. Add this information to the software as notes.
8. Meet with your internal departments (Planning, Engineering, Development Services etc.) to obtain information on future projects and associated traffic improvements planned for your jurisdiction. Add this information to the map.
9. Update the inventory periodically.

4. PRIORITY ITS USER SERVICES AND FUNCTIONS

Identifying the transportation needs and the appropriate ITS solutions to address those needs is a very important and critical step for an agency.

This chapter presents a basic overview of the National and Regional ITS Architecture and describes a process for smaller jurisdictions to identify ITS strategies that support their transportation goals. The National ITS Architecture (NIA) provides the national framework for developing various ITS technology applications that would address a set of basic User Services required in any transportation system. The Regional ITS Architecture (RIA) depicts the regional framework for developing ITS solutions, and is based on the NIA. Working with its internal stakeholders, the agency can use this process to identify its needs and develop a framework for ITS deployment within its jurisdiction that would make the most of the available ITS technologies.

A matrix of potential ITS User Services and ITS Service Packages and their benefits to a smaller jurisdiction are also presented in this chapter. ITS User Services, are defined as a key component of an ITS Architecture. These define the basic services that can be delivered by ITS technologies to meet existing transportation related needs. The 2001 MAG ITS Strategic Plan identifies a list of ITS User Services that are applicable to the MAG region. ITS User Services are delivered to customers via ITS Service Packages, defined as combinations of components that involve ITS subsystems, equipment and data flows. Each implemented ITS application on the transportation system is linked to a defined service package. Examples of ITS Service Packages implemented in the local jurisdictions in the MAG region can be found in the 2010 Regional ITS Architecture at: http://www.azmag.gov/ITS/ (*follow the link in the Menu on Service Packages by Stakeholder)*

4.1 National ITS Architecture

The *National ITS Architecture* provides a common framework for planning, defining, and integrating intelligent transportation systems. Within this framework, multiple design approaches can be developed tailored to meet the user (local agency) needs. The National ITS Architecture is comprised of the *logical architecture* and the *physical architecture*, which satisfy a defined set of user service requirements. The National ITS Architecture is maintained by the United States Department of Transportation (DOT) and is available on the DOT web site at http://www.its.dot.gov.

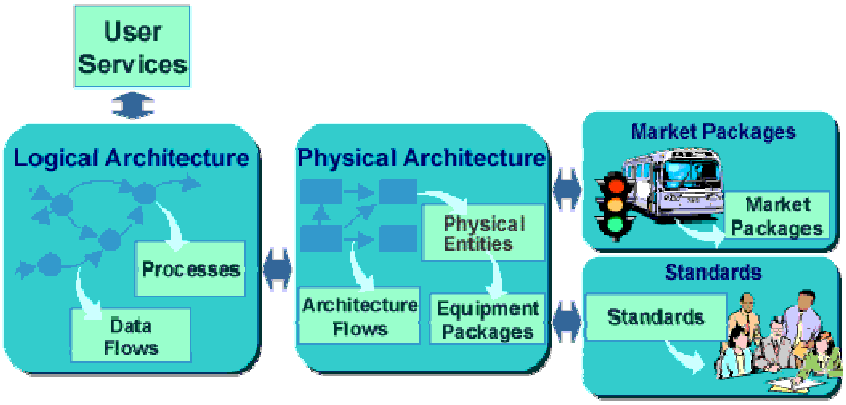
ITS User Services are the basic transportation services that ITS can provide to meet user's needs. The user may be a motorist, a transit rider, a system operator etc. The ITS User Services considers a broad range of users. The concept of user services allows the process of system or project definition to begin by thinking about services that will be provided to address identified problems and needs.

The *Logical Architecture* presents a functional view of the ITS user services. It defines the functions or process specifications that are required to perform ITS user services, and the data flows that need to be exchanged between these functions.

The *Physical Architecture* is a physical representation of important ITS interfaces and major system components. The physical architecture consists of two layers: 1) a transportation layer that identifies the transportation systems and the information exchanges that support ITS, and 2) a communication layer that identifies the communication technologies and systems that support the information exchanges.

Service Packages represent portions of the Physical Architecture and are basically ITS services that are tailored to fit – separately or in combination- real world transportation problems and needs.

Figure 4.1 provides a representation as to how these various entities relate to one another within the framework of the *National ITS Architecture*.



Source: *National ITS Architecture, USDOT*

Figure 4.1: National ITS Architecture

4.2 MAG Regional ITS Architecture

Since 2000, the ITS infrastructure deployed by agencies in the MAG region has increased substantially. Over the last decade, ADOT, MAG, MCDOT, cities, and transit have been actively investing and deploying systems and infrastructure which have significantly enhanced the capability of agencies in the Region to operate and manage the transportation network. MAG has helped to guide these efforts through collaborative development of the *ITS Strategic Plan*, *Regional Concept of Transportation Operations*, and recently with the *Regional ITS Architecture Update* and the *Future ITS Strategic Plan Update*.

The MAG region has developed a RIA that is compliant with all USDOT requirements and is consistent with the National ITS. All ITS applications currently implemented OR planned through 2014 in the MAG region are reflected in the RIA (http://www.azmag.gov/ITS/). Local agencies are not required to develop an ITS Architecture for their jurisdiction. Smaller jurisdictions could rely on the RIA for ITS planning purposes by ensuring that their ITS projects are accurately represented in the RIA.

When local agencies plan to implement ITS projects using regional funds obtained through the MAG Transportation Improvement Program, they are required by FHWA (and ADOT) to demonstrate that the local ITS project is consistent with the RIA.

The following MAG ITS resources can be used as a reference:

- *2001 MAG ITS Strategic Plan*: This plan identifies the ITS User Services that are applicable to the region.
  http://www.azmag.gov/Committees/Committee.asp?CMSID=1050
- *2010 Regional ITS Architecture*: This document identifies applicable ITS Service Packages that help in identifying the pieces of physical architecture that are required to implement a particular transportation service.
  http://www.azmag.gov/Committees/Committee.asp?CMSID=1050

4.3 ITS User Services and Service Packages

The ITS User Services are bundled into the following 8 categories and to-date thirty-three (33) user services have been identified:

- Travel & Traffic Management
- Public Transportation Management
- Electronic Payment
- Commercial Vehicle Operations
- Emergency Management
- Advanced Vehicle Safety Systems
- Information Management
- Maintenance & Construction Management

Service Packages are defined as sets of Equipment Packages that are required to work together to deliver a specific transportation service and the required exchange of data and information flows (architecture flows) between them and other important external systems. In other words, they identify the pieces of the National ITS Architecture required to implement a service. Most Service Packages are made up of Equipment Packages from two or more subsystems. Service Packages are designed to address specific transportation problems and needs and can be related back to the 33 user services and their more detailed requirements.

4.4 Identifying ITS Needs and Services for Smaller Jurisdictions

Smaller jurisdictions could take some early steps to ensure that they build safe and efficient transportation systems that would serve their jurisdictions well into the future by making ITS an integral part of their jurisdiction's infrastructure plan. The jurisdiction will first need to identify its agency's needs and then identify the ITS services that should be implemented to serve those needs.

Please note that there is no single right approach to develop a ITS strategic plan. The process outlined in this chapter is not intended to be followed in a rigid fashion, but rather indicates a general approach. Agencies should feel free to elaborate upon the steps presented so that the ITS strategic plan responds to local conditions and needs.

4.4.1 ITS Strategic Planning Process

The process for developing a ITS Strategic Plan for a smaller jurisdiction, can be represented using the flow chart shown in Figure 4.2.

The typical ITS Strategic Planning involves two main phases:

- Phase 1: ITS Concept Definition
- Phase 2: ITS Framework Development and Implementation Plan

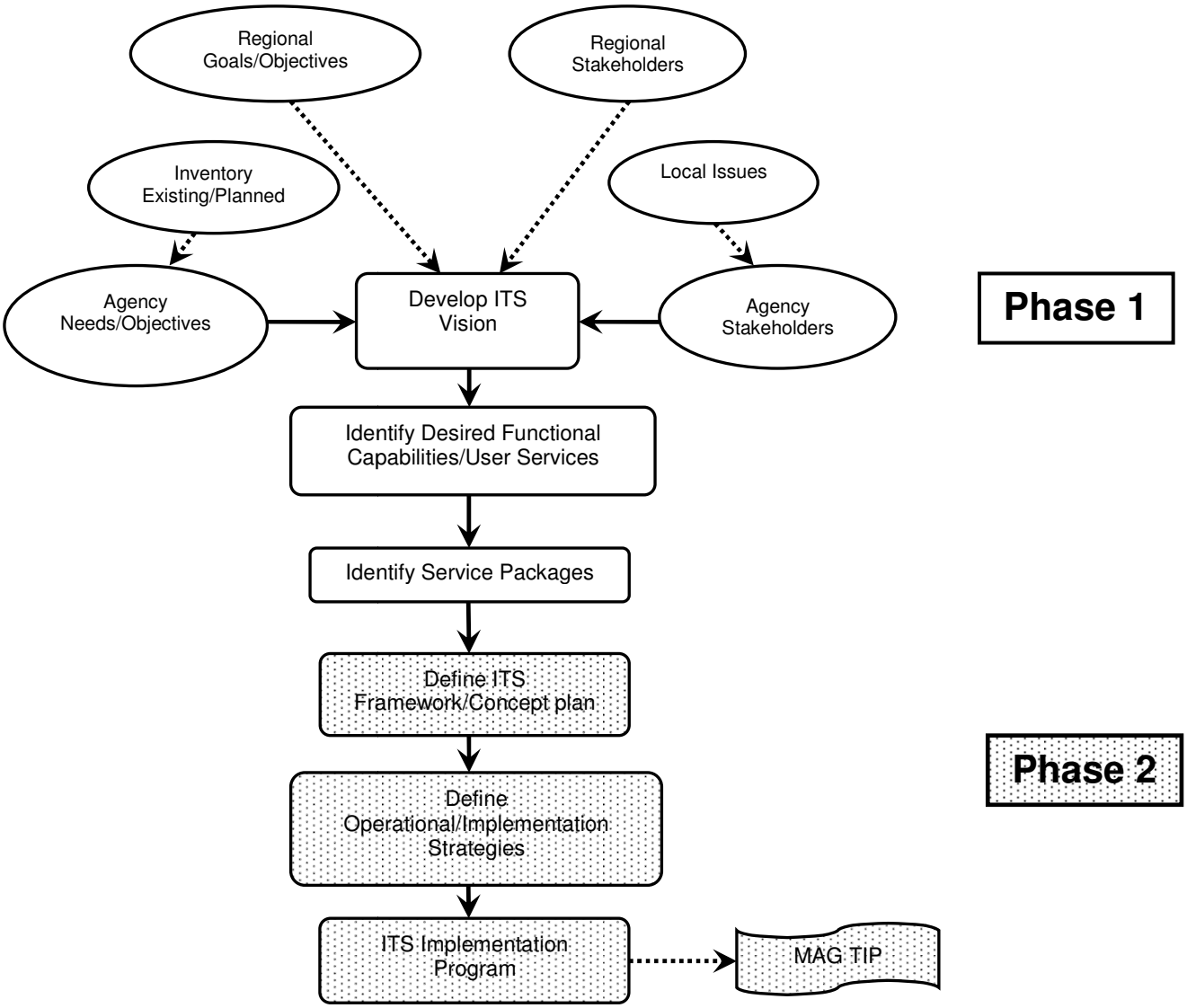


Figure 4.2: ITS Planning Process for Smaller Jurisdictions

4.4.2 Process for identifying ITS User Services and Service Packages

The following process details the steps to be followed in identifying the agency needs and determining the relevant ITS User Services and Service Packages for the agency:

1) **Develop ITS Vision:** ITS represents a relatively new area of transportation applications for many smaller jurisdictions. Developing a vision for the jurisdiction will provide a high-level description of the purpose, objectives and strategies for the agency. Some of the key tasks involved in defining the vision include:

   a) **Review Data:** In this step a review of all regional and local ITS efforts should be included. In addition, the data collected during the inventory of the existing and planned ITS elements in the jurisdiction, as discussed in Chapter 3, should also be reviewed.

      i) Conduct a review of the available local ITS Plans, ITS Studies and Regional ITS Plans.

      ii) Review regional goals and objectives.

      iii) Review the ITS inventory (as discussed in Chapter 3) and document the associated internal stakeholder department.

      iv) Review whether the system is existing or planned and add a brief description for the elements in the inventory.

   b) **Identify Agency Issues and Needs**: The problems with the transportation system within the agency and the associated needs of the operators, maintainers, and users of the system must be understood. The needs are identified by supplementing information collected in the previous step with stakeholder input. The needs collected from the documentation review can be refined with key internal stakeholders (within the agency). It is best to start with a candidate list of needs when gathering stakeholder input.

      i) Conduct an internal stakeholder meeting

      ii) Document agency needs

      iii) Identify candidate services that address those needs

      iv) Build consensus with the stakeholders on the agency needs

2) **Identify Desired Functional Capabilities/User Services:** The agency should use the ITS Vision and corresponding goals/objectives as the initial source of desired system functionality. Through an iterative process, stakeholders can develop the agency's fundamental system functional requirements by breaking down previously documented system goals and objectives. These fundamental system functional requirements should then be allocated to functional areas necessary to support the system and its users. By using the National ITS Architecture's "User Services" and "User Service Objectives", the agency can reduce their efforts and streamline the process.

   a) Identify the Desired Functional Capability of each system

   b) Identify the User Services from the available 33 User Services

3) **Identify Service Packages**: Service Packages identify the pieces of the National ITS Architecture required to implement a service. In this step each service package is analyzed to determine its ability to meet the identified agency transportation goals, objectives, and needs.

   a) Identify service packages that meet agency's needs

Please note that the process outlined in Steps 1-3 represent the Phase 1 portion of the Strategic Planning process. Phase 2 will be discussed in the next Chapter.

4.4.3 Resources

The following are some of the ITS resources that can be used as a reference in developing ITS User Services and Service Packages:

a) A complete list of the *ITS User Services* is available at USDOT's National ITS Architecture website: http://www.iteris.com/itsarch/html/user/userserv.htm

b) A complete list of the *ITS Service Packages* is available at USDOT's National ITS Architecture website: http://www.iteris.com/itsarch/html/mp/mpindex.htm

Note:

Staff at many local agencies and at MAG are very knowledgeable about the ITS planning process and may be able to provide any technical assistance necessary, related to ITS Planning and Development needs in your agency.

4.5 ITS Applications and Service Packages for Smaller Jurisdictions

Based on the information provided by the participating smaller jurisdictions in the May 2011 "*MAG ITS Planning Workshop For Smaller Jurisdictions Workshop*" and the supplemental information provided in the survey responses, the ITS applications and typical service packages that may be needed for smaller jurisdictions was identified.

4.5.1 Typical ITS Applications for Smaller Jurisdictions

A matrix identifying the type of ITS applications that are applicable to a smaller jurisdiction along with its potential benefits is provided in Table 4.1.

4.5.2 Typical ITS Service Packages for Smaller Jurisdictions

A matrix with the typical service packages that may be needed for smaller jurisdictions is provided in Table 4.2. This matrix also provides a description of the service packages and the potential benefits they provide.

It is important to note the final decision on service packages must be reached through consensus of the stakeholders within your jurisdiction. The following typical service packages are generated from the MAG Regional ITS Architecture and are based on information received from the various participating smaller jurisdictions.

Table 4.1: Typical ITS Applications for Smaller Jurisdictions

ITS Application	Benefits (consistent with ITS goals)
Interconnected Traffic Signal Systems	• Improves Safety • Enhances Mobility • Improves Transportation System Efficiency • Reduces Energy Consumption and Environmental costs • Increases Economic Productivity • Improves Customer Satisfaction
Emergency Vehicle Preemption	• Improves Safety • Reduces Liability • Improves Emergency Response Times • Cost Savings in Fire/Rescue and EMS Planning • Improves Customer Satisfaction
Dynamic Message Signs (fixed, portable)	• Improves Safety • Improves Transportation System Efficiency • Enhances Mobility • Reduces Energy Consumption and Environmental costs • Improves Customer Satisfaction
Speed Monitoring	• Improves Safety • Improves Transportation System Efficiency • Enhances Mobility
Travel Information to Public	• Enhances Mobility • Improves Transportation System Efficiency • Reduces Energy Consumption and Environmental costs • Increases Economic Productivity • Improves Customer Satisfaction
Traffic Data Collection (Counts etc.)	• Improves Transportation System Efficiency and Capacity • Enhances Mobility
CCTV Cameras	• Improves Safety • Improves Transportation System Efficiency • Enhances Mobility

Table 4.2: Typical ITS Service Packages for Smaller Jurisdictions

Traffic Management Service Area			
Service Package	**Service Package Name**	**Description**	**Benefits (consistent with ITS goals)**
ATMS01	Network Surveillance	Includes traffic detectors, CCTV cameras, other surveillance equipment, supporting field equipment and fixed point-to-point communications to transmit the collected data back to a traffic management center.	• Enhances Mobility • Reduces Energy Consumption and Environmental costs
ATMS02	Traffic Probe Surveillance	Provides an alternative approach for surveillance of the roadway network. Probe vehicles are tracked, and the vehicle's position and speed information are utilized to determine road network conditions such as average speed and congestion conditions.	• Enhances Mobility • Reduces Energy Consumption and Environmental costs
ATMS03	Surface Street Control	Provides the central control and monitoring equipment, communication links and signal control equipment that support local street and/or arterial traffic management. This service package is consistent with typical urban traffic signal control systems.	• Increases Transportation System Efficiency and Capacity • Enhances Mobility • Reduces Energy Consumption and Environmental costs • Improve Safety
ATMS06	Traffic Information Dissemination	Provides driver information using roadway equipment such as dynamic message signs or highway advisory radio. Information can include traffic and road conditions, closure and detour information, incident information, emergency alerts, disaster traveler information and driver advisories. This package also covers the sharing of traffic information with media, transit, emergency management and other service providers.	• Increases Transportation System Efficiency and Capacity • Enhances Mobility • Reduces Energy Consumption and Environmental costs
ATMS08	Traffic Incident Management System	Manages both unexpected incidents and planned events so that the impact to the transportation network and traveler safety is minimized. This service package includes incident detection capabilities through roadside surveillance devices as well as notification from other agencies. It supports traffic operations personnel in developing an appropriate response in coordination with emergency management, maintenance and construction management, and other incident response personnel.	• Increases Transportation System Efficiency and Capacity • Enhances Mobility • Reduces Energy Consumption and Environmental costs • Improve Safety
ATMS13	Standard Railroad Grade Crossing	Manages highway traffic at highway-rail intersections (HRIs) where rail operational speeds are less than 80 mph. Passive and active warning signs are supported.	• Improves Safety
ATMS19	Speed Monitoring	Monitors the speeds of vehicles traveling through a roadway system. This service can support notification to an enforcement agency to enforce speed limits on a roadway system.	• Increases Transportation System Efficiency and Capacity • Enhances Mobility • Improve Safety
ATMS21	Roadway Closure Management	Closes roadways to vehicular traffic when driving conditions are unsafe, maintenance must be performed, or other situations. Service package covers general road closures applications; specific closure systems that are used at railroad grade crossings, drawbridges, reversible lanes, etc. are covered by other service packages.	• Increases Transportation System Efficiency and Capacity • Enhances Mobility • Reduces Energy Consumption and Environmental costs
Traveler Information Service Area			
Service Package	**Service Package Name**	**Description**	**Benefits**
ATIS01	Broadcast Traveler Information	Collects traffic conditions, advisories, general public transportation, toll and parking information, incident information, roadway maintenance and construction information, air quality and weather information, and broadly disseminates this information through existing infrastructures (radio, cell phones, etc.).	• Increases Transportation System Efficiency and Capacity • Enhances Mobility • Reduces Energy Consumption and Environmental costs
ATIS02	Interactive Traveler Information	Provides tailored information in response to a traveler request. The traveler can obtain current information regarding traffic conditions, roadway maintenance and construction, transit services, ride share/ride match, parking management, detours and pricing information.	• Increases Transportation System Efficiency • Increases Transportation System Capacity • Enhances Mobility • Reduces Energy Consumption and Environmental costs

Table 4.2: Typical ITS Service Packages for Smaller Jurisdictions (Continued)

Emergency Management Service Area			
Service Package	**Service Package Name**	**Description**	**Benefits**
EM01	Emergency Call-Taking and Dispatch	Provides basic public safety call-taking and dispatch services. Includes emergency vehicle equipment, equipment used to receive and route emergency calls, wireless communications and coordination between emergency management agencies.	• Increases Transportation System Efficiency and Capacity • Improves Safety • Reduces Energy Consumption and Environmental costs • Increases Economic Productivity
EM02	Emergency Routing	Supports automated vehicle location and dynamic routing of emergency vehicles. Traffic information, road conditions and suggested routing information are provided to enhance emergency vehicle routing. Includes signal preemption and priority applications.	• Increases Transportation System Efficiency and Capacity • Improves Safety • Reduces Energy Consumption and Environmental costs • Increases Economic Productivity
EM03	Mayday and Alarms Support	Allows the user to initiate a request for emergency assistance and enables the emergency management subsystem to locate the user, gather information about the incident and determine the appropriate response.	• Improves Safety • Increases Economic Productivity
EM04	Roadway Service Patrols	Supports the roadway service patrol vehicles that aid motorists, offering rapid response to minor incidents (flat tire, accidents, out of gas) to minimize disruption to traffic. This service package monitors service patrol vehicle locations and supports vehicle dispatch.	• Increases Transportation System Efficiency and Capacity • Improves Safety • Reduces Energy Consumption and Environmental costs • Increases Economic Productivity
Maintenance and Construction Management Service Area			
Service Package	**Service Package Name**	**Description**	**Benefits**
MC03	Road Weather Data Collection	Collects current road weather conditions using data collected from environmental sensors deployed on and about the roadway.	• Increases Transportation System Efficiency and Capacity • Enhances Mobility • Improves Safety • Increases Economic Productivity
MC04	Weather Information Processing and Distribution	Processes and distributes the environmental information collected from the Road Weather Data Collection service package. This service package uses the environmental data to detect environmental hazards such as icy road conditions, high winds, dense fog, etc. to allow system operators can make decisions on corrective actions to take.	• Increases Transportation System Efficiency and Capacity • Enhances Mobility • Improves Safety • Increases Economic Productivity
MC07	Roadway Maintenance and Construction	Supports numerous services for scheduled and unscheduled maintenance and construction on a roadway system or right-of-way. Environmental conditions information is also received from various weather sources to aid in scheduling maintenance and construction activities.	• Increases Transportation System Efficiency and Capacity • Enhances Mobility • Improves Safety
MC08	Work Zone Management	Directs activity in work zones, controlling traffic through portable dynamic message signs and informing other groups of activity for better coordination management. Also provides speed and delay information to motorists prior to the work zone.	• Increases Transportation System Efficiency and Capacity • Reduces Energy Consumption and Environmental costs
MC09	Work Zone Safety Monitoring	Includes systems that improve work crew safety and reduce collisions between the motoring public and maintenance and construction vehicles. Detects vehicle intrusions in work zones and warns workers and drivers of safety hazards when encroachment occurs. Contractors should be required to provide work zone safety measures such as police enforcement or monitoring.	• Increases Transportation System Efficiency and Capacity • Improves Safety • Reduces Energy Consumption and Environmental costs • Increases Economic Productivity
MC10	Maintenance and Construction Activity Coordination	Supports the dissemination of maintenance and construction activity to centers that can utilize it as part of their operations. (i.e., traffic management, transit, emergency management)	• Increases Transportation System Efficiency and Capacity • Enhances Mobility • Reduces Energy Consumption and Environmental costs

5. ITS OPERATIONAL AND IMPLEMENTATION STRATEGIES

Having identified ITS applications and functions that are appropriate for the jurisdiction, the next step would be to identify, define and develop projects. This chapter will develop a process for developing ITS projects and associated costs. A sample list of ITS projects including their definition, description and an order of magnitude cost will be developed. This chapter will also include implementation and operational strategies to help small jurisdictions in deploying ITS projects.

5.1 Identification and Development of ITS Projects

After an agency has identified ITS applications and functions that would meet its needs, as discussed in Chapter 4, the next step is to identify, define, and develop these ITS projects.

The definition of the need to be addressed initiates the project development process. Once a proposed solution is identified, a project is ready to be developed. A sample project development template is provided in *Appendix K*. Please note that this template provides an outline of the features that are needed to help identify, define and develop a project and can be easily adapted to develop any ITS project – small or large.

If ITS projects are anticipated to be developed using federal highway funds, they have to answer the following key questions during various stages of the project development process:

- Is your project an ITS project or include ITS elements? – during early planning

  Your project is defined as an ITS project if it addresses one or more ITS Service Packages. Note that most projects that uses advanced information processing, communications, sensing, or control technologies to improve the safety and efficiency of the transportation system can be defined as an ITS project. Examples include interconnected traffic signals, transit signal priority systems, variable message signs, closed-circuit television cameras, automatic passenger counters, and traffic signal control software.

- Does your project conform to the National ITS Architecture or MAG Regional ITS Architecture? – during the application seeking MAG for federal funds

  This is to demonstrate how your project fits into the MAG Regional ITS Architecture which defines a regional framework for ensuring institutional agreement and technical integration for the implementation of ITS projects. MAG Regional ITS Architecture provides guidance and serves as a resource for the development of local ITS projects.

- Does your project meet the Systems Analysis Requirements? – during project design as part of the Design Concept Report

  Systems engineering analysis is a structured process that is meant to assist with developing the final design of a system. The analysis should be on a scale commensurate with the project scope – that is, the more complex the project, the more complex the analysis.

5.1.1 Resources for Development of ITS Projects

There are a number of local resources available for the development of ITS projects including strategic plans, checklists, ITS standards etc. The following are helpful links to some of these resources:

- **ADOT Freeway Management System (FMS) ITS Resources:** This link contains the Systems Engineering Checklist (required for all federally funded ITS project) and various other ITS-related documents.

  http://www.azdot.gov/Highways/TTG/TTG-Docs.asp

- **MAG ITS Resources:** Look under Resource Library and Related Projects

  http://www.azmag.gov/Committees/Committee.asp?CMSID=1050

- **AZTech: Regional ITS Resources**

  http://www.aztech.org/

- **City of Scottsdale Traffic Management**

  http://www.scottsdaleaz.gov/traffic/traffic_management_its

5.2 ITS Project Costs

Planning level cost estimates are needed to develop and prioritize individual ITS projects. Some of the principles that should be considered while developing planning level cost estimates include:

- Do not be overly conservative or liberal on cost estimates; however, one should probably err on the high side so as to retain credibility of the program by minimizing cost overruns
- Work on an installed unit cost basis (e.g., per intersection, per mile, per ramp, per bus, per control center, etc.), but also take into account major features
- Estimate full life-cycle costs, including design, development (especially software), procurement, installation, integration, acceptance testing, evaluation, O&M, management, and spare parts inventory
- Document assumptions so that adjustments in the costs can be more easily made if costs or quantities change
- Distinguish any systems or components that will be funded from other sources, so that this can be accounted for properly (and identified in the appropriate other plan such as the TIP)
- Use cost data from your own sources and experiences when possible
- Assess potential costs by analyzing the results and costs of similar projects successfully deployed in adjacent jurisdictions or region
- Incorporate ITS programs into new transportation projects to facilitate funding, construction coordination, and lessen the perceived cost of ITS (which is typically a small portion of other projects such as highway construction or rehabilitation)

- Commit sufficient funds and staff resources to adequately operate and maintain the proposed system
- Do not underestimate software development costs since they are often higher than planned
- Scrutinize communication costs as they are large compared to equipment costs

Table 5.1 provides a sample list of ITS projects including their definition, description and an order of magnitude cost.

5.3 Prioritization of ITS Projects

Once the ITS projects have been identified and defined, in scope and cost, it is important for the agency to prioritize these projects. Based on the ITS needs of the agency some of these projects may desirable immediately, however, funding, base infrastructure needs and interim remedies will dictate their implementation priority.

The prioritization of projects can follow a simple qualitative approach based on the needs of the agency and the logical phasing of the projects to realize the maximum possible benefits from the ITS deployments. The projects can be prioritized in a simple method as:

- Short-Term – High, Medium and Low
- Long-Term – High, Medium and Low

5.4 Implementation of ITS Projects

In developing an implementation plan for deployment it is important for the agency to coordinate the installation of ITS devices and communications infrastructure with other Capital Improvement Program (CIP) projects or ITS projects that are currently programmed for construction by the agency. This can substantially reduce construction costs and minimize the disruption to specific corridors due to construction activities.

ITS elements could be incorporated in projects that are included in:

- Agency's CIP
- MAG's TIP and Regional Transportation Plan (RTP)
- Agency's ITS projects (stand-alone projects)

Table 5.1: ITS Project Costs

Project Description	Capital Cost Estimate	O & M Cost Estimate per Year
CCTV camera [Includes: installation, enclosure, camera, encoder, cables]	$6,000 - $8,000 per location	$1,000
Dynamic message sign [Includes: installation, DMS sign panel, structure and foundation, conduits, conductors, pull box, control cabinet, power source]	$50,000 per location	$6,000
Traffic Counter System [Includes: including installation, wiring, conductors, pull box, conduit]	$2,000 – 3,000 per location	$1,000
Fiber optic communications in new conduit [Includes: trench, conduit, fiber optic cable, pull box at approximately every 600'-800']	$150,000 - 190,000 per mile	$400 per mile per year
Fiber optic communications in existing conduit [Includes: fiber optic cable, pull box at approximately every 600'-800']	$30,000 per mile	$400 per mile per year
New Traffic Signal (entire 4-legged intersection) [Includes: installation, pull boxes, conduit, foundations, signal poles, power service, control cabinet, UPS backup battery, mast arms, signal heads, signal mounting assembly, luminaire mast arm and luminaires, video detection, push buttons, pre-emption, internally illuminated street name signs, CCTV camera]	$220,000 - $250,000	$2,500 - $4,000
Single Mode Fiber Optic Cable (12 or 96 Fibers)	$2.00 - $3.00 per linear foot	see Fiber Optic
Emergency Vehicle Preemption Unit (typically 4 per intersection) [Includes: installation, beacon, sensors, cables, components located in the controller cabinet]	$2,500 each	$1,000
Video Detection Camera (single camera)	$6,000 - $8,000 each	$1,000
Video Detection System (for 1 intersection, typically 4 cameras) [Includes: installation, cameras, branch cables, cabinet interface unit]	$35,000 - $45,000	$1,000
Radar Speed Feedback Sign [Includes: installation, solar panel, 'your speed' display', speed limit sign, radar, cables, post and foundation]	$2,700 - $5,000 each	$1,000

5.4.1 Implementation Strategies

Some of the strategies that can be beneficial to smaller jurisdictions in preparation of projects for implementation may include the following:

- *Develop a Project Database*: The database should be designed to track infrastructure projects, their schedules etc. and should be accessible by all departments within an agency. This kind of database would facilitate resource coordination, maintenance, and construction activity.
- *GIS Database*: This database would track existing and planned infrastructure projects mapped on the agency's jurisdictional map. This is for agencies where GIS software and expertise is available.
- *Shared Procurement*: Coordinate the purchase of ITS equipment by sharing the procurement with adjacent jurisdictions or larger agencies in the region. This will ensure operational compatibility between adjacent jurisdictions.
- *Use Existing Contracts*: Use existing statewide and agency contracts for ITS equipment procurement
- *Sharing Data*: Share traffic data and available training resources in the region.

5.4.2 Resources for Implementation

The following are some important resources in the MAG region that can help in implementation of projects:

a) *MAG's TIP and RTP programs*: The information on these programs can be found at the following link:

http://www.azmag.gov/Projects/

b) *Project Programming*: Please refer to "A Guide to Transportation Programming – FY2012" for detailed process and requirements for programming projects at the following link:

http://www.azmag.gov/Documents/Transportation_Programming_Guidebook_FY2012.pdf

c) *Project Closeout Process*: New guidelines have been established for closing out the federal fiscal year and reallocate funds for projects that were not able to be obligated. This is detailed in the "MAG Project Status Development Workbook 2012".

5.5 Concept of Operations for Planned Project/System

Communications between the various system stakeholders is the key to effective management of transportation systems and its operations. The Concept of Operations defines the relationships among the various agency units and external organizations that are required for the deployment and operation of the project. It also identifies and communicates the qualitative and quantitative characteristics of the system to the user, developer, maintainer and all other affected stakeholders.

The Concept of Operations answers the who, what, when, where, why, and how for the new or existing system:

- What – What are the known elements and the high-level capabilities of the system?
- Where – What are the geographical and physical extents of the system?
- When – What is the time sequence of activities that will be performed?
- How – What resources do we need to design, build, or retrofit the system?
- Who – Who are the stakeholders involved with the system?
- Why – What does your organization lack that the system will provide?

The Regional Concept of Transportation Operations (RCTO) for the Phoenix metropolitan region describes the Concept of Operations that was signed on to by all regional stakeholders. This was developed by Maricopa Association of Governments (MAG) in 2003. The Regional Concept of Transportation Operations classified the functions that deal with operations into three levels: (1) the local level, (2) the local/regional level and (3) the regional level (see Figure 5.1). At the local level, operational functions are those need to be performed by individual agency regardless of other partners. At the local/regional level, functions need to be conducted by individual agency but with consideration for possible region wide impacts. This requires coordination and collaboration with other agencies affected by these functions. At the regional level, operations functions benefit local jurisdictions as well as an entire region.

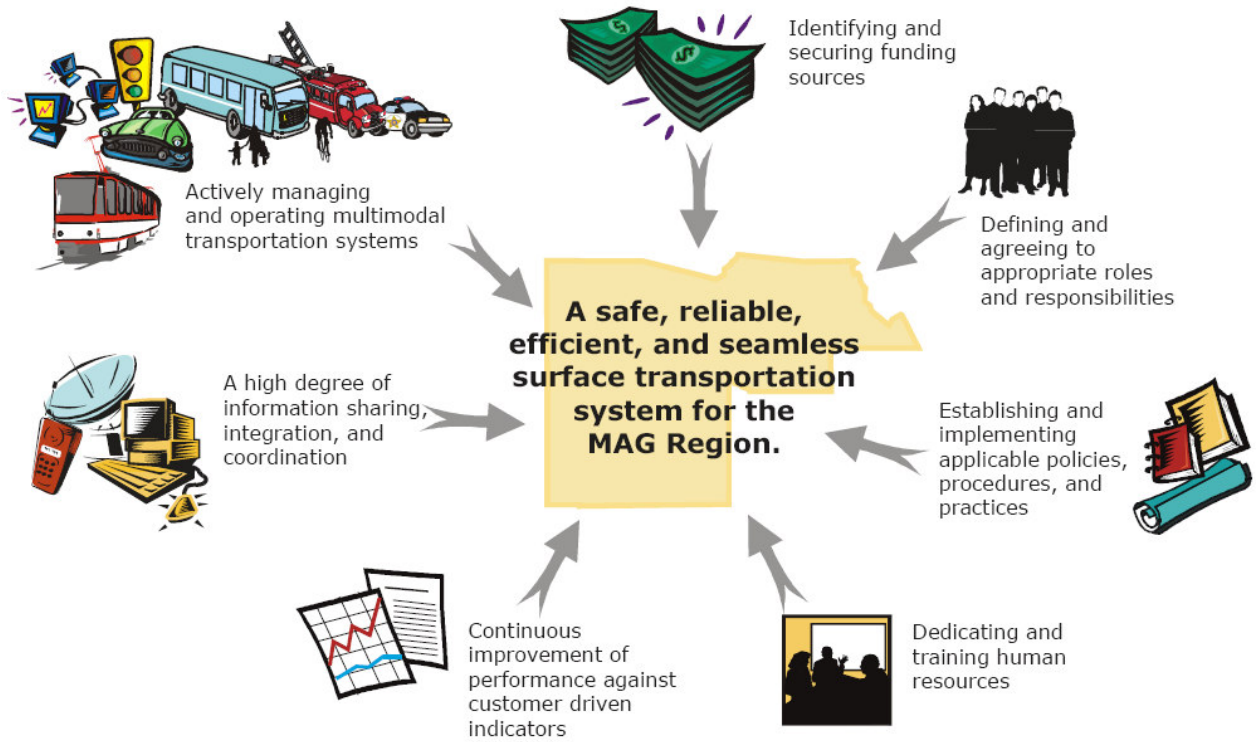


Figure 5.1: Mission and Vision of MAG Regional Concept of Transportation Operations

5.5.1 Developing a Project Level Concept of Operations

The following are some of the key activities in developing a Concept of Operations:

- *Identify the stakeholders associated with the system/project*

  Make sure that all the stakeholders involved in or impacted by the project – owners, operators, maintainers, users, and so forth – are identified and involved.

- *Define the core group responsible for creating the Concept of Operations*

  Depending on the size of the project and staff capabilities, this team might include a consultant or staff members with knowledge of the project and requisite writing and communications skills.

- *Define stakeholder needs*

  Provide a clear definition of the stakeholders' needs and constraints that will support system requirements.

- *Develop the initial Concept of Operations, review it with the broader group of stakeholders, and iterate*

  Incrementally create the Concept of Operations, review relevant portions with stakeholders, and adjust the concept as necessary to get buy-in.

- *Create a System Validation Plan*

  A Validation Plan provides a guide for evaluating a deployed ITS system to determine if it has met its goals.

Some of the operational strategies that have been beneficial to larger jurisdictions include:

- *Standard Operating Procedures*: Agencies can develop Standard Operational Procedures (SOP) between departments within their jurisdiction detailing the roles and responsibilities, e.g. Traffic department and Police department, Fire and EMS response.

- *Agreements*: Agencies can develop maintenance and operational agreements with adjacent agencies, e.g. With ADOT for signal O&M, Sharing CCTV viewing and control, coordinating incident management, etc.

5.5.2 Resources for Developing a Concept of Operations

The following are some important resources in the MAG region that provide information related to operations:

- **MAG – ITS Operations:** Functions at this level require regional cooperation and collaboration. The final report titled “Regional Concept Of Transportation Operations”, 2003, can be found at the following link:

  http://www.azmag.gov/Committees/Committee.asp?CMSID=1050

- **AZTech: Regional ITS Operations:** Resources related to regional operations can be found at the following link:

  http://www.aztech.org/

6. ITS COMMUNICATIONS

This chapter will address how small jurisdictions can go about developing a communications plan that would support the planned ITS functions and suggest criteria where infrastructure should go in the jurisdictions. This chapter will also review the ITS communication and related infrastructure needs for small jurisdictions based on review of the ITS Telecommunications Plan for the MAG region. It will also identify the short, medium and long-term strategies to help small jurisdictions in the development of the communication plan.

6.1 Background

Small jurisdictions must develop a communications plan that will support the planned ITS functions in order to effectively implement a successful ITS plan. A set of guiding principles must be established in order to implement a successful communications plan.

The Regional Community Network (RCN) is a regional communications facility initiated by MAG. It is a regional fiber optic communications network that is available to agencies for transportation related needs. The RCN increases the information sharing capabilities between the various public sector agencies and across jurisdictional boundaries and enhances the level of service that these agencies provide to the communities they serve. Smaller jurisdictions interested in being connected to the RCN could do so by utilizing nearby RCN nodes and communication links. The process for joining the RCN is initiated by submitting an application to MAG TAG and MAG ITS Committees. To understand the structure of the RCN and how your agency might tie-in please refer to *Appendix H* for a schematic of the RCN topology.

6.2 Communications Plan

Small jurisdictions must develop a communications infrastructure plan that will support the planned ITS functions in order to effectively implement a successful ITS plan. Nearly all ITS applications rely heavily on continuous data communications among various ITS field devices, as well as between field devices and a central control room where operators may intervene with traffic management strategies.

The communications infrastructure plan must execute several key steps for successful implementation. The communications plan should include:

a. *Existing Communications Infrastructure* – an inventory of the existing communications infrastructure (if any) in the jurisdiction should be conducted before planning for future communications infrastructure. Existing communications infrastructure may include fiber optic cables, wireless networks (which may be used by the Police Department), empty conduits which may already be in place at intersections or along arterial streets, etc. Please refer to Chapter 3 for the process and tools to conduct an inventory of existing communication and ITS Infrastructure.

b. *Future/Planned Communications Infrastructure* – in developing a communications plan, the future/planed communications infrastructure should be clearly defined. If not already in place, this may include the following:

- Empty Conduits - for future use
- Leased Telephone Lines - have insufficient capacity and costly monthly service charges
- Copper Twisted Pair - have significant capital cost but favorable lifecycle cost to that of the leased system
- Wireless Networks - Spread Spectrum Radio (SSR) and microwave have signal strength and noise problems, and they are used as a temporary measure until SMFO is installed.
- Single Mode Fiber Optic (SMFO) - has potential bandwidth large enough to accommodate all future ITS communications, reaches long distance without repeaters, and resists interference

The agency should develop a plan to highlight which corridors should first be developed with communication infrastructure. This can be based on growth patterns from the agency's General Plan or where most of the signals are located in the jurisdiction. The agency should create a fiber optic map with existing and proposed infrastructure.

In planning for future implementation of communication infrastructure, the agency should consider these minimum measures:

- Installation of appropriate cable sizes, or the installation of underground conduit for future cable installation
- Sizing of equipment enclosures, cabinets, and facility rooms to accommodate the future requirements
- Sizing provisions for power to include the load for future equipment
- Choice of transmission systems that will allow modular expansion to support the anticipated future requirements

c. *Communication Requirements* – all the devices and centers, for the communication requirements for the agency (or region), which must be supported by the communication network. Communication requirements should be established for the following existing and planned devices:

- Traffic Signals – can be supported by fiber optics, twisted pair, wireless or a combination of the three.
- CCTV Video – video can be carried as analog or digitized signal thru fiber cables.
- Automatic Traffic Recorders - can be carried by twisted pair and fiber optic cables.
- DMS – can be carried by fiber optic cables.
- Red-Light Running Enforcement Cameras – typically operated by a private entity. No additional communication devices are usually needed by the agency.

- Center-to-Center – fiber optic cables can be used to accommodate center-to-center communication (TMC, emergency operations centers, 911 centers, etc.)

d. *Communication Network Architecture* – a typical communications network has the following three basic elements:

- Backbone – the communications backbone carries all types of data in the system. The backbone connects the nodes which serve as central locations where data can be inserted/ removed from the backbone.
- Distribution – the distribution portion of the network connects buildings or groups of ITS devices to the backbone node.
- Local – the local portion of the network connects an end device, such as a traffic signal cabinet or building, to a distribution cable or directly to a node on a backbone.

The *MAG Regional ITS Architecture* (June 2010) report has valuable information regarding the communication network architecture.

e. *Maintenance and Operations* – typically, the rate of equipment or cable failure is very low, but the communication failure rate can be high. It may be more economical for a small agency to consider pooling their resources with adjacent agencies to select a lead agency or contractor to maintain the network instead of hiring in-house maintenance staff.

6.2.1 Communications Plan – Lessons Learned from Other Agencies

Since early 2000, several valley agencies have developed Communications Plans and deployed several ITS projects within their jurisdictions and at the same time have integrated their systems with regional and state facilities. Some of the suggestions from these agencies and lessons learned are listed below:

- Do not plan specific technology for more than 5 years ahead. Technology changes too quickly and the systems may become redundant.
- When co-sharing ITS and Communications infrastructure, make as many connections as possible. However, keep in mind that if the fiber optic backbone is built with federal funds then the first priority must be given to transportation applications, other departments cannot represent a greater share of the communication capacity.
- As part of the plan, create an overlay of the existing and proposed communications infrastructure on agency's aerial map.
- Plan a 'grid network' of the fiber and install managed switches at the major/major intersection nodes to provide automatic re-routing of communication in case of fiber breaks.
- Develop a communications plan that can be easily expanded in the future.

- Include all agency departments in the planning process. Create an internal agreement with the various departments designating roles and responsibilities.
- Consider high bandwidth radio connectivity if fiber is not an option.
- During the planning stages, also identify ITS standards for the communications infrastructure (conduit size, communication boxes, vaults, trench etc.)
- Have the Development Department from your agency require installation of fiber optic conduit on frontage of new development for proposed fiber corridors to connect traffic signals
- Create a standard communication network schema (i.e. IP addresses, V-LAN, etc.)

6.3 Communications Plan Guidelines

A set of guiding principles must be established to implement a successful communications plan. The following principles should also be considered during the detailed design:

- Reliability: The system must provide a high level of reliability, achieved through the use of components with a high mean time between failures (MTBF), combined with a redundancy in the network design.
- Growth: The network must be expected to grow gracefully. This requires the incorporation of a reasonable amount of unused capacity and a design approach that allows extra capacity to be provided by upgrading the transmission equipment.
- Standards: Communication protocols and component selection must use widely accepted standards that minimize ongoing operations and maintenance costs.
- Flexibility: The network configuration must be designed to maximize flexibility to accommodate future changes, rearrangements and equipment changes.
- Decentralized: As the network supports several agencies, it must be configured around several centers of control, and allow the control location to be changed according to current needs.

6.4 ITS Telecommunication Plan

Key recommendations from the ITS Telecommunications component of the MAG ITS Strategic Plan Update, 2001, include:

- Agencies should eliminate leased line service where possible and consider utilizing the RCN.
- Agencies should coordinate with local utilities to explore infrastructure-sharing possibilities. Where possible, installation of empty conduit in existing trenching operations should be considered to accommodate future fiber optic needs.

6.5 Strategies for the Communications Plan Development

Some of the short, medium, and long-term strategies that will help small jurisdictions in the development of the communication plan are shown in Table 6.1.

Table 6.1: Communication Plan Strategies for Smaller Jurisdictions

Short-Term	• Jurisdictions should ensure that all ITS plans are coordinated with the MAG ITS Strategic Plan and the Regional ITS Architecture. These documents can be downloaded on MAG's website (http://www.azmag.gov/Committees/) • Jurisdictions should involve their IT and Public Safety departments and coordinate with other agency communication planning efforts. Other larger, adjacent agencies may have more experience with communication planning efforts and may be able to provide vital information and 'lessons learned'. • The jurisdiction's planners and engineers should coordinate to identify the street corridors favorable for the location of their ITS facilities. It may be helpful to look at the MAG ITS Strategic Plan for street corridors that may already have been identified by other agencies in the area. • Jurisdictions should incorporate existing standards and guidelines for the installation of ITS infrastructure e.g. pull boxes, splice closures and manholes should be placed behind curb where feasible to facilitate ease of maintenance. • The communication plan should include sub-networks that are easily 'fire-walled' from the outside world. It is critical for the communication plan to be secure from the outside world. • The jurisdiction should create standard details for fiber optic infrastructure (conduit size, communication boxes, communication vaults, trench details, etc.). Adjacent jurisdictions may already have standard details that can be used or adopted. (See section 1.9 Standards)
Medium-Term	• The jurisdiction should explore opportunities for joint trenching with utilities in the placement of their fiber-optic communications. This is encouraged because it can lead to significant cost-savings for the agency. • Jurisdictions should consider collaborating with the private sector on current and future projects. For example, developers can be asked to install traffic signal pull-boxes (box-in) at future signalized intersections affected by their development. • The jurisdiction can ask the Development Department to require installation of fiber optic conduit on frontage of new development that is in the agency's proposed fiber corridors to connect traffic signals
Long-Term	• Jurisdictions should plan for wireless communication alternatives as appropriate. Wireless communication is being used for distributing services for an increasing number of systems due to its advantage of not requiring a physical cable installation. • Explore options for co-sharing traffic management facilities with agency's Public Safety department. This option may have significant cost savings and develop a closer working relationship between the traffic management operations and the Public Safety department. • Explore infrastructure options for locating traffic management function at a traffic management center (TMC) located in an adjacent larger city or town. Many of the agencies in the MAG region already have operational TMC's which may have available space to be shared with smaller adjacent agencies.

6.6 Regional Community Network

The Regional Community Network (RCN) is a regional communications facility initiated by MAG. It is a regional fiber optic communications network that is available to agencies for transportation related needs. The RCN increases the information sharing capabilities between the various public sector agencies and across jurisdictional boundaries, and enhances the level of service that these agencies provide to the communities they serve. Smaller jurisdictions interested in being connected to the RCN could do so by utilizing nearby RCN nodes and communication links. The process for joining the RCN is initiated by submitting an application to MAG TAG and MAG ITS Committees. To understand the structure of the RCN and how your agency might tie-in please refer to *Appendix H* for a schematic of the RCN topology.

6.7 Resources

Some of the local resources for ITS functions and communication can be found at the following links:

- MAG Regional ITS Architecture Final Report
  http://www.azmag.gov/Projects/Project.asp?CMSID=1050&CMSID2=1063
- MAG TAG
  http://www.azmag.gov/Committees/Committee.asp?CMSID=1057
- ADOT – FMS Design Guidelines
  http://www.azdot.gov/Highways/TTG/TTG-Docs.asp
- AZTech Center-to-Center Standards
  http://www.aztech.org/trafmgmt/c2c_stan.htm
- AZTech Regional Operational Guidelines
  http://www.aztech.org/trafmgmt/rog.htm

6.8 Standards

Some of the local agencies have established good ITS and communication standards. They can be found at the following links:

- City of Surprise Standard Details
  http://www.surpriseaz.gov/index.aspx?NID=1645
- City of Mesa Standard Details and Specifications
  http://www.mesaaz.gov/engineering/mesastandardandspecs.aspx
- City of Mesa Traffic Signal Design Manual
  http://www.mesaaz.gov/transportation/engineerguide.aspx
- City of Peoria Standard Details
  http://www.peoriaaz.gov/newsecondary.aspx?id=2881
- Town of Gilbert Standard Details
  http://www.gilbertaz.gov/eservices/engineering/standards.cfm
- City of Chandler Standard Details
  http://udm.chandleraz.gov/index.php?aid=690

- City of Glendale Standard Details
  http://www.glendaleaz.com/engineering/formsandpublications.cfm
- MCDOT Supplement to the MAG Uniform Standard Specifications
  http://www.mcdot.maricopa.gov/technical/

7. ITS DEVICE LOCATION AND OPERATION

The investment in ITS infrastructure is significant when considering all the assets of a government agency. Proper placement of ITS infrastructure is very important for effective governmental transportation management practices. An agency should have a set of ITS policies and practices, preferably a set of standards, to follow before implementing any ITS infrastructure.

This chapter gives an overview of the background for this task, as well as specific policies and practices for the location and operation of the following ITS components: Traffic Control System, CCTV cameras, DMS, Video Detection Cameras, Radar Speed Feedback Signs, and Emergency Vehicle Preemption (EVP).

7.1 Background

The placement of ITS infrastructure is important to any jurisdiction so that it does not impact the jurisdiction in an adverse manner. Certain policies and practices related to ITS devices, such as location and operation, need to be established for a consistent and effective ITS infrastructure plan.

For example, the placement of DMS structures should not be near residential homes if at all possible. In the past, residents have complained about signs that can be seen from back yards, or blocking views of mountains. Other examples are traffic signal controllers and signal poles - they should not be placed in sidewalk, in the path of pedestrians and bicyclists and out of the sight triangles for motorists at intersection corners.

Some local jurisdictions, in the MAG region, have established policies and standards for the location, placement, and operation of ITS infrastructure. A smaller jurisdiction in the MAG region can adopt and benefit from the already existing ITS policies and standards established by other jurisdictions. The applicable ITS policies and standards can be modified to fit the need of the smaller jurisdiction without a large effort.

7.2 Traffic Control System

A Traffic Control System refers to the traffic signals, pedestrian signals, traffic signal controllers, battery backup and other devices used to control a signalized intersection. Traffic signals are signaling devices positioned at road intersections, pedestrian crossings, and other locations to control competing flows of traffic.

Policies and practices adopted by other agencies in the region regarding the location, placement, and operation of traffic control systems are listed below:

- Traffic signals should be installed at locations where an engineering study of traffic conditions, pedestrian characteristics, and physical characteristics determine that a traffic control signal is justified.
- Refer to the current *Manual on Uniform Traffic Control Devices (MUTCD), Part 4, Highway Traffic Signals* for general guidance.
- Traffic signals should be placed so that road users approaching a signalized intersection or other signalized area have adequate time to react to the signal (for example, a red or yellow light).
- In areas where there may not be enough sight distance for the road user to see the signal, a sign should be installed warning road users that a signal is ahead such as a Signal Ahead sign (sign code W3-3).
- When installing traffic signal poles and mast arms in the vicinity of power lines, ensure that the traffic signal is at least the minimum distance, required by the Occupational Safety and Health Administration (OSHA), away from the power lines.

Countdown Pedestrian Signal Head

- Install signal heads in the cone of vision. If possible, center the signal heads over each travel lane.
- Add additional near-side signal heads on A-poles, if necessary.
- Do not install traffic equipment in areas where it will reduce the sight distance of road users and pedestrians.
- Do not install traffic signal poles, signal controllers, power meters, or battery backup in the sidewalk.
- Do not install signal equipment (such as controllers) where they may be viewed as unaesthetic by the public.
- Ensure that all pedestrian and bicycle push buttons are easily accessible by pedestrians and bicyclists.
- Install traffic signal controllers at locations where a technician working on the controller has a good view of the entire intersection.
- Install concrete pads for signal controllers and power meters to provide a stable ground for the technician to stand.
- Battery backup should be installed at major intersections in case of a loss of power.

Accessible Pedestrian Pushbutton

- Countdown pedestrian signal heads are required by the newest version of the MUTCD for all newly installed signalized intersections.

- Accessible Pedestrian Signals provide pedestrian signal information in an audible and/or vibro-tactile format and should be used at signalized intersections to help visually handicapped pedestrians at signalized intersections. *NCHRP Report 117A - Accessible Pedestrian Signals: A Guide to Best Practices* provides good guidance for the design and placement of Accessible Pedestrian Signals.
- If possible, illuminated street name signs should be used instead of regular street name signs for better visibility. New street name signs may be required to have both upper-case and lower-case lettering. Refer to the current *MUTCD, Chapter 2D. Guide Signs – Conventional Roads* for general guidance.

7.3 CCTV Cameras

Primarily located in higher traffic corridors, CCTV cameras are used for collecting video images for traffic and incident management. A variety of communications media including wireless and leased lines are used to communicate with and control these cameras.

Policies and practices adopted by other agencies in the region regarding the location, placement and operation of CCTV cameras are listed below:

- Place CCTV camera on a traffic signal pole that gives the best upstream and downstream view and mount 45 degrees from the mast arm pointed into the intersection.
- CCTV cameras are typically placed at mile to mile arterials or at locations important to the agency from a traffic management perspective. While determining the location of CCTV cameras it is important to address the viewing range and line of sight so that the cameras are not obstructed by either structures like buildings, bridges etc. or trees.
- Make sure that the CCTV cameras have pan-tilt-zoom capabilities.
- Do not install or minimize installation of CCTV cameras on poles that are higher than the reach of the aerial boom truck used by the agency without using a camera lowering device.
- Provide lighting protection for the CCTV cameras.
- Make sure that the CCTV camera is compatible with the software you will be using to control your cameras.
- Make sure that you have sufficient communication bandwidth to get the image back to the TMC.
- Make sure that you have enough space in the traffic signal cabinet to house the auxiliary equipment.
- Make sure to use Cameleon software for CCTV cameras if you want to share device control with ADOT and other jurisdictions.

CCTV Camera

7.4 Dynamic Message Signs

DMSs are electronic traffic signs often used on roadways to give travelers information about special events. Such signs warn of traffic congestion, accidents, incidents, or roadwork zones on a specific road segment. They may also ask vehicles to take alternative routes, warn of duration and location of the incidents, or just inform of the traffic conditions.

Dynamic Message Sign

Policies and practices adopted by other agencies in the region regarding the location, placement, and operation of DMSs are listed below:

- Refer to the current *MUTCD, Chapter 2L. Changeable Message Signs* for general guidance.
- Place DMS where they seem necessary and aesthetically pleasing.
- Do not place DMS where they can be seen from back yards or block views of mountains or other scenery.
- Do not place DMS structures in the pedestrian sidewalk.
- Do not place DMS at locations where the information load on drivers is already high due to guide signs and other types of information.
- Do not place DMS less than 2,000 feet from a major decision point.
- Place DMS at locations mid-block where side friction from retail or other distractions will not deter from the sign message.
- The bottom of the DMS or structure should be a minimum of 18 feet above the pavement.
- Real-time information displays and messages should be simple and short in order to accommodate the vast majority of the motorists reading the sign.
- DMS should tell drivers the following:
    - What is happening?
    - Where is it?
    - When will it take place?
    - What is the advice?
- The wording should generally be in the order described above.

- Use maximum of three panels (typically the DMS are not large enough for drivers to read four panels of messages before driving past the sign). If there is not enough room to display the full message, the 'advice' portion of the message may be deleted.
- Ensure that the DMS is located within the right-of-way.
- Install a CCTV or confidence camera to verify whether message is displayed correctly.

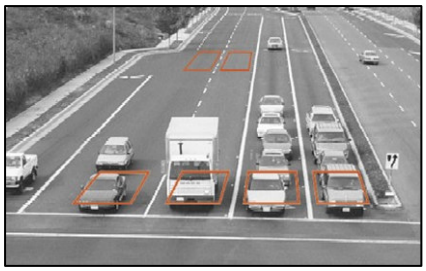
Keep in mind that Arizona Public Service (APS) requires a power meter (and does not allow direct connection to the street light power) for each sign because it has variable output due to the numbers. It may more economic to use a solar power sign in the APS area as other jurisdictions do. Salt River Project (SRP) does not have such a requirement.

7.5 Video Detection Cameras

Video Detection Cameras at intersections are used for vehicle detection and associated traffic signal actuation. Images can also be used to monitor lane usage for signal timing and these images can be viewed at the TMC. In addition, cameras can be located at mid-block arterial locations throughout the City operating as system detectors. These system detection cameras are used for traffic monitoring and data collection. Images can be sent back to the TMC where operators are able to monitor conditions and make signal timing adjustments as necessary.

Policies and practices adopted by other agencies in the region regarding the location, placement, and operation of Video Detection Cameras are listed below:

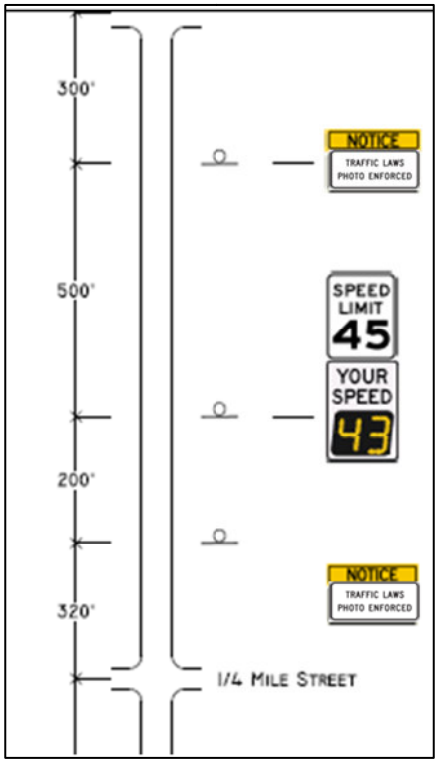
- Install video detection cameras at major intersections where no loops are used to detect vehicles or to replace existing loops.
- Install video detection cameras at mid-block arterial locations with high traffic volumes to monitor traffic and collect data.
- Mount the video detection cameras on the traffic signal luminaire mast arm. If no luminaire mast arm is available, mount the video detection camera on the traffic signal mast arm with a pipe extension.
- A higher mounting position allows for a better angle and wider view, which in turn generally allows for 1 camera to cover all lanes in a particular direction. Lower mounting heights (at signal indications' height) would not provide an effective image. Agencies generally look at mounting heights of around 30 feet, which is at least 10' above the height of the signal indications.



Video Detection Zones

- For vehicle detection at intersections, position the "zones" so that they are clearly defined for each lane. Point the camera down at the roadway so that sun glare does not interfere with the image. Detection accuracy is significantly degraded by the glare from the sun and from strong reflections.
- Regularly calibrate the camera field of view. Most video detection cameras have an image stabilization feature that can compensate for some camera motion. However, camera motion can adversely affect detection accuracy.
- Pay attention to the lights and power lines in the field of view. The camera field of view should be established to avail inclusion of objects that are brightly lit in the evening hours and objects which block a clear view of the intersection.

The *Intersection Video Detection Manual (Research Report 4285-2)* established by the Texas Transportation Institute (TTI) has useful guidance in the design and operation of video detection cameras.



Radar Speed Feedback Sign Placement
Source: City of Chandler

7.6 Radar Speed Feedback Signs

In an effort to improve safety in the City and around schools, many agencies (City of Mesa, City of Chandler, City of Peoria, etc.) have recently started installing radar speed feedback signs on some arterial streets in the vicinity of school zones. These electronic signs typically display the current speed of an approaching vehicle and are intended to provide a reminder to the driver to slow down when approaching school zones. In some locations, these radar speed feedback signs are installed along with a set of flashing school zone lights and a school zone speed limit sign. Radar speed feedback signs are installed to provide a real-time dynamic display of a driver's vehicular speed at a particular location where speeding has been documented to be a problem.

Policies and practices adopted by other agencies in the region regarding the location, placement, and operation of Rader Speed Feedback Signs are listed below:

- Place radar speed feedback signs on streets where speeding has been determined to be a problem (arterials, school zones, neighborhood streets, etc.)
- Place radar speed feedback signs approximately 800 feet in advance of the intersection, whenever possible.

- Place radar speed feedback signs approaching a school zone with a set of flashing school zone lights and a school zone speed limit.
- Place radar speed feedback signs near the curb where possible. If not possible, place the radar speed feedback sign behind the sidewalk or on a street light.
- If a radar speed feedback sign displaying approach speeds is installed, the legend *YOUR SPEED XX (MPH)* or such similar legend should be shown. The color of the changeable message legend should be a yellow legend on a black background or the reverse of these colors.

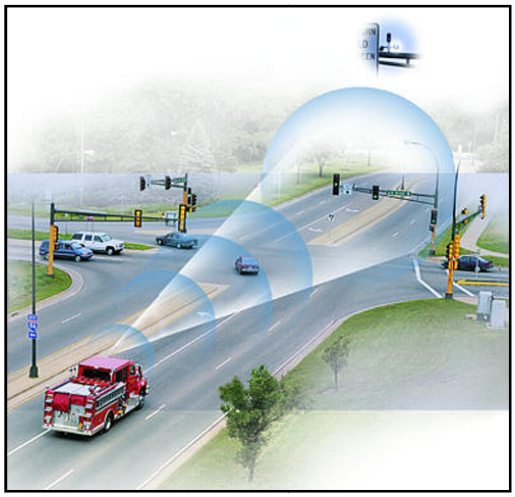
- Install radar speed feedback signs in combination with a Speed Limit sign (sign code R2-1).
- To improve driver comprehension, mount the radar speed feedback sign on the same support below the Speed Limit (R2-1) sign.
- To the degree practical, numerals for displaying approach speeds should be similar font and size as numerals on the corresponding Speed Limit (R2-1) sign.
- Ensure that the radar speed feedback signs are displaying the correct speed limit to drivers.
- Make sure that the radar speed feedback signs do not block sight distance and do not encroach on bicycle lanes and pedestrian sidewalks.
- The installation of the radar speed feedback signs should not interfere with the visibility and general effectiveness of any other signs in the area.
- When installed in association with school speed zones, the radar speed feedback signs should operate only when the school speed zone is in effect.
- Ensure that the radar speed feedback signs are located within the right-of-way.
- All elements of the radar speed feedback signs shall conform to the guidance and standards as outlined in the latest edition of the MUTCD.

Solar powered signs can be used where street lights are not present and in APS areas (similar to DMS).

Federal grant funding is available for elementary and middle schools through the Safe Routes to School (SRTS) Program (http://www.saferoutesinfo.org) for roadway safety measures which include traffic calming devices such as a driver feedback sign.

See the *ADOT Traffic Safety for School Areas Guidelines* on ADOT's Traffic Engineering Website (http://www.azdot.gov/highways/traffic/Standards.asp)

7.7 Emergency Vehicle Preemption



Traffic signal preemption is a type of system that allows the normal operation of traffic lights to be preempted, often to assist emergency vehicles. The most common use of these systems is the EVP which is used to manipulate traffic signals in the path of an emergency vehicle. To help reduce response times and enhance traffic safety, the EVP stops conflicting traffic and allows the emergency vehicle right-of-way. Other uses of, signal pre-emption are at railroad grade crossings to prevent collisions, and by light-rail and bus rapid transit systems to allow public transportation priority access through intersections to ensure they remain on schedule and improve commute times.

- Require all traffic signal designs to include EVP Systems. These systems include sensor device, beacon and associated wiring and cabling.
- Consider installing EVP at intersections that have frequent conflicts with emergency vehicles.
- When installing EVP equipment in areas that have closely spaced signalized intersections, it is important to consider the effect of overlapping detection distances.
- Bench test the equipment and software in the shop with the same equipment that is found in the field.
- Install the pre-emption sensor on the signal mast arm or on top of the signal head.
- Coordinate with local emergency response units (fire department and police department) to install the “in-vehicle subsystems” in all emergency vehicles.
- It is recommended that the contractor be responsible for quality control throughout the installation process.
- A detector sight distance of 1,800 feet is desirable.
- Optical detectors operate “line-of-sight” it is important to aim them as far down an intersection approach as possible.

8. ITS CAPITAL IMPROVEMENTS, OPERATIONS, AND MAINTENANCE

This chapter will focus on developing guidelines for an agency on how they might seek funds to support capital improvements, and operation and maintenance of ITS infrastructure. This chapter will identify potential funding resources available at the state, regional, and local level. This section will also describe the project programming process at MAG, the process to be followed for obligating and implementing ITS projects through the ADOT Local Governments Section, and the typical process for obtaining local funds through the CIP process.

8.1 Potential Funding Sources

The implementation costs for ITS projects include capital costs, design costs, and operations and maintenance costs. The following are some of the potential funding sources available for an agency for implementing it's ITS solutions:

8.1.1 Federal Funding

ADOT distributes and allocates Federal-aid funds between ADOT and local governments in a fair and equitable manner consistent with Federal laws, guidelines and regulations. The following are some of the federal funding available for the implementation of ITS projects in the MAG region:

1. *Highway Safety Improvement Program (HSIP)*: ADOT allocates safety funding for agencies in the MAG region for developing high accident location safety improvement projects in conformance with the Federal-Aid Hazard Elimination Program (HES) and ADOT's action plan. The objective of the ADOT HSIP program is to reduce the number and severity of crashes and decrease the potential for crashes on state highways and qualifying local roadways.

   Eligible Projects: Any project whose sole purpose of the improvement is to eliminate traffic hazards or to substantially improve safety is eligible for this funding. Certain ITS projects like (e.g.: Traffic signals and traffic signal upgrades, emergency vehicle preemption etc.) that can be shown to improve safety may be eligible for federal funding under this program. All decisions on federal funding eligibility for safety projects are made by the local FHWA office. If an agency is considering pursuing HSIP funds, then it is recommended that the agency consult the FHWA staff person responsible for Road Safety to determine funding eligibility. Safety improvement projects that are eligible for HSIP funds are periodically recommended by MAG to ADOT.

   Funding Process: According to the 2004 ADOT Local Government Project Manual, approved safety improvement projects will be funded at 94.3 percent through Federal HSIP funds, while the remaining 5.7 percent must be funded by the project sponsor. These funds are reimbursed to the agency. At present HSIP funds available through 2014 have been programmed for projects. It is important to note that ADOT is currently revising this document with revised guidelines and the information will be updated shortly and will be available at the following link:

   http://azdot.gov/highways/localgov/Projects_Manual.asp

2. *Congestion Mitigation and Air Quality Program (CMAQ)*: According to the final CMAQ Program Guidance, effective October 31, 2006, the purpose of the CMAQ program is to fund transportation projects or programs that will contribute to attainment or maintenance of the national ambient air quality standards for ozone, carbon monoxide, and particulate matter. The CMAQ Program provides funds for various types of projects to improve air quality, by reducing transportation related emissions in non-attainment and maintenance areas under the Clean Air Act. While they are allocated to the state, Arizona's funds have been dedicated entirely to the MAG Region, due to the high congestion levels and major air quality issues in the region.

   Eligible Projects: All ITS projects that qualify, based on definitions in the National ITS Architecture, are eligible for funding under this program and would include: traffic signal synchronization projects, traffic management projects, and regional multimodal traveler information systems, traffic signal control systems, freeway management systems, electronic toll-collection systems, transit management systems, and incident management programs.

   Federal Funding Requirements: All ITS projects that are funded with federal funds (CMAQ) are also required to meet federal requirements such as compliance with the Regional ITS Architecture, Regional ITS Strategic Plan and the required Systems Engineering Analysis for larger ITS projects. A Systems Engineering and Architecture Compliance Checklist must be submitted to the FHWA as part of the federal authorization paperwork. Prior to FHWA submittal, this checklist needs to be completed and submitted to ADOT Transportation Technology Group (TTG) Manager for review and approval. MAG's ITS program staff are very familiar with the requirements and will be available to assist local agency staff with completing the checklist and meet compliance requirements.

   The checklist can be found under the 'Resource Library' and is titled "ADOT Systems Engineering and Architecture Compliance (23 CFR 940.11)", at the following link:

   http://www.azmag.gov/Committees/Committee.asp?CMSID=1050

   Important Note: All federal CMAQ funds directed to ITS projects in 2012-2014 are fully programmed in the FY 2011-2015 MAG TIP. Check with MAG for current information regarding the next programming cycle for ITS projects in FY 2015 and beyond.

8.1.2 Regional Funding

The only regionally-administered source of funding for ITS improvements for the various jurisdictions in the MAG region is the Proposition 400.

- *Proposition 400* – Proposition 400 provides for a 20-year extension of an existing half-cent transportation sales tax in Maricopa County. A few ITS projects were funded with Proposition 400 funds in the 2003 Regional Transportation Plan. An opportunity to program new ITS projects with Proposition 400 funds is not anticipated at this time.

8.1.3 Local Funding

Taxes, bonds, general fund, Highway User Revenue Fund (HURF), state funds, and impact fees, allow member agencies to locally fund transportation projects, operations and maintenance, pavement preservation, and meet various match requirements for capital projects. CIP is a multi-year plan that every local agency develops for infrastructure development and improvements. CIP plans outline current capital and infrastructure needs, future anticipated needs, current projects and future costs to the community. CIP guidelines are set forth by the management of the local agency and the funds available through this program could be used for design, construction, operations and maintenance. The funding for capital improvements come from a variety of sources. Some of them may include the following:

- General Fund
- Grants
- User Fees
- Highway User Revenue Bonds
- County Transportation Sales Tax (Proposition 400)
- HURF
- General Obligation Bonds
- Revenue Bonds
- Excise Tax Revenue Bonds
- Development Impact Fees
- Local Transportation Assistance Fund (LTAF)

CIP Process: The following is the typical process followed by agencies to develop a CIP plan.

- Typically, in early Fall, the budget department and the CIP department liaisons meet to review and discuss guidelines for the upcoming CIP
- The various agency departments develop capital programs based on the priorities of needs and recommendations from citizen groups and Council members
- The capital programs are presented to the budget department who then analyze the budget decisions based on the agency's financial condition
- The capital projects are then ranked based on their importance to the agency and the availability of funds. The economic impact of these projects on the department operating and maintenance budgets are also evaluated
- The CIP plan is presented to the agency's manager (City Manager or Town Manager) for review and recommendations
- Typically by late spring, the City/Town Council will hold budget briefings to examine each aspect if the capital program including priorities, options, funding sources, etc.
- By mid-June, a public hearing is held and the CIP is presented, sometimes concurrent with the Annual Budget, for adoption by the City/Town Council.

8.2 Process for Programming Projects for Funding

As discussed in the previous section, regional funds are available through MAG for ITS infrastructure, matching funds needed for capital projects funded with federal CMAQ funds, local

funds needed for agency staff to operate ITS, funds required for on-going maintenance of infrastructure, and funds for replacement of systems at the end of their life cycle. This section describes the project programming processes that an agency will need to follow to program their projects for funding:

8.2.1 ADOT Local Governments Section

ADOT's role is to assist the local agencies through the project development process and insure compliance with ADOT/ FHWA policies, regulations, and guidelines. ADOT will also administer the construction phase of most local government projects. The typical project will take 18-24 months from inception to advertisement. The procedure to be used for processing federally funded local government Surface Transportation Program (STP), CMAQ, bridge replacement (BR), rail road (RR), and HES projects can be found in Section 7 of the *"A Guide to Transportation Programming – FY 2012",* at the link below:

http://www.azmag.gov/Projects/Project.asp?CMSID=1041&CMSID2=1140

Contact Information:

ADOT - Local Governments Section
John Dickson, ADOT-Local Governments Section Manager
1615 W Jackson St., Mail Drop EM11
Phoenix, AZ 85007
p. 602.712.8683, f. 602.712.3347
e-mail: jdickson@azdot.gov
ADOT Local Government webpage: http://www.azdot.gov/highways/Localgov/index.asp

8.2.2 CMAQ

The RTP allocates the available regional highway federal funds to different multi-modal categories. To select arterial ITS, Bicycle and Pedestrian, and Air Quality Projects to receive CMAQ funds, a competitive application and selection process is established. Beginning in 2015, all projects are to be programmed at the maximum federal share 94.3% and a minimum local match of 5.7% is required.

The FY 2011-2015 MAG TIP and future Transportation Improvement Programs program specific CMAQ funded projects in the first four years of the TIP and the fifth year will be programmed with CMAQ funds dedicated to the ITS Program, Bicycle and Pedestrian Program, Air Quality Program, and Transit Programs. There is an established competitive selection process for applying for funding through this program. Funding requests would require project specific information pertaining to expected change in travel speed, daily traffic volumes, and project length/area. For more information and details about the CMAQ funding refer to *Section 6* and *Appendices B & D* of *"A Guide to Transportation programming – FY 2012"* available at the link below (under *Transportation Programming Guidebook*):

http://www.azmag.gov/Projects/Project.asp?CMSID=1041&CMSID2=1140

8.2.3 MAG ITS Project Evaluation

The MAG ITS Committee has established a systematic project review and ranking process for programming ITS projects with CMAQ funds. In their review of a project's application, the MAG ITS Committee members consider various aspects of a proposed project's linkages and compatibility with the region's ITS Strategic Plan and ITS Architecture. At a special committee meeting, each proposed ITS project is presented by the proposing agency or group of agencies (in the case of multi-jurisdictional projects). The final ITS project prioritization or ranking is based on a summation of individual subjective project rankings generated by committee members, considering the following factors:

- How the project complies with the current MAG ITS Strategic Plan
- How the project conforms to the current MAG Regional ITS Architecture
- If the project is supported by the local agency with necessary staff and operating costs
- If the estimated project schedule seems realistic
- MAG emissions analysis

The current ITS Strategic Plan for the MAG region, developed in 2001, provides a list of new ITS projects identified for the region as the short, medium, and long-term ITS implementation plans. To the extent feasible, the ITS Committee utilizes the Plan to guide future regional investments in ITS.

Important Note: All funds directed toward ITS projects are fully programmed at this time; there are no funds to be programmed in FY 2012.

Contact Information:

Sarath Joshua, ITS and Safety Program Manager
Leo Luo, ITS & Safety Engineer
302 N. 1st Avenue, Suite 300, Phoenix, AZ 85003
p. 602.254.6300, f. 602.254.6490
e-mail: sjoshua@azmag.gov and lluo@azmag.gov

MAG ITS Committee webpage:

http://www.azmag.gov/Committees/Committee.asp?CMSID=1050&MID=Transportation

8.3 Resources

8.3.1 MAG ITS Committee

The MAG ITS Committee is a technical committee that consists of representatives from Federal Highway Administration, Arizona DOT, Arizona Department of Public Safety, Regional Public Transit Authority, METRO Rail, Arizona State University and fifteen MAG member agencies. The committee provides oversight to the development of regional plans, such as the ITS Strategic Plan, the Regional ITS Architecture and studies to support Planning. These plans serve as the overall roadmap for investments in regional ITS infrastructure and in the application of technology-based solutions for managing and operating the regional multimodal

transportation system. The committee also recommends ITS applications on the arterial and freeway systems through projects that are programmed in the TIP. The primary focus of the committee is on publicly owned transportation facilities in the region. However, a number of regional ITS applications provide real-time traffic information that support value added products and services from private sector ITS partners such as radio, TV and internet based traffic information services.

The MAG ITS Committee, coordinated by the staff from MAG's ITS and Safety Group, is led by a Chair and Vice-Chair and meets the first Wednesday of each month at 10:00 AM, throughout the year. This meeting is open to public and is primarily attended by Traffic and/or ITS engineers from member agencies and consultants.

For details regarding the meeting schedule, agendas, archives of previous meeting minutes etc. please refer to the following link:

http://www.azmag.gov/Committees/Committee.asp?CMSID=1050&MID=Transportation

8.3.2 ITS Procurement Contract - Resources

There are some existing procurement contracts available through ADOT for purchasing ITS equipment. A list of the available contracts is provided in *Appendix L*. For updated information regarding these contracts please contact ADOT Procurement at (602) 712-7211.

9. ITS STAFF AND TRAINING REQUIREMENTS

For any jurisdiction, regardless of size, to benefit from the successful implementation of an ITS plan would require skilled and competent staff to operate and maintain the ITS facilities. Smaller jurisdictions have limited traffic and ITS facilities which are technologically sophisticated. Their operations and maintenance budgets are usually small and they also face challenges including lack of specialized training, inadequate staffing, in addition to keeping up with equipment hardware and software upgrades, and managing operations and maintenance activities across their entire jurisdiction.

As the smaller jurisdictions grow or increase their ITS infrastructure ensuring that they have the right staff to maintain and operate their traffic and ITS facilities is extremely crucial. Ensuring that agency staff managing, operating, and maintaining the ITS facilities have been trained to successfully operate the system is a major component of ITS planning. Another major component of ITS planning is planning ahead for a sufficient number of engineers, technicians, and specialists.

Utilizing existing regional and/or local training programs would be beneficial to providing training opportunities for staff. Training activities could be as simple as arranging technical training sessions by neighboring or local agencies that already have well trained and experienced staff in the ITS field.

This chapter presents staffing models/guidelines for a smaller jurisdiction to utilize as part of their ITS planning efforts. The chapter also provides local and regional resources for technical training that a smaller jurisdiction could benefit from.

9.1 What are the typical working models for 'operations and maintenance'?

A smaller jurisdiction could follow one of the following models for the operations and maintenance of its Traffic and ITS infrastructure:

- Have in-house staff trained in operations and maintenance
- Outsource the operations and maintenance to a specialized company
- Collaborate and engage in agreements with adjacent or larger jurisdiction to provide operations and maintenance support

9.2 What type of staff is needed for the maintenance and operations of ITS facilities?

The upkeep of Traffic and ITS infrastructure requires staff that have training in the operations of the equipment, and, are able to perform preventative and responsive activities for the effective functioning of the ITS equipment in the field. While planning for staff, as part of ITS planning efforts, a smaller jurisdiction should consider the following:

- Develop a staffing plan that provides for sufficient, qualified, and experience staff for maintaining and operating ITS systems.
    - This should ensure adequate quantity and skill level of staff.
    - This should consider contracting options where appropriate.

  - They should investigate if there are opportunities for collaboration with adjacent jurisdictions or larger jurisdictions

- Identify the consequences (including the associated cost) of not having adequate staffing resources available. Use this as justification to secure adequate funding for maintenance and operation staff.
- Ensure that proper career ladder is provided for ITS maintenance and operations personnel.

An agency may need a variety of staff positions and roles to adequately operate and maintain traffic signals and ITS infrastructure. Depending on the size of the agency and its needs, the type of staff position may vary. Some of the typical positions and tasks of Traffic/ITS staff is discussed below:

a. *Traffic Signal Engineer* – This staff person is responsible for the day-to-day operations of the signal system.

   Typical tasks include the following: Responding to public comments, approving new signal turn-on's, assisting in the TMC, evaluating signal timing on existing arterials, managing signal operations staff, and coordinating with the signal design and maintenance supervisors.

b. *Traffic Signal Technician/Analyst* – Staff assist the Traffic Signal Engineer with their day-to-day operations. Focus areas include signal timing, new signals, and the TMC.

c. *ITS Engineer* - This staff person is responsible for the implementation of ITS projects.

   Tasks include the following: Responding to public comments, evaluating new products, assisting in the TMC, managing ITS contractors and vendors, and coordinating with the signal design and maintenance supervisors.

d. *Traffic Signal Maintenance Technician* – Staff are generally responsible for troubleshooting and maintenance of the physical traffic signal equipment.

e. *Electronic Specialist* – Staff are responsible for the complex electronic equipment at the heart of the signal system.

   Some typical tasks may include:

   - Closed circuit television system repair (field and central system)
   - Fiber optic cable system testing, repair, and termination
   - Telecommunications systems maintenance and repair
   - Traffic management center systems maintenance and repair
   - Traffic signal controller electronics testing repair and inventory
   - Other ITS devices repair

f. *TMC Operators* – Staff are responsible for observing the traffic conditions, responding to incidents that occur in the field, and providing support to homeland security efforts. Their role is critical to the rapid response and resolution of the situation.

g. *ITS Technician* – responsible for maintaining the ITS hardware equipment in the field as well as identifying failures at specific surveillance and control devices. He or she assists the electronics technician in troubleshooting, testing incoming equipment, and setting traffic controllers as specified by the system operator.

h. *ITS Electronics technician* – responsible for diagnostic maintenance up to the device exchange level in the field, including complete responsibility for the operation of the traffic controllers, communication modems, and/or multiplexers. He or she is capable of diagnosing a failure, initiating corrective action, and performing preventive maintenance on the field electronics.

i. *Electronics supervising technician* – responsible for the responsibilities described for technicians and electronics technicians as well as scheduling and recording work performed by the technicians in the group and for preparing quantity and cost estimates for the annual budget.

j. *Public Relations Coordinator* – Staff are responsible for field phone calls from the public, coordinating with the Traffic Signal Engineer and Technician on responses, marketing the TMC, incident management plan, and traffic signal operations to the public. Depending on the size of the agency, this position could be a full-time position or these tasks might be passed on to the Traffic Signal Engineer and Technician.

It is to be noted that this information is for reference purposes only and is to be used for planning for specialty staff based on your agency's ITS operations and maintenance needs.

9.3 What staffing levels are needed for my agency?

Based on the research of local and national practices there are some staffing guidelines available for the categories of traffic signal systems, ITS devices and communications system:

Traffic Signals and Systems:

Maintenance and operations of traffic signals and traffic signal systems require staff skilled in management and operations of the traffic signals, and, field personnel to troubleshoot and repair field devices. There is no formula for determining staff size and composition for maintenance actions. The International Municipal Signal Association (IMSA) recommends 30-35 signals per technician. Another general guideline that is used in the industry is 40 to 50 traffic signals per technician.

Chapter 8 of the Traffic Signal Timing Manual developed by FHWA provides general guidelines on staffing needs for a traffic signal system. A summary of the staffing needs provided by the FHWA is shown in Table 9.1.

Table 9.1: Summary of Staffing Needs

Position	Number of Traffic Signals				
	1 to 50	51 to 100	101 to 200	201 to 500	501 to 1,000
Traffic Signal Engineer	0 - 1	1	1 - 2	2 - 5	5 - 10
Traffic Signal Analyst/Technician	0 - 1	0 - 1	1	1 - 3	3 - 5
ITS Engineer	-	-	0 - 1	1	1 - 3
Traffic Signal Maintenance Technician	1 - 2	2 - 4	4 - 7	7 - 17	17 - 33
Electronic Specialists	1	1	1 - 2	2 - 4	4 - 9
TMC Operators	-	-	2	2 - 4	4 - 9
Public Relations Coordinator	0 - 1	0 - 1	1	1	2

Source: Traffic Signal Timing Manual, FHWA

Additional data from various cities including those from local cities in the MAG region is presented in Table 9.2. This data was obtained from the *City of Mesa's ITS Strategic Plan* and comprises of data from the northwestern and southwestern United States including the City of Phoenix and other cities in the Phoenix Metropolitan area.

According to ITE's "Traffic Control System Operations" manual, a traffic signal system should have one traffic engineer for every 75 to 100 traffic signals, and one signal technician for every 40-50 traffic signals or other field devices. An NCHRP report (Synthesis 245) also suggests 38 to 43 signals per technician. The manual provides staffing guidelines for a continuously operated TMC which includes one center manager, two supervisors, and five system operators.

Additional research in this area is necessary since all agencies vary in terms of their staff's skill levels, the infrastructure, and the environment in which the equipment operates. For example, a signal technician that has ten years of experience with a particular traffic controller is likely able to troubleshoot a problem faster than a technician with less experience. In many cases, the difference in staff time needed is significantly higher, while the cost to the agency may be insignificant. This particularly effects agencies with high levels of staff turnover and is a notable problem for many agencies throughout the country.

The environmental conditions in which the traffic signal equipment operates may be an issue because older infrastructure that may be less user friendly or may fail or malfunction more often. As with staff experience, there is no specific research on the performance of traffic signal equipment over time, and new equipment can result in other problems for agencies. However, by utilizing a systems engineering approach during the selection and procurement of new traffic

signal equipment, an agency may be able to reduce the maintenance costs (staffing and consultant time) needed for the signal system.

Table 9.2 summarizes the number of traffic signals that can be supported by a single traffic signal technician.

Table 9.2: Summary of Traffic Signals per Technician

Agency	Amount	Description
General Rule (ITE)	40 - 50	Traffic signals per technician
IMSA	30 - 35	Traffic signals per technician
Hampton Study	47.1	Traffic signals per technician
NCHRP	38 - 43	Traffic signals per technician
Menlo Park	50	Traffic signals per technician
City of Phoenix	22 - 44	Traffic signals per technician
Phoenix metropolitan area	30	Traffic signals per technician
Albuquerque	60	Traffic signals per technician
Northwest Region – existing	70+	Traffic signals per technician
Northwest Region – desired	40 - 45	Traffic signals per technician
Seattle – existing	61	Traffic signals per technician
Proposed Guideline	**50**	**Traffic signals per technician**

Source: ITS Strategic Plan, City of Mesa

ITS Devices:

As mentioned previously, there are currently no established guidelines that agencies can utilize to determine maintenance staffing levels by classification for the number and type of ITS devices that it owns and operates. There are, however, several agencies that maintain ITS devices that have staffing levels and/or practices that can be found in literature. Examples of these agencies are identified in Table 9.3 with the corresponding number of ITS devices per technician.

Communication Systems:

Communication equipment and systems include fiber optic cable, radio, microwave, voice, spread-spectrum, networking and other technologies. Most agencies outsource the maintenance and operations of the communication systems as they require specialized expertise and most often certifications. A staffing guideline of *one maintenance staff person per 400 linear miles* of communication fiber is recommended.

Table 9.3: Summary of ITS Devices per Technician

Agency	Description
Oregon DOT	8 positions for 1750 devices **219 ITS devices per technician**
Maryland SHA	8 technicians for 135 portable/permanent VMS **17 ITS devices per technician**
	11 technicians for 250 CCTV, RWIS, detectors, and traveler advisory radio units **23 ITS devices per technician**
Virginia DOT	7 technicians for 1500 devices 1 engineer **214 ITS devices per technician**
WSDOT's NW Region	12 technicians for 1150 devices 100 miles of FO cable system **96 ITS devices per technician**
Guideline	**100 ITS devices per technician**

Source: ITS Strategic Plan, City of Mesa

9.4 What type of training will be required for staff?

Ensuring that the staff managing, operating, and maintaining the ITS facilities has been trained to successfully operate the system is a major component of the ITS plan. Some of the considerations when planning for training include the following:

- Identify, document, and assess the training needs associated with maintaining and operating the agency's ITS systems.
- Develop a training program for all personnel who have responsibilities for maintaining and operating ITS equipment.
    - Use vendors to provide training where appropriate.
    - Include cross-training where appropriate.
    - Include training on safety (also post safety procedures and have period refreshers)
- When designing and conduction training, make sure it is job-specific and hands-on.
- In contracts for ITS equipment and/or software, mandate that vendor must provide initial and on-going training.

Utilizing existing regional and/or local training programs would be beneficial to providing training opportunities for staff. Training activities could be as simple as technical sessions by neighboring or local agencies that already have well trained and experienced staff in the ITS field.

These technical sessions could be offered on a regular monthly basis and consist of bringing in outside experts to discuss important ITS components, software, and maintenance topics. TMC

and signal timing projects could be additional topics. Other training opportunities might be provided through attendance at conferences, education seminars, or universities.

The *FHWA Guidelines for Transportation Management Systems: Maintenance Concept and Plans* highlights the following critical training elements:

- Training by Vendors: Procurement contracts should include a requirement for on-site training of agency staff in maintenance and operations of the equipment, preferably conducted by the vendor.
- Training by Contractors: Procurement contracts should also include a requirement for on-site training of agency staff in the maintenance and operation of the assembled systems, including software, hardware, and devices.
- Training Library: The operating agency should maintain a library of system documentation and, if available, a videotape or DVD library of training.
- Staff Retention: This can be difficult in a high-tech environment, but there are ways to improve retention, such as providing for additional training, allowing travel to technical conferences, and workshops and other non-salary related perquisites for agency staff.

9.5 Are there any local resources or technical forums for ITS operations?

There are several existing regional technical forums for ITS planning and operations.

MAG

MAG member agencies can attend and participate in the various technical committees. The MAG ITS Committee is a technical committee that consists of representatives from Federal Highway Administration, Arizona DOT, Arizona Department of Public Safety, Regional Public Transit Authority, METRO Rail, Arizona State University and fifteen MAG member agencies. The committee provides oversight to the development of regional plans, such as the ITS Strategic Plan, the Regional ITS Architecture and studies to support Planning. These plans serve as the overall roadmap for investments in regional ITS infrastructure and in the application of technology-based solutions for managing and operating the regional multimodal transportation system. The committee also recommends ITS applications on the arterial and freeway systems through projects that are programmed in the TIP. The primary focus of the committee is on publicly owned transportation facilities in the region. However, a number of regional ITS applications provide real-time traffic information that support value added products and services from private sector ITS partners such as radio, TV and internet based traffic information services.

AZTech™

In order to stay current on the most up-to-date ITS operations, agency staff should be encouraged to participate in the regional technical forums. These forums will provide the opportunity to learn from agencies who may have implemented similar technologies and benefit from the exchange of knowledge with the various local and regional experts. One such technical forum in the MAG region is AZTech™ (www.aztech.org).

AZTech™ is the model deployment and regional management of ITS developed for the Phoenix Metropolitan area. AZTech™ champions the integration of intelligent communication and transportation systems technologies for regional solutions that provide timely and accurate information, save lives, improve mobility and enhance quality of life. AZTech™ provides ITS regional documents, regional operational guidelines, standards, training, workshops, etc.

ITS AZ

The Intelligent Transportation Society of Arizona (ITS AZ) is a state chapter of ITS America. ITS Arizona is a non-profit organization consisting of transportation professionals dedicated to improving transportation efficiency and safety, using advanced technologies.

ITS AZ (www.itsaz.org) provides professional development and networking, presents the newest information on ITS, organizes conferences, provides technical sessions in partnerships with local agencies (such as MCDOT), etc.

IMSA AZ

IMSA is a leading International Resource for information, education and certification in public safety. IMSA AZ is the Arizona chapter of the organization. IMSA provides quality certification programs for the safe installation, operation and maintenance of public safety systems. It also provides the latest information and education in the industry.

The attainment of certification is a means for individuals to indicate to the general public, coworkers, employers, and others that an impartial, nationally-recognized organization has determined that they are qualified to perform specific technical tasks by virtue of their technical knowledge and experiences. Certification also bestows a sense of achievement upon the certified individual since it reflects professional advancement in a chosen field. Certification can also provide an entry into many job assignments that otherwise would be difficult to obtain, since employers recognize certification as an indication of the individual's ability to do specific job tasks without the need for on-the-job training.

IMSA currently offers certification in the following fields:

- Electronics in Traffic Signals
- Fiber Optics for ITS
- Fire Alarm Monitoring
- Flagging and Basic Traffic Control
- Interior Fire Alarm
- Microprocessors in Traffic Signals
- Municipal Fire Alarm
- Roadway Lighting
- Signs and Markings
- Traffic Signals
- Traffic Signal Inspection
- Work Zone Traffic Control Safety
- Telecommunicator/Public Safety Dispatch

APPENDIX A

SUMMARY OF SCOPE OF WORK PRESENTED AT THE MAY 4, 2011 MAG ITS COMMITTEE MEETING

Task Order PL11-2
MAG Intelligent Transportation Systems Program
ITS Planning Guidelines for Smaller Jurisdictions
UPWP Task No: 600-0170-11

Background

As the population of the nation, currently near 300 million, keeps increasing so does the number of towns and cities where nearly 75 percent of this population live and work. In regions of the nation that are experiencing rapid growth, new or rapidly growing jurisdictions are struggling to keep up with infrastructure needs. Many examples can be found in former small rural jurisdictions located not too far from large urban centers. These new or rapidly growing suburban jurisdictions have to plan and build roads, water, sewerage, schools etc. all at the same time and must also be able to meet the needs of residents who are likely to have high expectations from their transportation system. Jurisdictions could take some early steps to ensure that they build safe and efficient transportation systems that would serve their jurisdiction well into the future. Making Intelligent Transportation Systems (ITS) an integral part of the jurisdiction's infrastructure plan would be such a step.

Project Description

This study is in support of MAG's strategic vision to plan, implement and evaluate ITS technologies that address regional goals and objectives of all transportation users. The goal of this study is to develop guidelines that could be readily utilized by smaller jurisdiction in the MAG region to plan, implement and operate ITS technology and traffic management infrastructure that will be needed by these communities in the future. The guidelines will also describe how agencies could access available regional funds for qualifying ITS projects. The Phoenix metropolitan region consists of 25 incorporated cities and towns, 3 native Indian communities, and rest of the unincorporated areas of Maricopa County. Smaller jurisdictions are defined as those with a population under 50,000 and based on the 2010 census data there are 17 smaller jurisdictions in the MAG region that would be engaged in this study.

Scope of Work

The following are the tasks involved in this study:

- Task 1: Study Kickoff Meeting
- Task 2: Gather Background Information
- Task 3: Develop Guidelines for establishing local agency's internal stakeholder group
- Task 4: Process for developing an inventory of ITS related infrastructure
- Task 5: Process for identifying priority ITS user services and functions
- Task 6: Develop and Prioritize ITS operational and implementation strategies
- Task 7: Develop a plan for ITS communications
- Task 8: Policies and practices related to ITS device location and operation
- Task 9: Funds for ITS capital improvements, operations and maintenance
- Task 10: Staff and Training Requirements

The working papers developed from each of the tasks will be compiled into the final report titled "ITS Planning Guidelines for Smaller Jurisdictions".

Schedule

The study is anticipated to be completed by December 2011.

APPENDIX B

MAY 18, 2011 ITS PLANNING WORKSHOP
POWER POINT PRESENTATION

MAG ITS Program

ITS Planning Guidelines for Smaller Jurisdictions

May 18, 2011

MARICOPA ASSOCIATION of GOVERNMENTS

JACOBS

AGENDA

• Introduction	9:00 – 9:10
• Project Description	9:10 - 9:20
• Overview of MAG'S Strategic Planning for the region	9:20 – 9:30
• ITS Toolbox for Small Urban Jurisdictions	9:30 – 10:00
• Break	10:00 – 10:10
• Breakout Session – Discussion of Needs/Priorities of Smaller Jurisdictions	10:10 - 11:00
• Complete Survey Questionnaire – Information about your community's ITS infrastructure and Traffic Management Interest/Needs/Priorities	11:00 – 11:30

MARICOPA ASSOCIATION of GOVERNMENTS

JACOBS

PROJECT DESCRIPTION

- MAG's initiative to help small jurisdictions
- MAG Region:
  - 25 Incorporated Cities and Towns
  - 3 Native Indian Communities
- Smaller Jurisdictions (Population<50,000)
  - 14 Cities and Towns
  - 3 Native Indian Communities

MARICOPA ASSOCIATION of GOVERNMENTS

JACOBS

MAG Member Agencies

#	Agency	2010 Census Population Data	#	Agency	2010 Census Population Data
1	Avondale	76,238	17	Litchfield Park	5,476
2	Apache Junction	35,840	18	Mesa	439,041
3	ADOT*	N/A	19	Maricopa County*	N/A
4	Buckeye	50,876	20	Paradise Valley	12,820
5	Carefree	3,363	21	Peoria	154,065
6	Cave Creek	5,015	22	Phoenix	1,445,632
7	Chandler	236,123	23	Queen Creek	26,361
8	El Mirage	31,797	24	Scottsdale	217,385
9	Fountain Hills	22,489	25	Surprise	117,517
10	Fort McDowell Yavapai Nation	971	26	Salt River Pima-Maricopa Indian Community	6,289
11	Gila Bend	1,922	27	Tempe	161,719
12	Gilbert	208,453	28	Tolleson	6,545
13	Glendale	226,721	29	Wickenburg	6,363
14	Goodyear	65,275	30	Youngtown	6,156
15	Guadalupe	5,523	31	FHWA*	N/A
16	Gila River Indian Community	11,712	32	Valley Metro*	N/A
			33	ASU*	N/A

* indicates ex-officio members

Note: Red indicates agencies with population < 51,000

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What is ITS?

- ITS - Intelligent Transportation Systems

- Elements of ITS include :
  - Traffic Management Systems (active)
  - Traveler Information Systems (active)
  - Systems for Efficient Truck Operations (active)
  - Vehicle to Vehicle Communications (R&D)
  - Vehicle to Infrastructure Communications (R&D)

Why ITS?

- Ability *to increase* Transportation System *Capacity*
  - *Active Traffic Management*
  - *Reliable Travel Times*
- Potential *to improve* Transportation System *Safety*
  - *Quick clearance of crashes*
  - *Prevent secondary crashes*

Goal of the Study

To develop *guidelines* that could be readily utilized by the smaller jurisdictions to *plan, implement and operate ITS and Traffic Management Infrastructure* within their community.

<u>Areas of Focus</u>

- Identify ITS infrastructure to meet future needs
- Funds for implementation
- Staff required to operate and maintain ITS

"I see a community that looks a lot like it does now, but with kinder and gentler roads. A place where technology [and economic growth] will not radically change things, but will offer more choice and a lot more quality of life."

- A vision statement by a public official during similar efforts

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Overview Of MAG ITS Strategic Plan

- MAG's ITS Plan provides a roadmap to address transportation needs for next 20 years
- MAG's Plan is consistent with National ITS Architecture
- ***Vision –*** Enhance the quality of life in the MAG region by applying technology and information-sharing to improve the multimodal transportation system.
- ***Mission –*** To plan, implement and evaluate appropriate ITS technologies, consistent with the national ITS program, that address regional goals and objectives of the transportation users.

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What ITS Systems Do We Have In The MAG Region?

- ADOT Freeway Management System (Detectors, DMS, ramp metering, speed cameras, 511)
- Arterial Traffic Management Systems (Signal coordination, signal pre-emption, close-circuit TV, arterial Dynamic Message Signs)
- Transit (Signal Priority for LRT, Queue jumper for BRT system)
- Traffic Management Centers (ADOT TOC & Local Agency TMCs)
- Incident Management (REACT – West Valley)

ITS Toolbox - For Small Jurisdictions	
Incident Management	Data Management
	Integrated Communications & Regional Connectivity Network (RCN)
Traffic Management	Interconnected Traffic Signal Systems
	Emergency Vehicle Preemption
	Dynamic Message Signs (fixed, portable)
	Speed Monitoring
	Vehicle Detection
	Traffic Data Collection (counts etc.)
	CCTV Cameras
	Remote monitoring of field devices
Safety	Speed Warning System
	Low Crossing Warning System
	School Zone Speed Monitoring
Transit	Automatic Vehicle Locator (AVL)
	Computer Aided Dispatch Services (CADS)
Traveler/Tourist Information Systems	Highway Advisory Radio (HAR)
	Cable TV Channel
	Traveler Information Web Page
	Road Weather Information System (RWIS)
Operations/Maintenance	GIS System
	Electronic Inventory Management
	Real time road condition information

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ITS Local Collaborative Efforts

TMC Joint Operations

The signals in Paradise Valley are operated via the City of Scottsdale's Traffic Management Center (TMC)

Bell Road ITS Project

Inter-Jurisdictional cooperation between Peoria, Surprise and MCDOT on collaborative traffic management

TMC Backup

The TMC in the City of Peoria serves as a backup to ADOT's Traffic Operations Center (TOC)

Regional Emergency Action Coordination Team (REACT)

Incident Management Program at MCDOT partnered with local cities to ensure safety and mobility

Regional TMC

The City of Tucson TMC operates all the jurisdiction's traffic signals in the region (including ADOT signals)

Additional Examples

Traffic Signal Optimization Program (TSOP)

Traffic Signal Coordination (along arterial corridors)

Emergency Vehicle Preemption (EVP)

For Police and Emergency Vehicles

Incident Management

Data Dispatch

Traffic Signal and Sign Inventory

Small jurisdictions can use off-shelf software programs

Eg: Sharonville, Ohio

Standard Operating Procedures

Between departments Eg: Public works/Fire/Police/Maintenance

Eg: Springdale, Ohio

BREAK

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BREAK-OUT SESSION

DISCUSSION OF NEEDS AND PRIORITIES

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REVIEW OF QUESTIONNAIRE/SURVEY

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Scope of Work

- Task 1: Study Kickoff Meeting
  - Establish Study Advisory Group (SAG)
- Task 2: Gather Background Information
  - 3-hr Workshop for the smaller jurisdictions
  - Open to all member agencies to provide advice/input
  - Identify needs/priorities of smaller jurisdictions
- Task 3: Develop Guidelines for establishing local agency's internal stakeholder group
- Task 4: Process for developing an inventory of ITS related infrastructure

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Scope of Work (contd.)

- Task 5: Process for identifying priority ITS user services and functions
- Task 6: Develop and Prioritize ITS operational and implementation strategies
- Task 7: Develop a plan for ITS communications
- Task 8: Policies and practices related to ITS device location and operation

Scope of Work (contd.)

- Task 9: Funds for ITS capital improvements, operations and maintenance
- Task 10: Staff and Training Requirements

Schedule

- Schedule for Completion - December 2011

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Thank You !

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TOC/TMC Examples

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ADOT Traffic Operations Center

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Chandler Traffic Management Center

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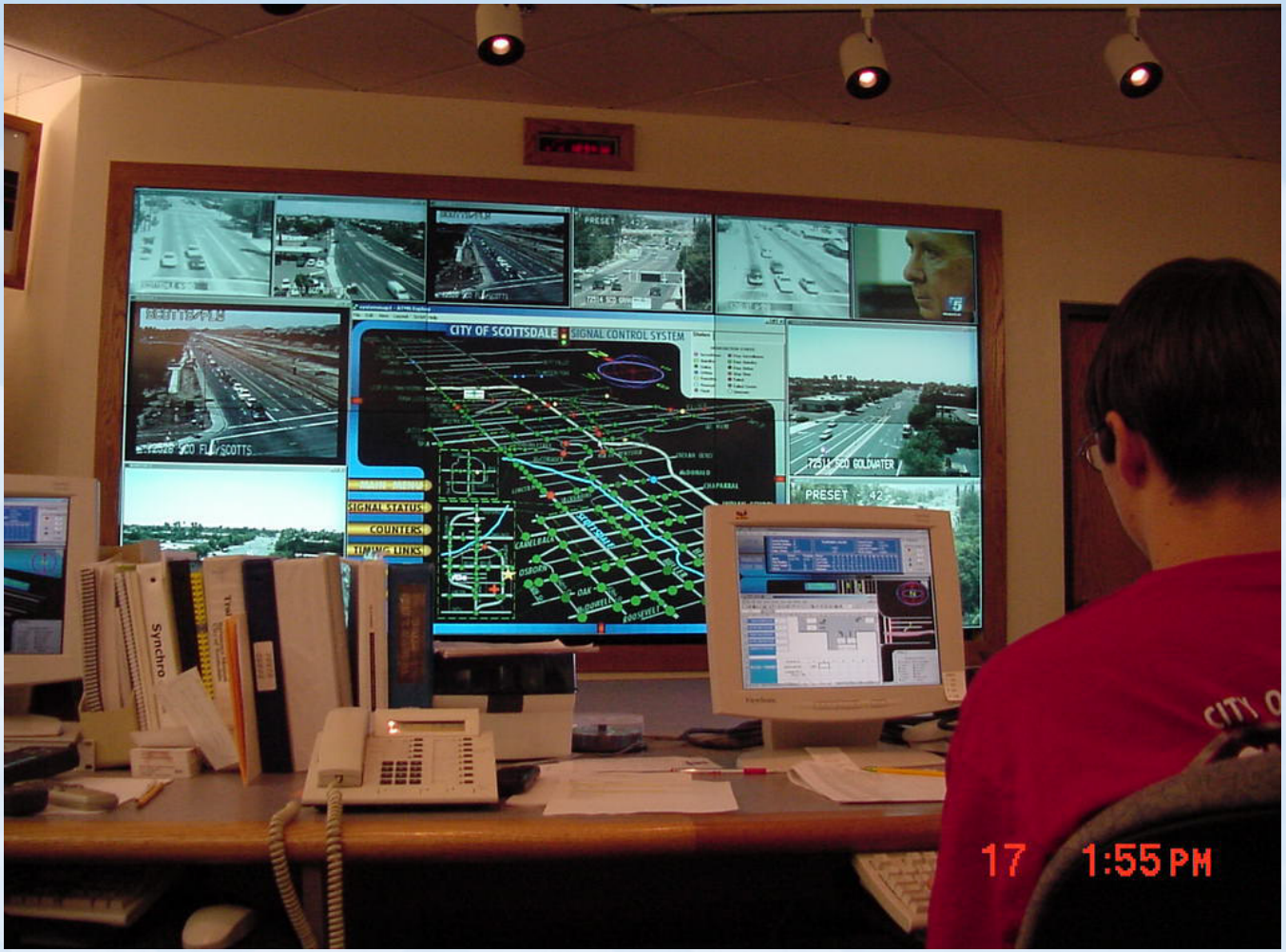
Scottsdale Traffic Management Center



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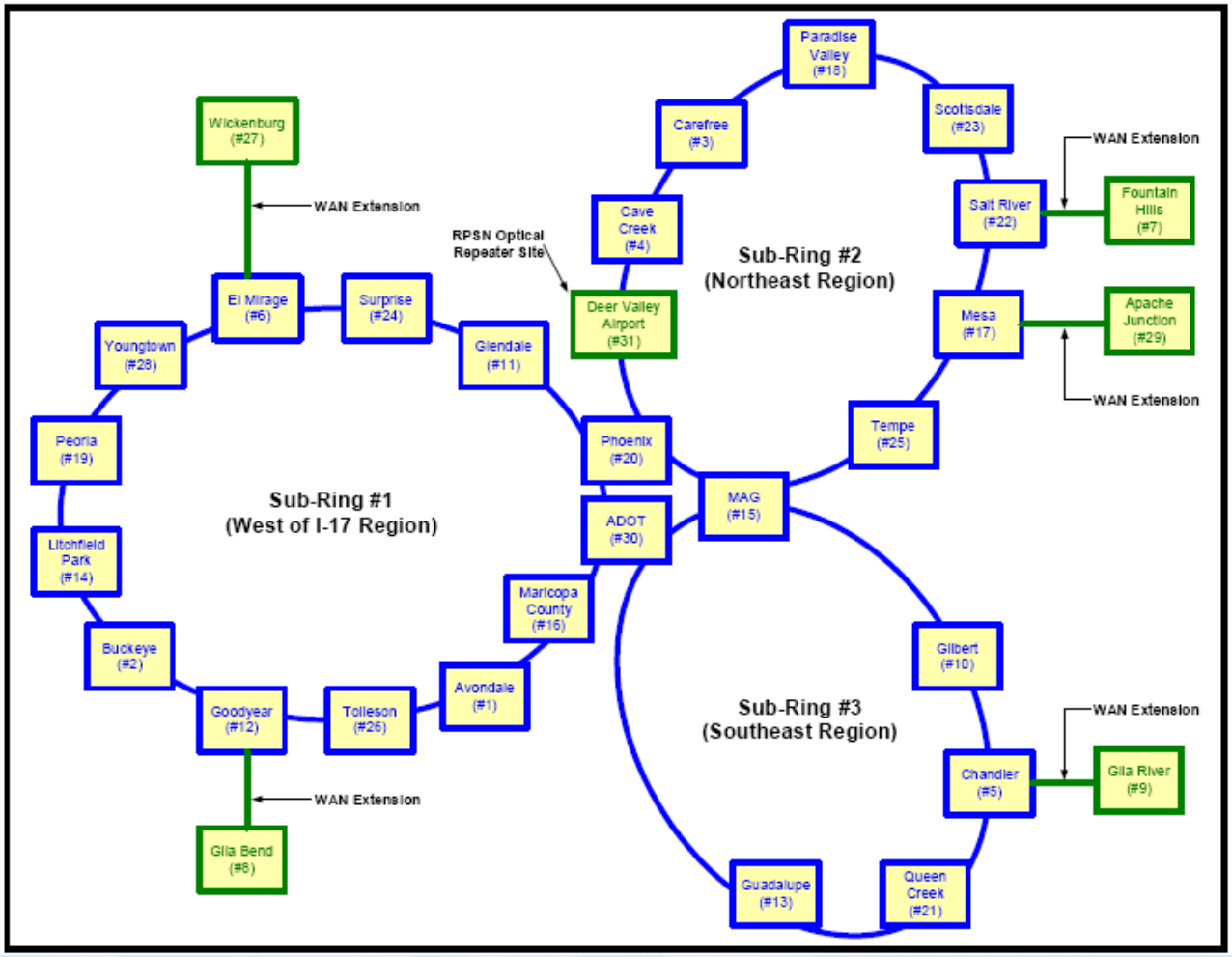
Regional Community Network (RCN) Map



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APPENDIX C

ITS PLANNING QUESTIONNAIRE

MARICOPA ASSOCIATION OF GOVERNMENTS ITS PROGRAM
ITS PLANNING GUIDELINES FOR SMALL JURISDICTIONS
QUESTIONNAIRE

Name _____

Title: _____

Organization _____

Address _____

_____

Phone _____

E-mail _____

Date _____

Project Description:

This study is being conducted to develop Intelligent Transportation Systems (ITS) Planning Guidelines for smaller jurisdictions, as part of the MAG's strategic vision and mission to help implement ITS solutions for the region. A key objective of this study is to develop guidelines that could be readily utilized by smaller jurisdiction to plan, implement and operate ITS.

Staff at smaller local jurisdiction will be able utilize the document produced through this project as a quick reference for: (1) Developing the scope of work for a consultant project to develop the agency's ITS Plan; OR (2) If such a Plan is premature, then parts of this document will be useful to help guide the agency prepare for a future that includes ITS infrastructure and traffic management functions.

To help develop the guidelines for smaller jurisdictions in the MAG region, the study needs your valuable input. Your response to this questionnaire will help us understand the needs and priorities of small jurisdictions and help guide the development of the ITS planning guidelines that will help your community.

We appreciate your time in providing us this information. Please take a few moments to read and respond to the following questions:

AGENCY INFORMATION

1. How is your agency organized? Please describe briefly how your department/section fits into the overall organization of your jurisdiction?

   _____
   _____
   _____

2. Does your agency have a specific mission statement referring to transportation? What are your agency's priorities?

   _____
   _____
   _____

3. Does your agency have a 10-20 yr. Transportation Plan? If so, what is the most current update?

   _____
   _____
   _____

4. What is the current process for transportation/road/traffic management infrastructure planning at your organization?

   _____
   _____
   _____

5. Who are the key staff responsible for transportation/roads/traffic management infrastructure planning at your organization?

   _____
   _____
   _____

6. What are the primary responsibilities of your department/section?

   _____
   _____
   _____

7. What are your individual responsibilities?

   _____
   _____
   _____

8. What traffic management technologies do you currently have or plan to implement in the near future?

   _____
   _____
   _____

AGENCY STRUCTURE/INTERACTIONS

INTERNAL

1. How does your department interact with other departments within your organization (e.g. with Planning, Information Technology, Police, Engineering, GIS, Maintenance, transit etc.)

   _____
   _____
   _____

2. What information do you provide to other departments within your organization? What methods/technologies do you use to share information? (e.g. emergency dispatch services, traffic information, construction activities, school information etc.)

   _____
   _____
   _____

3. What information is provided to you by other departments within your organization? What process/methods are used to provide that information?

   _____
   _____
   _____

4. Is your agency looking/planning any changes to the way information is being shared between departments (new technology, equipment)?

   _____
   _____
   _____

EXTERNAL

1. Does your agency share infrastructure, operations and maintenance support with adjacent jurisdictions? If so, please provide details.

   _____
   _____
   _____

2. What information do you provide to adjacent jurisdictions, regional or State organizations related to transportation operations?

   _____
   _____
   _____

3. What information do you receive adjacent jurisdictions, regional or State organizations related to transportation operations?

_____
_____
_____

4. Identify other stakeholders in your jurisdiction that are major traffic generators like schools, major employers, and special event organizers.

_____
_____
_____

AGENCY TRANSPORTATION SYSTEM

GENERAL

1. What are your jurisdictions biggest challenges affecting transportation operations? (i.e. congestion, special traffic generators, land-use, population composition, signal coordination, public safety, qualified staff etc.)

_____
_____
_____

2. How do you think these problems can be addressed? What would be your agency's top priorities? Please list.

_____
_____
_____

3. Are there any specific issues unique to your community?

_____
_____
_____

ITS AND TRAFFIC MANAGEMENT

1. Does your jurisdiction currently use any form of ITS technology? If so, please describe.

_____
_____

2. What type of signal system do you have?

_____
_____

3. Do you have emergency vehicle preemption at any intersection? If so, how many locations and what system is being used (3M or Tomar)?

   _____

   _____

4. How do you currently communicate to your devices in the field? (i.e. interconnect, fiber, radio etc.)

   _____

   _____

5. Do you share ITS infrastructure with other jurisdictions? If so, who and what?

   _____

   _____

6. At which location in your jurisdiction do you experience the highest incidence of annual crashes? traffic congestion?

   _____

   _____

7. Does your jurisdiction experience high tourist traffic? If so, please explain.

   _____

   _____

8. What types of Planned Special Events occur in your jurisdiction? (i.e. fairs, religious events, sporting events etc.)

   _____

   _____

FUTURE NEEEDS

1. What challenges does your jurisdiction have to overcome to improve the efficiency of the transportation system?

   _____

   _____

   _____

   _____

   _____

2. What opportunities exist in your planning process? (i.e. opportunities to coordinate with other projects, opportunity to collaborate with adjacent jurisdictions, possible funding sources etc.)

   _____

   _____

   _____

   _____

   _____

3. What are some unique strengths of your jurisdiction that you can use to leverage the opportunities to improve transportation within your community?

   _____
   _____
   _____

4. What information/resources are you looking to help you perform your daily activities (transportation related) more effectively? (i.e. construction updates, real-time video etc.)

   _____
   _____
   _____

OTHER

1. Would you be interested in serving on the Study Advisory Group (SAG) for this project (your time commitment to this effort will not exceed a total of 4 hours each month over a 6-8 month period) ?

   _____
   _____
   _____

2. Are there other people in your agency that you recommend we interview to get some of the information requested in the above sections? If so, please provide their contact information below:

   Name: _____ Name: _____
   e-mail: _____ e-mail: _____
   Phone #: _____ Phone #: _____

   Name: _____ Name: _____
   e-mail: _____ e-mail: _____
   Phone #: _____ Phone #: _____

APPENDIX D

RESPONSES TO ITS PLANNING QUESTIONNAIRE

Criminal Investigations
11485 W. Civic Center Drive
Avondale, AZ 85323
Phone: 623-333-7005
Fax: 623-333-0702

Avondale
Police Department

Fax

To: Shanthi Krishnan **From:** Lt. Espinoza

Fax: **Pages:**

Phone: 602-253-1202 **Date:**

Re: **CC:** [Click here and type name]

☐ **Urgent** ☐ **For Review** ☐ **Please Comment** X **Please Reply** ☐ **Please Recycle**

The information contained in the FAX is intended only for the use of the addressee and may contain information that is privileged and confidential. If you did not receive all the pages in this FAX, or you received this FAX in error please call the Avondale Police Department at (623) 333-7005.

MARICOPA ASSOCIATION of GOVERNMENTS

JACOBS

MARICOPA ASSOCIATION OF GOVERNMENTS ITS PROGRAM
ITS PLANNING GUIDELINES FOR SMALL JURISDICTIONS
QUESTIONNAIRE

Name	Memo Espinoza
Title:	Criminal Investigations Lieutenant
Organization	Avondale Police Department
Address	11485 W. Civic Center Dr.
	Avondale AZ. 85323
Phone	623-333-7235
E-mail	mespinoza@avondale.org
Date	06/07/11

Project Description:

This study is being conducted to develop Intelligent Transportation Systems (ITS) Planning Guidelines for smaller jurisdictions, as part of the MAG's strategic vision and mission to help implement ITS solutions for the region. A key objective of this study is to develop guidelines that could be readily utilized by smaller jurisdiction to plan, implement and operate ITS

Staff at smaller local jurisdiction will be able utilize the document produced through this project as a quick reference for: (1) Developing the scope of work for a consultant project to develop the agency's ITS Plan; OR (2) If such a Plan is premature, then parts of this document will be useful to help guide the agency prepare for a future that includes ITS infrastructure and traffic management functions.

To help develop the guidelines for smaller jurisdictions in the MAG region, the study needs your valuable input. Your response to this questionnaire will help us understand the needs and priorities of small jurisdictions and help guide the development of the ITS planning guidelines that will help your community.

We appreciate your time in providing us this information. Please take a few moments to read and respond to the following questions:

AGENCY INFORMATION

1. How is your agency organized? Please describe briefly how your department/section fits into the overall organization of your jurisdiction?

   The Criminal Investigations Bureau of the Avondale Police Department is responsible for investigating all felony cases in the City of Avondale. Furthermore, CIB is responsible for conducting follow-up in some misdemeanor cases.

2. Does your agency have a specific mission statement referring to transportation? What are your agency's priorities?

   The Avondale Police Department mission statement does not specifically refer to transportation directly. Our agencies priorities are to improve investigations, improve report writing, increase on-view activity and reduce crime.

3. Does your agency have a 10-20 yr. Transportation Plan? If so, what is the most current update?

   My agency's 5 year plan does discuss traffic, more specific, the traffic unit. The five year plan was last updated in 2008.

4. What is the current process for transportation/road/traffic management infrastructure planning at your organization?

   The traffic unit of the Avondale Police Department's infrastructure planning is joint endeavor between us and the Traffic Engineering Department of the City of Avondale. The infrastructure planning involved statistical data and forward thinking.

5. Who are the key staff responsible for transportation/roads/traffic management infrastructure planning at your organization?

   Myself.

6. What are the primary responsibilities of your department/section?

   Provide statistical data

7. What are your individual responsibilities?

   Provide statistical data to Traffic Engineering

8. What traffic management technologies do you currently have or plan to implement in the near future?
   N/A

AGENCY STRUCTURE/INTERACTIONS

INTERNAL

1. How does your department interact with other departments within your organization (e.g. with Planning, Information Technology, Police, Engineering, GIS, Maintenance, transit etc.)

   Very well. We have a very good relationship with our Traffic Engineering Department.

2. What information do you provide to other departments within your organization? What methods/technologies do you use to share information? (e.g. emergency dispatch services, traffic information, construction activities, school information etc.)

   Statistical data.

3. What information is provided to you by other departments within your organization? What process/methods are used to provide that information?

   Ongoing traffic information as far as road closures and restrictions from the Traffic Engineering Department.

4. Is your agency looking/planning any changes to the way information is being shared between departments (new technology, equipment)?

   Not at this time.

EXTERNAL

1. Does your agency share infrastructure, operations and maintenance support with adjacent jurisdictions? If so, please provide details.
   No

2. What information do you provide to adjacent jurisdictions, regional or State organizations related to transportation operations?
   None

3. What information do you receive adjacent jurisdictions, regional or State organizations related to transportation operations?
   None

4. Identify other stakeholders in your jurisdiction that are major traffic generators like schools, major employers, and special event organizers.
   Garden Lakes Elementary School, Collier Elementary, Universal Technical Institute.

AGENCY TRANSPORTATION SYSTEM

GENERAL

1. What are your jurisdictions biggest challenges affecting transportation operations? (i.e. congestion, special traffic generators, land-use, population composition, signal coordination, public safety, qualified staff etc.)
   Ongoing construction

2. How do you think these problems can be addressed? What would be your agency's top priorities? Please list.
   Managing the construction sites by hiring off-duty officers.

3. Are there any specific issues unique to your community?
   None that we can think of.

ITS AND TRAFFIC MANAGEMENT

1. Does your jurisdiction currently use any form of ITS technology? If so, please describe.
   Unknown

2. What type of signal system do you have?
   Unknown

3. Do you have emergency vehicle preemption at any intersection? If so, how many locations and what system is being used (3M or Tomar)?
   No

4. How do you currently communicate to your devices in the field? (i.e. interconnect, fiber, radio etc.)
   Radio

5. Do you share ITS infrastructure with other jurisdictions? If so, who and what?
   Unknown

6. At which location in your jurisdiction do you experience the highest incidence of annual crashes? traffic congestion?
   Dysart and McDowell Rd.

7. Does your jurisdiction experience high tourist traffic? If so, please explain.
   No

8. What types of Planned Special Events occur in your jurisdiction? (i.e. fairs, religious events, sporting events etc.)
   Sporting events at Friendship Park,

FUTURE NEEEDS

1. What challenges does your jurisdiction have to overcome to improve the efficiency of the transportation system?
   Unknown

2. What opportunities exist in your planning process? (i.e. opportunities to coordinate with other projects, opportunity to collaborate with adjacent jurisdictions, possible funding sources etc.)
   Inter-Department discussion/meetings

3. What are some unique strengths of your jurisdiction that you can use to leverage the opportunities to improve transportation within your community?
   Good communication between the police department and traffic engineering

4. What information/resources are you looking to help you perform your daily activities (transportation related) more effectively? (i.e. construction updates, real-time video etc.)

OTHER

1. Would you be interested in serving on the Study Advisory Group (SAG) for this project (your time commitment to this effort will not exceed a total of 4 hours each month over a 6-8 month period) ?
   Yes

2. Are there other people in your agency that you recommend we interview to get some of the information requested in the above sections? If so, please provide their contact information below:

   Name: Margaret Pixley
   e-mail: mboone-pixley@avondale.org
   Phone #: 623-333-4217

   Name: _____
   e-mail: _____
   Phone #: _____

   Name: _____
   e-mail: _____
   Phone #: _____

   Name: _____
   e-mail: _____
   Phone #: _____

MARICOPA ASSOCIATION OF GOVERNMENTS ITS PROGRAM
ITS PLANNING GUIDELINES FOR SMALL JURISDICTIONS
QUESTIONNAIRE

Name	Thomas Chlebanowski PE, PTOE
Title:	Traffic Engineer
Organization	W.C. Scouten, Inc-Town of Buckeye
Address	1626 N Litchfield Road #310
	Goodyear, Arizona 85395
Phone	623-691-8010
E-mail	thomas@scoutten.com
Date	6-29-11

Project Description:

This study is being conducted to develop Intelligent Transportation Systems (ITS) Planning Guidelines for smaller jurisdictions, as part of the MAG's strategic vision and mission to help implement ITS solutions for the region. A key objective of this study is to develop guidelines that could be readily utilized by smaller jurisdiction to plan, implement and operate ITS.

Staff at smaller local jurisdiction will be able utilize the document produced through this project as a quick reference for: (1) Developing the scope of work for a consultant project to develop the agency's ITS Plan; OR (2) If such a Plan is premature, then parts of this document will be useful to help guide the agency prepare for a future that includes ITS infrastructure and traffic management functions.

To help develop the guidelines for smaller jurisdictions in the MAG region, the study needs your valuable input. Your response to this questionnaire will help us understand the needs and priorities of small jurisdictions and help guide the development of the ITS planning guidelines that will help your community.

We appreciate your time in providing us this information. Please take a few moments to read and respond to the following questions:

AGENCY INFORMATION

1. How is your agency organized? Please describe briefly how your department/section fits into the overall organization of your jurisdiction?

   Town Engineering and Public Works as part of Community development services to provide Engineering services for the Town

2. Does your agency have a specific mission statement referring to transportation? What are your agency's priorities?

   The Town of Buckeye will plan for and build a balanced and comprehensive circulation system that moves people and goods.

3. Does your agency have a 10-20 yr. Transportation Plan? If so, what is the most current update?

   Yes- Draft 2009 TMP with a 20 year Horizon

4. What is the current process for transportation/road/traffic management infrastructure planning at your organization?

   CIP programming on 5 year level, general consensus building through the TMP and various corridor studies commission by the Town, MCDOT and the elements of the I-10 Hassayampa Framework Study.

5. Who are the key staff responsible for transportation/roads/traffic management infrastructure planning at your organization?

   Woodrow C. Scoutten, PE-Development Services Director and Town Engineer
   Larry Harmer-Planning and Zoning Manager
   Sean Banda - Town Associate Planner
   Scott Lowe, PE Public Works
   Thomas Chlebanowski, PE, PTOE-Traffic Engineer

6. What are the primary responsibilities of your department/section?

   Traffic Engineering, ITS, safety, grant/resource funding provisioning, planning of ITS systems.

7. What are your individual responsibilities?

   Traffic Engineering, ITS, safety, grant/resource funding provisioning, planning of ITS systems.

8. What traffic management technologies do you currently have or plan to implement in the near future?

During off peak hours, the continuation of deployment of the Town Standard advance detection systems at various intersections to enable operation of continuous platoon volume character monitoring, dilemma zone detection with continuous speed and lane tracking for smart gap control of traffic flow during off peak hours. During peak hours, and after eventual in fill of traffic signalization and development of traffic demand, provide for coordinated and interconnected fiber optic backbone corridors along key arterial streets with critical freeway connections.

AGENCY STRUCTURE/INTERACTIONS

INTERNAL

1. How does your department interact with other departments within your organization (e.g. with Planning, Information Technology, Police, Engineering, GIS, Maintenance, transit etc.)

   Direct consensus building and partnering with police communications department, water department and IT department by coordinated team sharing of information, ideas and planning to minimize redundancy of systems and infrastructure.

2. What information do you provide to other departments within your organization? What methods/technologies do you use to share information? (e.g. emergency dispatch services, traffic information, construction activities, school information etc.)

   General communication via email of future construction and development high level broad based plans of ITS information on incident, emergency and event mangagement. Future modes or concepts of information and operation are hoped to be developed.

3. What information is provided to you by other departments within your organization? What process/methods are used to provide that information?

   Same as previous question #2

4. Is your agency looking/planning any changes to the way information is being shared between departments (new technology, equipment)?

   Yes, agency is looking to change this and improve/build upon the way information is shared and perhaps envision and plan for a system to streamline the methods.

EXTERNAL

1. Does your agency share infrastructure, operations and maintenance support with adjacent jurisdictions? If so, please provide details.

   Currently no official infrastructure to share but general outreach to neighboring cities (Surprise and Goodyear, MCDOT) have previously be undertaken but have not progressed for some time.

2. What information do you provide to adjacent jurisdictions, regional or State organizations related to transportation operations?

   Nothing in particular except reported traffic crash incidents

3. What information do you receive adjacent jurisdictions, regional or State organizations related to transportation operations?

   Historic crash data, ADOT construction staging and incident/construction information that relates to compromised or reduction in operational efficiency on state and federal roadway segments (i.e., I-10, SR 85).

4. Identify other stakeholders in your jurisdiction that are major traffic generators like schools, major employers, and special event organizers.

   Concentrated quick service restaurant, convenience market and long haul fueling operations (i.e. Love's Truck Stop-Miller Road).

   Walmart distribution warehouse on Southern Avenue and Watson Road

   Odyssey Preparatory Academy (Private Charter School)

   Buckeye Rodeo-Hellzapoppin Event

   Youngker High School, Buckeye Union High School, Verrado High School, Verrado Middle School, Verrado Elementary School, Buckeye Elementary School, Bales Elementary School, Sundance Elementary School, Freedom Elementary School

AGENCY TRANSPORTATION SYSTEM

GENERAL

1. What are your jurisdictions biggest challenges affecting transportation operations? (i.e. congestion, special traffic generators, land-use, population composition, signal coordination, public safety, qualified staff etc.)

   Schools-adjacent ways and safe routes to school needs and roadway/traffic control infrastructure needed within close proximity (about 1-2miles) to schools.

   Public safety and conspicuity of traffic control devices by drivers.

2. How do you think these problems can be addressed? What would be your agency's top priorities? Please list.

   Public awareness and respect for traffic control devices
   Added adjacent ways funding around schools for school zone treatments
   Staggered school dismissal times

Access management control treatments at various high trip generator establishments (i.e., adjacent to convenience markets, gas stations, fast food restaurants).

3. Are there any specific issues unique to your community?

   None additionally noted than those stated in #2 above

ITS AND TRAFFIC MANAGEMENT

1. Does your jurisdiction currently use any form of ITS technology? If so, please describe.

   None

2. What type of signal system do you have?

   Isolated, uncoordinated, non-interconnected free mode operating signalization with advanced detection continuous tracking variable lane and speed detection of traffic.

3. Do you have emergency vehicle preemption at any intersection? If so, how many locations and what system is being used (3M or Tomar)?

   Yes-3M Opticom operations on all signals owned by the town except for old historic downtown Buckeye as these signals were installed in the 1970s and early 1980s.

4. How do you currently communicate to your devices in the field? (i.e. interconnect, fiber, radio etc.)

   No devices but some localized pockets of installed FO conduit raceways for future interconnect.

5. Do you share ITS infrastructure with other jurisdictions? If so, who and what?

   Nothing to share at this time

6. At which location in your jurisdiction do you experience the highest incidence of annual crashes? traffic congestion?

Some rural cross section roadways that are stop controlled and fully improved signalized arterial sections primary close to retail locations such as at along Watson Road.

7. Does your jurisdiction experience high tourist traffic? If so, please explain.

   None noted….not particularly a destination tourist attraction.

8. What types of Planned Special Events occur in your jurisdiction? (i.e. fairs, religious events, sporting events etc.)

   Rodeo-Hellzapoppin
   Demolition Derby
   Christmas Carnival
   Easter Egg Hunt

FUTURE NEEEDS

1. What challenges does your jurisdiction have to overcome to improve the efficiency of the transportation system?

   Scalloped street segments, lack of development and funding to drive additional improvements of roadway segments and proposed signalized intersections that could leverage the cheaper construction costs and value of money financing as an opportunity to be ahead of the improvements and infrastructure curve.

2. What opportunities exist in your planning process? (i.e. opportunities to coordinate with other projects, opportunity to collaborate with adjacent jurisdictions, possible funding sources etc.)

   Widening of Interstate-10 from Verrado Way to SR 85 as a basis for improving capacity and essentially borrowing information and resource provision tools from our City of Goodyear neighbors to possibly achieve the opportunity to accomplish this critical goal.

3. What are some unique strengths of your jurisdiction that you can use to leverage the opportunities to improve transportation within your community?

   Previous Town Manager of 18 years from the City of Goodyear to help strategize the partnering and learning from our City of Goodyear neighbors for transportation uniformity and connectivity.

4. What information/resources are you looking to help you perform your daily activities (transportation related) more effectively? (i.e. construction updates, real-time video etc.)

   It depends on what can be offered. Real time video is desirable, but most likely not available within the remote areas such as Buckeye. Also construction updates are also desirable, both at state and County level

OTHER

1. Would you be interested in serving on the Study Advisory Group (SAG) for this project (your time commitment to this effort will not exceed a total of 4 hours each month over a 6-8 month period) ?

   Yes please include me in on this SAG team.

2. Are there other people in your agency that you recommend we interview to get some of the information requested in the above sections? If so, please provide their contact information below:

   Name: _____ Name: _____
   e-mail: _____ e-mail: _____
   Phone #: _____ Phone #: _____

   Name: _____ Name: _____
   e-mail: _____ e-mail: _____
   Phone #: _____ Phone #: _____

MARICOPA ASSOCIATION OF GOVERNMENTS ITS PROGRAM
ITS PLANNING GUIDELINES FOR SMALL JURISDICTIONS
QUESTIONNAIRE

Name	Eric Fitzer
Title:	Planning & Economic Development Director
Organization	Town of Gila Bend
Address	644 W Pima Street P.O. Box A
	Gila Bend, AZ 85337
Phone	602-702-1742
E-mail	efitzer@gilabendaz.org
Date	5-24-11

Project Description:

This study is being conducted to develop Intelligent Transportation Systems (ITS) Planning Guidelines for smaller jurisdictions, as part of the MAG's strategic vision and mission to help implement ITS solutions for the region. A key objective of this study is to develop guidelines that could be readily utilized by smaller jurisdiction to plan, implement and operate ITS.

Staff at smaller local jurisdiction will be able utilize the document produced through this project as a quick reference for: (1) Developing the scope of work for a consultant project to develop the agency's ITS Plan; OR (2) If such a Plan is premature, then parts of this document will be useful to help guide the agency prepare for a future that includes ITS infrastructure and traffic management functions.

To help develop the guidelines for smaller jurisdictions in the MAG region, the study needs your valuable input. Your response to this questionnaire will help us understand the needs and priorities of small jurisdictions and help guide the development of the ITS planning guidelines that will help your community.

We appreciate your time in providing us this information. Please take a few moments to read and respond to the following questions:

AGENCY INFORMATION

1. How is your agency organized? Please describe briefly how your department/section fits into the overall organization of your jurisdiction?
   The Planning and Economic Development Department is the one stop shop for the Town of Gila Bend on all Planning and Engineering functions for the Town. The department is tasked with the coordination of all on-call contracts specific to engineering, design and GIS.

2. Does your agency have a specific mission statement referring to transportation? What are your agency's priorities?
   The Town does not have a current mission statement as of this time. However the Town is a funding partner, along with MAG and MCDOT, for the Gila Bend small Area Transportation Study. This Study should identify an overall mission statement with regards to Transportation for the Gila Bend Area.

3. Does your agency have a 10-20 yr. Transportation Plan? If so, what is the most current update?
   As of right now know, but the Gila Bend Small Area Transportation Study will fill this void.

4. What is the current process for transportation/road/traffic management infrastructure planning at your organization?
   Traffic management is mostly taken care of by ADOT. However the Town is looking to take a more proactive role. Any new development is required to submit either TIA's or Traffic letters verifying amounts of traffic generated. Both the Town and the Town's consultant engineer review such documents with regard to recommended improvements for such development.

5. Who are the key staff responsible for transportation/roads/traffic management infrastructure planning at your organization?
   Bill Menard; Public Works Director and Eric Fitzer, Planning and Economic Development Director.

6. What are the primary responsibilities of your department/section?
   Planning and Zoning, improving existing infrastructure, managing on-call engineering contracts, flood control coordination, code compliance, new infrastructure development, economic development, GIS coordination, CIP, Building Safety

7. What are your individual responsibilities?
   See above

8. What traffic management technologies do you currently have or plan to implement in the near future?

The Town will be getting its first Traffic light by 2012, with a possible second in 2013. As of right now we are looking to get ahead of the game and start to implement ITS standards prior to new development.

AGENCY STRUCTURE/INTERACTIONS

INTERNAL

1. How does your department interact with other departments within your organization (e.g. with Planning, Information Technology, Police, Engineering, GIS, Maintenance, transit etc.)
   The Town contracts with Maricopa County Sheriff's office for police service. All others are within the department, except for Maintenance which is under Public Works.

2. What information do you provide to other departments within your organization? What methods/technologies do you use to share information? (e.g. emergency dispatch services, traffic information, construction activities, school information etc.)
   Most information is shared via website, email, in person or notice.

3. What information is provided to you by other departments within your organization? What process/methods are used to provide that information?
   Same as above.

4. Is your agency looking/planning any changes to the way information is being shared between departments (new technology, equipment)?
   The Town is looking to revamp website to take advantage of social media.

EXTERNAL

1. Does your agency share infrastructure, operations and maintenance support with adjacent jurisdictions? If so, please provide details.
   As of this point, we do not, accept for ADOT.

2. What information do you provide to adjacent jurisdictions, regional or State organizations related to transportation operations?
   See above

3. What information do you receive adjacent jurisdictions, regional or State organizations related to transportation operations?
   ADOT notifies via email and notices sent to the Town.

4. Identify other stakeholders in your jurisdiction that are major traffic generators like schools, major employers, and special event organizers.
   _Gila Bend Unified School District, Abengoa (Solana Power Plant), Gila River Power Plant, Doubletree Papermills, Sarah Farms,

AGENCY TRANSPORTATION SYSTEM

GENERAL

1. What are your jurisdictions biggest challenges affecting transportation operations? (i.e. congestion, special traffic generators, land-use, population composition, signal coordination, public safety, qualified staff etc.)
   Qualified Staff, aging infrastructure, lack of multi modal transportation infrastructure, lack of crossings pedestrian crossings, increasing VPD.

2. How do you think these problems can be addressed? What would be your agency's top priorities? Please list.
   Yes with Proper infrastructure planning, proper maintenance planning, training, funding assistance, notification of funding programs.

3. Are there any specific issues unique to your community?
   Not necessarily, however only one school crossing along the state highway is an issue. Once school is out there are no crossings on State Route 85. With increasing VPD pedestrians and bicyclists have no way to cross.

ITS AND TRAFFIC MANAGEMENT

1. Does your jurisdiction currently use any form of ITS technology? If so, please describe.
   None

2. What type of signal system do you have?
   1st signal will be going in, in 2012, others hopefully will be built in later years.

3. Do you have emergency vehicle preemption at any intersection? If so, how many locations and what system is being used (3M or Tomar)?
   None

4. How do you currently communicate to your devices in the field? (i.e. interconnect, fiber, radio etc.)
   None

5. Do you share ITS infrastructure with other jurisdictions? If so, who and what?
   We do not.

6. At which location in your jurisdiction do you experience the highest incidence of annual crashes? Traffic congestion?
   Intersection of State Route 85 (Pima Street) and B-8 (Butterfield Trail) as well as at the intersection of Maricopa Road and State Route 85.

7. Does your jurisdiction experience high tourist traffic? If so, please explain.
   Yes, during winter months with winter visitors and especially on holiday weekends when people are traveling to and from Rocky Point, Glamis, San Diego and so forth.

8. What types of Planned Special Events occur in your jurisdiction? (i.e. fairs, religious events, sporting events etc.)
   Desert Sweet Shrimp Festival, Butterfield Stage Days, the Gila Bend Air Fare,

FUTURE NEEEDS

1. What challenges does your jurisdiction have to overcome to improve the efficiency of the transportation system?
   Funding, dealing with increased VPD, lack and deterioration of infrastructure.

2. What opportunities exist in your planning process? (i.e. opportunities to coordinate with other projects, opportunity to collaborate with adjacent jurisdictions, possible funding sources etc.)
   MAG, MCDOT and the Town are looking to start the Gila Bend Small Area Transportation Study this summer, which will be a road map for the development of a multi-modal transportation system.

3. What are some unique strengths of your jurisdiction that you can use to leverage the opportunities to improve transportation within your community?
   One point of contact, and since such planning has been initiated prior to a development boom there is not too much catch-up that need to occur.

4. What information/resources are you looking to help you perform your daily activities (transportation related) more effectively? (i.e. construction updates, real-time video etc.)
   All of the above including training and more conversation of the availability of funding options.

OTHER

1. Would you be interested in serving on the Study Advisory Group (SAG) for this project (your time commitment to this effort will not exceed a total of 4 hours each month over a 6-8 month period)?
   I would be interested.

2. Are there other people in your agency that you recommend we interview to get some of the information requested in the above sections? If so, please provide their contact information below:

   Name: _____ Name: _____
   e-mail: _____ e-mail: _____
   Phone #: _____ Phone #: _____

   Name: _____ Name: _____
   e-mail: _____ e-mail: _____
   Phone #: _____ Phone #: _____

MARICOPA ASSOCIATION OF GOVERNMENTS ITS PROGRAM
ITS PLANNING GUIDELINES FOR SMALL JURISDICTIONS
QUESTIONNAIRE

Name W. David Bunce

Title: Fire Chief

Organization Salt River Fire Department

Address 10005 E. Osborn Rd

Scottsdale, AZ 85256

Phone 480-362-7922

E-mail david.bunce@srpmic-nsn.gov

Date 5-24-2011

Project Description:

This study is being conducted to develop Intelligent Transportation Systems (ITS) Planning Guidelines for smaller jurisdictions, as part of the MAG's strategic vision and mission to help implement ITS solutions for the region. A key objective of this study is to develop guidelines that could be readily utilized by smaller jurisdiction to plan, implement and operate ITS.

Staff at smaller local jurisdiction will be able utilize the document produced through this project as a quick reference for: (1) Developing the scope of work for a consultant project to develop the agency's ITS Plan; OR (2) If such a Plan is premature, then parts of this document will be useful to help guide the agency prepare for a future that includes ITS infrastructure and traffic management functions.

To help develop the guidelines for smaller jurisdictions in the MAG region, the study needs your valuable input. Your response to this questionnaire will help us understand the needs and priorities of small jurisdictions and help guide the development of the ITS planning guidelines that will help your community.

We appreciate your time in providing us this information. Please take a few moments to read and respond to the following questions:

AGENCY INFORMATION

1. How is your agency organized? Please describe briefly how your department/section fits into the overall organization of your jurisdiction?
   The Fire Department is led by a Fire Chief assisted by a Deputy Chief of Operations and an Emergency Manager. The Department is an integral part of the Public Safety components of the Community and collaborates with the other Community departments to accomplish safety solutions for the Community Members, employees, and guests.

2. Does your agency have a specific mission statement referring to transportation? What are your agency's priorities?
   No. Priorities include fire prevention, prevention of injury, emergency response readiness, and emergency management preparedness.

3. Does your agency have a 10-20 yr. Transportation Plan? If so, what is the most current update?
   The Fire Department doesn't have a Transportation Plan.

4. What is the current process for transportation/road/traffic management infrastructure planning at your organization?
   The Fire Department is contacted when any changes are proposed or implemented within the Community. When a proposal is sent out, the Fire Department responds to the request for information as to response impact and access. When a project is underway, the Fire Department distributes the information to all stations for alternate response routes.

5. Who are the key staff responsible for transportation/roads/traffic management infrastructure planning at your organization?
   The Deputy Fire Marshals are the most involved with planning.

6. What are the primary responsibilities of your department/section?
   Fire prevention, public education, code compliance, event planning, emergency response, emergency management.

7. What are your individual responsibilities?
   Leadership of the Fire Department, strategic planning, budget creation-management-analysis, personnel management, organizational analysis and development.

8. What traffic management technologies do you currently have or plan to implement in the near future?
   None.

AGENCY STRUCTURE/INTERACTIONS

INTERNAL

1. How does your department interact with other departments within your organization (e.g. with Planning, Information Technology, Police, Engineering, GIS, Maintenance, transit etc.)
   The Fire Department collaborates with all of the above departments as it relates to emergency preparedness and response.

2. What information do you provide to other departments within your organization? What methods/technologies do you use to share information? (e.g. emergency dispatch services, traffic information, construction activities, school information etc.)
   We provide data on responses to other departments upon request. The public safety dispatch center is managed by the Police Department.

3. What information is provided to you by other departments within your organization? What process/methods are used to provide that information?
   The other departments assist us with our computer aided dispatch program, GIS for our mapping projects, and water supply information from Public Works and Engineering.

4. Is your agency looking/planning any changes to the way information is being shared between departments (new technology, equipment)?
   New technology is always being evaluated.

EXTERNAL

1. Does your agency share infrastructure, operations and maintenance support with adjacent jurisdictions? If so, please provide details.
   Only Mutual Aid responses.

2. What information do you provide to adjacent jurisdictions, regional or State organizations related to transportation operations?
   None, other than closed access points.

3. What information do you receive adjacent jurisdictions, regional or State organizations related to transportation operations?
   Access issues within their jurisdictions.

4. Identify other stakeholders in your jurisdiction that are major traffic generators like schools, major employers, and special event organizers.
   We work with the schools and any event coordinators that wish to put on special programs within the Community.

AGENCY TRANSPORTATION SYSTEM

GENERAL

1. What are your jurisdictions biggest challenges affecting transportation operations? (i.e. congestion, special traffic generators, land-use, population composition, signal coordination, public safety, qualified staff etc.)
   Lack of good roads throughout the Community. Roads blocked off between areas that cause the Fire Department to take alternate routes.

2. How do you think these problems can be addressed? What would be your agency's top priorities? Please list.
   _____
   _____
   _____

3. Are there any specific issues unique to your community?
   _____
   _____
   _____

ITS AND TRAFFIC MANAGEMENT

1. Does your jurisdiction currently use any form of ITS technology? If so, please describe.
   _____
   _____

2. What type of signal system do you have?
   _____
   _____

3. Do you have emergency vehicle preemption at any intersection? If so, how many locations and what system is being used (3M or Tomar)?
   None

4. How do you currently communicate to your devices in the field? (i.e. interconnect, fiber, radio etc.)

   _____

   _____

5. Do you share ITS infrastructure with other jurisdictions? If so, who and what?

   _____

   _____

6. At which location in your jurisdiction do you experience the highest incidence of annual crashes? traffic congestion?

   _____

   _____

7. Does your jurisdiction experience high tourist traffic? If so, please explain.

   _____

   _____

8. What types of Planned Special Events occur in your jurisdiction? (i.e. fairs, religious events, sporting events etc.)
   Iron Man Contest, Spring Training Baseball, local Community –sponsored events.

FUTURE NEEEDS

1. What challenges does your jurisdiction have to overcome to improve the efficiency of the transportation system?

   _____

   _____

   _____

   _____

   _____

2. What opportunities exist in your planning process? (i.e. opportunities to coordinate with other projects, opportunity to collaborate with adjacent jurisdictions, possible funding sources etc.)

   _____

   _____

   _____

   _____

   _____

3. What are some unique strengths of your jurisdiction that you can use to leverage the opportunities to improve transportation within your community?

   _____
   _____
   _____

4. What information/resources are you looking to help you perform your daily activities (transportation related) more effectively? (i.e. construction updates, real-time video etc.)

   _____
   _____
   _____

OTHER

1. Would you be interested in serving on the Study Advisory Group (SAG) for this project (your time commitment to this effort will not exceed a total of 4 hours each month over a 6-8 month period) ?

   _____
   _____
   _____

2. Are there other people in your agency that you recommend we interview to get some of the information requested in the above sections? If so, please provide their contact information below:

   Name: _____ Name: _____
   e-mail: _____ e-mail: _____
   Phone #: _____ Phone #: _____

   Name: _____ Name: _____
   e-mail: _____ e-mail: _____
   Phone #: _____ Phone #: _____

APPENDIX E

NEEDS AND PRIORITIES OF DEPARTMENTS QUESTIONNAIRE

JACOBS

MARICOPA ASSOCIATION of GOVERNMENTS

NEEDS AND PRIORITIES OF DEPARTMENTS QUESTIONNAIRE

Name: _____

Title: _____

Department: _____

Phone: _____

E-mail: _____

Date: _____

Questionnaire Description:

Your response to this questionnaire will help us understand the needs and priorities of your department and help guide the development of this project. We appreciate your time in providing us this information. Please take a few moments to read and respond to the following questions:

1. How is your department organized? Please describe briefly how your department/section fits into the overall organization of our City/Town?

   _____
   _____
   _____
   _____
   _____
   _____

2. What are the primary responsibilities of your department/section?

   _____
   _____
   _____
   _____
   _____
   _____

3. What are your department's priorities?

   _____
   _____
   _____
   _____
   _____
   _____

4. How does your department provide input on transportation projects?

_____
_____
_____
_____
_____

5. Who are the key staff in your department that will serve as a representative for this project?

_____
_____
_____
_____
_____

6. What are your individual responsibilities?

_____
_____
_____
_____
_____

7. How does your department interact with other departments? (e.g. with Planning, Information Technology, Police, Engineering, GIS, Maintenance, transit etc.)

_____
_____
_____
_____
_____

8. What information do you provide to other departments? What methods/technologies do you use to share information? (e.g. emergency dispatch services, traffic information, construction activities, school information etc.)

_____
_____
_____
_____
_____

9. What information is provided to you by other departments? What process/methods are used to provide that information?

_____
_____
_____
_____
_____

APPENDIX F

INTERNAL WORKSHOP MEETING AGENDA

Meeting Agenda

PROJECT: _____

DESCRIPTION: ____Internal Meeting to discuss project issues_____

DATE: _____

TIME:_____

LOCATION:_____

Note: A description of the Agenda items is provided in brackets [ ].

1. **Introduction**
   [Conduct an introduction of the various department representatives]

2. **Project Description**
   [Provide a description of the project and highlight the key issues]

3. **Overview of the City/Town's Vision**
   [Provide an overview of the agency's vision and goals as it is relevant to the project]

4. **Review Issues, Concerns, Opportunities and Trends**
   [Open discussion with the various departments regarding their issues and concerns about the project. Also discuss the opportunities and trends that they see in implementing this project based on experience with similar past projects]

5. **Identify priorities for the departments and the agency**
   [Identify the priorities of each of the departments and the agency as a whole as it is relevant to the project]

6. **Discuss various programs and initiatives of the departments**
   [Discuss how the current programs and initiatives of the various departments affect the project]

7. **Develop action plan**
   [Identify an action plan with the various department representatives to follow-up or obtain additional information about the project issues that may be helpful in developing solutions]

8. **Adjourn**

APPENDIX G

ITS RESOURCES

ITS Resources

USDOT ITS Websites:

- ITS Overview: www.its.dot.gov/its_overview.htm
- ITS Applications: www.itsoverview.its.dot.gov/
- ITS Benefits: www.itsbenefits.its.dot.gov/
- ITS Costs: www.itscosts.its.dot.gov/
- ITS Lessons Learned: www.itslessons.its.dot.gov/
- ITS Deployments: www.itsdeployment.its.dot.gov/
- ITS Library: www.its.dot.gov/library.htm
- ITS Research: www.tfhrc.gov/its/its.htm

ITS Architecture Resources:

- National ITS Architecture: http://www.its.dot.gov/arch/index.htm
- MAG ITS Architecture: http://www.azmag.gov/Committees/Committee.asp?CMSID=1050

ADOT Resources:

- Systems Engineering and Architecture Compliance Checklist: http://www.azdot.gov/highways/ttg/PDF/SystemsEngineeringChecklist.pdf
- ADOT State Planning and Research Reports: http://mpd.azdot.gov/TPD/ATRC/Publications/project_reports/index.asp

Systems Engineering Resources:

- S.E. Handbook – Introduction: http://ops.fhwa.dot.gov/publications/seitsguide/index.htm
- S.E. Guidebook – Comprehensive "how to" guide: http://www.fhwa.dot.gov/cadiv/segb/

ITS Training Websites:

- ITS Prof. Capacity Building: http://www.pcb.its.dot.gov
- National Highway Institute: www.nhi.fhwa.dot.gov/training/brows_catalog.aspx
  - then click on topic #137 – ITS
- UC Berkeley Tech Transfer: www.techtransfer.berkeley.edu/itstraining
- CITE (training via Internet): www.citeconsortium.org/curriculum.html

Americans with Disabilities Act Websites:

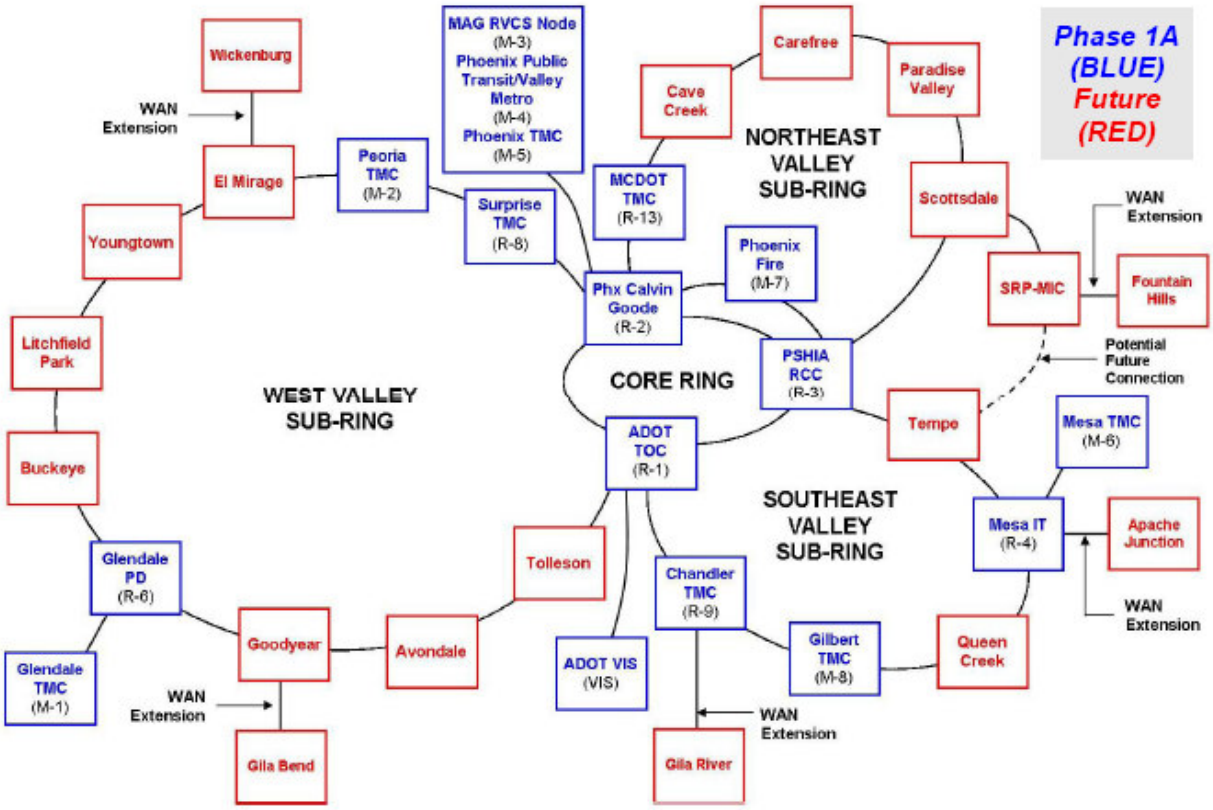
- USDOJ Americans with Disabilities Act website: www.ADA.gov
- USGSA website: www.section508.gov

FHWA Federal-aid Procurement Regulations and Contracting Options Website:

- http://www.its.dot.gov/jpodocs/repts_te/3029/chap3.htm#2

APPENDIX H

RCN TOPOLOGY



Source: ADOT RCN Newsletter

APPENDIX I

TYPES OF INVENTORY SOFTWARE

Inventory / Asset Management Software

Software	Description	Website
VIMMS (Vulcan, Inc.)	VTMS's Visual Information Maintenance Management System (VIMMS®) program consists of a family of base modules providing current device data for each type of traffic control device along with associated historical maintenance activities. The foundation of each respective device module in the System is a Central Stores Inventory, Pavement Marking Inventory, Road Network Inventory, Roadside Features Inventory, Sign Inventory, Traffic Signal Inventory and/or Street Light Inventory.	http://www.vulcaninc.com/?p=vulcan_traffic_management_VIMMS
CARTEGRAPH SIGNALview SIGNview LIGHTview	*SIGNALview* is a signal management tool used to capture and maintain inventory information, track inspection history, and monitor the age and condition of all components assigned to your signalized intersections.	http://www.cartegraph.com/
	SIGNview helps you implement a comprehensive sign management process, giving you the tools to capture and maintain inventory information, track retroreflectivity inspections, and monitor the age and condition of street signs and supports.	http://www.cartegraph.com/
	LIGHTview is a lighting management application used to capture and maintain inventory information, track inspection history, and monitor the age and condition of light assemblies and their support assets.	http://www.cartegraph.com/
Facet	Facet's use of digital video capabilities for asset management has led to newfound advantages in the area of digital roadway imagery and asset management. The Facet asset management system uses patented image-recognition software to extract attributes from digital photolog data and convert them into an asset database. Facet's solution offers seamless capture, inventory, and analysis of transportation-related assets.	http://www.facet-tech.com/transportation/asset_management.htm

APPENDIX J

INVENTORY CHECKLIST

TRAFFIC/ITS INFRASTRUCTURE INVENTORY

1. EQUIPMENT LOCATION

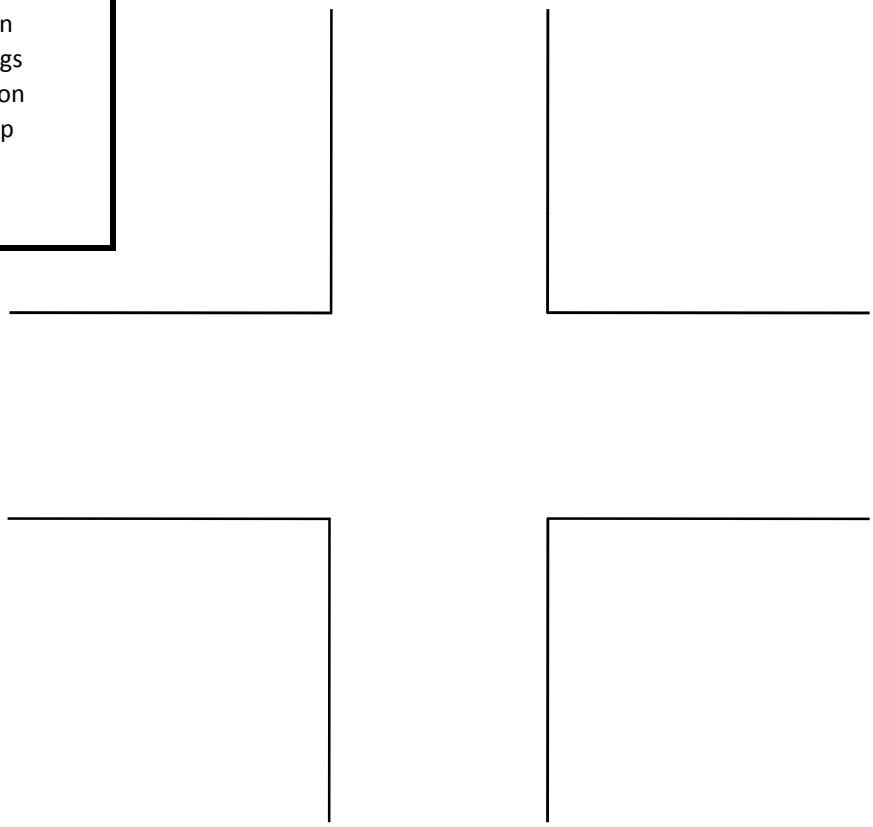
Street Name	Intersection	City
Date	Inventory Conducted By	Type of Equipment

2. INTERSECTION SKETCH

Note the following:

- North Arrow
- Street Names
- Intersection Layout
- Lane Configuration
- Pavement Markings
- Equipment Location
- Type of Curb Ramp
- Signs
- Speed Limits

SKETCH OF INTERSECTION



Type		**Coordination**	
Isolated (Free)	☐	Time-Based	☐
Coordinated(system)	☐	Traffic Responsive	☐

4. CONTROLLER DATA

Manufacturer | **Model Number** | **Serial Number**

Type
- Electromechanical
- Non-NEMA
- NEMA-Modular
- NEMA-Keyboard

Condition
- Good
- Fair
- Poor

Controller Phase Capability
- 2-Phase
- 4-Phase
- 8-Phase
- Other

Controller Type
- Pretimed
- Actuated

Detectors
- Loops
- Video

Detector Quantity/Type

Backpanel Size

Load Switches Installed

Flash Transfer Relays Installed

Software Level Size

Conflict Model Size

Flasher

Interconnect Cable

Coordinated

5. CABINET DATA

Manufacturer | **Model Number** | **Serial Number**

Outside Dimensions
- Height(in)
- Width(in)
- Depth(in)

Type of Mounting
- Side of Pole
- Pedestal
- Ground

Condition
- Good
- Fair
- Poor

Door
- Single
- Double
- Police

Other
- Vent
- Fan/Thermostat
- Manual Control
- Test Buttons
- Police Door
- Documentation

6. VEHICULAR SIGNAL HEAD DATA

Head #	# of Lenses/ Size of Lenses	Type of Mounting	Visor Type	Color	Condition	Backplates

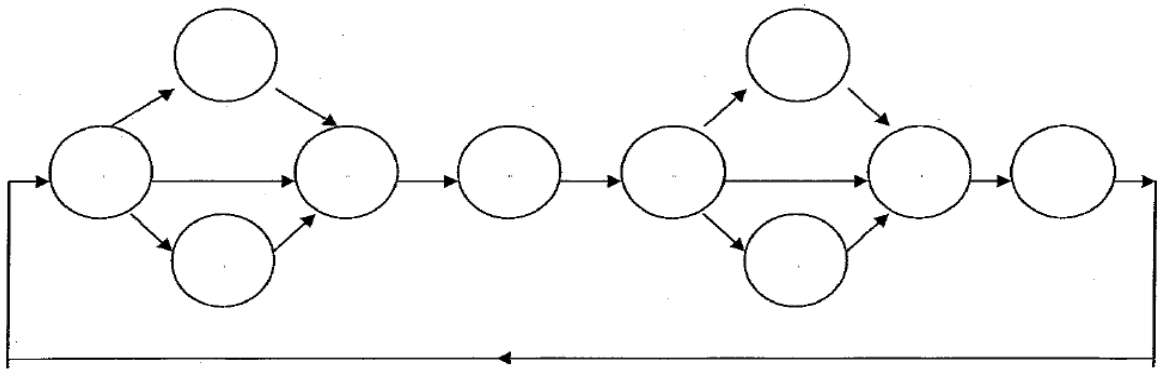
7. PEDESTRIAN SIGNAL HEAD DATA

Head #	W/DW or Countdown	Type of Mounting	Condition	Audible

8. CABINET ACCESSORIES

Device	Manufacturer	Model	Serial #	Function

9. TRAFFIC SIGNAL PHASING SEQUENCE



10. TRAFFIC SIGNAL TIMING

PHASE	ø1	ø2	ø3	ø4	ø5	ø6	ø7	ø8
Movement (Direction)								
Min Green (Initial)								
Extension (Passage)								
Yellow								
Red Clear								
Max Green I								
Max Green II								
Pedestrian Walk								
Pedestrian Clear								
Seconds Per Acuation								
Time to Reduce								
Before Reduction								
Minimum Gap								
Pedestrian Gap								
Walk (flash/steady)								
Recall								
Memory								
Delay								

Overlap	OLA	OLB	OLC	OLD

11. COORDINATION TIMING

Time-of-Day Patterns

Day	Time	Coord. Pattern C/O/S

Cycle Length	1	2	3	4
Offset	1	2	3	4

Splits	ø1	ø2	ø3	ø4	ø5	ø6	ø7	ø8
Split Plan 1								
Split Plan 2								
Split Plan 3								
Split Plan 4								
Split Plan 5								
Split Plan 6								
Split Plan 7								

12. COMMUNICATION

Coordinated

Interconnect Cable

Twisted Copper

Fiber Optic

Wireless

Interconnect Conduit

Location at intersection

7 Pullbox (# and location)

#9 Pullbox (# and location)

Sketch of Interconnect Conduit Routing

Note: Provide routing of the conduit/cable with terminal locations (Traffic Management Ctr., etc.)

INTERCONNECT CONDUIT ROUTING

APPENDIX K

SAMPLE PROJECT DEVELOPMENT TEMPLATE

ITS Project Development Template

1. Project Overview

Provide a brief description of the project, its location, the roadway corridors and the limits of the project.

2. Goals and Objectives

List the goals and objectives of the project and tie it into those of the corridor. Include the expected benefits of this project. See table below for typical goals and benefits.

Goals	Benefits
• Reduce congestion • Improve safety • Enhance communication with travelers • Reduce energy consumption and environmental costs • Improve emergency management • Improve operations	• Reduction in travel times • Reduction in delay • Reduction in incident duration • Improved customer satisfaction • Improved travel time reliability • Reduction in fuel consumption

3. Existing Conditions

Describe the existing conditions of the project. Include the information about existing ITS, traffic or communication infrastructure within or adjacent to the project limits.

4. Operational Needs

Identify the operational needs and concerns of the corridor or project location. Describe the needs in detail.

5. System Overview

Describe each of the ITS solutions in detail. Include number of devices, location, how it fits into the system & corridor, tie-in points, what the devices are intended to provide etc. (as applicable) Include a map of the project with a legend of the proposed devices and connectivity.

6. Project Architecture

Provide the framework that identifies how this project fits in a system with a focus on integration and operation of the system(s). Document how the project impacts the following:

- Key stakeholders (agency specific and regional)
- Key elements impacted
- Key ITS Market Packages

7. ITS Standards

Provide a list of the ITS standards that may be applicable for this project.

8. Implementation Recommendation

Provide a preliminary description of the implementation plan (if available).

APPENDIX L

ITS PROCUREMENT CONTRACTS

Intelligent Transportation Systems
ADOT Statewide Contracts

All of the contracts listed below are available to all state agencies, political subdivisions, school districts and universities. All contracts include the required FHWA terms and conditions. Questions regarding these please contact ADOT Procurement (602) 712-7211 to speak to the appropriate Procurement Officer for the contract.

Contract #	Description	Supplier Name	Renewal Date	Procurement Officer
T0659A0059	Roadway Weather Info Services;Including Equipment	Surface Systems Inc.	July 25, 2011	Gary Henry
T0659A0015	Wireless Equipment/Services	WWT	April 15, 2011	Valarie Vacanari
T0659B0015	Wireless Equipment/Services	Compel LLC	April 15, 2011	Valarie Vacanari
T0659C0015	Wireless Equipment/Services	Transcore ITS	April 15, 2011	Valarie Vacanari
T0659D0015	Wireless Equipment/Services	Accuvant Inc	April 15, 2011	Valarie Vacanari
T0659E0015	Wireless Equipment/Services	Darcomm Network Solutions	April 15, 2011	Valarie Vacanari
T0659F0015	Wireless Equipment/Services	ITS Engineers	April 15, 2011	Valarie Vacanari
T0659A0108	Traffic Cabinets/Controllers	Brown Wholesale	July 31, 2010	Gary Henry
T0659B0108	Traffic Cabinets/Controllers	Phx Highway Products	July 31, 2011	Gary Henry
T0659C0108	Traffic Cabinets/Controllers	GDI Communications LLC	July 31, 2011	Gary Henry
T0659D0108	Traffic Cabinets/Controllers	RTC Manufacturing	July 31, 2011	Gary Henry
T0659E0108	Traffic Cabinets/Controllers	AM Signal Inc	July 31, 2010	Gary Henry
T0759A0001	DMS – Freeway	Daktronics	August 14, 2011	Michelle Thissell
T0759B0001	DMS – Arterial Large/Small	Skyline	August 14. 2011	Michelle Thissell
T0759A0003	Two Line Truck Mounted Message Boards	Ver-Mac Inc	November 29, 2010	Michelle Thissell
T0759A0004	Solar Powered Message Boards	Ver-Mac Inc	November 29, 2010	Michelle Thissell
T0759A0047	ITS On-Call	PBS&J	January 6, 2011	Valarie Vacanari
T0759B0047	ITS On-Call	Kimley-Horn	January 6, 2011	Valarie Vacanari
T0759C0047	ITS On-Call	ITS Engineers	January 6, 2011	Valarie Vacanari
T0759D0047	ITS On-Call	Oz Engineering	January 6, 2011	Valarie Vacanari
T0759E0047	ITS On-Call	Sieman's	January 6, 2011	Valarie Vacanari
T0759F0047	ITS On-Call	Transcore ITS	January 6, 2011	Valarie Vacanari
T0959LA010	Traffic Signal System Software & Associated Hardware	Transcore ITS LLC	March 10, 2011	Valarie Vacanari
T0959LB010	Traffic Signal System Software & Associated Hardware	Siemans Energy & Automation Inc	March 10, 2011	Valarie Vacanari
T0959LC010	Traffic Signal System Software & Associated Hardware	Kimley-Horn & Assoc	March 10, 2011	Valarie Vacanari
T10-20-00004	CCTV Cameras/Parts/Install and Repair	TBD	Estimated award date 06/01/10	Gary
T10-43-00026	Camera Cameleon Software Support/ Maintenance	TBD	PIF to FHWA for approval	Michelle Thissell

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