MARICOPA ASSOCIATION of GOVERNMENTS

MAG ITS Strategic Plan Update

Technical Memorandum #3

- Inventory of existing and planned multimodal transportation systems
- Identification of stakeholder needs
- Regional Intelligent Transportation System objectives

Prepared by:

Kimley-Horn and Associates, Inc.

January 19, 2000
091452000

TABLE OF CONTENTS

Technical Memorandum #3

1. INTRODUCTION

Stakeholder input on the region's transportation needs and problems is the foundation for the Maricopa Association of Governments (MAG) Intelligent Transportation System (ITS) Strategic Plan Update. The needs identified as part of the Stakeholder Involvement Plan will be evaluated against existing and planned ITS programs to identify what ITS activities in the MAG region are meeting or will meet user identified needs. Consistent with the federal Strategic Planning Process, these prioritized needs will be matched with user services and market packages and ultimately used as the basis for development of a regional ITS architecture, selection and prioritization of candidate ITS technologies and programs, and the development of telecommunications requirements.

This Technical Memorandum provides an overview of existing and planned ITS in the MAG region, including AZTech™, Arizona Department of Transportation (ADOT), Maricopa County Department of Transportation (MCDOT), municipalities, transit agencies, airports, emergency management, commercial vehicles, and the private sector. The needs identified by the stakeholders during the focus group workshops and needs that were submitted on questionnaires are documented. Finally, user needs are reviewed and used to identify regional goals and objectives.

2. INVENTORY OF EXISTING INTELLIGENT TRANSPORTATION SYSTEMS

Several sources were reviewed to determine existing ITS systems in the MAG region. Documentation such as the Federal Highway Administration (FHWA) ITS Deployment Tracking Surveys (1997 and 1999) were reviewed as well as the *AZTech™ Lessons Learned* document and the *Valley Metro Vehicle Management System* report. Direct contact was made with representatives of many of the following agencies to discuss systems they have in place. While every attempt was made to be thorough, ITS continues to be deployed throughout the MAG region and therefore the list of existing systems will constantly be changing.

2.1 AZTech™ Existing ITS

Jurisdiction	Existing System Components	Number
AZTech™	SMART Corridors	8
AZTech™/Local Cities	Arterial closed-circuit television (CCTV) cameras	7
AZTech™/Mesa	Arterial variable message sign (VMS)	4
AZTech™/Local Cities	Vehicle detection stations	115
AZTech™/Valley Metro	Transit advanced vehicle location (AVL)	94
AZTech™/Local Government	Informational kiosks	25
AZTech™	FM subcarrier for traffic broadcast	1
AZTech™/Local Government	AZTech™ workstations	14
AZTech™	AZTech™ server which provides real time traffic information	1
AZTech™/ADOT	ADOT ATM/cell relay AZTech™ connection	1

Jurisdiction	Existing System Components	Number
AZTech™/Chandler Traffic	Chandler T1 AZTech™ connection	1
AZTech™/Gilbert Traffic	Gilbert T1 AZTech™ connection	1
AZTech™/Glendale Traffic	Glendale ATM/cell relay AZTech™ connection	1
AZTech™/Mesa Traffic and Transit	Mesa Traffic and Transit ATM/cell relay AZTech™ connection	1
AZTech™/MCDOT Traffic	MCDOT ATM/cell relay AZTech™ connection	1
AZTech™/Paradise Valley Traffic & Police	Paradise Valley Traffic and Police T1 AZTech™ connection	1
AZTech™/Peoria	Peoria T1 AZTech™ connection	1
AZTech™/Phoenix Fire	Phoenix Fire ATM/cell relay AZTech™ connection	1
AZTech™/Phoenix Traffic	Phoenix dedicated fiber AZTech™ connection	1
AZTech™/Phoenix Transit	Phoenix Transit ATM/cell relay AZTech™ connection	1
AZTech™/Scottsdale	Scottsdale Traffic ATM/cell relay AZTech™ connection	1
AZTech™/Tempe Traffic	Tempe ATM/cell relay AZTech™ connection	1
AZTech™/Chandler	Chandler Road Closure and Restriction System (RCRS)	1
AZTech™/Gilbert	Gilbert RCRS	1
AZTech™/Glendale	Glendale RCRS	1
AZTech™/Mesa	Mesa RCRS	1
AZTech™/Tempe	Tempe RCRS	1

In 1996, the FHWA awarded a Model Deployment Initiative grant to the Phoenix metropolitan area to assist in the deployment and integration of a model traveler information system. Using funding from both the federal grant and the project partners, a joint public and private partnership worked together under the name AZTech™ to deploy and integrate ITS and provide real time traveler information to the public.

Many ITS projects have been deployed in the MAG region as part of the AZTech™ project, including SMART Corridors, AVL on buses, broadcast of traffic information via FM subcarriers, and the connection of local governments to AZTech™ via various communications media. Also, as part of AZTech™, the ADOT Highway Closure and Restriction System (HCRS) was converted to allow reporting of conditions on arterial streets in a system known as the Road Closure and Restriction System (RCRS).

The AZTech™ SMART Corridors include CCTV cameras, VMS, and vehicle detection stations. After deployment, these technologies are operated and maintained by the jurisdiction in which they are located. This infrastructure is documented in **Section 2.3** of this memorandum. AVL was implemented on 94 buses and provides real time information on bus location and route diversions. This information is also included in **Section 2.4** of this report. Informational kiosks to provide real time traffic, weather, and event information are available throughout the MAG region for use by the public. Partnering with KBAQ, a local FM radio station, AZTech™ has an agreement to broadcast traffic information via an FM subcarrier on KBAQ that provides near complete coverage of the most populated areas of the MAG region. Finally, integration of the

local, county, and state government agencies involved in traffic management and emergency response was a key goal of the AZTech™ project. This has been achieved through an AZTech™ workstation in the operation rooms of the major agencies and via communications between the operations centers and the AZTech™ server. The types of communication media used to achieve this goal are described in the previous table.

2.2 Arizona Department of Transportation Existing ITS

Jurisdiction	Existing System Components	Number
ADOT	Traffic Operations Center (TOC)	1
	Freeway Management System (FMS)	50 miles
	VMS	42
	CCTV cameras	60
	Ramp metering devices	50
	Total number of traffic signals	156
	Signals under closed loop control or centralized control	18
	Signalized intersections allowing signal preemption for emergency vehicles	10
	Signalized intersections with loop detector data collection capabilities	156
	Arizona Local Emergency Response Team (ALERT)	7 vehicles
	AZTech™ workstation	1
	Voice Response Access System (VRAS) 1-888-411-ROAD	1
	HCRS information distribution through kiosks, Internet, and VRAS	1
	Travel speed and conditions are shared on the Internet web site	
	CCTV cameras available through Internet web site	
	Integration of traffic signal control with other agencies	
	Real-time electronic information, freeway travel times, speeds and conditions sharing with other agencies	

ADOT currently operates a 24 hour-TOC that provides support for most ADOT ITS functions in the Valley. ADOT operates 50 miles of FMS, 156 traffic signals, 42 VMS and 60 CCTV cameras. In addition, traveler information is provided through the Internet at http://azfms.com and through a toll free phone number. The ALERT team provides incident management capabilities at the scene of an accident.

2.3 County and Municipal Agencies Existing ITS

Jurisdiction	Existing System Components	Number
MCDOT	Traffic Management Center (TMC)	1
	Signalized intersections owned and operated by MCDOT	109
	Signalized intersections under closed loop or central control	35
	Signalized intersections with loop detector data collection capabilities	12
	Highway-rail intersections that are under video surveillance	4
Chandler	Traffic Signal Control Center	1
	Total number of signalized intersections	80
	Signals under closed loop control or central system control	69
	Signalized intersections allowing signal preemption for emergency vehicles	80
	Signalized intersections that have data collection capabilities through loop detectors	17
	Signalized intersections communicating with twisted pair cables	69
	AZTech™ workstation	1
	Signal timing plans shared with Mesa, ADOT, and Gilbert	
Gilbert	Total number of signalized intersections	50
	Signalized intersections allowing signal preemption for emergency vehicles	50
	AZTech™ workstation	1
	Shares signal timing plans and coordinates changes to timing plans with Chandler, Mesa	
Glendale	TMC	1
	Total number of signalized intersections	146
	Signals under closed loop control or central system control	43
	Signalized intersections allowing signal preemption for emergency vehicles	83
	Signalized intersections with loop detector data collection capabilities	6
	Signalized intersections communicating with twisted pair cables	34
	Signalized intersections communicating with wireless	10
	Signalized intersections communicating with dial-up modems	8
	AZTech™ workstation	1
	Shares signal timing plans information with the City of Phoenix	
Mesa	TMC	1
	Total number of signalized intersections	293
	Signalized intersections under closed loop or central system	290
	Signalized intersections allowing signal preemption for emergency vehicles	163
	Signalized intersection communicating with twisted pair cable	43
	Signalized intersection communicating with wireless	2
	Signalized intersection communicating with dial-up modems	2
	Signalized intersection communicating through leased lines	238

Jurisdiction	Existing System Components	Number
Mesa (continued)	VMS as part of AZTech™ components	4
	CCTV cameras as part of AZTech™ components	1
	Signalized intersections with loop detector data collection capabilities	22
	Signalized intersections with video detection cameras for data collection capabilities	1
	AZTech™ workstation	1
	Archives traveler information	
	Shares timing plans information with several cities	
Peoria	Total number of signalized intersections	69
	Signalized intersections allowing signal preemption for emergency vehicles	7
	AZTech™ workstation	1
Phoenix	TMC	1
	Total number of signalized intersections	877
	Signalized intersections under centralized control	470
	Signalized intersections allowing signal preemption for emergency vehicles	6
	Signalized intersections allowing signal priority for transit vehicles	7
	Signalized intersections with loop detector data collection capabilities	30
	Signalized intersections communicating with twisted pair cable	30
	Signalized intersections communicating with fiber optic cable	10
	Signalized intersections communicating through leased lines	480
	Archives data (volume, phasing, cycle length)	
	CCTV cameras	5
	AZTech™ workstation	1
Scottsdale	TMC	1
	Total number of signalized intersections	248
	Signalized intersections under centralized control	206
	Signalized intersections allowing signal preemption for emergency vehicles	123
	CCTV cameras as part of AZTech™ components	1
	CCTV cameras installed solely by Scottsdale	1
	AZTech™ workstation	1
Tempe	TMC	1
	Total number of signalized intersections	174
	Signalized intersections under centralized control	174
	Signalized intersections allowing signal preemption for emergency vehicles	105
	Signalized intersections under real-time traffic adaptive control	1
	Highway-rail intersections that are under electronic surveillance other than video	4
	Signalized intersections with loop detector data collection capabilities	16

Jurisdiction	Existing System Components	Number
Tempe (continued)	Signalized intersections with video detection cameras data collection capabilities	8
	Signalized intersection communicating with twisted pair cable	174
	Signalized intersection communicating through leased lines	174
	CCTV cameras	2
	AZTech™ workstation	1
	Archives data (volume, emergency vehicle signal preemption, event log)	
	Dissemination of traveler information through cable TV	
	Shares timing plan information with several cities	
	Provides information for public transit operators for several cities	

Chandler, Glendale, Mesa, Phoenix, Scottsdale, Tempe and MCDOT operate TMCs. Most of the larger cities in the MAG region have begun implementing a centralized control system for control of some or all of their signals. Many of the signals in the Valley are also equipped for signal preemption for emergency vehicles or with signal priority for transit vehicles. A larger number of cities share traffic signal control information with adjacent cities. Most of the cities that are participants in the AZTech™ project have received Windows NT workstations and kiosks.

2.4 Transit Existing ITS

Jurisdiction	Existing System Components	Number
Maricopa County Special Transportation Services Region	Demand responsive vehicles	70
	Archives passenger counts	
	Archives trip itinerary planning records	
Glendale	Demand responsive vehicles	15
	Real-time monitoring of vehicle components on demand responsive vehicles	15
	Automated dispatching or control software available on demand responsive vehicles	15
	Number of bus stops on fixed routes	300
	Number of locations that display traveler information	2
	Fixed route buses equipped with electronic fare collection capabilities	2
	Traveler information collected	
	Traveler information archived	
	Dissemination of transit routes, schedules, and fares through telephone, pagers, e-mail, cell phone, facsimile	
	Dissemination of real-time transit schedule adherence or arrival and departure times through pagers, e-mail, cell phone, and facsimile	

Jurisdiction	Existing System Components	Number
Mesa	Buses equipped with AVL capability	25
	Buses equipped with automatic vehicle identification (AVI) capability	25
	Buses equipped with electronic fare collection capabilities	25
	Buses operated under computer aided dispatch system	25
	Automated traveler information system for fixed route buses	
	Dissemination of transit routes, schedules, and fares through telephone and kiosks	
	Dissemination of real-time transit schedule adherence or arrival and departure times through Internet web sites	
Peoria	Demand responsive vehicles equipped with AVL capability	9
	Demand responsive vehicles equipped with AVI capability	9
	Demand responsive vehicles operated under computer aided dispatch system	9
	Demand responsive vehicle equipped with navigation aids	9
	Demand responsive vehicle with component system electronically monitored	9
	Archives traveler information	
Phoenix	Transit vehicles	400
	Buses equipped with AVL capability	55
	Buses equipped with electronic fare payment systems	400
	Demand responsive vehicles equipped with AVL capability	71
	Demand responsive vehicles operated under computer aided dispatch system	71
	Traveler information displayed at fixed bus transit routes	1
	Archives vehicle time and location and passenger counts	
	Dissemination of transit routes, schedules, and fares through telephone and Internet web sites	
	Dissemination of real-time transit schedule adherence or arrival and departure times through Internet web sites	
Regional Public Transportation Authority (RPTA)	Buses equipped with AVL capability	16
	Buses equipped with electronic fare payment systems	74
	Automated traveler information displayed in kiosks	2
	Automated traveler information system for fixed route buses	
	Dissemination of transit routes, schedules, and fares through telephone, Internet web sites and kiosks	
	Dissemination of real-time transit schedule adherence or arrival and departures times through kiosks	
Scottsdale	Buses equipped with electronic fare payment systems	26
	Demand responsive vehicle operated under computer aided dispatch system	9
	Traveler information displayed at fixed bus transit routes	1
	Transit routes, schedules and fares through cable TV, telephone, Internet web site and kiosks	

Jurisdiction	Existing System Components	Number
Sun City Area Transit System	Demand responsive vehicles	14
Tempe	Buses equipped with electronic payment systems	54
	Buses equipped with AVL and GPS	54
	Buses equipped with automatic passenger counters	11
	Buses equipped with security cameras	63

At the present time, only a fraction of the city transit buses are equipped with AVL capability; however, a majority of the buses are equipped with some type of electronic fare payment systems. Most of the demand responsive vehicles are operated under computer aided dispatch systems and are equipped with navigation aids. Cities that own kiosks have real-time transit schedule or arrival and departure times disseminated. For dissemination of transit routes, schedules, and fares, telephone, Internet web sites and kiosks are used.

2.5 Airport Existing ITS

Jurisdiction	Existing System Components	Number
Sky Harbor International Airport	Parking revenue control systems at East Economy, West Economy, Terminal 2, Terminal 3, and Terminal 4 lots	5 lots
Sky Harbor International Airport/AZTech™	Web site with flight schedules and maps available on the Internet and at AZTech™ kiosks	1 web site 25 kiosks

Sky Harbor International Airport is currently installing an automated parking revenue control system at parking lots around the airport. The system includes license plate recognition and allows drivers to pay for parking using credit cards without the assistance of parking attendants. Sky Harbor International Airport also was a participant in the AZTech™ program and information about flights and the airport is available at AZTech™ kiosks.

2.6 Emergency Management Existing ITS

Jurisdiction	Existing System Components	Number
ADOT	Arizona Local Emergency Response Team (ALERT)	7 vehicles
Phoenix Fire/AZTech™	Phoenix Fire ATM/cell relay AZTech™ connection	1
Phoenix Fire	Computer aided dispatch system	1
Rural Metro Fire	Computer aided dispatch system	1
Department of Public Safety (DPS)	Nikkon Total Station for accident investigation	2
Mesa Fire and Police	Computer aided dispatch system	1

Incident management in the MAG region falls under a number of different jurisdictions. These include ADOT, DPS, and local fire and police agencies. Communications were installed between AZTech™ and the Phoenix Fire Department which allows the fire department to share information on calls which may affect traffic conditions. The connection also allows the fire department to control CCTV cameras that have an AZTech™ workstation connection. Phoenix Fire, Rural Metro, Mesa Fire and Mesa Police all rely on computer aided dispatch systems to increase efficiency of their operations.

2.7 Commercial Vehicle Operations (CVO) Existing ITS

Jurisdiction	Existing System Components	Number
ADOT Motor Vehicle Division	Special Response Interactive Ports (Sprint Ports) are mobile ports outfitted with equipment for commercial vehicle inspections	2
ADOT	Weigh-in-motion sites located in Maricopa County to determine the weight and classification of vehicles on highways	6
Department of Public Safety	ASPEN roadside pen-based system that enables Department of Public Safety to access the Commercial Driver License Information System	

Many of the systems that have been deployed in the MAG region, such as the ADOT FMS and the HCRS, provide information useful to both commercial vehicle operators as well as the general traveling public. These types of systems are not included in the inventory for commercial vehicles as they are covered in other sections of this report. The ADOT Sprint Ports are used for mobile inspections of commercial vehicles throughout Arizona, including the MAG region. The advantage of the Sprint Ports is that they can be quickly set up for enforcement at a variety of sites. Rather than a stationary port, which commercial vehicles in violation of state and federal regulations can avoid, the mobility of the Sprint Ports allows enforcement officials to quickly set up enforcement sites where they suspect commercial vehicle violators to be operating. ADOT also operates a number of weigh-in-motion sites in the MAG region. These sites allow updates on vehicle weight and classification to be collected. The Department of Public Safety has implemented the ASPEN system, a roadside pen-based computer system that enables the DPS to access CDLIS during roadside inspections of commercial vehicles. Other ITS CVO deployments in Arizona include HELP/Prepass and the EPIC project. While these sites are not located in the MAG region, they are major ITS CVO projects that can impact commercial vehicles traveling to or from the MAG region.

2.8 Private Sector Existing ITS

Private Sector	Existing System Components	Number
ETAK	Traffic Check cable TV real-time traveler information broadcast in Tempe	1
ETAK	Real-time traveler information web site	1
ETAK	Traffic Angel™ real-time traveler information cellular phone service	Beta Test
ETAK	Traffic Touch™ real-time traveler information for Palm Pilot™	Beta Test
Fastline	Provide real-time traveler information to Personal Digital Assistants (PDA)	Available to public
Metro Networks	Traveler information provider to local media, includes workstation in the ADOT TOC	1
CUE/Auto PC	Real-time traveler information and in-vehicle directions	Beta Test

Through efforts such as the AZTech™ Model Deployment Initiative, private sector investment in ITS has increased tremendously in recent years. AZTech™ provided a convenient facility to private sector traveler information providers through the AZTech™ server, which contains real-time data collected through ITS technologies on both the freeways and arterial streets. Private sector agencies take this data and make it available to the public in various forms to provide real-

time traffic conditions, often personalized for the individual traveler's needs. Companies such as ETAK, Fastline, and CUE are currently deploying systems in the MAG region that will provide real-time traveler information. Several of the ETAK, Fastline and CUE systems will be available to the public shortly. Metro Networks, a provider of traffic information to the media, has teamed with AZTech™ and the ADOT TOC to provide their traveler information to AZTech™ partners and ADOT while sharing traveler information gathered by local public agencies.

3. REVIEW OF PLANNED INTELLIGENT TRANSPORTATION SYSTEMS

Planned ITS were identified as any ITS that has existing funding identified and will be implemented within the next 20 years. Documents such as the FHWA ITS Deployment Tracking Surveys (1999), *Valley Metro Vehicle Management System* report, and the MAG Transportation Improvement Program were reviewed. In addition, representatives from the different agencies were contacted to discuss other ITS that are planned for their jurisdiction but have not yet been documented.

3.1 AZTech™ Planned ITS

Jurisdiction	Planned ITS Systems	Number
AZTech™	SMART Corridors	16
AZTech™/ Local Cities	Arterial CCTV surveillance systems	25
AZTech™/ Local Cities	Arterial VMS	28
AZTech™/ Local Cities	Vehicle detection stations	200 (Estimate)
AZTech™/ Phoenix	Phoenix RCRS	1
AZTech™/ Scottsdale	Scottsdale RCRS	1

Phase II of the AZTech™ SMART Corridor deployment includes instrumenting nine major corridors with 16 CCTV cameras, 10 VMS, and 90 vehicle detection stations. After deployment, these technologies will be operated and maintained by the jurisdiction in which they are located. This infrastructure is also documented in **Section 3.3** of this memorandum. Phase III of the SMART Corridor deployments and any other future phases will add additional SMART Corridors and deploy additional CCTV cameras, VMS, and vehicle detection stations. The AZTech™ project is also assisting in implementing RCRS into the cities of Phoenix and Scottsdale. Private sector deployments of traveler information, which are being completed as part of AZTech™ Phase II, are discussed in **Section 3.8** of this document.

3.2 Arizona Department of Transportation Planned ITS

Jurisdiction	Planned ITS Systems	Number
ADOT	VMS - AZTech™ components	2
	Install FMS components on Valley freeway system (Phases 4, 7A, 6A, 7B, 12A, 8, 9A, 3B, 10, 7C, 6B, 12B, 11, 13, 14, 15, 16)	
	By 2003, have VMS coverage over 83.5 miles of freeway	
	By 2005, distribution of incident information through e-mail and in- vehicle navigation system	

ADOT will continue to implement the FMS on freeways in the MAG region, and will eventually provide coverage of all of the busiest segments of the freeways in the Valley. Currently programmed FMS projects will provide a total coverage of 83.5 miles by 2003. In addition, two VMS will be installed as part of the AZTech™ project on SR 87. ADOT also will support traveler information through e-mail and information provided to in-vehicle navigation systems.

3.3 County and Municipal Agencies Planned ITS

Jurisdiction	Planned ITS Systems	Number
MCDOT	Scalable AZTech™ Data Server Enhancements for Planning and Operations (Regional Archive Data Server)	1
	SMART Corridor Instrumentation as part of AZTech™ components	16
	CCTV camera as part of AZTech™	1
Chandler	Signals under central system control	120
	Total signalized intersections allowing signal preemption for emergency vehicles	120
	Total signalized intersections that have data collection capabilities through loop detectors	35
	Total signalized intersections communicating with twisted pair cable	90
	Total signalized intersections communicating with fiber optic cable	30
	CCTV cameras as part of AZTech™	5
	VMS as part of AZTech™	1
	Chandler TOC Upgrade	
Gilbert	Total signals under closed loop or central system control	100
	Total signalized intersections allowing signal preemption for emergency vehicles	100
	Total signalized intersections communicating with fiber optic cable	75
	Total signalized intersections communicating with wireless	25
	Traffic Control System Phase 1	
	Advanced Traffic Management System (ATMS) Phase 2	
Glendale	VMS as part of AZTech™	2
	CCTV cameras as part of AZTech™	3
	Signal system Phase 1	
	Signal system Phase 3	
	Computerized signal system Phase 2	
	Shares signal timing plans information with the City of Phoenix, Peoria, ADOT	

Jurisdiction	Planned ITS Systems	Number
Glendale (continued)	Computerized signal system	
	Fiber optic cable, conduit for signal system	
Mesa	Mesa Traffic Operation Center (TOC)	1
	Total signalized intersections communicating with twisted pair cable	120
	Total signalized intersections communicating with fiber optic cable	100
	Total signalized intersections communicating with wireless	10
	Total signalized intersections communicating with dial up modems	2
	Total signalized intersections communicating through leased lines	140
	CCTV cameras as part of AZTech™ components	3
	Install and evaluate adaptive signal control system	
	Install additional detectors, CCTV and fiber optic communication	
	Install signal system and tie in with Gilbert	
Peoria	Total number of signalized intersections	76
	New traffic signal system Phase 1 plans and specs	
	Traffic signal interconnect system Phase 3	
	New traffic control system	
Phoenix	Total signalized intersections under closed loop control	950
	Total signalized intersections allowing signal preemption for emergency vehicles	30
	Total signalized intersection communicating with fiber optic cable	50
	Total signalized intersections communicating through leased lines	900
	Total signalized intersections with loop detector data collection capabilities	50
	CCTV cameras	10
	VMS implemented by City of Phoenix	15
	VMS as part of AZTech™ components	4
	Highway Advisory Radio (HAR)	4
	Downtown Traffic Management System	
	Downtown Traffic Management System Phase 1	
	Traffic Management System Phase 2	
Scottsdale	CCTV cameras as part of AZTech™	4
	VMS as part of AZTech™	3
	CCTV as part of Indian School Road project	6
	VMS as part of Indian School Road project	6
Tempe	Construct Traffic/Transit Operation Center	1
	Total signalized intersections under centralized control	195
	Total signalized intersections allowing signal preemption for emergency vehicles	180
	Total signalized intersections under real-time traffic adaptive control	25
	Total signalized intersections allowing signal priority for transit vehicles	25
	Total highway-rail intersections that are under electronic surveillance other than video	25
	Total highway-rail intersections that have the ability to predict train arrivals electronically	25

Jurisdiction	Planned ITS Systems	Number
Tempe (continued)	Total signalized intersections with loop detector data collection capabilities	26
	Total signalized intersections with video detection data collection capabilities	20
	Total signalized intersection communicating with twisted pair cable	195
	Total signalized intersection communicating through leased lines	195
	Construct communication conduit system	
	Traffic signal control cabinet replacement Phase 1 and 2	

In the 1999 FHWA ITS Deployment Tracking Surveys, most cities showed an interest in moving towards operating all or the majority of their traffic signals under central system control. In the future, most of the signalized intersections will be equipped with signal preemption for emergency vehicles. Traveler information will be shared through various communication channels, including cable TV, telephone system, Internet web sites, pagers, e-mail and in-vehicle navigation system. Communication from the control centers to the signalized intersections will be through twisted pair cable, wireless, dial-up modems, and leased lines. Tempe and Phoenix are implementing parking and special event traffic management systems. CCTV cameras and VMS will be installed in more cities as part of the AZTech™ project.

3.4 Transit Planned ITS

Jurisdiction	Planned ITS Systems	Number
Maricopa County Special Transportation Services Region	Total demand responsive vehicles equipped with electronic fare payment systems	70
	Computer aided dispatching or control software	1
	Total demand responsive vehicles equipped with navigation aids	70
	Collects information on vehicle monitoring status	70
	Collects information on transit operations coordination information	
	Archives transit operations coordination information	
Glendale	Total demand responsive vehicles	18
	Total demand responsive vehicles equipped with electronic fare payment systems	18
	Total demand responsive vehicles equipped with AVL	18
	Total demand responsive vehicles equipped with navigation aids	18
	Total automated dispatching or control software available on fixed route bus	5
	Total fixed route buses equipped with electronic fare payment systems	5
	Disseminates real-time transit schedule adherence or arrival and departures times through telephone, kiosks, VMS, and monitors	
	Upgrading analog radio system	
	Global positioning system (GPS)	
	Traveler information displayed at fixed bus transit route stops	10

Jurisdiction	Planned ITS Systems	Number
Mesa	Traveler information displayed at fixed bus transit routes	6
	Disseminates real-time transit schedule adherence or arrival and departures times through kiosks	
Phoenix	Total buses equipped with AVL capability	400
	Total demand responsive vehicles equipped with AVL capability	70
	Total demand responsive vehicles operated under computer aided dispatch system	70
	Traveler information displayed at fixed bus transit routes	3
	Disseminates transit routes, schedules, and fares through Internet web sites and kiosks	
	Disseminates real-time transit schedule adherence or arrival and departures times through telephone system, Internet web sites and kiosks	
RPTA	Traveler information displayed at fixed bus transit routes	2
	Dial-a-Ride AVL	
	Dial-a-Ride call-in system	
	Dial-a-Ride scheduling system	
	Dial-a-Ride hardware/software upgrades	
	Dial-a-Ride electronic fare boxes	
Scottsdale	Total buses equipped with AVL capability	56
	Total buses equipped with AVI capability	56
	Total buses equipped with electronic payment systems	56
	Total buses operated under computer aided dispatch system	56
	Total buses with component systems electronically monitored	56
	Total demand responsive vehicles equipped with AVL capability	15
	Total demand responsive vehicles equipped with AVI capability	15
	Total demand responsive vehicles equipped with electronic fare payment systems	15
	Total demand responsive vehicles operated under computer aided dispatch system	15
	Total demand responsive vehicles equipped with navigation aids	15
	Total demand responsive vehicles with component system electronically monitored	15
	Traveler information displayed at fixed bus transit routes	10
	Real-time transit schedule adherence or arrival and departure times through cable TV, telephone, Internet web site, pagers, e-mail, in-vehicle systems and kiosks	
Sun City Area Transit System	Demand responsive vehicles	15

Several of the city transit systems plan to equip their buses and their demand responsive vehicles with advanced vehicle location and advanced vehicle identification capabilities. Both city transit buses and demand responsive vehicles will be equipped with electronic fare payment systems such as smart card readers, electronically registering fareboxes, and debit or credit card readers. Many of the demand responsive systems will use computer aided dispatch systems.

3.5 Airport Planned ITS

Jurisdiction	Planned ITS Systems	Number
Phoenix Sky Harbor International Airport	Install parking revenue control system at Mohave and Tonto parking lots	2 lots

The installation of the parking revenue control system at the Mohave and Tonto parking lots will complete the upgrade of all lots under control of Phoenix Sky Harbor International Airport to the parking revenue control system. In addition, Sky Harbor is considering methods to direct people to parking lots, such as the installation of VMS at the airport. The airport is also considering methods to detect vehicles that use the airport as a cut-through road.

3.6 Emergency Management Planned ITS

Jurisdiction	Planned ITS Systems	Number
ADOT/ Department of Public Safety	Fiber optic connection between the ADOT TOC and the DPS	1

ADOT and the DPS are planning the installation of a fiber optic connection between the ADOT TOC and the DPS dispatching center. The connection would allow the two agencies to electronically share information about incidents on local freeways and provide the DPS the ability to view and control ADOT CCTV cameras.

3.7 Commercial Vehicle Planned ITS

Jurisdiction	Planned ITS Systems	Number
ADOT	Weigh-in-motion sites	Additional WIMs added as funding allows
ADOT Motor Vehicle Division	Special Response Interactive Ports (Sprint Ports)	Additional ports added as funding allows
Department of Public Safety	Safety and Fitness Electronic Records System (SAFER)	1
TranSmart Technologies	CVO traveler information system, including e-mail traveler information system, real-time congestion map, and real-time CVO restriction information	1

In 1998, Arizona completed an ITS CVO Business Plan as part of ADOT's effort to become a Commercial Vehicle Information Systems and Networks (CVISN) state. Participation in the CVISN program will increase federal funding to Arizona's ITS CVO program and could lead to additional ITS CVO projects deployed in Arizona. The 1998 ITS CVO Business Plan identified 10 projects that were recommended for deployment in Arizona to assist with CVO. Several of these projects are recommended for deployment outside of the MAG region or pertain to all vehicles, such as the deployment of VMS, and have been covered in other sections of this report. The first three projects in the above table were identified in the 1998 ITS CVO Business Plan. The fourth project, deployment of a CVO traveler information system, is being completed as part of the AZTech™ Phase II deployment.

3.8 Private Sector Planned ITS

Private Sector	Project
TranSmart Technologies (Also listed in **Section 3.7**)	CVO traveler information system, including e-mail traveler information system, real-time congestion map, and real-time CVO restriction information
Traffic Station	Real-time traveler information in-vehicle devices
Traffic Station	Telewarning™ cellular telephone traveler information network
Traffic Station	Digital television with traveler information feeds
Traffic Station	Personalized real-time traveler information web site
Traffic Station	Real-time traveler information broadcast fax network
Traffic Station	Real-time traveler information paging network
CUE	Real-time traveler and transit information paging network
CUE	Palm-sized PC with real-time traveler information
CUE	RouteFinder and StreetPilot hand held devices with real-time traveler information

The on-going efforts of the AZTech™ Phase II deployment, and the growing population and traffic in the Valley, has encouraged the continual development of private sector ITS deployments. Many of these deployments focus on providing traveler information to the public. Traffic Station and CUE are both focusing their efforts on providing real-time personalized traveler information to the public. The total number of units eventually deployed for many of these systems will depend on the demand by the public. Obviously, the greater the demand the higher the number of units deployed. TranSmart Technologies is focusing their deployment on the CVO area. Their system will target routes and include real-time information on CVO restrictions. The successes of these deployments will, in many ways, affect the future of private sector involvement in ITS. If the public demands these products and is willing to pay a fee, continued involvement by the private sector in ITS will be assured.

4. USER NEEDS

4.1 Approach to Identifying Regional Transportation Needs

To obtain input from a wide range of transportation users in the MAG region, the study team conducted a comprehensive outreach and education program. Transportation users throughout the MAG region were given the opportunity to submit their comments and input on the regional transportation needs by attending focus groups, mailing or faxing in questionnaires, as well as providing input via a project e-mail address and hotline. Information about the project is accessible to anyone with Internet access at www.mag.maricopa.gov.

4.1.1 Focus Groups

The primary means of identifying the transportation needs in the MAG region was through focus group workshops. Four workshops were scheduled as part of the Stakeholder Involvement Plan (refer to Technical Memorandum #1 for a detailed overview of all stakeholder relations activities). Input was received from stakeholders who attended three of the four workshops, as well as from questionnaires that were mailed back to the study team. Stakeholders were notified of the focus groups via the first project newsletter (which also included a questionnaire), faxed reminders, and workshop times and dates posted on the project web page.

Focus group workshops were scheduled for the following dates and locations:

No.	Date	Location	Number of Participants
1	October 26, 1999	MAG offices	10
2	November 2, 1999	YWCA Leadership Development Center (ITS Arizona Annual Meeting)	32
3	November 17, 1999	Arizona Builders Alliance	0
4	November 18, 1999	Rural Metro/Scottsdale (911 Public Safety Answering Point [PSAP] Managers Meeting)	29

The first focus group was open to stakeholders from public agencies in the region. For the second focus group, the team used the ITS Arizona Annual Meeting as a forum to promote the project to the local ITS and transportation community, as well as solicit input from the conference attendees. The third workshop was scheduled as a public meeting, with invitations sent to members of the local media, major employers, and community groups. The last workshop was held as part of the regularly-scheduled 911 PSAP Managers meeting. Due to the lack of attendance at the third focus group meeting (public meeting), the needs questionnaire was posted on the project web page in an effort to solicit more input.

In addition to feedback from focus group participants, the study team received nine completed questionnaires from various stakeholders.

4.1.2 Focus Group Methodology

Each of the workshops was structured around ITS education and a brainstorming session. The format for the focus group workshops was as follows:

- An overview of the MAG ITS Strategic Plan Update;
- A PowerPoint presentation about ITS technologies, benefits, and local ITS applications (refer to Technical Memorandum #2);
- An interactive brainstorming session to talk about ITS issues and solutions; and
- Prioritizing of needs.

The brainstorming component was designed to encourage participation from the attendees, as well as spur some cross-discussion about relevant transportation issues. A number of important issues were raised during this portion of the workshop.

As part of the brainstorming segment, participants were asked to prioritize regional transportation needs that were on boards placed throughout the room by tagging them with color-coded stickers corresponding to "high," "medium," and "low" priorities. These priorities were used by the study team to develop the ranking of needs (described and listed in **Section 4.2**).

Because this project is an update to 1995 MAG ITS Strategic Plan, it was important to show an element of comparison (as well as continuity) between the needs previously identified and those that were identified as part of this update. To accomplish this, several of the priority needs from the 1995 study were listed corresponding to the following areas:

- Traffic Signal Control Systems;
- Freeway Management Systems;
- Incident and Emergency Management Systems;
- Commercial Vehicle Operations;
- Transit Management Systems;
- Traveler Information Systems; and
- Institutional Issues.

Needs in the above areas were listed on boards, and space was provided for participants to indicate whether or not that need had been met since the 1995 plan, designate a priority ranking, as well as list any benefits that would be obtained by addressing a particular need. On all boards, ample space was provided for participants to write-in new needs that they wanted to see considered as part of this project.

The second focus group followed a different format than described above. The timing of the MAG ITS Strategic Plan Update needs identification effort coincided with the ITS Arizona annual conference in early November, 1999. A table-top project booth was displayed throughout the day-long conference, and included an overview and key objectives of the MAG ITS Strategic Plan Update, a continuously-looped presentation that was shown on a laptop (the same presentation given at the other workshops), as well as the needs boards. Conference attendees were asked to prioritize the needs using the color-coded stickers, similar to the other focus groups, as well as write-in any additional needs they wanted to see as part of this Strategic Plan.

4.2 ITS Needs Ranking

Using the input and priorities obtained from the questionnaires and focus group workshops, the study team developed a list of priority needs that will serve as the foundation for the rest of the strategic plan update.

A point value was assigned to “high,” “medium,” and “low” priority need statements identified by the stakeholders. Each “high” priority was assigned a point value of three; “medium” priorities were assigned a point value of two; and “low” priorities were given one point each. The “points” were then added up for each need to develop a priority score. For example:

Need	High (x3)	Medium (x2)	Low (x1)	TOTAL
Real-time transit schedule information	7 (21)	4 (8)	1 (1)	30

The first number in the "high," "medium," and "low" columns indicates how many times that need was identified at that particular priority level. The second number in those columns is the assigned point value.

The table below provides a ranking of the prioritized need statements that were gathered as part of the needs identification task and their corresponding scores. Also included in this table are needs that were identified through the focus groups or questionnaires but were not assigned a priority by the responder.

ID#	Need	Score
1	Need to integrate signal systems with freeway management system	91
2	Need improved incident clearance at freeway interchanges	68
3	Need enhanced transit service (routes, frequency, hours)	68
4	Need to enhance regional signal coordination/improve progression	67
5	Need to reduce incident clearance time	64
6	Need to improve accuracy and timeliness of traffic information to public	60
7	Need to VMS utilization with more traffic/incident information	47
8	Need to improve incident detection and notification to motorists	47
9	Need a regional light rail system	39
10	Need to increase inter- and intra-agency coordination	38
11	Need real-time transit schedule information	30
12	Need more accurate information about road construction/closures and alternate routes	29
13	Need bus priority at traffic signals	29
14	Need more HOV lanes on freeways	28
15	Need to develop and facilitate ITS education and marketing efforts to public	28
16	Need enhanced traffic management capabilities for special events	27
17	Need to increase use of computerized traffic signals	26
18	Need to improve real-time communication between TMCs and CVOs	25
19	Need to increase use of HAR	23
20	Need in-vehicle traffic information	22
21	Need more advanced warning at RR/street crossings	21
22	Need to increase use of automated enforcement technologies (red lights, speed, etc.)	21
23	Need to integrate transit information with arterial and freeway management systems	21
24	Agencies need more traffic data to plan infrastructure improvements	20
25	Need freeway call boxes	20
26	Need AVL for transit	19
27	Need political support for ITS projects/programs	15
28	Need to implement a consistent regional map for PSAPs	15
29	Need to enhance/expand electronic fare collection for transit	14
30	Need a regional centralized clearinghouse for incident information	13

ID#	Need	Score
31	Need expanded route/destination information (i.e., travel times)	13
32	PSAPs need access to real-time traffic information	12
33	Need a uniform emergency signal preemption system	11
34	Need AVL capability for CVOs	11
35	Need collision warning systems for CVOs (i.e., overpass heights)	10
36	Need to identify major sources of funding for ITS	10
37	Need to improve safety at intersections	9
38	Need to equip major arterials as SMART corridors	9
39	Need to integrate dial-a-ride information with regional transit service	9
40	Need more traffic signals in suburbs and rural areas	9
41	Need to identify user-based funding opportunities for ITS	8
42	Need a uniform computer aided dispatch system for EMS throughout the region	8
43	Need a computerized rideshare program for the region	8
44	Need to get local agency commitment to long-term O&M for ITS programs	7
45	Need portable VMS and trailblazers	6
46	Need to improve safety on buses/at bus stops	6
47	Need additional MAYDAY capability	6
48	Need to use CVOs as probe vehicles (i.e., Super Shuttle, taxis, etc.)	5
49	Need enhanced information at transit centers (i.e., schedules, distance-to-destination, etc.)	5
50	Need speed differential information (CVOs/vehicles)	4
51	Need real-time information during special events	4
52	Need to increase use of detector data/travel time data	3
53	Need to use VMS only for emergencies	3
54	Need to integrate park-and-ride information with other traffic information	2

The following needs were identified but not prioritized:		
	Better information CVO/truck traffic restrictions on local roadways	
	Standardized information for multiple CVO dispatchers	
	Use media/traffic reporters to educate public about ITS	
	Tailor information to specific groups of users	
	Communicate information on speed differentials to motorists	
	Pedestrian and bicycle ITS (audio at crossings, special detectors for signals, hand-held receivers)	
	PSAP Internet access	
	Coordinate signals to route traffic away from incidents	
	More information about alternate routes during construction	
	Uniform speed limits throughout region	

In addition to the above needs, several non-ITS needs or issues were raised by the stakeholders, including:

- Local street routing for CVOs during freeway closures/incidents;
- Need dedicated truck lanes;
- Dedicated lanes for EMS vehicles;
- Median barriers; and
- Reduce time to complete freeway/roadway construction.

4.3 Findings

The workshops and questionnaires yielded valuable information about regional transportation needs from a broad range of perspectives. Many of the high-ranking needs that were identified focused on improved signal coordination, enhancements to transit service, improving incident response and management, and providing timely, accurate information to motorists. Many of those needs also were key needs that were identified in the previous regional ITS Strategic Plan.

There were several needs identified that focused on two significant issues: a regional light rail system and a comprehensive ITS education and outreach program. While light rail in and of itself is not an ITS element, it does demonstrate that the stakeholders are viewing transportation from a multimodal perspective. The expressed need for an ITS educational program (identified primarily by public-sector attendees) included suggestions for integrating ITS education with drivers education, partnering with traffic reporters from local media to help educate the public about ITS, and finding other opportunities to educate the public about local ITS programs and their benefits.

5. IDENTIFICATION OF REGIONAL OBJECTIVES

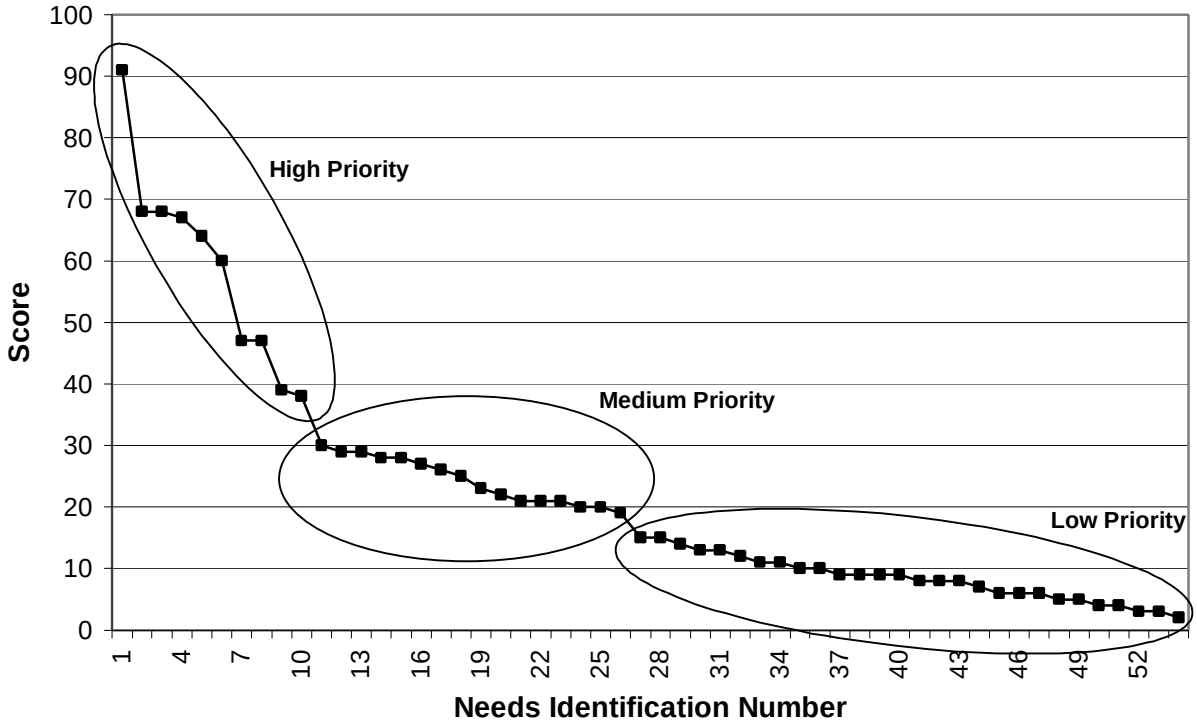
5.1 ITS Needs Addressed Through Existing and Planned Systems

To determine the ITS regional objectives, the ITS needs identified by the regional stakeholders were closely examined. To focus on higher priority goals in the ITS strategic plan a plot of the priority scores of each need was developed and is represented in **Figure 5-1**. As shown in this plot, there are three groups of needs. The first group represents the highest priority needs, corresponding to need identification numbers 1 through 10. The second group represents those in the medium priority, corresponding to need identification numbers 11 through 26. Finally, there is a break at need 27 where the score drops from 19 to 15. This group, from need identification number 27 to 54, are lower priority needs.

In order to focus resources on the higher priority needs as identified by the stakeholders in the MAG region, only the high and medium priority needs were used to identify regional objectives. After a review of the lower priority needs by MAG, it was decided to include three additional lower priority needs into the group of higher and medium priority needs. These three needs, and their corresponding identification numbers, are as follows:

- PSAPs need access to real-time traffic information. (32)
- Need enhanced information at transit centers. (49)
- Need to increase use of detector data/travel time data. (52)

Figure 5-1
Stakeholder Needs Score



The needs statements were reviewed to determine if they were in fact ITS needs, or if the need would be more appropriately addressed through a different type of project. For example, a regional light rail system was identified as a need. While ITS could certainly be a part of a regional light rail system, the light rail system is not an ITS system and the decision to implement light rail should be made in a separate forum from the MAG ITS Strategic Plan Update.

The Regional ITS Stakeholders Group (RISG), the oversight committee for the MAG ITS Strategic Plan Update, also reviewed the needs to determine if it was feasible to address the need in the ITS Strategic Plan Update. Based on the review of the RISG, it was decided to address all stakeholders needs identified as ITS needs.

Finally, needs were reviewed to determine if existing systems are in place that address the need. The existing system was rated as "No" (no systems exist to address the need), "Partially" (some systems exist to partially meet need), or "Yes" (adequate systems are in place to meet the need.) Planned systems were also reviewed to determine if the systems planned in the MAG region may meet the need. Finally, the planned systems were rated as "No," "Partially," or "Yes" to describe the ability of the planned systems to meet the identified need.

The results of this review are presented in the following table. In the case of most needs, at least one system is planned that will continue to address that need in the future; however, there were no needs identified where planned systems were expected to fully meet the need. This is due to the fact that the transportation system continually grows and changes, and while systems may be planned to address the need, it is difficult to say that any system will fully meet a transportation need in the future. As the transportation system and the transportation needs grow, ITS will need to continue to be deployed to meet the needs of transportation stakeholders.

ID#	Need	Score	ITS Need	RISG Agreement With Need	Existing Systems Address Need
1	Need to integrate signal systems with freeway management system	91	Yes	Yes	Partially
2	Need improved incident clearance at freeway interchanges	68	Yes	Yes	Partially
3	Need enhanced transit service (routes, frequency, hours)	68	No	-	-
4	Need to enhance regional signal coordination/improve progression	67	Yes	Yes	Partially
5	Need to reduce incident clearance time	64	Yes	Yes	Partially
6	Need to improve accuracy and timeliness of traffic information to public	60	Yes	Yes	Partially
7	Need to increase use of VMS for more types of information	47	Yes	Yes	No
8	Need to improve incident detection and notification to motorists	47	Yes	Yes	Partially
9	Need a regional light rail system	39	No	-	-
10	Need to increase inter- and intra-agency coordination	38	Yes	Yes	Partially
11	Need real-time transit schedule information	30	Yes	Yes	Partially
12	Need more accurate information about road construction/closures and alternate routes	29	Yes	Yes	Partially
13	Need bus priority at traffic signals	29	Yes	Yes	Partially
14	Need more HOV lanes on freeways	28	No	-	-
15	Need to develop and facilitate ITS education and marketing efforts to public	28	Yes	Yes	Partially
16	Need enhanced traffic management capabilities for special events	27	Yes	Yes	No
17	Need to increase use of computerized traffic signals	26	Yes	Yes	Partially
18	Need to improve real-time communication between TMCs and CVOs	25	Yes	Yes	No
19	Need to increase use of HAR	23	Yes	Yes	No
20	Need in-vehicle traffic information	22	Yes	Yes	Partially
21	Need more advanced warning at RR/street crossings	21	Yes	Yes	No
22	Need to increase use of automated enforcement technology (red lights, speed, etc.)	21	No	-	-
23	Need to integrate transit information with arterial and freeway management systems	21	Yes	Yes	Partially
24	Agencies need more traffic data to plan infrastructure improvements	20	Yes	Yes	Partially
25	Need freeway call boxes	20	Yes	Yes	No
26	Need AVL for transit	19	Yes	Yes	Partially
32	PSAPs need access to real-time traffic information	12	Yes	Yes	No
49	Need enhanced information at transit centers	5	Yes	Yes	Partially
52	Need to increase use of detector data/travel time data	3	Yes	Yes	Partially

5.2 Regional Objectives

Based on the ITS needs identified by stakeholders, several regional objectives were developed to help meet those needs. The regional objectives for the MAG ITS Strategic Plan Update, and the identification numbers of the needs they address, are identified below.

- Coordinate signal systems across jurisdictional boundaries and improve progression. (1, 4, 10, 17, 52)
- Improve incident detection capabilities and reduce incident clearance times. (2, 5, 8, 52)
- Improve accuracy, timeliness and availability of real-time traveler information to the public. (6, 11, 12, 19, 20, 23, 26, 32, 49, 52)
- Increase the use of VMS for more types of information. (7)
- Increase inter-agency and intra-agency coordination. (1, 16, 17)
- Improve bus progression through the use of traffic signal priority. (13)
- Develop and facilitate ITS education and marketing efforts to the public. (15)
- Enhance traffic management capabilities for special events. (16)
- Provide advanced warning at railroad/street crossings. (21, 52)
- Increase automated traffic data collection and archiving ability. (15, 52)
- Install freeway call boxes. (25)
- Provide PSAP managers with access to real-time traffic information. (32)