Pomona Valley
ITS Project

Project Deliverable 5.1.2

ATMS User Requirements Report

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PROJECT DESCRIPTION

The County of Los Angeles, in cooperation with the cities within the Pomona Valley, has determined that development of an Intelligent Transportation System (ITS) in the Pomona Valley would help to reduce congestion, enhance mobility, provide traveler information during non-recurring and event traffic congestion, and manage event traffic. The Pomona Valley Intelligent Transportation Systems (PVITS) project was conceived as a recommendation from the Pomona Valley ITS Feasibility Study completed by the LACMTA in 1995. The ultimate objectives of the Project are to:

- Improve mobility by optimizing traffic management on arterials and freeways;
- Enhance Route 60 capacity by better coordinating freeway traffic with parallel arterials;
- Improve agency efficiency by coordinating management of operations and maintenance efforts among agencies; and
- Increase agency staff productivity by providing low-maintenance, high-quality communications and computational tools to assist in daily management and coordination activities.

Phase 1 of the PVITS project is the development of a conceptual design that defines solutions to enhance capacity, reduce congestion, and improve traveler information in the Pomona Valley.

1.0 BACKGROUND

1.1 Purpose of Report

The Advanced Traffic Management System(s) (ATMS) for the Pomona Valley is a system (or systems) that will provide agencies in the Pomona Valley with tools for managing traffic within the Forum. The ATMS will operate traffic signals, CCTV cameras, Dynamic Message Signs (DMS), and Trailblazers, and provide information to other systems (such as a subregional Pomona Valley Advanced Traveler Information System [ATIS]) and other stakeholders.

The subregional ATIS will be a system that collects information automatically from the ATMS(s) and collects information that is manually input by agency operators and other stakeholders regarding events such as planned construction or incidents, processes this data and provides it to the general public via a variety of dissemination media. The dissemination media include an Internet web site, kiosks, highway advisory radio (HAR), community access television (CATV) and a dial-in (511) phone service.

The ATMS is being designed to meet the needs of both the local and subregional roles in the Forum. The system will be designed for application in any city in the Pomona Valley, the County unincorporated area, and the subregional TMC.

This document identifies the users of the future Pomona ATMS and presents their requirements for the ATMS in support of **Subtask 5.1: ATMS User Requirements**, of the PVITS project. The user requirements is intended to provide an explicit specification of the users' operational and functional requirements of the ATMS, and are uniquely numbered so that they may be traceable during all phases of the project.

Specific system functional details and specifications of how the ATMS fulfills these user requirements are described in the **ATMS Functional Requirements Report**. ATIS User Requirements are being defined as part of a separate effort and can be found in the **ATIS Requirements Report**. The ATMS Functional Requirements Report will be produced as an effort of Subtask 5.2 of this project. The ATIS Requirements Report will be produced as a result of Subtask 5.7 of this project.

1.2 Methodology

The Pomona ATMS is proposed to enhance vehicular traffic management and operations, reduce congestion levels, and improve incident response and agency coordination. It also aims at increasing efficiency of operating and maintenance staff through high quality communications and computational tools. In other words, the technologies that will be implemented in the Pomona Valley Forum area are intended to act as tools to assist local and regional agencies in better and more efficiently managing recurring and non-recurring traffic.

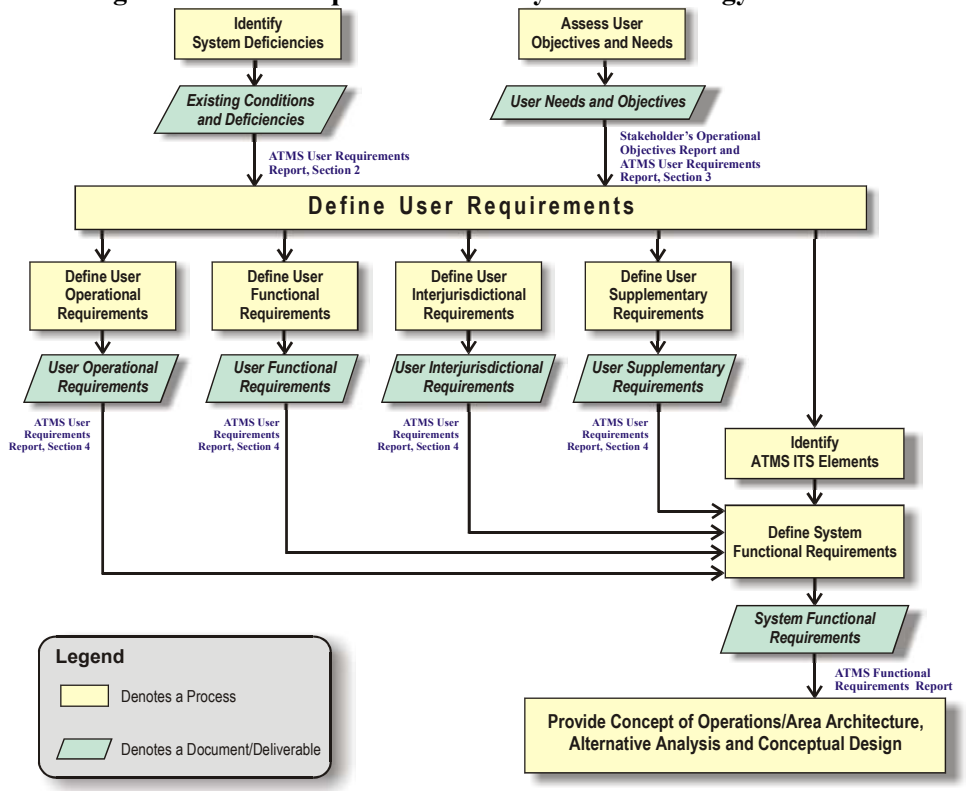
Understanding user requirements is the first step of the conceptual design of the Pomona ATMS and is critical to the success of the system. User requirements specify what functionality the users want and determines what operational features are required for the system from a user's perspective. The requirements define *what* needs to be designed rather than *how* it is to be designed. The development of the Pomona ATMS user requirements began with the identification of system deficiencies, and users' needs and objectives. System deficiencies were identified

through an analysis of existing conditions in the Pomona Valley region. The needs of the project stakeholders for traffic management formed the objectives of the PVITS project. These objectives were obtained as a result of a series of outreach efforts conducted as part of previous tasks for this project. These needs and deficiencies led to the determination of the ATMS elements that can address them. The user objectives should be achievable through the identified ITS elements.

The ATMS user requirements are defined in terms of operational, functional, interjurisdictional, and supplementary requirements. The identified ATMS elements are assigned to a set of system functional specifications based on these various requirements. These system functional specifications are the ATMS Functional Requirements. The ATMS User Requirements together with the ATMS Functional Requirements lay the groundwork for the baseline system design.

The user requirements analysis methodology is illustrated in **Figure 1-1**. The sections of this report that summarize each step are called out in the figure.

Figure 1-1 User Requirements Analysis Methodology Flowchart



This methodology is consistent with the approach of the National ITS Architecture, a nationally-standardized and required approach to ITS planning. Ensuring that a project is consistent with the National Architecture better positions the project for future funding and helps to ensure interoperability on a local level. The National ITS Architecture's approach starts with the identification of user needs and objectives. These needs and objectives are those that will be addressed through the implementation of various ITS applications and will be mapped to various user services.

User services present what ITS applications can be provided to address a particular user need or objective and what these ITS applications will do from the users' perspectives. It is an

encapsulation of needs that must be satisfied if the ITS application is going to be considered successful by the user.

The identified ATMS elements represents the ITS applications that will be used to provide the identified user services. The capabilities of each identified ATMS element, as well as its associated operational aspects, are defined in the functional requirements. Together the user and functional requirements for the Pomona ATMS provide an accessible, deployment-oriented perspective of the National Architecture.

A specific example of the relationship between needs and objectives, user services, ATMS elements, user requirements, and functional requirements is provided in **Table 1-1**.

Table 1-1 Example of User Services, User and Functional Requirements

Needs and Objectives	User Services	ATMS Elements	User Requirements	Functional Requirements
Implement a central traffic control system to improve mobility	Traffic Control	Traffic Control and Monitoring System	• The system shall provide centralized traffic control and monitoring capabilities to efficiently manage the movement of traffic on streets and highways. This will also include control of network signal systems.	• Administrators shall be able to monitor and control all signals within their jurisdiction via the ATMS.
			• The system shall be able to collect data to support traffic control at both local and interjurisdictional levels.	• The ATMS shall collect and maintain all data required for once-per-second monitoring and displays from all intersections at all times.

1.3 Report Organization

The information in this report is presented in the following sections:

Section 1 - This section provides an overview of the PVITS project and introduces the report's purpose, approach, and identifies where this deliverable fits into the overall project work effort.

Section 2 - This section provides an overview of existing conditions in the Pomona Valley region and identifies deficiencies of the stakeholders' existing system

Section 3 - This section summarizes the needs and objectives of the stakeholders, which were defined as part as Task 4, "Stakeholders and Operational Objectives" of this project.

Section 4 - This section presents the results of this portion of the project work effort, culminating in the identification of the user requirements of the PVITS project's ATMS.

Section 5 - Summary and final comments

2.0 OVERVIEW OF EXISTING CONDITIONS

This section of the report provides an overview of existing conditions of the PV Forum cities with respect to the ATMS. The descriptions of the existing conditions also explain briefly the purpose or description of the element or function. This information falls into the following six major areas:

- Traffic Control and Monitoring
- System Detection
- Closed Circuit Television (CCTV) Surveillance
- Communication
- Other ITS Elements
- Operations/Maintenance/Staffing

Other elements such as ATIS are not part of this document and will be discussed in other project deliverables.

2.1 Traffic Control and Monitoring

Traffic control and monitoring systems that react to changing traffic conditions are an important component of any project with a goal of improving transportation system efficiency. Traffic signals can be operated in a number of different ways including:

- Independent intersections running on time-of-day plans,
- Groups of independent intersections coordinated through time-based coordination (using WWV to synchronize the clocks),
- Signals that are centrally controlled from a local traffic control system,
- Signals that are centrally controlled from a multi-jurisdictional or subregional traffic control system.

The latter two options for operating traffic signals provide centralized control and monitoring of intersections. These operational modes require not only traffic signal equipment and traffic signal controllers, but also communications from the signals to the central system, detection, communications between traffic signals (in some cases), a central traffic control system (hardware and software), and related peripherals/ monitoring equipment.

Most of the agencies in the Pomona Valley region utilize Type 170 controllers for traffic control. Pomona is the only PV Forum agency that has a central traffic control system (QuicNet 2), and its signals are coordinated using Time-of-Day (TOD) plans. The City of Pomona's system is old and is not currently being used. For other jurisdictions, the signals on regionally significant arterials are coordinated and running in FTA mode using TOD plans and WWV-synchronization. **Table 2-1** provides a summary of the traffic control systems of the seven PV Forum cities and LA County in terms of traffic controllers, traffic control systems, traffic signal system operations, and maintenance. The ATMS is being recommended for operation and monitoring of those signals on regionally significant arterials in the study area. The table summarizes those signals.

Table 2-1 Summary of Local Traffic Control and Maintenance on Regionally Significant Arterials

Entity	Controller Type on Regionally Significant Arterials	Traffic Control System and Operational Mode for Traffic Signals on Regionally Significant Arterials	Signal Ownership on Regionally Significant Arterials	Signal Maintenance on Regionally Significant Arterials
City of Claremont	• All Type 170	• No central traffic control system • Signal operation/ coordination through fully traffic actuated (FTA)/ time of day (TOD) plans (with WWV) at each controller	• 25 signals (24 existing and one planned) • 12 owned by Claremont (11 existing and one planned) • Three owned jointly by Claremont and Pomona • 10 owned by Caltrans	Contracted out
City of Diamond Bar	• All Type 170	• No central traffic control system • Signal operation/ coordination through FTA/ TOD plans (with WWV) at each controller	• A total of 50 signals (46 existing and four planned) • 42 owned by Diamond Bar (38 existing and four planned) • One owned jointly by Diamond Bar and Pomona • One owned jointly by Diamond Bar and Caltrans • Six owned by Caltrans	Contracted out
City of Industry	• Type 170 controllers	• No central traffic control system • Signal operation/ coordination through FTA/ TOD plans (with WWV) at each controller	• A total of 81 signals • 33 owned by Industry • 27 owned jointly by Industry and LA County • Six owned jointly by Industry and La Puente • One owned jointly by Industry and West Covina • Two owned jointly by Industry and Walnut • 12 owned by Caltrans	LA County

Entity	Controller Type on Regionally Significant Arterials	Traffic Control System and Operational Mode for Traffic Signals on Regionally Significant Arterials	Signal Ownership on Regionally Significant Arterials	Signal Maintenance on Regionally Significant Arterials
City of La Verne	• 17 Type 170 controllers • Four Traconex TMP-390 controllers (NEMA) • Three Econolite Type ACS-2-2100 controllers (NEMA) • One Multisonics Type 820 controller (NEMA)	• No central traffic control system • Signal operation/ coordination through FTA/ TOD plans (with WWV) at each controller • Signals along White Ave are hardwire interconnected	• A total of 25 signals • Ten owned by La Verne • Two owned jointly by La Verne and San Dimas • 13 owned by Caltrans	Contracted out
City of Pomona	• One NEMA controller • Remainder are Type 170 controllers	• QuicNet II currently has the ability to monitor approximately 80 signals city-wide (not just on regionally significant arterials); not currently being used • Signal operation/ coordination through FTA/ TOD plans (with WWV) at each controller	• A total of 92 signals • 77 owned by Pomona • Two owned jointly by Pomona and Claremont • One owned jointly by Pomona and Diamond Bar • 12 owned by Caltrans	Maintained by Pomona

Entity	Controller Type on Regionally Significant Arterials	Traffic Control System and Operational Mode for Traffic Signals on Regionally Significant Arterials	Signal Ownership on Regionally Significant Arterials	Signal Maintenance on Regionally Significant Arterials
City of San Dimas	• All Type 170	• No central traffic control system • Signal operation/ coordination through FTA/ TOD plans (with WWV) at each controller	• 13 signals • 9 owned by San Dimas • One owned jointly by San Dimas and La Verne • One owned jointly by San Dimas and Glendora • One owned jointly by San Dimas and Caltrans • One owned by Caltrans	One city staff plus contract
City of Walnut	• All Type 170	• No central traffic control system • Signal operation/ coordination through TOD plans (with WWV) at each controller	• 15 signals • All owned by Walnut	Maintained by LA County
LA County	• All Type 170	• No central traffic control system • Signal operation/ coordination through TOD plans (with WWV) at each controller	• 16 signals • All owned by LA County	Maintained by LA County
Caltrans	• All Type 170	• Central traffic control system	• 10 in Claremont • 6 in Diamond Bar • 12 in Industry • 13 in La Verne • 12 in Pomona • 1 in San Dimas	Maintained by Caltrans

2.2 Vehicle Detection

Detection of real-time traffic conditions is an important component of traffic signal operations. Three types of vehicle detection are used in traffic signal operations:

- Presence,
- Advanced, and
- System.

Presence detectors are provided at the stop bar and are designed to detect the presence of a vehicle. Advanced detection is provided generally between 250 to 350 feet upstream of the intersection (depending on the travel speed of vehicles). These detectors provide queue information to the signal controller. System detection is provided 500 to 800 feet upstream of the intersection (depending on the prevailing maximum queue lengths at the intersection). The primary objective of system detection is to provide volume, occupancy, and speed information to a central system. Information received from system detectors can be fed into either a traffic responsive or adaptive algorithm or processed for data sharing among agencies or conveyance to the traveling public. A traffic responsive or adaptive algorithm would then implement efficient, system-wide timing plans based on current conditions.

Inductive loop detectors have traditionally been the primary technology used for vehicle detection. However, technological innovations have given rise to many different types of advanced non-roadway invasive traffic detectors (e.g., video, microwave, sonic, etc).

Table 2-2 summarizes the existing vehicle detection in the PV Forum.

Table 2-2 Summary of Vehicle Detection

Agency	Vehicle Detection
City of Claremont	• Presence and advanced inductive loop detection for all signals on regionally significant arterials • Bicycle detection loops installed at Bonita Ave/Indian Hill Blvd
City of Diamond Bar	• Presence and advanced inductive loop detection for all signals on regionally significant arterials
City of Industry	• Presence and advanced inductive loop detection for all signals on regionally significant arterials
City of La Verne	• Presence and advanced inductive loop detection for all signals on regionally significant arterials
City of Pomona	• Presence and advanced inductive loop detection for all signals on regionally significant arterials • Video detection used at several intersections
City of San Dimas	• Presence and advanced inductive loop detection for all signals on regionally significant arterials • Video detection installed at the north and south approaches of the Arrow Hwy/Sam Dimas Ave
City of Walnut	• Presence and advanced inductive loop detection for all signals on regionally significant arterials
County of Los Angeles	• Presence and advanced inductive loop detection for all signals on regionally significant arterials

2.3 CCTV Surveillance

A Closed Circuit Television (CCTV) system can be used to remotely view roadway traffic conditions or verify incidents in real-time. In addition, this type of system can be used for other traffic management purposes including queue monitoring, congestion monitoring, equipment status monitoring, and occasional manual traffic counting. Cameras used for CCTV surveillance can be fixed-mounted or can utilize pan/tilt/zoom units for maneuverability. These two types of cameras can be either color or monochrome. Currently there are no CCTV cameras in use for traffic monitoring on the Pomona Valley arterials.

2.4 Communication

The primary goal of a surface transportation communication system is to support the deployment of various traffic control and ITS elements that will allow system operators to perform traffic management functions such as view traffic operations, upload and download signal timing plans, deliver traffic information to travelers, etc. There are different types of communication media available for ITS deployment, both wireless and hardwire. These media can either be installed, owned, and maintained by a governing agency or leased through a private entity. The following points summarize the existing communication in the Pomona Valley for transportation use:

- GST Telecom has a fiber optic cable that extends along the entire length of Arrow Highway within the City of Claremont. The City may be able to lease a portion of this fiber, if desired, for transportation uses.
- The City of Pomona has a fiber optic communication system that connects the schools to each other and connects this school network into the City Hall. This system was installed for educational use. There is an opportunity to utilize some bandwidth of this existing fiber line for transportation uses as well.
- The City of Pomona has signal interconnect that is currently not operational as the line has been cut between the field and the City Hall.
- Privately owned fiber optic cables are strung above ground via utility poles along Walnut Avenue and Arrow Highway in the City of San Dimas. The City may be able to lease some of these fiber lines, if desired, for transportation uses.

3.0 SUMMARY OF ATMS USER NEEDS AND OBJECTIVES

User needs and objectives of the Pomona ATMS will be used to establish the user requirements for the system. For example, one desire within the Pomona Valley Forum is to have the ability to provide CCTV surveillance capability for traffic management and maintenance staff. In this case, "CCTV Surveillance Capability" will be the user's need. The user objective would be to view traffic on the arterials and at the intersections to assist and facilitate traffic management and maintenance capabilities. One of user requirements for this user objective would be the requirement for the CCTV cameras to be able to pan, tilt, and zoom.

In addition, the user needs and objectives will be used to identify the specific ITS elements that can address those needs and objectives. In the previous case, CCTV cameras would be the identified ITS element.

Stakeholder identification is the first step in assessing user needs. While there are 16 stakeholders in the PVITS project, eight are primary stakeholders that will have direct operational, financial, and legal control over the system(s) recommended.

Primary Stakeholders	Secondary Stakeholders
▪ City of Claremont	▪ Alameda Corridor East Construction Authority
▪ City of Diamond Bar	▪ Foothill Transit
▪ City of Industry	▪ The Fairplex at Pomona
▪ City of La Verne	▪ Raging Waters
▪ City of Pomona	▪ Cal Poly Pomona University
▪ City of San Dimas	▪ Mount San Antonio College
▪ City of Walnut	▪ LA County MTA
▪ LACDPW	▪ Caltrans

The needs, objectives, and issues to consider in the planning, design, and implementation of the Pomona ATMS by the project stakeholders were primarily obtained from the 1995 Pomona Valley Forum Signal Synchronization Study, recent surveys, coordination meetings with the stakeholders, and other outreach efforts. This information was collected and documented in the Stakeholder Operational Objectives Report. The following sections provide a summary of this information.

3.1 ATMS

Stakeholder needs and objectives related to traffic control and monitoring were identified during the stakeholder outreach efforts performed in Task 4 of this project. **Table 3-1** is a summary of stakeholders' needs and objectives. The needs and objectives have been generalized to illustrate similarities and dissimilarities between the stakeholders. Detailed needs and objectives for each individual stakeholder can be found in the Stakeholder Operational Objectives Report.

Table 3-1 Summary of Traffic Control and Monitoring Needs and Objectives

	Primary Stakeholders							
Stakeholder Needs and Objectives	**City of Claremont**	**City of Diamond Bar**	**City of Industry**	**City of La Verne**	**City of Pomona**	**City of San Dimas**	**City of Walnut**	**LACDPW**
Want/ need an ATMS	X	X	X		X	X	X	X
Want an adaptive control system	X	X			X			

	Primary Stakeholders							
Stakeholder Needs and Objectives	**City of Claremont**	**City of Diamond Bar**	**City of Industry**	**City of La Verne**	**City of Pomona**	**City of San Dimas**	**City of Walnut**	**LACDPW**
Maintain or reduce staff commitment	X	X	X	X	X	X	X	X
Ability to share data with other agencies	X	X	X	X	X	X	X	X
Ability to share video with other agencies	X	X			X	X		X
Ability for another agency to control signals/ ITS	X		X		X		X	
Ability to manage event traffic	X			X	X			X
Want/ need video surveillance capabilities in the field	X	X			X	X		X
Want/ need improved coordination with Caltrans		X		X	X	X		X

3.2 ATMS User Service Mapping

Based on a review of the existing system deficiencies and the user needs and objectives, ITS user services that address the needs and objectives have been mapped out to form a basis for the area-wide architecture to be developed in subsequent tasks. **Table 3-2** summarizes the User Needs to User Services mapping.

Table 3-2 User Needs to User Services Mapping

ATMS User Needs	User Services
Want/ need an ATMS	• Traffic Control • Incident Management
Want an adaptive control system	• Traffic Control

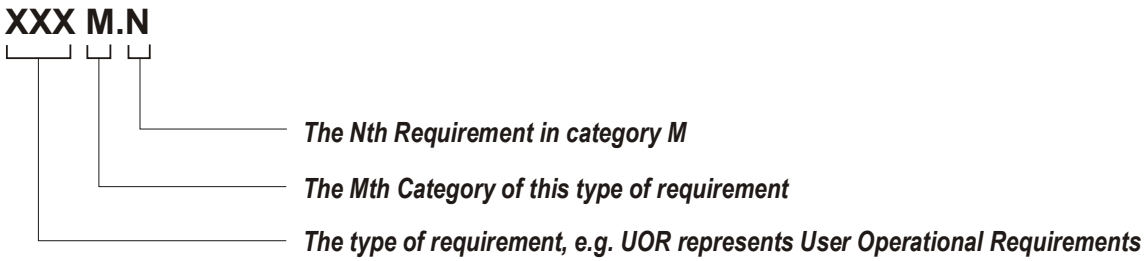
ATMS User Needs	User Services
Maintain or reduce staff commitment	• Traffic Control • Incident Management
Ability to share data with other agencies	• Traffic Control • Incident Management
Ability to share video with other agencies	• Traffic Control • Incident Management
Ability for another agency to control signals/ ITS	• Traffic Control • Incident Management
Ability to manage event traffic	• Traffic Control • Incident Management • En-route Traveler Information
Want/ need video surveillance capabilities in the field	• Traffic Control • Incident Management
Want/ need improved coordination with Caltrans	N/A

4.0 USER REQUIREMENTS

This section of the report describes the user requirements for the associated needs and objectives of the Pomona Valley ATMS discussed in **Section 3.0**. User requirements for the Pomona Valley ATMS can be defined in terms of the following requirements:

- User Operational Requirements (UOR)
- User Functional Requirements (UFR)
- User Interjurisdictional Requirements (UIR)
- User Supplementary Requirements (USR)

The above requirements describe the capabilities of the ATMS that are necessary, from the user's point-of-view, to achieve the user objectives. These requirements are uniquely numbered so that they can be tracked during all phases of the project. Requirements tracking is necessary because it is anticipated that the user requirements for the Pomona ATMS will continue to evolve during the course of the project. Changes in user requirements can be caused by many factors, such as the user need for additional system capabilities based on new information that had not come to light during an earlier stage of the project, or perhaps the recognition that satisfying a particular requirement is not technically feasible. In addition, requirement identification numbers allow other documents to reference any user requirements defined in this document. The following numbering convention is adopted in this document with regards to the requirement numbers:



For example, UOR 1.3 represents the 3rd requirement in category 1 of the User Operational Requirements.

The user requirements are expressed as a series of "shall and will" statements that describe functionality. The requirements tracking process will be utilized through the design, implementation, and testing phases of the project. By establishing and maintaining a relationship between the requirements, design, implementation, and test plans for the system, the impact of any changes to the requirements can be immediately identified and assessed.

4.1 Definitions

"System" is defined as the Pomona Valley ATMS. System elements are the ITS elements which can be controlled and operated by the system. "Users" of the system are the PVITS project stakeholders, including, but not limited to, operators, maintenance technicians, operational supervisors, and system administrators. It should be noted that not all users will have the same operational responsibilities or authority for control or operations of the ATMS. "Administrators" are defined as users who maintain ultimate authority on system control, operations and maintenance of the system and system elements over their own jurisdictions. "Other Users" are defined as users who have no operational responsibilities and authority for control and operations of the system and the system elements.

The control and operations of the ATMS must be governed by system hierarchy levels, priorities, standard operating policies and procedures, and Memoranda of Understandings (MOUs). These issues must be addressed during detail design for final agreement by all project stakeholders.

4.2 User Operational Requirements

In order to provide the operational capabilities needed by the ATMS users, the following ATMS operational categories will need to be addressed in the user operational requirements:

- Data Collection
- System Control
- Information Exchange
- Level of Control
- Modes of Operation
- Security/Access
- Graphical User Interface (GUI)

Table 4-1 presents the user operational requirements for the Pomona ATMS with respect to these user operational categories.

Table 4-1 User Operational Requirements

Requirement No.	Operational Category	Requirement Description
UOR 1.1	Data Collection	The system shall be able to collect data to support the following functions at both local and subregional levels: • Traffic Signal Control • En-route Driver Information • Traffic Signal Monitoring • Congestion Monitoring • Incident Management • Incident Verification • Special Event Management • Seasonal Traffic Management • Emergency Management • Queue Monitoring • Equipment Status Monitoring
UOR 1.2	Data Collection	The system shall be able to collect the following data from field device controllers and from other systems: • Phase indication • Timing plans • Speed • Volume • Occupancy • Video detection images • CCTV video images • Equipment status information • Maintenance information such as equipment status and diagnostic alarms
UOR 1.3	Data Collection	The system shall be able to interface with multiple types of ITS elements, such as vehicle detectors, traffic signal controllers, CCTV cameras, DMS, and Trailblazers, to collect data.
UOR 1.4	Data Collection	The system shall be able to process the collected data so that it can be used by the existing/planned system.
UOR 1.5	Data Collection	Data collected will be stored in a database.
UOR 1.6	Data Collection	The system will provide database management functions that include archiving, backup, diagnosing, displaying, distributing, processing, recovery, removing, retrieving, storing, and viewing of all data stored in the system.
UOR 2.1	System Control	The administrators shall be able to control any of their own traffic signals and ITS elements.
UOR 2.2	System Control	The users shall have the ability to control traffic signals and ITS elements in other jurisdictions through the IEN, given the control management below (UOR 2.3).

Requirement No.	Operational Category	Requirement Description
UOR 2.3	System Control	The system will provide functions allowing users to control the system security (i.e., users will be able to adjust who has what type of access to system security features).
UOR 3.1	Information Exchange	The system shall be capable of providing inter-jurisdictional exchange of the following types of data: • Phase indication • Timing plans • Speed • Volume • Occupancy • CCTV and video detection video images • Equipment status • DMS and Trailblazer messages • Incident location, type, severity and duration • Arterial closure and restriction information • Arterial construction information • Special event information • Multimodal information (if available) • Rail/intersection data (if available)
UOR 3.2	Information Exchange	The system shall allow information exchange with other stakeholders, including but not limited to: ▪ Fairplex ▪ Cal Poly Pomona University ▪ ACE ▪ Foothill Transit ▪ Mount San Antonio College ▪ Raging Waters ▪ Private news broadcasters (for direct video links).
UOR 3.3	Information Exchange	The system shall allow control of the information exchange function by users (i.e., users can define who receives data and who does not)
UOR 3.4	Information Exchange	The protocol used for information exchange will be compatible with the LA County Information Exchange Network (IEN) standards.
UOR 3.5	Information Exchange	The protocol used for information exchange will be compatible with the Southern California Priority Corridor standards.
UOR 4.1	Level of Control	The system shall allow administrators to maintain ultimate authority on system control and operations over their own jurisdictions.
UOR 4.3	Level of Control	The system shall allow users to define system control by other users (i.e., define who is allowed to access the system for operating devices).
UOR 4.4	Level of Control	The system shall provide users the ability to restrict automated upload or download of any traffic signal or ITS element data (including timing plans, messages, equipment status, etc.).

Requirement No.	Operational Category	Requirement Description
UOR 5.1	Mode of Operation	The system will provide users the ability to operate traffic signals in numerous modes including: ▪ time-of-day plans ▪ traffic responsive plans ▪ manual override
UOR 5.2	Mode of Operation	The system will provide functions allowing users to control the mode of operation including: ▪ time-of-day plans ▪ traffic responsive plans ▪ manual override
UOR 6.1	Security/Access	Security control shall be provided to access control and operations of the system.
UOR 6.2	Security/Access	The system shall provide control and management functions to administrators for security and access.
UOR 6.3	Security/Access	The system shall allow the management of security/access by other users.
UOR 7.1	GUI	The user interface of the system shall be graphic-based, intuitive, and user-friendly.

4.3 User Functional Requirements

The following ITS elements categories were identified to satisfy the ATMS user needs and objectives:

- Traffic Control and Monitoring
- CCTV Surveillance
- Vehicle Detection
- En-route Driver Information

The user functional requirements for these identified ITS elements are presented in **Table 4-2**.

Table 4-2 User Functional Requirements

Requirement No.	ITS Element Category	Requirement Description
UFR 1.1	Traffic Control and Monitoring	The system shall provide centralized traffic control and monitoring capabilities to efficiently manage the movement of traffic on streets and highways. This will also include control of network signal systems.
UFR 1.2	Traffic Control and Monitoring	The traffic control and monitoring system shall allow users to perform the following functions: • Traffic Control (i.e., traffic signal timing changes) • Traffic Monitoring (i.e., vehicle detection and controller status)

Requirement No.	ITS Element Category	Requirement Description
		• Traffic Surveillance (i.e., video monitoring) • Special Event Management • Seasonal Traffic Management • Emergency Management • En-route Driver Information
UFR 1.3	Traffic Control and Monitoring	The traffic control and monitoring system shall provide the capability to support future use of adaptive traffic control system.
UFR 1.4	Traffic Control and Monitoring	As per the DOT final rule, this ATMS shall use applicable ITS standards and interoperability tests that have been officially adopted through rulemaking by the DOT.
UFR 2.1	CCTV Surveillance	The system shall provide CCTV viewing capability.
UFR 2.2	CCTV Surveillance	The system shall be capable of controlling the CCTV cameras.
UFR 2.3	CCTV Surveillance	The CCTV surveillance system shall allow users to perform the following functions through viewing of CCTV video: • Traffic Monitoring • Incident Management • Incident Verification • Special Event Management • Seasonal Traffic Management • Emergency Management • Queue Monitoring • Equipment Status Monitoring
UFR 2.4	CCTV Surveillance	The CCTV viewing and control functions shall be integrated into the system.
UFR 2.6	CCTV Surveillance	As per the DOT final rule, this CCTV system(s) shall use applicable ITS standards and interoperability tests that have been officially adopted through rulemaking by the DOT.
UFR 3.1	Vehicle Detection	The system shall provide the capability of accurately detecting vehicle volume, occupancy and speed in real-time.
UFR 3.2	Vehicle Detection	The vehicle detection system shall provide the data to allow users to perform the following functions: • Traffic Monitoring • Queue Monitoring • Equipment Status Monitoring • Develop Traffic Counts
UFR 3.3	Vehicle Detection	The vehicle detection functions shall be integrated into the ATMS.
UFR 3.5	Vehicle Detection	As per the DOT final rule, this vehicle detection system(s) shall use applicable ITS standards and interoperability tests that have been officially adopted through rulemaking by the DOT.

Requirement No.	ITS Element Category	Requirement Description
UFR 3.6	Alarm Monitoring	The users shall be able to monitor alarms reported by the system including, but not limited to: ▪ Controller and cabinet alarm data ▪ System or subsystem alarms

4.4 User Interjurisdictional Requirements

Table 4-3 presents the user interjurisdictional requirements for the Pomona ATMS.

Table 4-3 User Interjurisdictional Requirements

Requirement No.	Requirement Description
UIR 1.1	The system shall allow the users to manage traffic in a coordinated manner across jurisdictional boundaries.
UIR 1.2	The system shall allow users to coordinate and communicate with other users for the following purposes. • Traffic Control • Traffic Monitoring • Traffic Management • Traffic Surveillance • Congestion Monitoring • Incident Management • Incident Verification • Special Event Management • Seasonal Traffic Management • Emergency Management • Signal Coordination • Event Coordination • En-route Driver Information
UIR 1.3	The system shall allow users to exchange information with other users.
UIR 1.4	The system shall allow users to control system elements of other users.
UIR 1.6	The system shall allow users to limit operation of their system elements by other users as needed.
UIR 1.8	As per the DOT final rule, this project shall use applicable ITS standards and interoperability tests that have been officially adopted through rulemaking by the DOT.
UIR 1.9	The system shall comply with Southern California Priority Corridor requirements for interjurisdictional information sharing and exchange, control and operations as applicable.
UIR 1.10	The system shall comply with the LA County IEN for interjurisdictional information sharing and exchange, control and operations.

4.5 User Supplementary Requirements

The following supplementary categories were identified to satisfy the ATMS user needs and objectives:

- O&M
- Cost

Table 4-4 presents the user supplementary requirements for the Pomona ATMS.

Table 4-4 User Supplementary Requirements

Requirement No.	Category	Requirement Description
USR 1.1	O&M	The system shall be easy to operate and maintain.
USR 1.2	O&M	An adequate amount of training shall be provided for control and operations of the system.
USR 1.3	O&M	An adequate amount of training shall be provided for maintenance of the system.
USR 1.4	O&M	The control of the system will be done through a highly intuitive interface developed for personnel with only general personal computer (PC) familiarity, and no particular computer programming experience.

5.0 SUMMARY

This report documents the first level requirements – user requirements. The functional requirements will be developed to meet these user requirements. The functional requirements are explicit specifications of capabilities of the Pomona ATMS. They will be mapped to the user requirements and tracked. These final ATMS functional requirements will provide the basis for the conceptual design of the system.

LIST OF ACRONYMS

ACE	Alameda Corridor East Construction Authority
ATIS	Advanced Traveler Information System
ATMS	Advanced Traffic Management System
Caltrans	California Department of Transportation
CAMS/IEN	Los Angeles County Arterial Management System/ Information Exchange Network
CCTV	Closed Circuit Television
DMS	Dynamic Message Sign
ITS	Intelligent Transportation System(s)
LA	Los Angeles
LACDPW	Los Angeles County Department of Public Works
LACMTA	Los Angeles County Metropolitan Transportation Authority
MOU	Memorandum Of Understanding
NTCIP	National Transportation Communications for ITS Protocol
O&M	Operations and Maintenance
PC	Personal Computer
PTZ	Pan, Tilt and Zoom
PVITS	Pomona Valley Intelligent Transportation System
TMC	Traffic Management Center
TOD	Time-of-Day
UFR	User Functional Requirements
UIR	User Interjurisdictional Requirements
UOR	User Operational Requirements
USR	User Supplementary Requirements
WWV	National Institute of Standards and Technology Time & Frequency shortwave radio station that broadcast accurate real time