January 10th, 2007

San Gabriel Valley Traffic Forum
ATMS Improvement Project

ATMS User Requirements

(Deliverable 2.3.2.2)

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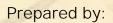## ATMS Functional Requirements

(Deliverable 2.3.3.2)

Final

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SAN GABRIEL VALLEY TRAFFIC FORUM

Deliverable 2.3.2.2 – ATMS User Requirements (Final)
Deliverable 2.3.3.2 – ATMS Functional Requirements (Final)

FINAL

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TABLE OF CONTENTS   PAGE#

1.   INTRODUCTION

1.1   PROJECT OVERVIEW

The Los Angeles County Department of Public Works (County) Traffic Forum Program has proven successful in creating institutional infrastructure to coordinate the activities of the Agencies responsible for traffic signal operations in LA County. These Traffic Forums allow groups of bordering Agencies to work together to promote inter-Agency cooperation. The Traffic Forums have enabled funding to be targeted at infrastructure improvements along arterial and arterial/freeway corridors in the County's sub-regions. Such projects are a critical part of what will eventually be a network of integrated Intelligent Transportation Systems (ITS) projects in LA County and in Southern California.

1.2   SAN GABRIEL VALLEY TRAFFIC FORUM

The San Gabriel Valley Traffic Forum (SGVTF) project is one such project that will result in arterial infrastructure improvements within the project boundaries. The SGVTF project area ranges from the CA SR 110 and I-710 freeways to the west, I-210 freeway to the north, CA SR 57 freeway to the east, and the CA SR 60 freeway to the south. It encompasses 24 municipalities as well as unincorporated portions of LA County. The traffic signals in the Region are operated by many of the individual Agencies, the County, and Caltrans District 7.

The goal of the SGVTF project is to design, develop, and deploy an Advanced Traffic Management System (ATMS) specifically tailored to each Agency's operations in the Corridor so that traffic signals can be synchronized and ITS systems integrated across jurisdictional boundaries. The SGVTF project focuses on the specific needs of each Agency to manage its ATMS and recommends improvements to field infrastructure (e.g., controllers, detection systems, communications, etc.) and centralized Traffic Control Systems (TCSs) and/or Transportation Management Centers (TMCs) to meet those requirements. When the SGVTF project is successfully completed, each of the Agencies responsible for traffic signal operations will have full access to an ATMS that monitors and controls the traffic signals within its jurisdiction. In addition, Agencies will be able to synchronize their signals and exchange traffic information in real-time with neighboring Agencies. This will allow the Agencies to respond to recurrent and non-recurrent congestion in a coordinated fashion across jurisdictional boundaries.

1.3   COUNTYWIDE INFORMATION EXCHANGE NETWORK

Developed by the County, the Countywide Information Exchange Network (IEN) is the integrated system framework that connects all of the individual Agency ATMSs into a Regional network to support the operational goals identified above. As shown in Exhibit 1.1, the Countywide IEN supports traffic signal operations in three (3) levels:

- Local Level
    - Comprises day-to-day traffic signal operations and maintenance (O&M) activities carried out by the individual Agency
    - Includes activities such as signal timing, equipment monitoring, response to local traffic conditions and events, etc.

- Corridor Level
  - Supports inter-Agency coordination and joint signal operations within the particular Traffic Forum (or Sub-Region)
  - Includes activities such as signal coordination across jurisdictional boundaries, monitoring and exchange of local traffic data throughout the Corridor, joint response to traffic conditions, incidents, and events that affect more than one jurisdiction, etc.
- Regional Level
  - Permits arterials of Regional significance to be monitored, managed, and controlled as a single entity
  - Supports multi-Agency, cross-Corridor data exchange permitting a Countywide response to traffic conditions and major events
  - Facilitates communications between systems/Agencies not part of a Traffic Forum (e.g., Caltrans, LADOT, etc.).

Exhibit 1.1 – Countywide IEN

The SGVTF assumes the availability of the Countywide IEN at the Corridor and Regional levels. Therefore, the SGVTF project is focused on the selection of TCSs and the integration of those systems to the Countywide IEN at the local level. The eventual ATMS design for the SGVTF will take into account the interface to the IEN and its requirements at the Local level and encompass the following six (6) core components:

- ATMS and/or TCS (Individual Agency)
- Detection and Surveillance
- TMC and/or W/S Layouts (ATMS and/or IEN)

- Communications Network
- SGVTF Participation/Coordination (City-specific and/or SGVTF-Regional integration)
- Operations & Maintenance (O&M)

The Countywide IEN comprises the series of computer servers, communications, networks, graphical user interface (GUI) displays, etc. that integrates these components for the collection/transfer of data to support Corridor and Regional functions throughout LA County.

1.4 PROJECT AREAS & AGENCIES INVOLVED

The SGVTF Project encompasses several jurisdictions. Furthermore, it will be integrated, or have the ability to integrate with other projects and existing systems in the Region through the Countywide IEN. SGVTF Project Stakeholders include 22 local Agencies, the County, and Caltrans District 7 as the table below indicates:

City of Arcadia	City of Alhambra
City of Azusa	City of Baldwin Park
City of Duarte	City of Covina
City of Glendora	City of El Monte
City of La Puente	City of Irwindale
City of Montebello	City of Monrovia
City of Pasadena	City of Monterey Park
City of San Dimas	City of Rosemead
City of San Marino	City of San Gabriel
City of South El Monte	City of South Pasadena
City of Temple City	City of West Covina
LA County Dept. of Public Works	Caltrans District 7

1.5 PURPOSE OF DOCUMENT

This document represents the following deliverables:

- Deliverable 2.3.2.1 – ATMS User Requirements (Draft)
- Deliverable 2.3.3.1 – ATMS Functional Requirements (Draft)

The above sub-tasks within the SGVTF's Task 2.3 – Operational Concept and System Requirements were performed in parallel due to the close nature of the work activities involved within each. Due to the fact that functional requirements are inter-related with user requirements, both have been combined into a single document.

The objective of this report is to identify ATMS user and functional requirements for the SGVTF. The intent is that these requirements will form the basis for the detailed design and implementation of the ATMS improvements within the SGVTF. The success of the Project will be dependent upon each involved Agency's active participation in identifying critical issues and implementing systems to respond to these issues. In previous tasks, the TransCore Team investigated/analyzed the existing ITS system inventory, identified operational objectives and system needs, and developed the concept-of-operations for the SGVTF Project Stakeholders. Building upon these findings, this document defines the ATMS user and functional requirements

for the SGVTF Agencies so that systems can be designed and implemented that will support and address these needs.

1.6   REFERENCED DOCUMENTS

The following documents have been used as reference material in the preparation of this report:

- San Gabriel Valley Traffic Forum Project
    - Deliverable 2.1.2 – Operational Objectives
    - Deliverable 2.2.2 – System Needs
    - Deliverable 2.3.1.1 – Concept-of-Operations
- I-5/Telegraph Road Corridor Project
    - Deliverable 3.1.2 – Advanced Traffic Management System (ATMS) User Requirements
- I-105 Corridor Project
    - TSMACS User Requirements Report (Final)
    - Functional Requirements Report (Draft)
- San Gabriel Valley Pilot Project
    - System Design Report (Final, Version 1.0)
- South Bay Traffic Signal Synchronization and Bus Speed Improvement Plan –Part III
    - Deliverable 2.2.4 – Final Local Traffic Control Center(s) Facility and Computer System Requirements

2. REQUIREMENTS

The User Requirements represent the first layer of requirements for the SGVTF Project. The User Requirements specify the capabilities of the system from the user's perspective in terms a user can understand. This generates a common understanding of the systems by both the users as well as developers.

Once the User Requirements have identified the capabilities of the system, the second layer of requirements is the development of the Functional Requirements. Typically, the Functional Requirements identify the elements of the system that are required to implement the user requirements. This procedure enables a systematic approach to the first level of system architecture.

The Functional Requirements describe the major system functions for each of the core system components. In addition, all required system capabilities are expressed using "shall" statements to further indicate what the system must do and/or accomplish.

The Functional Requirements presented in this report comprise a combination of the requirements for the Agencies in the SGVTF area. Preparing the functional requirements for a specific system usually comprises the selection of the relevant requirements based upon the information contained in the User Requirements that detail Agency-specific features.

2.1 DEFINITIONS

Within this document, the following definitions are used:

- ATMS
  - The SGVTF ATMS elements/components that are controlled and operated by a centralized computer system
- Users
  - SGVTF ATMS Project Stakeholder Agencies that use the System
  - Includes operators, maintenance technicians, operational supervisors, etc.
  - It should be noted that not all users will have the same operational responsibilities or authority for control or operations of the ATMS
- Administrators
  - Users who maintain ultimate authority on system control, operations, and maintenance of the system and system elements over their own jurisdictions
- Other Users
  - Users who have no operational responsibilities and authority for control and operations of the system and the system elements. It can be used for demonstration, training, etc. purposes.

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) (if needed). These issues must be addressed during detail design for final agreement by all Project Stakeholders.

3. SYSTEM REQUIREMENTS

The following sub-sections identify the key User Requirements and Functional Requirements for achieving advanced traffic management within the SGVTF project area. Each sub-section is made-up of relevant User Requirements and derived Functional Requirements. Functional Requirements have been derived from the documents identified in Section 2.2, the Countywide IEN program, and current industry standards.

The following numbering convention is adopted in this document with regards to the requirement numbers. The alpha-numeric system by which the requirements are listed will be "type (ATMS) "subject"-"requirement", such as "ATMS-TCS-U1", for ATMS, Traffic Control System, User Requirement #1. The first functional requirement in the same section will be listed as "ATMS-TCS-F1 and so on. For purposes of presentation and ease of use, this structure and the requirements information will be transferred into a tabular format.

All of the requirements have been grouped into the operational/categorical classifications that follow in order to provide better ease of reference for the reader as well as to group similar and/or associated requirements in one (1) location:

- **General Requirements** – Groups together functionality and system characteristics that do not apply to a specific category.
    - System Overview
    - Inter-Jurisdictional Coordination
    - Involved Stakeholder Agencies
    - System Architecture
- **System Status** – Groups together the characteristics associated with the current operating level(s) of the system.
- **System Control** – Groups together the characteristics associated with the control capabilities/functionality of the system.
- **User Interface** – Groups together the characteristics associated with the User's ability to view/monitor, interact/control, and input data/information with the system.
    - Ease-of-Use
    - Multi-User Capability
    - Confirmation & Error Checking
    - Progress Indicator
    - Tool Bar and Status Bar
    - Operator Error Message
    - System Error Message
    - Multi-Tasking Capabilities
    - Map Display & Real-Time Displays

- **Report Generation** – Groups together the characteristics associated with the system's ability to notify the User of system operations or status in the form of printed reports.
    - General Requirements
    - Equipment Reports
    - Communication Reports
    - Detector Fault Reporting
    - Detector Reporting
    - Maintenance Log Reports
- **Database Editing** – Groups together the characteristics associated with the system's ability to input, store, and retrieve data/information.
- **System Security and Access** – Groups together the characteristics associated with the system's ability to provide/restrict access to the system by various levels of Users and/or Administrators.
- **ITS Systems & Components** – Groups together the characteristics associated with the system's ability to provide the required ATMS functionality and operation.
    - General Requirements
    - Advanced Traffic Management System (ATMS)
    - Traffic Control Modes
    - Upload/Download Features
    - Traffic Responsive
    - Manual Control Modes
    - Monitor Signals
    - Maintain Signals
    - Synchronize Clocks
    - Generate Timing Plans
    - Manage Timing Plans
    - Schedule Operations
    - Temporary & Permanent Commands
    - Exchange Coordination Data
    - Monitor Congestion
    - Repair Equipment
    - Configure Operations
    - Command/Data Interface (CDI) to the IEN
    - Detection System
    - Closed Circuit Television (CCTV) System
    - View Images
    - Control Cameras
    - Select Cameras
    - Changeable Message Sign (CMS) System
    - Message Development
    - Sign Plans
    - Scheduling
    - Message Library
    - Control Signs
    - Incident Management
    - Transit Priority Systems
    - Emergency Vehicle Pre-Emption

- Communications
- Future ITS Elements

- **ATMS Data** – Groups together the characteristics associated with the system's ability to collect, process, share, and store data.
  - General Requirements
  - Data Archiving
  - Analyze Data
- **Event Logs & Alarms** – Groups together the characteristics associated with the system's ability to monitor, store, and inform the User of its current operating status.
- **Users** – Groups together the characteristics associated with the User's ability to interact with the system.
  - Network Administration
  - System Administration
  - System Operators
- **System Performance** – Groups together the characteristics associated with the system's ability to provide the required functionality in a reliable and timely manner.
  - Reliability
  - Scalability
  - Equipment Technology
  - Performance Measures
- **Operations & Maintenance (O&M)** – Groups together the characteristics associated with the system's general operations and maintenance principles.
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3.1 GENERAL REQUIREMENTS

3.1.1 System Overview

User Requirements

ATMS-GEN-U1   The ATMS shall implement a download/plan select, distributed control philosophy. Typically, the ATMS will support the ability of signal timing plans being developed and stored in a central location and able to be downloaded to the local field controller.

3.1.2 Inter-Jurisdictional Coordination

User Requirements

ATMS-GEN-U2   The ATMS shall provide seamless traffic flow operations between jurisdictions.

ATMS-GEN-U3   The ATMS shall be capable of viewing all traffic signals and monitoring roadway traffic conditions within its jurisdiction [as well as the jurisdiction(s) that it "hosts".

ATMS-GEN-U4   Through the ATMS, one Agency shall be able to request/implement plan changes in other Agencies systems (that share and/or are connected to it) to accommodate emergency operations and/or non-recurrent congestion situations.

ATMS-GEN-U5   The ATMS shall develop/support a CDI based on the "IEN CDI Recommendations" document for inter-jurisdictional information sharing and exchange, control, and operations.

ATMS-GEN-U6   The ATMS shall support transit priority systems (TPS), bus signal priority (BSP) systems, transit signal pre-emption, etc. between transit operators and local Agencies in relation to transit routes, LRT, and transit priority.

3.1.3 Involved Stakeholder Agencies

User Requirements

Los Angeles County Department of Public Works (LACODPW)

ATMS-GEN-U7   LACODPW shall have operational control of traffic signals within its jurisdiction.

ATMS-GEN-U8   LACODPW shall be able to perform operational monitoring (phase display, real-time plan data, alarms, etc.) and functional monitoring (alarms, fault reporting, etc) for all traffic signals in their jurisdiction as well as for all traffic signals for those Agencies that they "host" on the LACO TCS.

California Department of Transportation (Caltrans)

ATMS-GEN-U9   Caltrans shall have operational control of arterial traffic signals within its jurisdiction.

ATMS-GEN-U10   Caltrans shall be able to perform operational monitoring of all traffic signals within the SGVTF Region (e.g., phase displays, real-time plan data, etc.)

SGVTF Stakeholder Agencies/Cities

ATMS-GEN-U11   SGVTF Stakeholder Agencies/Cities shall have operational control of traffic signals within their jurisdiction.

ATMS-GEN-U12   SGVTF Stakeholder Agencies/Cities shall be able to perform operational monitoring (phase display, real-time plan data, alarms, etc.) and functional monitoring (alarms, fault reporting, etc) for all traffic signals in their jurisdiction as well as for all traffic signals for those Agencies that they "host" on their ATMS.

ATMS-GEN-U13   SGVTF Stakeholder Agencies/Cities shall be able to re-direct control of their ATMS to alternate Agencies.

3.1.4   System Architecture

User Requirements

ATMS-GEN-U14   The ATMS shall be consistent with the County's IEN Architecture.

ATMS-GEN-U15   The ATMS shall be modular and scaleable.

ATMS-GEN-U16   The ATMS hardware shall have networking capability.

ATMS-GEN-U17   The ATMS shall be based on web based or client-server architecture.

ATMS-GEN-U18   The ATMS shall use industry standard processors and network components.

ATMS-GEN-U19   To the greatest extent possible, the ATMS shall be designed/support an "open" system architecture format (as described herein) to allow flexibility, interoperability, and future expansion of the system to meet future needs.

Functional Requirements

ATMS-GEN-F1	The ATMS shall use the latest version of Microsoft's multi-tasking operational system for Intel-architecture PC-based servers in a client-server architecture.
ATMS-GEN-F2	The ATMS workstations shall use the latest version of Microsoft's multi-tasking operational system for Intel-architecture PC-based servers in a client-server architecture.
ATMS-GEN-F3	The Supplier shall place the source code for all such restrictive software that has been placed under configuration management and control (i.e., software required to edit or alter the source code and successfully recompile and operate the software, including operating systems, libraries, tools and utilities, database structures and code, and compilers, including a list of all software documentation tools) in escrow, accompanied by detailed source code documentation, including a list of applicable software development tools.
ATMS-GEN-F4	Source Code shall be updated in conjunction with all Configuration Management plans/activities at least annually, or earlier, if the Supplier issues an update that contains substantial revisions to the software.
ATMS-GEN-F5	Source Code shall be released in the event that the Supplier is unable to deliver services (including warranty services, maintenance, upgrades, bug fixes, and expanded features.
ATMS-GEN-F6	Upon release of the Source code under these terms, the Client shall have a royalty-free, non-transferable, non-exclusive license to use, for the Client's ATMS purposes only, the machine-readable/executable software.
ATMS-GEN-F7	The central ATMS software shall be capable of handling a minimum of up to twice (2x) the number of intersections currently under the control of the Agency.
ATMS-GEN-F8	Detector data shall be collected and stored in the database for up to n detectors [where n is equal to 8 times (8x) the number of intersections supported by the ATMS].
ATMS-GEN-F9	These detectors can be any combination of local or system detectors.
ATMS-GEN-F10	The delivered ATMS shall support up to x simultaneous operations on the local area network (LAN) (where x is equal to the number of intersections supported by the ATMS divided by 25).
ATMS-GEN-F11	The delivered ATMS equipment shall be sized to support XX local Operators initially, with expansion requiring the addition of Operator workstations only (where XX is dependent on the specific ATMS).

ATMS-GEN-F12   The ATMS shall be scalable in a manner that allows for integration of planned software and hardware and/or foreseeable future upgrades.

3.2 SYSTEM STATUS

User Requirements

ATMS-SS-U1   The ATMS shall display and log all equipment faults, errors, and system alarms sent to the TCS and allow the printing of such alarms.

ATMS-SS-U2   Within the ATMS, a system alarm shall report and record when any timing plan changes have occurred on any controller.

ATMS-SS-U3   The ATMS shall display the status of system controllers.

ATMS-SS-U4   At a minimum, the ATMS shall alert the User when the following controller situations occur:

- Controller detects a cabinet door open
- Controller is in conflict flash
- Controller reports an operating status change
- Controller detects a pedestrian indication out
- Controller power failure or recovery
- Controller reports local database changed
- Controller detects loop and/or system detector

ATMS-SS-U5   The ATMS shall display the status of the system and local detectors.

ATMS-SS-U6   At a minimum, the ATMS shall alert the User when the following detector situations occur:

- Detectors are experiencing constant calls for user-set time period
- Detectors are experiencing no calls for user-set-time period
- Detectors are experiencing excessive calls (User set)

Functional Requirements

ATMS-SS-F1   Within the ATMS, the alarm feature shall have at least two (2) priority levels:

- Priority Level 1 – Event requires immediate attention
- Priority Level 2 – Event does NOT require immediate attention

ATMS-SS-F2   The ATMS shall have the capability to add new alarms or events to one component of the system without rebuilding any other part of the system.

ATMS-SS-F3   For each alarm, the ATMS shall have the ability to automatically time stamp, route, notify, and/or page it to specific user station(s).

ATMS-SS-F4   The ATMS shall provide users the capability to turn ON or OFF each type of alarm separately. However, alarms will still be logged.

ATMS-SS-F5   The ATMS shall provide have the ability to immediately display alarms as they occur.

ATMS-SS-F6   The ATMS shall provide have the ability to automatically print user-selectable alarms on designated log printer.

ATMS-SS-F7   At a minimum, the ATMS shall provide the following user-selectable features for each type of alarm:

- Delay – the ability to select a configurable time period for which you can set the alarm to be displayed/reported to the User AFTER the actual alarm occurs. This way, the system is given a chance to "repair/correct" itself.

- Priority – the ability to select a configurable time period for which various users of the system can easily prioritize the alarm and event information that is displayed. The alarm and event configuration is highly flexible and is configured by a user to display particular events in a hierarchical manner, as directed by the user. The user sets a desired alarm priority, selecting high importance alarms for more urgent display and annunciation and rendering a lower display status to less urgent events.

3.3   SYSTEM CONTROL

User Requirements

ATMS-SC-U1   Through their ATMS, Agency Administrators and Users shall have operational control (e.g., monitor, control, check equipment status, etc.) of every traffic signal and ITS element connected to their system.

ATMS-SC-U2   The ATMS shall 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).

ATMS-SC-U3   ATMS Users shall be able to manipulate intersection controllers if they have the proper privileges.

ATMS-SC-U4   The ATMS shall provide local Agencies the ability to delegate control authority to another Agency (whose ATMS is shared and/or connected to it).

ATMS-SC-U5   ATMS Users shall be able to log in from a remote location and be able to monitor, control, upload and download signal plans, etc. to the intersection controllers.

ATMS-SC-U6   ATMS Users shall have operational control (e.g., monitor, control, check equipment status, etc.) of every traffic signal and ITS element in other jurisdictions (that share and/or are connected to it) through the ATMS per established MOUs.

ATMS-SC-U7   The time-based clocks for each User's ATMS shall be synchronized with the entire system to coordinate adjacent intersections in different jurisdictions.

Functional Requirements

ATMS-SC-F1   ATMS Users shall be able to preset and name geographical map/viewing locations and view preset locations through the GUI module.

ATMS-SC-F2   The ATMS shall allow only one (1) User to control or configure a given device at any given time.

ATMS-SC-F3   ATMS clients (i.e., workstation PC's) shall connect to the system server automatically upon initiation of the client software program at the workstation. In like fashion, the system server shall also connect to all system devices and to the database(s) automatically upon initiation of the server.

ATMS-SC-F4   Applicable ITS device types shall have a control GUI, allowing Users to control specific devices. The ATMS shall provide concurrent control of at least five (five) devices of each ITS device type (e.g., CCTV, CMS, detector station, etc.), without more than a (3) three second delay in system response time, which excludes time needed for establishing a communication connection as in the case of dial-up devices.

ATMS-SC-F5   Applicable ITS device types shall have a data display GUI, allowing Users to view polled information from specific devices. Users may view data from multiple device types and multiple devices of each type concurrently, without noticeable degradation (by the User) in system performance.

ATMS-SC-F6   The ATMS shall provide a task scheduler which provides the following functionality (at a minimum) to the User through a graphical user interface (GUI):

- Should provide a quick-scheduler function for each ITS device type, where Users can post a command for a set period of time in a single step (i.e., 5-min button, 15-min button, 1-hour button, etc.). Once time has expired, a reminder to the User should allow for extending the duration of the command.

- Shall allow random schedules, where one or more events/commands are defined for one or more ITS device types for dates and times up to (12) twelve months into the future.

- Shall allow consistent schedules, set by day-of-week or day spacing (1, 2, 3,) at a fixed time. Consistent schedules should run – once enabled – until disabled by a User.

- Shall provide a list or calendar viewer where Users may view scheduled commands, the ITS Device type(s) to be used, and the times/dates for the events/commands up to (12) twelve months into the future.

ATMS-SC-F7   The ATMS scheduler shall support at least 100 simultaneous active, scheduled commands/events at any given time.

ATMS-SC-F8   The ATMS scheduler should be able to integrate other subsystems, such that additional ITS devices and actions may be scheduled (i.e., set camera views for time of day, schedule ramp metering operations, etc.).

ATMS-SC-F9   The ATMS shall provide for local area network (LAN) capability so that several workstations can simultaneously access the ATMS and database(s).

ATMS-SC-F10   The ATMS shall have the capability to change alarm routing to different User stations and/or pagers by time of day.

ATMS-SC-F11   The ATMS shall provide the ability to upload and download local controller databases.

ATMS-SC-F12   The ATMS shall collect events from the communications server regarding intersection communications status as they occur.

ATMS-SC-F13   The ATMS shall have the ability to allow a maintenance person to initiate a full download of the controller database from central to the field, initiated from the field.

ATMS-SC-F14   The ATMS shall provide "off-line" capability for signal controllers so that they automatically revert to internal time-based coordination (TBC) operation during any communication failures or User "override."

ATMS-SC-F15   The ATMS shall support the output of the off-line preparation of timing plans (using off-line optimization models such as SYNCHRO).

ATMS-SC-F16   The ATMS shall be capable of interfacing with the system database(s). Using detector data and timing data, the ATMS shall be capable of automatically updating the database(s).

ATMS-SC-F17   The ATMS shall provide for download/upload capability, allowing the User to perform this function for individual and/or appropriate subsets of controller database parameters at selected schedules, or as desired.

ATMS-SC-F18   The ATMS shall provide for operation of the ATMS through multiple Users/Operators within the "owning" jurisdiction and from other, secondary jurisdictions.

ATMS-SC-F19   The ATMS shall maintain time for the system and broadcast time to all controllers. Local controller time will serve as back up if communication is lost.

ATMS-SC-F20   The ATMS shall have the ability to translate Scenario Response Plans received from the Countywide IEN into the correct set of local plan changes.

ATMS-SC-F21   The ATMS shall provide for graceful system shutdowns, when necessary, and local and remote unattended system restart capability.

3.4   USER INTERFACE

3.4.1 Ease-of-Use (General)

User Requirements

ATMS-GUI-U1   The ATMS user interface shall be graphics-based, intuitive, and user-friendly. All ATMS user accessible software shall use a graphical user interface (GUI).

ATMS-GUI-U2   ATMS Users shall be able to pan maps, zoom maps to provide more detailed views, and zoom the map to the full extend possible of the image through the use of a mouse.

ATMS-GUI-U3   The ATMS GUI shall provide Users with drop-down menus for commands to the system and mouse clicking and dragging, text input, button actions, and menu command actions.

ATMS-GUI-U4   The ATMS GUI shall provide context sensitive on-line help.

ATMS-GUI-U5   The ATMS user interface shall provide geographically accurate maps for the Agencies connected to it. Geographic Information System (GIS) is preferable because geographically correct maps are necessary when carrying-out functions that use a spatial reference (i.e., this is used for transit priority in some systems).

ATMS-GUI-U6   The ATMS maps shall allow the display of arterial incidents.

ATMS-GUI-U7   The ATMS Users with proper access level shall be able to edit maps.

Functional Requirements

ATMS-GUI-F1   The ATMS GUI Software shall provide the User with a graphical operating environment of the type commonly found on today's desktop computers.

ATMS-GUI-F2   The ATMS GUI shall allow the User to select objects on the screen by point-and-click manipulation with a mouse, thereby minimizing typing and the need to memorize lengthy commands.

ATMS-GUI-F3   It shall be possible to add or delete an intersection from a section through point-and-click manipulation of the intersection on the ATMS GUI.

ATMS-GUI-F4   The ATMS GUI shall be fully operational within a 32-bit, multi-tasking environment. It shall be Windows™ GUI-based, and support the use of standard Windows™ OS features and interface standards, such as multi-tasking, scalable windows, minimization, clipboard, etc.

ATMS-GUI-F5   The ATMS GUI shall include standard Windows™ printer interfaces and utilize standard Windows™ printer drivers.

ATMS-GUI-F6   All windows within the ATMS GUI shall support a mouse with a right button, left button, and a wheel.

ATMS-GUI-F7   The ATMS GUI shall incorporate the following features/functionality (at a minimum):

- Interactive screens

- Multiple windows

- Pop-up multiple display objects (or windows)

- Pull-down display objects (or windows)

- Menu icons and controls

- Dialog boxes

- Push button and other active commands

- Tool bars

- Visual and audio alarms

- Use of object characteristics such as colors, highlighting, and flashing to inform Users of status changes

ATMS-GUI-F8   The ATMS GUI shall be user friendly.

ATMS-GUI-F9   Within the ATMS GUI, several windows may be active at the same time and may overlap on the screen; however, the User shall be able to interact with only one (1) window at a time.

ATMS-GUI-F10   Within the ATMS GUI, the User shall be able to easily switch from one (1) window to another, such as pointing with the mouse cursor to the uncovered part of another window.

ATMS-GUI-F11   Within the ATMS GUI, the User shall be able to move any window on the screen, to change window size, and to collapse a window to an icon.

ATMS-GUI-F12   The ATMS workstation client shall be able to operate normally with additional software programs operating concurrently on the workstation. This includes such functions as office software, Internet browsers, and model or analysis programs (i.e., MS Office, Netscape, SYNCHRO, etc.).

ATMS-GUI-F13   Within the ATMS, the graphic display area shall be capable of being displayed on workstation monitors and the video wall with a minimum resolution of 1280x1024 pixels and support a simultaneous display of at least 65,536 colors.

ATMS-GUI-F14   Pull down or pop-up menus shall provide access to the entire functionality of the ATMS.

ATMS-GUI-F15   The ATMS User input shall include, but not be limited to, mouse clicking and dragging, text input, button actions, and menu command actions.

ATMS-GUI-F16   The ATMS shall provide full GUI display of database tables.

ATMS-GUI-F17   "Cut", "Copy", and "Paste" functions shall be provided to the ATMS User for all appropriate data entry tasks.

ATMS-GUI-F18   Drag and drop facilities shall be provided to the ATMS User where appropriate.

ATMS-GUI-F19   The ATMS shall provide a "Help" feature. The Help facility shall include an on-line version of the ATMS User Guide and provide the following assistance (at a minimum):

- List of contents

- Keyword search facility

- Printing of Help topics

- Help on using Help

- Navigation through Help topics using hypertext links

- Context sensitive Help for all screens

- The software version of each application or optional module displayed in the Help/About dialog

3.4.2 Multi-User Capability

Functional Requirements

ATMS-GUI-F20   The Supplier-furnished operating system (OS) and software shall support a multi-terminal, multi-user interface and the software shall allow access to multiple levels of the ATMS software simultaneously.

ATMS-GUI-F21   Within the ATMS, common icons shall be used to the extent possible for all display levels.

ATMS-GUI-F22   Within the ATMS, a list of Users that are currently logged onto the ATMS shall be available to be viewed by a user-defined set of Users and/or Administrators.

ATMS-GUI-F23   The ATMS shall support a variable number of User workstations for the system as a whole and at individual locations.

ATMS-GUI-F24   The ATMS shall provide integration control and operations with all Existing and Planned ATMS Elements (or ITS Devices).

3.4.3   Confirmation & Error Checking

Functional Requirements

ATMS-GUI-F25   Within the ATMS, validity checking shall be incorporated in all forms.

ATMS-GUI-F26   Within the ATMS, range error checking shall be performed at each controller, if possible.

ATMS-GUI-F27   Within the ATMS, consistency error checking shall be performed before the data on a form is saved to the database. For example, if the allowable maximum cycle length is 60-seconds and the User inputs 90-seconds, the ATMS will check and inform the User of the situation/problem.

ATMS-GUI-F28   The ATMS User shall be asked to confirm any action that would result in data being modified or deleted in the database.

3.4.4   Progress Indicator

Functional Requirements

ATMS-GUI-F29   If the User is required to wait more than 10 seconds for the completion of an ATMS operation, then a progress indicator shall be shown.

ATMS-GUI-F30   In particular, an ATMS progress indicator shall be given for the generation of reports where the specified wait time is exceeded.

ATMS-GUI-F31   Within the ATMS, the progress indicator shall graphically represent the completion status of the operation as a percentage.

ATMS-GUI-F32   If a progress indicator is shown within the ATMS, the User shall be given the option of canceling the current function.

ATMS-GUI-F33   Where the ATMS User is able to initiate several operations simultaneously, a separate progress indicator shall be given for each operation as required.

3.4.5   Tool Bar & Status Bar

Functional Requirements

ATMS-GUI-F34   Within the ATMS GUI, a tool bar shall be provided for the commonly used menu items.

ATMS-GUI-F35   Within the ATMS GUI, standard icons shall be used wherever possible.

ATMS-GUI-F36   Within the ATMS GUI, tool tips shall be provided for all icons

ATMS-GUI-F37   Within the ATMS GUI, a status bar shall be provided to show information on the object currently selected. In particular, a description of the currently highlighted menu shall be shown.

ATMS-GUI-F38   Within the ATMS GUI, the status bar shall be divided into separate panels, as required, to separate various types of information.

ATMS-GUI-F39   Within the ATMS GUI, a list of status message types shall be specified in the documentation provided to the User.

3.4.6   Operator Error Message

Functional Requirements

ATMS-GUI-F40   Within the ATMS, Operator error messages shall be displayed in a consistent format.

ATMS-GUI-F41   Within the ATMS, all Operator error messages shall be specified in the documentation provided to the User, with corresponding indexing, and appropriate grouping of error message types.

ATMS-GUI-F42   Within the ATMS, the text in an Operator error message shall not imply that the User is at fault.

ATMS-GUI-F43   Within the ATMS, the text in an Operator error message shall give the User guidance regarding the corrective action to be taken.

ATMS-GUI-F44   Within the ATMS, the text in an Operator error message shall be free from technical jargon, as far as possible.

3.4.7   System Error Message

Functional Requirements

ATMS-GUI-F45   Within the ATMS, all Software- or Hardware-related exceptions shall be trapped and displayed to the User as system error messages, if possible. These shall also be logged to the Event Log.

ATMS-GUI-F46   ATMS error messages shall be displayed in a consistent format.

ATMS-GUI-F47   All ATMS error messages shall be specified in the documentation provided to the User, with corresponding indexing, and appropriate grouping of error message types.

ATMS-GUI-F48   The text in an ATMS error message shall refer the User to the Windows Application Event log, if applicable.

3.4.8 Multi-Tasking Capabilities

Functional Requirements

ATMS-GUI-F49   Within the ATMS, several User interface applications shall be able to be accessed concurrently by a User, up to a maximum specified.

ATMS-GUI-F50   Within a single ATMS User interface application, and where applicable, the User shall be able to initiate several operations that may execute concurrently (such as report generation).

ATMS-GUI-F51   The ATMS shall allow all Users to view any specified data concurrently.

ATMS-GUI-F52   The ATMS shall prevent a User from modifying or deleting data that is currently being modified or deleted by another User.

ATMS-GUI-F53   The ATMS User profiles shall be able to be stored and subsequently restored when the User logs in again.

3.4.9 Map Displays & Real-Time Displays

User Requirements

ATMS-GUI-U8   The ATMS user interface shall provide geographically accurate maps for the Agencies connected to it. Geographic Information System (GIS)-based maps are preferable because geographically correct maps are necessary when carrying out functions that use a spatial reference (i.e., this is used for transit priority in some systems).

Functional Requirements

System Graphics

ATMS-GUI-F54   The ATMS GUI shall incorporate a system map that covers the entire limits of the controlled area.

ATMS-GUI-F55   Within the ATMS, graphical views (when maximized) shall return to the scale at which they were displayed immediately prior to being minimized.

ATMS-GUI-F56   Within the ATMS, clicking on areas of the system map shall select more detailed views of controlled areas (area maps).

ATMS-GUI-F57   The ATMS shall provide the capability to draw map and graphic displays.

ATMS-GUI-F58   The ATMS shall provide the capability to import map displays from a Geographic Information System (GIS).

ATMS-GUI-F59   The ATMS shall provide the capability to import graphics in the following formats (at a minimum):

- .bmp
- .wmf
- .jpg
- .tiff

ATMS-GUI-F60   The ATMS's dynamic mapping shall incorporate full pan/zoom capability on system and area maps.

ATMS-GUI-F61   The ATMS Operator shall be able to set up both dynamic and static informational layers that are displayed at different view scale levels by defining the view scale levels in a zoom level set-up configuration database table.

ATMS-GUI-F62   Within the ATMS, different layers shall be enabled as a default at different zoom levels.

ATMS-GUI-F63   By setting the zoom scale range and appropriately enabled/disabled layers, the ATMS Operator shall be able to control which layers display at different zoom scales. For example, at the Region-wide scale level the Operator might enable roadway centerlines (static information) as well as a communication status indication (dynamic information) for each intersection controller in the system.

ATMS-GUI-F64   The ATMS shall be capable of displaying arterial incidents located within the entire limits of its controller area. Display of all freeway incidents (located outside the limits of the ATMS's controlled area) is a function of the Countywide IEN.

ATMS-GUI-F65   The ATMS shall support multiple base maps, where Users may select the map to be displayed. Graphical and GIS map image formats should be supported.

ATMS-GUI-F66   ATMS Users shall be able to display a minimum of four (4) unique map sessions within any system client.

ATMS-GUI-F67   The ATMS shall support user-interactive panning and zooming commands for the map (i.e., extent of pan and zoom are defined by the User, using the mouse). Pre-defined, locked zoom and pan extents may also be used.

ATMS-GUI-F68   ATMS map elements (i.e., streets, speed/flow segments, device icons, etc.) shall be scalable between zoom levels, such that they are resized appropriately at each zoom level.

ATMS-GUI-F69   The ATMS user interface shall provide geographically accurate maps of every Agency that has intersection controllers that share and/or are connected to it.

ATMS-GUI-F70   Within the ATMS, clickable areas on the maps shall allow switching to more detailed views of the jurisdiction, sections, or intersections.

ATMS-GUI-F71   Within the ATMS and per Agency MOUs, clickable areas on the maps shall allow switching to more detailed views of the other Agency's jurisdiction, sections, or intersections that share and/or are connected to it.

ATMS-GUI-F72   The ATMS's map display shall be able to be run on multiple workstations so that each workstation shall be able to display data from the same or different intersections simultaneously.

ATMS-GUI-F73   Within the ATMS, objects on the map shall be capable of being programmed to turn on or off at different zoom levels. Text labels shall be comparable in size between different zoom levels.

ATMS-GUI-F74   Within the ATMS, Users shall be able to zoom maps to more detailed views in less than 5 seconds. Once zoomed, the User shall be able pan the view through different areas of the map.

Intersection Displays

ATMS-GUI-F75   The ATMS shall allow Users to view real-time intersection status and detector status/data (e.g., speed, volume, occupancy, etc.) overlaid on maps and graphic displays showing the layout of the intersection. The ATMS shall provide for real-time display of intersection operations.

ATMS-GUI-F76   The ATMS User shall be able to double-click on a section of the main map area to maximize the previously minimized intersection graphics.

ATMS-GUI-F77   Within the ATMS, the intersection graphics shall fill the entire screen when commanded by the User. In all menu selections, the ATMS shall include a list of intersections by standard name and number.

ATMS-GUI-F78   When an intersection graphics window is minimized within the ATMS, it shall be possible to maximize the window be selecting the same intersection from the menus.

ATMS-GUI-F79   The ATMS shall display status of conflict monitor.

ATMS-GUI-F80   The ATMS shall display details of coordination at a controller (i.e., coordination timers), such as permissive period.

ATMS-GUI-F81   The ATMS shall display status of coordination at each controller.

ATMS-GUI-F82   The ATMS shall display the pedestrian push button calls in real-time.

ATMS-GUI-F83   The ATMS shall display an indication of which interval is currently timing on each controller.

ATMS-GUI-F84　　　Based on current intersection/timing plan database, the ATMS GUI shall have the capability to display a real-time green-band time-space display.

ATMS-GUI-F85　　　The ATMS shall allow the GUI to modify a subset of the intersection timing plan database items (typically offset or green splits) via a time/space diagram editor.

ATMS-GUI-F86　　　At a minimum, the ATMS intersection displays shall depict/include static displays of the following:

- Street names
- Intersection number
- Phase numbering
- Special function definition
- North arrow
- Roadway curb lines
- Roadway lane lines

ATMS-GUI-F87　　　The ATMS intersection displays shall also include dynamic indicators. At a minimum, the intersection displays shall indicate the status of the following:

- Controller operational mode (e.g., TOD/DOW, traffic responsive, manual, free, free/flash, police flash, technician flash, etc.)
- Controller status (e.g., offset transition, pre-empted, type of pre-emption, conflict flash, etc.)
- Difference between the programmed offset and the actual timed offset
- Communications status (e.g., on-line, bad communication, no communication, etc.)
- Cabinet door status
- Timing parameters currently in effect (e.g., control mode, transition status, control section assignment, timing plan number, cycle length, offset, split values, etc.)
- Color status of all vehicular phases and overlaps (including the circular red, yellow, and green indications and all arrows)
- Status of pedestrian push-buttons
- Color status of all pedestrian phases (including walk, flashing don't walk, and steady don't walk)
- Actuation status of all local detectors (vehicular and pedestrian) and all system detectors associated with the intersection
- Pre-emption in effect and what pre-emption mode

- Special function status
- Indication of failure and type of failure
- Master and Local Cycle Counters
- Count-up of the number of seconds for the split of the phase in service

ATMS-GUI-F88   The ATMS intersection graphics window shall include a window header with the standard intersection name and number in it.

Detector Displays

ATMS-GUI-F89   The ATMS shall allow Users to view real-time intersection status and detector status/data (e.g., speed, volume, occupancy, etc.) overlaid on maps and graphic displays showing the layout of the intersection. The detector status for a given intersection shall be displayed on the screen with the intersection graphics.

ATMS-GUI-F90   Within the ATMS, traffic detector information (e.g., volume, occupancy, speed, congestion level quantities, etc.) shall be displayed.

ATMS-GUI-F91   Within the ATMS, detector information (e.g., volume, occupancy, speed, congestion level quantities, V+kO, etc.) shall be displayed as colored links.

ATMS-GUI-F92   Within the ATMS, the User shall be able to select the relevant item(s) for display via the GUI (e.g., detector status, traffic detector information, link detector information, etc.). Assumed vehicle length and loop size shall be User-definable system-side parameters.

ATMS-GUI-F93   Within the ATMS, V+kO values shall be displayed per detector.

ATMS-GUI-F94   Within the ATMS, new data types available from existing or new controllers will be able to be displayed. Once the new data is configured, it will be available to the rest of the ATMS without further configuration.

ATMS-GUI-F95   The ATMS shall display detector occupancy in percentages (%). Occupancy shall be defined as the percentage of time the detector loop is occupied.

ATMS-GUI-F96   The ATMS shall display average speed over a detector. Speed shall be calculated if based on the output from detector loops. If calculated and not measured directly, the ATMS shall calculate a speed value for links based on an assumed vehicle length and loop size.

ATMS-GUI-F97   The ATMS shall display vehicle detector calls.

ATMS-GUI-F98   The ATMS shall display detector volume counts. Volume shall be defined as the number of vehicles counted in an interval of time.

Other ITS Devices

ATMS-GUI-F99   ATMS data from each ITS device type shall be displayed on the map within its own data layer. The ATMS shall provide User-operated on/off controls for all data layers, accessible with a single user action from any map view. The following layers shall be supported (at a minimum):

- ATMS traffic signal controllers
- CCTV
- CMS
- Incidents
- Construction and/or Planned Events
- Five (5) additional layers beyond those listed here

ATMS-GUI-F100   The ATMS shall provide a way for Users to select which data to view within the ATMS icons and Speed/Flow segments on the map – speed, volume, or occupancy.

ATMS-GUI-F101   The ATMS shall allow Users to save at least ten (10) specific map "views" (where a view is defined as the current settings which are in place for a User looking at the map, including the map being viewed, the zoom level, and pan position, etc.) under User-defined names for future recall. Users shall also be able to specify a default map "view" to be loaded when the User logs onto the system.

ATMS-GUI-F102   The ATMS map shall support map icon and base map editing by System Administrators. The Vendor shall also provide several icons for the map, allowing the System Administrator to select which icon to use with which data input.

ATMS-GUI-F103   The ATMS map shall display icons representing all ITS field devices defined by the System Administrator. Each ITS device type shall be linked to a unique icon type. The map shall also display unique icons for both traffic incidents and construction/planned events as defined by the User.

ATMS-GUI-F104   The ATMS map shall display dynamic speed/flow segments overlaid on the street and freeway network within the base map. Segments that are linked to specific ATMS (configurable by the System Administrator) should be user selectable, indicating the values of the data being received by the ATMS (i.e. travel speed, flow rate, etc) linked to the segment. For segments not linked to an ATMS, manual input of speed/flow conditions by a User shall be allowed.

ATMS-GUI-F105   The ATMS shall support icon changes (i.e., color change, motion, flashing, size change, etc.), which may be linked to device/data states. The following states should be supported for each ITS device type: (For ATMS and Speed/Flow segments, the System Administrator shall be able to define the values of speed, volume, and occupancy which correspond to each state.)

CCTV: Hardware Failure, Comm. Failure, Good/Working, In Use (a User is currently in command of the device).

CMS: Comm. Failure, Message Displayed (Operator, TOD, System), No Message Displayed.

ATMS: Comm. Failure, Low-Range Data, Low/Mid-Range Data, High/Mid-Range Data, High-Range Data, Out of Range Data/No Data Reported. (Data may be volume, speed, or occupancy values.)

Speed/Flow Segments: Comm. Failure, Low-Range Data, Low/Mid-Range Data, High/Mid-Range Data, High-Range Data, Out of Range Data/No Data Reported. (Data may be volume, speed, or occupancy values for the associated ATMS).

ATMS-GUI-F106   The ATMS shall support mouse rollover tags for all map icons linked to devices or incident records. These tags shall display the information listed below for each icon type (at a minimum):

- CCTV Icons: Device ID, Device Location, Device Status, Current Azimuth, Current Elevation, Current User.
- CMS Icons: Device ID, Device Location, Device Status, Current Message, Current User.
- ATMS Icons: Device ID, Device Location, Device Status, Current Poll Data (volume, speed, occupancy).
- Speed/Flow Segments: Device ID(s), Segment Location, Current Poll Data (volume, speed, occupancy).
- Incident Icons: Incident ID, Incident Type, Incident Location, Incident Response Level (severity), Incident Status, Comments, Current User.
- Construction Icons: Event ID, Event Location, Event Description, Event Response Level (severity), Start/End Dates, Comments, Current User.

ATMS-GUI-F107   ATMS Users shall be able to access device control, configuration, and data view GUI's for specific devices from the system map by mouse clicking on device icons. For each icon type, the following should be available to Users (at a minimum):

- Incident/Construction Icons: Double-click to view the editing/update window for the selected incident record.
- CCTV Icons: Double-click to view the video from the selected camera on the user's default monitor and simultaneously open the control GUI for the selected camera.
- CMS Icons: Double-click to view the CMS control GUI for the selected sign. Right-click to open menu of potential actions (edit message, send message, poll sign, etc.)
- ATMS Icons: Double-click to view the schematic graphic and real-time lane specific data for the selected segment. Right-click to open menu of potential actions (poll controller, display data, etc).
- Speed/Flow Segments: Double-click to view the schematic graphic and real-time lane specific data for the selected segment. Right-click to open a menu of potential actions (display data, etc).

ATMS-GUI-F108   For each ITS device type connected to the ATMS, a unique GUI shall exist which allows configuration of all static device parameters by a System Administrator (Users shall have read-only access), including the following:

- CCTV Cameras: Control Channel, Video Channel, Control Drop, Video Drop, Device ID, Device Type, Device Description, Device Location, Device Geocode Location, Video Label Text, Presets.
- CMS Signs: Control Channel, Data Channel, Control Drop, Data Drop, Device Type, Matrix Display Type, Device ID, Device Description, Device Location, Device Geocode Location.
- ATMS Detectors: Control Channel, Data Channel, Control Drop, Data Drop, Device Type, Polling Interval, Aggregate Bin Sizes, Device ID, Device Description, Device Location, Device Geocode Location.
- Video Switch: Device Type, Device Description, Input Channels, Output Channels.

3.5   REPORT GENERATION

3.5.1   General Requirements

User Requirements

ATMS-RG-U1   The ATMS shall be capable of generating reports from some ATMS-generated data.

ATMS-RG-U2   The ATMS shall be capable of generating maintenance reports for use by the following parties:

- Operations Staff
- Maintenance Staff
- Signal Maintenance Contractor(s)

ATMS-RG-U3   The ATMS shall be capable of automatically generating reports via time-of-day (TOD) scheduling.

ATMS-RG-U4   The ATMS shall be able to generate reports for logged events, detector data, measures of effectiveness (MOEs), and communications statistics.

ATMS-RG-U5   The ATMS shall generate reports on detector percentage availability at an approach level, an intersection level, or an area level.

ATMS-RG-U6   ATMS Users shall be able to print out full or partial database reports with formatted layouts.

Functional Requirements

ATMS-RG-F1   The ATMS shall generate reports for logged events, detector data, measures-of-effectiveness, alarms (as triggered by traffic conditions), and communications statistics.

ATMS-RG-F2   Within the ATMS, the reports shall be generated on a system-wide, section, or intersection basis.

ATMS-RG-F3   The ATMS User shall be able to generate custom reports using commercial off the shelf (COTS) software.

ATMS-RG-F4   Within the ATMS, it shall be possible to schedule automatic report generation via the TOD scheduler.

ATMS-RG-F5   The ATMS shall provide routine, pre-formatted reports.

ATMS-RG-F6   The ATMS User shall be able to print reports on-demand.

ATMS-RG-F7   ATMS shall be able to export the database reports with comma, space and/or tabs between the fields to be able to input to other programs such as Excel, Access, etc.

ATMS-RG-F8   When a report is generated within the ATMS, the default mode of report output shall be to the screen.

ATMS-RG-F9   When displayed, ATMS reports shall appear in a window that can be re-sized by the User.

ATMS-RG-F10   Multiple reports shall be able to be displayed simultaneously on the ATMS User's screen

ATMS-RG-F11   Once a report is displayed on the screen, the ATMS User shall be able to print the report.

ATMS-RG-F12   The ATMS shall provide a printout of the time/space diagram, either to graphics printer or text printer.

3.5.2   Equipment Reports

Functional Requirements

ATMS-RG-F13   The ATMS shall permit the User to view the status of equipment on a filtered basis.

ATMS RG-F14   Within the ATMS, the following elements shall be the selectable basis for use as filters in the display of system, communications, or equipment status:

- System, section, intersection, or individual detector
- Status
- Fault

ATMS-RG-F15   The ATMS User shall be able to view the status of the system, communications, or equipment filtered by time and date (limits).

3.5.3   Communications Reports

Functional Requirements

ATMS-RG-F16   The ATMS shall have a display/report that shows the communications throughput.

ATMS-RG-F17   Within the ATMS, this display/report shall include the following (at a minimum):

- Number of communication attempts
- Number of successes
- Number of failures
- Percentage of successful communications per intersection
- Percentage of successful communications per channel
- Percentage of successful communications per system

ATMS-RG-F18   Within the ATMS, the communications status views shall include a reference to the standard intersection name and number.

3.5.4 Detector Fault Reporting

Functional Requirements

ATMS-RG-F19   Within the ATMS, the detector feedback obtained from the field via loop detectors and video detectors shall be continuously monitored for proper operation.

ATMS-RG-F20   Within the ATMS, detectors shall be classified as acceptable, marginal, disabled, and failed.

ATMS-RG-F21   Within the ATMS, detector failures shall be reported to the system log and the system workstation.

ATMS-RG-F22   The ATMS shall have user-definable failure filters that define the thresholds that a detector must exceed to be considered failed.

ATMS-RG-F23   Within the ATMS, the filter values shall be selectable on a TOD basis.

ATMS-RG-F24   Within the ATMS, the following failure types shall be provided (at a minimum):

- Maximum Presence: If an active detector exhibits continuous detection for a program entered period (0-255 minutes in one minute increments)
- No Activity: If an active detector does not exhibit an actuation during a program period (0-255 minutes in one minute increments)
- Erratic Output: If an active detector exhibits excessive actuation (program entered maximum counts per minute 0-255 in increments of one)
- Bad communications

3.5.5 Detector Reports

Functional Requirements

ATMS-RG-F25   The ATMS shall print formatted reports from logged volume, occupancy, and speed data.

ATMS-RG-F26   The ATMS shall provide a report on "Monthly Delay Average" per intersection.

ATMS-RG-F27   The ATMS shall provide the following graphical and tabular reports for a detector:

- Speed
- V+kO
- Volume
- Occupancy

ATMS-RG-F28   Within the ATMS, raw and smoothed volume shall be displayed in user-defined intervals.

ATMS-RG-F29   The ATMS shall provide the following graphical and tabular reports for a link:

- Speed
- V+kO
- Volume
- Occupancy

ATMS-RG-F30   The ATMS shall provide a report computing Seasonal Volume Coefficients.

ATMS-RG-F31   The ATMS shall provide a report of Historical Traffic Flow Reports (1-year).

ATMS-RG-F32   The ATMS User shall be able to select the time period for traffic counting reports

ATMS-RG-F33   The ATMS User shall be able to schedule automatic report generation via the TOD Scheduler.

3.5.6   Maintenance Log Reports

Functional Requirements

ATMS-RG-F34   The ATMS shall generate information every 24-hours indicating device/system failures. A maintenance report suitable for in-house or contracted signal control maintenance use should be able to be generated.

ATMS-RG-F35   A 24-hour maintenance report shall indicate type of device, type, and responsibility for maintenance for the past 24 hours (Upon request).

ATMS-RG-F36   It shall be possible to route maintenance reports to City operation staff.

ATMS-RG-F37   It shall be possible to route maintenance reports to City maintenance staff.

ATMS-RG-F38   It shall be possible to route maintenance reports to a signal maintenance contractor.

ATMS-RG-F39   It shall be possible for Level 1 and/or 2A Agencies for which LA County is hosting their traffic signals to route maintenance reports to LA County DPW.

ATMS-RG-F40   The ATMS User shall be able to schedule the printing and choose printer for traffic counting reports.

ATMS-RG-F41   For each traffic control device in the ATMS, the system shall track dates for preventive maintenance.   This may include visual inspection and replacement of parts.

ATMS-RG-F42   Warranty for all traffic control devices shall also be maintained with each traffic signal.

3.6   DATABASE EDITING & RECOVERY

User Requirements

ATMS-DER-U1   The ATMS shall provide a mechanism for auto-upload, auto-download, and auto-compare.

ATMS-DER-U2   The ATMS shall provide on-screen display and editing of controller parameters.

Functional Requirements

ATMS-DER-F1   The ATMS shall use a multi-user, commercial relational database software product. The ATMS shall use an open database standard for all database files. The ATMS shall use a relational database in support of system operations and data storage. Only one (1) database solution shall be required to operate the ATMS (i.e., different database products shall not be required to operate different portions of the ATMS). The database solution shall use Oracle, Informix, Sybase or approved equivalent.

ATMS-DER-F2   The ATMS database shall be used to store, retrieve, and maintain system data and parameter files.

ATMS-DER-F3   The ATMS database files shall be accessible to System Administrators using standard SQL tools for editing file contents. Likewise, database files shall support the use of both canned reports (available within the software) and user-defined reports generated with third-party query tools (i.e., Crystal Reports).

ATMS-DER-F4   The ATMS shall provide a database interface for display and editing controller databases, which shall be integrated into the ATMS software to provide seamless operation for the User.

ATMS-DER-F5   The ATMS database editor shall be accessible directly from the intersection display.

ATMS-DER-F6   The ATMS software and database software shall provide for off-line and online database generation and maintenance. This shall include loading, modifying, examining, copying, and retrieving the data used to operate the ATMS software. These data include traffic system configuration, timing plans, TOD/DOW schedules, operator databases, and alarm databases.

ATMS-DER-F7   The ATMS software shall provide the means to keep multiple intersection database windows open simultaneously to facilitate comparison and data manipulation.

ATMS-DER-F8   Any database changes shall be achievable without having to restart the ATMS software.

ATMS-DER-F9   Within the ATMS, all reports and/or tables in the database shall be printable in the same form as shown on the computer screen for use by the traffic engineers and maintenance technicians in the field.

ATMS-DER-F10   When an ATMS User attempts to open a controller database that is in use, the ATMS software shall display a message explaining to the User that the database is already open.

ATMS-DER-F11   Within the ATMS, editing of the controller database entries shall be via a tabular format.

ATMS-DER-F12   The ATMS database will support the format of the Agency-specific controllers.

ATMS-DER-F13   Within the ATMS, all database back-up and recovery shall be through the use of COTS software. This COTS software shall be able to perform the following (at a minimum):

- Automatically compress and back-up the database on a User-specified TOD setting or upon User command
- Restore the back-up copy of the database to the database

ATMS-DER-F14   Within the ATMS, static database back-ups shall be performed using a DAT tape back-up or writeable CD-ROM drive.

3.7 SYSTEM SECURITY & ACCESS

User Requirements

ATMS-SEC-U1   Within the ATMS, local Agencies shall retain control authority.

ATMS-SEC-U2   The ATMS shall be able to assign access privileges by previously defined groups of Users/Operators.

ATMS-SEC-U3   The ATMS shall have different access levels. Access levels shall control access to functions and to equipment.

ATMS-SEC-U4   The ATMS shall allow multiple simultaneous Users to monitor controller behavior.

ATMS-SEC-U5   Within the ATMS, security control shall be provided to access control and operations of the ATMS Workstation.

ATMS-SEC-U6   The ATMS shall provide control and management functions to Administrators for security and access.

ATMS-SEC-U7   The ATMS shall be installed at a location that minimizes the costs of installing equipment and maximizes security.

Functional Requirements

ATMS-SEC-F1   The ATMS shall provide and maintain a security system to prevent unauthorized access to the system.

ATMS-SEC-F2   ATMS Administrators shall assign a unique name and password to each User. Each User name shall be unique throughout the ATMS.

ATMS-SEC-F3   ATMS passwords shall be stored in the database in an encrypted format.

ATMS-SEC-F4   ATMS Administrators and Users shall create and maintain profiles of information and capabilities for each User.

ATMS-SEC-F5   Within the ATMS, multiple Users shall be able to monitor the same data item if they have been granted read access to that data item.

ATMS-SEC-F6   ATMS Administrators may grant different Users different levels of access to ability to control and operate the system.

ATMS-SEC-F7   The ATMS shall log all User actions that modify its behavior. The log entry shall include User name, action, time, and date of action.

ATMS-SEC-F8   Within the ATMS, authorized Users shall be able to create new Users and add new pieces of equipment to the system.

ATMS-SEC-F9   An ATMS User with the correct security privileges shall be able to edit the base map displays, and textual or graphical information in them.

ATMS-SEC-F10   The ATMS shall support the capability for System Administrators to assign/change User write access to the controller.

ATMS-SEC-F11   Authorized ATMS Users shall be able to modify yellow and red clearance intervals for certain intersection controllers.

ATMS-SEC-F12   The ATMS shall warn Users when they perform actions that may violate pre-defined critical signal timing parameters such as minimum greens, all red, etc.

ATMS-SEC-F13   Authorized ATMS Users shall be able to select the timing plan in use on certain intersection controllers.

ATMS-SEC-F14   Through the ATMS, a Local Agency shall be able to grant certain outside Users and/or locations monitoring and control access to some or all of the jurisdiction's intersection controllers.

ATMS-SEC-F15   Authorized ATMS Users shall be able to resolve conflicting requests for write access to particular intersection controllers.

ATMS-SEC-F16   Within the ATMS, only one User at a time shall be able to modify behavior of an intersection controller.

ATMS-SEC-F17   Through the ATMS, a Local Agency shall be able to define intersection groups and grant access to a group in a single operation.

ATMS-SEC-F18   Authorized ATMS Users shall be able to modify timing plans stored in a traffic control system.

ATMS-SEC-F19   ATMS Administrators shall be able to configure the system to deliver various alarms to multiple destinations by time of day.

ATMS-SEC-F20   The ATMS shall be able to deter and detect unauthorized access, tampering, and destruction of critical system information and components.

ATMS-SEC-F21   The ATMS shall track workstation inactivity, such that after a configurable amount of time, Users are required to log back into their client session.

ATMS-SEC-F22   All ATMS security options shall be applicable to both networked and remote/dial-in Users.

ATMS-SEC-F23   The ATMS shall support at least 100 unique User profiles, with each assigned specific privileges within the program.

ATMS-SEC-F24   The ATMS shall allow for User privileges to be defined by the System Administrator. By default, all Users shall have read-only privileges for the full system.   Additional operating privileges shall be available for the following functional activities:

System Administration & Configuration:

- User Profile Configuration
- Device Configuration
- Database Configuration
- Database Report Creation & Generation
- Map Editing

System Operation:

- CCTV Operation
- Video Switch Operation
- CMS Operation
- CMS Scheduler
- TMS Operation
- TMS Data Viewing
- Incident Creation & Editing
- Response Plan Creation & Editing
- Response Plan Implementation

ATMS-SEC-F25   The ATMS shall provide a User priority assignment, configurable by the System Administrator, for resolution of command conflicts from concurrent users. Users with higher priority should be able to override commands from lower priority users, take control of devices from lower priority users, etc.

ATMS-SEC-F26   The ATMS User privileges shall be definable on a functional level.

ATMS-SEC-F27   The ATMS security levels shall include (at a minimum):

- No access
- View-only
- Upload-only
- Download-only
- Full access

ATMS-SEC-F28   Each ATMS User shall have a privilege level "profile" as defined by the System Administrator.

ATMS-SEC-F29   This ATMS User profile shall define the specific functions that the particular User is authorized to perform. For example, a particular User may be given the ability to view all reports, but not to modify some or all levels of the database.

ATMS-SEC-F30   The ATMS User profile shall allow for any number of different levels of User access capability.

ATMS-SEC-F31   The ATMS Administrator level shall have full access to the system as well as the responsibility for maintaining account passwords and privilege level profiles.

ATMS-SEC-F32   Before gaining access to the ATMS, the User shall be required to enter a User identification code.

ATMS-SEC-F33   The ATMS shall validate the code (per above) against an encrypted database of authorized Users.

ATMS-SEC-F34   Successful completion of the ATMS login shall result in execution of a session start-up procedure.

ATMS-SEC-F35   The ATMS start-up procedure shall establish the privileges, object menu options, windows, and tools the User may utilize.

ATMS-SEC-F36   Any functions that a particular ATMS User is not authorized to access shall either not be shown or shall be "grayed-out" so that the User can easily distinguish the functions to which they have access.

ATMS-SEC-F37   LAN access shall be limited to those activities that support the ATMS.

ATMS-SEC-F38   Unsuccessful login attempts shall be logged to the ATMS log.

3.8   ITS SYSTEMS & COMPONENTS

3.8.1   ATMS – Genral Requirements

User Requirements

ATMS-GEN-U20   Through the ATMS, local Agencies shall be able to delegate equipment status monitoring functions to other Agencies (that share and/or are connected to it) in the SGVTF.

ATMS-GEN-U21   Through the ATMS, local Cities shall be able to monitor and/or control all signals within their jurisdiction.

ATMS-GEN-U22   The ATMS shall support multiple workstation locations at a single Agency (i.e., for maintenance and/or law enforcement operations and monitoring).

ATMS-GEN-U23   The ATMS shall allow Administrators to maintain ultimate authority on system control and operations within their own jurisdiction.

ATMS-GEN-U24   The ATMS shall allow Users to define system control by other Users (i.e., define who is allowed to access the system for operating and/or monitoring devices).

ATMS-GEN-U25   The ATMS 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.).

ATMS-GEN-U26   Through the ATMS, local Cities shall be able to perform functional monitoring of controllers for maintenance purposes.

ATMS-GEN-U27   Through the ATMS, local Cities shall be able to redirect control of their system to alternate Agencies (that share and/or are connected to it).

ATMS-GEN-U28   Through the ATMS, local Agencies, (e.g., those that do not have full-time staff), may delegate control authority to another Agency (that share and/or are connected to it) by time of day.

ATMS-GEN-U29   The ATMS shall provide diagnostic routines that report failures and malfunctions in the sign and/or controller upon inquiry from the ATMS. Detected failure conditions shall be automatically returned to the ATMS.

3.8.2   ATMS – Traffic Control Modes

User Requirements

ATMS-TCM-U1   The ATMS shall support the "Central Coordinated" mode of operation – the controllers operate according to a pre-determined coordinated timing plan schedule that is stored in the central database.

ATMS-TCM-U2   The ATMS shall support the "Local Coordinated" mode of operation – the controllers operate according to a pre-determined coordinated timing plan schedule that is stored locally in the individual controllers.

ATMS-TCM-U3   The ATMS shall support the "Local Isolated (Free Operation)" mode of operation – the controller is not being commanded for on-line operation by a Master System.

ATMS-TCM-U4   The ATMS shall support the "Manual" mode of operation – the controller responds to system commands for plan selection issued from the central control using manual override.

ATMS-TCM-U5   The ATMS shall support the "Traffic Responsive" mode of operation – the controller responds to system commands for plan selection issued from the central control based on the traffic-responsive algorithm. This approach selects timing plans by comparing system detection thresholds for which the plan has been developed to the real-time traffic conditions in the field.

ATMS-TCM-U6   The ATMS shall support the "Flashing" mode of operation – the controller is put on flash either manually by the central or at the cabinet. This also includes tripped conflict monitor at the local intersection.

ATMS-TCM-U7   The ATMS shall support the "Pre-Empted" mode of operation – the controller is pre-empted by an external system to provide priority to fire, police, or emergency service vehicles.

Functional Requirements

ATMS-TCM-F1   The ATMS shall be able to delegate control authority to another Agency by time-of-day.

ATMS-TCM-F2   The ATMS shall operate in a distributed mode issuing plan and mode changes to local controllers.

ATMS-TCM-F3   The ATMS shall upload and download to intelligent local controllers the timing plans, time-of-day/day-of-week (TOD/DOW) schedules, and all other parameters required to operate the local intersections.

ATMS-TCM-F4   All intersection controllers shall be monitored on a real-time basis by the ATMS.

ATMS-TCM-F5   The ATMS shall support communications with the field controllers at rates from 1.2 Kbps to 38.4 Kbps.

ATMS-TCM-F6   Upon system start-up, the ATMS shall establish communications with all intersection controllers and begin real-time monitoring.

ATMS-TCM-F7   Any ATMS upload, download, or time/date requests shall take precedence over real-time monitoring.

ATMS-TCM-F8   The ATMS shall be designed for unattended operation twenty-four (24) hours per day, seven (7) days a week, without requiring a User to be logged into the system.

ATMS-TCM-F9   The ATMS shall provide system control by coordinating intersection operation on an individual, section, or system-wide basis.

ATMS-TCM-F10   ATMS control modes shall be User-selectable from the Graphical User Interface (GUI).

ATMS-TCM-F11   When the ATMS is commanding an intersection to a timing plan different than the TOD/DOW, either by manual override or through the traffic-responsive algorithm, the controller shall be commanded to the appropriate plan.

ATMS-TCM-F12   In the event that, while in software-commanded override, a controller does not receive a valid timing plan number from the ATMS within a User-defined timeframe, it shall revert back to its local TOD/DOW.

ATMS-TCM-F13   In the event of a failure other than power failure or the severing of communications between the ATMS and the controller, the User shall have manual control over the intersection.

ATMS-TCM-F14   The ATMS shall allow the User to monitor intersection operation to verify compliance with the selected timing plan.

ATMS-TCM-F15   The ATMS shall provide plan selection capability, both scheduled such as special event plan and by User determination.

ATMS-TCM-F16   The ATMS shall allow the User to specify parameters for traffic responsive signal plans by time-of-day.

ATMS-TCM-F17   The ATMS shall be capable of storing nine (9) or more timing plans per intersection.

ATMS-TCM-F18   Within the ATMS, fixed and "floating" holiday exception tables shall be provided. Holidays shall override the standard TOD/DOW control tables.

ATMS-TCM-F19   Within the ATMS, manual plan selection shall override time-of-day/traffic responsive plan (TOD/TRP), by system-wide, section, and intersection.

ATMS-TCM-F20   Within the ATMS, TOD/DOW plans shall be specified via system-wide, section, and individual intersection, with command hierarchy.

3.8.3   ATMS – Upload/Download Features

Functional Requirements

ATMS-UDF-F1   The ATMS shall allow download on a system-wide, section, or intersection basis. Upload shall be provided on an intersection basis.

ATMS-UDF-F2   Upload/download commands shall be executed immediately upon command at a communication rate of 1.2 Kbps to 38.4 Kbps between the ATMS and the field controllers.

ATMS-UDF-F3   The ATMS shall upload and download the following data (at a minimum):

- Intersection timing parameters
- Detector data from at least 32 detectors per intersection controller
- Controller and cabinet alarm data
- Event data
- Controller date and time

ATMS-UDF-F4   The ATMS shall highlight errors or missing data in timing plans prior to permitting download of the timing plans to a controller.

ATMS-UDF-F5   The ATMS shall generate a comparison report listing all data discrepancies between the database and controller.

ATMS-UDF-F6   The ATMS shall write this report to a text file for printing or editing.

ATMS-UDF-F7   It shall be possible to schedule uploads and compares by TOD (auto-compare).

ATMS-UDF-F8   The results of the auto-compare will be logged and made available to the ATMS User for review.

ATMS-UDF-F9   It shall be possible to request a download from the field without the need for ATMS User support (remote download request).

ATMS-UDF-F10   It shall be possible to place controllers in a local isolated mode on a system-wide, section, or intersection basis.

ATMS-UDF-F11   The ATMS shall be able to disable controllers through the user interface.

ATMS-UDF-F12   When disabled, the ATMS shall not communicate with the controller and the controller shall run its local TOD/DOW schedule.

ATMS-UDF-F13   The ATMS User shall have the ability to re-activate disabled, or off-line, intersections via the ATMS.

ATMS-UDF-F14   The ATMS shall recognize the release of an intersection from communications into stand-by mode without displaying the status as a communications failure.

ATMS-UDF-F15   The ATMS User shall be able to monitor the intersection components through the ATMS, even while not commanding it (Flash & Free/Flash)

ATMS-UDF-F16   In the flash mode, the controller shall run uncoordinated and will not provide green time to any movements at the intersection.

ATMS-UDF-F17   To initiate flashing operation remotely, the controller shall be commanded to flash from the ATMS.

ATMS-UDF-F18   If the controller has been commanded to the flash mode and remains on-line, it shall be shown as being in flash mode in the GUI.

ATMS-UDF-F19   If the intersection is in flash mode because it is off-line, it shall be shown as being in free/flash mode.

3.8.4   ATMS – Traffic Responsive

Functional Requirements

ATMS-TRP-F1   In the traffic responsive mode of operation, the ATMS shall select the timing plan that is best suited to the existed traffic conditions as measured by the system detectors and analyzed by the system's traffic responsive process.

ATMS-TRP-F2   Once the traffic responsive process has selected the appropriate timing plan, the plan number shall be commanded to the intersections on a continual basis until the traffic responsive process recognizes, based on sufficient change in traffic conditions, the need to command a different timing plan.

ATMS-TRP-F3   The traffic responsive algorithm shall be based on the UTCS algorithm or other approved traffic-responsive algorithm.

ATMS-TRP-F4   The ATMS User shall be able to define a single detector station as a section.

ATMS-TRP-F5   When the traffic-responsive process detects that this detector station has exceeded User-defined thresholds, the associated sections shall automatically change to the appropriate traffic-responsive plan.   This process is intended for use in conjunction with special events (such as to detect and respond to a surge of traffic leaving the parking facility of a stadium or arena following the end of a sporting event).

ATMS-TRP-F6   It shall be possible to group commands together by device or section.

3.8.5   ATMS – Manual Control Modes

Functional Requirements

ATMS-MCM-F1   Manual selection of timing plans shall have a higher priority than all other modes of timing plan selection.

ATMS-MCM-F2   The ATMS User shall have two (2) options for implementing manual override:

- Setting the manual override and later releasing the override manually
- Setting the manual override with a specified timeframe for automatic termination

ATMS-MCM-F3   Under the second option, the manual override shall terminate automatically at the end of the specified time.

ATMS-MCM-F4   When manual override is terminated, each affected controller shall revert to its previous mode of operation.

3.8.6   ATMS – Monitor Signals

Functional Requirements

ATMS-MS-F1   The ATMS shall monitor the traffic signal controllers on a second-by-second basis.

ATMS-MS-F2   If polling rates are restricted by elements of the field communications infrastructure, the ATMS shall monitor the traffic signal controllers at the most frequent rate possible, up to second-by-second rates where possible.

ATMS-MS-F3   At start-up, the ATMS shall establish communications with all intersection controllers via the central communication system and begin second-by-second monitoring.

ATMS-MS-F4   The ATMS shall process both incoming data and User requests.

3.8.7   ATMS – Maintain Signals

Functional Requirements

ATMS-MSS-F1   The ATMS shall have the capability to automatically send alphanumeric messages to maintenance personnel upon detecting critical problems with the ATMS.

ATMS-MSS-F2   Upon detection of the critical event, which triggers a system event, the designated phone number shall be dialed and the message presented.

ATMS-MSS-F3   This feature (critical event trigger) shall be fully programmable allowing designation of TOD/DOW, phone number, and which critical event to trigger.

3.8.8   ATMS – Synchronize Clocks

User Requirements

ATMS-SC-U8   Time bases in each ATMS shall be synchronized.

ATMS-SC-U9   The time reference clocks of each local ATMS shall be synchronized with the entire system to enable area-wide coordination.

ATMS-SC-U10   The ATMS shall synchronize ATMS clocks based on an external, universal time reference time.

Functional Requirements

ATMS-SC-F22   The Supplier shall provide the means by which the ATMS time clock is automatically synchronized with the universal time through the WWV radio broadcast, WWV internet source or Coordinated Universal Time (UTC).

ATMS-SC-F23   The ATMS shall be able to use WWV as system time reference. Local controller time will serve as backup if communication is lost.

ATMS-SC-F24   The ATMS shall provide time-of-day synchronization of controllers. The controller's time-of-day clock shall be updated at least once a day by the ATMS, which shall be automatically synchronized with the WWV radio broadcast, WWV internet source or Coordinated Universal Time (UTC).

ATMS-SC-F25   Such automatic synchronization shall occur at least once a day.

ATMS-SC-F26   The capability shall also be provided for the User to disable and re-enable this function.

ATMS-SC-F27   The ATMS shall provide for the automatic downloading of clock updates to each field controller.

ATMS-SC-F28   The frequency of such updates shall be User-programmable within the range of once-per-minute to once-per-day.

ATMS-SC-F29   The ATMS shall also permit the controller clock to be updated when a controller is brought on-line.

3.8.9   ATMS – Generate Timing Plans

Functional Requirements

ATMS-GTP-F1   It shall be possible to export data to SYNCHRO.

ATMS-GTP-F2   It shall be possible to import timings generated by SYNCHRO.

ATMS-GTP-F3   The ATMS User must approve imported timings before inputting SYNCHRO-generated timings into the controller database.

3.8.10 ATMS – Manage Timing Plans

Functional Requirements

ATMS-MTP-F1   The ATMS shall permit the User to switch from the stored database to an uploaded controller database without either database closing or losing changes.

ATMS-MTP-F2   The number of timing plans, timing plan pages, and coordinated plan pages that can be stored by the ATMS shall only be limited by the physical storage capabilities of the hardware.

ATMS-MTP-F3   Each timing plan shall be able to contain unique values for cycle length and offset, a phase sequence, and split values.

ATMS-MTP-F4   The ATMS shall provide the automatic calculation of permissive periods (based on splits values).

ATMS-MTP-F5   The ATMS shall also provide the capability to handle specific signal and/or timing plans to accommodate unusual traffic flow patterns during special events.

ATMS-MTP-F6   The ATMS shall copy the timing plans, tables, and coordination tables from one controller to another when commanded by the User.

ATMS-MTP-F7   The ATMS shall contain libraries of approved timing plans that will be available to assign to intersection controllers.

3.8.11 ATMS – Schedule Operations

Functional Requirements

ATMS-SO-F1   TOD/DOW mode shall be used for controlling traffic conditions that occur regularly.

ATMS-SO-F2   In this mode, each controller shall automatically select and implement traffic signal timing plans in accordance with the defined schedule, locally stored, on a TOD/DOW basis.

ATMS-SO-F3   TOD/DOW plans shall be downloadable from the ATMS to the controller in the field.

ATMS-SO-F4   The ATMS User shall be able to schedule any plan or mode change command for execution at any time.

ATMS-SO-F5   The ATMS Administrator shall be able to prohibit User access to the event scheduler. (Event Scheduler is a function within the ATMS that provides the User with the ability to program/schedule the begin/end time of an event (e.g., upload/download of timing plans, database recovery/back-up, etc.).

ATMS-SO-F6   The entries in the event scheduler shall be automatically sequences in ascending order by TOD/DOW, regardless of the order in which the entries were made.

ATMS-SO-F7   ATMS User commands shall have priority over scheduled entries in the event scheduler.

ATMS-SO-F8   The ATMS User shall be able to make entries into the event scheduler for up to a minimum of one (1) year in advance. In addition, up to 1,000 entries shall be permitted.

ATMS-SO-F9   The scheduler shall have the capability to load multiple commands at the same time.

ATMS-SO-F10   For events scheduled at the same time, the execution shall occur simultaneously.

3.8.12 ATMS – Temporary & Permanent Commands

Functional Requirements

ATMS-TPC-F1   Commands entered into the event scheduler shall be of two (2) types – permanent and temporary.

ATMS-TPC-F2   Permanent commands shall be performed every time the matching of time parameters occurs.

ATMS-TPC-F3   Temporary commands shall be performed once and then be deleted from the scheduler database.

ATMS-TPC-F4   The ATMS User shall be able to enter the following permanent commands (at a minimum):

Every day basis (i.e., every day of the year)

Every week basis (i.e., on a given day or days of every week)

Every time span basis (i.e., every hour)

Every weekday (i.e., every given weekday from Monday through Friday)

Every weekend (i.e., given weekend day such as Saturday or Sunday)

ATMS-TPC-F5   The ATMS User shall be able to enter the following temporary commands (at a minimum):

Specific date basis (e.g., February 14th, 2004)

Specific time basis (e.g., at 5:00 PM or 1700 hours)

Specific date/time basis (e.g., 11/7/04 @ 10:00 AM)

ATMS-TPC-F6   Fixed and "floating" holiday exception tables shall be provided.

ATMS-TPC-F7   Holidays will override the standard TOD/DOW tables.

3.8.13 ATMS – Exchange Coordination Data

User Requirements

ATMS-ECD-U1   The ATMS shall provide seamless traffic flow between jurisdictions.

ATMS-ECD-U2   The ATMS shall provide inter-Agency plan selection capability.

Functional Requirements

ATMS-ECD-F1   Data exchanges between the ATMS and the Countywide IEN shall conform to National standards (as appropriate).

ATMS-ECD-F2   The ATMS shall accept external plan change commands.

3.8.14 ATMS – Monitor Congestion

User Requirements

ATMS-UC-U1   The ATMS shall provide congestion monitoring capabilities (with associated alarms) for recurrent and non-recurrent congestion.

Functional Requirements

ATMS-MC-F1   The ATMS shall provide methods in the user interface to show levels of congestion for intersections including (at a minimum):

Level-of-Service

Detector volumes, occupancy, and average speed

Aggregate intersection detector volumes, occupancy, and average speed

3.8.15 ATMS – Repair Equipment

Functional Requirements

ATMS-RE-F1   Based on information from the 24-hour Maintenance Report (per ATMS-RG-F36), the ATMS shall track the status of maintenance including (at a minimum):

Failure date

Maintenance personnel/Contractor contact date

Name of maintenance personnel/Contractor contacted

Scheduled time/estimated time for repair

Actual date of failure repaired

Comments

3.8.16 ATMS – Configure Operations

Functional Requirements

ATMS-CO-F1   The ATMS shall enable the User to define a minimum of "X" control sections, or subsystems where "X" is equal to the maximum number of intersections supported by the system.

ATMS-CO-F2   Each (control section) shall be completely independent of the connection of any particular intersection to the communications network.

ATMS-CO-F3   The number of intersections in a particular subsystem shall be programmable from a minimum of one (1) to a maximum of the total number of intersections in the system.

3.8.17 ATMS – Command/Data Interface to the Countywide IEN

Functional Requirements

ATMS-CDI-F1   The ATMS shall support a command/data interface (CDI) (and all other necessary system components) to provide a connection with the Countywide IEN.

ATMS-CDI-F2   Within the SGVTF, each unique instance/installation of an ATMS shall have a Command Data Interface (CDI) developed/implemented so that each ATMS can share data/information and/or control capabilities via the Countywide IEN.

3.8.18 Detection System

User Requirements

ATMS-DET-U1   The ATMS shall provide the capability of collecting and maintaining all data required for monitoring, and confirmation of displays from all intersections concurrently.

ATMS-DET-U2   If the intersection is not running coordinated, data shall continue to be collected.

ATMS-DET-U3   The ATMS shall be capable of exporting signal timing and volume information for off-line timing generation (Off-line timing generation).

ATMS-DET-U4   Data collected by the ATMS shall be capable of being aggregated to peak hour volume as used to satisfy Metro's Congestion Management Plan highway monitoring requirements.

ATMS-DET-U5   At a minimum, per lane volume and occupancy between all major intersections (mid-block) shall be collected.

ATMS-DET-U6   Above data will be used for planning purposes, timing plan generation, and as input into incident detection and adaptive traffic control algorithms.

ATMS-DET-U7   Detection technology shall be reliable and provide accurate data on a per lane basis.

ATMS-DET-U8   Detection technology shall be cost-effective on a life cycle cost basis.

ATMS-DET-U9   Detection technology may be permanent or temporary.

ATMS-DET-U10   Detection technology shall perform in all weather conditions.

Functional Requirements

ATMS-DET-F1   The ATMS shall process detector data every one (1) minute for traffic responsive operation.

ATMS-DET-F2   The ATMS shall re-evaluate the traffic responsive data every five (5) minutes to determine the appropriateness of the timing and make changes (as necessary).

ATMS-DET-F3   The field hardware shall include both system and local detectors that shall be used for both traffic counting and traffic responsive operation.

ATMS-DET-F4   The ATMS shall process and maintain detector count and occupancy data on a continuous basis to be used for various traffic control strategies and/or reporting tasks.

ATMS-DET-F5   Detector feedback shall be obtained on a user definable timeframe and the timeframe shall not be less than once per minute.

ATMS-DET-F6   The ATMS shall gather and/or calculate, recognize, process, and display detector information including traffic volume, occupancy, and speed data independent of local actuation and detector functions.

ATMS-DET-F7   The ATMS shall detect a stopped vehicle (or vehicles).

3.8.19 Closed Circuit Television System – General Requirements

Functional Requirements

ATMS-CCTV-F1   The ATMS shall support individual CCTV cameras, expandable to the limits of the system hardware.

ATMS-CCTV-F2   Within the ATMS, the CCTV control functions shall include the following (at a minimum):

    Select and switch monitors and cameras manually

    Adjust the image brightness by the iris control manually

    Adjust the image quality by the focus control manually

    Perform pan, tilt, and zoom manually

    Digital Signal Processing (DSP)

    Switch cameras continuously through a predefined sequence at a user-defined interval until disabled or overridden by another camera function (i.e., provide a "slideshow/tour" capability)

ATMS-CCTV-F3   Within the ATMS, the camera viewing time for external Agencies shall be controlled by the time-out feature provided by the CCTV control module.

ATMS-CCTV-F4   The ATMS shall be developed to interface with the CCTV cameras or the camera Vendor-supplied control program to provide (at a minimum) the same capabilities or better. However, integration of the CCTV subsystem with the ATMS shall be transparent to Users.

ATMS-CCTV-F5   Within the ATMS, the latency of control signals sent from the ATMS to the CCTV cameras shall not exceed one (1) second. [Latency of control signals means the delay between when a User presses a keyboard key or moves a joystick to when the signal reaches the camera and is implemented (e.g., the camera begins to move)].

ATMS-CCTV-F6   The ATMS shall be capable of supporting various types of video equipment including cameras, monitors, video walls, video switches, and video recording equipment.

ATMS-CCTV-F7   The ATMS shall provide users the CCTV camera in-use status. If there is no pan, tilt, zoom, focus, or image adjust operation performed on a camera within the User-selected [nominally, five (5) minute] time frame, that camera is defined as "not-in-use".

3.8.20 CCTV System – View Images

Functional Requirements

ATMS-CCTV-F8 The ATMS shall allow Users to use their workstations to assign input from any camera to any port on the bank of monitors in the Operations Center, or to the User workstation itself.

ATMS-CCTV-F9 The ATMS shall display the images in views that can be minimized or maximized.

3.8.21 CCTV System – Control Cameras

Functional Requirements

ATMS-CCTV-F10 The ATMS shall support serial and/or IP communication camera control to the camera controller.

ATMS-CCTV-F11 The ATMS shall support multiple camera controllers using different serial protocols.

ATMS-CCTV-F12 The ATMS Administrator shall be able to assign a protocol to an individual camera controller.

ATMS-CCTV-F13 The ATMS shall support simultaneous control of a minimum of 16 cameras by 16 different Users at the same time without apparent interference as long as the video channels and monitors are adequate to support the transport and display of the video.

ATMS-CCTV-F14 CCTV control commands (e.g., pan, tilt, zoom, etc.) shall be issued to the individual cameras within 0.2 seconds of the User executing the command.

ATMS-CCTV-F15 The CCTV control GUI shall support all camera functions available at the camera controller, excluding those parameters that may render the camera controller non-functional (e.g., communications address, baud rate, etc.)

ATMS-CCTV-F16   The CCTV control GUI shall support the following functionality (at a minimum):

Selectable listing of all system camera sites. Users shall be able to take control of a camera site directly from this listing. Users shall be able to view video from a camera site directly from this listing.

Manual pan, tilt, zoom, focus, and iris control, using the mouse, keyboard, or a joystick (connected to the workstation), for selected cameras shall be near instantaneous except when communication restraints prevent it.

Editing (create, change, delete) controls for at least 20 presets per camera. Each preset should allow for a text description to identify the view provided by the preset.

Selectable listing of available camera preset positions for the selected camera. Users shall be able to send a camera to a specific preset directly from this listing.

Tour/sequence creation editor, allowing Users to edit (create, change, delete) camera tours/sequences. This should include the ability to select and order camera video and configure viewing time for each camera site. The ATMS shall support a minimum of 32 sequences, with each sequence able to contain a minimum of 64 unique cameras.

Creation of a system preset which shall define a predetermined set of routings and presets so that a User can simultaneously set a complete display configuration. This will cause a list of cameras with specific presets to be shown on a selected list of monitors. There is no sequence; rather, these transactions all occur at once when commanded by the User.

A selectable listing of available camera tours/sequences, allowing Users to select and send a specific tour/sequence to an output (display) device in a single step.

Display of user ID for the User currently controlling the selected camera.

Control of auxiliary camera devices supported by the CCTV supplier's communications protocol

ATMS-CCTV-F17   The CCTV control GUI should support the following functionality (at a minimum):

Editing controls for at least 200 individual system presets. Each preset should allow for a text description to identify the view provided by the preset.

Selectable listing of available system presets (including groups of cameras, each with a specific preset). Users shall be able to activate a specific system preset directly from this listing.

ATMS-CCTV-F18   The ATMS shall process simultaneous requests for the same CCTV camera so that only one (1) User can control a given camera at one time. Along with this mechanism, a CCTV camera access-prioritizing scheme shall be implemented. As a result, conflicts of CCTV camera usage shall be resolved. However, the ATMS Users shall have the capability to override the prioritizing scheme.

ATMS-CCTV-F19   The ATMS shall provide Users with the capability to carry out all camera control functions from the User workstation.

ATMS-CCTV-F20   An individual camera shall be capable of being chosen by clicking on the camera icon from the zoomed-in map, or by selecting the CCTV button from the toolbar.

ATMS-CCTV-F21   From the CCTV menu, the ATMS User shall be able to select preset scenes by choosing the sample view that represents the scene they desire.

ATMS-CCTV-F22   The ATMS shall enable Users to create and store preset scenes for each camera in the database.

ATMS-CCTV-F23   The scene shall comprise camera position (pan & tilt), zoom, focus, and/or other controller selection options.

ATMS-CCTV-F24   Each preset scene shall allow an associated text phrase.

ATMS-CCTV-F25   Sample views of the preset scenes available for each camera shall be shown and the User shall be able to easily "Activate" the desired preset sample image.

ATMS-CCTV-F26   It shall be possible to establish an initial set of preset scenes for each camera.

ATMS-CCTV-F27   The ATMS shall support panning, tilting, and zooming CCTV cameras.

ATMS-CCTV-F28   ATMS Users shall be able to select a CCTV camera from a list or from the map and view a camera image (with the appropriate MOUs in-place).

3.8.22 CCTV System – Select Cameras

Functional Requirements

ATMS-CCTV-F29   The ATMS shall allow Users to use their workstations to assign input from any camera to any port on the bank of monitors in the Operations Center, or to the User workstation itself.

ATMS-CCTV-F30   The ATMS shall display the images in views that can be minimized or maximized.

3.8.23 Changeable Message Sign System – General Requirements

Functional Requirements

ATMS-CMS-F1   The ATMS shall support at least 50 individual Changeable Message Signs (CMS), expandable to the limits of the system hardware.

ATMS-CMS-F2   The ATMS shall support multiple sign controllers using different serial protocols.

ATMS-CMS-F3   The ATMS shall support Internet Protocol (IP) communications to the individual signs.

ATMS-CMS-F4   The ATMS Administrator shall be able to associate a specific sign protocol to individual signs.

ATMS-CMS-F5   Sign commands shall be issued to the individual signs within 60 seconds of the ATMS User executing the command.

ATMS-CMS-F6   The ATMS shall support serial and/or IP communication to the sign controller.

ATMS-CMS-F7   The ATMS shall support User control of all sign functions available at the sign controllers.

ATMS-CMS-F8   The ATMS shall support a minimum of three (3) message phases for all signs controlled by the system. For example a three (3) phase would be as follows:

> Line 1 – Describe the problem
>
> Line 2 – Identify location
>
> Line 3 – Provide motorist instructions

ATMS-CMS-F9   The ATMS shall auto-center all sign messages within text editors and viewing displays, and shall support such functionality at the sign as well.

ATMS-CMS-F10   In the event of a sign failure or lost communication to a sign, all User, scheduler, and response plan commands should be retained by the ATMS and implemented when the sign is able depending if the command is valid and has not expired.

ATMS-CMS-F11   The ATMS shall automatically validate message length (each line) based on the size of the sign being used. If the message is too long, the system should alert the User to the problem and not allow the message to be posted.

ATMS-CMS-F12   The ATMS CMS control GUI shall incorporate the following abilities (at a minimum):

- Provide a selectable listing of all system signs, where Users can take control of a sign directly from this listing with a single action.

- Provide a message library, which lists all sign messages contained therein and allows Users to view selected messages prior to choosing them. Once the desired sign(s) are selected, Users shall be able to post a message to them in a single step.

- Provide a message hierarchy control, allowing Users to specify the priority of multiple messages being posted to a specific sign. The system should automatically prioritize messages according to the following, and display the highest priority message at all times unless manually overridden by the User. Users may likewise assign priority to individual messages [i.e., in the event of two (2) manually created messages].

    1. Manually Input
    2. Response Plan Generated
    3. Scheduled

- Automatically manage the priority of messages and ensure that the highest priority message requested is always displayed on the sign. Where there are multiple requests at the same priority, the last message shall prevail. When a higher priority message is removed, the lower priority message awaiting display shall automatically be sent and displayed on the sign.

- Provide a free-form message text editor with basic editing functions. This editor should display messages within a simulated sign face, which represents the selected sign properties (i.e., full vs. line matrix, 2 vs. 3 lines, correct character count, etc.). Once the sign(s) for display have been selected, the editor should allow Users to post a message to them in a single step.

- Provide a sign properties configuration GUI, where items such as font, brightness, number of phases, time between phase transition, etc. may be specified.

- Provide a download and display function where a current message posted on a selected sign is queried by the ATMS and viewed by the User, formatted as it appears on the sign in the field (i.e., full vs. line matrix, 2 vs. 3 lines, correct character count, etc.).

- Allow Users to "blank" all selected signs with a single mouse-click.

- Provide an automatic word-checker, which runs prior to messages being posted, using a table of acceptable wording populated by the System Administrator.

- Support a library of up to 25 unique messages per sign, each saved under a User-defined name. Saved messages shall include all the text and sign configuration information as entered by the User saving the message.

- Order sign messages in the library by sign type (i.e., portable or freeway).

- Support the diagnostic functions of the specific sign type.

- Allow a User to view the event history of the sign.

- Provide a message posting "plan" editor, for Users to specify multiple messages to post to multiple signs, and then save the entire grouping as a sign "plan" under a User-defined text name. The ATMS should support a minimum of 50 unique message plans.

- Provide a selectable listing of available "plans", with Users able to activate plans directly from this listing.

- Provide control for sign graphics display.

- Provide a special effects selector (e.g., flashing, scrolling displays, etc.) for available sign functions.

ATMS-CMS-F13   The ATMS shall operate the CMS signs and monitor the status of all sign hardware.

ATMS-CMS-F14   The ATMS shall be capable of displaying static messages, flashing messages, and two (2) alternating messages formed by two (2) static or flashing messages. The time required to display a new message shall not exceed 0.8 second from a blank state, and 2.0 seconds from any non-blank state.

ATMS-CMS-F15   The ATMS shall erase the previous message prior to the writing of a new message.

ATMS-CMS-F16   The ATMS shall, for alternating (two-phase) messages, provide selection of the display time for each phase and the blank-out time between messages in tenths of a second.

ATMS-CMS-F17   The ATMS shall provide selectable message display time, including unlimited display time for each message.

ATMS-CMS-F18   The ATMS shall provide for comprehensive database(s) for CMS messages.

3.8.24 CMS System – Message Development

Functional Requirements

ATMS-CMS-F19   The ATMS shall support the User in creating and editing sign messages.

ATMS-CMS-F20   The ATMS shall assist the User in configuring the message for the given sign format. The system shall be able to handle all ASCII symbols, centering, justifying, and alternating messages in the same way that the sign controllers do.

ATMS-CMS-F21   The ATMS shall display the new message on the screen just as it would on the sign. (aka what-you-see-is-what-you-get)

ATMS-CMS-F22   The ATMS shall support flashing, with User-defined on and off times.

ATMS-CMS-F23   The ATMS shall enable the User to create one (1) or two (2) phase messages.

ATMS-CMS-F24   The ATMS shall remove the "message duration" field from this window and put it in the window (s) used to post messages on signs.

3.8.25 CMS System – Sign Plans

Functional Requirements

ATMS-CMS-F25   The ATMS shall provide a way to develop sign plans. Sign plans are groups of signs with an associated message. The message may be a library message or one entered by the User.

3.8.26 CMS System – Scheduling

Functional Requirements

ATMS-CMS-F26   The ATMS shall facilitate the creation of new sign schedules for the schedule library or edit schedules previously stored.

ATMS-CMS-F27   The ATMS shall be able to schedule messages on signs for a given period of time.

ATMS-CMS-F28   The ATMS shall be able to schedule sign plans.

ATMS-CMS-F29   The ATMS shall create, modify, suspend, or cancel a schedule of commands for the sign system to issue to each sign controller at the times specified in the schedule. A User shall not be able to schedule any command that they do not have the privilege to execute directly.

ATMS-CMS-F30 If the User chooses to apply the schedule to multiple signs, the ATMS shall present the User with a list of all signs (of the proper type), so that the User can select to which signs the new schedule goes. Using a single command, the User shall be able to cause the newly created schedule to be stored for all signs selected, replacing the previously stored schedules.

3.8.27 CMS System – Message Library

Functional Requirements

ATMS-CMS-F31 The ATMS shall be able to store a library of messages in the central database.

ATMS-CMS-F32 In addition to the message text, a message entry in the library shall contain all the control codes, timing data, and other information needed for a sign to properly display the message.

ATMS-CMS-F33 The library should be easily searchable (i.e., keyword search) to facilitate the selection of appropriate messages.

3.8.28 CMS System – Control Signs

Functional Requirements

ATMS-CMS-F34 The ATMS shall control the sign in response to instructions from Users and/or a schedule.

ATMS-CMS-F35 Sign control functions to be supported include replacing or blanking the current display.

ATMS-CMS-F36 Sign control functions to be supported include replacing or deleting the schedule for a CMS.

ATMS-CMS-F37 The ATMS shall poll each sign at regular intervals (this parameter shall be re-configurable) to verify the message currently being displayed. Users shall have the ability to select certain sign units to be left out of the polling cycle.

ATMS-CMS-F38 If the ATMS User chooses to send the message to one (1) or more signs, the ATMS shall present the User with a list of all signs (of the proper type), so that the User can select to which signs the new message goes.

ATMS-CMS-F39 The ATMS User shall designate signs by clicking on their icons on the system map.

ATMS-CMS-F40 Using a single command, the ATMS User shall be able to cause the newly created messages to be stored in the signs they specified and, if desired, to be displayed on each of those signs.

3.8.29 Incident Management

Functional Requirements

ATMS-IM-F1	The ATMS shall track the resources used to respond to an incident (regardless of Agency that is responding or contributing resources to the response) including the following (at a minimum):
	Vehicle (e.g., emergency vehicles, DOW vehicles, tow trucks, etc.)
	Equipment (e.g., CMS, HAR, traffic signal plans, etc.)
	Personnel
	Operations center
ATMS-IM-F2	Changes in response status shall be communicated with other Agencies via a notification.
ATMS-IM-F3	The ATMS shall also provide for tracking of special events and roadway construction.
ATMS-IM-F4	The incident tracking system shall provide for automatic generation of response plans.
ATMS-IM-F5	Response plans shall be customizable by the User.
ATMS-IM-F6	Incidents shall be displayed on the ATMS map displays.
ATMS-IM-F7	The ATMS shall track the location and status of an incident from start to finish.
ATMS-IM-F8	Data elements used in the incident tracking system shall be compatible with the Advanced Traffic Management System Data Dictionary Standard.
ATMS-IM-F9	The incident tracking system shall track incidents and be able to compute incident duration.
ATMS-IM-F10	The incident tracking system shall include provisions for special events and roadway construction.
ATMS-IM-F11	The incident tracking system shall be bale to receive various notification alarms.
ATMS-IM-F12	The incident tracking system shall include a mechanism to track receipt of information sent from one Agency to another.

ATMS-IM-F13   The incident tracking system shall include a contacts and inventory of equipment available for incident response.

ATMS-IM-F14   The incident tracking system shall provide for automatic geo-coding of incident location on the GIS-based map.

3.8.30 Transit Priority Systems

Functional Requirements

ATMS-TPS-F1   The ATMS shall support transit priority consistent with the approach adopted by Metro for Countywide deployment.

3.8.31 ATMS – Emergency Vehicle Pre-Emption

Functional Requirements

ATMS-EMS-F1   The ATMS shall recognize the occurrence of locally initiated pre-emption for emergency vehicles and thereby not erroneously diagnose a coordination failure because the local controller has been pre-empted.

ATMS-EMS-F2   The beginning and ending times of all pre-emption events shall be recorded in the system log.

ATMS-EMS-F3   The ATMS shall include reports and displays that show the beginning and ending times (or alternately, the beginning time and duration) of all pre-emption events for a selected time period.

ATMS-EMS-F4   Vehicle preemptions shall be reported by intersection approach.

3.8.32 ATMS – Communications

Functional Requirements

ATMS-COM-F1   The ATMS shall support different baud rates for communications channels to the controllers.

ATMS-COM-F2   The ATMS should support controllers using the AB3418E protocol.

ATMS-COM-F3   The ATMS should include communications support for the NTCIP protocol (Level-1 conformance).

ATMS-COM-F4   The ATMS shall communicate with each intersection once per second.

ATMS-COM-F5   The ATMS shall support multiple communications protocols as needed by the specific installation.

ATMS-COM-F6   The ATMS shall be transparent to the User regarding the communication methods and mediums used to access system devices (i.e., commands and UI's should be the same regardless of communications method). The system shall support control, data and video, communications using fiber optic, dial-up and wireless mediums.

3.8.33 ATMS – Future ITS Elements

Functional Requirements

ATMS-ITS-F1   The ATMS shall provide capabilities for real-time adaptive traffic control.

ATMS-ITS-F2   The ATMS shall provide for transit interface, such as Light Rail Transit (LRT) and bus priority opportunities.

3.9   ATMS DATA COLLECTION

3.9.1   General Requirements

User Requirements

ATMS-DAT-U1   The ATMS shall be able to collect data from all roadside ITS devices connected to it. The ATMS shall be able to process the collected data so that it can be used to perform the required ATMS functionality.

ATMS-DAT-U2   The ATMS shall support the viewing of CCTV and/or Video Imaging Detection systems (VIDs) images from multiple Agencies including adjacent Cities, and LACO DPW connected to it or IEN.

ATMS-DAT-U3   The ATMS shall provide database management functions that include archiving, back-up, diagnosing, displaying, distributing, processing, recovery, removing, retrieving, storing, and viewing of all data stored in the system.

ATMS-DAT-U4   All data collected by the ATMS shall be stored in a database.

ATMS-DAT-U5   The ATMS shall support data collection through various types of communications media/systems including, but not limited to, copper, TWP, fiber optic, and wireless.

Functional Requirements

ATMS-DAT-F1   The ATMS shall be able to compare detection data/information with historical plans within its database(s) and update for forecasting purposes.

ATMS-DAT-F2   The ATMS shall provide for comprehensive database(s) for detector data, system activity, and signal operation. This should include capacity for all configuration and timing parameters and storage for at least 100 different system-timing plans, graphics, and geometrics.

ATMS-DAT-F3   The ATMS shall provide for automated logging and reports at the TMCs, Local City Control Sites, and maintenance shops. This should include detection of all "malfunctions" and providing alarms as scheduled by the User.

ATMS-DAT-F4   The ATMS shall provide the ability to monitor detector operation, identify detector failure, and prepare reports with User-definable consequences.

ATMS-DAT-F5   The ATMS shall accept commands from and provide data to external systems via its interface/connection to the Countywide IEN.

ATMS-DAT-F6   The ATMS shall be capable of interfacing with the existing/planned CCTV cameras at the Local and Regional level without extensive software modification.

ATMS-DAT-F7   The ATMS shall be capable of interfacing with the existing/planned vehicle detection systems at the Local and Regional level without extensive software modification.

ATMS-DAT-F8   The ATMS shall be capable of interfacing with the existing/planned ATMS elements and/or ITS devices at the Local and Regional level without extensive software modification.

ATMS-DAT-F9   The ATMS shall collect and maintain all data/information required for real-time monitoring and displays from all intersections at all times.

ATMS-DAT-F10   New data types available from existing or new controllers shall be able to be displayed by the ATMS without code recompilation. Once the new data is configured on the local ATMS, it shall be available to the rest of the system without further configuration.

ATMS-DAT-F11   At a minimum, the ATMS shall be capable of supporting the following controllers and/or firmware:

- **Type 170 Controllers**
  LACO-4E
  BI Tran 222CIC
  Wapiti W4IKS
- **Type 2070 Controllers**
  Econolite 2070 (NTCIP)
  Eagle SEPAC (NTCIP)
  Siemens Nextphase (NTCIP)
- **NEMA TS/2 Controllers**
  Econolite ASC/2 (NTCIP)
  Econolite ASC/2 (AB3418)
  Eagle EPAC 300 (NTCIP)

ATMS-DAT-F12   The ATMS shall be capable of processing all data/information collected from local intersections.

ATMS-DAT-F13   All data/information collected by the ATMS shall be stored and maintained using an off-the-shelf Relational Database Management System (RDMS) accessible via Sequential Query Language (SQL).

ATMS-DAT-F14   ATMS Users shall be able to select periodic archiving of certain dynamic data into the static database or onto a backup medium such as magnetic tape or writeable CD-ROM.

ATMS-DAT-F15   ATMS Users shall be able to copy each major system component in its entirety to a backup medium in order to restore that component after a system failure.

ATMS-DAT-F16   The ATMS shall provide for comprehensive database(s) for vehicle system detector data, system activity, and signal operation.

ATMS-DAT-F17   The ATMS shall be capable of processing all data/information collected from system detector technologies including, but not limited to, the following:

- Inductive loop
- Radar
- Microwave

ATMS-DAT-F18   The ATMS shall be capable of processing all data, information, and images collected from VIDS detection systems.

ATMS-DAT-F19   The ATMS shall support automated device polling for defined data objects, for multiple device types. Poll rates of once-per-30 seconds are desired for speed data, however, the system shall support poll rates ranging from a minimum of once-per-second up to once-per-day configurable by individual device, and set by the System Administrator. Data polled should include the following for each device type (at a minimum):

- CCTV: Current Status, Zoom settings, Current Focus and Iris settings, Current Azimuth and Elevation settings, Current User
- CMS: Current Status, Current Intensity, Current Font, Current Message Displayed, Current User
- ATMS: Current Status, Current Volume/Speed/Occupancy Data

3.9.2   Data Archiving

Functional Requirements

ATMS-DAT-F20   The ATMS shall automatically record detector data in the database.

ATMS-DAT-F21   Detector data shall be stored in memory on a five (5) minute basis.

ATMS-DAT-F22   If bad data or no data is received from the detector loops during any or all of the five (5) minute collection time, the data will be tagged as questionable or not available in the database.

ATMS-DAT-F23   Each five (5) minute block shall be date and time-stamped.

ATMS-DAT-F24   The ATMS User shall have the ability to enable or disable the detector data collection feature.

ATMS-DAT-F25   Each 24 hours, the 5-minute detector data shall be automatically compressed and written to the storage media.

ATMS-DAT-F26   Detector data shall be retrievable from the storage media for use with the relational database or traffic modeling packages.

3.9.3   Analyze Data

Functional Requirements

ATMS-DAT-F27   The ATMS shall provide a mechanism to export any detector data that is entered or archived in the central database for the purpose of analysis.

ATMS-DAT-F28   Travel time and delay simulations based on proposed timings with real-time volumes, shall be carried out by exporting data to SYNCHRO.

ATMS-DAT-F29   The ATMS shall have the ability to generate time-space diagrams from both real-time data and from programmed data contained in the database and to display such time-space diagrams on-screen.

ATMS-DAT-F30   The ATMS shall have the ability to save time/space diagrams in either AutoCAD (.dwg) or MicroStation (.dgn) format or other standards.

ATMS-DAT-F31   The ATMS User shall be able to perform "on-screen fine-tuning" using click and drag methods to adjust the offsets, with the resulting changes in the widths of the progression bands being displayed.

ATMS-DAT-F32   The ATMS shall have the ability to provide a graphical display/report showing split times for a past period for an intersection.

ATMS-DAT-F33   The split time report shall be selectable a

- Between specific times (on a given date)
- Plan number

3.10 EVENT LOGS & ALARMS

User Requirements

ATMS-EL-U1   The ATMS shall record actions taken and changes of status.

ATMS-EL-U2   ATMS Users shall be able to add comments to the system event log.

ATMS-EL-U3   The ATMS shall provide automatic archiving of alarm logs on disk.

Functional Requirements

ATMS-EL-F1   The ATMS event log shall record changes in the status of all traffic control devices and ITS subsystems (e.g., traffic signals, CMS, CCTV, HAR, etc.)

ATMS-EL-F2   All data base modifications, uploads/downloads, alarms, and system commands shall be logged in the system log.

ATMS-EL-F3   System log-ins and log-outs shall be recorded (with time and date stamp) and accessible to the System Administrator.

ATMS-EL-F4   The ATMS event log shall be searchable by ITS device type (or subsystem), specific device, User/Operator, and severity of error.

ATMS-EL-F5   Reports from the event log from the searchable event log viewer shall be printable.

ATMS-EL-F6   The ATMS shall have the ability to detect system malfunctions, diagnose/analyze the situation (for potential resolution), and automatically log its status. (This capability is intended to minimize the time to repair of critical ATMS components).

ATMS-EL-F7   The ATMS shall detect controller power failure and recovery.

ATMS-EL-F8   Upon failure, the ATMS shall log the event and also display a visual alarm to the User.

ATMS-EL-F9   The occurrence of each such alarm shall be recorded in the system log.

ATMS-EL-F10   The event log shall include the ATMS time that the alarm is recorded.

ATMS-EL-F11   The ATMS shall continue to attempt communication with the failed component.

ATMS-EL-F12   If the failed component communicates successfully for a User-specified amount of time, the component shall be considered operational.

ATMS-EL-F13   This event shall also be logged, along with the clearing of the alarm for the failed component.

ATMS-EL-F14   Alarms shall be displayed in the active window on the ATMS screen.

ATMS-EL-F15   The alarm window shall be intrusive (pre-empt or interfere with the User's editing tasks).

ATMS-EL-F16   It shall be possible to change alarm routing to different User stations by time-of-day.

ATMS-EL-F17   Immediate display of alarms taking into account the data latency of the ATMS.

ATMS-EL-F18   It shall be possible to specify that a given alarm must occur a User-specifiable number of times before it is reported.

ATMS-EL-F19   The ATMS shall monitor the controller to verify that the controller is operating under a selected timing plan.

3.11 ATMS USERS

3.11.1 Network Administration

Functional Requirements

ATMS-USER-F1   Using tools provided with the Windows operating system, the ATMS Administrator (or Network Administrator) shall have the capability to monitor the network, including (at a minimum):

- Which Users are logged onto the system
- Status of any/all system firewalls
- Status of any/all system servers

3.11.2 System Administration

Functional Requirements

ATMS-USER-F2   The ATMS shall automatically recover from a power failure.

ATMS-USER-F3   The ATMS shall automatically begin communications with all field equipment via the central communications system (CCS).

ATMS-USER-F4   If the ATMS detects a non-fatal error within one (1) or more of its processes, it shall log a message to the system log,

ATMS-USER-F5   The ATMS shall continue to operate in a degraded state.

ATMS-USER-F6   Each 24-hour history shall be date stamped.

ATMS-USER-F7   The ATMS User shall have the ability to enable or disable the detector data archival feature.

ATMS-USER-F8   The ATMS User shall be able to select periodic archiving of certain dynamic data from the database to an archive file.

3.11.3 System Users

Functional Requirements

ATMS-USER-F9   The ATMS shall provide a full range of security and administration functions. The types of functions shall include the following (at a minimum):

- Log-in, log-out, and exit
- Security (ID/password combination)
- Add and delete Users
- Specifications of User's rights on a menu-by-menu basis (User profile)
- System Administrator's ability to change User's password
- User's ability to change their own password

ATMS-USER-F10   The ATMS Administrator shall assign User rights.

ATMS-USER-F11   The User's profile shall be accessible from any User workstation on the system.

ATMS-USER-F12   User access shall be by function and specific equipment.

ATMS-USER-F13   For access definition, equipment may be grouped together.

ATMS-USER-F14   Each User must log into the ATMS User interface with a username and password.

ATMS-USER-F15   The ATMS shall be able to determine by username and password, if the requester is permitted on the system and what rights that individual will have.

ATMS-USER-F16   The ATMS Administrator shall have the ability to limit User rights down to a specific menu level.

ATMS-USER-F17   Menus and functions to which the User has access shall be in dark letters while restricted menus or command options will be "grayed-out".

ATMS-USER-F18   Remote Users shall be required to provide a username and password to connect to the network and then a separate login to the ATMS.

ATMS-USER-F19   The rights of the remote User shall be determined and set-up in the same manner as a local User.

3.12 SYSTEM PERFORMANCE

3.12.1 Reliability

Functional Requirements

ATMS-SP-F1   ATMS software and hardware shall be reliable to industry standards and minimize system freezes, crashes, and failures.

ATMS-SP-F2   The ATMS workstations, server, and/or network software and hardware shall have the computing capability to carry out all the designated functions of the entire system and every workstation connected to it.

3.12.2 Equipment Technology

Functional Requirements

ATMS-SP-F3   The ATMS shall make use of existing communications infrastructure and standards.

ATMS-SP-F4   The ATMS shall incorporate commercial-off-the-shelf (COTS) software, equipment, components, and subsystems that can be operated and/or maintained by the Agency Vendor, or a local service provider.

ATMS-SP-F5   The ATMS shall be capable of interfacing to competing and complementary technologies from a variety of Vendors.

ATMS-SP-F6   The ATMS shall use state-of-the-art technology.

ATMS-SP-F7   The ATMS shall be capable of adapting and/or interfacing with new communication media.

ATMS-SP-F8   The ATMS detection technology shall have minimal maintenance needs.

ATMS-SP-F9   The ATMS detection technology shall be cost-effective.

ATMS-SP-F10   The ATMS detection technology shall be easy to operate and maintain.

ATMS-SP-F11   The ATMS detection technology will support permanent, non-permanent, and mobile detectors.

ATMS-SP-F12   The ATMS detection technology shall perform in all weather conditions.

ATMS-SP-F13   The ATMS shall use shared communications infrastructure with other ITS devices wherever possible.

ATMS-SP-F14   The ATMS shall support the most cost effective approach to interfacing with legacy systems and equipment.

ATMS-SP-F15   The ATMS shall make use of the existing infrastructure in the SGVTF to the extent possible.

3.12.3 Performance Measures

Functional Requirements

ATMS-SP-F16   The ATMS shall isolate safety-critical operations into manageable modules that have adequate safety features (i.e. redundancy, limited access, lockout, information presentation limits, etc.) to minimize the probability and impact of safety-related failures.

ATMS-SP-F17   The ATMS shall not let its performance and operation be impacted adversely by the malfunction, removal, or addition of interfaces.

ATMS-SP-F18   The ATMS shall respond to User information requests and service requests in a timely manner.

ATMS-SP-F19   The ATMS shall exhibit reliability to the degree that the system operations shall not fall below the safe service operation in a degraded mode of operation and performance.

ATMS-SP-F20   The ATMS shall provide continual information as to the status of the system's operations.

ATMS-SP-F21   The ATMS workstations shall meet or exceed the performance measures including the following (at a minimum):

- System start-up or re-boot time (10-minutes)
- Data latency (3-seconds)
- Display intersection graphic fully drawn and updated with dynamic attributes (10-seconds)
- Refresh rate for largest map (1-second)
- Refresh rate for all other displays (1-second)
- Time for User to monitor, display, and access any control interface (3-seconds)
- Display of detail list views (3-seconds)
- Controller commands to occur (3-seconds)
- Number of intersections supported (2,000)
- Number of system detectors (not only those for local actuation) supported (5,000)
- Minimum number of simultaneous Users (Limited only by network)

ATMS-SP-F22   The ATMS dial-up access (telephone or cellular) shall meet or exceed the performance measures including the following (at a minimum):

- Remote computer system start-up (5-minutes)
- Monitor and control any signal controller (15-seconds)
- Controller commands to occur (5-seconds)
- Display intersection graphics and status view, fully updated with dynamic attributes (15-seconds)
- Data latency (3-seconds)

3.13 ATMS FACILITY

3.13.1 Coordination Requirements

User Requirements

ATMS-COR-U1   Agencies will have the capability to release control of all, or a part, of their ATMS to another Agency (that share and/or are connected to it) and be able to use this in a "manual" or "automated" mode.

ATMS-COR-U2   The ATMS shall collect the traffic control system and other ITS device data from its system components and provide it to the SGVTF Sub-Regional TMC after processing and consolidating it.

ATMS-COR-U3   The ATMS shall report data in a manner in which the data can be used to assess future area planning efforts.

Functional Requirements

ATMS-COR-F1   The ATMS shall provide off-the-shelf (OTS) network management software to manage the Local Area Network (LAN) and Wide Area Network (WAN).

ATMS-COR-F2   The ATMS shall provide for "operator-free" operation so that the system performs all minimally necessary control and monitoring processes unattended.

3.14 OPERATION & MAINTENANCE

User Requirements

ATMS-O&M-U1   The control of the ATMS shall be done through a highly intuitive interface developed for personnel with only general personal computer (PC) familiarity, and no particular computer programming experience.

ATMS-O&M-U2   The ATMS shall provide automated database management and network monitoring and management functions.

ATMS-O&M-U3   The ATMS shall administer and maintain a central database, which shall allow on-line queries and reporting functions.

ATMS-O&M-U4   The ATMS shall have an uninterruptible power supply so operations can be continued during power outages.

ATMS-O&M-U5   The cost of operating and maintaining the ATMS hardware and software shall be the responsibility of each local Agency.

ATMS-O&M-U6   The ATMS shall have three (3) levels of maintenance priority for system hardware.

ATMS-O&M-U7   The ATMS shall have an on-going software maintenance program to maintain, improve, and enhance the system software.

ATMS-O&M-U8   An adequate amount of training shall be provided for control, operations, and maintenance of the ATMS.

ATMS-O&M-U9   The ATMS shall support standardized training approaches, and familiarize maintenance technicians, operators, managers, and other personnel with the proper use of system/service devices, components, technologies, operations and management strategies.

Functional Requirements

ATMS-O&M-F1   The ATMS shall include a fault reporting system capable of exporting all reports to a standard database or spreadsheet file.

ATMS-O&M-F2   The ATMS shall have three (3) levels of maintenance priority for system hardware including the following (at a minimum):

- Remedial maintenance to restore operations due to equipment malfunctions and failures
- Preventative maintenance to minimize the probability of failure during the product design life
- Modification/reconstruction maintenance to remedy manufacturing or design flaws, or to incorporate hardware improvements that enhance system performance

ATMS-O&M-F3   In order to minimize software failures/problems and reduce their impact to manageable proportions, ATMS software shall do the following (at a minimum):

- Employ verified or proven software
- Use software packages that are written in a compiler-level language
- Come with a complete set of accurate software documents, including user manuals and compiler listings

ATMS-O&M-F4   The ATMS shall include alarms to notify operators and maintenance personnel of system and device failures. Appropriate personnel shall be able to initially troubleshoot the situation without going to the site. The ATMS shall provide the staff with information as to which part should be replaced and if that part is in existing inventory. Recommended procedures on how to replace the part will also be available.

ATMS-O&M-F5   The ATMS shall be maintained by the local Agency and/or its signal maintenance contractor (other Agency or Private firm) where it resides.

ATMS-O&M-F6   The ATMS shall comply with the Agency's computer system/network policies and procedures.

4. APPENDIX A – ACRONYMS/DEFINITIONS

ACE	Alameda Corridor East Construction Authority
ATIS	Advanced Traveler Information System
ATMS	Advanced Traffic Management System
BPS	Bus Priority System
Caltrans	California Department of Transportation
CCS	Central Communication System
CCTV	Closed Circuit Television
CDI	Command Data Interface
CMS	Changeable Message Sign
COTS	Commercial-Off-The-Shelf
DOW	Day-of-Week
DSP	Digital Signal Processing
GIS	Geographical Information System
GUI	Graphical User Interface
IEN	Los Angeles County Countywide Information Exchange Network
IP	Internet Protocol
ITS	Intelligent Transportation Systems
LA	Los Angeles
LACDPW	Los Angeles County Department of Public Works
LACMTA	Los Angeles County Metropolitan Transportation Authority (Metro)
LACO	Los Angeles County
LAN	Local Area Network
LRT	Light Rail Transit
MOE	Measures of Effectiveness
MOU	Memorandum of Understanding
NTCIP	National Transportation Communications for ITS Protocol
O&M	Operations and Maintenance
OTS	Off-the-shelf
PC	Personal Computer
PTZ	Pan, Tilt, & Zoom

RDMS	Relational Database Management System (RDMS)
SGVTF	San Gabriel Valley Traffic Forum
SQL	Sequential Query Language
TBC	Time-based Coordination
TCS	Traffic Control System
TMC	Traffic Management Center
TOD	Time-of-Day
TPS	Transit Priority System
TRSP	Traffic Responsive Signal Plan
TSD	Time/Space Diagram
TSM	Traffic System Management
UTC	Coordinated Universal Time
WAN	Wide Area Network
WWV	National Institute of Standards and Technology Time & Frequency shortwave radio station that broadcast accurate real-time