SAN GABRIEL VALLEY TRAFFIC FORUM

TYPICAL LOCAL CITY CONTROL SITE FACILITY AND COMPUTER SYSTEM REQUIREMENTS (Deliverable 2.3.4.1)

DRAFT

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1 INTRODUCTION

1.1 SAN GABRIEL VALLEY TRAFFIC FORUM

The San Gabriel Valley Traffic Forum (SGVTF) is one of the planned Intelligent Transportation Systems (ITS) improvement projects that the Los Angeles County Department of Public Works (County) is developing as part of the Traffic System Management (TSM) program in order to improve traffic flow and enhance arterial capacity in a cost-effective way where roadway widening is not possible. The purpose of the SGVTF project is to design, develop, and deploy an Advanced Transportation 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 their ATMS and recommends improvements to field infrastructure (e.g., controllers, detection systems, communications, etc.) and centralized Traffic Control Systems (TCSs) and/or Traffic Management Centers (TMCs) to meet those requirements. When the SGVTF project is successfully completed, each of the Agencies responsible for their traffic signal operations will have full access to an ATMS that monitors and controls the traffic signals within their 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.

The SGVTF project area includes Cities bordering the California State Route (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, County, and Caltrans District 7.

1.2 COUNTYWIDE INFORMATION EXCHANGE NETWORK (IEN)

Developed by the County, the Countywide Information Exchange Network (IEN) is a system that connects participating individual Agency ATMSs within Los Angeles County into a Regional network to support the operational goals identified above. The Countywide IEN supports traffic signal operations at the Local Level, Corridor Level, and Regional Level. The SGVTF project assumes the availability of the Countywide IEN at the Corridor & Regional levels. Therefore, the SGVTF project is focused on the local TCSs and their interface to the Countywide IEN. The eventual ATMS design for the SGVTF project will take into account the TCSs 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 Workstation 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, application software communication networks, IEN software application, etc. that integrates these components for the collection and exchange of data to support Corridor and Regional functions throughout LA County.

1.3   LOCAL AGENCY LEVELS

Four (4) levels of operations have been defined in order to categorize each Agency's level of involvement in managing their traffic and responding to incidents within their jurisdiction. These levels are defined in the *Operational Objectives & System Needs* document and are briefly described below.

Level 1 Agency (Bradbury, San Marino, and Sierra Madre)

- Agency does NOT operate its traffic signals
    - Agency wants to be "Agency B" on another Agency's ATMS
    - Another Agency operates its traffic signals (e.g., LA County DPW)
- Provided with an IEN W/S to monitor traffic signals & incident management activities
- No separate ATMS W/S provided

Level 2A Agency (Baldwin Park, Duarte, El Monte, Glendora, La Puente, Monrovia, South El Monte, and Temple City)

- Agency passively manages its traffic signals
    - Establish initial signal timings, monitor system status daily, etc.
    - Typically operate on an exception basis & occasionally peak periods
- Agency wants to be "Agency B" on another Agency's ATMS
- Provided with an IEN W/S to monitor traffic signals & incident management activities [Regional view]
- Separate ATMS W/S connected to "host" Agency's ATMS [Local view]

Level 2B Agency (Alhambra, Arcadia, Azusa, Covina, Irwindale, Montebello, Monterey Park, Rosemead, San Dimas, San Gabriel, South Pasadena, and West Covina)

- Agency actively manages & operates its own ATMS
    - Actively manage ATMS during exceptions & peak periods
    - Passively manage ATMS during off-peak
- Agency may operate some other ITS devices (small amount)
- Agency may "host" another Agency's traffic signals
- Houses an IEN LCCS to manage traffic signals & incident management activities
    - IEN W/S [Regional view]
    - ATMS W/S [Local view]
    - CDI between the ATMS & IEN

Level 3 Agency (Caltrans, LA County Department of Public Works, and Pasadena)

- Agency actively manages its own ATMS & other ITS devices (large amount)
    - Typically AM peak thru PM peak operations
    - May support 24/7 operations
- Agency may operate other Agencies' traffic signals (Level 1)
- Agency may "host" other Agencies' traffic signals (Level 2A)
- Agency will have a TMC from which to operate its ATMS, the IEN, & other ITS devices
- Houses an IEN LCCS to manage ATMS & incident management activities
    - IEN W/S (Regional view)
    - ATMS W/S (Local view)
    - CDI between the ATMS & IEN

To summarize, Level 1 and 2A Agencies will passively manage their respective traffic signal systems and the IEN workstation will allow them to monitor their traffic signals and incident management activities within the SGVTF project area. The IEN workstation for these Agencies will most likely be located in the office of the individual that is most involved with traffic engineering issues. The IEN workstation would typically consist of a new desktop computer connected to the IEN Wide Area Network (WAN) (isolated from other networks) with a dedicated monitor, keyboard, and mouse. However, if space is limited and/or the user prefers, the IEN computer could share an existing monitor, keyboard, and mouse with the use of a keyboard-video-mouse (KVM) switch.

Level 2B and 3 Agencies will actively manage their own, and possibly other Agencies', traffic signal systems and other ITS devices with IEN and ATMS workstations. In this case, each workstation would consist of a new desktop computer with a dedicated monitor, keyboard, and mouse. For Level 2B Agencies, these workstations would probably be located in the City Traffic Engineer's office or in a nearby room that is easily accessible to the primary user(s). For Level 3 Agencies, these workstations would be located within their respective TMC's and would include connections to existing and/or new wall-mounted video displays.

2   REQUIREMENTS OVERVIEW

2.1   PURPOSE OF DOCUMENT

This document provides the local Agency workstation and site requirements (Deliverable 2.3.4.1), which is one of the deliverables related to the Concept-of-Operations/System Requirements task. As discussed in the SGVTF Concept-of-Operations, it is envisioned that local Agencies within the San Gabriel Valley Region will have a relatively basic IEN Workstation or a more sophisticated ATMS system. An IEN workstation is essentially a personal computer connected to the IEN WAN with the IEN GUI and software application installed. It is generally used by a local Agency to monitor traffic conditions and operations in its jurisdiction (passive management) and for viewing those of neighboring jurisdictions. For Agencies that are more active in managing their traffic operations, an ATMS system will also be deployed. The ATMS system is basically a TCS (central system with a workstation) with a Command Data Interface (CDI) that allows it to communicate with the Countywide IEN. All of these central systems and workstations will be physically located either at a local City Control Site (LCCS) or a more advanced Transportation Management Center (TMC).

This document provides the user and functional requirements for the IEN and ATMS workstations and the general space requirements for the LCCS or TMC system for a typical local Agency within the San Gabriel Valley Region. Other than the general space requirements, the user and functional requirements associated with the ATMS system are provided in the ATMS User and Functional Requirements document, which is a separate deliverable for the SGVTF Project. It is anticipated that all local Agencies with traffic signals will have an IEN workstation regardless of the "level" of their operations (see Section 1.3). Local Agencies that actively manage their own, and/or other Agency's, signal system and other ITS devices should also have an ATMS workstation (Level 2B and 3 Agencies). These requirements are based on information that was obtained from surveys of, and interviews with, the local SGVTF Agencies as described in the *Operational Objectives & System Needs* document.

The user requirements identify the desired system operations and functions for the proposed workstation hardware, software, physical layout, and furnishings for the typical user at a local Agency. The functional requirements identify the required high-level system functions and operations for the hardware, software, physical layout, and furnishings associated with a typical IEN or ATMS workstation. The user and functional requirements provide information that will be used to develop the LCCS System Architecture. Sample layouts or diagrams for a LCCS will be provided in a separate document (i.e. as part of *Area Architecture/Local City Control Site (LCCS) Diagram* deliverable).

2.2   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

- Deliverable 2.3.2.1 – ATMS User Requirements
- Deliverable 2.3.3.1 – ATMS Functional Requirements
- I-5/Telegraph Road Corridor Project
    - Deliverable 3.6 – Requirements Analysis (Final - Section 8)
- Pomona Valley ITS Project
    - Deliverable 5.3.4 – Typical Local Control Center Report
- San Gabriel Valley Pilot Project
    - System Design Report (Final, Version 1.0)
- South Bay Traffic Signal Synchronization and Bus Speed Improvement Plan –Part III
    - Local Traffic Control Center Requirements
- Treasure Valley ITS System Control Software Functional Requirements Specifications

2.3 DEFINITIONS

Within this document, the following definitions are used:

- LCCS
    - The Local City Control Site is the location (center) where the local Agency monitors and/or manages traffic operations within their jurisdiction.
- IEN Workstation
    - A personal computer connected to the IEN network with the IEN GUI and application software installed that is used by a local Agency to monitor traffic conditions and operations in its jurisdiction and those of neighboring jurisdictions.
- ATMS System
    - The ATMS system is basically a Traffic Control System (TCS) with a Command Data Interface (CDI) that allows it to communicate with the IEN and includes the SGVTF ATMS elements/components that are controlled and operated by a centralized computer system.
- Users
    - SGVTF 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.
- Administrators
    - Users who maintain ultimate authority on system control, operations, and maintenance of the system and system elements over their own jurisdictions.

3   IEN WORKSTATION AND LCCS FACILITY REQUIREMENTS

As mentioned previously, an IEN workstation will be located at all of the local Agencies that have traffic signals within the SGVTF. The following sub-sections identify the key User Requirements and Functional Requirements for the front-end (workstation and associated software) aspects of the Los Angeles Countywide IEN. In addition, general requirements for Level 2B and 3 Agencies that are not addressed in the SGVTF ATMS Requirements (such as general space requirements, equipment layout, etc.) are provided. 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 alphanumeric system by which the requirements are listed is as follows:

<div align="center">"type" -"Subject"-"requirement number"</div>

For example, "IENF-SC-U1", for IEN Front-end, System Control, User Requirement #1 or "LCCS-GEN-U1" for LCCS system, General, User Requirement #1. The first functional requirement in the same section will be listed as "IENF-SC-F1" or "LCCS-GEN-F1" and so on. For purposes of presentation and ease of use, this structure and the requirements information are provided in 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 into one location:

- **General Requirements** – Groups together functionality and system characteristics that do not apply to a specific category.
    - General Space Requirements
    - Staffing, Training, and Hours of Operation
    - Inter-Jurisdictional Coordination
- **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
    - Operator Error Message
    - System Error Message
    - Map Display and Real-Time Displays
    - Video 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.

- **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.
- **Data Collection** – Groups together the characteristics associated with the system's ability to collect, process, share, and store data.
- **Event Logs and 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 and Technology
- **Operations and Maintenance (O&M)** – Groups together the characteristics associated with the system's general operations and maintenance principles.

3.1   GENERAL REQUIREMENTS FOR ALL AGENGIES

3.1.1   General Space Requirements

User Requirements

IENF-GEN-U1	The IEN System shall be located in a space that provides convenient access to primary Users.
IENF-GEN-U2	The IEN System hardware shall meet specific spatial requirements and availability of space for each Agency.
IENF-GEN-U3	The IEN Workstation shall be located in an existing workspace that will minimize costs related to building remodeling and installing equipment.

Functional Requirements

IENF-GEN-F1	The IEN System shall make use of existing infrastructure to the extent possible.
IENF-GEN-F2	Where space is limited, or to enhance user functionality, the IEN-related desktop computer shall share a monitor, keyboard, and mouse with another

desktop computer with the use of a KVM switch.

3.1.2 Staffing, Training, and Hours of Operation

User Requirements

IENF-GEN-U4   Staff authorized to use the IEN System shall be determined by each local Agency.

IENF-GEN-U5   The IEN System shall be able to operate any time of the day and any day of the week.

Functional Requirements

IENF-GEN-F3   The IEN System 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.

3.1.3 Inter-Jurisdictional Coordination

User Requirements

IENF-GEN-U6   The IEN System shall allow Users to limit operation of their system elements by other Users.

IENF-GEN-U7   The IEN System shall allow an Agency to request/implement plan changes in another Agencies' ATMS System to accommodate emergency operations and/or non-recurrent congestion situations.

IENF-GEN-U8   The IEN System shall support the development of scenario response plans and traffic management strategies for inter-jurisdictional traffic management within the SGVTF during recurrent and non-recurrent traffic congestion.

IENF-GEN-U9   The IEN System shall have a standard time reference for coordination across jurisdictional boundaries.

Functional Requirements

IENF-GEN-F4   The IEN System shall allow Local Agencies to monitor the operation of signals in adjacent jurisdictions.

IENF-GEN-F5   Through manual alarms, the IEN System shall allow Users to record incidents, planned events, and other types of notifications.

IENF-GEN-F6   Through manual alarms and Agency-specific e-mail, the IEN System's user interface shall allow jurisdictions to request neighboring Agencies to implement certain plans.

IENF-GEN-F7   Through scenario response plans, the IEN System shall provide methods to facilitate joint Agency planning for coordinated timing plan implementation.

IENF-GEN-F8   The IEN System shall provide standard time reference for coordination across jurisdictional boundaries.

IENF-GEN-F9   The IEN System shall be able to reference data including: traffic conditions, device status, and current timing plan information (plan number, cycle, offset) from other ATMS as part of the plan selection decisions.

3.2   GENERAL REQUIREMENTS FOR LEVEL 2B AND 3 AGENGIES

In addition to the general requirements provided above in Section 3.1, the following requirements also apply to Level 2B and 3 Agencies within the SGVTF.

User Requirements

LCCS-GEN-U1   The ATMS System Workstation should be located near the IEN Workstation so that it is easy for a system operator to move between workstations.

LCCS-GEN-U2   The ATMS System shall be located in a space that is easy to secure.

LCCS-GEN-U3   The ATMS System should be installed at a location that will minimize installation costs of equipment and communication links to the field devices.

LCCS-GEN-U4   The ATMS System shall be located in a space that is ventilated and can be heated or cooled to maintain a temperature that is desirable for System Operations.

LCCS-GEN-U5   The LCCS facility shall have an uninterruptible power supply and other back-up utilities systems as needed so operations can be continued during interruptions of normal utility service.

LCCS-GEN-U6   The LCCS facility must accommodate communications infrastructure enabling both the IEN System and ATMS system to download information to, and upload information from, the Sub-Regional TMC.

LCCS-GEN-U7   The LCCS facility shall have security features to protect from and detect unauthorized access, tampering, and destruction of critical system information and components.

Functional Requirements

LCCS-GEN-F1   The LCCS facility should be sized to accommodate the Agency's operations staff, administrative staff, the computer systems, and the video display systems.

LCCS-GEN-F2   The heat load factor associated with the ATMS System shall be determined and the facility's HVAC system shall be adjusted accordingly.

LCCS-GEN-F3   The LCCS facility's HVAC system shall be able to operate 7 days per week, 24 hours per day.

LCCS-GEN-F4   The specific layout of furniture and equipment within the LCCS facility shall be configured to optimize the ergonomic interaction among various staff and equipment.

LCCS-GEN-F5   The LCCS facility shall be designed to control glare and visual displays shall be located to minimize glare.

LCCS-GEN-F6   Adequate floor and rack space, wall clearance, and access room/area shall be provided based on the requirements of the specific computer/communications equipment used.

LCCS-GEN-F7   Storage space shall be provided for manuals, files, paperwork, equipment accessories, and for the belongings of staff who do not have office space elsewhere in the building.

3.3 SYSTEM STATUS

User Requirements

IENF-SS-U1   The IEN Workstation shall display a specific subset of system alarms provided by the ATMS System, and allow the printing of such alarms, for the following items:

- System controller status
- Traffic signal controller cabinet door open
- Traffic signal controller conflict flash

Functional Requirements

IENF-SS-F1   The IEN System shall provide Users the capability to turn on or off each type of alarm separately. However, the IEN System shall still log alarms.

IENF-SS-F2   When the Alarm subsystem GUI is "open", the IEN System shall provide immediate display of alarms as they occur.

3.4   SYSTEM CONTROL

User Requirements

IENF-SC-U1	Local Agencies shall be able to monitor every traffic signal connected to the IEN System on a Countywide basis (Local, Sub-Regional, & Regional).
IENF-SC-U2	The IEN Workstation shall support the dissemination of data and information to local Agency internal and external websites, television station, or other utilized TIS (Planned).
IENF-SC-U3	The IEN System shall support multiple workstation locations at a single Agency (i.e., for maintenance and/or law enforcement operations and monitoring).
IENF-SC-U4	The IEN System shall allow Users to define system control by other users (i.e., define who is allowed to access the system for operating devices).
IENF-SC-U5	The IEN System shall allow Local Agencies to redirect control of their ATMS System and/or ITS elements to alternate Agencies.
IENF-SC-U6	Through each Agency's IEN Workstation, authorized personnel shall be able to control any of their own traffic signals and ITS elements that are connected to/supported by the IEN System. (Please note that an Agency may have ITS elements that will not be controlled by the IEN).
IENF-SC-U7	The IEN System shall provide functions allowing Users to control system security (i.e., Users will be able to adjust who has what type of access to system security features).
IENF-SC-U8	IEN System Users will be able to manipulate intersection controllers if they have the proper privileges.
IENF-SC-U9	The IEN System shall provide local Agencies that do not have full-time staff the ability to delegate control authority to another Agency.
IENF-SC-U10	IEN System Users shall have the ability to control traffic signals and ITS elements in other jurisdictions through the IEN per established MOU's.

Functional Requirements

IENF-SC-F1	The IEN System shall allow Local Agencies to have operational control of signals and be able to monitor the operation and equipment status of signals within their jurisdiction.
IENF-SC-F2	Users at any IEN Workstation will have the ability to control any intersection in the system if they have been granted that privilege. Control will be limited to plan selection and possibly mode selection depending upon the capability of the native system and the interface.

IENF-SC-F3   The IEN System shall process simultaneous requests for the same CCTV camera so that only one (1) User can control a given CCTV camera at one time. Along with this mechanism, a camera access-prioritizing scheme should be implemented. As a result, conflicts of CCTV camera usage can be resolved. However, the User shall have the capability to override the prioritizing scheme.

IENF-SC-F4   LACDPW shall be able to monitor the equipment status of all signals connected to the IEN System that it maintains in the SGV region.

IENF-SC-F5   The IEN System user interface shall allow designated lead Agencies to implement scenario response plans that cross-jurisdictional boundaries.

IENF-SC-F6   Users shall be able to preset and name viewing locations and view preset locations through the IEN System's GUI module.

IENF-SC-F7   The IEN System shall be developed to interface with the CCTV system's control program. However, integration of the CCTV subsystem with the IEN System shall be transparent to Users.

IENF-SC-F8   The IEN System shall provide for graceful system shutdowns, when necessary, and local and remote unattended system restart capability.

IENF-SC-F9   Through the Local Agency TCS, the IEN System shall allow the User to issue plan and mode changes to local controllers.

IENF-SC-F10   The IEN System shall allow the User to monitor intersection operation to verify compliance with the selected timing plan.

IENF-SC-F11   The IEN System shall provide plan selection capability, such as a special event plan, by User determination.

3.5   USER INTERFACE

3.5.1   Ease of Use

User Requirements

IENF-GUI-U1   All IEN System user accessible software shall use a Graphical User Interface (GUI) that operates on a PC-compatible workstation running the Windows operating system.

IENF-GUI-U2   The IEN System GUI shall provide Users with pull-down or pop-up menus for commands to the system.

IENF-GUI-U3   The IEN System GUI shall provide on-line help.

IENF-GUI-U4   The IEN System user interface shall be graphics-based, intuitive, and user-friendly.

Functional Requirements

IENF-GUI-F1	The IEN System GUI shall run on a workstation running the Windows Operating system.
IENF-GUI-F2	The IEN System GUI shall run on a PC-compatible workstation.
IENF-GUI-F3	The IEN System 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.
IENF-GUI-F4	The IEN System GUI shall use interactive screens, multiple windows, pull down or pop-up menus, tool bars, and dialogue boxes in accordance with the Microsoft Windows interface standards.
IENF-GUI-F5	The IEN System GUI shall allow the use of pull down or pop-up menus to access user functions.
IENF-GUI-F6	The IEN System GUI shall allow the use of a mouse to access user functions.
IENF-GUI-F7	IEN System user input shall include, but not be limited to, mouse clicking and dragging, text input, button actions, and menu command actions.
IENF-GUI-F8	The IEN System user interface will provide geographically accurate maps of the SGVTF and LA County.
IENF-GUI-F9	The IEN System shall allow the User to change the map detail level in order to display views of the SGVTF, jurisdictions, sections, or intersections.
IENF-GUI-F10	The IEN System and its map display can be run on multiple workstations and each can display data from the same or different intersections simultaneously.
IENF-GUI-F11	Objects on the IEN System map can be programmed to turn on or off at different zoom levels. Text labels shall be comparable in size between different zoom levels.
IENF-GUI-F12	Users may zoom IEN System maps to more detailed views in less than 5 seconds. Once zoomed, they may pan the view through different areas of the map.
IENF-GUI-F13	The IEN System shall provide for real-time display of intersection operation.
IENF-GUI-F14	The IEN System shall display status of conflict monitor.
IENF-GUI-F15	The IEN System shall display details of coordination at a controller (i.e., coordination timers), such as permissive period.

IENF-GUI-F16   The IEN System shall display status of coordination at each controller

IENF-GUI-F17   The IEN System shall display detector occupancy (%).

IENF-GUI-F18   The IEN System shall display the pedestrian push button calls in real-time.

IENF-GUI-F19   The IEN System shall display average speed over detector.

IENF-GUI-F20   The IEN System shall display an indication of which interval is currently timing on each controller.

IENF-GUI-F21   The IEN System shall display vehicle detector calls.

IENF-GUI-F22   The IEN System shall display detector volume counts.

IENF-GUI-F23   The IEN System's Help facility shall include an on-line version of the User Guide and shall provide the following:

- A List of Contents shall be provided
- A Keyword search facility shall be provided
- Printing of Help topics shall be provided
- Navigation through Help topics using hypertext links shall be provided
- The software version of each application or optional module shall be displayed in the Help | About dialog

IENF-GUI-F24   In functions where configuration or modification of system or equipment parameters is necessary, the IEN System shall provide a GUI to allow for modifications.

IENF-GUI-F25   The IEN System shall support a variable number of User workstations for the system as a whole and at individual locations.

IENF-GUI-F26   The IEN System will provide full GUI display of database tables.

3.5.2   Operator Error Message

Functional Requirements

IENF-GUI-F27   Within the IEN System, Operator error messages shall be displayed in a consistent format.

IENF-GUI-F28   Within the IEN System, all Operator error messages shall be specified in the documentation provided to the User, with corresponding indexing, and appropriate grouping of error message types.

IENF-GUI-F29   Within the IEN System, the text in an Operator error message shall not imply that the User is at fault.

IENF-GUI-F30   Within the IEN System, the text in an Operator error message shall give the User guidance regarding the corrective action to be taken.

IENF-GUI-F31   Within the IEN System, the text in an Operator error message shall be free from technical jargon, as far as possible.

3.5.3   System Error Message

Functional Requirements

IENF-GUI-F32   Within the IEN System, 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.

IENF-GUI-F33   IEN System error messages shall be displayed in a consistent format.

IENF-GUI-F34   All IEN System error messages shall be specified in the documentation provided to the User, with corresponding indexing, and appropriate grouping of error message types.

IENF-GUI-F35   The text in an IEN System error message shall refer the User to the Windows Application Event log, if applicable.

3.5.4   Map Display and Real-Time Displays

User Requirements

IENF-GUI-U5   The IEN Workstation graphical user interface (GUI) shall provide a geographically accurate map of Los Angeles County. GIS is preferable because geographically correct maps are necessary when carrying out functions that use a spatial reference.

IENF-GUI-U6   The IEN Workstation GUI shall be able to zoom and pan maps, to provide more detailed views, with the use of a mouse.

IENF-GUI-U7   The IEN Workstation GUI shall be able to provide real-time information concerning the status of all signal equipment and related detectors for each intersection that is connected to the IEN System.

IENF-GUI-U8   A "zoomed-in" or detailed view of an intersection will include an identifying name and number.

IENF-GUI-U9   IEN System Users, with proper access privileges, shall be able to edit the IEN System's overlaying map layers. (Please note that the IEN System's base level roadway graphics cannot be edited).

Functional Requirements

IENF-GUI-F36   Intersection displays (supported when embedded into the IEN System's ATMS Explorer backgrounds) shall depict roadway curb lines and lane lines and shall include static displays of the following (at a minimum):

- Street names
- Intersection number
- Phase numbering
- North arrow

IENF-GUI-F37   The IEN System's intersection display shall also include dynamic indicators. The intersection display shall indicate the status of the following (at a minimum):

- Controller operational mode (TOD/DOW, traffic responsive, manual, free, and free/flash))
- Controller status (offset transition, preempted, and type of preemption, conflict flash,)
- Programmed offset
- Actual timed offset
- Communications status (on-line, bad communication, and no communication)
- Cabinet door status
- Timing parameters currently in effect (control mode, transition status, control section assignment, timing plan number, cycle length, offset, and split values)
- 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
- Preemption in effect and what preemption mode
- Indication of failure and type of failure
- Count-up of cycle clock
- Count-up of the number of seconds for the split of the phase in service

IENF-GUI-F38   The IEN System's intersection graphics window shall include a window header with the standard intersection name and number in it.

IENF-GUI-F39   Within the IEN System, the detector status for a given intersection shall be displayed on the screen with the intersection graphics.

IENF-GUI-F40   Within the IEN System, traffic detector information (volume, occupancy, speed, congestion level quantities) shall be displayed.

IENF-GUI-F41   Within the IEN System, link detector information (volume, occupancy, speed, congestion level quantities) shall be displayed as colored links.

IENF-GUI-F42   Within the IEN System, it shall be possible for the Operator to select the relevant quality for display via the GUI.

IENF-GUI-F43   Within the IEN System, V+kO values will be displayed per detector.

IENF-GUI-F44   The IEN System GUI shall incorporate a system map that covers the entire limits of the controlled area.

IENF-GUI-F45	When maximized or minimized, the IEN System's graphical views shall return to the scale at which they were displayed immediately prior to the action being taken.
IENF-GUI-F46	Clicking on areas of the IEN System map shall select more detailed views of controlled areas (area maps).
IENF-GUI-F47	The IEN System shall provide the capability to create custom map displays for a given intersection (using ATMS Explorer).
IENF-GUI-F48	The IEN System shall provide the capability to import map displays from a Geographic Information System.
IENF-GUI-F49	The IEN System shall provide the capability to import graphics in the following formats: • .bmp • .wmf • .jpg [Not directly supported, but images can be converted into a supported format using the included COTS graphics editor (e.g. MS Visio)] • .tiff [Not directly supported, but images can be converted into a supported format using the included COTS graphics editor (e.g. MS Visio)]
IENF-GUI-F50	Within the IEN System, the dynamic mapping shall incorporate full pan/zoom capability on system and area maps.
IENF-GUI-F51	Within the IEN System, the User 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.
IENF-GUI-F52	Within the IEN System, different layers shall be enabled as a default at different zoom levels.
IENF-GUI-F53	By setting the zoom scale range and appropriately enabled/ disabled layers, the User shall be able to control which IEN System layers display at different zoom scales.

3.5.5   Video Displays

User Requirements

IENF-GUI-U10	The IEN Workstation video display shall fit within the space designated by each Agency and may use other video monitors besides the monitor associated with the IEN workstation. Video displays may be located in other rooms within the City, such as in the Maintenance Department, conference rooms, etc.

3.6 REPORT GENERATION

User Requirements

IENF-RG-U1   The IEN Workstation shall be capable of generating the following reports using ATMS-generated data:
- Archived system detector volume/occupancy/speed (VOS) measurements
- Archived controller communication response metrics
- Archived controller alarms

IENF-RG-U2   The IEN Workstation shall be capable of generating maintenance reports for the following parties:
- City Operations Staff
- Maintenance Staff
- Signal Maintenance Contractors

IENF-RG-U3   The IEN Workstation shall be capable of automatically generating reports via time-of-day scheduling (Planned).

Functional Requirements

IENF-RG-F1   The IEN System shall provide routine pre-formatted reports.

IENF-RG-F2   The IEN System shall allow Users to print reports.

IENF-RG-F3   When a report is generated within the IEN System, the default mode of report output shall be to the screen.

IENF-RG-F4   When displayed, IEN System reports shall appear in a window that can be resized by the User.

IENF-RG-F5   Within the IEN System, multiple reports shall be able to be displayed simultaneously on the User's screen.

IENF-RG-F6   Once a report is displayed on screen, the IEN System shall allow the User to print the report.

IENF-RG-F7   Within the IEN System, the User shall be able to generate custom reports using COTS software.

3.7 DATABASE EDITING

Functional Requirements

IENF-DE-F1   The IEN System shall utilize a multi-user, commercial database software product.

IENF-DE-F2   The IEN System database shall be used to store, retrieve, and maintain system data and parameter files.

3.8   SYSTEM SECURITY AND ACCESS

User Requirements

IENF-SEC-U1   As provided by the Windows Operating System, security control shall be provided to access control of the IEN Workstation so that unauthorized Users shall be unable to access the IEN Workstation.

IENF-SEC-U2   Only the IEN System Administrator within each Agency will be able to assign User access.

IENF-SEC-U3   Security control shall be provided to access control and operations of the IEN Workstation.

IENF-SEC-U4   The IEN System shall allow for multiple levels of security and access so that different Users will be allowed access to different functions based on user rights granted by System Administrator.

Functional Requirements

IENF-SEC-F1   IEN System Administrators will assign a unique name to each User. User name will be unique across all systems Countywide.

IENF-SEC-F2   Each User on the IEN System will have an individual password.

IENF-SEC-F3   No User will gain access to the IEN System without entering a valid user name and password. Unauthorized casual Users may be granted visitor level (read-only) access to selected parts of the system by the IEN System Administrator.

IENF-SEC-F4   IEN System Administrators and Users will create and maintain profiles of information and capabilities for each User.

IENF-SEC-F5   Within the IEN System, multiple Users may monitor the same data item if they have been granted read access to that data item.

IENF-SEC-F6   IEN System Administrators may grant different Users different levels of access to the system.

IENF-SEC-F7   All SGVTF project stakeholders will have read access to all equipment status and congestion data in the SGVTF.

IENF-SEC-F8   Within the IEN System, each User will be assigned an access level for each system resource.

IENF-SEC-F9   Authorized Users may create new Users and add new pieces of equipment to the IEN System.

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

IENF-SEC-F11	Within the IEN System, authorized Users may select the timing plan in use on certain intersection controllers.
IENF-SEC-F12	IEN Users shall have view/monitoring capabilities of all signalized intersections connected to the IEN System (with the exception of alarms).
IENF-SEC-F13	For a scenario response plan, the IEN System shall resolve conflicting requests for a particular intersection controller by request priority (i.e., last request overrides previous requests).
IENF-SEC-F14	Within the IEN System, jurisdictions may define intersection groups and grant access to a group in a single operation.
IENF-SEC-F15	The IEN System shall be able to deter and detect unauthorized access, tampering, and destruction of critical system information and components.

3.9 DATA COLLECTION

Functional Requirements

IENF-DC-F1	The IEN System shall be capable of providing detector status and volume/occupancy/speed (VOS) information collected by such detection systems.
IENF-DC-F2	The IEN System shall provide Users the CCTV camera in-use status. If there is no pan, tilt, zoom, focus, or image adjust operations performed on a CCTV camera within the User-selected (nominally, five-minute) time frame, that CCTV camera is defined as "not-in-use."
IENF-DC-F3	The IEN System's local database will be stored in a Relational Database Management System (RDMS) allowing Sequential Query Language (SQL) based queries.
IENF-DC-F4	The IEN System shall provide a means of reporting system alarms to Users.
IENF-DC-F5	IEN System Users shall be able to print out full or partial database reports with formatted layouts.

3.10 EVENT LOGS AND ALARMS

User Requirements

IENF-EL-U1	The IEN System shall record actions taken and changes of status.
IENF-EL-U2	The IEN System User shall be able to add informational events and/or comments to the system event log.
IENF-EL-U3	The IEN System shall provide a means of reporting system alarms to Users.
IENF-EL-U4	The IEN System shall provide automatic archiving of alarm logs on disk.
IENF-EL-U5	The IEN System shall place alarm data in a log file.

| IENF-EL-U6 | The IEN System shall provide for automated permanent archival data storage of malfunction event logs. |
| IENF-EL-U7 | The IEN System shall record when timing plan changes have occurred. |

Functional Requirements

IENF-EL-F1	The IEN System event log shall record changes in the status of all traffic control devices and ITS subsystems (e.g., traffic signals, CMS, CCTV, HAR, etc.)
IENF-EL-F2	All database modifications, uploads/downloads, alarms, and system commands shall be logged in the IEN system log.
IENF-EL-F3	System log-ins and log-outs shall be logged (with time and date stamp) and shall be accessible to the IEN System Administrator.
IENF-EL-F4	The IEN System event log shall be searchable by ITS device type (or subsystem), specific device, User/Operator, and severity of error.
IENF-EL-F5	Reports from the event log from the searchable event log viewer shall be printable.
IENF-EL-F6	Malfunction detection and diagnosis and automatic status logging shall be provided to minimize the time-to-repair of critical components of the IEN System.
IENF-EL-F7	The IEN System shall detect controller power failure and recovery.
IENF-EL-F8	The IEN System shall support as alarms any failures reported by the controller to the central ATMS system.
IENF-EL-F9	If the failed component communicates successfully for a User-specified amount of time, the component shall be considered operational.
IENF-EL-F10	This event shall also be logged, along with the clearing of the alarm for the failed component.
IENF-EL-F11	Upon failure, the IEN System shall log the event and also display a visual alarm to the User.
IENF-EL-F12	The occurrence of each such alarm shall be recorded in the system log.
IENF-EL-F13	Alarms shall have at least two (2) priority levels.
IENF-EL-F14	Alarm priority level shall be User-selectable. The IEN System log shall include a reference to the intersection name and number with which any given event is associated.
IENF-EL-F15	The event log shall include the IEN System time that the alarm is recorded.
IENF-EL-F16	Alarms shall be displayed in the active window on the IEN System screen.

IENF-EL-F17	The alarm window shall be intrusive (pre-empt or interfere with the User's editing tasks).
IENF-EL-F18	Alarms shall be automatically recorded into an alarm log.
IENF-EL-F19	Alarms shall be automatically time-stamped and routed to a specified User station.
IENF-EL-F20	It shall be possible to change alarm routing to different User stations by time-of-day.
IENF-EL-F21	The IEN System shall be capable of immediate display of alarms (taking into account the data latency of the IEN System).
IENF-EL-F22	Alarms shall be User-selectable "ignored" by specific device(s).
IENF-EL-F23	It shall be possible to specify that a given alarm must occur a User-specifiable number of times before it is reported.
IENF-EL-F24	It shall be possible to print the alarm log.
IENF-EL-F25	The IEN System shall monitor the controller to verify that the controller is operating under a selected timing plan.

3.11 IEN USERS

3.11.1 Network Administration

Functional Requirements

IEN-USER-F1	Using tools provided with the Windows operating system, the IEN System 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

IEN-USER-F2	The IEN System shall automatically recover from a power failure.
IEN-USER-F3	The IEN System shall automatically begin communications with all Servers and related workstations via the IEN WAN.
IEN-USER-F4	If the IEN System detects a non-fatal error within one (1) or more of its processes, it shall log a message to the system log,
IEN-USER-F5	The IEN System shall continue to operate in a degraded state.
IEN-USER-F6	Each 24-hour history shall be date stamped.

3.11.3 System Users

Functional Requirements

IEN-USER-F7	The IEN System 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

IEN-USER-F8	The IEN System Administrator shall assign User rights.
IEN-USER-F9	The User's profile shall be accessible from any User workstation on the system.
IEN-USER-F10	Each User must log into the IEN System user interface with a username and password.
IEN-USER-F11	These two (2) identifiers shall be used by the IEN System to determine if the requester is permitted on the system and what rights that individual will have.
IEN-USER-F12	The IEN System Administrator shall have the ability to limit User rights down to a specific menu level.
IEN-USER-F13	Menus and functions to which the User has access will be in dark letters while restricted menus or command options will be "grayed-out".
IEN-USER-F14	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

User Requirements

IENF-SP-U1	IEN System software and hardware shall be reliable to industry standards and minimize system freezes, crashes, and failures.

Functional Requirements

IENF-SP-F1	IEN workstations, server, and/or network software and hardware shall have the computing capability to carry out all the designated functions of the workstation.

IENF-SP-F2   The IEN System shall provide continual information as to the status of the IEN and ATMS systems.

IENF-SP-F3   The IEN System shall respond to User information requests and service requests in a timely manner.

3.12.2 Scalability

User Requirements

IENF-SP-U2   A variable number of Users may be logged onto the IEN system at any given time within one (1) jurisdiction or within the SGVTF region.

IENF-SP-U3   The IEN System shall be scalable in a manner that allows for the integration of planned software and hardware and/or foreseeable future upgrades.

Functional Requirements

IENF-SP-F4   The IEN System database shall be scaleable to at least 400 intersections for the local Agency TCS. The IEN System database shall be scaleable to at least 2,000 intersections for the SGVTF.

3.12.3 Equipment Technology

Functional Requirements

IENF-SP-F5   The IEN System shall be designed with an "open" architecture format to allow flexibility, interoperability, and future expansion of the system to meet future needs.

IENF-SP-F6   The IEN System shall use equipment that is easy to operate and maintain.

IENF-SP-F7   The IEN System shall incorporate commercial-off-the-shelf (COTS) software, equipment, components, and subsystems that can be maintained by the Vendor or a local service provider.

IENF-SP-F8   The IEN System shall utilize technology capable of supporting the framework for User Requirements that can be configured, implemented, and integrated to provide reliable, accurate, and seamless User information delivery and exchanges in a timely, cost-effective manner.

IENF-SP-F9   The IEN System shall provide a consistent level of high service quality between service providers, geographic locations, or system configurations, where compatible.

IENF-SP-F10   The IEN System shall be capable of interfacing to competing and complementary technologies from a variety of Vendors.

IENF-SP-F11   The IEN System shall use state-of-the-art technology.

IENF-SP-F12	The IEN System shall be capable of adapting and/or interfacing with new communication media.
IENF-SP-F13	At each Agency site, the IEN System shall consist of an IEN Workstation, IEN Site Server (with similar hardware specifications as an IEN workstation), and a 384 Kbps circuit to the SGVTF's IEN Corridor WAN.
IENF-SP-F14	At each Agency site that is hosting a TCS, the IEN System shall consist of an IEN Workstation, IEN Site Server, CDI system/server (with similar hardware specifications as an IEN Workstation), and a 384 Kbps circuit to the SGVTF's IEN Corridor WAN.

IENF-SP-F15

The IEN System shall support the following hardware specifications at a minimum:

- Memory: 512(+) SCSI RAM
- CPU: 2 GHz (+) Intel P4 CPU
- Hard Drive: 40 GB (+) Hard Drive
- Network: 10/100 Ethernet adapter
- Video: Graphics card able to display a minimum of 1280 x 1024 resolution and support dual monitors
- Monitor: 19" monitor
- Peripherals: 24x CD-ROM Drive, CD (or DVD) Read-Write Drive, 1.44 MB Floppy Drive, Keyboard, Mouse

IENF-SP-F16

The IEN System shall support the following COTS software specifications at a minimum:

- O/S: Microsoft Windows 2000 Professional (SP-3 or later)
- Office Suite: Microsoft Office 2000 Professional (SP-3 or later)
- Browser: Microsoft Internet Explorer 6 (or later)
- Database Client: Oracle 10g Client
- Graphics: Microsoft Visio 2002 Professional
- Peripherals: Microsoft Data Access Components 2.5 RTM, Microsoft Windows Script Control (sct10en.exe), Microsoft Windows Script Host 5.5 (scr55en.exe), Win Zip, and TeleAtlas Map Data

IENF-SP-F17

The IEN System shall support the following network and printer hardware specifications at a minimum:

- V.90 Data/FAX Modem
- HP LaserJet 4050N 17ppm laser printer (including 10BaseT port, HP Jet Administrator, and 16 MB RAM)
- CISCO 2524 Ethernet RJ45 Modular Standalone WAN Router
- CISCO 2524 4-wire 56K DSU/CSU Module
- Ethernet Hub

IENF-SP-F18

The IEN System shall provide for a transit interface, such as Light Rail Transit (LRT) and bus priority opportunities.

3.13 OPERATIONS AND MAINTENANCE (O&M)

User Requirements

IENF-O&M-U1   To the extent possible, the IEN System shall utilize state-of-the-art technology, be user-friendly, and minimize Agency resources needed to operate and maintain it.

IENF-O&M-U2   IEN System training shall be provided for control and operations of the system.

IENF-O&M-U3   IEN System training shall be provided for maintenance of the system.

IENF-O&M-U4   The control of the IEN System shall be done through a highly intuitive interface developed for personnel with only general personal computer (PC) familiarity, and no particular computer programming experience.

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

Functional Requirements

IENF-O&M-F1   The IEN System shall provide for "operator-free" operation so that the system performs all minimally necessary control and monitoring processes unattended.

IENF-O&M-F2   The IEN System GUI shall provide on-line context-sensitive help for the entire functionality for the system as well as on-line instructions for each command in the system. The GUI shall have the capability to send these help screens and instructions to designated printers.

IENF-O&M-F3   The IEN System user interface shall be graphical and intuitive.

Appendix A – Acronyms/Definitions

ATMS	Advanced Transportation Management System
CA SR	California State Route
CCTV	Closed Circuit Television
CDI	Command Data Interface
COTS	Commercial-Off-The-Shelf
DOW	Day-of-Week
DPW	Department of Public Works
GUI	Graphical User Interface
HVAC	Heating, Ventilation, and Air Conditioning
ID	Identification
IEN	Information Exchange Network
ITS	Intelligent Transportation System(s)
KVM	Keyboard-Video-Mouse
LA	Los Angeles
LACDPW	Los Angeles County Department of Public Works
LCCS	Local City Control Site
MOU	Memorandum of Understanding
O/S	Operating System
O&M	Operations & Maintenance
PC	Personal Computer
RDMS	Relational Database Management System
SGVTF	San Gabriel Valley Traffic Forum
TOD	Time-of-Day
TCS	Traffic Control System
TMC	Traffic Management Center
TSM	Traffic System Management
W/S	Workstation