

ATTACHMENT B1: ADVANCED TRAFFIC MANAGEMENT SYSTEM SPECIFICATIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the requirements for furnishing and installing a Commercially-available Off-the-Shelf (COTS) Advanced Transportation Management Software (ATMS) that is able to monitor and control the FITS equipment that is procured for the Port of Oakland under this contract, as well as the existing FITS equipment that will be integrated under this contract.
- B. The ATMS shall be capable of accommodating all requirements stated herein and shall have provisions for the addition of new FITS elements or other operational enhancements that may be needed in the future.
- C. The ATMS shall integrate with the existing Genetec Video Management System that is upgraded to the latest version as part of this work. A substitution Video Management System that meets or exceeds the same level of functionality of the existing Genetec Video Management System may be provided as part of this work with prior approval from the Port. In comparison with the Genetic system, the Port shall make final determination of the level of functionality of proposed substitution Video Management System.
- D. This Section includes procurement of hardware needed to operate the ATMS at the Port, as well as any hardware necessary to support the video management system that provides video feeds to the ATMS. Any other hardware, cabling, or other equipment needed to operate the ATMS and all associated modules are included in this item.
- E. Work in this section will need to coordinate closely with the Contractor that is responsible for other device deployment, subsystem integration, and network design. That Contractor is referred herein as the "FITS Contractor." The Contractor that provides the ATMS shall coordinate with the FITS Contractor by providing any server equipment for the FITS Contractor to install. The Contractor shall coordinate with the FITS Contractor on any integration needed to be scheduled and shall demonstrate completion of integration to the FITS Contractor and to the Port.
- F. The Contractor shall also coordinate with work done by others in the development and integration of the GoPort Application and the Smart Parking System. The Contractor shall submit a written request to the Port for information this is needed from the respective work by others in order to allow for the development and integration of respective modules.
- G. This document includes Attachment B2: GoPort ATMS SPS 100% Design High-Level Data Flow Diagram.

1.2 REFERENCES

- A. The following references are incorporated into the requirements of the Work as described herein:

1. National Transportation Communications for Intelligent Transportation Systems Protocol (NTCIP) – Latest Version, including, but not limited to:
 - a. 1201 – Global Object Definitions
 - b. 1202 – Object Definitions for Actuated Traffic Signal Controller Units
 - c. 1203 - Object Definitions for Dynamic Message Signs (DMS)
 - d. 1205 – Object Definitions for Closed Circuit Television (CCTV) Camera Control
 - e. 1206 – Object Definitions for Data Collection and Monitoring (DCM) Devices
 - f. 1209 – Object Definitions for Transportation Sensor Systems (TSS)
 - g. 2304 – Application Profile for DATEX-ASN (AP-DATEX)
 - h. 2306 – Application Profile for XML Message Encoding and Transport in ITS Center-to-Center Communications (C2C XML)

1.3 SYSTEM DESCRIPTION

- A. The ATMS shall be an off-the-shelf software application designed to assist in the collection, dissemination, and management of transportation systems and information. It shall be the most recent version developed.
- B. The ATMS shall include a modular and scalable FITS software architecture in which the system is configured based on the project's system modules and integrated seamlessly into a single user interface.
- C. The ATMS shall utilize the following Microsoft® products for each aspect of the system:
 1. Core Database: SQL 2012 or newer, or approved equivalent
 2. Server OS: Server 2012 or newer, or approved equivalent
 3. Workstation OS: Windows 7 Professional or newer, or approved equivalent
 4. Laptop OS: Windows 7 Professional or newer, or approved equivalent
- D. The ATMS shall be compliant with the NTCIP standards and protocols:
 1. NTCIP communications protocol standard shall be implemented in such a manner that the system can adapt to changes in technology and increase functionality over time with minimal impact on individual system components.
 2. The system developer and the controller manufacture shall verify that the system and controller firmware are NTCIP compliant and compatible.
 3. The primary communications standards shall be NTCIP-based for communicating from Center-to-Field (C2F).
 4. The Contractor shall document which standards the ATMS conforms to.
- E. The ATMS shall support as a minimum the following communication connections and protocols:
 1. Ethernet connections, using both TCP/IP and UDP/IP transport, including support for wireless modems.
 2. Serial connections, using PMPP transport.
 3. Ethernet connections, with PMPP serial embedded within either TCP/IP or UDP/IP.
 4. Dial up connections using either PMPP or PPP protocols.
 5. Support for a modem array, where a bank of dial up modems is supported, using PMPP.

F. The ATMS shall:

1. Maintain communication statistics for each FITS device it is connected to, so that the number of dropped packets and other communication errors can be readily determined.
2. Establish log polling to each FITS device connected, with the frequency of polling as adjustable between 1 minute and 24 hours.
3. Have a capability of disabling log polling of selected FITS devices.
4. Have the capability to synchronize the ATMS time server with device controllers.
5. Establish real-time polling to each connected FITS device, with the following configurable parameters:
 - a. The user, for each device type, shall be able to select which NTCIP objects are to be included in each real time poll.
 - b. It shall be possible to configure NTCIP STMP (Dynamic Objects) for real time polling, and the ATMS shall automatically manage the refresh of these objects to ensure correct STMP operation.

1.4 SUBMITTALS

A. The Contractor shall submit the following as per the requirements of this software procurement:

1. Shop drawing or product documentation to outline the functionalities of the proposed ATMS software, submitted prior to procurement for review and approval.
 - a. Documentation shall provide a line-by-line account of how the proposed ATMS meets each of the iterated functionalities that are required in this specification. This document shall use the same headers and outline format to allow ease of review.
 - b. The Contractor shall provide the ATMS Vendor's or manufacturer's certification as part of a submittal indicating that the ATMS software meets the requirements of the specification.
2. ATMS acceptance testing plan for ATMS system and subsystems, submitted prior to conducting any acceptance testing.
3. ATMS server or other necessary ancillary hardware cut sheets.
4. Training materials that illustrate the proposed coursework for training operators, supervisors, and other end-users, submitted a minimum of 60 days prior to the scheduled training.

1.5 QUALITY ASSURANCE

A. The Contractor shall:

1. Have qualified systems engineers do equipment and software installations. Qualified systems engineers shall have resumes and qualifications submitted prior to commencement of work for Port review and approval.
2. Assure software is complete for the applications defined herein.
3. Assure software is compatible with the Port's existing or proposed IT architecture and equipment.

1.6 WARRANTY

A. The Contractor shall:

1. Provide a minimum 1-year warranty against workmanship and operation for hardware.
2. Provide a minimum 1-year warranty for software.
3. Warranty shall commence upon Port's written acceptance of the ATMS as proven through a completed acceptance test plan.

1.7 SUPPORT PERIOD

A. The Contractor shall:

1. Provide a minimum 3-year maintenance support period for the ATMS with 24/7 technical support options.
2. Maintenance support period shall commence upon Port's written acceptance of the ATMS as proven through a completed acceptance test plan.
3. Provide an option for the Port to continue the support period.

PART 2 - PRODUCTS

2.1 GENERAL

A. The ATMS shall:

1. Be a Commercial-off-the-shelf (COTS) software product that can be modified or customized for project needs.
2. Incorporate commercial-off-the-shelf software, equipment, components and subsystems that can be operated and/or maintained by the Port, Vendor, or a local service provider.
3. Have at least three deployments of comparable size and operation anywhere worldwide in the last five (5) years.
4. Use latest vendor or manufacturer's version.
5. Have intuitive controls and user interfaces that can allow ease of operations and maintenance.
6. Support integration of permanent, non-permanent, and mobile FITS equipment.
7. Be designed and built in a modular fashion, consisting of a base system and optional subsystem modules or functional components that are licensed individually.
8. Be able to control a minimum of 100 traffic signals, 200 CCTV Cameras, 50 CMSs, 100 vehicle detection cameras, and 500 RFID detectors. It shall be scalable to control more FITS equipment in the future.
9. Provide for or allowing growth toward emerging technologies, such as communications with Dedicated Short-Range Communications (DSRC) and 5G devices.
10. Be configured in such a way that operating personnel can add, delete, or edit a FITS device or device type without any vendor intervention.
11. Run on a local license, allowing other government agencies to access and operate in any:
 - a. TMC facility
 - b. Approved remote location, or
 - c. Any other approved government agency location.

12. Provide the ability to assign prioritized ATMS control between the Port TMC, the City's TMC, and Caltrans D4 TMC.
13. Allow secure remote access for system support and TMC operations.
14. Offer a graphic user interface (GUI) capable of being launched and operated within any commonly available Internet browser, and not specific to any one particular browser.
15. Allow full functionality of the ATMS via a web-based interface, providing remote centers and users the same functionalities as the TMC/EOC operators.
16. Contain all data in a commonly accepted enterprise class relational database system, such as Microsoft SQL Server.
17. Provide a single integrated Graphical User Interface (GUI) to access all modules.
18. Have the capabilities to add, modify, and delete custom user scripts for subsystem functions.
19. Integrate and operate with all existing FITS equipment as part of its operation.
20. Provide a unified data exchange for connection of various systems of various technologies.
21. Be licensed to operate as a standalone service within the Port's network architecture without an expiration date or a need to verify licensing credentials with an online service.
22. Include all necessary third-party licensing to allow full operation of the system.
23. Be able to receive firmware updates that support changes or improvements to the software baseline, either through the included maintenance service period or as part of a one-time Port purchase.
 - a. Updates shall be version-controlled with unique release/version numbers and have a version library with notes of improvements.
 - b. Updates shall be tested by the vendor with certified documentation provided to the Port prior to implementation.
 - c. Updates to the whole system or subsystem shall be uniformly applied so that all components continue functioning properly together.
 - d. New versions of software shall be installed as a separate version in the *Configuration Management (CM)* Library that holds the software, with changes to code identified in relevant code headers.
 - e. Upon implementation, all updates shall be reviewed and approved by the Port prior to being considered complete.

B. All subsystems described within this specification shall be part of the same ATMS software platform, accessible from the same GUI as operated by a single operator. Subsystems shall include:

1. Traffic Signal System
2. RFID
3. CCTV Video Management System
4. Queue and Incident Video Detection System
5. Travel Time System
6. Alarm, Events, and Notifications
7. C2C Communication System
8. CMS
9. GoPort Application
10. Supplemental Vehicle Detection
11. Adaptive Signal System
12. Smart Parking
13. Advanced Train Detection System
14. Weigh-In-Motion

15. Additional Modular Items as needed

2.2 SYSTEM OPERATION AND PERFORMANCE

A. Presentation Requirements:

1. The ATMS shall:
 - a. Use a GUI with the same look and feel regardless of which subsystem it operates.
 - b. Data entry fields shall provide spell check, text wrapping, and copy/cut/paste capabilities that can be modified by the Port.
 - c. Have consistent fonts, formats and layout in the software coding and report generation features.
 - d. Provide context sensitive, user friendly help for key functionality within the product.
 - e. Use typical MS Windows style GUI conventions such as resizable windows, point and click, right click context menus, drop down menus, toolbars, color displays, icons, drag and drop, scroll bars, scroll, wheel mouse, status bars, etc.
 - f. Include a user interface that is accessible and intuitive for all users.
 - g. Use Google Maps or an approved equivalent for the map display.
 - h. Provide an audible alert when events and incidents are detected that users can customize, as well as the conditions that would trigger these alerts.
 - i. Allow for any FITS device selected, in either the map or list, to be highlighted.

2. The ATMS GUI shall:
 - a. Be displayed in English as the default language across all functionalities.
 - b. Utilize U.S. Customary measurements for speed, distance, and other measurable parameters.
 - c. Use plain language common with the trucking industry.
 - d. Be branded with the Port and Alameda CTC names and logos.
 - e. Support various map views, with full zoom, pan and auto-centering capability
 - f. Have the option to display a tabular user interface and a schematic display for a given route.
 - g. Support a map view that can be separate from other views related to ATMS subsystem functionalities.
 - h. Use customizable color-keyed icons to represent different types of equipment for operators to request an immediate status update for all equipment of a same type.
 - i. Have a map display that is capable of displaying a variety of geographic features, which can be made visible or hidden:
 - 1) Freeways and highways (with appropriate shields and alternate names)
 - 2) Major and minor streets (with appropriate names)
 - 3) Port Terminals
 - 4) Rail track
 - 5) Landmarks
 - 6) Rivers, lakes, and other major bodies of water
 - 7) Parks
 - 8) Airports, hospitals, police stations, fire stations, and schools
 - j. Allow Operators the ability to import and view data in shapefile format.
 - k. Allow Operators the ability to center the map view on specific group or individual equipment by selecting them.
 - l. Display the user name for the user currently logged into the system.
 - m. Provide equipment information when the cursor hovers over equipment icon on map.

B. OPERATING ENVIRONMENT

1. The ATMS shall:
 - a. Be accessed via a single sign-on solution.
 - b. Be of the same operation at different workstations.
 - c. Save all user preferences by user logon so that users may access their saved preferences from any workstation.
 - d. Include functionality for the display of multiple screens from multiple workstations on a large screen or video wall display.

C. PERFORMANCE REQUIREMENTS

1. The ATMS shall:
 - a. Support up to 20 concurrent users without degradation of processing speed, with ability to expand the number of users via hardware upgrades.
 - b. Operate within the limits of the hard drive, memory, and processor identified for the workstations and servers procured as part of this contract.
 - c. Work with FITS equipment installed as part of this contract, and integrated as existing, without disruption to the operation of the ATMS or the FITS equipment.

D. RESPONSE TIME

1. The ATMS subsystems shall:
 - a. Update at a 1 to 30 second poll rate for data collection, depending on the subsystem.
 - b. Have a configurable poll rate.
2. The ATMS shall meet or exceed the performance measures including the following minimum and maximum thresholds:
 - a. Data latency (1 to 3 seconds)
 - b. Display graphical representation of the intersections fully drawn and updated with dynamic attributes (1 to 10 seconds)
 - c. Refresh rate for largest map (1 to 3 seconds)
 - d. Refresh rate for all other displays (1 to 3 seconds)
 - e. Time for User to monitor, display, and access any control interface (1 to 3 seconds)
 - f. Display of detail list views of component information (1 to 3 seconds)
 - g. Operator commands to occur (1 to 3 seconds)

E. RELIABILITY AND AVAILABILITY

1. The ATMS software shall:
 - a. Be available for use 24 hours a day, 365 days per year.
 - b. Be fully operational 99.5% of the time.
 - c. Be reliable to industry standards and minimize system freezes, crashes and failures.
 - d. Be capable of operating within the ATMS workstation, server, and/or network environment to carry out all specified functions.
 - e. Fall back to Time-of-day (TOD) or isolated free operation, as specified by the operator, without causing disruption to traffic flow, in the event of equipment, communications, and software failure.
 - f. Isolate safety-critical operations into manageable modules that have adequate safety features to minimize the probability and impact of safety-related failures.
 - g. Provide continuous system operational status.

- h. Create periodical back-ups of ATMS data with periods that can be user modified.
2. The ATMS shall not:
- a. Be impacted adversely in terms of performance and operation by the malfunction, removal, or addition of interfaces.

2.3 ADMINISTRATION AND SECURITY

A. SYSTEM ADMINISTRATION

1. The ATMS shall:
- a. Include automatic procedures for startup of subsystems.
 - b. Provide the capability to start or stop a single subsystem without affecting any of the other subsystems.
 - c. Require a reboot only when Operating System upgrades or modifications are created, or upgrades to executable applications are installed.
 - d. Include configurable procedures for creating backups.
 - e. Include configurable procedures for restoring from a backup.
 - f. Provide system updates at one location to be propagated to all other locations.
 - g. Provide for the capability to create templates for commonly used process scripts.
 - h. Allow updates to the database without affecting any open ATMS sessions.
 - i. Allow only authorized and validated users into the system.
 - j. Allow the system administrator the ability to add, modify, and delete user accounts while maintaining historical information.
 - k. Allow the system administrator the ability to add, modify, and delete user passwords and privileges while maintaining historical information.
 - l. Allow the system administrator the ability to assign unique user accounts and passwords to each individual user.
 - m. Allow the system administrator the ability to determine which users are currently logged onto the system and where they are located.
 - n. Prioritize users by providing different privileges on a per-subsystem level.
 - o. Validate each command executed from a user for the proper privileges to confirm that the user has the privileges to execute that command.
 - p. Allow the system administrator the ability to add, modify, and delete group privileges.
 - q. Allow the system administrator the ability to add or delete a user from one or more groups while maintaining historical information.
 - r. Log an event message to the alarm and event logger whenever a user logs in. The event shall contain the date, time, operator name, and log in location.
 - s. Allow the system administrator the ability to add, modify, and delete ATMS equipment in the ATMS system, including devices operated by other stakeholders.
2. The ATMS shall not:
- a. Require a user to log off and back on to view devices that were added, modified, or deleted.
 - b. Require a subsystem reboot when a device is added, modified, or deleted.

B. SECURITY REQUIREMENTS

1. The ATMS shall:

- a. Have a security management and administrative system that allows access and operational privileges to be assigned, monitored and controlled by an administrator, and conform to the Port's access and network infrastructure security policies.
- b. Encode/encrypt user passwords.
- c. Allow users to modify their passwords.
- d. Provide a method to log system, device, and security activity for online reporting and archival storage to the alarm and event logger.
- e. Alert the system administrator automatically of unusual system activity, network activity and security breaches.

C. REPORTING

- 1. The ATMS shall:
 - a. Be able to be configured to automatically create performance reports based on operational performance measures obtained from the ATMS subsystems that include, at a minimum:
 - 1) Equipment errors and health metrics as capable of being produced by each device
 - 2) Average travel times across user defined routes
 - 3) Average turn times at each terminal
 - 4) Average vehicular flows at each intersection
 - 5) Average truck flows at intersections (trucks determined by traffic signal subsystem detection classifications)
 - 6) Average queue lengths at each terminal and each intersection
 - 7) Monthly incident reports
 - b. Period of performance measure shall be user definable to resolution of a minute.
 - c. Be configurable to develop other type of reports from the data collected.
 - d. Be configurable to change the level of detail of each report in a customizable manner.
- 2. Performance reports shall:
 - a. Be archived and available for review.
 - b. Have an easily readable format that is in printable format.

D. FITS EQUIPMENT INTEGRATION

- 1. The ATMS shall:
 - a. Be capable of interfacing with the existing/planned FITS CCTV cameras without extensive software modification.
 - b. Be capable of interfacing with the existing/planned FITS queue, incident, and vehicle detection systems without extensive software modification.
 - c. Be capable of interfacing with the existing/planned FITS CMS system without extensive software modification.
 - d. Be capable of interfacing with the existing/planned FITS RFID system without extensive software modification.
 - e. Be capable of interfacing with the existing/planned Port or third-party signal elements without extensive software modification.
 - f. Support signal priority consistent with the approach adopted by the City of Oakland, Caltrans and the Port.
 - g. Be capable of interfacing with the advanced train warning system using advanced detectors from near the rail crossing to provide estimated time of arrival and duration

of trains at at-grade crossings so that emergency vehicle responders and travelers can avoid unnecessary delays.

- h. Be capable of interfacing with the existing/planned FITS weigh-in-motion system without extensive software modification.
 - i. Be capable of interfacing with the existing/planned FITS Smart Parking System without extensive software modification.
 - j. Be capable of interfacing with the existing/planned FITS GoPort System without extensive software modification.
 - k. Be capable of interfacing with the Caltrans TMC ATMS without extensive software modification.
 - l. Be capable of interfacing with third-party San Francisco Marine Exchange or other vendor for vessel information.
 - m. Integrate with existing Port systems, including but not limited to: GIS, Video Management System, Physical Security Information Management (PSIM) System, Truck Management System, Oakland Portal, and eModal (or an equivalent container information service).
 - n. Make use of existing communications infrastructure and standards.
2. The external system integration shall:
- a. Provide, at a minimum, the ability to generate an XML formatted file for exporting to other external stakeholders.
 - b. Be able to interface and share data to/from the Bay Area's 511 system as maintained and operated by MTC.
 - c. Be able to receive XML formatted files and other data sources from other external systems for integration into the system.
 - d. Log an event message to the alarm and event logger whenever a file is imported or exported that contains:
 - 1) Date
 - 2) Time
 - 3) Operator name
 - 4) File information
 - 5) Action taken

2.4 ATMS SUBSYSTEMS / MODULES

A. Graphical User Interface / Map:

1. The ATMS GUI shall have an interactive map that displays current status of the roadway network and FITS field devices presented in different layers that can be turned on and off.
2. Map views shall include, but not be limited to:
 - a. Current incidents
 - b. Current queues
 - c. Devices by Device type
 - d. Congestion/Speed
 - e. Marine terminal entry point queue lengths and street wait times
3. The maps shall:
 - a. Be GIS based, using standard GIS files (e.g., shape files or other equivalent) to render a geographically accurate, to-scale map.

- b. Display all major interstates and arterials with appropriate classification identified (i.e., interstate shield, state route shield).
 - c. Include the capability to zoom in and out with multiple zoom levels.
 - d. Include pre-defined regional zoomed areas, as defined by the Port.
 - e. Have a default view so that the user, based on user name and password, can set the initial view when the map is first started.
 - f. Have map icons that are proportional to the zoom reference of the map.
 - g. Include the capability to pan in any direction with a smooth transition.
4. At minimum zoom extension, the map shall display:
- a. Roadway congestion conditions as line segments or vehicle detection points that are colorized by current traffic conditions.
 - b. FITS devices, e.g. cameras, message signs, vehicle detectors, each incident type, etc., as icons in their relative location.
5. At maximum zoom extension, the map shall display:
- a. ATMS devices as a graphical representation of the actual device.
 - 1) A CMS shall look like a CMS, in the correct position relative to the roadway, and shall display the message within the map graphic as it is displayed on the actual CMS.
 - 2) Cameras, traffic signals, and rail detection, shall be realistic graphical representations of the actual devices.
6. During use, the ATMS GUI map shall:
- a. Allow users to pan the map via clicking and dragging the map in the desired direction, including simultaneous movement of both x- and y-axis.
 - b. Receive and display data from other systems (like MTC 511), as well as any other systems connected over the network via the C2C interface.
 - c. Present data, based on layers, that can be individually enabled or disabled by the user.
 - d. Represent each discrete data type within the map within its own layer, including roadway classification, device, and incident types.
 - e. Provide a unique icon for all FITS device types in the system that is a uniform or equal representation relative to other subsystems regardless of their functionality.
 - f. Provide a unique user-defined icon color for all FITS device type status in the system, as a minimum, but not be limited to:
 - 1) Communications or power error
 - 2) Offline
 - 3) Operational or active
 - g. Allow the user to place an incident icon on the map and automatically provide the location coordinates.
 - h. Allow the user to define whether a user defined incident can be read by other C2C interfaces.
 - i. Allow users to use different icons by type of incident, as well as a description of the incidents created, that shall be customizable by the Port.
 - j. Place a device or incident icons on the map when GPS coordinates are included in the device or incident configuration information is provided.
 - k. Allow for selection of any device or incident icon.
 - l. Allow users to select one or more devices or incidents.
 - m. Allow users to perform an action on the one or more selected devices or incidents.

- n. Be configurable to display either speed or congestion data, based on instrumented roadways.
 - o. Allow users to select and control subsystems by selecting equipment on the map or selecting it from a list of equipment in tabular form.
 - p. Display equipment in layer format, showing only the equipment of the system selected, and further system information in a separate window.
 - q. Provide a sortable, filterable list of all FITS devices types.
 - r. Allow the following functionalities:
 - 1) Control Capabilities
 - 2) Status (power, communication, online/offline)
 - 3) Device configuration parameters
 - s. Switch focus to the affected object and the object area when an object in error or alarm is detected.
7. As defined or restricted by a user's privileges, the map interface shall provide for quick control of independent devices and modules through a dialog box for capabilities of:
- a. Traffic Signal System (including traffic signal system cameras)
 - 1) Monitor camera performance.
 - 2) Ability to capture and transmit images.
 - 3) Ability to change signal operations from the TMC, including pre-programmed signal timings and continue operating rail-crossing pre-emption programs.
 - 4) Hovering over intersection or camera shall display current operation information.
 - 5) Hovering over the CCTV camera icon shall result in display of a current image snapshot.
 - b. RFID Detectors:
 - 1) Monitor detector data and performance.
 - 2) Hovering over detector shall display current operation information and current reported turn time, as available.
 - c. CCTV camera:
 - 1) Pan, tilt, and zoom a CCTV camera.
 - 2) Ability to capture and transmit images.
 - 3) Hovering over the CCTV camera icon shall result in display of a current image snapshot.
 - d. CMS:
 - 1) Add/Modify/Delete the message on a CMS.
 - 2) Add message on a CMS from ad hoc or from library.
 - 3) Hovering over the CMS shall result in display of the current CMS message.
 - e. Queue Detection:
 - 1) Automatically detect when queue grows to configurable lengths and alert user.
 - 2) Ability to query data (volume, speed, occupancy).
 - f. Incident Detection:
 - 1) Automatically detect when an incident occurs in the study area.
 - g. Travel Time:
 - 1) Provide travel times to Port terminals.
 - h. Alarms, Events, and Notifications:
 - 1) Create/View/Edit an alarm, event, and notification.
 - i. Supplemental Vehicle Detection:

- 1) Monitor radar performance.
 - 2) Hovering over radar device shall display current vehicle detection information.
 - j. Smart Parking:
 - 1) Monitor parking occupancy.
 - 2) Hovering over parking area shall display current parking information.
 - k. Advanced Train Detection:
 - 1) Monitor train activity in the study area.
 - 2) Provide:
 - a) Detailed device status and control.
 - b) Incident data entry and control.
 - c) Configuration information.
 - d) Complete data log of all the activities and system interactions of the device.
 - l. Weigh-In-Motion:
 - 1) Monitor weigh-in-motion devices in the Port.
8. GUI GIS shall:
- a. Avoid proprietary solutions and controls and must support open GIS standards directly.
 - b. Be able to connect to, and display maps from, an OpenGIS© Web Map Service (WMS) compatible map server.
 - c. Support WMS standard versions 1.1.1 and 1.3.0.
 - d. Be able to display a GIS imagery from a locally stored image tile pyramid.
 - e. Support display of freely available GIS tile imagery such as OSM© (Open Street Map) or any other GIS tile set using the OSM tile naming conventions.
 - f. Support display of GIS data in the EPSG:3857 projections.
 - g. Support different displaying areas:
 - 1) Single or multiple monitors.
 - 2) Video-walls.
 - 3) Single or multiple workstations.
 - h. Reflect the actual system configuration and deployment on the road.

B. Traffic Signal System (TSS) Subsystem:

- 1. The TSS subsystem shall:
 - a. Operate as a module within the ATMS software.
 - b. Adaptively control a minimum of 20 traffic signals concurrently, expandable to 40 traffic signals in future.
 - c. Adaptively control a minimum of 12 independent groups of signals.
 - d. Adaptively coordinate signals on two crossing routes simultaneously.
 - e. Vary the number of signals in an adaptively-controlled group to accommodate the prevailing traffic conditions.
 - f. Retrieve status information from traffic signal controllers and log the information to the alarm and event logger, including, but not limited to:
 - 1) Operational status (in or out of service)
 - 2) Timing plan activation
 - 3) Device failures
 - 4) Communication failures.
 - g. Be capable of supporting the following controllers and/or firmware, at a minimum:
 - 1) Type 170 Controllers

- 2) Type 2070 Controllers
- 3) NEMA TS/2 Controllers
- h. Have the capability to poll traffic signal controllers in order to test communications.
- i. Have a configurable polling rate.
- j. Allow the user to initiate a poll at any time.
- k. Have the capability to access traffic signal controllers to engage pre-approved timing plans, including all-red flash.
- l. Have the ability to change the signal timing plans for traffic signal controllers in a single operation.
- m. Allow users to select traffic signal controllers from the TSS list or GUI map.
- n. Allow users with a higher priority level to lock traffic signal control for a specific length of time, so that other users cannot control the locked traffic signal controller.
- o. Allow the existing operator to lock the traffic signal controller, but a user with a higher priority may operate/release the traffic signal controller.
- p. Indicate the owner of a locked traffic signal controller.
- q. Have the capability to place a traffic signal controller offline from system access.
- r. Have the capability to place a traffic signal controller online for system access or change the current status of its operational state.
- s. Log an event message to the alarm and event logger whenever a traffic signal controller is manipulated, that contains:
 - 1) Date
 - 2) Time
 - 3) Operator name
 - 4) Traffic signal controller
 - 5) Action taken.
- t. Log an alarm message with the alarm and event logger with an error message when an action cannot be performed on a traffic signal controller that contains a suggested course of action to bypass or correct the problem.
- u. Stream video from traffic signal detection cameras.
- v. Send controller timing data to another system that would allow the other agencies to coordinate operations with the TSS. Controller timing data shall include, but not limited to:
 - 1) Phase Vehicle Basic Timing Data (e.g., phase, min_grn, passage, max1, max2, yellow, all red)
 - 2) Phase Vehicle Density Timing Data (e.g., added initial, max_initial, time B4 reduction, cars before, time to reduce, min_gap)
 - 3) Phase Pedestrian Timing Data (e.g., phase, walk, ped clear, flashing walk, extended ped clear, actuated rest in walk)
 - 4) Phase General Control Data (e.g., veh recall, ped recall, recall delay)
 - 5) Phase Miscellaneous Data (e.g., non lock, dual entry, last car passage, gap out)
 - 6) Phase Spec Sequence Data
 - 7) Phase Vehicle Detector Data
 - 8) Phase Pedestrian Detector Data
 - 9) Unit Overlap Data
 - 10) Unit Ring Data
 - 11) Unit Port 1 Data
 - 12) Unit Channel Output Data
 - 13) Coordination Mode Data
 - 14) Coordination Timing Plan Data

15) Intersection Configuration

- w. Receive data from Port Information Exchange Network (IEN) that allows the TSS to coordinate operations with adjacent agency's systems.
- x. Accommodate infrequent pedestrian operation, as defined by operator, and then adaptively recover.
- y. Incorporate frequent pedestrian operation, as defined by operator, into routine adaptive operation.
- z. Accommodate early start of walk and exclusive pedestrian phases.
- aa. Detect traffic conditions during which adaptive control is not the preferred operation, and implement some pre-defined operation while that condition is present, such as rail-crossing preemption.
- bb. Schedule pre-determined operation by time of day.
- cc. Allow the operator to override adaptive operation.
- dd. Implement different strategies individually or in combination to suit different prevailing traffic conditions that include:
 - 1) Provide adequate capacity to meet demand
 - 2) Provide smooth flow along coordinated routes
 - 3) Distribute phase times in an equitable fashion relative to demand
 - 4) Manage the length of queues
 - 5) Manage the locations of queues within the network
 - 6) "Flush" and re-route traffic at blocked rail crossings
 - 7) At an isolated intersection, optimize operation with a minimum of phase failures (based on the optimization objectives).
- ee. Manage the coordination in small groups of signals to link phase service at some intersections with phase service at adjacent intersections.
- ff. Change the operational strategy based on changing traffic conditions as defined by the user.
- gg. Detect repeated phase failures and control signal timing to prevent phase failures building up queues.
- hh. Minimize the chance that a queue formation spillback to subsequent intersections at specified locations.
- ii. Modify the sequence of phases to support the various operational strategies.
- jj. Fix the sequence of phases at any specified location.
- kk. Designate the coordinated route based on traffic conditions and the selected operational strategy.
- ll. Set signal timing parameters (such as minimum green, maximum green, extension time, and clearance interval) to comply with the City of Oakland and other agency policies.
- mm. Display traffic flow status on the road segments that shall be calculated from traffic data collected from FITS equipment, refreshed in real time and presented in standard traffic-engineering terms (traffic demand, capacity, LOS, etc.)
- nn. Implement the following advanced controller features while maintaining adaptive operation:
 - 1) Service a phase more than once per cycle.
 - 2) Operate at least four (4) overlap phases.
 - 3) Operate four rings, 16 phases and up to three phases per ring.
 - 4) Permit different phase sequences under different traffic conditions.
 - 5) Allow one or more phases to be omitted under certain traffic conditions or signal states.

- 6) Prevent one or more phases being skipped under certain traffic conditions or signal states.
 - 7) Allow detector logic at an intersection to be varied depending on local signal states.
 - 8) Allow any phase to be designated as the coordinated phase.
 - 9) Allow the operator to specify which phase receives unused time from a preceding phase.
 - 10) Allow the controller to respond independently to individual lanes of an approach, such as using extension/passage timers or based on data from a specific detector or by excluding specific detectors.
 - 11) Allow the coordinated phase to terminate early under prescribed traffic conditions.
 - 12) Allow flexible timing of non-coordinated phases (such as late start of a phase) while maintaining coordination.
 - 13) Allow Protected/permissive phasing and alternate left turn phase sequences.
 - 14) Use of flashing yellow arrow to control permissive left turns and right turns.
 - 15) Service side streets and pedestrian phases at minor locations more often than at adjacent signals when possible without compromising the quality of the coordination.
- oo. Monitor and control all required features of adaptive operation from the following locations:
 - 1) Port's Traffic Management Center at HFC
 - 2) Port's office at 530 Water Street
 - 3) Remote facilities operated by Port
 - 4) Local controller cabinets that are connected to a communications backhaul.
 - 5) Remote locations via internet
 - pp. Allow the operator access to the database management, monitoring and reporting features and functions of the signal controllers and any related signal management system from the access points defined for those system components.
 - qq. Interact and access the traffic signal system and adaptive systems through the use of graphics, menus, and tables.
 - rr. Be compatible with and have the capability of responding to accommodate emergency vehicle preemption technology used by the City of Oakland and the Port.
 - ss. Report traffic volume and other performance data and measures from TSS equipment.

C. Radio-Frequency Identification (RFID) Subsystem:

- 1. The RFID subsystem shall:
 - a. Receive real-time tag readings from field equipment and RFID server data-feed services.
 - b. Log the tag identification number and time of reading.
 - c. Send real-time RFID tag readings to the FITS GoPort System for trucks that are detected by the RFID system and have a corresponding appointment, as reported by eModal (or an equivalent container information service) to the ATMS. Allow users to poll individual RFID readings.
 - d. Receive alerts of malfunctioning field equipment.
 - e. Calculate, query, and report current and average travel time and speeds between specific RFID detectors.

- f. Calculate and report current and average street wait time, terminal turn time, and total turn time at each terminal as defined by the Port, numerically and graphically.
- g. Store the calculated turn times in the database, along with the parameters used to perform that calculation.
- h. Allow for operator adjustments to the parameters used to calculate turn times.
- i. Allow operators to query archived terminal turn time data and generate reports that are customizable by user, and able to be exported in csv, xlsx, and pdf format.

D. Closed Circuit Television (CCTV) Video Management Subsystem:

- 1. The CCTV subsystem shall:
 - a. Report communication status from cameras and log the information to the alarm and event logger including, but not limited to:
 - 1) Operational status (in or out of service)
 - 2) Communication failures to the camera.
 - b. Allow users to select, view, and control cameras on the system from the CCTV list or GUI map.
 - c. Allow users to display up to 16 simultaneous streaming video images on a single user workstation and up to 32 simultaneous streaming video images on the TMC's video wall, using any combination of video decoding standards without degradation in workstation performance.
 - d. Be capable of controlling camera pan, tilt (up/down/diagonal), zoom, focus, presets, and patterns.
 - e. Activate all configured preset camera positions available to operators.
 - f. Be capable of adding, modifying, or deleting presets.
 - g. Have preset names that are available for use in other external operations, such as a script that runs on a scheduled basis to move the cameras to view a different direction.
 - h. Have the ability to add, modify, delete, play, pause, resume, and stop video tours.
 - i. Be capable of at least 16 independent camera tours per workstation without degradation in workstation performance.
 - j. Allow for selection and routing of video to:
 - 1) Auxiliary monitors or display devices
 - 2) Images to the video wall controller.
 - k. Allow users with a higher priority level to lock camera control for a specific length of time, where other users cannot control the locked camera.
 - l. Allow the existing operator to lock the camera, but a user with a higher priority may operate/release the camera.
 - m. Indicate the user of a locked camera.
 - n. Have the capability to place a camera offline from system access.
 - o. Have the capability to place a camera online for system access or to change the current status of its operational state.
 - p. Have the capability to block the video output of one or more cameras from specific users.
 - q. Have the capability to unblock the video output of one or more cameras from specific users.
 - r. Be capable of decoding video that is encoded, using standard or common video compression algorithms, that include, but are not limited to:
 - 1) H.264
 - 2) H.265

- 3) MJPEG
 - 4) MPEG2
 - 5) MPEG4
 - s. Provide the same functionalities of the vendor software and device drivers through the ATMS for the operator/support staff.
 - t. Support pan/tilt/zoom control interfaces for a wide variety of camera interfaces, including, but not limited to:
 - 1) All cameras deployed on Port property that are connected to the FITS fiber network
 - 2) NTCIP 1205 model cameras (Pelco, Cohu, Bosch, etc.)
 - 3) SONY CCTV with embedded encoder
 - u. Display the camera location information, such as, but not limited to:
 - 1) Camera ID
 - 2) Camera location
 - 3) Preset position
 - 4) Status
 - v. Display current date and time.
 - w. Capture snapshot video images (JPEGs) from available cameras.
 - x. Have the ability to save and overwrite to a file the current snapshot image of every camera within the system at a definable interval.
 - y. Allow for capturing one or more streaming images that will be made available in a standard video file format to be accessible by staff for analytical purposes.
 - z. Log an event message to the alarm and event logger whenever:
 - 1) A camera tour is added/edited/deleted.
 - 2) A camera preset is added/edited/deleted.
 - 3) A camera is added to the system.
 - 4) A camera is turned on/off.
 - aa. Be capable of detecting and reporting to the ATMS any roadway congestion, incidents and anomalies through the use of video detection analytics software.
 - bb. Allow the operator to size the video image window without distorting the video image.
 - cc. Log an alarm message to the alarm and event logger with an error message when an action cannot be performed on a camera that contains a suggested course of action to bypass or correct the problem.
2. CCTV Subsystem shall interface with the Port's Video Management System (VMS) (if the procured ATMS solution requires a separate video management system) to receive video feeds.
- a. The ATMS shall:
 - 1) Receive requested video feeds from the VMS at the native frame rate and resolution.
 - 2) Pan, tilt, and zoom the camera, if done through the VMS. Contractor may bypass this step if this feature does not limit or restrict the use of the Video Management System's PTZ features.
 - b. The Contractor shall either:
 - 1) Utilize the existing Genetec System as the Video Management System, but upgrade all software features to the latest (Genetec Security Center 5.7), or
 - 2) Provide an alternative VMS that is given prior approval by the Port that can accomplish the same level of functionality—in the opinion of the Port—of

the current Genetec System. In this case, the VMS shall be part of the ATMS platform.

- c. VMS shall be housed on the proposed Video Management Server that is specified within this document, unless determined to be not needed due to the provided solution being part of the ATMS. If the existing Genetec Video Management System is upgraded, that system shall be transferred from the existing server to the new server location within minimal downtime.
 - d. Contractor shall procure any necessary camera seat licenses to provide video feeds for the cameras that are to be integrated into the ATMS. As part of a separate contract, a number of camera seat licenses had been procured for the existing Genetec Video Management System in order to provide interim video feeds to new cameras provided by that contract until the ATMS was brought online. Contractor shall verify whether additional seat licenses are necessary; additional seat licenses are paid for as part of this work.
3. CCTV Subsystem shall be able to connect to cameras that have been identified by the Port as not to be streamed through the Video Management Server. Contractor shall submit a request to the Port for confirmation as to which cameras, if any, are to operate independently of the Video Management Server. Any such cameras are either within the Port's internal network or at a fixed public network location.

E. Queue and Incident Video Detection Subsystem:

1. The Queue Monitoring part of this subsystem shall:
 - a. Utilize video footage and incorporate vehicle detection algorithms to detect vehicle positions and speeds.
 - b. Use system analytics to reduce negative impacts of environmental conditions, such as:
 - 1) Camera vibrations due to wind and traffic
 - 2) Weather conditions (rain, fog, hail, etc.)
 - 3) Global luminance variations (e.g. change from overcast to sunny weather, change of illumination level in tunnels, etc.)
 - 4) Blooming and smearing
 - 5) Low light and noisy image
 - 6) Shadows and other local light variations
 - 7) Obstructions of camera lenses due to raindrops, etc.
 - c. Automatically detect long vehicular queues and potential incidents, and report these events to the ATMS users.
 - d. Be based on advanced detection algorithms, including Artificial Intelligence and Machine Learning object detection using object tracking, and foreground object detection algorithms to provide superior detection performance compared to traditional video incident detection and a low false-alarm ratio.
 - e. Be integrated to the ATMS GUI platform.
 - f. Have a positive detection rate of 90% or greater for all alarms combined, subject to level of visibility in the input video.
 - g. Be able to render two headlights in case of oversaturation due to vehicle headlights.
 - h. Observe a portion of the road that is configured by the user in order to specify a detection zone for detecting traffic irregularities and gathering traffic statistics, such as queue length statistics.
 - i. Detect incidents that are of minimum size within the frame.

- 1) The minimum size is determined to be 20 x 20 pixels for an image that is scaled to a standard 4CIF resolution (704 × 576) at a minimum video stream of 5 frames per second, with vehicles/pedestrians/motorcycles at least 12 x 24 pixels.
 - 2) Focus/Zoom the input cameras to maximize the detection zones.
 - j. Detect and report slow vehicle (per lane) for queuing detection, using a configurable slow vehicle speed threshold and a slow vehicle that is visible in the detection zone for at least 10 seconds.
 - k. Provide trip-wire detection functionality with ability to define a line which reports an alarm if a stopped vehicle is detected.
 - l. Automatically report video signal loss, unacceptable video stream quality, camera malfunction, or other performance disabling events.
 - m. Have the capability to group statistics information from different lanes to provide summarized statistic per direction of traffic (in case of bidirectional traffic).
 - n. Classify vehicles into vehicular categories (per lane), as determined by the Port, with accuracy at or above 90% at proper road illumination.
 - o. Include a Configuration Tool that provides simple, user-friendly calibration process for video detection cameras, which includes a way to draw calibration lines on screenshots or live video from video detection cameras.
 - p. Detect queues from downstream intersections and allow the modification of the TSS subsystem via the ATMS to accommodate the queuing.
 - q. Detect queues within the system's boundaries and allow the modification of the TSS subsystem via the ATMS operation to accommodate the queuing.
 - r. Accommodate permanent or temporary detection technology.
2. The Incident Response part of this subsystem shall:
- a. Track the resources used to respond to an incident including the following:
 - 1) Vehicle (e.g., emergency vehicles, DOW vehicles, tow trucks, etc.)
 - 2) Equipment (e.g., CMS, HAR, traffic signal plans, etc.)
 - 3) Personnel Operations center
 - b. Track the changes in response status and relay these changes via notification to other Agencies.
 - c. Provide for tracking of special events and roadway construction.
 - d. Provide for automatic generation of response plans.
 - e. Provide customizable response plans.
 - f. Display incidents on the ATMS map displays.
 - g. Track the location and status of an incident from start to finish.
 - h. Use compatible data elements that align with the Advanced Traffic Management System Data Dictionary Standard.
 - i. Track incidents and be able to compute incident duration.
 - j. Include provisions for special events and roadway construction.
 - k. Be able to receive various notification alarms.
 - l. Include a mechanism to track receipt of information sent from one Agency to another.
 - m. Include a listing of contacts, vendors, and inventory of equipment available for incident response.
 - n. Provide for automatic geo-coding of incident location on the GIS-based map.
 - o. Provide an automated response mechanism for TMC/EOC operators to planned and unplanned incidents and/or events.

- p. Generate a suggested plan in response to an unplanned or planned incident/event that can be implemented, in part or in whole, by a user with the appropriate permissions.
- q. Generate automatic response actions, for review by the operator based on the IM input and a user-configurable set of distance constraints, including, but not limited to:
 - 1) Recommended CMS to use in response to an incident
 - 2) Recommended messages for CMS
 - 3) Public messages for 511 traveler information and Twitter distribution
 - 4) Recommendations for electronic notifications for staff via e-mail, text message, pager, phone, fax, or Twitter.
- r. Provide a mechanism to create, store, modify, and implement response plans for special situation events.
- s. Allow the user to select any one of the stored response plans or to generate a new one.
- t. Provide for notification to outside agencies via an email distribution list (from ATMS) for each incident.
- u. Provide for notification to the public via a Twitter distribution list (from ATMS) for each incident.
- v. Allow the incident notification email and Twitter distribution lists to be configurable.
- w. Log an event message to the alarm and event logger whenever an incident response plan is manipulated. The message shall contain the date, time, operator name, incident response plan, and action taken.

F. Travel Time Subsystem:

- 1. The travel time subsystem shall:
 - a. Be capable of obtaining internal RFID data, queue detection data, and external data feeds such as TrafficCast, Navteq, Inrix, etc., for use in calculating travel times for display on CMS and other dissemination methods (GoPort, website, 511, Twitter).
 - b. Generate a single view of all calculated travel times throughout the system for internal and external stakeholders.
 - c. Be available for definable routes that include links consisting of a start, multiple middle, and end points.
 - d. Calculate travel times based on information obtained from the vehicle detectors, historical data, external data, or any estimation algorithm data for each link between the selected start and end points of a route by summing the travel times for each link within that route.
 - e. Allow the user to configure the frequency at which an automated travel time message is posted to a sign.
 - f. Allow the operator to disable one or more travel time messages from displaying on a CMS.
 - g. Provide the capability to schedule travel time messages to be displayed on one or more CMSs.
 - h. Interpolate the travel time for the distance of non-failed links to cover the distance of all links in that route that may include failed links.
 - i. Provide no travel time if the number of working links for a route drops below a configurable threshold.

- j. Assign zero or more routes to CMS so that it only displays travel times for those routes.
 - k. Display travel times greater than 1 minute and less than 59 minutes as a range +/- 1 minute.
 - l. Display travel times that are greater than or equal to 60 minutes in a format that displays both hours and minutes, and can automatically change between formats as reported travel time changes.
 - m. Be able to incorporate outlier travel times if travel times detected drops or raises outside the allowable range that is configurable for each route.
 - n. Default to display no travel time when there is no data being collected on a route.
 - o. Account for the number of characters on the CMS displaying the travel time, in order to display a clear message.
 - p. Store the calculated route travel times in the database, along with the parameters used to perform that calculation.
 - q. Be capable of exporting the raw travel time data via an XML feed.
 - r. Configurable as a priority to other ATMS messaging.
 - s. Log an alarm message to the alarm and event logger with an error message when there is no data being collected on a route, with a suggested course of action to bypass or correct the problem.
2. The travel time subsystem shall not:
- a. Interfere with the timely display of any other operator-generated message on the CMS when displaying travel time messages.

G. Vessel Information Subsystem:

1. The vessel information subsystem shall:
- a. Obtain and display scheduled and current vessel information from the San Francisco Marine Exchange or other third-party data source, including but not limited to:
 - 1) Vessel name
 - 2) Vessel identifier
 - 3) Estimated time of arrival (ETA) date/time
 - 4) Actual time of arrival
 - 5) Berth
 - 6) Estimated time of departure (ETD) date/time
 - 7) Actual time of departure
 - 8) Earliest receiving date (ERD) date/time
 - 9) Cutoff date/time
 - b. Allow for manual entry of vessel information data.
 - c. Calculate and report vessel on-time performance metrics as defined by the Port, numerically and graphically.
 - d. Store the calculated on-time performance metrics in the database, along with the data and parameters used to perform that calculation.
 - e. Allow operators to query archived vessel on-time performance data and generate reports that are customizable by user, and able to be exported in csv, xlsx, and pdf format.

H. Alarms, Events, and Notifications Subsystem:

1. The alarms, events, and notifications subsystem shall:
- a. Display alarms, events, and notifications received from any subsystem or interface.

- b. Allow the user to configure, sort and filter the alarm, event, and notification list based on different parameters, such as, but not limited to, alarm type, severity, date/time, action, region, etc.
- c. Allow an alarm to be configured by a user.
- d. Allow a custom action to be executed when an alarm is triggered.
- e. Maintain a copy of each alarm, event, and notification reported.
- f. Record changes in the status of all traffic control devices and ITS subsystems (e.g., traffic signals, CMS, CCTV, etc.).
- g. Log all data base modifications, uploads/downloads, alarms, and system commands.
- h. Record system log-ins and log-outs (with time and date stamp) and be accessible to the System Administrator.
- i. Provide a searchable event log by ITS device type (or subsystem), specific device, User/Operator, and severity of error.
- j. Allow a printing option for reports from the event log from the searchable event log.
- k. Have the ability to detect system malfunctions, diagnose/analyze the situation for potential resolution, and automatically log its status.
- l. Detect controller power failure and recovery.
- m. Log a failure event and also display a visual alarm to the User.
- n. Allow querying and modifications of archived reports, keeping changes logged.
- o. Allow for easy transfer of reports with external users through ATMS' C2C capabilities.

I. Center-To-Center (C2C) Communication Subsystem:

- 1. The C2C interface shall:
 - a. Be national ITS standards based. (i.e., NTCIP, IEEE, etc.)
 - b. Support C2C standard data types and transmission protocols.
 - c. Support input and output of data based on the Traffic Management Data Dictionary (TMDD) Standard v3.03 for the Center to Center Communications
 - d. Support all subsystem interfaces.
 - e. Support legacy systems' proprietary communication interfaces from external agencies.
 - f. Provide security for data exchange of all data types, so that data may be selectively included or excluded from transfer to an external agency.
 - g. Provide a mechanism for automatically publishing data and video images from multiple sources to various traveler information web sites at specific intervals.
 - h. Enable assigned ATMS functionalities to external users.
- 2. The C2C interface shall:
 - a. Obtain and display Caltrans and City of Oakland data and information relevant to the operators and trucking community for GoPort, including but not limited to:
 - 1) Regional CMS locations and messages
 - 2) Freeway information and alerts
 - 3) Permitted or prohibited truck routes
 - 4) Oversize / Overweight (OS/OW) information

J. Changeable Message Sign (CMS):

- 1. The CMS subsystem shall:
 - a. Support all fixed and portable CMSs.

- b. Retrieve status information from signs and log the information to the alarm and event logger, including, but not limited to:
 - 1) Operational status (in or out of service)
 - 2) Module status
 - 3) Pixel status
 - 4) Voltage
 - 5) Temperature
 - 6) Internal malfunction
 - 7) Other configurable parameters
 - 8) Date/time of last successful poll
 - 9) Date/time of last failed poll
 - 10) Device failures
 - 11) Communication failures.
- c. Have the capability manually initiate a poll to one or more CMSs in a single operation in order to test communications.
- d. Have a configurable polling rate, and shall allow the user to initiate a poll at any time.
- e. Allow users to select, view, and control one or more signs on the system from the CMS list or GUI map.
- f. Allow users to add, remove, and edit configuration parameters for one or more signs from the CMS list or GUI map.
- g. Utilize one central sign library accessible by all statewide, regional, and local TMCs.
- h. Be able to create a single-phase message and a multi-phase message in the CMS message library.
- i. Be able to open a message stored in the CMS message library and shall be able to save an existing message to the CMS message library.
- j. Be able to delete a message stored in the CMS message library.
- k. Have the capability to display a message stored in the CMS message library on one or more CMSs.
- l. Maintain a list of prohibited words and shall check any message before displaying or queuing for prohibited words.
- m. Allow for an updatable dictionary to be used in the spell check.
- n. Have the capability to manually compose a message for a CMS and then send/post it to one or more signs in a single operation.
- o. Have the capability to blank one or more CMSs in one command and also shall have the capability to edit, or remove the current message displayed on one or more CMSs.
- p. Have the capability to add a message stored in the CMS message library to one or more CMSs' priority message queue.
- q. Have the capability of editing a message prior to queuing and displaying the message.
- r. Be able to preview a message exactly as it would appear on a targeted CMS and allow the user to review messages stored in the priority message queue of a CMS.
- s. Maintain a message priority hierarchy containing at least 4 levels of priority within the message queue.
 - 1) The highest priority slot in a CMS message queue shall be the override priority.
 - 2) The lowest priority slot in a CMS message queue shall be the manual priority.
- t. Provide a sortable, filterable list of all signs with their current message, as well as a configurable number of messages in the priority message queue for that CMS.

- u. Be able to set the display time for phases of a message.
- v. Support text messages, graphic messages, and a hybrid of the two and also shall support monochrome and color messages.
- w. Support the capability to perform all actions on a simulated CMS.
- x. Support proprietary CMS control protocols, as required.
- y. Allow for future scheduling of CMS messages for a single sign or multiple signs.
- z. Show the current active CMS messages on the selected signs.
- aa. Allow for different messages to be scheduled at different times on a single sign or multiple signs and shall alert the user that a scheduled message is about to be displayed.
- bb. Include support for automated messaging from other subsystems or manual messaging from an operator.
- cc. Allow the performance of a pixel test.
- dd. Allow users with a higher priority level to lock sign control for their own use for a specific length of time so that other users cannot control the locked sign.
- ee. Indicate the owner of a locked sign to other users.
- ff. Have the capability to place a CMS offline from system access and shall have the capability to place a CMS online for system access or change the current status of its operational state.
- gg. Have the capability to reset a CMS.
- hh. Provide an error message if there is a mismatch between the text displayed on the ATMS for any CMS sign, and the text being displayed on the CMS.
- ii. Provide an error message if the message to be published exceeds the number of allowable characters for this CMS.
- jj. Allow configuration of sign display parameters.
- kk. Log an event message to the alarm and event logger whenever a sign is manipulated, which contains:
 - 1) Date
 - 2) Time
 - 3) Operator name and location
 - 4) Sign
 - 5) Action taken.
- ll. Log an alarm message to the alarm and event logger with an error message when an action cannot be performed on a sign, which contains a suggested course of action to bypass or correct the problem.
- mm. Poll the CMS location of a portable unit that has GPS-receiving capabilities and update the location in the map display.

K. GoPort Application Interface:

- 1. The ATMS shall be able to provide data to an external and separate GoPort Application. The GoPort Application shall be able to acquire real-time Port operations data from the ATMS automatically, including::
 - a. CMS messages.
 - b. Incident, events, security, public safety, and terminal-specific alerts.
 - c. Other notifications (eg. closures, outages, weather warnings).
 - d. Queue length.
 - e. Turn times.
 - f. Travel times.
 - g. Traffic volumes.

- h. Video camera feeds.
 - i. Vessel information.
 - j. Smart Parking data.
 - k. WIM.
2. The GoPort Application subsystem shall:
 - a. Provide the ATMS with the ability to receive communications from the GoPort Application, as applicable.
 - b. Transmit data from the ATMS to the GoPort Application automatically, as applicable.
- L. Supplemental Vehicle Detection Subsystem:
1. The Supplemental Vehicle Detection Subsystem shall:
 - a. Be able to integrate field hardware to detect, monitor, and classify vehicles in its range.
 - b. Be able to allow the Port to integrate interfaces to new supplemental vehicle detection equipment without the need of external assistance.
 - c. Gather and/or calculate, recognize, process, and display detector information including speed, vehicle count, and vehicle classification for ATMS aggregation to 15-minute or hourly volumes for traffic monitoring requirements.
 - d. Allow display of real-time speeds collected by the supplemental vehicle detection equipment on the ATMS GUI map view, presenting aggregated speed values, and color-coding these speeds, resulting in a link-based speed display.
 2. The ATMS shall:
 - a. Allow operators to view, select, and monitor supplemental vehicle detection equipment from the ATMS GUI map view.
 - b. Allow users to prepare reports from archived supplemental vehicle detection data that are customizable by user and able to be exported in csv, SQL, xlsx, and pdf format.
- M. Smart Parking Subsystem:
1. The Smart Parking Subsystem shall:
 - a. Integrate the Smart Parking System with the ATMS solution while complying with the requirements described in Section 272616 "Smart Parking System."
 - b. Allow operators to monitor parking conditions in the Port in real-time and query parking performance through the ATMS GUI map view.
 - c. Allow operators to select parking facilities in the Port and query parking performance measures, including but not limited to:
 - 1) Parking occupancy.
 - 2) Stall reservation information.
 - 3) Parking availability.
 - 4) Overstayed reservations.
 - d. Allow operators to query archived parking data and generate reports that are customizable by user, and able to be exported in csv, xlsx, and pdf format.
- N. Advanced Train Detection Subsystem:
1. The Advanced Train Detection Subsystem shall:

- a. Detect the front and rear end of the train via video (if applicable from camera views) to estimate train length and speed.
 - b. Alert TMC/EOC operators of train detection event and clearance, and allow operators to publish alerts to users through the ATMS information dissemination channels.
 - c. Sustain detection events if the train stops moving, and clear detection once train entirely passes a defined threshold.
 - d. Allow for calibration of train detection thresholds and parameters to current train activity in the Port.
 - e. Calculate and predict blockage time based on train length and speed, as well as other evaluation criteria.
 - f. Allow operators to disseminate train detection information and alerts via canned messages.
 - g. Allow users to monitor video footage by selecting the camera in the ATMS GUI map view or list.
2. ATMS users shall be able to query and create reports of train activity in the Port from archived train detection data. Reports shall:
 - a. Include time-based presence of train activity in the Port and crossing blockage timings.
 - b. Be customizable by user.
 - c. Be able to be exported in csv, xlsx, and pdf format.

O. Weigh-In-Motion Subsystem:

1. The WIM subsystem shall:
 - a. Collect data from the WIM scales to provide similar information that is posted on the display sign.
 - b. Be able to report on axle and total vehicle weight to the ATMS for historical recordkeeping.
 - c. Show camera images from any video enforcement devices installed at the WIM site, as applicable, either received directly from the WIM site or from a designated WIM data storage site.
 - d. Report vehicle weights in the ATMS with errors no greater than that of the WIM field system.
 - e. Provide an option for alerting operators in real-time when certain thresholds have been violated, including:
 - 1) Read of a single vehicle over a specified weight, either in total pounds or pounds per axle.
 - 2) Percentage of all measured vehicles over a specified weight over a specified rolling time period, such as an issued alert of "over 10% of traffic flow over 125,000 pounds for 4 axles in the last 30 minutes at WIM Station 123".
 - 3) Percentage of all measured vehicles over a specified weight load per axle over a specified rolling time period, such as an issued alert of "over 10% of traffic flow over 6 tons per axle in the last 30 minutes at WIM Station 123".
 - f. Use alert thresholds for operators that are configurable by Port staff, and allow for either measurable units of tons or pounds to be selected by Port staff.

2.5 SUPPORTING HARDWARE

A. ATMS Server:

1. The ATMS server shall:
 - a. Be a dedicated server with processing capacity that meets or exceeds the capacity necessary for all functionalities described within this specification for software.
 - b. Exceed the reliability parameters described within this specification for software.
 - c. Be housed physically within the Port's facilities, at a location that is selected by the Port.
 - d. Operate solely within the Port's IT architecture in a manner that does not require direct data exchange between server and Port workstations to leave the Port's IT network.
 - e. Be capable of regular backup transfers that can be customized by the Port.
 - f. Be connected to the Port's designated Disaster Recovery site, as defined by the Port.
 - g. Be compatible with all other IT assets that are required in order for the server to operate properly.
 - 1) IT assets that require upgrade in order to be compatible with the ATMS server shall be paid as part of this specification.
 - h. Be physically expandable to add future capacity and storage.
 - i. Be capable of successfully transferring data to a storage device for long-term reporting.
 - 1) The Port may specify a preferred existing data storage site in lieu of creating new storage on the ATMS server.
 - j. Consider the following minimum hardware concept requirements:
 - 1) 2400MT/s RDIMMs Memory Slots
 - 2) Dual, Redundant Power Supplies
 - 3) High-speed network data card
 - 4) Modular design for easy part replacement.
 - 5) Redundant disk arrays with automatic failover.
2. The ATMS server should consider the following hardware requirements:
 - a. Rack Server Configuration
 - b. 2 Intel Xeon E5-2620 v4, 2.1 GHz, 20M Cache, 8.0 GT/s QPI, Turbo, HT, 8C/16T (85W) Max, Memory 2133MHz
 - c. 2 CPU Standard Processor Thermal Configuration
 - d. 2400MT/s RDIMMs Memory
 - e. PCIe Riser with:
 - 1) One x16 PCIe Gen 3 FH slot
 - 2) One x16 PCIe Gen3 LP slot
 - f. 32GB RDIMM, 2400MT/s, Dual Rank, x4 Data Width Memory Capacity
 - g. RAID 5 Configuration
 - h. 1 TB 7.2 RPM SATA 6Gbps 2.5-in. Hot-Plug Hard Drive
 - i. On-Board Broadcom 5720 Quad Port 1Gb LOM Network Card
 - j. Internal SD Module
 - k. Internal Optical DVD Drive
 - l. Performance BIOS Settings for Power Management
 - m. Standard North America 10-ft Power Cord
 - n. Dual, Hot-Plug Redundant Power Supply (1+1)
 - o. Windows Server 2016 Operating System, Factory Installed
 - p. Microsoft SQL Server 2016, Standard, OEM

3. Contractor is ultimately responsible for procuring an ATMS server that allows the ATMS software to meet the minimum performance requirements and functions within the Port's IT environment.
 - a. Shop drawing should include a manufacturer's or contractor's certification that the server meets the requirements of the ATMS software.
 - b. Necessary enhancements to modify the server after procurement to meet these requirements shall be documented to the Port and paid for as part of this specification.
4. ATMS Server shall be reviewed while in operation by the Port in order to determine acceptance. Contractor shall submit a testing plan and approval checklist for Port review and approval prior to commencement of hardware testing.

B. VIDEO MANAGEMENT SERVER

1. Contractor shall install a dedicated Video Management Server (VMS) where shown on the plans in order to support a relocated and upgraded Genetec Security 5.7 software, or the approved VMS alternative. If the ATMS solution has a built-in Video Management System that does not require an additional server, Contractor may submit a request to the Port to demonstrate that the ATMS Server is a sufficient alternative to a Video Management Server. Substitution of the ATMS Server in lieu of a separate Video Management Server shall be permissible with Port approval.
2. Video Management Server shall be equipped with sufficient processing speeds to allow video feeds to be viewable in real-time without additional visible lag or stuttering.
3. Video Management Server shall have the following minimum characteristics:
 - a. Quad Core Intel Xeon E5640 2.66GHz.
 - b. 16 GB of RAM.
 - c. 64-bit operating system.
 - d. 80 GB SATA II Hard Drive for OS and/or Security Center Applications.
 - e. GbE network interface card.
 - f. Standard SVGA video card.
4. Video Management Server shall include video storage that shall:
 - a. Provide a minimum of 480 TB Hard Drives with write speed capabilities that can store and retrieve video in real-time.
 - b. Provide a minimum 1920x1080 (Full HD) resolution with H.264-30 compression at 12 Frames Per Second (FPS).
 - c. Provide a minimum of 90 days retention under these parameters for all cameras that are part of this work.

C. OTHER SERVER HARDWARE

1. Contractor shall:
 - a. Procure any additional server hardware solutions that are necessary in order to support the ATMS modules that cannot be operated as part of the ATMS or VMS servers or offer advantages of operating on a separate server. Additional servers would be to serve the functional requirements of the ATMS program and are paid for as part of this work.
 - b. Submit a justification for the requirement of additional servers to the Port for review and approval prior to procurement and installation. Submissions shall include data spec sheets regarding processor speeds, memory, operating system, hard drive,

network interface, and other requirements relevant to the operation and security of the new server.

D. IT NETWORK

1. Contractor shall review the Port's IT network prior to installation in order to verify that the proper communications channels can be established between the ATMS server and users.
2. Contractor shall submit written requests to review IT architecture in person to the Port at least 15 business days prior to the proposed visit, unless otherwise allowed.

E. COORDINATION

1. Contractor shall:
 - a. Coordinate with the FITS Contractor for handoff of the ATMS Server, Video Management Server (as applicable), and other associated server hardware. FITS Contractor will be responsible for installing all appropriate servers into the designated Port locations, providing network connections, and providing sufficient power service.
 - b. Provide 30 days of notification to the Port and the FITS Contractor for when server hardware shall be ready.
 - c. Verify, at completion of the FITS Contractor's integration work, that servers have been given sufficient network access and power service.
2. Contractor may:
 - a. Load the ATMS, the Video Management System, and any other modules at a date that is later than the date in which the FITS Contractor attains possession of the servers. If intending to load updates over Port network infrastructure, submit a written request a minimum of 30 days prior to such work.

2.6 DATA MANAGEMENT

A. Data Hosting:

1. The ATMS shall:
 - a. Be able to store and query historical data and information for access by Port staff at any time.
 - b. Provide for comprehensive database for detector data, system activity, and signal operation.
 - c. Collect and maintain all data/information required for real-time monitoring and displays from all intersections and equipment at all times.
 - d. Be capable of processing all data/information collected from local intersections and equipment.
 - e. Provide for comprehensive database for vehicle system detector data, system activity and signal operation.
 - f. Be capable of processing all data/information collected from system detector technologies including, but not limited to the following:
 - 1) Inductive loop.
 - 2) Radar.
 - 3) Microwave.
 - 4) Video Detection.

- 5) RFIDs.
- g. Be capable of processing all data, information and images collected from VDS detection systems.
- h. Use a secure and reliable data host server, which the Port shall agree upon using before equipment is installed.
- i. Have a fallback data host server, and provide a comprehensive data archive, backup, and recovery plan and the equipment and systems necessary to implement the plan.

B. Data Archiving:

- 1. The ATMS shall:
 - a. Archive all data retrieved from all ITS field device types, as well as all subsystem-generated data, such as, but not limited to:
 - 1) Events.
 - 2) Alarms.
 - 3) Travel times.
 - b. Include the date and timestamp when the data was collected and archived.
 - c. Limit access to the archiving and reporting module by user and group-level security to ensure trusted access and in compliance with the Port's privacy policy.
 - d. Use the Microsoft SQL server relational database management systems.

C. Data Reporting:

- 1. The ATMS shall:
 - a. Provide for automated logging and reports at the TMCs considered for this project (Port, City of Oakland, and Caltrans), including detection of all "malfunctions" and providing alarms as scheduled by the User.
 - b. Provide the ability to monitor detector operation, identify detector failure, and prepare reports with User-definable consequences.
 - c. Store at least 3 years of raw data for reporting and analysis with the exception of video footage.
 - d. Store summary report data (e.g., Marine Terminal turn times) to the database or storage site designated by the Port and have the capability of retrieving and query of any stored report from any date.
 - e. Store video footage for a period agreed to by the Port.
 - f. Indefinitely store monthly reports and other performance measure reports developed by the ATMS.

D. Data Sharing:

- 1. The ATMS shall:
 - a. Allow archived data and reports to be available for all integrated users.

2.7 DOCUMENTATION AND TRAINING

A. Documentation:

- 1. The Contractor shall:
 - a. Provide documentation describing in detail their ATMS interface to users.

- b. Provide sufficient documentation and instructions for installing and integrating new equipment such that Port's staff can perform the installation in the event of equipment replacement or upgrade.
 - c. Provide all documentation provided by vendors on new hardware and software installed.
 - d. Provide a TMC/EOC Operators and System Administrators manual.
 - e. Provide detailed documentation that describes the system design, configuration, training, as-built conditions, operation and maintenance.
 - f. Include the necessary time and resources to modify the documentation to incorporate comments from the Port.
2. Documentation submitted to the Port shall:
- a. Be in English, shall utilize U.S. Customary measurements
 - b. Submitted directly to the Port in paper hardcopy and electronically in Word/AutoCAD/Visio/Excel/MS Project and Adobe Acrobat.
 - c. Include any and all communications or submissions.
 - d. Be a minimum of six bound, hard copies of the documentation and one digital copy shall be provided.
 - e. Include all technical drawings requiring measurements in AutoCAD (per Port Standard) and PDF format.
 - f. Provide a report for each stage of the project, including but not limited to product design, Test periods, installation, and system acceptance phases.

B. Training:

1. The Contractor shall:
- a. Train the Port's designated personnel according to the requirements specified herein.
 - b. Provide training at the Port's designated facilities.
 - c. Provide training presentations and material in English.
 - d. Providing all training materials, all copies of training materials, training aids, audiovisual equipment and visual aids for the conduct of these courses.
 - e. Provide instructional materials consisting of applicable equipment operation and maintenance manuals, and supplemental notebooks consisting of additional drawings, procedures, and descriptive information.
 - f. Provide student guides with full topic descriptions, illustrations as needed to enhance content presentation, and common problems with comprehensive solutions given that mirror the instructor guides.
 - g. Provide experienced and qualified instructors to conduct all training sessions that are familiar with technical information and are able to utilize proper methods of instruction, training aids, audiovisuals and other materials to provide for effective training.
2. Training curriculum shall:
- a. Cover equipment familiarization and systems operation at a level necessary to bring those employees designated to the level of proficiency required for performing their respective duties.
 - b. Meet all training requirements and indicate trainee prerequisite knowledge, course content, training time requirements, and who should attend.
 - c. Be provided to the Port for review a minimum 60 days prior to commencement of equipment installation.
 - d. Have a level of competency that is reviewed and approved by the Port.

- e. Provide training on the following systems:
 - 1) ATMS software;
 - 2) Data Analysis and Report Generation;
 - 3) ATMS Remote Operation;
 - 4) TSS Operations;
 - 5) CCTV Video Monitoring Operations;
 - 6) CMS Operations;
 - 7) Queue and Incident Detection System Operations;
 - 8) Travel Time System Operations;
 - 9) Alarm, Events, and Notifications Operations;
 - 10) System Administration Training;
 - 11) Maintenance Training; and
 - 12) IT Training
- 3. All training materials shall become the property of the Port at the conclusion of training.
- 4. Training sessions shall include personnel from City of Oakland, Caltrans D4, and MTC.
- 5. There shall be an agreed upon number of training sessions in order to accommodate personnel working schedules. Contractor should anticipate a minimum of three separate sessions per training event to provide coverage for all work shifts. Each training event may have up to 30 attendees.

PART 3 - EXECUTION

3.1 General:

A. The Contractor shall:

- 1. Submit a software testing plan a minimum 60 days prior to acceptance testing of the software for review and approval.
- 2. Coordinate with the FITS Contractor regarding the handover of servers for implementation into the Port's network by the FITS Contractor. Provide a minimum 30 days of notice to the Port and the FITS Contractor for when the handover of servers would be able to occur.
- 3. Initiate the implemented ATMS server, per approved implementation plan from the Port.
- 4. Commence software work no earlier than the completed testing and acceptance of the ATMS server.
- 5. Complete work no earlier than the acceptance of all associated systems or subsystems in order to confirm that all functionality has been met. It is anticipated that the GoPort and Smart Parking Systems will not be at full acceptance, but will be at a level of development that would allow all associated modules to be integrated with a test environment. Contractor shall immediately notify the Port if, through coordination with others, it is determined that integration with these other systems cannot be completed without impacting the ATMS schedule.
- 6. Stage and test the combined system in a factory environment.
- 7. Conduct software modifications in a test environment prior to implementation on the live system.
- 8. Document all software or other modifications made that deviate from the standard software package.
- 9. Document any risks or issues that may arise related to existing conditions at the Port's facilities prior to ATMS installation.

- B. The ATMS software acceptance testing plan shall:
1. Encompass test plans that include the following elements:
 - a. A statement of the purpose of the tests
 - b. The location, date(s) and time(s) tests will be performed
 - c. Staff required to perform the test
 - d. If applicable, the quantity of units to be tested
 - e. The test equipment to be used, identified by manufacturer and model number
 - f. A step by step description of the procedure to be performed
 - g. Specific pass/fail criteria for each test
 - h. A sample of the form(s) to be used to record test data
 2. Include a system interface test that:
 - a. Occurs after all equipment is installed and interconnected and ready to operate as a system.
 - b. Strategically isolates interconnected sub-systems and demonstrates in a piece-wise manner that the transfer of information occurs properly and is capable of achieving functional objectives described in these Specifications
 3. Include system performance tests that:
 - a. Are conducted from the TMC/EOC and designated field locations, as elected by the Port.
 - b. Exercise all functions for the traffic signal system.
 - c. Exercise all functions for the RFID system.
 - d. Exercise all functions for the CCTV camera system to test video transmission and control functions of the installed cameras remotely.
 - e. Display all video streams on the Video Wall and workstations through use of the ATMS.
 - f. Exercise all functions for the queue detection system to test the procedures of monitoring queues.
 - g. Utilize the ATMS to fully test all functions of vehicle detection equipment, in multiple combinations, including infrequently occurring combinations.
 - h. Utilize the ATMS to fully test all functions for all CMS types
 - i. Exercise all functions between the ATMS Server and the GoPort Server.
 - j. Exercise all functions between the ATMS and the Smart Parking System.
 - k. Utilize the reporting features to generate reports for all types of devices in the ATMS platform.
 - l. Exercise all functions of the devices provided by this Project or integrated as part of this Project for each field location.
 4. Encompass test forms that include the following information:
 - a. Test title
 - b. The manufacturer, model number and calibration date of each piece of test equipment
 - c. A table to record individual readings taken and inspections performed for each unit tested, identified by the serial number of the unit tested
 - d. An indication that the unit has passed or failed each individual test
 - e. A line for signature of the technician performing the test and date
 - f. A line for signature of the Project Manager and date
 - g. A line for signature of the Port representative witnessing the test

- h. Drawings illustrating the configuration of the software and/or equipment tested and all test equipment utilized
5. Demonstrate that the ATMS can properly identify a device that is in a failed state, message mismatch, loss of communication, traffic signal flash, or other undesired operational situation within the expected incidents that occur to a device of that type.
 6. Provide User Acceptance Testing that demonstrates that:
 - a. The software, modules, and applications do not crash.
 - b. The software, modules, applications, and subparts accept the correct inputs and provide the correct outputs.
 - c. The ATMS as a whole consumes an amount of computational resources within the design parameters of the ATMS server and TMC/EOC workstations.
 - d. The ATMS as a whole can accommodate all devices in the Project or integrated as part of the Project without visible degradation in quality to a user.
 - e. The ATMS operates reliability and transitions between interfaces in a timely manner, in the opinion of the Port.
 - f. The software, modules, and applications are intuitive to users and do not require an excessive number of steps to achieve a desired result.

3.2 INSTALLATION

A. The Contractor shall:

1. Submit a section within the overall Project Management Plan within 2 weeks of NTP that is dedicated to the Contractor's Approach for each of the ATMS-related project stages, including:
 - a. System Design Review.
 - b. Factory Acceptance Test.
 - c. Training.
 - d. Installation.
 - e. Acceptance Testing.
 - f. Operability Period Test.
 - g. Maintenance and Operations Support.
2. Provide all functional server hardware to the FITS Contractor for installation into the Port network.
3. Furnish, install, integrate, activate, and test all required communications, device driver, GUI and applications software and software modifications to provide and support communications and management of all existing and new devices and subsystems being provided on this contract into the ATMS.
4. Integrate all existing and proposed devices defined within this contract into the ATMS.
5. Deploy client or client-equivalent software onto all scoped TMC/EOC workstations and demonstrate that client software can interface with the ATMS server.
 - a. Conduct work at times that are given prior approval by the Port, which may include off-peak periods.
 - b. Conduct work with minimal disruption to Port staff activities.
6. Deploy client or client-equivalent software onto third-party workstations at a previously-approved time, which may include up to 2 workstations at each agency including the City of Oakland, the California Highway Patrol, and Caltrans District 4.

- a. Conduct work at times that are given prior approval by the third-party agency, which may include off-peak periods.
 - b. Conduct work with minimal disruption to third-party agency staff activities.
7. Integrate ATMS with the GoPort Server.
 8. Verify and certify that the ATMS has been integrated with all assets at the level of functionality described in this specification, including:
 - a. Traffic Signal System.
 - b. RFID.
 - c. CCTV Video Management System.
 - d. Queue and Incident Detection System.
 - e. Travel Time System.
 - f. Alarm, Events, and Notifications.
 - g. C2C Communication System.
 - h. CMS.
 - i. GoPort Application.
 - j. Supplemental Vehicle Detection.
 - k. Adaptive Signal System.
 - l. Smart Parking.
 - m. Advance Train Detection System.
 - n. Weigh-In-Motion.
 9. Verify and certify that the GUI map shows all devices in their geographic coordinates, unless a different location is stated by the Port.
 10. Configure and test response plans as required on this project such that functionality provided aligns with the Port's defined response plans for this system, or provided by this specification.
 11. Conduct all on-site work with a Port Representative present.
 12. Conduct all work by properly-trained installers; replace any unqualified installer upon written notice from the Port.

3.3 ACCEPTANCE TESTING

A. The Contractor shall:

1. Schedule a proposed testing period a minimum of 10 business days prior to the desired start date for Port review and approval.
2. Start the ATMS testing at a time when all subsystems have passed their standalone acceptance tests (performed by the FITS Contractor), in the opinion of the Port.
3. Provide 5 bound hard copies of the testing plan, checklists, procedures, and other approved documentation for the Port-designated witness(es).
4. Conduct the tests identified in the approved ATMS testing plan and demonstrate to Port-designated witness(es). Tests may be done in concurrence with other system tests if approved by the Port.
5. Verbally announce the test item in the approved plan to the witness prior to demonstration or execution of the test.
6. Conduct all tests in the order indicated.
7. Immediately note any deviations from the test procedure to the Port-designated witness for verbal concurrence prior to moving forward with deviations.

8. Analyze and categorize any defects as to whether they are limited to a particular systems, subsystem, or core ATMS software.
9. Conduct re-tests of items that have demonstrated to not pass the requirement after the proper modification has occurred.
10. Schedule testing with ample additional time allotted for the Engineer to request that certain portions of a test be repeated.
11. Prepare a report of all ATMS modifications made as a result of this testing procedure and submit to the Port for review and acceptance.
12. Maintain the Port-designated copy of the testing results that will serve as the record copy for the project:
 - a. Complete all checklists for PASS/FAIL and other notes.
 - b. Provide to the Port-designated witness for signature in order to certify the results.
 - c. Submit all test records to the Engineer immediately following the test.
 - d. Submit a report summarizing the results with relevant test records and any actions required by the Contractor or the Port.
 - e. One original, two copies, and an electronic copy of the test results shall be submitted.
13. Record test failures, system defects, system errors, or missing functionalities and assign a "Defect Severity" rating as follows:
 - a. Severity 1: Required functionality is substantially not available; normal in-service operation of the device or subsystem cannot be maintained.
 - b. Severity 2: Functionality is substantially available, but one or more sub-functions are not operating as specified. Or, full functionality is available, but performance is not within specifications. Normal in-service operation can be maintained via workload.
 - c. Severity 3: Minor software defect or usability problem for which there is fix or workaround.
14. Correct Severity 1 and Severity 2 defects prior to completion of the stage of testing.
15. Correct Severity 3 prior to the completion of the subsequent testing stage.
16. Conduct the 30-day Operability Period Test (OPT) upon completion of the system acceptance testing, where full operations for the full-scale deployment are monitored for 30 days to measure the system reliability and availability, and ensure that the performance requirements are met.

B. The Port may:

1. Stop the testing in real-time in order to request clarification on a particular test procedure or purpose.
2. Request a particular test procedure or procedures be tested at a later date when conditions are more representative of real-world use.
3. Fail a particular ATMS testing item if Contractor cannot demonstrate a passing requirement after 3 tries in the Port's opinion.
4. Fail the ATMS acceptance testing if more than 10 percent of test procedures in the approved test plan do not pass on the first demonstration in the Port's opinion.
5. Reject the entire system if failed items are not demonstrated to receive a reliable modification that does not take away from perceived functionality of the ATMS in the Port's opinion.
6. Start the warranty period or burn-in period, as applicable, upon receipt of a completed and certified ATMS acceptance test.

C. ATMS Acceptance Testing shall not:

1. Relieve the Contractor of his responsibility to provide a completely acceptable and operating system that meets the requirements of these Contract Documents.
2. Relieve the Contractor of meeting all milestones in the designated schedule.

END OF SECTION