APPENDIX D: SYSTEM REQUIREMENTS

SYSTEM REQUIREMENTS

for the

CITY OF OXNARD
ITS Master Plan

Submitted to:

City of Oxnard

Prepared by:

ITERIS

February 18, 2008

Oxnard Contract No. 3825-06-PW
Iteris Project No. 17-J06-1725x0040

Document History

Document Name	Submittal Date	Version No.
Draft System Requirements	February 18, 2008	Version 1.0

References

This document was developed with the following references and standards:

1. System Engineering Guidebook for ITS, Version 2.0; January 2, 2007
   Source: FHWA
   http://www.fhwa.dot.gov/cadiv/segb/files/segbversion2.pdf
2. Regional ITS Architecture Guidance; October 12, 2001
   Source: FHWA
   http://www.itsdocs.fhwa.dot.gov/JPODOCS/REPTS_TE/13598.pdf
3. ATMS Concept of Operations and Generic System Requirements; October 1993
   Source: FHWA
   http://www.itsdocs.fhwa.dot.gov/JPODOCS/REPTS_TE/3887.pdf
4. Configuration Management For Transportation Management Systems; September 2003
   Source: FHWA
   http://www.itsdocs.fhwa.dot.gov/JPODOCS/REPTS_TE/13885.html

TABLE OF CONTENTS

TABLE OF TABLES

1.0 INTRODUCTION

The City of Oxnard has initiated the ITS Master Plan project as a tool to strategically deploy Intelligent Transportation Systems (ITS) strategies to improve mobility and safety to the traveling public within the Oxnard region. The desired outcome of this project is to develop an ITS Master Plan that achieves all of the following goals.

1. Details a long-term ITS deployment strategy
2. Inventories the existing transportation infrastructure to maximize the use of existing resources when deploying future ITS deployments to maximize funding
3. Improves public safety and incident response times
4. Provides the City with the tools to more efficiently and effectively manage the existing transportation network
5. Provides operations and maintenance cost estimates
6. Develops detailed deployment cost estimates for the phased deployment of ITS strategies
7. Employs Systems Engineering Best Practices and the *Systems Engineering Guidebook for ITS*.
8. Provides an evaluation of the City's existing QuicNet/4 traffic signal control system and assess the suitability of this system based upon functional requirements and user needs.
9. Develops a Concept of Operations to ensure the ITS Master Plan meets the City's current and future transportation management needs.
10. Addresses systems integration to support multi-jurisdictional coordination with additional City and regional stakeholders including Oxnard Police, Ventura County, neighboring cities, as well as other stakeholders including heavy rail, transit rail (Metrolink) and bus transit
11. Complies with and becomes part of the adopted SCAG Regional ITS Architecture
12. Addresses the need for traveler information to the end user, the general public.

The Oxnard ITS Master Plan project involves five tasks as noted below.

- Task 1: Prepare Systems Engineering Management Plan (SEMP)
- Task 2: Preliminary Data Collection
- Task 3: Develop Concept of Operations
- Task 4: System Requirements and Verification Plan
- Task 5: Strategic Deployment Plan (SDP)

This document represents the *draft* Systems Requirements report prepared by Iteris in support of **Task 4** of the Oxnard ITS Master Plan. The *draft* System Requirements report will identify what the ITS in the Oxnard Region must do to achieve its objectives and meet the needs of the Region's stakeholders. This document also includes a high-level Verification Plan that describes what needs to be validated to ensure Oxnard's ITS meets its requirements.

2.0 SYSTEMS REQUIREMENTS

System requirements are the result of a systems engineering approach to developing ITS in the Oxnard Region. This document defines high-level requirements, meaning they are not refined to the scale of the individual project or technology. At this point in the project process, the requirements more generally define the expectations of the system for each stakeholder.

Using the inputs of the Concept of Operations developed in **Task 3** of this project, stakeholder needs and the Regional ITS Architecture, the requirements are developed to:

- Determine what ITS must do;
- Design systems that achieve the requirements;
- Manage system development and stakeholder expectations; and
- Validate system function and performance against the requirements.

System requirements are comprised of four types:

1. **User Requirements** – These define parameters established by the users under which the system must operate. User requirements are derived from an understanding of the current operations, capabilities and limitations of each stakeholder. For example, a user requirement may be necessitated by one stakeholder's limited space, thus requiring the system as used by them to be compact and able to fit within the available facility.
2. **Functional Requirements** – These define WHAT a system must do. In other words, they are the functions that the system must perform. They are typically statements that contain "shall" to describe a function in terms the stakeholders can understand. An example of a functional requirement statement for traffic signal control from the National ITS Architecture is: "The field element shall control traffic signals at intersections and on main highways for urban and rural areas, under center control."
3. **Performance Requirements** – These define how well the system does its functions. Performance Requirements may include measurements of quantity, quality, timeliness or readiness. An example of a performance requirement for a traffic camera light sensitivity is: "Able to capture focused images in 1 to 10,000 lux."
4. **Environmental and Non-functional Requirements** – These define the environmental conditions that the system must operate in, and other conditions, such as reliability and availability. Environmental requirements are specific to the conditions that system elements are subjected to. For example, environmental requirements may clarify that an outdoor camera needs to be operational in a wider range of temperatures and levels of moisture than an indoor system. Reliability and availability requirements indicate how much of the time a system must be operational. For example, a server may be required to be fully functional 99% of the time, 24 hours a day, seven days a week.

Because this is not a design document, the system requirements described here primarily focus on function and user requirements. Performance and environmental requirements are generally developed at a detailed lever during the design process. At that point, the specific performance and reliability needs and environmental conditions can be determined through field and operational review as well as the capabilities of specific technologies.

The objective of the ITS system requirements for the Oxnard Region is to describe the requirements from the stakeholder perspective. They should give each stakeholder a clear depiction of what function ITS will perform for them, how effectively they will perform them, and under what circumstance.

The characteristics of a good and meaningful system requirement are:

- **Understandable** – The meaning of the requirement must be clear from the text in the document.
- **Unambiguous** – Each requirement must have a single, clear meaning.
- **No redundancy** – Each requirement should be stated only once.
- **Complete** – Every functional behavior in the implemented project must appear in a requirement, and the requirements must capture the entire functionality of the system. All functionality described in scenarios must be described by a requirement.
- **Consistent** – The requirements must not contradict each other.
- **Correct** – The requirements must not specify invalid or undesirable behavior.
- **Testable** – It must be possible to construct a test that can be executed by a person who is not a member of the development team to determine whether the requirement is satisfied.

2.1 System Requirement Development Process

The process followed to develop the system requirements begins with the stakeholder interviews. From these, an understanding of needs, their priorities and existing conditions is developed. Throughout the system requirement process, the requirements are traced back to needs to insure that they are organic to the overall project.

Following is a description of the system requirements process, as described by the FHWA in the *System Engineering Guidebook for ITS, Version 2.0.*

1. Develop requirements from stakeholder needs and input products. Once the requirements are documented, they are prioritized, de-conflicted, and validated with the stakeholders. *In this study, many requirements were drawn from descriptions in the National ITS Architecture because they are consistent, already evaluated for usefulness and technology-independent.*
2. Write and document requirements, ensuring that each meets the criteria for "good and meaningful" as previously described in this section.

3. Check the completeness of the set of requirements by tracing them back to the stakeholder needs. *In this study, the traceability was done by mapping each requirement to the stated needs of each stakeholder.*
4. Analyze, refine and decompose requirements by examining each to verify that it meets the criteria for "good and meaningful". Each requirement may be decomposed into a more refined set of requirements allocated to subsystems, and performance requirements will be defined. It is expected that new requirements will be identified during this process, leading to an iterative process for them that goes back to Step 2. *In this study, it is expected that the needs and resulting requirements will change over time, and through review of the identified described here.*
5. Validate requirements by insuring they are correct for the system and its scope. Stakeholders may be involved during this step to help analyze and trace requirements back to their needs. *The review of requirements by stakeholders includes a "reality" check where stakeholders are expected to verify the existing list for its match to their needs and scope.*
6. Manage requirements once they are established by documenting changes to them and using a structured change management process. *The same spreadsheet where requirements are mapped is used to document comments and changes.*

In this document, the system requirements are categorized by stakeholder and have been developed following the SEMP, using the Concept of Operations and the stakeholder needs.

2.2 System Requirements Summary

There are ten stakeholders represented in the system requirements. The stakeholders listed are a subset of those involved in the entire project. The list here is limited to those who had ITS needs in the *Concept of Operations* Report. For each stakeholder, the requirements are decomposed by the elements of the ITS system with which they will interact. The stakeholders are, in alphabetical order after the lead agency:

- City of Oxnard Public Works – Traffic (Lead agency)
- Caltrans
- City of Oxnard Geographic Information Systems (GIS)
- City of Oxnard Information Technology
- City of Oxnard Police
- City of Oxnard Public Works – Capital Projects (Wastewater)
- City of Oxnard Public Works – Maintenance
- City of Port Hueneme
- Gold Coast Transit (Formerly South Coast Area Transit)
- Ventura County
- Ventura County Transportation Commission

The following sections maps the systems requirements to each stakeholder's stated needs, and identifies whether each is a user, functional, performance or environmental requirement.

2.2.1 City of Oxnard – Public Works Traffic

Table 1 lists the stated needs, their priority and the associated system requirements for the City of Oxnard Public Works Traffic department. The traffic department will be deploying and operating the TMC and the City of Oxnard's field devices. They will also be interacting with other agencies in the area to exchange data and share control of devices.

Table 1. City of Oxnard – Public Works Traffic System Requirements

City of Oxnard – Traffic			
Need	**Priority**	**System Requirement**	**Type**
1. Centralized facility to conduct transportation management activities	Near-term	1. The Oxnard TMC shall centralize Oxnard's traffic management functions within a single physical location	Functional
		2. The Oxnard TMC shall be able to securely communicate with all selected roadside devices, including but not limited to cameras, signal controllers, traffic information subsystems and traffic sensors	Functional
		3. The Oxnard TMC shall have appropriate space for all staff and hardware required to manage the transportation network, including personnel management, administration, operations, public relations, training, conference space and space for visiting entities	User
		4. The Oxnard TMC shall allow for secure remote access from terminals by authorized personnel	Functional
		5. The Oxnard TMC shall be secure and limit access to authorized individuals	Functional
		6. The Oxnard TMC facility shall be designed with the input of all participating stakeholders	User
		7. The Oxnard TMC shall be capable of maintaining appropriate operating conditions, such as power availability, humidity, temperatures and space	Environmental
		8. The Oxnard TMC shall respond to control data from center personnel regarding sensor and surveillance data collection, analysis, storage, and distribution.	Functional
		9. The center shall collect current traffic and road conditions data that is collected and shared by other centers.	Functional

City of Oxnard – Traffic			
Need	**Priority**	**System Requirement**	**Type**
		10. The Oxnard TMC shall remotely control traffic signal controllers.	Functional
		11. The Oxnard TMC shall collect traffic signal controller operational status and compare against the control information sent by the center.	Functional
		12. The Oxnard TMC shall collect traffic signal controller fault data from the field.	Functional
		13. The Oxnard TMC shall implement control plans to coordinate signalized intersections, under control of center personnel, based on data from sensors and surveillance monitoring traffic conditions, incidents, emergency vehicle preemptions, the passage of commercial vehicles with unusual loads, equipment faults, pedestrian crossings, etc.	Functional
		14. The Oxnard TMC shall remotely control dynamic messages signs for dissemination of traffic and other information to drivers.	Functional
		15. The Oxnard TMC shall collect operational status for the driver information systems equipment	Functional
		16. The Oxnard TMC shall collect fault data for the driver information systems equipment for repair.	Functional
		17. The Oxnard TMC shall retrieve locally stored traffic information, including current and forecasted traffic information, road and weather conditions, traffic incident information, information on diversions and alternate routes, closures, and special traffic restrictions etc.	Functional
		18. The Oxnard TMC shall distribute traffic data to maintenance and construction centers, transit centers, emergency management centers, and traveler information providers.	Functional
		19. The Oxnard TMC shall distribute traffic data to the media; the capability to provide the information in both data stream and graphical display shall be supported.	Functional
		20. The Oxnard TMC shall provide the capability for center personnel to control the nature of the data that is available to non-traffic operations centers and the media.	Functional

City of Oxnard – Traffic			
Need	**Priority**	**System Requirement**	**Type**
		21. The Oxnard TMC shall be operable and accessible 24 hours a day, seven days a week	Performance
		22. The Oxnard TMC shall communicate and exchange data with and control legacy and new field devices	Functional
		23. The Oxnard TMC shall control all connected traffic signal controllers through a single user interface	Functional
		24. The Oxnard TMC shall control all portable and permanent connected DMS through a single user interface	User
		25. The Oxnard TMC shall control all Oxnard, jointly operated and Caltrans traffic cameras through a single user interface	User
		26. The Oxnard TMC shall control all other roadside devices through efficient and user-friendly interfaces	User
		27. The Oxnard TMC shall communicate using National ITS Architecture Standards wherever possible	Functional
		28. The Oxnard TMC shall use digital maps provided by Oxnard GIS for map display purposes	Functional
2. Remote workstations to conduct transportation management activities	Near-term	1. The Oxnard TMC shall allow for secure remote access by authorized personnel	Functional
		2. The Oxnard TMC shall allow remote access users to view the Oxnard transportation systems including, but not limited to, traffic camera images, roadside and mobile device status, signal control, digital maps, weather and road condition information	Functional
		3. The Oxnard TMC shall control all remote access using hierarchical limitations such that the level of access and control may be limited by the Oxnard TMC and its staff	Functional
		4. The Oxnard TMC shall allow selected remote access users to control Oxnard transportation management subsystems, subject to limitations	Functional
		5. The Oxnard TMC shall allow selected remote access users to remotely control traffic signal controllers	Functional
		6. The Oxnard TMC shall allow selected remote access users to collect traffic signal controller operational status and compare against the control information sent by the center.	Functional

City of Oxnard – Traffic			
Need	**Priority**	**System Requirement**	**Type**
		7. The Oxnard TMC shall allow selected remote access users to collect traffic signal controller fault data from the field.	Functional
		8. The Oxnard TMC shall allow selected remote access users to implement control plans to coordinate signalized intersections, under control of center personnel, based on data from sensors and surveillance monitoring traffic conditions, incidents, emergency vehicle preemptions, the passage of commercial vehicles with unusual loads, equipment faults, pedestrian crossings, etc.	Functional
		9. The Oxnard TMC shall allow selected remote access users to remotely control dynamic messages signs for dissemination of traffic and other information to drivers.	Functional
		10. The Oxnard TMC shall allow selected remote access users to collect operational status for the driver information systems equipment	Functional
		11. The Oxnard TMC shall allow selected remote access users to collect fault data for the driver information systems equipment for repair.	Functional
		12. The Oxnard TMC shall allow selected remote access users to retrieve locally stored traffic information, including current and forecasted traffic information, road and weather conditions, traffic incident information, information on diversions and alternate routes, closures, and special traffic restrictions, etc.	Functional
		13. The Oxnard TMC shall allow selected remote access users to provide the capability for the remote personnel to control the nature of the data that is available to non-traffic operations centers and the media.	Functional
		14. The Oxnard TMC shall allow selected remote access users to monitor and analyze images collected from traffic cameras under remote control of the center.	Functional
		15. The Oxnard TMC shall allow selected remote access users to control the pan/tilt/zoom of traffic cameras at priority intersections	Functional

City of Oxnard – Traffic			
Need	**Priority**	**System Requirement**	**Type**
		16. The Oxnard TMC shall be available to remote access users via a secured connection to the Internet	Functional
		17. Security measures shall limit remote access to the Oxnard TMC only to authorized personnel	Functional
3. Remote access to traffic signal controllers	Near-term	1. Oxnard field devices shall be accessible and controllable via a secure direct connection from the field (e.g. laptop computer)	Functional
		2. Oxnard field devices shall report to the Oxnard TMC any changes in operational status resulting from field access.	Functional
		3. Oxnard field device access systems (e.g. laptops) shall have interfaces for monitoring and controlling Oxnard roadside devices	Functional
		4. Oxnard field device access systems (e.g. laptops) shall be able to connect to and control Oxnard traffic signal controllers at the controller location.	Functional
4. Video surveillance at priority intersections	Near-term	1. Oxnard traffic cameras shall collect, process, digitize, and send traffic sensor data (speed, volume, and occupancy) to the Oxnard TMC for further analysis and storage, under center control.	Functional
		2. Oxnard traffic cameras shall collect, process, and send traffic images to the center for further analysis and distribution.	Functional
		3. Oxnard traffic cameras shall send fault and status information to the Oxnard TMC	Functional
		4. Oxnard traffic cameras shall meet industry standards for capturing legible images in a wide range of light conditions, including day and night	Performance
		5. Oxnard traffic cameras shall operate in a range of environmental conditions including heat, cold, rain, snow and lightning strikes	Environmental
		6. Oxnard traffic cameras shall be able to pan, tilt and zoom under remote control	Functional
		7. Oxnard traffic cameras shall capture images continuously and process and digitize them at the roadside	Functional

City of Oxnard – Traffic			
Need	**Priority**	**System Requirement**	**Type**
5. Signal coordination with neighboring agencies' signalized intersections: a. Caltrans b. Ventura County c. Port Hueneme	Near-term	1. The Oxnard TMC shall exchange traffic information with other traffic management centers including incident information, congestion data, traffic data, signal timing plans, and real-time signal control information.	Functional
		2. The Oxnard TMC shall exchange traffic control information with other traffic management centers to support remote monitoring and control of traffic management devices (e.g. signs, sensors, signals, cameras, etc.).	Functional
6. Improved signal coordination at priority intersections and along priority corridors: a. Vineyard to Saturn b. Downtown area c. Improve detection	Near-term	1. Oxnard TMC shall implement control plans to coordinate priority signalized intersections, under control of center personnel, based on data from sensors and surveillance monitoring traffic conditions, incidents, emergency vehicle preemptions, the passage of commercial vehicles with unusual loads, equipment faults, pedestrian crossings, etc.	Functional
		2. Oxnard field element shall collect, process, digitize, and send traffic sensor data (speed, volume, and occupancy) to the center for further analysis and storage, under center control.	Functional
		3. Oxnard field element shall detect traffic volumes, speeds and patterns to report back to the Oxnard TMC for use in coordination	Functional
		4. Oxnard field elements and continuously detect and report traffic within priority corridors to the Oxnard TMC	Functional
7. Share traffic data with other Oxnard departments using fiber:	Near-term	1. The Oxnard TMC shall have shared or dedicated fiber connections to other Oxnard governmental departments	User
		2. The Oxnard TMC shall have the capacity to exchange data at high-speeds via fiber with other Oxnard governmental departments. The speed shall be suitable for streaming multiple traffic camera feeds as well as other traffic data.	Performance
8. Share traffic data with neighboring agencies using Internet / VPN a. Caltrans b. VCTC c. Ventura County	 Long-term Long-term Near-term	1. The Oxnard TMC shall securely share transportation data with other regional agencies via the Internet using secure methods, such as Virtual Private Network (VPN)	Functional
		2. The Oxnard TMC shall distribute traffic data to maintenance and construction centers, transit centers, emergency management centers, and traveler information providers.	Functional

City of Oxnard – Traffic			
Need	**Priority**	**System Requirement**	**Type**
d. Port Hueneme	Near-term	3. The Oxnard TMC connection to other regional agencies shall be at data rates appropriate for sharing streaming traffic video, signal and system status and other transportation data.	Performance
9. Coordinate ITS deployments with VCTC – compliance with Regional ITS Architecture	Long-term	1. The Departments of Traffic and Maintenance shall coordinate with VCTC to ensure that Oxnard ITS development and deployment is consistent with the regional ITS architecture and strategic planning	User
10. Parking management a. Downtown area b. Oxnard Transit Center c. Beach area/Harbor	Long-term	1. The Oxnard parking element shall maintain parking lot information including static information such as hours of operation, rates, location, entrance locations, capacity, type, and constraints; as well as dynamic information such as current state of the lot, occupancy, arrival rates, and departure rates.	Functional
		2. The Oxnard parking element shall share information with the Oxnard TMC to identify queues at entrances, exits that should be used, and other information that supports coordinated local traffic control in and around the parking facility.	Functional
		3. The Oxnard parking element shall manage local dynamic message signs that display messages to travelers such as the parking lot state, number of spaces available, location of entrances, and current charges.	Functional
		4. The Oxnard parking element shall provide the capability to detect, count, and classify vehicles at entrances, exits, and designated locations within a parking facility.	Functional
		5. The Oxnard parking element shall exchange parking management data with other parking facilities including location, hours, availability, status, lot usage, operating strategies, and charging information.	Functional
		6. The Oxnard parking element shall provide parking management data to the Oxnard TMC upon request as part of the implementation of demand management programs in the region. This could include changes to hours of operation or pricing.	Functional

City of Oxnard – Traffic			
Need	**Priority**	**System Requirement**	**Type**
		7. The Oxnard parking element shall distribute parking lot information to the Oxnard TMC upon request to support integrated regional traffic control and parking management. This could include information on facility hours of operation and current parking availability.	Functional
		8. The Oxnard parking element shall distribute parking lot information upon request to transit management centers for park and ride facilities, parking shuttle services, and other applications that integrate transit and parking services.	Functional
		9. The Oxnard parking element shall distribute parking lot information upon request to traveler information providers to support travel planning.	Functional
		10. The Oxnard parking element shall support requests for parking reservations.	Functional
11. Deploy high-bandwidth communications a. Ethernet-based b. Coordinate with Oxnard IT (share conduit/shared or separate fiber)	Near-term	1. The Oxnard TMC shall securely share transportation data with other regional agencies via the Internet using secure methods, such as Virtual Private Network (VPN)	Functional
		2. The Oxnard TMC connection to other regional agencies shall be at data rates appropriate for sharing streaming traffic video, signal and system status and other transportation data.	Performance
		3. The Oxnard TMC shall have shared or dedicated fiber connections to other Oxnard governmental departments	User
		4. The Oxnard TMC shall have the capacity to exchange data at high-speeds via fiber with other Oxnard governmental departments. The speed shall be suitable for streaming multiple traffic camera feeds as well as other traffic data.	Performance
		5. The Oxnard TMC shall develop and deploy its communications within the City of Oxnard with the Information Technology Department	User
		6. The Oxnard TMC shall develop and deploy its communications with other governmental departments with the Information Technology Department	User
		7. Where feasible, the Oxnard TMC shall share existing and planned conduit for fiber optic used for data exchange	Performance

City of Oxnard – Traffic			
Need	**Priority**	**System Requirement**	**Type**
		8. The Oxnard TMC shall use both shared and dedicated fiber optic dependent upon analysis of needed bandwidth for data exchange	Performance
12. Deploy traveler information systems	Near-term	1. The Oxnard TMC shall disseminate traffic and highway condition information to travelers, including incident information, detours and road closures, event information, recommended routes, and current speeds on specific routes.	Functional
		2. The Oxnard TMC shall disseminate maintenance and construction information to travelers, including scheduled maintenance and construction work activities and work zone activities.	Functional
		3. The Oxnard TMC shall disseminate parking information to travelers, including location, availability, and fees.	Functional
		4. The Oxnard TMC shall disseminate weather information to travelers.	Functional
		5. The Oxnard TMC shall disseminate event information to travelers.	Functional
		6. The Oxnard TMC shall provide the capability to support requests from the media for traffic and incident data.	Functional
		7. The Oxnard TMC shall provide the capability for a system operator to control the type and update frequency of broadcast traveler information.	Functional
a. Portable DMS	Near-term	1. Oxnard portable dynamic messages signs shall be used for dissemination of traffic and other information to drivers, and be under Oxnard TMC or direct field access control; the DMS may be either those that display variable text messages, or those that have fixed format display(s) (e.g. vehicle restrictions, or lane open/close).	Functional
		2. Oxnard portable DMS shall be under the control of the Oxnard TMC unless under other access authorized by the TMC	Functional
		3. Oxnard portable DMS shall allow for direct field access and control via mobile device (e.g. laptop computer)	Functional

City of Oxnard – Traffic			
Need	**Priority**	**System Requirement**	**Type**
		4. Oxnard portable DMS shall report direct field access and control to the Oxnard TMC	Functional
		4. Oxnard portable DMS shall provide operational status to the Oxnard TMC	Functional
		5. Oxnard portable DMS shall provide fault data to the Oxnard TMC and maintenance for repair	Functional
		6. Oxnard portable DMS shall be on a mobile, self-contained platform that can be moved to different sites	Functional
		7. Oxnard portable DMS shall operate in Oxnard's range of environmental conditions including heat, cold, rain, high winds, freezing conditions and lightning strikes	Environmental
b. Permanent DMS (fixed location)	Long-term	1. Oxnard permanent dynamic messages signs shall be used for dissemination of traffic and other information to drivers, and be under Oxnard TMC or direct field access control; the DMS may be either those that display variable text messages, or those that have fixed format display(s) (e.g. vehicle restrictions, or lane open/close).	Functional
		2. Oxnard permanent DMS shall be under the control of the Oxnard TMC unless under other access authorized by the TMC	Functional
		3. Oxnard permanent DMS shall allow for direct field access and control via mobile device (e.g. laptop computer)	Functional
		4. Oxnard permanent DMS shall provide operational status to the Oxnard TMC	Functional
		5. Oxnard permanent DMS shall provide fault data to the Oxnard TMC and maintenance for repair	Functional
		6. Oxnard permanent DMS shall be located at the proper height and location over or near roadways to maximize visibility to oncoming traffic	Functional
		7. Oxnard permanent DMs shall operate in a range of environmental conditions including heat, cold, rain, high winds, freezing conditions and lightning strikes	Environmental
c. Traffic Website	Long-term	1. The web site shall receive traffic information from the Oxnard TMC and present it to the traveler.	Functional

City of Oxnard – Traffic			
Need	**Priority**	**System Requirement**	**Type**
		2. The web site shall receive event information from the Oxnard TMC and present it to the traveler.	Functional
		3. This web site shall receive evacuation information from the Oxnard TMC, emergency management or other regional agencies and present it to the traveler.	Functional
		4. The web site shall receive wide-area alerts from the Oxnard TMC, emergency management or other regional agencies and present it to the traveler.	Functional
		5. The web site shall support traveler input in manual form.	Functional
		6. The web site shall present information to the traveler in audible or visual forms consistent with a kiosk, including those that are suitable for travelers with hearing or vision physical disabilities.	Functional
		7. The web site shall be able to store frequently requested data.	Functional
		8. The web site shall link to, and be linked from, other regional governmental web sites (e.g. City of Oxnard, VCTC, Ventura County sites)	Functional
		9. Information presented on the web site shall be consistent with messages disseminated by other means from the Oxnard TMC, such as 511, cable TV, DMS and HAR	Performance
d. Cable TV broadcast	Long-term	1. The cable TV broadcast for travelers shall receive traffic information from the Oxnard TMC and present it to the traveler.	Functional
		2. The cable TV broadcast for travelers shall receive event information from the Oxnard TMC and present it to the traveler.	Functional
		3. This cable TV broadcast for travelers shall receive evacuation information from the Oxnard TMC and present it to the traveler.	Functional
		4. The cable TV broadcast for travelers shall receive wide-area alerts and present it to the traveler.	Functional
		5. The cable TV broadcast for travelers shall provide the capability for digitized map data from Oxnard GIS to act as the background to the information presented to the traveler.	Functional
		6. The cable TV broadcast shall be made available to the traveling public in the Oxnard region	Performance

City of Oxnard – Traffic			
Need	**Priority**	**System Requirement**	**Type**
		7. Information presented on the cable TV broadcast shall be consistent with information disseminated by other means from the Oxnard TMC, such as 511, DMS, Internet, and HAR	Performance
e. 511/RIITS interface	Long-term	1. The Oxnard TMC shall transmit traffic information to a 511 system/RIITS interface for travelers	Functional
		2. The Oxnard TMC shall transmit traffic information to a 511 system/RIITS interface for travelers	Functional
		3. The Oxnard TMC shall transmit event information to a 511 system/RIITS interface for travelers	Functional
		4. The Oxnard TMC shall transmit evacuation information to a 511 system/RIITS interface for travelers	Functional
		5. The Oxnard TMC shall transit information to a 511/RIITS that is consistent with information disseminated by other means, such as cable TV, DMS, Internet, and HAR	Performance
13. Access to Caltrans Traffic Cameras	Near-term	1. The Oxnard TMC shall have secure remote access to Caltrans traffic cameras	Functional
		2. The Oxnard TMC secure access shall be able to monitor and analyze images collected from Caltrans traffic cameras.	Functional
		3. The Oxnard TMC shall have access to the Caltrans traffic cameras via remote workstation at the discretion of Caltrans	Functional
		4. The Oxnard TMC shall have the capacity to receive traffic images data at high-speeds via fiber from Caltrans. The speed shall be suitable for streaming multiple traffic camera feeds.	Performance
14. Jointly deploy CCTV cameras at with Ventura County at County signalized intersections	Long-term	1. The Oxnard TMC shall be able to monitor and analyze images collected from jointly deployed (Oxnard and Ventura County) traffic cameras	Functional
		2. The Oxnard TMC shall be able to control the pan/tilt/zoom of jointly deployed (Oxnard and Ventura County) traffic cameras at priority intersections	Functional
		3. The jointly deployed (Oxnard and Ventura County) traffic cameras shall collect, process, and send traffic images to Ventura County and the Oxnard TMC for further analysis and distribution.	Functional

City of Oxnard – Traffic			
Need	**Priority**	**System Requirement**	**Type**
		4. The jointly deployed (Oxnard and Ventura County) traffic cameras shall send fault and status information to Ventura County and the Oxnard TMC	Functional
		5. The jointly deployed (Oxnard and Ventura County) traffic cameras shall meet industry standards for capturing legible images in a wide range of light conditions, including day and night	Performance
		6. The jointly deployed (Oxnard and Ventura County) traffic cameras shall operate in a range of environmental conditions including heat, cold, rain, high winds, freezing conditions and lightning strikes	Environmental
		7. The jointly deployed (Oxnard and Ventura County) traffic cameras shall be able to pan, tilt and zoom under remote control	Functional
		8. The jointly deployed (Oxnard and Ventura County) traffic cameras shall capture images continuously and process and digitize them at the roadside	Functional
		9. Oxnard Traffic and Maintenance shall have remote access to jointly deployed (Oxnard and Ventura County) traffic cameras	User
		10. Ventura County and the City of Oxnard shall establish an agreement to determine the maintenance and hierarchical control of the jointly deployed (Oxnard and Ventura County) traffic cameras	User
15. Transit signal priority / bus rapid transit	Long-term	1. The Oxnard field element shall respond to requests for indicator (e.g., signal) priority requests from transit vehicles at intersections, pedestrian crossings, and multimodal crossings.	Functional
		2. The Oxnard field element shall notify the Oxnard TMC and/or Caltrans that the signal timing has changed based on a signal preemption/priority request to help those centers determine whether a fault detected at the signal is a true malfunction or due to a signal override.	Functional
16. Jointly deploy CCTV cameras at City of Port Hueneme signalized intersections	Long-term	1. Oxnard TMC shall be able to monitor and analyze images collected from jointly deployed (Oxnard and Port Hueneme) traffic cameras	Functional

City of Oxnard – Traffic			
Need	**Priority**	**System Requirement**	**Type**
		2. Oxnard TMC shall be able to control the pan/tilt/zoom of jointly deployed (Oxnard and Port Hueneme) traffic cameras at priority intersections	Functional
		3. The jointly deployed (Oxnard and Port Hueneme) traffic cameras shall collect, process, and send traffic images to Port Hueneme and the Oxnard TMC for further analysis and distribution.	Functional
		4. The jointly deployed (Oxnard and Port Hueneme) traffic cameras shall send fault and status information to Port Hueneme and the Oxnard TMC	Functional
		5. The jointly deployed (Oxnard and Port Hueneme) traffic cameras shall meet industry standards for capturing legible images in a wide range of light conditions, including day and night	Performance
		6. The jointly deployed (Oxnard and Port Hueneme) traffic cameras shall operate in a range of environmental conditions including heat, cold, rain, high winds, freezing conditions and lightning strikes	Environmental
		7. The jointly deployed (Oxnard and Port Hueneme) traffic cameras shall be able to pan, tilt and zoom under remote control	Functional
		8. Traffic cameras shall capture images continuously and process and digitize them at the roadside	Functional
		9. Oxnard Traffic and Maintenance shall have remote access to jointly deployed (Oxnard and Port Hueneme) traffic cameras	Functional
		10. Port Hueneme and the City of Oxnard will establish an agreement to determine the maintenance and hierarchical control of the jointly deployed (Oxnard and Port Hueneme) traffic cameras	User
17. Receive traffic infrastructure database in GIS	Long-term	1. Oxnard Traffic and Maintenance shall provide information on planned and existing ITS field device descriptions and locations for incorporation into the traffic infrastructure database	User
18. Transition Caltrans signals along Oxnard Boulevard to City	Near-term	1. The City of Oxnard and Caltrans shall establish an agreement for control of the Oxnard Boulevard signals	User

City of Oxnard – Traffic			
Need	**Priority**	**System Requirement**	**Type**
control		2. The City of Oxnard shall connect to and integrate the Oxnard Boulevard signals into their control system with the support of Caltrans	User
19. Transition City signals along Rice Avenue to Caltrans control	Near-term	1. The City of Oxnard and Caltrans shall establish an agreement for control of the Rice Avenue signals	User
		2. The City of Oxnard shall support Caltrans as they connect to and integrate the Rice Avenue signals into their control system	User

2.2.2 Caltrans System Requirements

Table 2 lists the stated needs, their priorities and the associated system requirements for Caltrans (District 7) as relates to the Oxnard area. Caltrans owns or will own field devices, such as traffic signal controllers and traffic cameras. Caltrans' primary interest, as expressed in the needs, is to share data and device control with the City of Oxnard.

Table 1. Caltrans System Requirements

Caltrans			
Need	**Priority**	**System Requirement**	**Type**
1. Improved signal coordination with Oxnard signals	Near-term	1. Caltrans shall exchange traffic information with the Oxnard TMC including incident information, congestion data, traffic data, signal timing plans, and real-time signal control information.	Functional
		2. Caltrans shall exchange traffic control information with the Oxnard TMC to support remote monitoring and control of traffic management devices (e.g. signs, sensors, signals, cameras, etc.).	Functional
2. Receive video feeds from Oxnard CCTV cameras	Near-term	1. Caltrans shall have secure remote access to Oxnard traffic cameras	Functional
		2. Access to the traffic cameras via remote workstation shall be available at the discretion of the Oxnard TMC and its staff	User
		3. Caltrans remote access shall be able to monitor and analyze images collected from Oxnard traffic cameras under remote control of the Oxnard TMC	Functional
		4. Remote workstation access shall be able to control the pan/tilt/zoom of traffic cameras at priority intersections	Functional
		5. Caltrans shall be able to receive traffic images data at high-speeds via fiber from the Oxnard TMC. The speed shall be suitable for streaming multiple traffic camera feeds.	Performance
3. Deploy Caltrans CCTV cameras	Near-term	1. The Caltrans traffic cameras shall collect, process, digitize, and send traffic sensor data (speed, volume, and occupancy) to Caltrans for further analysis and storage, under center control.	Functional
		2. The Caltrans traffic cameras shall collect, process, and send traffic images to Caltrans for further analysis and distribution.	Functional

Caltrans			
Need	**Priority**	**System Requirement**	**Type**
		3. The Caltrans traffic cameras shall send fault and status information to Caltrans	Functional
		4.The Caltrans traffic cameras shall meet industry standards for capturing legible images in a wide range of light conditions, including day and night	Performance
		5. The Caltrans traffic cameras shall operate in a range of environmental conditions including heat, cold, rain, high winds, freezing conditions and lightning strikes	Environmental
		6. The Caltrans traffic cameras shall be able to pan, tilt and zoom under remote control	Functional
		7. The Caltrans traffic cameras shall capture images continuously and process and digitize them at the roadside	Functional
4. Transition Caltrans signals along Oxnard Boulevard to City control	Near-term	1. Caltrans and the City of Oxnard shall establish an agreement for control of the Oxnard Boulevard signals	User
		2. Caltrans shall support the City of Oxnard's as they connect to and integrate the Oxnard Boulevard signals into their control system	User
5. Transition City signals along Rice Avenue to Caltrans control	Near-term	1. Caltrans and the City of Oxnard shall establish an agreement for control of the Rice Avenue signals	User
		2. Caltrans shall connect to and integrate the Rice Avenue signals into their control system with the support of the City of Oxnard	User
6. Control Oxnard signal systems, CCTV, DMS, etc., during after hours operation	Near-term	1. Caltrans remote access to the Oxnard TMC shall allow users to view transportation systems including, but not limited to, traffic camera images, roadside and mobile device status, signal control, digital maps, weather and road condition information	Functional
		2. Caltrans remote access to the TMC shall have hierarchical limitations such that the level of access and control may be limited by the TMC and its staff	User
		3. Caltrans remote access to the Oxnard TMC shall allow the user to control Oxnard transportation management subsystems	Functional
		4. Caltrans remote access shall be able to collect traffic signal controller operational status and compare against the control information sent by the center.	Functional

Caltrans			
Need	**Priority**	**System Requirement**	**Type**
		5. Caltrans remote access shall be able to collect Oxnard traffic signal controller fault data from the field.	Functional
		6. Caltrans remote access shall be able to remotely control Oxnard dynamic messages signs for dissemination of traffic and other information to drivers.	Functional
		7. Caltrans remote access shall be able to collect operational status for the Oxnard driver information systems equipment	Functional
		8. Caltrans remote access shall be able to collect fault data for the Oxnard driver information systems equipment for repair.	Functional
		9. Caltrans remote access shall be able to retrieve locally stored Oxnard traffic information, including current and forecasted traffic information, road and weather conditions, traffic incident information, information on diversions and alternate routes, closures, and special traffic restrictions, etc.	Functional
		10. Caltrans remote access shall be able to provide the capability for the remote personnel to control the nature of the data that is available to non-traffic operations centers and the media.	Functional
		11. Security measures shall limit Caltrans remote access to the Oxnard TMC only to authorized personnel	Functional
7. Establish web-based interface with Oxnard TMC	Long-term	1. Caltrans remote access to the Oxnard TMC shall be through a web-based interface	Functional
		2. Caltrans shall have secure web-based access to the Oxnard TMC	Functional

2.2.3 City of Oxnard GIS

Table 3 lists the stated needs, their priority and the associated system requirements for the City of Oxnard's GIS department. The City of Oxnard will provide the map backgrounds for the Oxnard TMC and remote workstations, as well as maintain data about the location and types of field devices.

Table 3. City of Oxnard - Geographic Information Systems System Requirements

City of Oxnard - GIS			
Need	**Priority**	**System Requirement**	**Type**
1. Receive traffic infrastructure database in GIS	Long-term	1. Oxnard GIS shall incorporate new and modified ITS components in its database of traffic infrastructure on a regular basis to be determined by GIS, Traffic and CIP	Functional
		2. Oxnard GIS shall maintain a database of surveillance and sensors and the freeways, surface street and rural roadways, e.g. where they are located, to which part(s) of the network their data applies, the type of data, and the ownership of each link (that is, the agency or entity responsible for collecting and storing surveillance of the link) in the network.	Functional
2. Provide updated GIS maps to Traffic for use as GUI	Long-term	1. Oxnard GIS shall provide updated and correct GIS maps to serve as digital reference and display within the Oxnard TMC	Functional
		2. Oxnard GIS maps shall be in the correct coordinate system and level of detail for use by the TMC, web site, cable TV broadcast and remote workstations	Functional
		3. Oxnard GIS shall provide updated and correct GIS maps to Oxnard Capital Improvement Projects	Functional
		4. Oxnard GIS shall provide updated maps on a regular schedule determined by GIS, Traffic and CIP	User

2.2.4 City of Oxnard – Information Technology

Table 4 lists the stated needs, their priority and the associated system requirements for the City of Oxnard's Information Technology department. The Information Technology department will primarily be responsible for helping deploy and maintain the communications network used by the TMC and field devices.

Table 4. City of Oxnard – Information Technology System Requirements

City of Oxnard – Information Technology			
Need	**Priority**	**System Requirement**	**Type**
1. Responsible for maintenance of Ethernet communications network a. Involve IT in communications planning b. Lead operations and maintenance of communications system	Near-term	1. Oxnard IT shall be responsible for the maintenance and operations of communication networks for Oxnard ITS	User
		2. The Oxnard IT shall work with the TMC to plan, develop and deploy its communications within the City of Oxnard	User
		3. The Oxnard IT shall oversee, manage and maintain shared or dedicated fiber connections between the Oxnard TMC and Oxnard governmental departments	User
		4. The Oxnard IT Traffic and Maintenance departments shall develop a Memorandum of Understanding for the planning and development of ITS communications	User
		5. The Oxnard IT Traffic and Maintenance departments shall establish an operating agreement prior to deployment of new or modified communications for ITS	User
2. Shared communications infrastructure	Near-term	1. Where feasible, the Oxnard IT will identify and support the Oxnard TMC sharing existing and planned conduit for fiber optic used for data exchange	User
		2. The Oxnard IT shall use both shared and dedicated fiber optic strands dependent upon analysis of needed bandwidth for data exchange for Oxnard TMC data exchange	Functional

2.2.5 City of Oxnard – Police

Table 5 lists the stated needs, their priority and the associated system requirements for the City of Oxnard's Police department. The ITS plan calls for Oxnard Police to share control and access to their existing and planned cameras, and have access and control of the Oxnard traffic cameras.

Table 5. City of Oxnard – Police System Requirements

City of Oxnard – Police			
Need	**Priority**	**System Requirement**	**Type**
1. Access to City CCTV cameras: Near-term a. View and control all cameras b. Secondary user rights c. High-bandwidth communications to Oxnard TMC	Near-term	1. The Oxnard Police shall have secure remote access to Oxnard traffic cameras	User
		2. Access to the traffic cameras via remote workstation shall be available at the discretion of the Oxnard TMC and its staff	Functional
		3. Remote workstation access shall be able to monitor and analyze images collected from traffic cameras under remote control of the center.	Functional
		4. Remote workstation access shall be able to control the pan/tilt/zoom of traffic cameras at priority intersections	Functional
		5. Oxnard Police shall have shared or dedicated fiber connections to the Oxnard TMC	User
		6. The Oxnard Police shall have the capacity to receive data at high-speeds via fiber from the Oxnard TMC. The speed shall be suitable for streaming multiple traffic camera feeds.	Functional

2.2.6 City of Oxnard – Public Works Capital Improvement Projects

Table 6 lists the stated needs, their priority and the associated system requirements for the City of Oxnard Public Works Capital Improvement Projects department. Capital Improvement Projects will track projects and develop budgets, and will coordinate with Traffic on planning and implementing improvements.

Table 6. City of Oxnard – Public Works Capital Improvement Projects System Requirements

City of Oxnard – Capital Improvement Projects			
Need	**Priority**	**System Requirement**	**Type**
1. Receive traffic infrastructure database in GIS	Long-term	1. Oxnard CIP shall receive and use digital maps provided by Oxnard GIS	Functional
2. Provide updated GIS maps to Traffic for use as GUI	Long-term	1. Oxnard CIP shall provide updated inventory information to Oxnard GIS for inclusion in traffic infrastructure maps	Functional
		2. Oxnard CIP shall provide updates on a regular basis determined by CIP, GIS and Traffic	User

2.2.7 City of Oxnard – Public Works Maintenance

Table 7 lists the stated needs, their priority and the associated system requirements for the City of Oxnard Public Works Maintenance department. The maintenance department will be maintaining equipment that is deployed through the ITS Master Plan. That includes repairing devices such as signals, controllers, cameras and dynamic message signs.

Table 7. City of Oxnard – Public Works Maintenance System Requirements

City of Oxnard – Maintenance			
Need	**Priority**	**System Requirement**	**Type**
1. Remote access to traffic signal controllers	Near-term	1. Oxnard field devices shall be accessible and controllable via a secure direct connection from the field (e.g. laptop computer)	Functional
		2. Oxnard field devices shall report to the Oxnard TMC any changes in operational status resulting from field access.	Functional
		3. Oxnard field device access systems (e.g. laptops) shall have interfaces for monitoring and controlling Oxnard roadside devices	Functional
		4. Oxnard field device access systems (e.g. laptops) shall be able to connect to and control Oxnard traffic signal controllers at the controller location.	Functional
		5. Oxnard traffic cameras shall capture images continuously and process and digitize them at the roadside	Functional
		6. Oxnard field element shall collect, process, digitize, and send traffic sensor data (speed, volume, and occupancy) to the center for further analysis and storage, under center control.	Functional
		7. Oxnard field element shall detect traffic volumes, speeds and patterns to report back to the Oxnard TMC for use in coordination	Functional
		8. Oxnard field elements and continuously detect and report traffic within priority corridors to the Oxnard TMC	Functional
		9. The Oxnard TMC connection to other regional agencies shall be at data rates appropriate for sharing streaming traffic video, signal and system status and other transportation data.	Performance
2. Continuous system monitoring for maintenance	Long-term	1. The Oxnard TMC shall collect and store sensor fault data and send to the maintenance center for repair.	Functional
		2. The Oxnard TMC center shall collect and store signal and signal controller fault data and send to the maintenance center for repair	Functional

City of Oxnard – Maintenance			
Need	**Priority**	**System Requirement**	**Type**
		3. The Oxnard TMC and maintenance center shall collect and store CCTV surveillance system fault data send to the maintenance center for repair.	Functional
		4. The center shall exchange data with maintenance centers concerning the reporting of faulty equipment and the schedule/status of their repair. Information exchanged includes details of new equipment faults, and clearances when the faults are cleared.	Functional
		5. The Oxnard TMC shall continuously monitor roadside devices for fault data	Performance
		6. The Oxnard TMC shall automatically send roadside device fault data to the maintenance center	Functional
a. Email/pager alarms	Long-term	1. The Oxnard TMC shall automatically report roadside device faults to key maintenance staff via e-mail and or pager	Functional
		2. The Oxnard TMC shall report roadside device faults as soon as they are detected	Performance
		3. The Oxnard TMC shall allow center personnel to change contact information and establish contact information by a schedule for reporting roadside device fault data	Functional
b. Laptop access at field device	Long-term	1. Roadside devices shall be accessible and controllable via a secure direct connection from the field (e.g. laptop computer)	Functional
		2. Roadside devices shall report to the Oxnard TMC any changes in operational status resulting from field access.	Functional
		3. Field devices shall have interfaces for monitoring and controlling roadside devices	Functional
		3. The Oxnard TMC shall have access to the Caltrans traffic cameras via remote workstation at the discretion of Caltrans	Functional
		4. The Oxnard TMC shall have the capacity to receive traffic images data at high-speeds via fiber from Caltrans. The speed shall be suitable for streaming multiple traffic camera feeds.	Performance

2.2.8 City of Port Hueneme

Table 8 lists the stated needs, their priority and the associated system requirements for the City of Port Hueneme. Port Hueneme owns some traffic signals and may jointly deploy traffic cameras with the City of Oxnard.

Table 8. City of Port Hueneme System Requirements

City of Port Hueneme			
Need	**Priority**	**System Requirement**	**Type**
1. Improved signal coordination with Oxnard signals a. Implement coordination / communications at Hueneme Road / Ventura Rd. b. Implement coordination / communications at Hueneme Road / S. Surfside Dr.	Near Term	1. Port Hueneme shall exchange traffic information with the Oxnard TMC including incident information, congestion data, traffic data, signal timing plans, and real-time signal control information.	Functional
		2. Port Hueneme shall exchange traffic control information with the Oxnard TMC to support remote monitoring and control of traffic management devices (e.g. signs, sensors, signals, cameras, etc.).	Functional
2. Receive video feeds from Oxnard CCTV cameras a. Monitor traffic conditions at Port Hueneme base b. Monitor truck traffic	Near-term	1. Port Hueneme shall have secure remote access to Oxnard traffic cameras	Functional
		2. Port Hueneme access to the Oxnard traffic cameras via remote workstation shall be available at the discretion of the Oxnard TMC and its staff	User
		3. Port Hueneme remote access shall be able to monitor and analyze images collected from Oxnard traffic cameras under remote control of the center.	Functional
		4. Port Hueneme remote access shall be able to control the pan/tilt/zoom of Oxnard traffic cameras at selected intersections	Functional

City of Port Hueneme			
Need	**Priority**	**System Requirement**	**Type**
		5. Port Hueneme shall be able to receive Oxnard traffic images data at high-speeds via fiber from the Oxnard TMC. The speed shall be suitable for streaming multiple traffic camera feeds.	Performance
3. Jointly deploy CCTV cameras at City of Port Hueneme signalized intersections	Long-term	1. Port Hueneme shall be able to monitor and analyze images collected from jointly deployed (Oxnard and Port Hueneme) traffic cameras	Functional
		2. Port Hueneme shall be able to control the pan/tilt/zoom of jointly deployed (Oxnard and Port Hueneme) traffic cameras at priority intersections	Functional
		3. The jointly deployed (Oxnard and Port Hueneme) traffic cameras shall collect, process, and send traffic images to Port Hueneme and the Oxnard TMC for further analysis and distribution.	Functional
		4. The jointly deployed (Oxnard and Port Hueneme) traffic cameras shall send fault and status information to Port Hueneme and the Oxnard TMC	Functional
		5. The jointly deployed (Oxnard and Port Hueneme) traffic cameras shall meet industry standards for capturing legible images in a wide range of light conditions, including day and night	Performance
		6. The jointly deployed (Oxnard and Port Hueneme) traffic cameras shall operate in a range of environmental conditions including heat, cold, rain, high-winds, freezing conditions and lightning strikes	Environmental
		7. The jointly deployed (Oxnard and Port Hueneme) traffic cameras shall be able to pan, tilt and zoom under remote control	Functional
		8. Traffic cameras shall capture images continuously and process and digitize them at the roadside	Functional
		9. Port Hueneme shall have remote access to jointly deployed (Oxnard and Port Hueneme) traffic cameras	Functional

City of Port Hueneme			
Need	**Priority**	**System Requirement**	**Type**
		10. Port Hueneme and the City of Oxnard will establish an agreement to determine the maintenance and hierarchical control of the jointly deployed (Oxnard and Port Hueneme) traffic cameras	User
4. Establish web-based interface with Oxnard TMC	Long-term	1. Port Hueneme remote access to the Oxnard TMC shall be through a web-based interface	Functional
		2. Port Hueneme shall have secure remote access to the Oxnard TMC	Functional
		3. Port Hueneme remote access to the Oxnard TMC shall have hierarchical limitations such that the level of access and control may be limited by the TMC and its staff	User

2.2.9 Gold Coast Transit

Table 9 lists the stated needs, their priority and the associated system requirements for Gold Coast Transit. Gold Coast transit plans to deploy transit signal priority. They also have an active interest in improving traffic flow in key corridors.

Table 9. Gold Coast Transit System Requirements

Gold Coast Transit			
Need	**Priority**	**System Requirement**	**Type**
1. Improved signal coordination	Near-term	1. The Oxnard TMC shall exchange traffic information with other traffic management centers including incident information, congestion data, traffic data, signal timing plans, and real-time signal control information.	Functional
		2. The Oxnard TMC shall exchange traffic control information with other traffic management centers to support remote monitoring and control of traffic management devices (e.g. signs, sensors, signals, cameras, etc.).	Functional
		3. The Oxnard TMC shall implement control plans to coordinate priority signalized intersections, under control of center personnel, based on data from sensors and surveillance monitoring traffic conditions, incidents, emergency vehicle preemptions, the passage of commercial vehicles with unusual loads, equipment faults, pedestrian crossings, etc.	Functional
		4. The Oxnard field element shall collect, process, digitize, and send traffic sensor data (speed, volume, and occupancy) to the center for further analysis and storage, under center control.	Functional
		5. The Oxnard field element shall detect traffic volumes, speeds and patterns to report back to the TMC for use in coordination	Functional
		6. Oxnard field elements and continuously detect and report traffic within priority corridors to the TMC	Functional
2. Transit signal priority / bus rapid transit	Long-term	1. The Gold Coast Transit vehicle shall determine the schedule deviation and estimated times of arrival (ETA) at transit stops.	Functional
		2. The Gold Coast Transit vehicle shall send priority requests to Oxnard traffic signal controllers at intersections that enable a transit vehicle schedule deviation to be corrected.	Functional
		3. The Gold Coast Transit vehicle shall send the schedule deviation data and status of priority requests to Gold Coast Transit	Functional

2.2.10 Gold Coast Transit

Table 10 lists the stated needs, their priority and the associated system requirements for Ventura County. Ventura County owns traffic signals and controllers in the Oxnard Region and may jointly deploy traffic cameras with the City of Oxnard.

Table 10. Ventura County System Requirements

Ventura County			
Need	**Priority**	**System Requirement**	**Type**
1. Improved signal coordination with Oxnard signals a. Implement coordination / communications at N Rose Avenue / Walnut Dr. b. Implement coordination / communications at N Rose Avenue / Central Avenue c. Implement coordination at Santa Clara Ave. / Friedrich d. Implement coordination / communications at Santa Clara Ave. / Central Ave. e. Implement coordination / communications at Victoria Ave. / Doris Ave. f. Implement coordination / communications at Rice Ave. / Wooley Rd. g. Implement coordination / communications at Rice Ave. / Channel Islands Blvd.	Near-term	1. Ventura County shall exchange traffic information with the Oxnard TMC including incident information, congestion data, traffic data, signal timing plans, and real-time signal control information.	Functional
		2. Ventura County shall exchange traffic control information with the Oxnard TMC to support remote monitoring and control of traffic management devices (e.g. signs, sensors, signals, cameras, etc.).	Functional
		3. Ventura County shall establish an operations agreement with the City of Oxnard that defines signal coordination and control between the entities	User
2. Receive video feeds from Oxnard CCTV cameras	Near-term	1. Ventura County shall have secure remote access to Oxnard traffic cameras	Functional
		2. Ventura County shall be able to monitor and analyze images collected from jointly Oxnard traffic cameras	Functional

Ventura County			
Need	**Priority**	**System Requirement**	**Type**
		3. Ventura County shall have the capacity to exchange data at high-speeds with the Oxnard TMC. The speed shall be suitable for streaming multiple traffic camera feeds.	Performance
3. Jointly deploy CCTV cameras at County signalized intersections	Long-term	1. Ventura County shall be able to monitor and analyze images collected from jointly deployed (Oxnard and Ventura County) traffic cameras	Functional
		2. Ventura County shall be able to control the pan/tilt/zoom of jointly deployed (Oxnard and Ventura County) traffic cameras at priority intersections	Functional
		3. The jointly deployed (Oxnard and Ventura County) traffic cameras shall collect, process, and send traffic images to Ventura County and the Oxnard TMC for further analysis and distribution.	Functional
		4. The jointly deployed (Oxnard and Ventura County) traffic cameras shall send fault and status information to Ventura County and the Oxnard TMC	Functional
		5. The jointly deployed (Oxnard and Ventura County) traffic cameras shall meet industry standards for capturing legible images in a wide range of light conditions, including day and night	Performance
		6. The jointly deployed (Oxnard and Ventura County) traffic cameras shall operate in a range of environmental conditions including heat, cold, rain, high winds, freezing conditions and lightning strikes	Environmental
		7. The jointly deployed (Oxnard and Ventura County) traffic cameras shall be able to pan, tilt and zoom under remote control	Functional
		8. The jointly deployed (Oxnard and Ventura County) traffic cameras shall capture images continuously and process and digitize them at the roadside	Functional
		9. Ventura County shall have remote access to jointly deployed (Oxnard and Ventura County) traffic cameras	Functional

Ventura County			
Need	**Priority**	**System Requirement**	**Type**
		10. Ventura County and the City of Oxnard shall establish an agreement to determine the maintenance and hierarchical control of the jointly deployed (Oxnard and Ventura County) traffic cameras	User
4. Establish web-based interface with Oxnard TMC	Long-term	1. Ventura County remote access to the Oxnard TMC shall be through a web-based interface	Functional
		2. Ventura County shall have secure remote access to the Oxnard TMC	Functional
		3. Ventura County remote access to the TMC shall have hierarchical limitations such that the level of access and control may be limited by the TMC and its staff	User

2.2.11 Gold Coast Transit

Table 11 lists the stated needs, their priority and the associated system requirements for Ventura County Transportation Commission. VCTC coordinates and plans transportation projects in the region and has a need to know when and how ITS is deployed in the Oxnard region.

Table 11. Ventura County Transportation Commission System Requirements

Ventura County Transportation Commission			
Need	**Priority**	**System Requirement**	**Type**
1. Facilitate interface of Oxnard ITS into regional system via Caltrans District 7 or RIITS a. Web-based application b. Memorandum of Understanding	Near-term	1. The VCTC shall support and facilitate the interface of the Oxnard ITS and regional 511/RIITS for travelers to ensure that Oxnard traveler information is incorporated and properly included in the systems	User
		2. The VCTC shall accept submissions for ITS architecture modifications via a web-browser based form	User
		3. The VCTC and Oxnard Traffic and Maintenance Departments shall develop a formal agreement to define the frequency and types of ITS information submitted to the architecture process	User
2. Receive input from Oxnard for updates to Regional ITS Architecture	Near-term	1. VCTC shall coordinate with the Oxnard Departments of Traffic and Maintenance ensure that Oxnard ITS development and deployment is consistent with the regional ITS architecture and strategic planning	User
		2. The VCTC shall work with Oxnard Traffic and Maintenance to establish a process for identifying and incorporating regional ITS changes into the architecture and strategic planning	User

3.0 VERIFICATION PLAN

The Verification Plan is a tool used by the stakeholders to ensure that the system meets the requirements identified in **Section 2**. The Plan establishes guidelines for measuring system's effectiveness. In the traceability matrix, the measures are mapped to each system requirement, similar to the process of mapping requirements to needs. The end result allows a user to trace performance measures to needs, not only by the requirements, but by the actual functions, performance and abilities of the system.

The plan identifies and/or defines:

- How the requirements will be tested within the system and sub-systems
- Who will perform the testing and where the test will be performed
- What system elements are involved in performing the test.

Two other elements of a typical Verification Plan are not included here. They are, one, a description of how the subsystems should be configured and interacting for the verification tests, and two, a next step for the tester if a subsystem or element fails the test. These elements are very dependent upon the technologies selected and their specifications. They will be more effectively developed by the stakeholders and the system implementer in a detailed acceptance testing plan.

3.1 Verification Plan Process

Because the system requirements were developed as testable and verifiable, the Verification Plan can be traced directly to them. The first step in developing the Plan is to create a strategy for developing and performing the verification tests. For Oxnard, the Verification Plan strategy is to create simple, low-impact and low-cost testing. Low-impact means that the requirements can be verified with little to no disruption of operations, and with a minimum of additional effort by stakeholder staff. Low-cost means the tests require little to no cost in terms of actual cash or in-kind contribution by stakeholders.

As previously mentioned, the Verification Plan described in this document is defined at a high-level. The functional details are highly dependent upon the final design, implementation and technologies used to achieve the requirements. For example, a traffic camera subsystem using wireless communications may have different performance requirements than one using multiple fiber-optic strands. The system implementer and the stakeholders should use the Verification Plan to guide them in establishing acceptance and performance tests based on the system to be deployed.

The Plan assumes that many existing systems have already been verified by their owners. The Plan does not verify communications outside of this ITS Master Plan, or

the functionality or performance of existing systems, except as they affect the elements of the ITS Master Plan. For example, the functionality of existing traffic controllers that are known to work will not be verified. However, the interaction of that same controller with the TMC and other ITS elements will be verified.

It should also be noted that the level of detail in the tests may be dependent upon the system's level of customization. A system developed from commercial-off-the-shelf (COTS) components may have a lower burden of proof of operability than a system customized for a local stakeholder. Many COTS elements may have a proven track record and qualifications from other deployments that can be used to verify some of the requirements. A customized system will not have similar qualifications and will have to verify the requirements in their entirety.

3.2 Verification Plan Output

The output of the Verification process is:

- The Plan which documents the types of tests needed for verifying system and subsystem requirements. This output is included in this section.
- Verification Procedures document each type of test. This output is developed after system design by the stakeholders and the implementer.
- Verification Reports document the results of the testing. This output cannot be generated until a testable system is deployed.
- Verified systems and subsystems that perform their functions and can be operated and integrated with other elements.

Where the System Requirements are organized by stakeholder, the Verification Plan is organized by system element. This is because the verification tests will likely be conducted on an element-by-element basis. However, the traceability matrix identifies both the stakeholder responsible for testing and the element or elements where the test will take place.

3.3 Verification Plan Summary

The following section provides the high-level Verification Plan for the Oxnard ITS. Unlike system requirements, the Plan is categorized by ITS elements. For each test, the testing stakeholders are identified, as are all other ITS elements needed for the test.

The Oxnard ITS elements included in the Verification Plan are:

- City of Oxnard TMC
- City of Oxnard field devices (e.g. traffic signal controllers, cameras, traffic detection, dynamic message signs)
- City of Oxnard remote access devices
- City of Oxnard Police remote workstation
- City of Oxnard Police cameras
- City of Oxnard GIS database
- Caltrans District 7 TMC
- Caltrans field devices
- Gold Coast Transit management center
- Gold Coast Transit vehicles
- Port Hueneme remote workstation
- Port Hueneme field devices
- Ventura County remote workstation
- Ventura County field devices

3.3.1 City of Oxnard TMC

Table 12 shows the verification planned for the Oxnard TMC. The Oxnard TMC will be located at City Hall and be used as the operations center for monitoring and controlling traffic. It will also serve as the hub for traffic data for the City of Oxnard, and communicate with other agencies in the region.

Table 12. City of Oxnard TMC Verification Summary

Test to Verify	Participating Stakeholders	Involved Elements
1. Secure access to the TMC, both physical access to the facility and remote access to the systems	Oxnard Traffic	Oxnard TMC
2. Adequate ventilation and environmental protection for system hardware at the TMC	Oxnard Traffic	Oxnard TMC
3. Adequate space, equipment and hardware for operating the TMC	Oxnard Traffic	Oxnard TMC
4. Access and control of City of Oxnard field devices, including cameras, signals, dynamic message signs and traffic detectors	Oxnard Traffic	Oxnard TMC, Oxnard field devices
5. Access and control of other agencies' field devices, including cameras and signals	Oxnard Traffic, Other agencies	Oxnard TMC, Other agencies' field devices
6. Display of signal controller operations, status and fault	Oxnard Traffic, Other agencies	Oxnard TMC, Oxnard field devices, Other agencies' field devices
7. Display of camera images, status and fault	Oxnard Traffic, other agencies	Oxnard TMC, Oxnard field devices, Other agencies' field devices
8. Display of dynamic message sign information, status and fault	Oxnard Traffic	Oxnard TMC, Oxnard field devices
9. Display, collection and local storage of traffic data, including traffic sensor	Oxnard Traffic	Oxnard TMC
10. Access and control of traffic signal timing plans	Oxnard Traffic	Oxnard TMC, Oxnard field devices, Other agencies' field devices
11. Coordinate signals within corridors, including Channel Islands Blvd., Fifth Street, Gonzalez Ave., Oxnard Blvd., Rose Ave., Ventura Road and Victoria	Oxnard Traffic	Oxnard TMC, Oxnard field devices, Other agencies' field devices
12. Management of access by remote workstations	Oxnard Traffic, Oxnard Police, Oxnard Maintenance, Caltrans, Port Hueneme, Ventura County	Oxnard TMC, remote workstations

Test to Verify	Participating Stakeholders	Involved Elements
13. Secure data exchange with remote workstations, including City of Oxnard Public Works Maintenance, City of Oxnard Police, Caltrans, Port Hueneme and Ventura County	Oxnard Traffic, Oxnard Police, Oxnard Maintenance, Caltrans, Port Hueneme, Ventura County	Oxnard TMC, remote workstations
14. Exchange of traveler information with traveler information systems such as RIITS and 511 and other regional traffic operations centers	Oxnard Traffic, Caltrans, other agencies	Oxnard TMC, Caltrans RIITS, other regional traffic operations centers
15. Transmit traveler information to the media	Oxnard Traffic	Oxnard TMC
16. Transmit traveler information to the public	Oxnard Traffic	Oxnard TMC
17. Exchange data using National ITS Architecture standards for data format and protocol	Oxnard Traffic	Oxnard TMC
18. Display and control parking management information	Oxnard Traffic	Oxnard TMC, Oxnard field devices
19. Display of status and control of transit signal priority	Oxnard Traffic, Gold Coast Transit	Oxnard TMC, Oxnard field devices, Gold Coast Transit Vehicles
20. Field device fault alert to mobile devices	Oxnard Traffic, Oxnard Maintenance	Oxnard TMC, Oxnard field devices, Oxnard Maintenance mobile devices
21. Performance of the TMC	Oxnard Traffic	Oxnard TMC
22. Performance of communications between the TMC and remote workstations	Oxnard Traffic, other agencies	Oxnard TMC, remote workstations
23. Performance of communications between the TMC and field devices	Oxnard Traffic, other agencies	Oxnard TMC, Oxnard field devices, other agencies' field devices

3.3.2 City of Oxnard Field Devices

Table 13 summarizes the verification planned for City of Oxnard field devices. Field devices may include traffic signal controllers, traffic cameras, dynamic message signs and vehicle detection systems.

Table 13. City of Oxnard Field Devices Verification Summary

Test to Verify	Participating Stakeholders	Involved Elements
1. Access and control of the Oxnard field devices from field access devices (e.g. laptops)	Oxnard Traffic	Oxnard TMC, Oxnard field devices, Oxnard remote access devices
2. Data exchange between field devices and the remote access devices	Oxnard Traffic	Oxnard field devices, Oxnard remote access devices
3. Access and control of Oxnard field devices from the TMC	Oxnard Traffic	Oxnard TMC, Oxnard field devices
4. Data exchange between field devices and the TMC	Oxnard Traffic	Oxnard TMC, Oxnard field devices
5. Data exchange between field devices and other agencies	Oxnard Traffic and other agencies	Oxnard field devices, remote workstations, Caltrans District 7 TMC
6. Access and control of cameras by other agencies	Oxnard Traffic and other agencies	Oxnard TMC, Oxnard field devices, remote workstations
7. Access and control of dynamic message signs by Caltrans	Oxnard Traffic and Caltrans	Oxnard TMC, Oxnard DMS, Caltrans District 7 TMC
8. Quality and timeliness of data from sensors, cameras and controllers	Oxnard Traffic	Oxnard TMC, Oxnard field devices
9. Reception of, and response to, signals from transit vehicles for transit signal priority	Oxnard Traffic, Gold Coast Transit	Oxnard field devices, Gold Coast Transit vehicles
10. Performance of field devices	Oxnard Traffic	Oxnard field devices
11. Performance of signal reception from transit vehicles	Oxnard Traffic, Gold Coast Transit	Oxnard field devices, Gold Coast Transit vehicles

3.3.3 City of Oxnard Remote Access Devices

Table 14 summarizes the verification planned for the City of Oxnard remote access devices. The remote access devices will be laptop computers, or similar, equipped to communicate and control field devices, such as traffic signal controllers, traffic cameras, dynamic message signs and vehicle detection systems.

Table 14. City of Oxnard Remote Access Devices Verification Summary

Test to Verify	Participating Stakeholders	Involved Elements
1. Access and control of the Oxnard field devices	Oxnard Traffic	Oxnard TMC, Oxnard remote access devices, Oxnard field devices
2. Data exchange between field devices and remote access devices	Oxnard Traffic	Oxnard remote access devices, Oxnard field devices
3. Quality and timeliness of data from sensors, cameras and controllers to the remote access device	Oxnard Traffic	Oxnard remote access devices, Oxnard field devices
4. Performance of remote access devices	Oxnard Traffic	Oxnard remote access devices

3.3.4 City of Oxnard Police Remote Workstation

Table 15 summarizes the verification planned for the City of Oxnard Police remote workstation. The remote workstation will provide the Oxnard Police with access to, and control of, the City's traffic cameras.

Table 15. City of Oxnard Police Remote Workstation Verification Summary

Test to Verify	Participating Stakeholders	Involved Elements
1. Access and control of the Oxnard traffic cameras	Oxnard Police, Oxnard Traffic	Oxnard Police remote workstation, Oxnard field devices
2. Quality and timeliness of Oxnard traffic camera images	Oxnard Police, Oxnard Traffic	Oxnard Police remote workstation, Oxnard field devices
3. Data exchange between Police remote workstation and Oxnard traffic cameras	Oxnard Police, Oxnard Traffic	Oxnard Police remote workstation, Oxnard field devices
4. Data exchange between Police remote workstation and Oxnard TMC	Oxnard Police, Oxnard Traffic	Oxnard Police remote workstation, Oxnard TMC
5. Performance of remote workstation	Oxnard Police	Oxnard Police remote workstation
6. Performance of communications between the Police remote workstation and Oxnard traffic cameras	Oxnard Police, Oxnard Traffic	Oxnard Police remote workstation, Oxnard field devices
7. Performance of communications between the Police remote workstation and Oxnard TMC	Oxnard Police, Oxnard Traffic	Oxnard Police remote workstation, Oxnard TMC

3.3.5 City of Oxnard Police Cameras

Table 16 summarizes the verification planned for the City of Oxnard Police cameras. Existing and future cameras will be owned and operated by the Oxnard Police, but with access and control by the Oxnard TMC. The arrangement will be similar to how the Oxnard Police will have access and control of traffic cameras.

Table 16. City of Oxnard Police Cameras Verification Summary

Test to Verify	Participating Stakeholders	Involved Elements
1. Access and control by the Oxnard TMC	Oxnard Police, Oxnard Police	Oxnard police cameras, Oxnard TMC
2. Data exchange between police cameras and the TMC	Oxnard Police, Oxnard Traffic	Oxnard police cameras, Oxnard TMC
3. Performance of communications between the police cameras and the TMC	Oxnard Police, Oxnard Traffic	Oxnard police cameras , Oxnard TMC

3.3.6 City of Oxnard GIS Database

Table 17 summarizes the verification planned for the City of Oxnard GIS database. The database will provide the graphical map background for the TMC and remote workstation displays.

Table 17. City of Oxnard GIS Database Verification Summary

Test to Verify	Participating Stakeholders	Involved Elements
1. Data exchange with the Oxnard TMC	Oxnard GIS, Oxnard Traffic	Oxnard GIS, Oxnard TMC
2. Quality of GIS data	Oxnard GIS	Oxnard GIS
3. Timeliness of updates to the GIS database	Oxnard GIS	Oxnard GIS

3.3.7 Caltrans District 7 TMC

Table 18 summarizes the verification planned for the City of Oxnard GIS database. The Caltrans TMC may be a virtual operation that operates on a desktop or laptop computer. The ITS Master Plan identifies many potential applications and data exchanges it may have in the Oxnard region.

Table 18. Caltrans District 7 Verification Summary

Test to Verify	Participating Stakeholders	Involved Elements
1. Access and control of Caltrans field devices, including cameras, signals, dynamic message signs and traffic detectors	Caltrans	Caltrans District 7 TMC, Caltrans field devices
2. Access and control of Oxnard field devices, including cameras and signals	Caltrans, Oxnard Traffic,	Caltrans District 7 TMC, Oxnard field devices
3. Access and data exchange with the Oxnard TMC	Caltrans, Oxnard Traffic	Caltrans District 7 TMC, Oxnard TMC
4. Display of signal controller operations, status and fault	Caltrans	Caltrans District 7 TMC
5. Display of camera images, status and fault	Caltrans	Caltrans District 7 TMC, Caltrans field devices
6. Display, collection and local storage of traffic data, including traffic sensor	Caltrans	Caltrans District 7 TMC
7. Access and control of traffic signal timing plans	Caltrans, Oxnard Traffic	Caltrans District 7 TMC, Oxnard TMC
8. Performance of the TMC	Oxnard Traffic	Oxnard TMC
9. Performance of communications between the District 7 TMC and the Oxnard TMC	Caltrans, Oxnard Traffic	Caltrans District 7 TMC, Oxnard TMC
10. Performance of communications between the District 7 TMC and Caltrans field devices	Caltrans	Caltrans District 7 TMC, Caltrans field devices
11. Performance of communications between the District 7 TMC and Oxnard field devices	Caltrans, Oxnard Traffic	Caltrans District 7 TMC, Oxnard field devices

3.3.8 Caltrans Field Devices

Table 19 summarizes the verification planned for the Caltrans Field Devices. Caltrans owns some traffic signal controllers in the Oxnard region, and also may deploy cameras.

Table 19. Caltrans Field Devices Verification Summary

Test to Verify	Participating Stakeholders	Involved Elements
1. Data exchange between the Caltrans field devices and the Caltrans District 7 TMC	Caltrans	Caltrans Field Devices, Caltrans District 7 TMC
2. Data exchange between the Caltrans field devices and the Oxnard TMC	Caltrans, Oxnard Traffic	Caltrans field devices, Oxnard TMC
3. Access and control of Caltrans field devices from the Caltrans District 7 TMC	Caltrans	Caltrans Field Devices, Caltrans District 7 TMC
4. Access and control of the Caltrans field devices from the Oxnard TMC	Caltrans, Oxnard Traffic	Caltrans field devices, Oxnard TMC
5. Quality and timeliness of data from sensors, cameras and controllers	Caltrans	Caltrans Field Devices
6. Performance of the communications between the Caltrans field devices and the Oxnard TMC	Caltrans, Oxnard Traffic	Caltrans field devices, Oxnard TMC
7. Performance of field devices	Caltrans	Caltrans field devices

3.3.9 Gold Coast Transit Management Center

Table 20 summarizes the verification planned for the Gold Coast Transit management center. The transit management center provides control and monitoring of transit operations. It also enacts scheduling and collects data for planning and reporting.

Table 20. Gold Coast Transit Management Center Verification Summary

Test to Verify	Participating Stakeholders	Involved Elements
1. Data exchange with the Oxnard TMC	Gold Coast Transit, Oxnard Traffic	Gold Coast Transit management center, Oxnard TMC
2. Data exchange with Gold Coast Transit vehicles	Gold Coast Transit	Gold Coast Transit management center, Gold Coast Transit vehicles
3. Quality of data exchanged between transit management center and vehicles	Gold Coast Transit	Gold Coast Transit management center, Gold Coast Transit vehicles
4. Performance of communications between transit management center and vehicles	Gold Coast Transit	Gold Coast Transit management center, Gold Coast Transit vehicles
5. Performance of communications between transit management center and Oxnard TMC	Gold Coast Transit, Oxnard Traffic	Transit management center, Oxnard TMC

3.3.10 Gold Coast Transit Management Center

Table 21 summarizes the verification planned for the Gold Coast Transit vehicles. The transit vehicles will exchange data with the transit management center and also communicate with traffic signals to receive signal priority.

Table 21. Gold Coast Transit Vehicles Verification Summary

Test to Verify	Participating Stakeholders	Involved Elements
1. Data exchange with Gold Coast Transit management center	Gold Coast Transit	Gold Coast Transit management center, Gold Coast Transit vehicles
2. Quality of data exchanged between vehicles and Gold Coast Transit management center	Gold Coast Transit	Gold Coast Transit management center, Gold Coast Transit vehicles
3. Performance of communications between vehicles and Gold Coast Transit management center	Gold Coast Transit	Gold Coast Transit management center, Gold Coast Transit vehicles
4. Signal transmission from vehicles to Oxnard traffic signals	Gold Coast Transit	Gold Coast Transit management center, Gold Coast Transit vehicles
5. Performance of vehicles in transmitting signals to traffic signals	Gold Coast Transit, Oxnard Traffic	Gold Coast Transit vehicles, Oxnard field devices

3.3.11 City of Port Hueneme Remote Workstation

Table 22 summarizes the verification planned for the City of Oxnard Police remote workstation. The remote workstation will provide Port Hueneme with access to, and control of, the City's traffic cameras, and access to the status of the traffic signals under the control of the Oxnard TMC.

Table 22. City of Port Hueneme Remote Workstation Verification Summary

Test to Verify	Participating Stakeholders	Involved Elements
1. Access and control of the jointly deployed traffic cameras	Port Hueneme, Oxnard Traffic	Port Hueneme remote workstation, jointly deployed field devices
2. Quality and timeliness of jointly deployed traffic camera images	Port Hueneme, Oxnard Traffic	Port Hueneme remote workstation, jointly deployed field devices
3. Data exchange between Port Hueneme remote workstation and jointly deployed traffic cameras	Port Hueneme, Oxnard Traffic	Port Hueneme remote workstation, jointly deployed field devices
4. Data exchange between Port Hueneme remote workstation and Oxnard TMC	Port Hueneme, Oxnard Traffic	Port Hueneme remote workstation, Oxnard TMC
5. Performance of Port Hueneme remote workstation	Port Hueneme	Port Hueneme remote workstation
6. Performance of communications between the Port Hueneme remote workstation and jointly deployed traffic cameras	Port Hueneme, Oxnard Traffic	Port Hueneme remote workstation, jointly deployed field devices
7. Performance of communications between the Port Hueneme remote workstation and Oxnard TMC	Port Hueneme, Oxnard Traffic	Port Hueneme remote workstation, Oxnard TMC

3.3.12 City of Port Hueneme Field Devices

Table 23 summarizes the verification planned for the Port Hueneme Field Devices. Port Hueneme owns some traffic signal controllers in the Oxnard region, and also may jointly deploy traffic cameras.

Table 23. Port Hueneme Field Devices Verification Summary

Test to Verify	Participating Stakeholders	Involved Elements
1. Data exchange between the Port Hueneme and jointly deployed field devices and the Port Hueneme remote workstation	Port Hueneme	Port Hueneme and jointly deployed field devices, Port Hueneme remote workstation
2. Data exchange between the Port Hueneme and jointly deployed field devices and the Oxnard TMC	Port Hueneme, Oxnard Traffic	Port Hueneme and jointly deployed field devices, Oxnard TMC
3. Access and control of Port Hueneme and jointly deployed field devices (i.e. jointly deployed cameras) from the Port Hueneme remote workstation	Port Hueneme	Port Hueneme and jointly deployed field devices, Port Hueneme remote workstation
4. Access and control of Port Hueneme and jointly deployed field devices from the Oxnard TMC	Port Hueneme, Oxnard Traffic	Port Hueneme and jointly deployed field devices, Oxnard TMC
5. Quality and timeliness of data from sensors, cameras and controllers	Port Hueneme	Port Hueneme and jointly deployed field devices
6. Performance of field devices	Port Hueneme	Port Hueneme field devices
7. Performance of the communications with the Port Hueneme remote workstation	Port Hueneme, Oxnard Traffic	Port Hueneme and jointly deployed field devices, Port Hueneme remote workstation
8. Performance of the communications between the Port Hueneme and jointly deployed field devices and the Oxnard TMC	Port Hueneme, Oxnard Traffic	Port Hueneme and jointly deployed field devices, Oxnard TMC

3.3.13 Ventura County Remote Workstation

Table 24 summarizes the verification planned for the Ventura County remote workstation. The remote workstation is planned for the long-term to monitor jointly-deployed traffic cameras and have remote access to the Oxnard TMC.

Table 24. Ventura County Remote Workstation Verification Summary

Test to Verify	Participating Stakeholders	Involved Elements
1. Access and control of the jointly deployed traffic cameras	Ventura County, Oxnard Traffic	Ventura County remote workstation, jointly deployed field devices
2. Quality and timeliness of jointly deployed traffic camera images	Ventura County, Oxnard Traffic	Ventura County remote workstation, jointly deployed field devices
3. Data exchange between Ventura County remote workstation and jointly deployed traffic cameras	Ventura County, Oxnard Traffic	Ventura County remote workstation, jointly deployed field devices
4. Data exchange between Ventura County remote workstation and Oxnard TMC	Ventura County, Oxnard Traffic	Ventura County remote workstation, Oxnard TMC
5. Performance of Ventura County remote workstation	Ventura County	Ventura County remote workstation
6. Performance of communications between the Ventura County remote workstation and jointly deployed traffic cameras	Ventura County, Oxnard Traffic	Ventura County remote workstation, jointly deployed field devices
7. Performance of communications between the Ventura County remote workstation and Oxnard TMC	Ventura County, Oxnard Traffic	Ventura County remote workstation, Oxnard TMC

3.3.14 Ventura County Field Devices

Table 25 summarizes the verification planned for the Ventura County Field Devices. Ventura County owns some traffic signal controllers and a long-term plan to jointly deploy traffic cameras with the City of Oxnard has been identified.

Table 25. Port Hueneme Field Devices Verification Summary

Test to Verify	Participating Stakeholders	Involved Elements
1. Data exchange between the Ventura County and jointly deployed field devices and the Ventura County remote workstation	Ventura County	Ventura County and jointly deployed field devices, Ventura County remote workstation
2. Data exchange between the Ventura County and jointly deployed field devices and the Oxnard TMC	Ventura County, Oxnard Traffic	Ventura County and jointly deployed field devices, Oxnard TMC
3. Access and control of Ventura County and jointly deployed field devices (i.e. jointly deployed cameras) from the Ventura County remote workstation	Port Hueneme	Ventura County and jointly deployed field devices, Ventura County remote workstation
4. Access and control of Ventura County and jointly deployed field devices from the Oxnard TMC	Ventura County, Oxnard Traffic	Ventura County and jointly deployed field devices, Oxnard TMC
5. Quality and timeliness of data from sensors, cameras and controllers	Ventura County	Ventura County and jointly deployed field devices
6. Performance of field devices	Ventura County	Ventura County field devices
7. Performance of the communications with the Ventura County remote workstation	Ventura County, Oxnard Traffic	Ventura County and jointly deployed field devices, Ventura County remote workstation
8. Performance of the communications between the Ventura County and jointly deployed field devices and the Oxnard TMC	Ventura County, Oxnard Traffic	Ventura County and jointly deployed field devices, Oxnard TMC

4.0 CONCLUSION

The Systems Requirement and Verification Plan provide a baseline for developing specific ITS solutions. The next product of this story, the ITS Master Plan, will identify technologies and projects for the near-term and long-term. It will also evaluate traffic control systems for their ability to meet the system requirements identified in this report.

As the City of Oxnard and the region's stakeholders move forward in designing, procuring and deploying ITS, it is expected that the system requirements will be revised and refined. The verification plan will also be developed in more detail once the specifications and functionality of the ITS is defined at a detailed level.

An important companion document to the Systems Requirement report is the Traceability Matrix. It maps the stakeholder needs to system requirements and to Verification tests. While this document is static, the Matrix can—and should be—updated as the needs of the region change and more detail about system specifications are defined.