Submitted to

Los Angeles County

Conceptual Design – Final Report

Gateway Cities Traffic Signal Synchronization And Bus Speed Improvement Project

May 2005

Version 2.0

National Engineering Technology Corporation

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

Table 1-1: Revision History

Version	Date Submitted	Changes by	Comments
Draft Version 1	March 2004	NET Corporation	
Final Version 1	January 2005	NET Corporation	
Final Version 2	May 2005	NET Corporation	

1 INTRODUCTION

This section presents a brief document overview, methodology, purpose and background of the project.

1.1 Document Overview

Based on the scope of work, the design process for the I-105 Corridor Project has been arranged into a series of three *High Level Design (HLD) Definitions and Recommendation Documents*. These documents are based on the major components that make up the system and have the following titles:

- *Traffic Signal Management and Control System HLD Definitions and Recommendations*
- *TMC High Level Design Definitions and Recommendations*
- *Traveler Information Surveillance, Integration and Communications System HLD Definitions and Recommendations*

Each of these HLD documents for their respective components defines, evaluates and recommends the various technologies, architectures, locations and/or vendor products needed to meet the functional requirements of the system.

This document, the Conceptual Design Document summarizes the recommendations from the three High Level Design Documents, considers new requirements that have arisen since the High Level Design Documents were published, and provides a comprehensive view of the transportation improvements recommended for implementation. The development of the User Requirements, System Requirements, and the High Level Design Documents were completed with the assumption of unlimited funding would be available. These recommendations are documented in Section 3. Also presented in this document is a scenario that correlates to the anticipated funding that would be available for implementation. These recommendations are documented in Section 3. As the implementation costs across the Gateway Cities Forum Projects were identified, cost savings measures were required. To map the recommended improvements to the available budget, the implementation of the I-105 Corridor improvements were assigned to phases. The current phase improvements are documented in Section 4. As additional funding becomes available in the future, additional improvements identified in Section 3 can be programmed.

The remainder of this document is organized into the following sections:

- Section 1.3 (Referenced Documents) – Provides identification for all documents referenced in this document.
- Section 3 (Recommended System Design) – This section describes the ITS recommendations for the I-105 Corridor.
- Section 4 (Current Deployment Systems Design) – This section identifies the implementation strategy for those improvements proposed to be implemented with the current budget.
- Section 5 (Coordination with Other Projects) – This section identifies other projects within the Corridor and methods for coordination.
- Section 6 (Configuration Management Plan) – Provides an overview of configuration management activities and items.

- Section 7 (Construction Staging Plan) – This section discusses the construction staging activities for the project.
- Section 8 (Cutover Plan) – This section describes the cutover activities for the existing systems.

1.2 System Overview

The system recommended for the I-105 Corridor project includes the following functionality for each participant agency:

- The ability to monitor and control the signals within the project area.
- The ability to view and control cameras located throughout the corridor.
- The ability to control Changeable Message Signs located within their jurisdiction.
- The ability to monitor traffic signals throughout the sub region (through the Information Exchange Network).
- The ability to enter and monitor active events throughout the sub region (through the Information Exchange Network).

To accommodate the systems, facility improvements at each agency are proposed to be designed and implemented. For most cities this includes minor modifications to existing spaces to locate the computers and communications equipment. For one city the improvements would also include video display equipment.

1.3 I-105 Corridor Project Overview

The Los Angeles County Department of Public Works (LACDPW) enlisted the services of NET Corporation to design the recommended ITS improvements. This project is entitled the *Gateway Cities Traffic Signal Synchronization and Bus Speed Improvement Project* (or *The I-105 Corridor Project),* which consist of ten phases implementing five major recommended components. The components of the Project are:

- Traffic Signal Management and Control System (TSMACS)
- Sub-Regional Traffic Management Center (Sub-Regional TMC) and local city control sites (LCCS)
- Traveler Information and Surveillance System (TIASS)
- System Components Integration
- Communications System

Installation of the five components identified in the I-105 Corridor Project is proposed to provide an Intelligent Transportation System Corridor for the I-105 Area. The infrastructure deployed for the I-105 Corridor Project would be integrated with the Sub-Regional and County TMCs through the use of the Information Exchange Network (IEN) for traffic signal coordination.

The I-105 Corridor project area consists of Firestone Boulevard, Rosecrans Avenue, and Imperial Highway which run parallel to I-105 and four perpendicular arterials, Paramount Boulevard, Lakewood Boulevard, Bellflower Boulevard, and Studebaker Road. The arterials cross several local, and two regional, jurisdictional boundaries. There are a total of nine local jurisdictions, which are cumulatively referred to as the Gateway Cities. These include Bellflower, Compton, Downey, La Mirada, Lynwood, Norwalk, Paramount, Santa Fe Springs, and South Gate. The two regional jurisdictions are Los Angeles County (LA County) and

Caltrans District 7 (Caltrans D7). There are a total of 194 signalized intersections within the I-105 Corridor project area. The I-105 Corridor project area is shown in Figure 1-1.

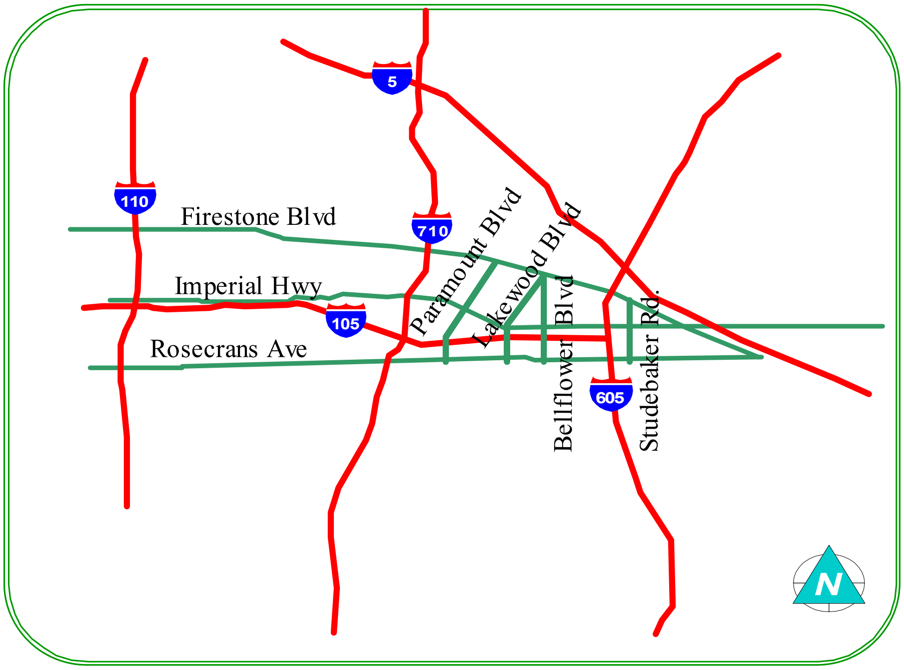


Figure 1-1: I-105 Corridor Project Area

1.3 Reference Documents

The following documents were used in the process of completing this document:

1. *The Gateway Cities Traffic Signal Synchronization and Bus Speed Improvement Project (I-105 Corridor) - User Requirements document.*
2. *The Gateway Cities Traffic Signal Synchronization and Bus Speed Improvement Project (I-105 Corridor) - Strategic Plan.*
3. *The Gateway Cities Traffic Signal Synchronization and Bus Speed Improvement Project (I-105 Corridor) - Functional Requirements document.*
4. *The Gateway Cities Traffic Signal Synchronization and Bus Speed Improvement Project (I-105 Corridor) – Sub regional TMC and Local City Control Site High Level Design Final Report*
5. *The Gateway Cities Traffic Signal Synchronization and Bus Speed Improvement Project (I-105 Corridor) – Traffic Signal Management and Control System High Level Design Definitions and Recommendations – Final Report*
6. *The Gateway Cities Traffic Signal Synchronization and Bus Speed Improvement Project (I-105 Corridor) – Traveler Information Surveillance, Integration, and Communications System High Level Design Definitions and Recommendations - Draft Report*
7. *Traffic Control System Alternatives Analysis for The San Gabriel Valley Pilot Project*
8. *The San Gabriel Valley Pilot Project System Design Report – Final Version*

2 COORDINATION WITH OTHER PROJECTS

There are several projects that would be designing and constructing improvements within the I-105 Corridor simultaneous with this project. These projects, their anticipated schedule and coordination activities are contained in this section.

2.1 I-5 / Telegraph Road

The I-5 Telegraph Road project designs and implements ITS improvements including communications, signal systems, local city control site (LCC) improvements and cameras within several cities along Telegraph Road in Southeast Los Angeles County and is proceeding concurrently with the I-105 Project. There are four cities common to both the Telegraph Road project and the I-105 Corridor Project: Downey, La Mirada, Norwalk, and Santa Fe Springs. To avoid duplication of work, it has been decided based upon the quantities of signals in each project area, that the Telegraph Road project would provide the LCC improvements and signal system for the cities of Santa Fe Springs and Downey. The I-105 project is proposed to provide the LCC improvements and signal system for the cities of La Mirada and Norwalk. The signal systems deployed in each of these cities should consider the additional quantities planned for integration with the I-5 project.

The intersection improvements and communications within each of these cities are proposed to be accomplished by the respective project. For example, intersections on Firestone Blvd. would be integrated to the Downey Signal System through the I-105 project; the plans indicate that the signal system exists. The intersection of the fiber optic cables being installed on Telegraph Road and Imperial Highway are proposed to be coordinated to achieve communications routing diversity. Coordination would take place through project meetings, document reviews, and telephone conversations.

2.2 I-710 Corridor

The I-710 Corridor project will design and implement ITS improvements including communications, signal systems, and cameras within several Cities along the I710 freeway in Southeast Los Angeles County. This project was expected to begin requirements development and system design in spring of 2004. There are four cities common to both the I-710 project and the I-105 Corridor Project: Paramount, Compton, South Gate, and Lynwood. The I-105 project is proposed to be implemented prior to the I-710 Project. The intersection improvements and communications within each of these cities would be accomplished by the respective project. The I-710 project can integrate their signals with the existing systems in each of these cities. The signal systems deployed in each of these cities are proposed to consider the additional quantities planned for integration with the I-710 project.

2.3 I-5 Corridor CVO Project

The proposed I-5 Corridor Commercial Vehicle Operations (CVO) Integration Project will support the deployment of a complete traveler information system, geared primarily toward commercial vehicles but also supporting passenger vehicles, on the I-5 corridor in the vicinity of the border between Los Angeles and Orange Counties. This project may begin design this summer. The project consists of the following parts: a system integration (communication backbone and commercial vehicle traveler information) component and a Dynamic Message Signs (DMS) component. The project proposes to install 150,000 ft. of aerial fiber optic cable along portions of Valley View Blvd., Orangethorpe, Knott, La Palma and Beach Blvd in Los Angeles and Orange Counties, and install DMS locations in Orange County cities. One possible use of this fiber optic cable is to interconnect traffic signal controllers to their respective cities' master control systems. The I-105 Project is proposed to build integration with the I-5 Project through communications connections points. Their design would be tracked to identify any potential connection points, and fibers would be reserved for this use.

2.4 City of Compton TMOC Project

The City of Compton has received Federal funds to implement their Transportation Management and Operations Center Project. This project proposes to provide a signal system, controller upgrades, communications, a traveler information system, a traveler information center and a Transportation Management and Operations Center. This project is now beginning their preliminary design and it is expected that they would lag the I-105 corridor project. The I-105 Corridor project is proposed to implement the IEN interface to the system deployed with the TMOC project and provide communication and integration for the signals on Rosecrans Blvd. within the City of Compton. Discussions are underway with the City of Compton to explore opportunities to expedite the signal system portion of the TMOC project.

2.5 County's Information Exchange Network Project

The County has developed the Information Exchange Network data definitions and corridor servers to facilitate traffic signal and event data exchange amongst the agencies in the sub region. The I-105 Project is proposed to utilize the data definitions and integrate with the corridor server developed by the County's IEN Project. The County's IEN project would provide technical and integration support as needed to facilitate the integration.

2.6 City of Downey Fiber Optic Improvements on Firestone Blvd. and Lakewood Blvd.

The City of Downey has two projects underway to implement fiber optic communications and to connect the traffic signals along Firestone Blvd. and Lakewood Blvd. Construction is nearly completed for the project along Firestone Blvd and construction is due to begin shortly on Lakewood Blvd. The I-105 Project proposes to integrate with the fiber installed on both of these projects. Downey is also implementing an Emergency Operation Center on Paramount Blvd. south of Alameda. The EOC would be considered when developing the communications design to explore options to provide connectivity. Coordination would occur through review of the City of Downey plans, project meetings and developing a communications architecture that utilizes the existing infrastructure.

2.7 City of Norwalk Pavement Rehab on Firestone Blvd.

The City of Norwalk is resurfacing Firestone Blvd. between Hoxie Ave. and Imperial Highway. Coordination is occurring through the review of plans. Construction is being deferred until the fiber optic cable and communications conduit is installed as part of the I-105 project. Also, video detection is being installed at the intersections of Imperial and Firestone, Studebaker and Imperial and, Studebaker and Norwalk. Major improvements are scheduled to begin at the intersection of Firestone and Imperial Hwy. in April or May of 2004.

The I-105 Project is proposed to investigate incorporating the video images from the detection cameras on the communications network to allow viewing of the video at Norwalk Local City Control site.

2.8 City of Santa Fe Springs

The City is planning a grade separation project at Rosecrans Ave. and Marquardt Ave. Rosecrans Ave. will be routed under the railroad tracks with signals on either side. This project is expected to lag the I-105 project by approximately one year. The I-105 project is planning to provide wireless communications to the traffic signal located at this intersection. The signal system would be sized to accommodate the future addition of a second signal in this area. The progress of the grade separation project would be tracked.

2.9 City of Lynwood

The City of Lynwood is implementing video detection along Imperial Highway. Where video detection is installed, the I-105 project is proposed to utilize that detection. The locations of existing detection that requires additional detector lead in cable and sensor units would be adjusted. The video detection system is anticipated to be complete by June 2005.

2.10 Traffic Signal Synchronization Program (TSSP)

Los Angeles County Department of Public Works has numerous projects that are proposed to implement synchronized traffic signal timing. These projects are in various stages of development and construction.

Firestone Blvd. - Construction is completed for the TSSP improvements. The improvements for the City of Downey are under design.

Rosecrans Ave. – The TSSP improvements along Rosecrans are completed. Peak Period Parking Improvements (adding a 3rd lane) for Rosecrans within Norwalk are planned and design is yet to start.

Imperial Hwy - Construction of TSSP improvements are nearly completed. A larger curb radius is in design for Imperial @ Garfield.

Studebaker Rd. – Improvements are recommended to be included in a future call for projects

Bellflower Blvd. – TSSP are in the final design stage.

Lakewood Blvd - TSSP improvements within the City of Downey are under design

Paramount Blvd. – TSSP improvements are completed.

3 RECOMMENDED SYSTEM ARCHITECTURE DESIGN

The purpose of this section is to present the recommended view of the system architecture for the I-105 Corridor project area. This section details for the Sub-regional TMC location and integration as well as, details associated with the signal system, CCTV cameras, CMS signs, detection, and communications as it relates to the recommended system design.

3.1 System Architecture Description

System architectures identify high-level components of the system and how they interrelate. These components are referred to as configuration items. A configuration item can be a hardware component (HCI), a software component (SCI), or a combination of both that satisfies an end use function and is designated for separate configuration management by the user (supporting subsystem). A supporting subsystem is generally manufactured by vendors or developed. Figure 3-1 depicts the recommended system architecture for the I-105 Corridor project.

3.1.1 Hardware Configuration Items (HCI)

Hardware configuration items are an aggregation of hardware that satisfies an end use function and is designated for separate configuration management. For the purposes of this architecture, all hardware elements can be classified as computer hardware.

Table 3-1 provides a description of the possible functionality of each hardware configuration items (HCIs) for the recommended system design. The function of each HCI will be defined in the detailed design phase of the project. All hardware configuration items (HCIs) are proposed to use hardware compatible with software that would be installed.

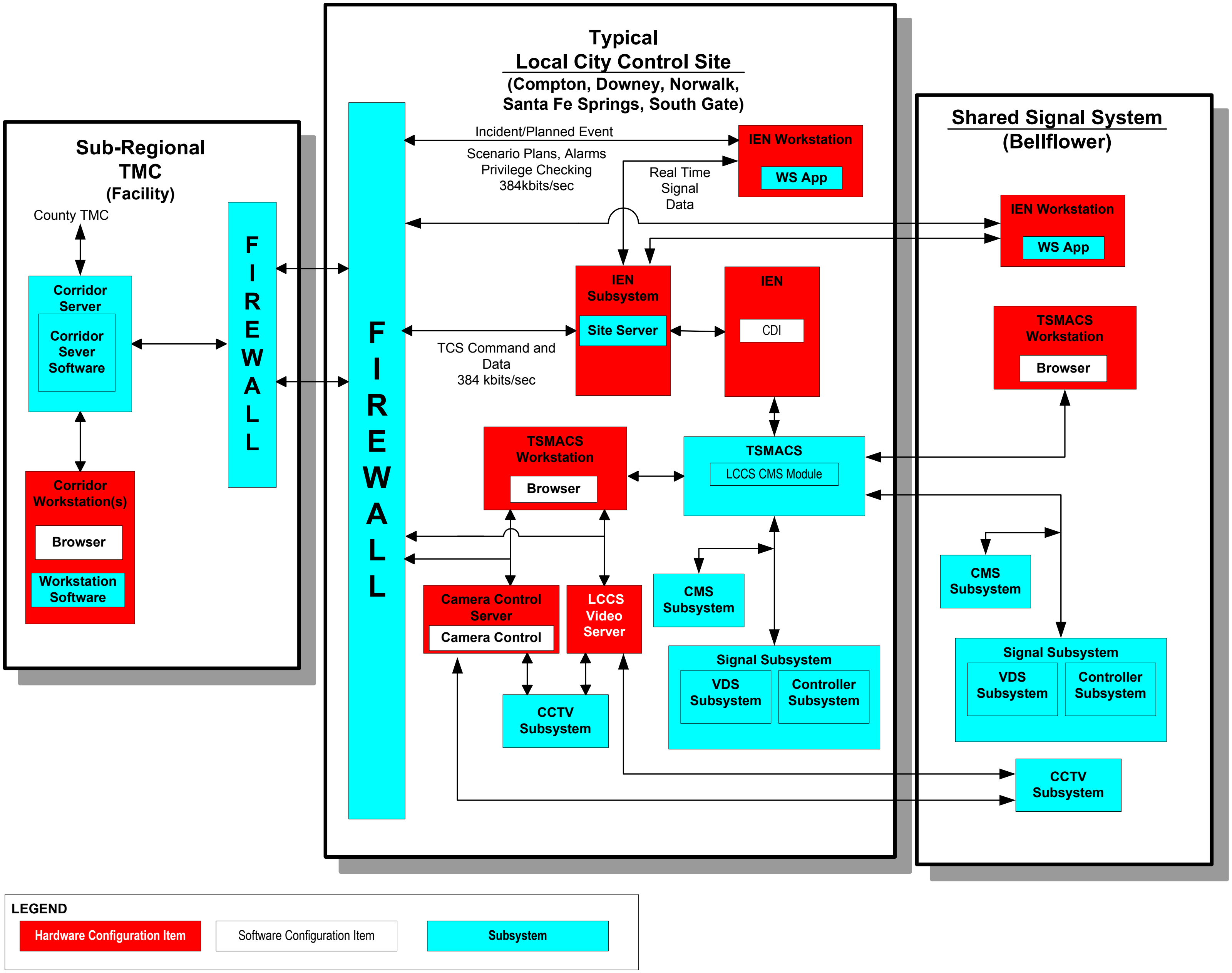


Figure 3-1: Recommended System Architecture

Table 3-1: HCI Inventory for the Recommended System Design

HCI	Location	Description
Corridor Workstation	Sub-Regional TMC	Provides to the user with an interface to the Corridor Server. The Corridor workstation provides the user at the TMC the ability to set access control parameters, define scenario response plans and the triggering conditions, and configures alarms within the I-105 corridor. A browser could run on the Corridor Workstation to access and control cameras. The relationship between the corridor workstation and the IEN will be further defined in the detailed design phase.
IEN Workstation	Local City Control Site	Supports the Workstation Data Manager and Workstation Application software. This workstation allows users to view and issue commands to TCS to coordinate signals across the corridor. The IEN workstation functionality will be further detailed in IEN deploying projects.
IEN Site Server	Local City Control Site	This server supports the Site Data Manager. This server is connected to the Corridor Server, the CDI, and the IEN Workstation.
IEN CDI Server	Local City Control Site	The Command/Data Interface (CDI) Server supports the CDI software. The CDI Server is connected to the Traffic Control System to translate Traffic Signal data and commands to the format of the IEN and to the Site Server to distribute the IEN formatted data.
TSMACS Workstation	Local City Control Site	Supports the following user interfaces: TSMACS and the LCCS Video and Camera Control. Access to video and camera control is proposed to be through a Web Based User interface and accessed from a Browser located on the TSMACS Workstation. The TSMACS Workstation is proposed to run signal system user interface software provided by the signal system vendor. During implementation it would be investigated if the TSMACS and IEN User interfaces can be hosted on the same computer.
LCCS Video Server	Local City Control Site	Located in each of the LCC sites for access of video images via the Internet or fiber network. Supports the following operating interfaces: TSMACS Workstation and CCTV Subsystem. The City of Bellflower is proposed to share the Video Server and Signal System located at the City of Paramount.
Camera Control Server	Local City Control Site	Located in each of the LCC sites to provide camera control functions on both leased networks and fiber-based networks. The City of Bellflower is proposed to share the Camera Control Server located at the City of Paramount.

3.1.2 Supporting Subsystems

A supporting subsystem is defined as any system that is procured through a vendor that achieves a set of system requirements in itself. The table below provides a description of the supporting subsystems.

Table 3-2: Subsystem Inventory for the Recommended System Design

Subsystem	Location	Description
Corridor Server	Sub-Regional TMC	The Corridor Server contains application software for the corridor database, event server, and user privilege authentication. This system is available from the County and is proposed to be installed and integrated as part of this project. The Corridor Server functions as a repository for all logged events and corridor level display data of the TSMACS subsystem. It provides high-level supervisory and monitoring capabilities for the corridor. A single corridor server maintains direct communications with all local TSMACS within the project and monitors overall IEN activity to detect potential network problems. The Corridor Server is not a primary user interface device, but does include configuration, status, and diagnostics functionality. The Corridor Server is designated a subsystem as the hardware and software would be provided to the project.
Corridor Workstation Application	Sub-Regional TMC	Provides to the user with an interface to the Corridor Server. The Corridor workstation provides the user at the TMC the ability to set access control parameters, define scenario response plans and the triggering conditions, and configures alarms within the I-105 corridor. The Workstation software provided by the County would be integrated with hardware provided by this project. The relationship between the corridor workstation and the IEN will be further defined in the detailed design phase.
IEN Workstation Applications	Local City Control Site	Supports the Workstation Data Manager and Workstation Application software. This workstation allows users to view and issue commands to TCS to coordinate signals across the corridor. This workstation provides a user interface to create Scenario Plans and Events. The Workstation software provided by the County would be integrated with hardware provided by this project. The IEN workstation functionality will be further detailed in IEN deploying projects.
IEN Site Server Software	Local City Control Site	The Site Data Manager is a Windows services that performs the following functions: • Collects data from the local TSCS CDI and distributes that data to both local workstations and the corridor data manager. • Collects remote TCS data from the corridor data manager and distributes that data to local workstations. • Sends commands issued from local IEN workstations to the corridor server for authorization and distribution to the appropriate site. • Collects commands for local TCS devices from the corridor server and distributes those

Subsystem	Location	Description
		commands to the TCS CDI. During implementation it would be investigated if the Site Data Manager and the CDI can be run on the same computer server.
Signal Subsystem	Field	The Signal Subsystem is comprised of two subsystems: a Vehicle Detection System (VDS) Subsystem and a Controller Subsystem.
The VDS Subsystem	Field	The VDS Subsystem is responsible for gathering vehicle traffic information consisting of volume, occupancy and speed. This subsystem is proposed to interface with the TSMACS subsystem on a second-by-second basis. The systems interface with traffic signal controllers to provide volume, occupancy and speed data.
Controller Subsystem	Field	The Controller Subsystem is responsible for traffic signal operation and carries out all timing and control logic for the signal. This subsystem is designed to interface with the TSMACS on a second-by-second basis. There are two types of system architectures for the Controller Subsystem. One type is a centralized architecture in which a single master computer, typically located in the LCC, provides control for all local traffic signal controllers. Another type is a distributed architecture, in which an “on-street” master controller has one or more slave controllers interconnected to it and performs timing synchronization and signal timing plan implementation as well as second-by-second telemetry. Both types of architectures are proposed for the various agencies in the I-105 corridor.
TSMACS Subsystem	LCCS	The Traffic Signal Management and Control System (TSMACS) is responsible for monitoring, controlling, managing and collecting data from the Signal Subsystem. This system is interconnected to the IEN/CDI Subsystem and provides the ability for the real-time data exchange, command and control to the Signal Subsystem. The TSMACS interfaces, via modules, with the CMS Subsystem for sign control functionality.
CCTV Subsystem	Field	This subsystem is responsible for collecting CCTV images from the field for display. The system consists of field cameras, camera control units, Video Decoders/Encoders (if required for transport), and control equipment. The subsystem interfaces with the Camera Control and the LCCS Video Server.
CMS Subsystem	Field	This subsystem is responsible for displaying traveler information messages in the field. The subsystem consists of both fixed and portable Changeable Message Signs (CMS), the structure or trailer the sign is attached to, and the field control computer for the sign. The subsystem interfaces with the TSMACS via a CMS Module that manages and controls the subsystem.

Subsystem	Location	Description
Security Subsystem (Firewall)	LCCS & Sub-regional TMC	This subsystem is responsible for securing the communications network interface from unauthorized access to the system at each of the sites. Communications links from the Sub-Regional TMC to the Local City Control Sites, as well as, Local-to-Local communications would pass through Firewall security and policy enforcement routines. In addition, any data communications through leased services (i.e. DSL) which goes over the Internet would be encrypted by establishing a Virtual Private Network (VPN) connection between the sites The Security Subsystem is proposed to consist of a commercially available hardware solution involving VPN enabled routers that have data encryption capabilities in accordance with known industry standards. The router would also have firewall capabilities that enable at a minimum, packet filter and circuit level gateway functionality.

3.1.3 Software Configuration Items (SCI)

Software Configuration Items (SCIs) are an aggregation of software that satisfies an end use function and is designated for separate configuration management. The SCIs are described in the table below.

Table 3-3: SCI Inventory for the Recommended System Design

SCI	Location	Description
Camera Control Server Software	Local City Control Site	Located in each of the LCC sites to provide camera control functions on both leased networks and fiber-based networks. The camera control server can communicate pan/tilt/zoom commands to multiple vendors' protocols. The camera control server is designed to store and authenticate user access privileges and manage contention among multiple users of differing priority. The user interface is proposed to run in a browser and allow users to select a camera for viewing and control from a map.
IEN CDI	Local City Control Site	The CDI is connected to the Traffic Control System to translate and distribute status and command data between the TSMACS and the local site data manager. CDI are specific to the TSMACS software deployed.
Browser	Local City Control Site & Sub-regional TMC	The browser would be a commercially available product that is installed on the hardware as shown. The browser would be used to access video images and camera control software.

3.1.4 Facility

This subsystem is responsible for the physical building in which the Sub-Regional TMC and the Local City Control Site (LCCS) would reside. This subsystem consists of two general areas: the computer/communications area or room and the workstation/control area or room. Each Facility is connected via the Communications System to provide center-to-center communications and center-to-field communications to their field devices.

Each local city is proposed to receive racks to house the communications and server equipment. The workstations are proposed to be located on existing furniture in an existing room.

3.1.5 Communications Systems

The communication system architecture is separated into the following two components:

Center-to-Center Communications:

- DATA – The Center-to-Center data communications for the TSMACS are proposed to utilize fiber optic cable between the LCCS (where fiber is proposed) to a communications hub in Downey. In areas where no fiber optic cable is proposed, a leased, high-speed DSL connection from the communications hub to the Sub-Regional TMC is proposed. Communications from LCC to the Sub-Regional TMC would utilize CORBA according to the IEN's definitions.
- VIDEO – Each LCCS is proposed to host a video server (with the exception of the Bellflower LCCS which would share with the City of Paramount) that would provide access to local video images for that particular city. Video access between cities/agencies is proposed to be over the Internet through leased, high-speed DSL circuits wherever the fiber optic cable does not interconnect the sites.

Center-to-Field Communications:

- DATA – The Center-to-Field data communications for the TSMACS would be over fiber optic cable where fiber is proposed and all other locations would use a leased Next Generation 2.5G wireless technology. The TSMACS Subsystem is proposed to define the communication protocol. The TSMACS is proposed to be able to communicate with either 170 or NEMA controllers as required.
- VIDEO – The video from CCTV cameras is proposed to be sent directly to their respective Local City Control Site using fiber optic cable where applicable. For CCTV camera locations where fiber optic cable routes are not proposed, a leased high-speed DSL communications circuit is proposed to be used to transmit video signals from the field to the respective LCCS.

3.2 Sub-Regional TMC Location

Several cities and agencies expressed interest in housing the Sub-Regional Traffic Management Center (TMC). The process of determining the most suitable location for the Sub-Regional TMC has several components, the foremost being the establishment of a set of criteria that would be used to determine the most suitable location.

3.2.1 Selection Criteria

The criteria used to evaluate potential Sub regional TMC locations included:

- **CONTROL ROOM / AREA-** Factors included the amount of space in one large square open room, sufficient ceiling height, the availability of wireless communications, proximity and/or ability to coordinate with emergency services, raised or lowered floor, conditioned environment with independent HVAC controls, good lighting design, fire suppressions systems.
- **COMPUTER / COMMUNICATIONS ROOM / AREA –** Factors included availability of: space to accommodate equipment, wiring (power/communications/data), separate security area, raised or lowered floor, separate air conditioning and humidifying system, conditioned power, UPS. and emergency generator.
- **STAFF, OFFICE SPACES, AND STAFF AMENITIES –** Factors included the ability to provide: in-house staff resources for engineering and maintenance, general work and office areas, staff meeting space, parking, and proximity of staff conveniences and services.
- **VISITOR SPACES AND AMENITIES –** Factors included the ability to provide: visitor facilities, visitor viewing space and meeting space for Sub-Regional TMC-related work meetings.
- **GENERAL BUILDING -** Factors included: degree of tenant improvements required, proximity of control room/area and computer/communications room/area, service panel adequate to handle projected workloads for the electrical system, seismic rating of the existing facility, centrally located and accessible, presentability, and vandalism-proofing (e.g., fencing, access control, reinforced doors/windows).
- **PROXIMITY TO CORRIDOR -** Proximity to the Corridor is gauged by existing/planned communication trunks (WANs). For cost, response, and maintenance issues it is ideal to locate the Sub-Regional TMC near communications backbone.
- **SCHEDULE –** The potential site must have the ability to house the Sub-Regional TMC in a time frame that matches this project.
- **SECURED FUNDING -** This potential site should already have secured funding. This project would provide funding for the Sub-Regional TMC but in cases where an entirely new facility has been proposed additional funding may be needed.

Four cities within Southeast Los Angeles County (SELAC), along with Los Angeles County itself, were evaluated for housing the Sub-Regional Traffic Management Center. Each of these agencies had either existing space in which to place the Sub-Regional TMC or was planning a new facility that could incorporate the center into its design. Refer to The Gateway Cities Traffic Signal Synchronization and Bus Speed Improvement Project (I-105 Corridor) – Sub regional TMC and Local City Control Site High Level Design Final Report for details on the site evaluation process.

3.2.2 Site Recommendation

Los Angeles County's Regional TMC in Alhambra was recommended to serve as the Sub-Regional TMC location for the I-105 Corridor Project. The LA County Regional TMC facility would encompass 6,000 to 9,000 square feet. A portion of the available space is proposed to be utilized for the Sub-Regional TMC functions. LA County's Regional TMC has the most suitable existing facility as its space is being designed specifically for a TMC and its design encompasses the requirements for the Sub-Regional TMC. LA County has secured funding and would provide sufficient technical staff to complement the planned facility design.

3.3 Traffic Signal System

The corridor region encompasses approximately 194 intersections in 11 jurisdictions that include city, county, and state level. As part of the overall corridor management concept of the I-105 Corridor project, a traffic signal management and control systems (TSMACS) at the local city control sites would be used to manage the flow of traffic on the project arterials. The IEN would be utilized as the mechanism to transfer traffic data and control capabilities to each of the agencies using a TSMACS. The IEN allows the flexibility for an agency to select an appropriate TSMACS for their agency while providing for corridor management and control. The selection of the TSMACS systems is proposed to be based on the types of controllers used by the individual cities/agencies.

3.3.1 Traffic Signal System Recommendation

It is recommended that a signal system be deployed in the cities of Norwalk, Downey, Santa Fe Springs, Paramount, Compton, Lynwood, and La Mirada/LA County. The City of Bellflower is proposed to share a signal system with the City of Paramount.

The City of South Gate is currently operating two TSMACS systems. South Gate acquired and installed Icons to manage their signals along Firestone Blvd. The Icons system in South Gate is several years old, an upgrade to a newer version of Icons is recommended. The city also has Aries system controlling signals and may combine the two systems.

The following agencies predominately use 170 controllers and do not have existing control systems:

- Bellflower
- Downey
- LA County
- La Mirada
- Lynwood
- Paramount

These agencies all use LA County's 170 LACO firmware. In addition, La Mirada contracts with the County for traffic signal maintenance. For all these cities, it is recommended that they install or share a TSMACS based on, or configured for, control of 170s. For ease of future firmware upgrades as well as support and maintenance, these agencies may wish to select the same TSMACS as Los Angeles County. The following TSMACS are applicable for these agencies based on this scenario:

- KITS
- Icons
- i2TMS
- Pyramids
- Series 2000

The following agencies predominately use NEMA controllers and do not have existing control systems:

- Norwalk
- Santa Fe Springs

The following TSMACS are applicable for these agencies based on this scenario:

- Icons
- Series 2000
- i2TMS

Compton has very old controllers that are incompatible with the modern systems on the market. Compton, under a separate project, is inventorying the City's signal and selecting a controller standard for the City. The City of Compton is proposed to also be selecting and procuring a signal system compatible with their controllers as part of their separate project. The I-105 project is proposed to provide an IEN interface and workstation for the City of Compton's system.

Caltrans utilizes CT NET with 170 controllers for signal control. There are several 170 controllers in the I-105 corridor area; however none are currently connected to CT NET. This is planned for the future. This system is proposed to remain and an IEN interface would be created to CT NET.

3.3.2 Controller Upgrade Recommendation

Where controllers have been identified as needing to be replaced, the following minimum criteria should be followed:

- The controllers should support the AB3418 (E) protocol.
- The Central System should support the AB3418 (E) protocol and be shown to be capable of supporting NTCIP for field communications in the future.

The following table provides specific recommendations for each agency to upgrade their controllers:

Table 3-4: Controller Upgrade Matrix by City

City/Agency	Controller Upgrade Recommendations
Bellflower	No upgrades required. Modify firmware, as necessary, based on selected TSMACS and City desires.
Compton	Upgrades are required and should be consistent with the City's plans.
Downey	Replace four "Other" controllers with four new 170s to be compatible with the selected TSMACS.
LA County	No upgrades required.
La Mirada	No upgrades required. Modify firmware, as necessary, based on selected TSMACS and City desires.
Lynwood	No upgrades required. Modify firmware, as necessary, based on selected TSMACS and City desires.
Norwalk	Replace ten 170 controllers with ten new Econolite controllers to be compatible with the selected TSMACS and City desires.
Paramount	No upgrades required. Modify firmware, as necessary, based on selected TSMACS and City desires.
Santa Fe Springs	Replace two 170 controllers with two new NEMA controllers to be compatible with the selected TSMACS and City desires.
South Gate	Replace a 170 controller with a new Econolite controller to be compatible with the selected TSMACS and City desires.
Caltrans	No upgrades required. Modify firmware, as necessary, based on requirements of CT NET.

3.4 CCTV Camera System

CCTV cameras use surveillance technology for displaying traffic images from the field. The CCTV system consists of field cameras, camera control units, video decoders/encoders, and video switching and control equipment. CCTV imagery data is used for real-time verification of incidents and congested traffic conditions. The images can be displayed at the Traffic Management Center (TMC) or made available from a video server, which is accessible to other agencies through the Internet.

3.4.1 CCTV Camera Placement Factors

The ability to view images of real-time traffic conditions is an advantage in incident verification. As soon as an incident is suspected or reported, an operator can view all relative information including type (rear-end, head-on, etc.), severity, and location along with other relevant traffic data. This can be used with an incident management response plan.

CCTV cameras are installed at selected intersections, special event generators, or other locations where the need for surveillance exists. For arterial operations, the range of a CCTV camera is approximately one-half mile in each direction. It is also desirable to install a CCTV camera in the proximity of a CMS sign for operation verification.

3.4.2 CCTV Camera Location Criteria

CCTV cameras are proposed at major arterial crossings consistent with the placement factors described in Section 3.4.1. Several locations throughout the corridor are recommended for CCTV camera deployment for the recommended system design. The locations are based on roadway classification (high volume arterials), proximity to freeway, and overlap in coverage area (assuming ½ mile range). The following is the recommended CCTV camera location criteria within the I-105 corridor:

- Video Surveillance should be installed at the intersections of all primary/primary arterials for coverage on all approaches. The LA County's, County Highway Plan, defines primary and secondary routes.
- CCTV cameras should be installed in the proximity of all freeway interchanges within the corridor, unless otherwise covered (overlap).
- CCTV camera should be installed at intersections, other than freeways and primary/primary arterials, where a gap in coverage occurs due to spacing. This should be done according to roadway classification hierarchy (i.e. secondary arterial first, then collector, and so on).

3.4.3 CCTV Camera Technology

The analysis contained in The Gateway Cities Traffic Signal Synchronization and Bus Speed Improvement Project (I-105 Corridor) – Traveler Information Surveillance, Integration, and Communications System High Level Design Definition and Recommendations Document concluded the following technology recommendations for the CCTV camera and its related components:

Table 3-5: CCTV Camera Technology Recommendation

CCTV Subsystem	Technology
CCTV Camera	Digital Signal Processing (DSP)
Lens Type	Mechanical with 10x (or better) zoom capability
CCTV Camera Housing	Pressurized Enclosure
Pan/Tilt Unit	Medium to heavy duty pan/tilt drive unit

3.4.4 CCTV Camera Locations

Based on the placement factors and the criteria listed in the previous sections, the proposed CCTV camera locations for the recommended system design are listed in Table 3-6 below. There are a total of 45 CCTV camera locations recommended which are proposed to utilize various communications technologies. Cameras identified as future were identified to fill gaps and to provide full coverage along the project routes. Bold face type indicates the intersection of two study arterials.

Table 3-6: CCTV Camera Locations for the Recommended System Design

Cross Street	Classification	Jurisdiction	Install CCTV
FIRESTONE BLVD			
S Central Ave	Primary	LA County	Recommended
Holmes Ave	*N/A*	*LA County*	*Future*
Alameda St.	*Secondary*	*LA County*	*Future*
Santa Fe Ave	Primary	South Gate	Recommended
Long Beach Blvd	Primary	South Gate	Recommended
Otis Ave	*Collector*	*South Gate*	*Future*
Atlantic Ave	Primary	South Gate	Recommended
Garfield Ave	Primary	South Gate	Recommended
Old River School	*Secondary*	*Downey*	*Future*
Paramount Blvd	**Primary**	**Downey**	**Recommended**
Lakewood Blvd	**Primary**	**Downey**	**Recommended**
Woodruff Ave S	Primary	Downey	Recommended
Studebaker Rd	**Primary**	**Norwalk**	**Recommended**
Imperial Hwy	**Primary**	**Norwalk**	**Recommended**
Pioneer Blvd	Primary	Norwalk	Recommended
Rosecrans/I-5 SB	**Primary**	**Norwalk**	**Recommended**

Cross Street	Classification	Jurisdiction	Install CCTV
IMPERIAL HWY			
S Central Ave	Primary	LA County	Recommended
Wilmington Ave	Primary	LA County	Recommended
Alameda St.	*Secondary*	*Lynwood*	*Future*
Long Beach Blvd	Primary	Lynwood	Recommended
Bullis Rd	*Secondary*	*Lynwood*	*Future*
Atlantic Ave	Primary	Lynwood	Recommended
Garfield Ave	Primary	South Gate	Recommended
Paramount Blvd	**Primary**	**Downey**	**Recommended**
Lakewood Blvd	**Primary**	**Downey**	**Recommended**
Woodruff Ave	Primary	Downey	Recommended
Studebaker Rd	**Primary**	**Norwalk**	**Recommended**
Pioneer Blvd	Primary	Norwalk	Recommended
Norwalk Blvd	Primary	Norwalk	Recommended
Bloomfield Ave	Primary	Santa Fe Springs	Recommended
Carmenita Rd	Primary	LA County	Recommended
Valley View Ave	Primary	La Mirada	Recommended
Telegraph Rd	Primary	La Mirada	Recommended
La Mirada Blvd	Primary	La Mirada	Recommended
Santa Gertrudes Ave	*Secondary*	*La Mirada*	*Future*
ROSECRANS AVE			
S Broadway St.	Primary	LA County	Recommended
Main St	Primary	LA County	Recommended
Avalon Blvd	Primary	LA County	Recommended
S Central Ave	Primary	Compton	Recommended
Wilmington Ave	Primary	Compton	Recommended
Santa Fe Ave	Primary	Compton	Recommended
Long Beach Blvd	Primary	Compton	Recommended
Atlantic Ave	Primary	Compton	Recommended
I-710 NB Ramp	*Freeway*	*Paramount*	*Future*
Garfield Ave	Primary	Paramount	Recommended
Paramount Blvd	**Primary**	**Paramount**	**Recommended**
Lakewood Blvd	**Primary**	**Downey/Bellflower**	**Recommended**
Woodruff Ave	Primary	Bellflower	Recommended
Studebaker Rd	**Primary**	**Norwalk**	**Recommended**
Pioneer Blvd	Primary	Norwalk	Recommended
Carmenita Rd	Primary	Norwalk	Recommended
Valley View Ave	Primary	Santa Fe Springs	Recommended
La Mirada Blvd	Primary	La Mirada	Recommended
Santa Gertrudes Ave	*Secondary*	*La Mirada*	*Future*
PARAMOUNT BLVD			
Stewart & Gray Rd.	*Secondary*	*Downey*	*Future*
Gardendale St.	*Secondary*	*Downey*	*Future*
LAKEWOOD BLVD			
Stewart & Gray Rd.	*Secondary*	*Downey*	*Future*

3.5 Changeable Message Sign (CMS) System

Changeable Message Signs display traveler information messages to the motoring public. The CMS is capable of providing travelers with advanced warnings from a fixed (sign attached to a structure) or portable (sign attached to a moveable structure) position. The CMS provide the engineer with informational access to motorists for the purposes of traffic control, incident management, and congestion mitigation. The analysis for the technology placement and location of CMS is contained in The Gateway Cities Traffic Signal Synchronization and Bus Speed Improvement Project (I-105 Corridor) – Traveler Information Surveillance, Integration, and Communications System High Level Design Definition and Recommendations Document.

3.5.1 CMS Placement Factors

For arterial operations, CMS are installed in the proximity of special event generators, adjacent to freeways near diversion points, in advance of roadway construction, and in advance of special operational areas for information dissemination (i.e. rail crossings).

Fixed CMSs are used to mitigate recurring traffic conditions. The fixed CMS is located ahead of a major decision making point to provide the motorist with an opportunity to select an alternative route. Fixed CMS are post mounted along the shoulder of the roadway, though it can be attached to a bridge overpass or other stationary structure with an appropriate line of site.

Portable CMSs are used in the proximity of non-recurring event locations such as construction zones, and incident locations. Portable CMS are also used at special event generators such as sports arenas, parades, and shopping centers during holiday season. The Portable CMS is proposed to be attached to the bed of a truck or trailer.

3.5.2 CMS Location Criteria

A total of 17 fixed CMS signs are proposed for the I-105 Corridor Project. The target deployment is planned for all cities/agencies except Santa Fe Springs, La Mirada, and LA County. The CMS locations, shown in Figure 3-2, are based on proximity to freeway diversion points. It is important to note that the recommended CMS locations apply only to the fixed CMS.

The recommended system design also specifies two portable CMS per local jurisdiction to be used for non-recurring traffic conditions with variable conditions. This would enable simultaneous portable sign deployment at two different locations.

The following is an overview of the recommended CMS location criteria within the corridor:

- Fixed CMS should be installed along project arterials in advance of freeway diversion points on primary arterials.
- Each jurisdiction should have at least two portable CMS.

3.5.3 CMS Technology

The analysis contained in The Gateway Cities Traffic Signal Synchronization and Bus Speed Improvement Project (I-105 Corridor) – Traveler Information Surveillance, Integration, and Communications System High Level Design Definition and Recommendations Document concluded the following technology recommendations for both the fixed CMS and portable CMS type signs.

Table 3-7: CMS Technology Recommendation

CMS Subsystem	Technology
Fixed CMS	Single Color LED Technology
Portable CMS	Single Color LED Technology Solar Powered with Rechargeable Batteries Trailer-Mounted, Three Line Sign with Standard Character Size

3.5.4 Fixed CMS Locations

The table below provides a listing of the locations selected for a fixed CMS.

Table 3-8: Recommended Fixed CMS Locations

Project Arterial	Direction	In Advance Of	Communication	Jurisdiction
ZONE 1				
Paramount Blvd	Northbound	I-105	Wireless	Paramount
Paramount Blvd	Southbound	I-105	Wireless	Downey
Lakewood Blvd	Northbound	I-105	Fiber	Paramount
Lakewood Blvd	Southbound	I-105	Fiber	Downey
Bellflower Blvd	Northbound	I-105	Wireless	Bellflower
Bellflower Blvd	Southbound	I-105	Wireless	Downey
ZONE 2				
Firestone Blvd	Eastbound	I-710	Fiber	South Gate
Firestone Blvd	Westbound	I-710	Fiber	South Gate
Imperial Hwy	Eastbound	I-710	Fiber	Lynwood
Imperial Hwy	Westbound	I-710	Fiber	Lynwood
Rosecrans Ave	Freeway	I-710	Fiber	Paramount
Rosecrans Ave	Freeway	I-710	Fiber	Paramount
ZONE 3				
Firestone Blvd	Eastbound	I-605	Fiber	Norwalk
Imperial Hwy	Eastbound	I-605/I-105	Fiber	Norwalk
Imperial Hwy	Westbound	I-5	Fiber	Norwalk
Rosecrans Ave	Eastbound	I-605	Fiber	Norwalk
Rosecrans Ave	Westbound	I-5	Fiber	Norwalk

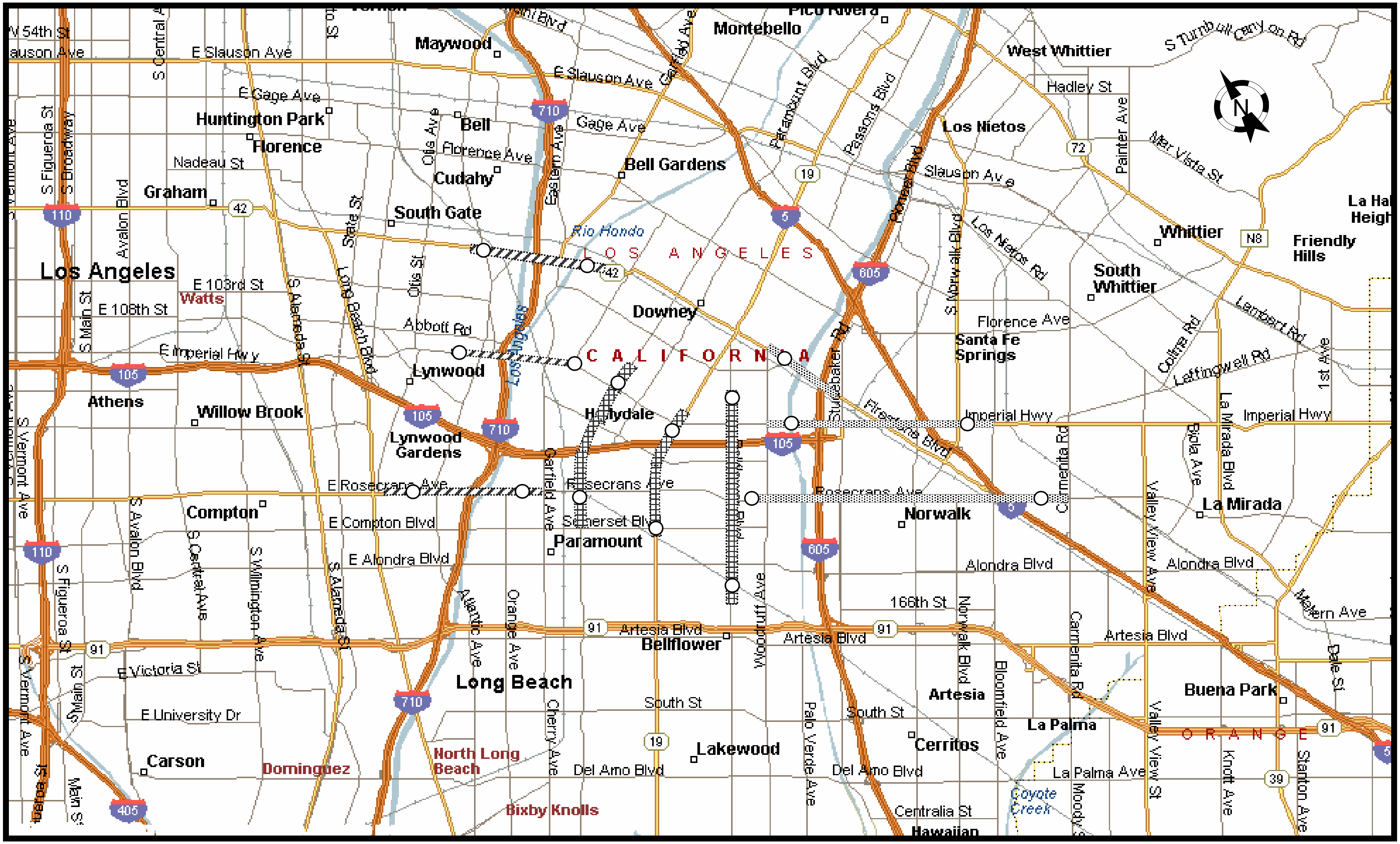
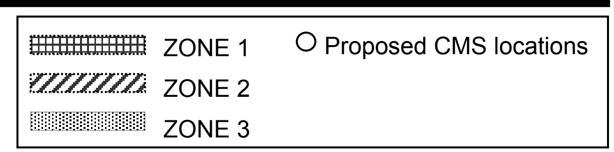


Figure 3-2: Proposed CMS locations



Three freeways (I-605, I-5, and I-105) converge on the east of the project area with the project arterials. This is referred to as “Zone-3”. The I-710 intersects the three east-west project arterials on the west of the project area. This is referred to as “Zone-2”. The locations where motorists (traveling along project arterials) enter a zone coincide with the location for CMS placement. “Zone 1” covers the four north-south arterials in the project area and includes the I-105 exclusively. The Zones were defined as part of the document titled “Technical Appendix – Preliminary Field Device Locations”.

3.6 Vehicle Detection System (VDS)

The VDS is responsible for gathering vehicle traffic information consisting of volume, occupancy and speed. There are two types of VDS technologies used within the corridor: inductive loop detectors and video imagery. Regardless of the technology used, the systems interface with traffic signal controllers. The volume, occupancy, and speed data enable the monitoring of traffic operations at a designated location or over an area.

3.6.1 VDS Placement Factors

In arterial (non-freeway) operations, detectors are typically used in the vicinity of a signalized intersection to achieve actuated traffic control.

The placement of detectors at the intersection determines the type of detection achieved. There are two types of detectors: presence detectors and advance detectors. Presence detectors (also known as stop line detectors) are placed at the line where vehicles should stop in advance of a traffic signal. Advance detectors are located a considerable distance ahead of an intersection based on approach speed and the passage time through the intersection (or vehicle extension).

3.6.2 VDS Location Criteria

The majority of the intersections have presence detection on the minor approach and advance detection on the major approach. Advance detection on the major approach is optimal as this promotes unimpeded progression along the more congested roadway. The following is an overview of the recommended VDS location criteria within the corridor:

- Presence detection should be installed on the minor approach to every signalized intersection within the project area.
- Advance detection should be installed along the approach legs for the project arterials at every signalized intersection within the project area.
- At intersections of primary/primary, primary/secondary and secondary/secondary arterials advance detection should be installed on all approaches to the intersection. The LA County’s County Highway Plan, defines primary and secondary routes.
- The system should integrate with presence and/or advance detection that currently exist at project intersections.
- Signalized Caltrans on and off ramps would remain with current detection standards.

3.6.3 VDS Technology

The table below lists the technology recommendations for the Vehicle Detection System (VDS).

Table 3-9: VDS Technology Recommendation

Detection Type	VDS Technology
Advance Detection	Inductive Loops
Presence Detection	Video Imaging or Inductive Loops

The choice between inductive loops and video imaging for presence detection would be tempered by location and by the preferences of each city.

3.6.4 VDS Locations

The recommended VDS locations proposed for the I-105 Corridor Project identifies advance detection on all major-to-major approaches and presence detection on the minor approaches. A table identifying the cross-streets and jurisdictional boundaries for the recommended VDS locations is presented in detail in the document titled Technical Appendix – Preliminary Field Device Locations.

3.7 Communication Architecture System

3.7.1 Communications Criteria

The table below provides a list of the criteria used to design the communication architecture for the recommended system design.

Table 3-10: Communications Criteria

Criteria	Definition
Integration System Requirements	Integration of the communications system should be seamless for the system's operators.
Non-Transportation Related Issues	Non-transportation-related issues can include additional city/agency departments (i.e. police and fire departments) using the system for their needs. At this time, no additional non-transportation uses have been identified.
O&M Issues	The communications system should be designed for low operation and maintenance costs over the expected operational life.
Expandability	The communications system should be expandable for growth. Communications systems should initially be sized to include at least a 50% margin in bandwidth capacity. Expandability should also consider the ability to add cables to conduit as well as additional ports on head-end equipment.
Reliability	MTBF (Mean Time Between Failure) for a communications system are in the thousands of hours or 99.9% availability. These systems use hardware and backup circuits so when a failure occurs information is routed down to a backup path with virtually no loss of connectivity.

Redundancy	Communication systems should have redundancy built into the design to increase the systems' reliability. The availability of redundancy was considered.
Bandwidth Requirements	Data NTCIP compliant protocols use considerably more bandwidth than a more proprietary protocol such that is used in the 170 controllers. To use NTCIP protocol may require controller replacement or firmware upgrade. This project does not anticipate controller replacement based on communication considerations alone, therefore, the communication systems would consider using more proprietary protocols like those used in standard 170 and NEMA controllers. Video A minimum 384 Kbps data rate is needed for each camera as this is considered the lowest acceptable quality of CCTV video for ITS applications. This minimum data rate was used when providing analysis for leased video solutions. Full motion video would be exchanged in locations where fiber optic cable exists.

3.7.2 Communication Bandwidth Requirements

There are a number of field device subsystems that the communication system must support. The table below provides a listing, description, and bandwidth considerations for the specific components.

Table 3-11: Communication Bandwidth Support

Component	Bandwidth	Origin/Destination	Description
TSMACS	384 kbps minimum	Center-to-Center	Communications to/from the Sub-Regional TMC and Local City Control Sites for the TSMACS systems is proposed to be through the County's Information Exchange Network (IEN). The IEN is proposed to provide center-to-center communications for traffic data and control.
Traffic Controller Subsystem	1200 bps	Center-to-Field	Controllers are polled on a second-by-second basis by the TSMACS via low-speed serial port communications. Vehicle Detection Subsystem data is also included in this bandwidth estimate. 9600 bps is recommended, but in locations where only limited bandwidth is available, 1200 bps is sufficient.
CCTV Video	384 Kbps	Center-to-Field Center-to-Center	Minimum bandwidth requirement for analog video uses a CODEC (CODER/DECODER) device to encode and compress the analog signal into a digital signal that can be transported over standard digital communication lines. Video over fiber is full-motion, uncompressed video. Due to the bandwidth imitations of the communications link

			between centers where no fiber optic cable will be available, sites hosting a video server will transmit compressed video images. The exact number of simultaneous video images exchanged between LCCs is defined in Section 4, on a city-by-city basis.
CCTV Camera Control	9600 bps	Center-to-Field	Camera control is low speed, “bursty” communications.
CMS	9600 bps	Center-to-Field	Communications between the LCCS and the controllers is low speed, “bursty” and is required when a message is being sent to be displayed by the sign, or when the status of the sign is assessed

3.7.3 Communication System Design

The concept of communications architecture refers to how the communications devices physically connect field devices and facilities. The goal of system design is to plan both in a cost-effective way and to provide for timely and accurate collection and management of the devices’ data.

For this discussion of communication architecture, the following physical devices are being considered:

- The field devices (i.e. traffic signals, CMS, and CCTV).
- The ten Local City Control Sites (LCCS) and one Sub-Regional TMC.

3.7.3.1 Communication Infrastructure Description

The recommended communication design, which assumes for planning purposes that unlimited funding is available, proposes new fiber optic cable deployment along the three main corridors of Firestone Boulevard, Imperial Highway, and Rosecrans Avenue to interconnect the video and data elements located at intersections within the east/west project limits.

This new fiber deployment would leverage fiber optic cable planned to be installed along Lakewood Blvd. and serve to connect all three main east/west corridors with a fiber path running north/south. To form a complete fiber optic cable link from Rosecrans Avenue to Imperial Highway Fiber along Lakewood Blvd., fiber cable is recommended to be installed along Lakewood Blvd. from Rosecrans Ave. to Imperial Highway (~1.05 miles). All proposed CCTV locations along Rosecrans Ave. can be connected to proposed fiber along Rosecrans Ave. then onto the proposed fiber along Lakewood Blvd.

The remainder of the north/south arterials, which includes Bellflower Blvd. and Paramount Blvd., are proposed to employ a Next Generation (2.5G) leased wireless solution to provide seamless coverage for all remaining field data components not within the vicinity of the fiber optic cable path. Traffic signal controllers along Paramount Blvd. and Bellflower Blvd. do not necessarily require high-bandwidth communications such as fiber optics, rather can be achieved using a wireless data communications capability of the 2.G technology. All CCTV cameras not near a fiber optic cable path are proposed to use a leased high-speed DSL circuit to transmit video to the Local City Control Site.

The proposed communication design for the recommended system leverages fiber optic cable planned for installation in the City of Downey within the following limits:

- Firestone Blvd. from Ryerson Ave. to Stewart & Gray Rd. (~3.6 miles)
- Lakewood Blvd. from Imperial Highway to Telegraph Rd. (or to Firestone Blvd. in the case of the I-105 Corridor Project) (~ 1.6 miles)
- Bellflower Blvd. from Imperial Highway to Stewart & Gray Rd. (~ 0.8 miles)
- Stewart & Gray Rd. from Lakewood to Bellflower Blvd. (~ 0.25 miles)

The City of South Gate has existing twisted-pair along Firestone Blvd. between Santa Fe Ave. and Ryerson Ave. however, under this design it is recommended to replace the existing twisted-pair cable plant with new fiber optic cable.

Figure 3-3 illustrates the geographical layout of the fiber optic cable paths for the recommended system design.

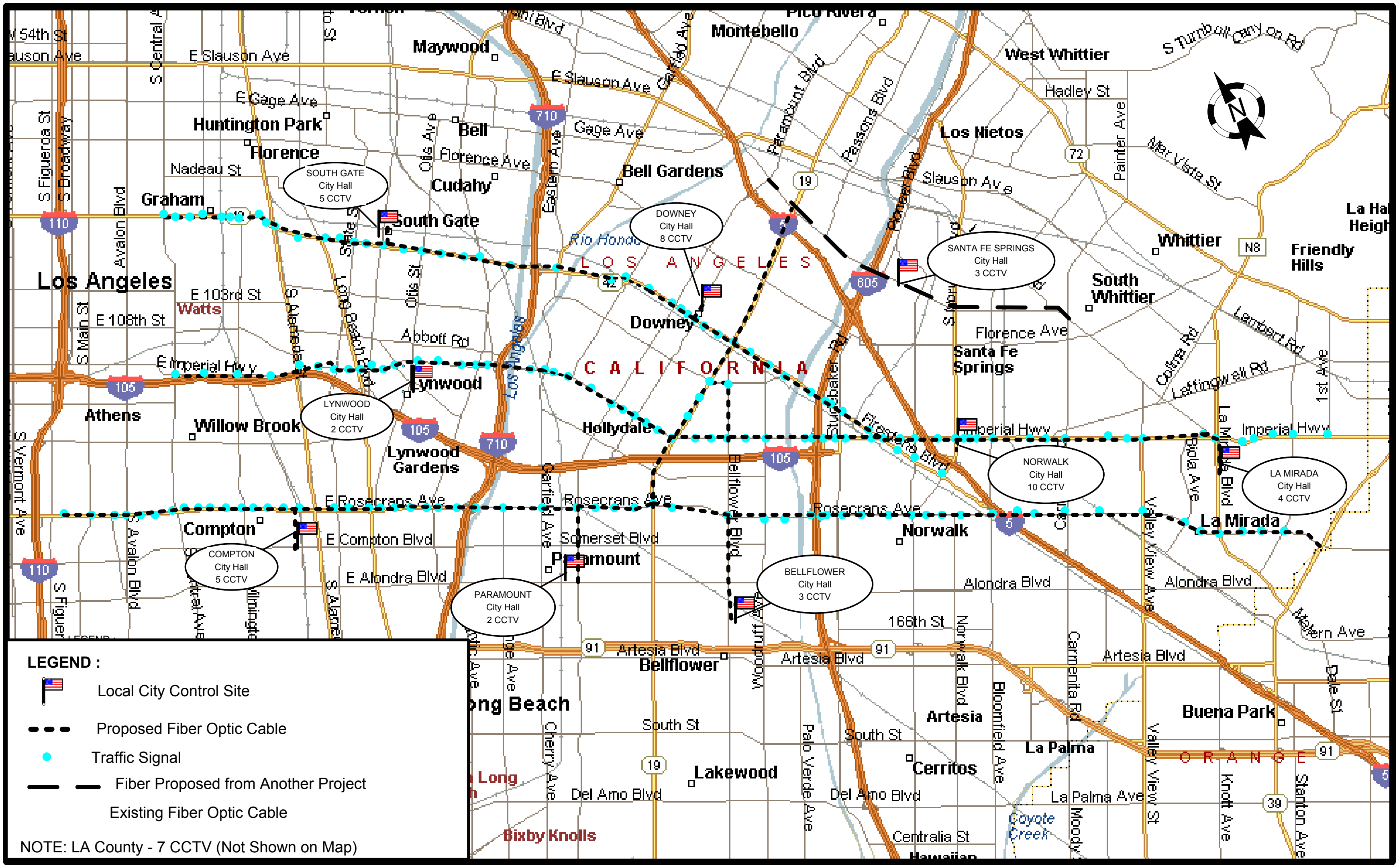


Figure 3-3: Geographic System Deployment for Recommended Design

Center-to-Field

The Center-to-Field communications supports two primary communications devices, those that are considered low speed data devices (i.e. traffic controls, CMS, and VDS subsystem) and CCTV cameras, which are, considered high bandwidth devices.

Although each Local City Control Site would be designed on their specific geographical and actual field device layout, each Local City Control Site would have a centralized architecture (e.g., star topology) design for communications with its field devices. Figure 3-4 represents a centralized communications topology where multiple field elements come into a single hub location – the Local City Control Site.

- VIDEO: Video communications are proposed to be Ethernet over SM fiber where new fiber optic cable would be deployed. All remaining CCTV cameras that are not near a fiber optic cable run would use high-speed DSL to transmit video signals back to their respective Local City Control Site.

- DATA: The field data elements are proposed to communicate with the LCC via add/drop modem communications topology over SM fiber where new proposed fiber would be deployed. The field elements along the north/south arterials (where no fiber is planned) would communicate using Next Generation (2.5G) leased wireless technology.

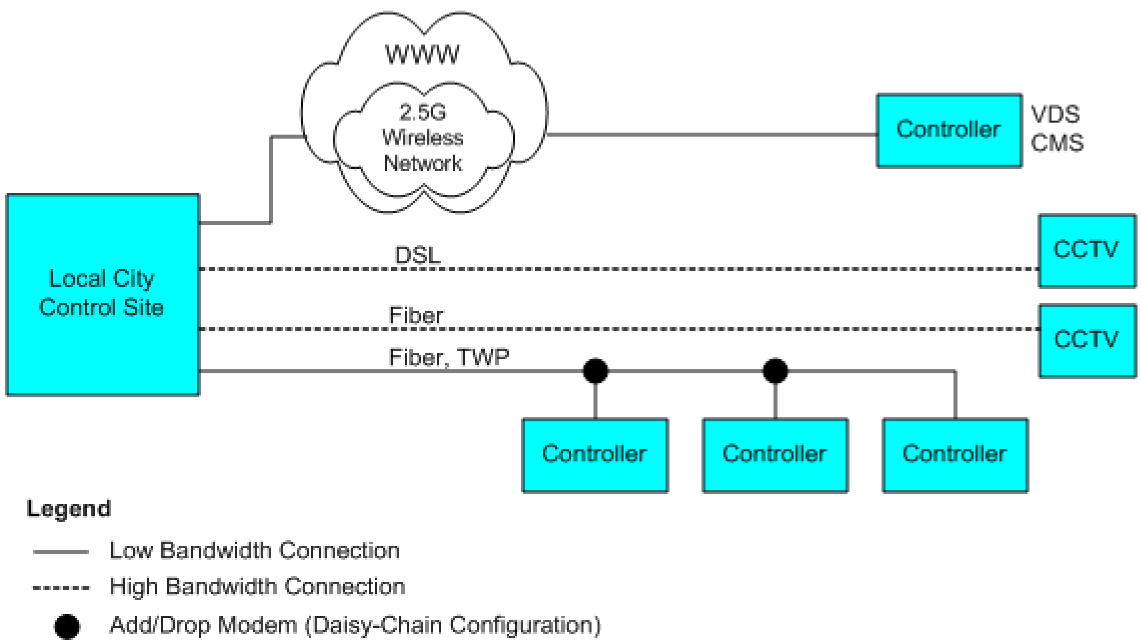


Figure 3-4: Typical Center-to-Field Communications Topology

Center-to-Center

The Center-to-Center communication topology depends on the following factors:

- The amount and type of data to be exchanged
- If communications lines and equipment are leased or owned
- The quality of service requirements for the data or video
- What type of communications technology is most appropriate for the applications being served

➢ VIDEO: Video transmissions topology is proposed to be Ethernet over the fiber between the LCCSs (where fiber is deployed) to a communications hub in Downey and a leased DSL connection from the communications hub to the Sub-Regional TMC at LA County. Center-to-Center communication is proposed to be Ethernet-based.

➢ DATA: Data transmissions are proposed to be Ethernet-based and follow the same methodology as the video communications between agencies.

Figure 3-5 represents the high-level, center-to-center communications topology where the communications cloud is representative of a high-speed DSL communication infrastructure for support of both data and video requirements.

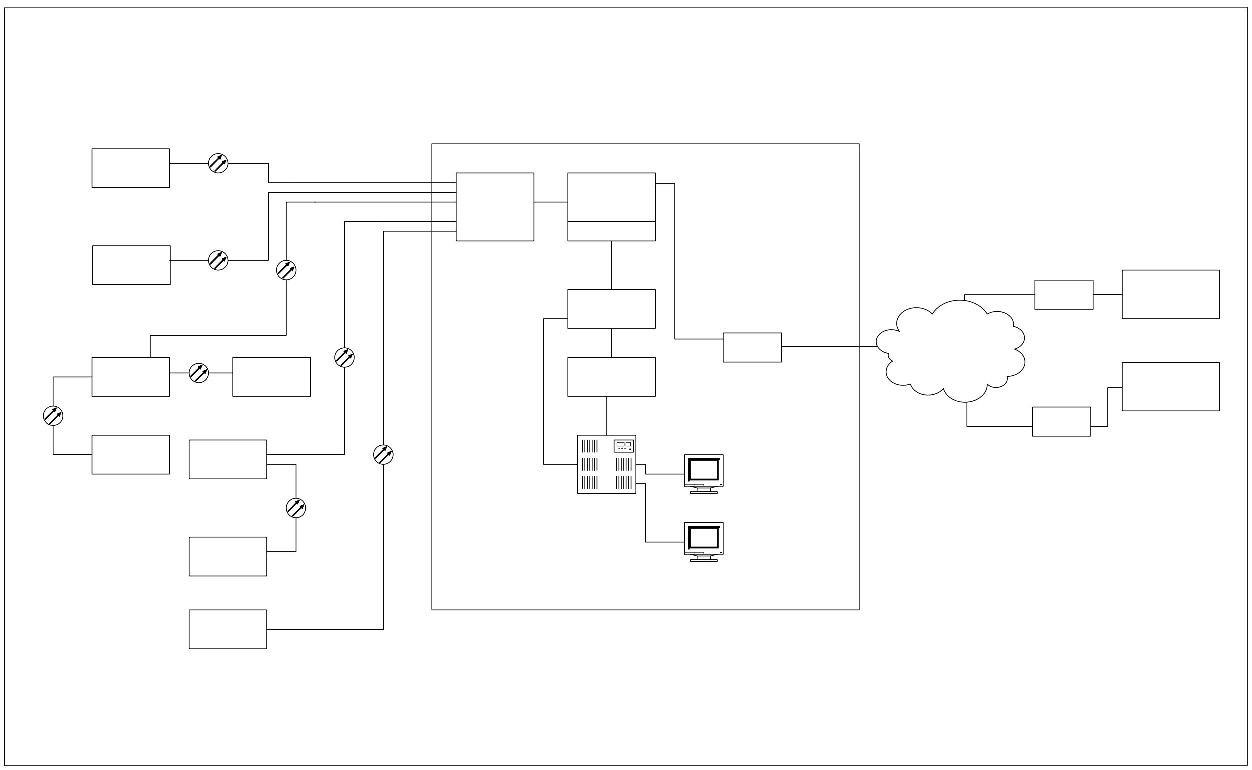


Figure 3-5: Center-to-Center Communications Topology for Recommended System

3.8 Cost Breakdown

The following table provides an estimated breakdown of the costs associated with the recommended system design deployment for all the agencies combined:

Table 3-12: Recommended System Design Construction Costs

Technology	Unit Cost Installed	Est. Quantity		Total
Terrestrial Systems				
Fiber Optic Cable in Conduit	$26	299,730	FT	$7,792,980
Fiber Optic Transceiver Pairs	$1,800	49	Unit	$88,200
Fiber Optic Data Modem	$2,000	174	Unit	$348,000
Splice Vaults	$1,800	65	Unit	$117,000
Splice Closures	$1,200	65	Unit	$78,000
Pull Boxes	$700	599	Unit	$419,300
Field Systems				
CCTV Cameras	$20,000	48	Unit	$960,000
Video Codec Pairs	$9,000	0	Unit	$0
Fixed CMS	$60,000	17	Unit	$1,020,000
Portable CMS	$23,000	20	Unit	$460,000
Vehicle Detector System (Advance loops)	$5,500	184	EA	$1,012,000
Vehicle Detector System (Presence loops)	$3,500	84	EA	$294,000
Controller Software/Firmware Upgrades	$350	80	EA	$28,000
Controller Hardware Upgrades	$9,500	39	EA	370,500
LCCS Systems				
Signal System	$182,000 - $250,000	8	LS	1,775,250
IEN Server Hardware	$8,000	10	EA	$80,000
IEN Workstation Hardware	$3,000	10	EA	$30,000
TSMACS Workstation	$3,000	10	EA	$30,000
Router w/Firewall	$5,000	20	EA	$100,000
Ethernet Switch LAN	$3,000	20	Unit	$60,000
Video Cards	$300	34	Unit	$10,200
Video Server	$6,000	10	Unit	$60,000
LCCS racks, cabling, and FF&E	$20,000	8	LS	$160,000
Miscellaneous				
Traffic Control	$30,000	10	LS	$300,000
Communication Systems				
Wireless 2.5G for CMS	$350	25	EA	$8,750
Wireless 2.5G for VDS	$350	12	EA	$4,200
Wireless 2.5G for LCCS	$350	10	EA	$3,500
DSL (C2C) to Downey 1.5/1.5M	$600	4	EA	$2,400
DSL (C2C) for Caltrans 384/384K	$600	1	EA	$600
Total Construction Costs				**$15,612,880**
10-Year Wireless Service Totals				**$650,400**
10-Year 2.5G Wireless Service	$960	47	EA	$451,200
10-Year DSL (C2C) to Downey 1.5/1.5M	$4,440	4	EA	$177,600
10-Year DSL (C2C) to Caltrans 384/384K	$2,160	1	EA	$21,600
Total Design Costs				**$2,185,845**
TOTAL				**$18,449,125**
Contigency 20%				**$3,689,825**
GRAND TOTAL				**$22,138,950**

4 INITIAL DEPLOYMENT SYSTEM DESIGN

As the implementation costs across the Gateway Cities Forum Projects were identified, cost savings measures were required. To map the recommended improvements to the available budget, the implementation of the I-105 Corridor improvements were assigned to phases. The current phase improvements are documented in this section. As additional funding becomes available, additional improvements can be programmed.

This section will provide details regarding the location of the Sub-regional TMC location and integration as well as, details associated with the signal system, CCTV cameras, CMS signs, detection, and communications as it relates to the current system design. Finally, this section will present a city-by-city description of the current system design.

The system architecture for initial deployment of the I-105 corridor system is depicted in Figure 4-1. In this system design, the number of Traffic Signal Systems to be deployed has been reduced and several cities are proposed to be sharing a signal system. In this configuration, signals and changeable message signs from one city would be connected to a system in another city. Each city would have a Traffic Signal Workstation to access and control their signals and an IEN workstation to view the signals in other jurisdictions. It has been determined by the quantity of signals in the project area that the following cities would receive signal systems: Downey, Norwalk, Santa Fe Springs, and La Mirada. The City of Compton is procuring a signal system through a separate project and would therefore have their own. The City of South Gate has an existing system that would be upgraded as part of this project. Video and camera control servers would be located in selected cities that have Traffic Signal Systems.

Further cost savings were reached by reducing the quantities of cameras and changeable message signs that would be deployed with this phase. In addition, fiber optic cables are proposed to be deployed in limited areas. Signals and signs in areas outside the fiber coverage would utilize wireless communications. Closed circuit television camera outside the fiber limits would utilize leased DSL.

The definitions of the Supporting Subsystems, Hardware and Software Configuration items are consistent with the recommended system architecture found in Section 3. In the recommended system architecture one city was identified to share a signal system, in the current deployment four cities fall in this category.

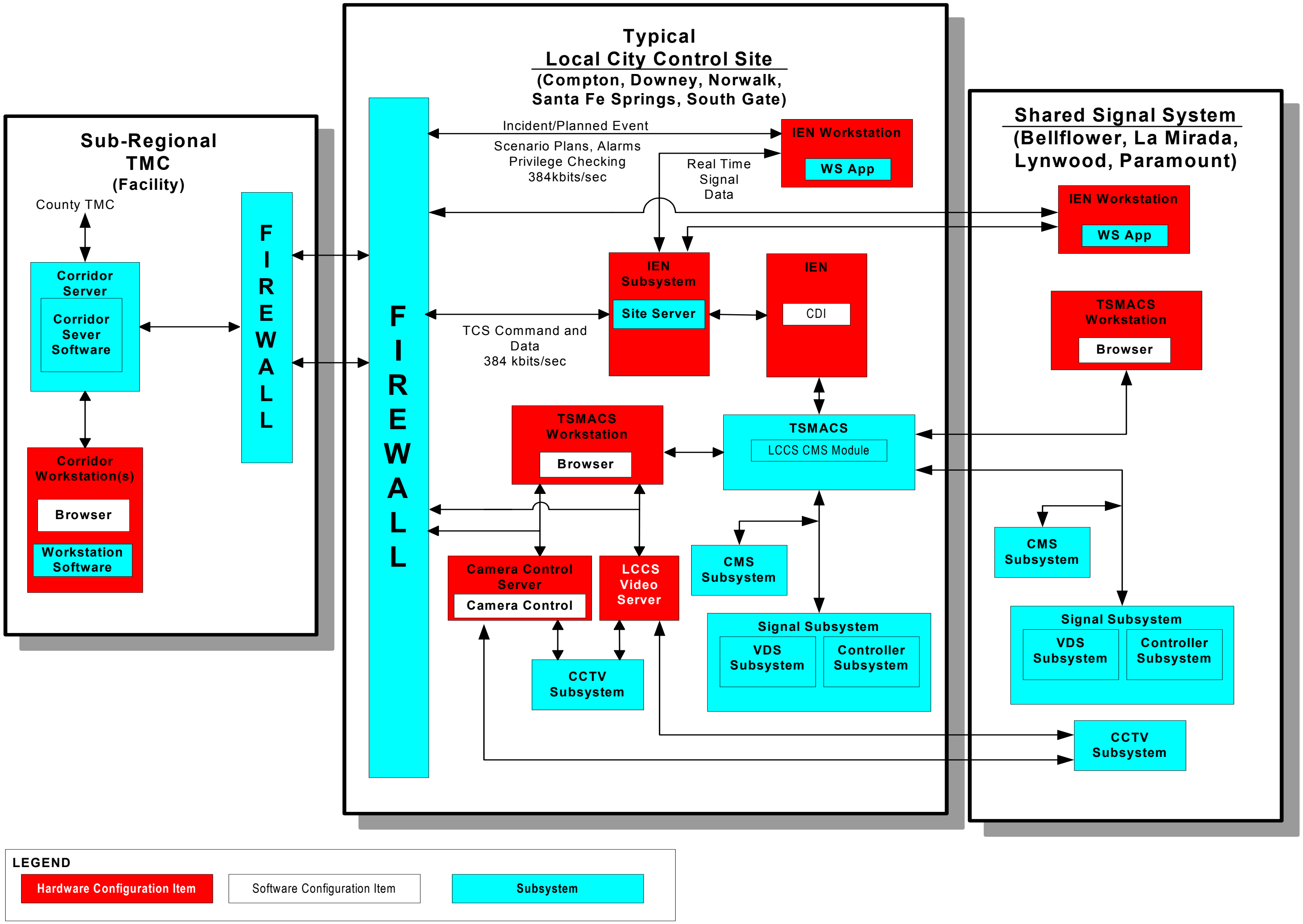


Figure 4-1: I-105 Corridor System Architecture for Current System Design

4.1 Sub-Regional TMC Location

The recommendation for co-locating the Sub-Regional TMC at the LA County facility applies to the current deployment system design as well. Refer to Section 3.2 Sub-Regional TMC Location for a detailed description of the site recommendation analysis.

4.2 Traffic Signal System

To reduce costs it is recommended that only cities with the most signals within the I-105 and I-5 Telegraph Rd. project limits would receive a traffic signal system. Cities would then be identified to share a system based upon the type of controllers and adjacent agencies. Table 4-1 indicates the quantity, predominant controller type and the location of the signal system for each agency within the I-105 corridor. For the current deployment system design, it is recommended that a signal system be deployed in the cities of Norwalk, Downey, Santa Fe Springs, and Compton. The City of Compton would procure a new signal system under separate contract. The cities of Paramount, Lynwood, and Bellflower would share a signal system with the City of Downey. The City of La Mirada would share the signal system with LA County.

The City of South Gate is currently operating an Icons system to manage their signal system. This system was deployed several years ago and would be upgraded with this project.

Table 4-1: Current Phase Signal System Location

Agency	Predominant Controller Type	Number of Intersections in I-105 Study Area	Location of Signal System
Bellflower	170	4	City of Downey
Caltrans	170	6	District 7
Compton	Recommendation underway	19	City of Compton
Downey	170	40	City of Downey
LA County	170	24	County TMC
La Mirada	170	15	County TMC
Lynwood	170	12	City of Downey
Norwalk	NEMA	42	City of Norwalk
Paramount	170	9	City of Downey
Santa Fe Springs	NEMA	4	City of Santa Fe Springs
South Gate	NEMA	19	City of South Gate

4.3 CCTV Camera System

CCTV cameras use surveillance technology for displaying traffic images from the field. The CCTV system consists of field cameras, camera control units, video decoders/encoders (if required for transport), and video control equipment. CCTV imagery data is required for real-time verification of incidents and congested traffic conditions. The images can be displayed at the LCC and/or stored in a digital video server, which is accessible through the Internet. Consistent with the recommendations in Section 3, the CCTV camera technology is recommended to be DSP with mechanical zoom lens, pressurized enclosures, and pan/tilt drive units.

4.3.1 CCTV Camera Locations

The camera locations recommended in Table 4-2 were further reviewed in order to provide the most optimal sites and fit within the available budget. The following factors were considered when the sites were re-evaluated:

- High volume intersections
- Density of camera coverage (even spacing)
- Viewing capabilities of cameras (physical obstructions such as curves in the roadway)

Table 4-2 contains the 29 CCTV camera locations planned for the current system deployment.

Table 4-2: CCTV Camera Locations for the Current System Deployment

Cross Street	Classification	Jurisdiction	Install CCTV
FIRESTONE BLVD			
Compton Ave	Secondary	LA County	Current
Long Beach Blvd	Primary	South Gate	Current
Atlantic Ave	Primary	South Gate	Current
Garfield Ave	Primary	South Gate	Current
Paramount Blvd	**Primary**	**Downey**	**Current**
Lakewood Blvd	**Primary**	**Downey**	**Current**
Studebaker Rd	**Primary**	**Norwalk**	**Current**
Imperial Hwy	**Primary**	**Norwalk**	**Current**
Pioneer Blvd	Primary	Norwalk	Current
IMPERIAL HWY			
Long Beach Blvd	Primary	Lynwood	Current
Atlantic Ave	Primary	Lynwood	Current
Paramount Blvd	**Primary**	**Downey**	**Current**
Lakewood Blvd	**Primary**	**Downey**	**Current**
Bellflower Blvd	**Secondary**	**Downey**	**Current**
Bloomfield Ave	Primary	Santa Fe Springs	Current
Carmenita Rd	Primary	LA County	Current
Valley View Ave	Primary	La Mirada	Current
La Mirada Blvd	Primary	La Mirada	Current

Cross Street	Classification	Jurisdiction	Install CCTV
ROSECRANS AVE			
Avalon Blvd	Primary	LA County	Current
Wilmington Ave	Primary	Compton	Current
Long Beach Blvd	Primary	Compton	Current
Atlantic Ave	Primary	County	Current
Paramount Blvd	**Primary**	**Paramount**	**Current**
Lakewood Blvd	Primary	Downey/Bellflower	Current
Woodruff Ave	Primary	Bellflower	Current
Studebaker Rd	Primary	Norwalk	Current
Pioneer Blvd	Primary	Norwalk	Current
Carmenita Rd	Primary	Norwalk	Current
Valley View Ave	Primary	Santa Fe Springs	Current

4.4 Changeable Message Sign (CMS) System

Changeable Message Signs display traveler information messages to the motoring public. The fixed CMS technology recommendation for single color LED signs is consistent with the recommendations found in Section 3. The quantity of signs has been reduced to fit within the available budget. The table below provides a listing of the locations selected for a fixed CMS for the current system design.

Table 4-3: Recommended CMS Locations

Project Arterial	Direction	In Advance Of	Jurisdiction
ZONE 1			
Paramount Blvd	Northbound	I-105	Paramount
Lakewood Blvd	Northbound	I-105	Paramount
Bellflower Blvd	Northbound	I-105	Bellflower
ZONE 2			
Rosecrans Ave	Freeway	I-710	Paramount
Rosecrans Ave	Freeway	I-710	Paramount
ZONE 3			
Imperial Hwy	Eastbound	I-605/I-105	Norwalk

4.5 Vehicle Detection System (VDS)

The VDS is responsible for gathering vehicle traffic information consisting of volume, occupancy and speed. For the current deployment system design the recommendation for the Vehicle Detection Systems (VDS) is to install separate detector lead-in cables (DLC) for each advance loop detector to allow lane-by-lane traffic detection.

An inventory of the VDS locations along the project routes is presented by agency in Sections 4.8 to 4.17.

4.6 Communication System

4.6.1 Communications System Architecture

The concept of communications architecture generally refers to how the communications devices physically connect field devices and facilities for communication purposes, which is also closely related to the topology of where data is stored and processed. The goal of the near-term system design is to plan in a cost-effective way and to provide for timely and accurate collection and management of the devices' data.

For discussion of communications system architecture, the following physical entities are being considered for interconnection:

- field devices (i.e. traffic signals, CMS, and CCTV)
- ten Local City Control Sites
- one Sub-Regional TMC

Within the Local City Control Sites the system architecture defines two subsystems:

- The IEN Subsystem which is required to communicate with Sub-Regional TMC systems and other Local City Control Sites.
- Within the Sub-Regional TMC, the Corridor Server (more specifically the IEN Subsystem) would communicate with each Local City Control Site, as well as the County TMC and other ITS-related systems.

The communication system architecture is partitioned into two components for analysis and described in terms of data communications and video transmission. These components are as follows:

- o Center-to-Center
- o Center-to-Field

4.6.1.1 Center-to-Center Communications

The Center-to-Center communication topology depends on the following factors:

- The amount and type of data to be exchanged
- The Quality of Service (QoS) requirements (guaranteed throughput) for the data or video
- What type of communications technology is most appropriate for the applications being served

➢ DATA – Data transmissions is proposed to be Ethernet-based and follow the same methodology as the video communications between agencies. The Center-to-Center data communications for the TSMACS is proposed to utilize fiber optic cable between the Local City Control Sites (where fiber exists or is planned) to a communications hub in either Downey or Norwalk and a leased high-speed DSL connection from the two communication hubs to the Sub-Regional TMC. Locations where fiber optic cable is not planned, a DSL connection is proposed to be used to transmit data between the cities/agencies. Communications from LCC to the Sub-Regional TMC is proposed to utilize CORBA according to the IEN's definitions.

- VIDEO – Video transmissions topology is proposed to be Ethernet over fiber between the LCCs (where fiber is deployed) to a video server and a leased DSL connection from the communications hub to the Sub-Regional TMC at LA County and other jurisdictions. Center-to-Center communication would be Ethernet-based. The cities of Norwalk and Downey would host video servers that would provide access to video for a group of particular cities/agencies. Video image access between cities/agencies would be over the Internet through leased high-speed DSL circuits where a fiber optic cable path does not exist.

Figure 4-2 represents the center-to-center communications topology where the communications cloud is representative of a high-speed DSL communication infrastructure for support of both data and video requirements. DSL would be replaced by fiber optic cable as noted in Figure 4-2.

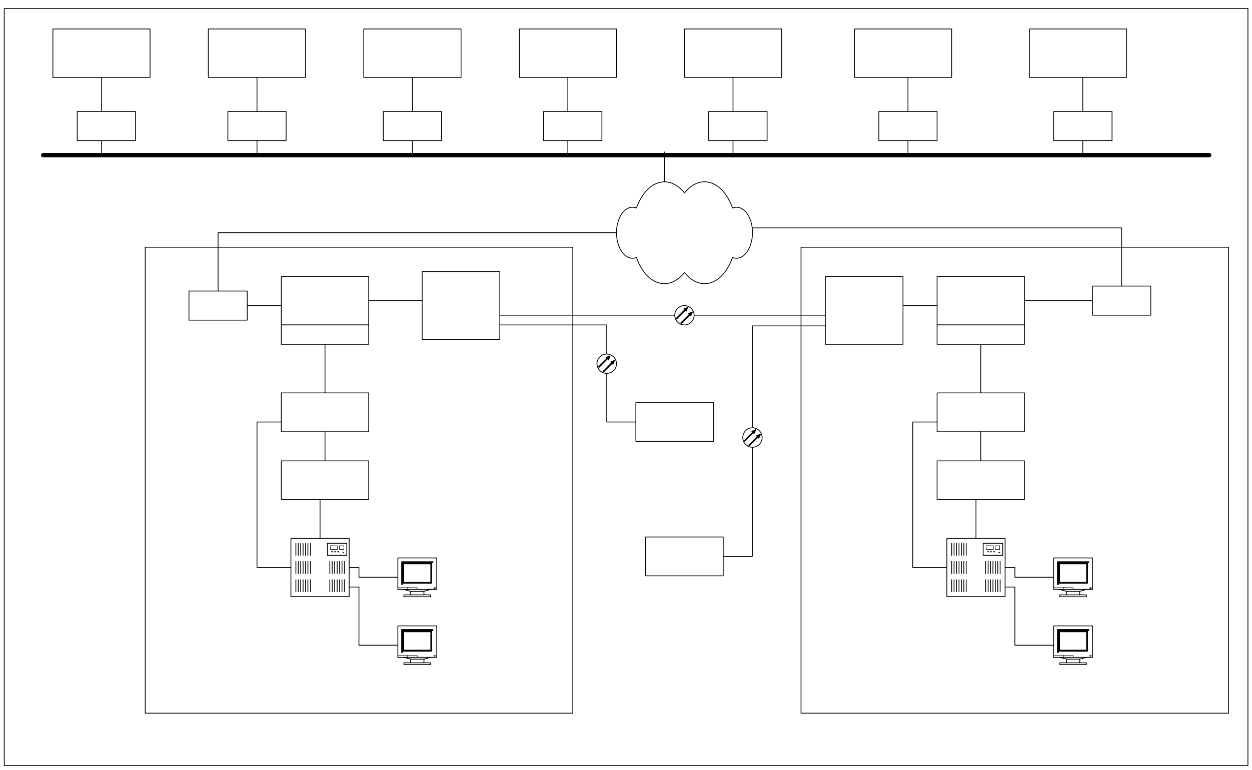


Figure 4-2: Center-To-Center Communications Topology for Initial System Deployment

4.6.1.2 Center-to-Field Communications

The Center-to-Field communications supports two primary communications devices, those that are considered low speed data devices (i.e. traffic controls, CMS, and VDS subsystem) and CCTV cameras, which are, considered high bandwidth devices.

Although each Local City Control Site would be designed on their specific geographical and actual field device layout, each Local City Control Site would have a centralized architecture (e.g., star topology) design for communications with its field devices. Figure 4-3 represents a centralized communications topology where multiple field elements come into a single hub location – the Local City Control Site.

- DATA – The field data elements would communicate with the LCC via add/drop communications topology over the existing fiber and twisted-pair cable infrastructure as well as, the new proposed fiber optic cable deployment. All other field data elements would communicate via point-to-point using Next Generation (2.5G) leased wireless technology. The Center-to-Field data communications for the TSMACS would be over fiber optic cable where fiber is proposed and all other locations would use a leased 2.5G Next Generation Wireless technology. Locations with existing twisted-pair cable would re-use the existing cable plant infrastructure for field data elements. The TSMACS Subsystem would define the communication protocol. The TSMACS would be able to communicate with either 170 or NEMA controllers as required. Those cities/agencies selected for a new signal system would serve as hosting partners (i.e. sharing agencies) for those cities/agencies not targeted for a new signal system.
- VIDEO – Video communications are proposed to be Ethernet over single mode fiber where new fiber optic cable would be deployed. All remaining CCTV cameras that are not near a fiber optic cable run would use high-speed DSL to transmit video signals back to the Local City Control Site. The video from CCTV cameras would be sent directly to either the Norwalk or Downey video servers using either fiber optic cable or DSL.

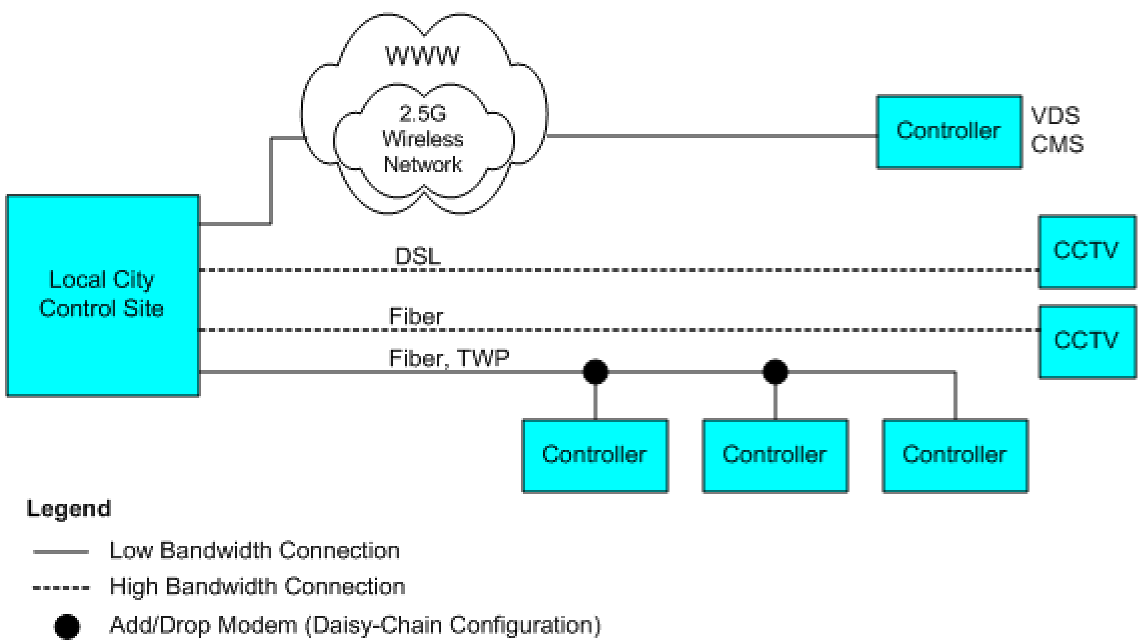


Figure 4-3: High-Level Center-to-Field Communications Topology

4.6.2 Communication Infrastructure Description

The current deployment system design is proposed to deploy fiber in proposed locations to complement the already existing fiber and twisted-pair infrastructure. The existing and new fiber deployments are proposed to pick up all video and data elements within their immediate vicinity. All remaining video from the field along the corridors including the north/south arterials, not within the vicinity of fiber, would use high-speed DSL to transmit video signals from the field to a Local City Control Site that is hosting a video server. All remaining field data elements along the corridors including the north/south arterials would employ Next Generation Wireless (2.5G) technology to transmit data from the field back to their respective Local City Control Site (LCCS).

The current system design proposes fiber optic cable deployment along the following routes:

- Imperial Highway from Garfield Avenue to Bellflower Blvd.
- Imperial Highway from Firestone Blvd. to La Mirada City Hall (via La Mirada Blvd.)
- Firestone Blvd. from Stewart and Gray Street to Imperial Highway

The current deployment plans to leverage the City of Downey's existing and planned fiber optic cable within the proposed limits:

- Firestone Blvd. from Ryerson Ave. to Stewart & Gray Rd.
- Lakewood Blvd. from Imperial Highway to Telegraph Rd. (or to Firestone Blvd. in the case of the I-105 Corridor Project)
- Bellflower Blvd. from Imperial Highway to Stewart & Gray Rd.
- Stewart & Gray Rd. from Lakewood to Bellflower Blvd.

The City of South Gate has existing twisted-pair along Firestone Blvd. between Santa Fe Ave. and Ryerson Ave., which is proposed to be used as part of this current deployment. The City of South Gate would use the existing twisted-pair cable plant for data transmissions only and high-speed DSL would be used for the video transmissions.

Figure 4-4 illustrates the geographical layout of the fiber optic cable paths for the recommended system design.

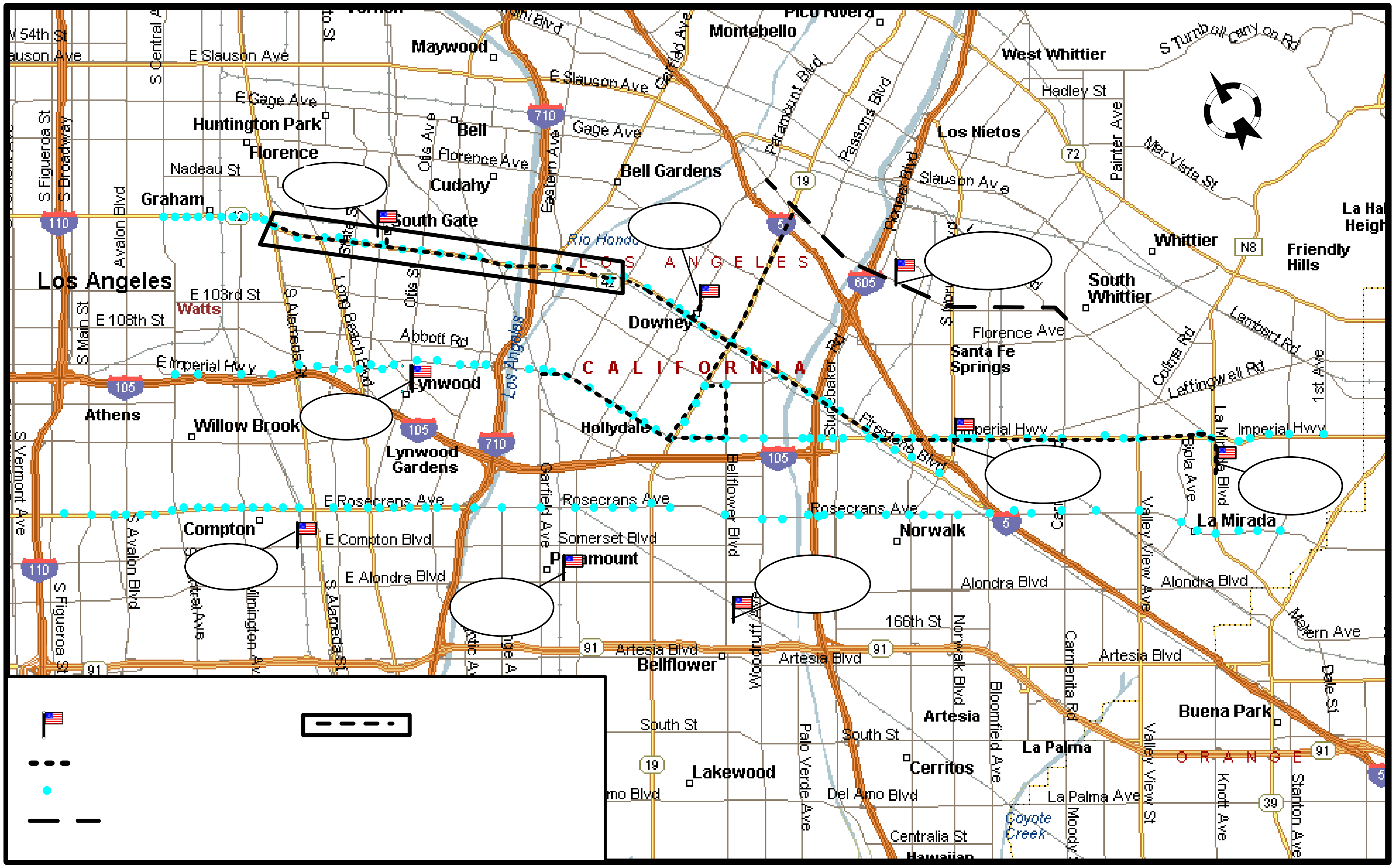


Figure 4-4: Geographic System Deployment for Initial System Deployment

SOUTH GATE
City Hall
3 CCTV

4.6.3 Video Server Sharing Methodology

The cities of Norwalk and Downey would serve as the video server locations for the other LCCS. The video server-sharing scheme leverages the traffic signal system sharing methodology for the current system design.

It is recommended that the cities of Bellflower, Paramount, and Lynwood share the signal system located at the City of Downey therefore, these cities along with LA County and La Mirada would share the video server located at the Downey LCCS. The remaining cities would share the video server located at the Norwalk LCCS. The table below shows the breakout, by city, of the video server-sharing scheme proposed for the current system design.

Table 4-4: Video Server Sharing Scheme

Downey Video Server	Norwalk Video Server
La Mirada (2 CCTV)	Santa Fe Springs (1 CCTV)
Bellflower (2 CCTV)	Compton (3 CCTV)
Paramount (1 CCTV)	South Gate (3 CCTV)
Lynwood (2 CCTV)	Norwalk (7 CCTV)
LA County (3 CCTV)	
Downey (5 CCTV)	

4.7 Proposed Improvements for Each Agency as part of Initial System Deployment

The following sections describe the improvements that are proposed for each agency as part of the initial deployment phase. These improvements are described for each agency and include field elements and LCC components followed by the proposed communications required to support them. The proposed improvements consist of field elements such as CCTV cameras at intersections, fixed changeable message signs (CMS), and traffic signal modifications that enable vehicle detection station (VDS) to support the corridor system. Note that, not all signalized intersections in the I-105 Corridor have been selected for interconnection with an LCC, only those intersections along the major east/west and north/south arterials in the corridor have been considered for this. Proposed LCC components may consist of new or upgraded traffic signal master control system, and video servers. Communication system descriptions are specific to each agency and range from fiber-based systems to leased-lines, to wireless technologies. Finally, a cost estimate associated with the system deployment recommendations for each agency is also provided. The agencies within the I-105 corridor planned for system improvements are listed below:

- City of Downey
- City of Norwalk
- City of Santa Fe Springs
- City of Paramount
- City of Compton
- City of Lynwood
- City of La Mirada
- City of South Gate
- City of Bellflower
- County of Los Angeles

4.7.1 City of Downey

The City of Downey is one of the target cities selected to receive a new signal system (TSMACS).

The city limits for Downey encompass all three of the east/west corridors of Firestone Boulevard, Imperial Highway, and Rosecrans Avenue as well as, three of the north/south arterials: Paramount Boulevard, Lakewood Boulevard, and Bellflower Boulevard. Figure 4-5 indicates the locations of proposed CCTV cameras and traffic signal controllers for connection to the LCC.

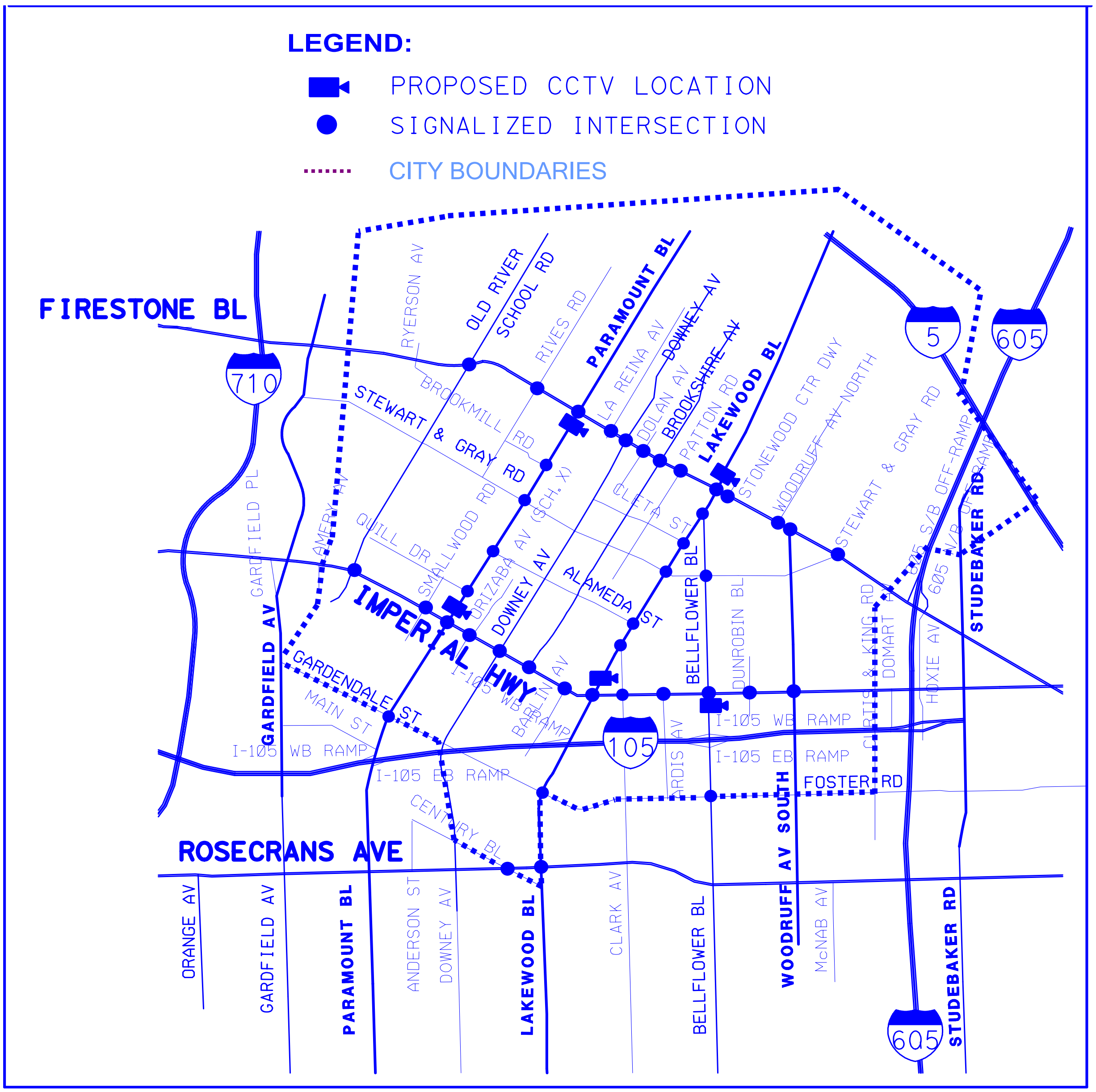


Figure 4-5: City of Downey

4.7.1.1 Field Deployment

The I-105 Corridor Project has identified several components as part of the deployment initiative for the City of Downey. The table below provides a more detailed view of the deployment initiative targeted for the city.

Table 4-5: City of Downey Field Deployment Inventory

Component	Qty	Location(s)	Communication Type
Traffic Signal System	1	Downey LCC (City Hall)	Network based
Traffic Signal Controllers	29	Various	Fiber Optic Cable
Traffic Signal Controllers	12	Various	Wireless
CCTV Cameras	5	Firestone & Paramount Firestone & Lakewood Imperial & Paramount Imperial & Lakewood Imperial & Bellflower	Fiber Optic Cable Fiber Optic Cable Fiber Optic Cable Fiber Optic Cable Fiber Optic Cable
Fixed CMS	0	N/A	N/A
Digital Video Server	1	Downey LCC (City Hall)	Network based

A listing of the existing Vehicle Detection Systems (VDS) for the City of Downey is provided in the tables below. Each intersection listed represents a field controller that is proposed to be interconnected with the communications infrastructure for the initial deployment to enable that signal to be monitored and controlled from Downey's City Hall.

Table 4-6: Downey VDS Locations

			Existing Detection		
Primary Street	**Cross Street**	**Communication**	**Presence**	**Advanced**	**Ganged?**
Firestone Blvd	Old River School	Existing Fiber	All	Major	No
Firestone Blvd	Rives Ave	Existing Fiber	All	Major	No
Firestone Blvd	Paramount Blvd	Existing Fiber	Minor	All	No
Firestone Blvd	La Reina Ave	Existing Fiber	All	Major	No
Firestone Blvd	Downey Ave	Existing Fiber	All	Major	No
Firestone Blvd	Dolan Ave	Existing Fiber	All	Major	No
Firestone Blvd	Brookshire Ave	Existing Fiber	All	All	No
Firestone Blvd	Patton Rd	Existing Fiber	All	Major	No
Firestone Blvd	Lakewood Blvd	Existing Fiber	All	All	No
Firestone Blvd	Stonewood Ctr Dwy	Existing Fiber	All	Major	No

			Existing Detection		
Primary Street	**Cross Street**	**Communication**	**Presence**	**Advanced**	**Ganged?**
Firestone Blvd	Woodruff Ave N	Existing Fiber	All	Major	No
Firestone Blvd	Woodruff Ave S	Existing Fiber	All	Major	No
Firestone Blvd	Stewart & Gray Rd	Existing Fiber	All	Major	No
Imperial Hwy	Old River School Rd	Fiber	All	Major	Major
Imperial Hwy	Smallwood Ave	Fiber	All	Major	Major
Imperial Hwy	Paramount Blvd	Fiber	All	All	Major
Imperial Hwy	Orizaba Ave	Fiber	Minor	Major	Major
Imperial Hwy	Downey Ave	Fiber	Minor	All	Major
Imperial Hwy	Brookshire Ave	Fiber	Minor	Major	Major
Imperial Hwy	Barlin Ave	Fiber	Minor	Major	Major
Imperial Hwy	Lakewood Blvd	Fiber	All	All	No
Imperial Hwy	Clark Ave	Fiber	Minor	All	Major
Imperial Hwy	Ardis Ave	Fiber	Minor	Major	All
Imperial Hwy	Bellflower Blvd	Fiber	All	All	No
Imperial Hwy	Dunrobin Ave	Wireless	Minor	Major	Major
Imperial Hwy	Woodruff Ave	Wireless	All	All	All
Rosecrans Ave	Century Blvd	Wireless	N/A	N/A	
Rosecrans Ave	Lakewood Blvd	Wireless	All	All	
Lakewood Blvd	Bellflower Blvd.	Wireless	Minor	Major	
Lakewood Blvd	Cleta St.	Existing Fiber	Minor	Major	
Lakewood Blvd	Stewart & Gray Rd.	Existing Fiber	Minor	Major	
Lakewood Blvd	Alameda St.	Existing Fiber	Minor	Major	
Lakewood Blvd	Clark Ave.	Existing Fiber	Minor	Major	
Lakewood Blvd	Gardendale St.	Wireless	Minor	Major	
Bellflower Blvd	Stewart & Gray Rd.	Existing Fiber	All	All	Major
Bellflower Blvd	Foster Rd.	Wireless	Minor	Major	Major
Paramount Blvd	Brookmill Rd.	Wireless	Minor	Major	No
Paramount Blvd	Stewart & Gray Rd.	Wireless	All	All	
Paramount Blvd	Alameda St.	Wireless	Minor	Major	No
Paramount Blvd	Quill Dr.	Wireless	Minor	Major	No
Paramount Blvd	Gardendale St	Wireless	Minor	All	No

4.7.1.2 Communications Design

The City of Downey LCC is proposed to serve as a communications hub to the Sub-regional TMC at LA County for the I-105 Corridor project. Communications between the City of Downey and the Sub-Regional TMC at LA County will be via high-speed leased DSL circuits.

All five CCTV cameras are within the vicinity of the fiber optic cable path proposed for the City of Downey. This would enable the video to be transmitted over fiber to the Downey LCC.

The field data elements within the vicinity of fiber optic cable path are proposed to transmit data add/drop modems over the fiber optic cable to the Downey LCC. The remaining VDS locations are proposed to interconnect with the City of Downey LCC using Next Generation (2.5G) Wireless communications technology to transmit data to and from the field.

The City of Downey has existing fiber optic cable within the following limits:

- Firestone Blvd. from Ryerson Ave. to Stewart & Gray Rd. (~ 3.6 miles)
- Lakewood Blvd. from Imperial Highway to Telegraph Rd. (or to Firestone Blvd. in the case of the I-105 Corridor Project) (~ 1.6 miles)
- Bellflower Blvd. from Imperial Highway to Stewart & Gray Rd. (~ 0.8 miles)
- Stewart & Gray Rd. from Lakewood to Bellflower Blvd. (~ 0.25 miles)

The I-105 Corridor Project proposes installing new fiber optic cable in the City of Downey along the following route:

- Imperial Highway from Garfield Avenue to Bellflower Blvd. (~ 2.9 miles)

The cities of Lynwood, Paramount, Bellflower, La Mirada, and LA County are proposed to share the video server located at the Downey LCCS. The Downey LCCS communication requirements must support the eight CCTV cameras planned for the five agencies transmitting video from the field over DSL to the Downey video server.

In addition, Lynwood, Paramount, and Bellflower are sharing the signal system located at the Downey LCCS and the communication requirements would support the data transmission between the agencies and the City of Downey.

The Downey LCCS DSL communication design requires:

<u>Center-to-Field</u>

- Two T1 circuits to support the eight incoming CCTV camera video signals at 384 Kbps per camera.

<u>Center-to-Center</u>

- Two T1 circuits to support eight outgoing video signals at 384 Kbps per video signal to other LCCS
- 1 x 384 Kbps circuit for symmetric, bi-directional data communications.

The diagram below illustrates the logical, high-level communications system design for the Local City Control (LCC) Site for the City of Downey.

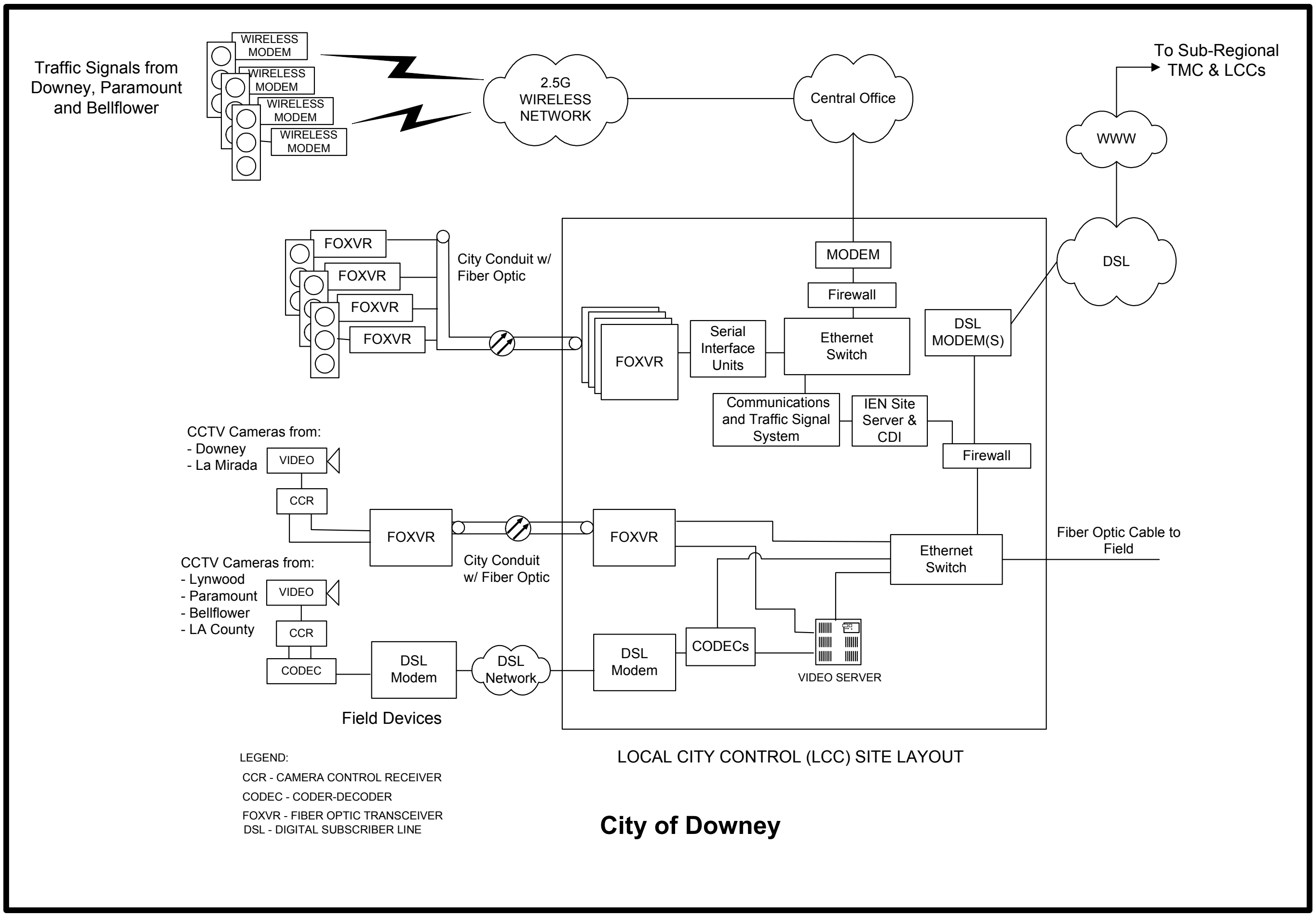


Figure 4-6: City of Downey Communication System Design

4.7.1.3 City of Downey Cost Breakdown

The following section provides a breakdown of the estimated costs associated with the current deployment system design for the City of Downey.

Table 4-7: City of Downey Implementation Estimates

Technology	Unit Cost Installed	Est. Quantity		Total
DOWNEY				
Terrestrial Systems				
Fiber Optic Cable in Conduit	$26	14,730	FT	$382,980
Fiber Optic Transceiver Pairs	$1,800	5	Unit	$9,000
Fiber Optic Data Modem	$2,000	29	Unit	$58,000
Splice Vaults	$1,800	5	Unit	$9,000
Splice Closures	$1,200	5	Unit	$6,000
Pull Boxes	$700	29	Unit	$20,300
Field Systems				
CCTV Cameras	$20,000	5	Unit	$100,000
Video Codec Pairs	$9,000	0	Unit	$0
Fixed CMS	$60,000	0	Unit	$0
Portable CMS	$23,000	0	Unit	$0
System Detection (Unganging Only)	$2,600	15	Apprch	$39,000
Controller Software/Firmware Upgrades	$350	0	EA	$0
Controller Hardware Upgrades (170)	$2,000	4	EA	$8,000
LCCS Systems				
Signal System	$250,950	1	LS	$250,950
IEN Server Hardware	$8,000	1	EA	$8,000
IEN Workstation Hardware	$3,000	1	EA	$3,000
Router w/Firewall	$5,000	2	EA	$10,000
Ethernet Switch LAN	$3,000	2	Unit	$6,000
Video Cards	$300	4	Unit	$1,200
Video Server	$6,000	1	Unit	$6,000
LCCS racks, cabling, and FF&E	$20,000	1	LS	$20,000
Miscellaneous				
Traffic Control	$30,000	1	LS	$30,000
Communication Systems				
Wireless 2.5G for CMS	$350	0	EA	$0
Wireless 2.5G for VDS	$350	12	EA	$4,200
Wireless 2.5G for LCCS	$350	1	EA	$350
DSL (C2C) 384/384K	$600	1	EA	$600
DSL (C2C/C2F) 1.5/1.5M	$600	2	EA	$1,200
Total Construction Costs				**$973,780**
10-Year Wireless Service Totals				**$235,200**
10-Year 2.5G Wireless Service	$960	13	EA	$124,800
10-Year DSL (C2C) 384/384K	$2,160	1	EA	$21,600
10-Year DSL (C2C/C2F) 1.5/1.5M	$4,440	2	EA	$88,800
Total Design Costs				**$174,345**
TOTAL				**$1,383,325**
Contigency 20%				**$276,665**
GRAND TOTAL				**$1,659,990**

4.7.2 City of Norwalk

The City of Norwalk is one of the cities selected to receive a new traffic signal system.

The city limits for Norwalk encompass all three of the east/west corridors of Firestone Boulevard, Imperial Highway, and Rosecrans Avenue as well as, one of the north/south arterials, specifically, Studebaker Road. Figure 4-7 indicates the locations of proposed CCTV cameras and traffic signal controllers for connection to an LCCS.

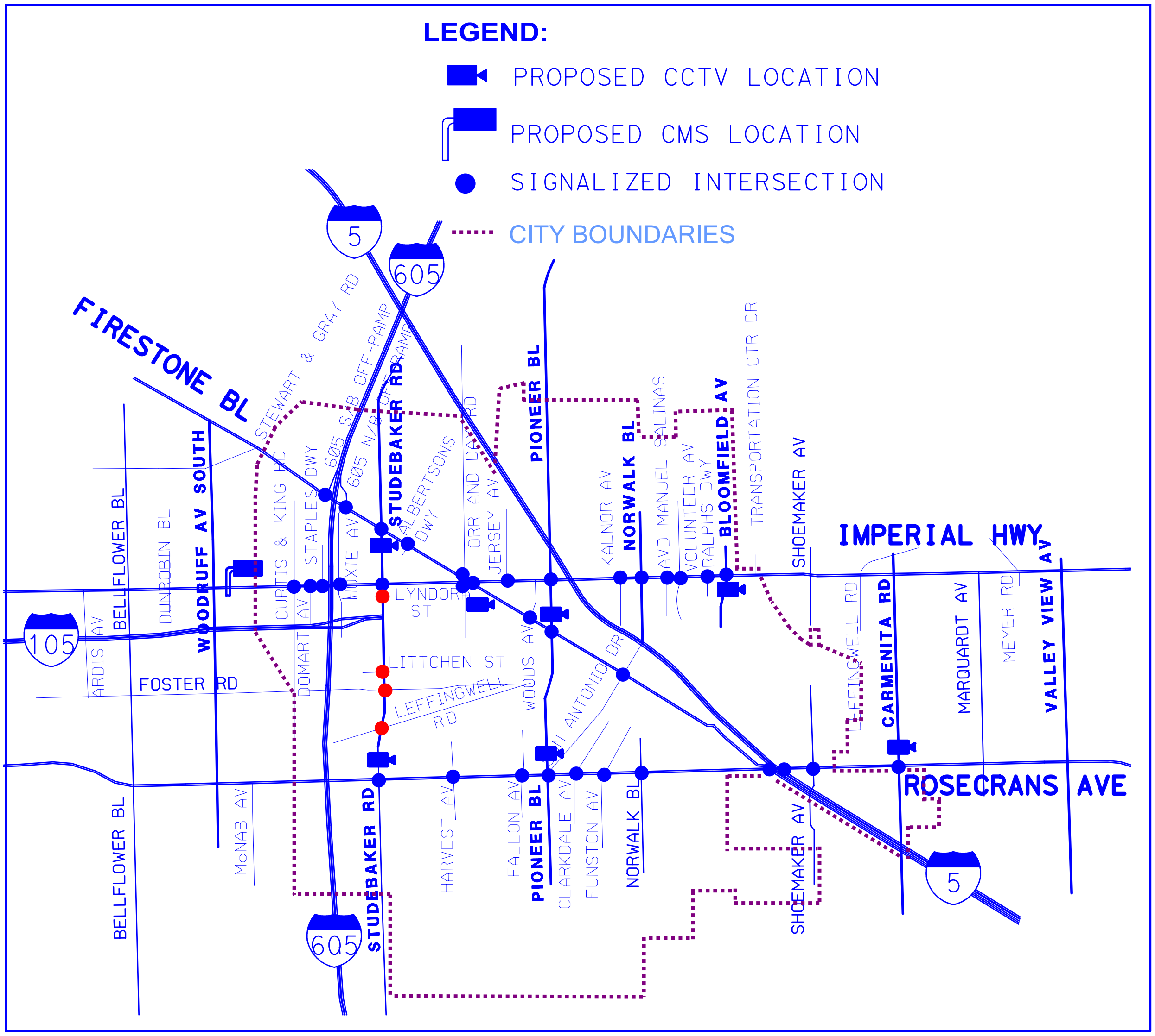


Figure 4-7: City of Norwalk

4.7.2.1 Field Deployment

The I-105 Corridor Project has identified several components as part of the deployment initiative for the City of Norwalk. The table below provides a more detailed view of the deployment initiative targeted for the city.

Table 4-8: City of Norwalk Field Deployment Inventory

Component	Qty	Location(s)	Communication Type
Traffic Signal System	1	Norwalk LCC	Network based
Traffic Signal Controllers	16	Various	Fiber Optic Cable
Traffic Signal Controllers	19	Various	Wireless
CCTV Cameras	7	Firestone & Studebaker Firestone & Imperial Firestone & Pioneer Imperial & Bloomfield Rosecrans & Studebaker Rosecrans & Pioneer Rosecrans & Carmenita	Fiber Optic Cable Fiber Optic Cable DSL Fiber Optic Cable DSL DSL DSL
Fixed CMS	1	Imperial Hwy (Eastbound in advance of I-605/I-105)	Wireless (2.5G)
Digital Video Server	1	Norwalk LCC	Network based

A listing of the existing Vehicle Detection Systems (VDS) for the City of Norwalk is provided in the tables below. Each intersection listed represents a field controller that is proposed to be interconnected with the communications infrastructure for the initial deployment to enable that signal to be monitored and controlled from Norwalk's City Hall.

Table 4-9: Norwalk VDS Locations

			Existing Detection		
Primary Street	**Cross Street**	**Communication**	**Presence**	**Advanced**	**Ganged?**
Firestone Blvd	Hoxie Ave	Fiber	All	Major	
Firestone Blvd	Studebaker Rd	Fiber	N/A	N/A	
Firestone Blvd	Albertsons Dwy	Fiber	N/A	N/A	
Firestone Blvd	Orr & Day Rd	Fiber	N/A	N/A	
Firestone Blvd	Imperial Hwy	Fiber	N/A	N/A	
Firestone Blvd	Woods Ave	Fiber	N/A	N/A	No
Firestone Blvd	Pioneer Blvd	Fiber	N/A	N/A	No
Firestone Blvd	San Antonio Dr	Fiber	N/A	N/A	
Firestone Blvd	Rosecrans/I-5 SB	Fiber	N/A	N/A	
Imperial Hwy	Curtis & King Rd	Wireless	Minor	Major	Major
Imperial Hwy	Domart Ave	Wireless	N/A	N/A	
Imperial Hwy	Staples Dwy	Wireless	N/A	N/A	
Imperial Hwy	Hoxie Ave	Wireless	N/A	N/A	
Imperial Hwy	Studebaker Rd	Wireless	All	All	All
Imperial Hwy	Orr & Day Rd	Wireless	N/A	N/A	
Imperial Hwy	Jersey Ave	Fiber	N/A	N/A	
Imperial Hwy	Pioneer Blvd	Fiber	All	All	All
Imperial Hwy	Kalnor Ave	Fiber	Minor	Major	Major
Imperial Hwy	Norwalk Blvd	Fiber	N/A	N/A	
Imperial Hwy	AVD Manuel	Fiber	Minor	Major	Major
Imperial Hwy	Volunteer Ave	Fiber	Minor	Major	Major
Imperial Hwy	Ralphs Dwy	Fiber	N/A	N/A	
Rosecrans Ave	Studebaker Rd	Wireless	All	All	Major
Rosecrans Ave	Harvest Ave	Wireless	Minor	Major	Major
Rosecrans Ave	Flallon Ave	Wireless	N/A	N/A	All
Rosecrans Ave	Pioneer Blvd	Wireless	N/A	N/A	All
Rosecrans Ave	Clarkdale Ave	Wireless	N/A	N/A	All
Rosecrans Ave	Funston Ave	Wireless	Minor	Major	Major
Rosecrans Ave	Norwalk Blvd	Wireless	N/A	N/A	All
Rosecrans Ave	Shoemaker Ave	Wireless	N/A	N/A	All

			Existing Detection		
Primary Street	Cross Street	Communication	Presence	Advanced	Ganged?
Rosecrans Ave	Carmenita Rd	Wireless	All	All	All
Studebaker Rd	Lyndora St.	Wireless	N/A	N/A	
Studebaker Rd	Littchen St.	Wireless	N/A	N/A	
Studebaker Rd	Foster Rd.	Wireless	All	All	
Studebaker Rd	Leffingwell Rd.	Wireless	Minor	Major	

4.7.2.2 Communications Design

The City of Norwalk communicates to the Downey hub via an Ethernet-based fiber optic communication link between the Norwalk LCC and the Downey LCC. Communication to the Sub-regional TMC at LA County is through leased high-speed DSL circuits.

The fiber routes defined for the City of Norwalk encompass three CCTV camera locations. Table 4-8 shows the CCTV cameras covered by the proposed fiber optic cable path and the specific CCTV cameras that would be covered through leased DSL services to the Norwalk LCC.

The field data elements within the vicinity of fiber optic cable path would transmit data in a daisy-chain configuration over the fiber optic cable to the Norwalk LCC. The remaining field data locations would interconnect with the City of Norwalk LCC in a point-to-point configuration using Next Generation (2.5G) Wireless communications technology to transmit data to and from the field.

The proposed fixed CMS location on eastbound Imperial Highway in advance of the I-605/I-105 Freeway would communicate with the City of Norwalk LCC via Next Generation (2.5G) Wireless technology similar to the remote field data elements.

The I-105 Corridor Project proposes installing new fiber optic cable in the City of Norwalk along the following routes:

- Imperial Highway from Firestone Blvd. to Ralphs Driveway
- Firestone Blvd. from I-605 SB Off-Ramp to Imperial Highway

The cities of Santa Fe Springs, South Gate, and Compton would share the video server located at the Norwalk LCC. The Norwalk communication requirements must support the 11 CCTV cameras planned for the three agencies transmitting video from the field over DSL to the Norwalk video server.

The Norwalk LCCS DSL communication design requires:

<u>Center-to-Field</u>

- Three T1 circuits to support the 11 incoming CCTV camera video signals at 384 Kbps per camera.

<u>Center-to-Center</u>

- Three T1 circuits to support 12 outgoing video signals at 384 Kbps per video signal to other LCCS.
- 1 x 384 Kbps circuit for symmetric, bi-directional data communications.

The diagram below illustrates the logical, high-level communications system design for the Local City Control (LCC) Site for the City of Norwalk.

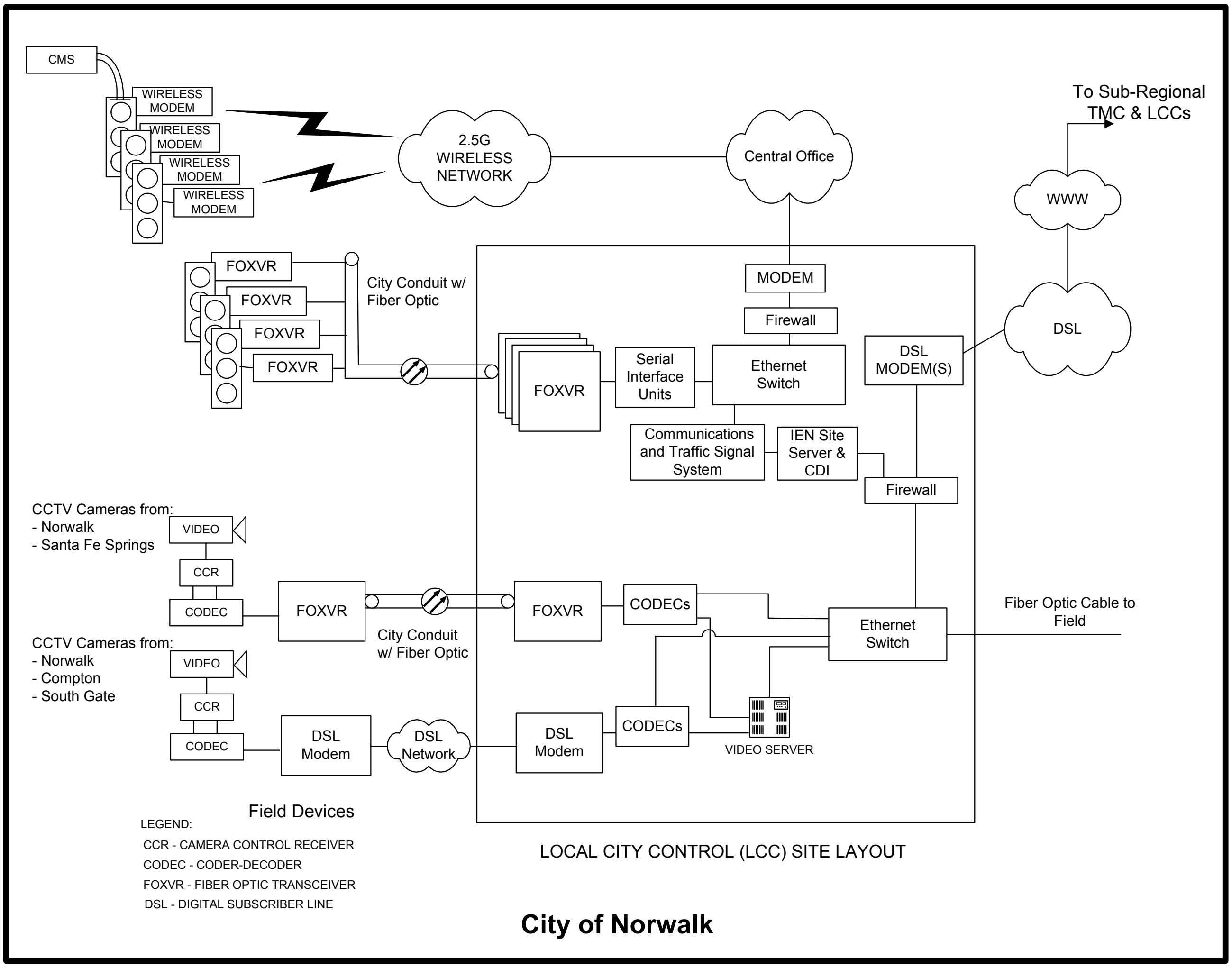


Figure 4-8: City of Norwalk Communication System Design

4.7.2.3 City of Norwalk Cost Breakdown

The following section provides a breakdown of the estimated costs associated with the current deployment system design for the City of Norwalk.

Table 4-10: City of Norwalk Implementation Estimates

Technology	Unit Cost Installed	Est. Quantity		Total
NORWALK				
Terrestrial Systems				
Fiber Optic Cable in Conduit	$26	15,999	FT	$415,974
Fiber Optic Transceiver Pairs	$1,800	3	Unit	$5,400
Fiber Optic Data Modem	$2,000	18	Unit	$36,000
Splice Vaults	$1,800	3	Unit	$5,400
Splice Closures	$1,200	3	Unit	$3,600
Pull Boxes	$700	32	Unit	$22,400
Field Systems				
CCTV Cameras	$15,000	7	Unit	$105,000
Video Codec Pairs	$9,000	4	Unit	$36,000
Fixed CMS	$60,000	1	Unit	$60,000
Portable CMS	$23,000	0	Unit	$0
System Detection (Unganging Only)	$2,600	23	Apprch	$59,800
Controller Software/Firmware Upgrades	$350	0	EA	$0
Controller Hardware Upgrades	$9,500	13	EA	$123,500
LCCS Systems				
Signal System	$269,400	1	LS	$269,400
IEN Server Hardware	$8,000	1	EA	$8,000
IEN Workstation Hardware	$3,000	1	EA	$3,000
TSMACS Workstation	$3,000	1	EA	$3,000
Router w/Firewall	$5,000	2	EA	$10,000
Ethernet Switch LAN	$1,500	2	Unit	$3,000
Video Cards	$300	4	Unit	$1,200
Video Server	$6,000	1	Unit	$6,000
LCCS racks, cabling, and FF&E	$20,000	1	LS	$20,000
Miscellaneous				
Traffic Control	$30,000	1	LS	$30,000
Communication Systems				
Wireless 2.5G for CMS	$350	1	EA	$350
Wireless 2.5G for VDS	$350	24	EA	$8,400
Wireless 2.5G for LCCS	$350	1	EA	$350
DSL (C2C) 384/384K	$600	1	EA	$600
DSL (C2C/C2F) 1.5/1.5M	$600	3	EA	$1,800
Total Construction Costs				**$1,238,174**
10-Year Wireless Service Totals				**$404,400**
10-Year 2.5G Wireless Service	$960	26	EA	$249,600
10-Year DSL (C2C) 384/384K	$2,160	1	EA	$21,600
10-Year DSL (C2C/C2F) 1.5/1.5M	$4,440	3	EA	$133,200
Total Design Costs				**$202,632**
TOTAL				**$1,845,206**
Contigency 20%				**$369,041**
GRAND TOTAL				**$2,214,247**

4.7.3 City of Santa Fe Springs

The City of Santa Fe Springs is one of the target cities selected to receive a new traffic signal system.

The city limits for Santa Fe Springs encompass two of the east/west corridors: Imperial Highway and Rosecrans Avenue. None of the north/south arterials are part of Santa Fe Springs. Figure 4-9 indicates the locations of proposed CCTV cameras and traffic signal controllers for connection to an LCCS.

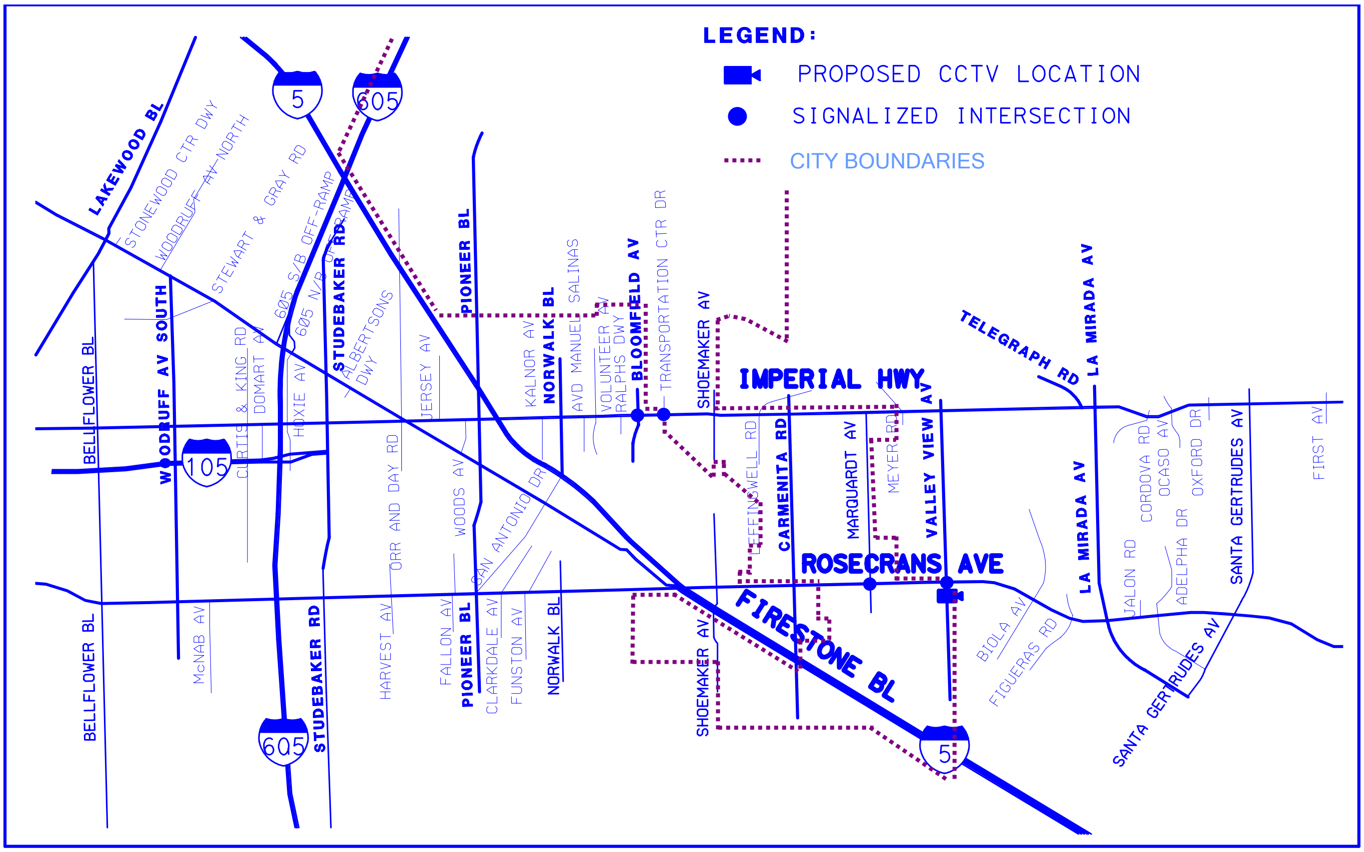


Figure 4-9: City of Santa Fe Springs

4.7.3.1 Field Deployment

The I-105 Corridor Project has identified several components as part of the deployment initiative for the City of Santa Fe Springs. The table below provides a more detailed view of the deployment initiative targeted for the city. The communication between the Santa Fe Springs LCC and the Norwalk LCC would be over fiber optic cable. The City of Santa Fe Springs has planned a fiber optic cable deployment for Telegraph Road as part of the I-5/Telegraph Rd. project initiative. The proposed deployment is targeted for Telegraph Road from Paramount Boulevard to Carmenita Road. Refer to Figure 4-4 for a graphical representation of the proposed fiber limits along Telegraph Road.

Table 4-11: City of Santa Fe Springs Field Deployment Inventory

Component	Qty	Location(s)	Communication Type
Traffic Signal System	1	Santa Fe Springs LCC	Network based
Traffic Signal Controllers	2	Various	Fiber Optic Cable
Traffic Signal Controllers	2	Various	Wireless
CCTV Cameras	1	Rosecrans & Valley View	DSL
Fixed CMS	0	N/A	N/A
Digital Video Server	0	Share with Norwalk LCC	DSL

A listing of the existing Vehicle Detection Systems (VDS) for the City of Santa Fe Springs is provided in the table below. Each intersection listed represents a field controller that is proposed to be interconnected with the communications infrastructure for the initial deployment to enable that signal to be monitored and controlled from Santa Fe Springs' City Hall.

Table 4-12: Santa Fe Springs VDS Locations

			Existing Detection		
Primary Street	**Cross Street**	**Communications**	**Presence**	**Advanced**	**Ganged?**
Imperial Hwy	Bloomfield Ave	Fiber	All	All	All
Imperial Hwy	Transportation Ctr	Fiber	N/A	N/A	Major
Rosecrans Ave	Marquardt Ave	Wireless	All	All	All
Rosecrans Ave	Valley View Ave	Wireless	All	All	All

4.7.3.2 Communications Design

The City of Santa Fe Springs communications infrastructure design for the field consists of a fiber optic cable and wireless based design for the traffic signals for the city. Two intersections on Imperial Highway are proposed to be fiber based and two intersections on Rosecrans Avenue would be wireless based. The video transmission would use high-speed DSL to transmit from the field and would share the digital video server located at Norwalk.

The communication between the Santa Fe Springs LCC and the Norwalk LCC would be over fiber optic cable. The City of Santa Fe Springs has planned a fiber optic cable deployment for Telegraph Road under a separate project initiative. The proposed deployment is targeted for Telegraph Road from Paramount Boulevard to Carmenita Road. Refer to **Figure 4-4** for a graphical representation of the proposed fiber limits along Telegraph Road.

The DSL bandwidth requirement for Santa Fe Springs:

<u>Center-to-Field</u>

- 1 x 384Kbps circuit for a CCTV camera from the field to the video server located at the City of Norwalk.

The diagram below illustrates the logical, high-level communications system design for the Local City Control (LCC) Site for the City of Santa Fe Springs.

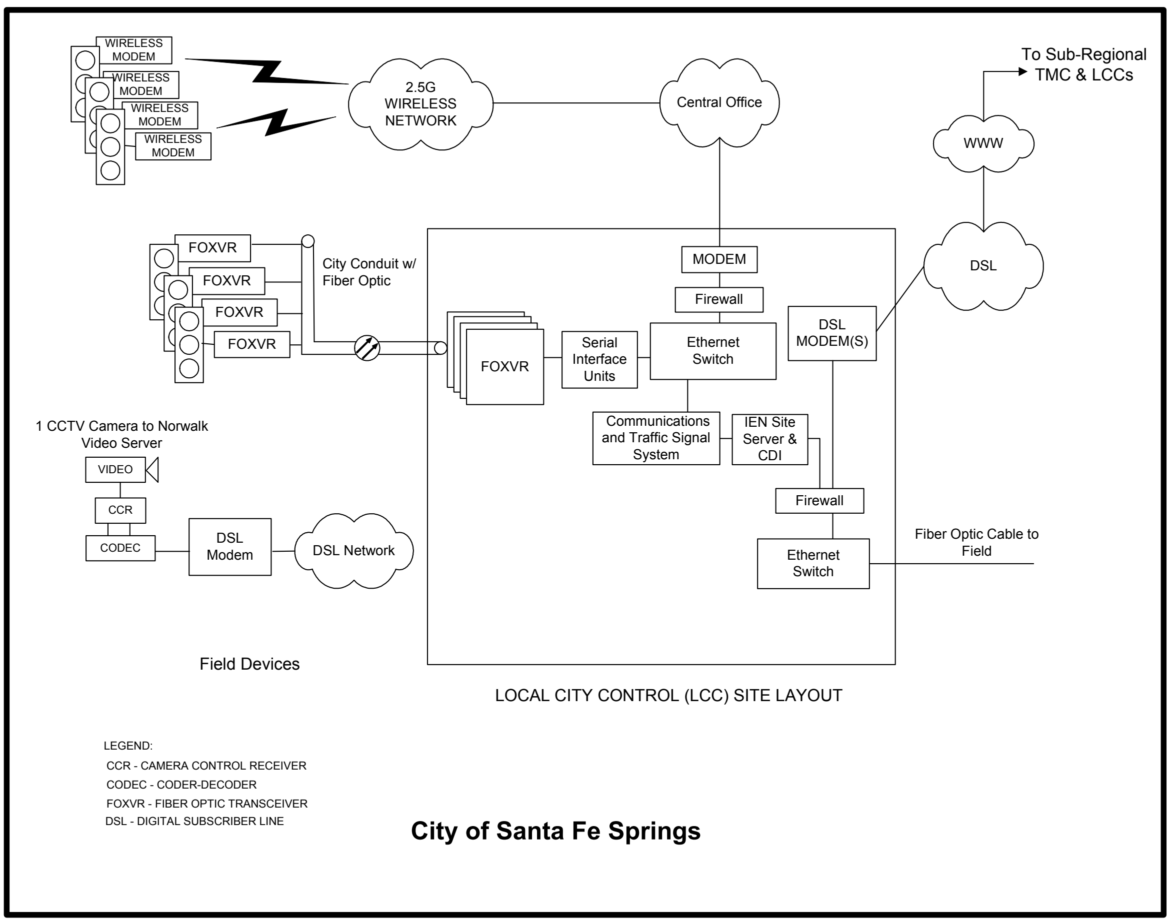


Figure 4-10: City of Santa Fe Springs Communication System Design

4.7.3.3 City of Santa Fe Springs Cost Breakdown

The following section provides a breakdown of the estimated costs associated with the current deployment system design for the City of Santa Fe Springs.

Table 4-13: City of Santa Fe Springs Implementation Estimates

Technology	Unit Cost Installed	Est. Quantity		Total
SANTA FE SPRINGS				
Terrestrial Systems				
Fiber Optic Cable in Conduit	$26	8,818	FT	$229,268
Fiber Optic Transceiver Pairs	$1,800	0	Unit	$0
Fiber Optic Data Modem	$2,000	2	Unit	$4,000
Splice Vaults	$1,800	1	Unit	$1,800
Splice Closures	$1,200	1	Unit	$1,200
Pull Boxes	$700	18	Unit	$12,600
Field Systems				
CCTV Cameras	$15,000	1	Unit	$15,000
Video Codec Pairs	$9,000	1	Unit	$9,000
Fixed CMS	$60,000	0	Unit	$0
Portable CMS	$23,000	0	Unit	$0
System Detection (Unganging Only)	$2,600	8	Apprch	$20,800
Controller Software/Firmware Upgrades	$350	0	EA	$0
Controller Hardware Upgrades	$9,500	2	EA	$19,000
LCCS Systems				
Signal System	$229,500	1	LS	$229,500
IEN Server Hardware	$8,000	1	EA	$8,000
IEN Workstation Hardware	$3,000	1	EA	$3,000
TSMACS Workstation	$3,000	1	EA	$3,000
Router w/Firewall	$5,000	2	EA	$10,000
Ethernet Switch LAN	$1,500	2	Unit	$3,000
Video Cards	$300	1	Unit	$300
Video Server	$6,000	0	Unit	$0
LCCS racks, cabling, and FF&E	$20,000	0	LS	$0
Miscellaneous Systems				
Traffic Control	$30,000	1	LS	$30,000
Communication Systems				
Wireless 2.5G for CMS	$350	0	EA	$0
Wireless 2.5G for VDS	$350	2	EA	$700
Wireless 2.5G for LCCS	$350	1	EA	$350
DSL (C2F) 384/384K	$600	1	EA	$600
Total Construction Costs				**$601,118**
10-Year Wireless Service Totals				**$50,400**
10-Year 2.5G Wireless Service	$960	3	EA	$28,800
10-Year DSL (C2F) 384/384K	$2,160	1	EA	$21,600
Total Design Costs				**$108,206**
TOTAL				**$759,724**
Contigency 20%				**$151,945**
GRAND TOTAL				**$911,669**

4.7.4 City of Paramount

The City of Paramount would share the traffic signal system with the City of Downey.

The city limits for Paramount encompasses one of the east/west corridors, Rosecrans Avenue and one of the north/south arterials, specifically Paramount Boulevard. Figure 4-11 indicates the locations of proposed CCTV cameras and traffic signal controllers for connection to an LCCS.

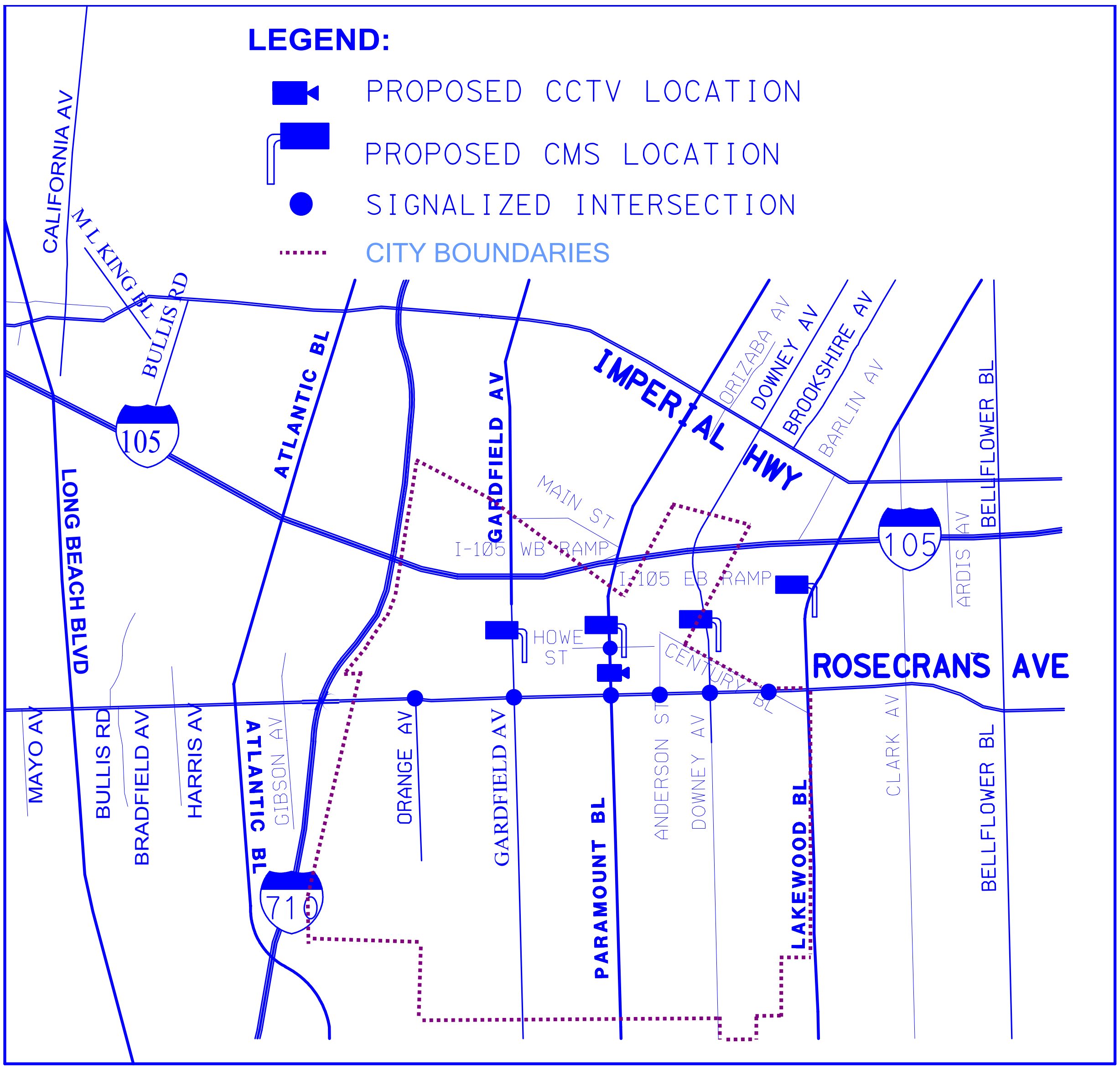


Figure 4-11: City of Paramount

4.7.4.1 Field Deployment

The I-105 Corridor Project has identified several components as part of the deployment initiative for the City of Paramount. The table below provides a more detailed view of the deployment initiative targeted for the city.

Table 4-14: City of Paramount Field Deployment Inventory

Component	Qty	Location(s)	Communication Type
Traffic Signal System	0	Share with Downey	DSL
Traffic Signal Controllers	7	Various	Wireless
CCTV Cameras	1	Rosecrans & Paramount	DSL
Fixed CMS	4	Paramount Blvd (northbound in advance of I-105) Lakewood Blvd (northbound in advance of I-105) Rosecrans Ave (freeway in advance of I-710) Rosecrans Ave (freeway in advance of I-710)	Wireless Wireless Wireless Wireless
Digital Video Server	0	Share with Downey	DSL

A listing of the existing Vehicle Detection Systems (VDS) for the City of Paramount is provided in the table below. Each intersection listed represents a field controller that is proposed to be interconnected with the communications infrastructure for the initial deployment to enable that signal to be monitored and controlled from Downey's City Hall.

Table 4-15: Paramount VDS Locations

			Existing Detection		
Primary Street	**Cross Street**	**Communications**	**Presence**	**Advanced**	**Ganged?**
Rosecrans Ave	Orange Ave	Wireless	All	Major	Major
Rosecrans Ave	Garfield Ave (VIDS)	Wireless	All	All	All
Rosecrans Ave	Paramount Blvd	Wireless	All	All	All
Rosecrans Ave	Anderson St	Wireless	All	Major	Major
Rosecrans Ave	Downey Ave	Wireless	All	All	All
Rosecrans Ave	Century Blvd	Wireless	N/A	N/A	
Paramount Blvd	Howe St	Wireless	All	Major	Major

4.7.4.2 Communication Design

The communications infrastructure design in the field consists of a wireless based design for the traffic signals and the four fixed CMS locations. Video transmissions would use high-speed DSL to transmit from the field and would share the video server located at the City of Downey.

Communication between the Paramount LCCS and the Downey LCCS would be over high-speed DSL. The DSL bandwidth requirement for Paramount includes support for video in the field and data communication for the shared signal system.

The DSL bandwidth requirement for Paramount:

Center-to-Field

- 1 x 384Kbps circuit for a CCTV camera from the field to the video server located at the City of Downey.

Center-to-Center

- 1 x 384Kbps circuit for traffic signal system data communications between the Paramount LCCS and the Downey LCCS.

The diagram below illustrates the logical, high-level communications system design for the Local City Control (LCC) Site for the City of Paramount.

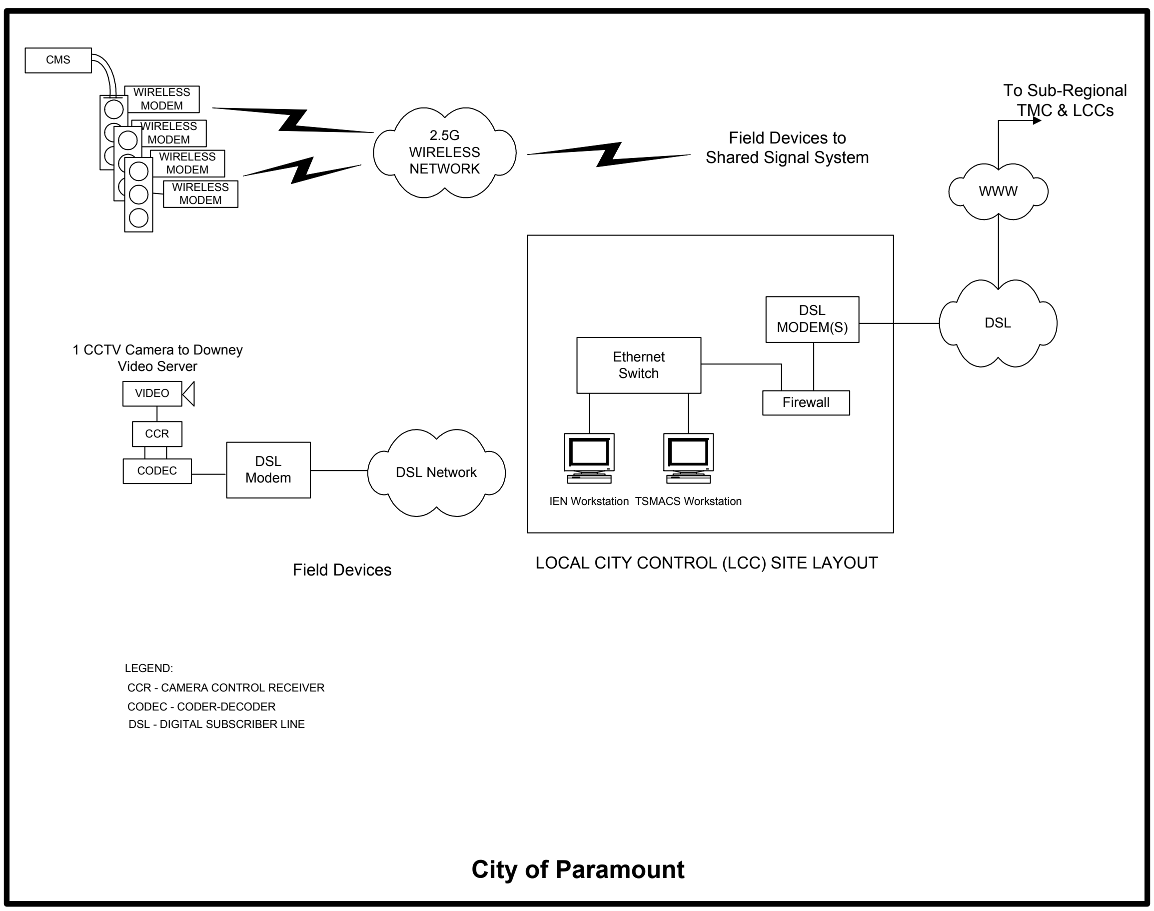


Figure 4-12: City of Paramount Communication System Design

4.7.4.3 City of Paramount Cost Breakdown

The following section provides a breakdown of the estimated costs associated with the current deployment system design for the City of Paramount.

Table 4-16: City of Paramount Implementation Estimates

Technology	Unit Cost Installed	Est. Quantity		Total
PARAMOUNT				
Terrestrial Systems				
Fiber Optic Cable in Conduit	$26	0	FT	$0
Fiber Optic Transceiver Pairs	$1,800	0	Unit	$0
Fiber Optic Data Modem	$2,000	0	Unit	$0
Splice Vaults	$1,800	0	Unit	$0
Splice Closures	$1,200	0	Unit	$0
Pull Boxes	$700	1	Unit	$700
Field Systems				
CCTV Cameras	$15,000	1	Unit	$15,000
Video Codec Pairs	$9,000	1	Unit	$9,000
Fixed CMS	$60,000	4	Unit	$240,000
Portable CMS	$23,000	0	Unit	$0
System Detection (Unganging Only)	$2,600	9	Apprch	$23,400
Controller Software/Firmware Upgrades	$350	8	EA	$2,800
Controller Hardware Upgrades	$9,500	0	EA	$0
LCCS Systems				
Signal System	$0	0	LS	$0
IEN Server Hardware	$8,000	0	EA	$0
IEN Workstation Hardware	$3,000	1	EA	$3,000
TSMACS Workstation	$3,000	1	EA	$3,000
Router w/Firewall	$5,000	2	EA	$10,000
Ethernet Switch LAN	$1,500	2	Unit	$3,000
Video Cards	$300	1	Unit	$300
Video Server	$6,000	0	Unit	$0
LCCS racks, cabling, and FF&E	$15,000	1	LS	$15,000
Miscellaneous				
Traffic Control	$30,000	1	LS	$30,000
Communication Systems				
Wireless 2.5G for CMS	$350	4	EA	$1,400
Wireless 2.5G for VDS	$350	9	EA	$3,150
Wireless 2.5G for LCCS	$350	1	EA	$350
DSL (C2C) 384/384K	$600	1	EA	$600
DSL (C2F) 384/384K	$600	1	EA	$600
Total Construction Costs				**$361,300**
10-Year Wireless Service Totals				**$177,600**
10-Year 2.5G Wireless Service	$960	14	EA	$134,400
10-Year DSL (C2C) 384/384K	$2,160	1	EA	$21,600
10-Year DSL (C2F) 384/384K	$2,160	1	EA	$21,600
Total Design Costs				**$124,280**
TOTAL				**$663,180**
Contigency 20%				**$132,636**
GRAND TOTAL				**$795,816**

4.7.5 City of Compton

The City of Compton would procure a traffic signal system under a separate contract.

The city limits for Compton encompasses only one of the east/west corridors: Rosecrans Avenue. None of the north/south arterials are part of Compton. Figure 4-13 indicates the locations of proposed CCTV cameras and traffic signal controllers for connection to an LCCS.

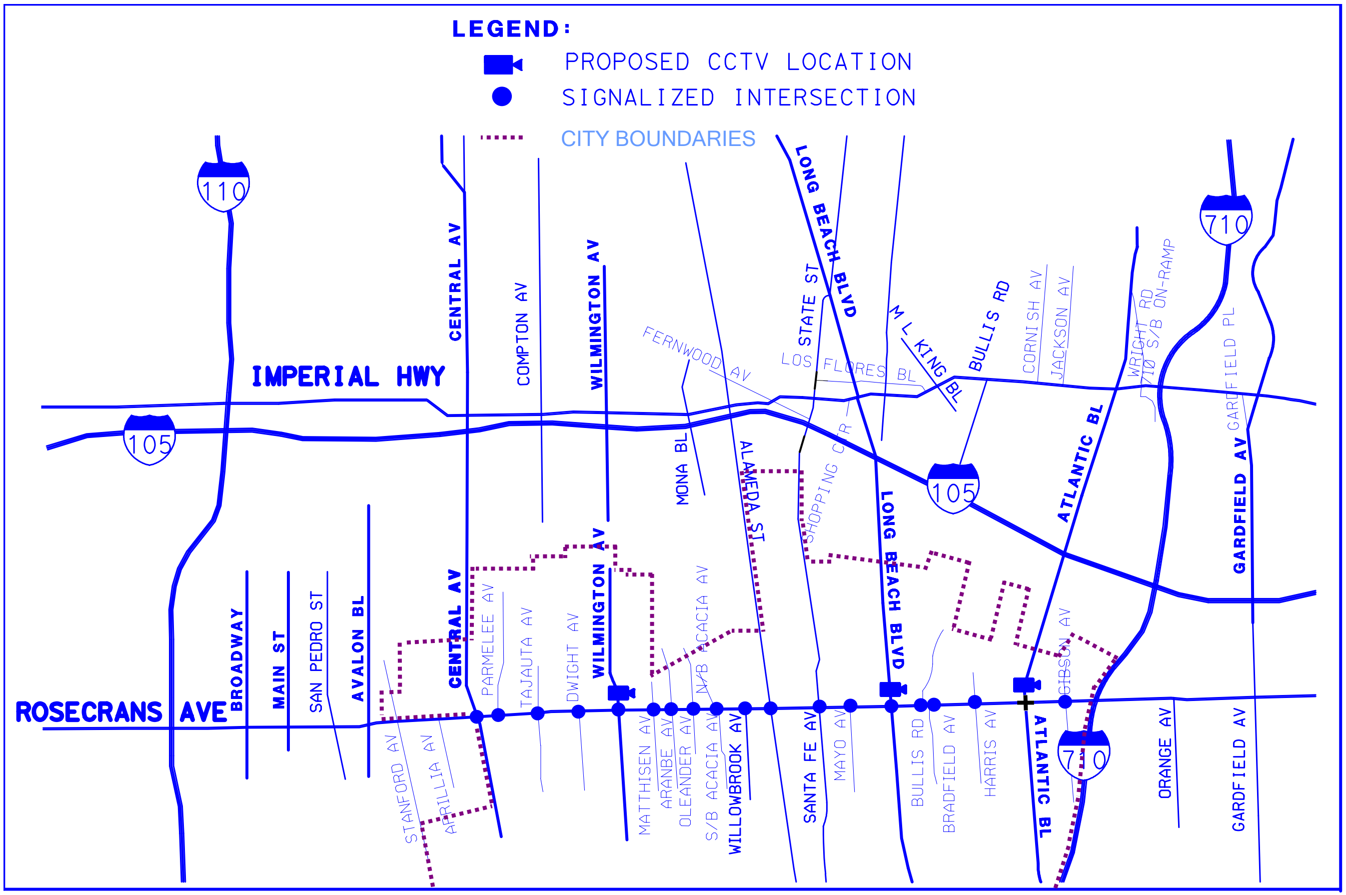


Figure 4-13: City of Compton

4.7.5.1 Field Deployment

The I-105 Corridor Project has identified several components as part of the deployment initiative for the City of Compton. The table below provides a more detailed view of the deployment initiative targeted for the city.

Table 4-17: City of Compton Field Deployment Inventory

Component	Qty	Location(s)	Communication Type
Traffic Signal System	1	Compton LCC	Network based
Traffic Signal Controllers	9	Various	Wireless
CCTV Cameras	2	Rosecrans & Wilmington Rosecrans & Long Beach Blvd	DSL DSL
Fixed CMS	0	N/A	N/A
Digital Video Server	0	Share with Norwalk	DSL

A listing of the existing Vehicle Detection Systems (VDS) for the City of Compton is provided in the table below. Each intersection listed represents a field controller that is proposed to be interconnected with the communications infrastructure for the initial deployment to enable that signal to be monitored and controlled from Compton's City Hall.

Table 4-18: Compton VDS Locations

			Existing Detection		
Primary Street	**Cross Street**	**Communications**	**Presence**	**Advanced**	**Ganged?**
Rosecrans Ave	S Central Ave	Wireless	All	All	
Rosecrans Ave	Parmalee Ave	Wireless	All	Major	
Rosecrans Ave	Tajuata Ave	Wireless	All	Major	
Rosecrans Ave	Dwight Ave	Wireless	All	Major	
Rosecrans Ave	Wilmington Ave	Wireless	All	All	
Rosecrans Ave	Mathisen	Wireless	Minor	Major	Major
Rosecrans Ave	Aranbe Ave	Wireless	Minor	Major	Major
Rosecrans Ave	Oleander Ave	Wireless	Minor	Major	Major
Rosecrans Ave	Acacia Ave	Wireless	Minor	Major	Major
Rosecrans Ave	Willowbrook Ave	Wireless	All	Major	
Rosecrans Ave	Alameda St	Wireless	All	Major	
Rosecrans Ave	Santa Fe Ave	Wireless	All	All	All
Rosecrans Ave	Mayo Ave	Wireless	Minor	Major	Major
Rosecrans Ave	Long Beach Blvd	Wireless	All	All	All

			Existing Detection		
Primary Street	Cross Street	Communications	Presence	Advanced	Ganged?
Rosecrans Ave	Bullis Rd	Wireless	Minor	All	All
Rosecrans Ave	Bradfield Ave	Wireless	Minor	Major	Major
Rosecrans Ave	Harris Ave	Wireless	Minor	Major	Major
Rosecrans Ave	Gibson Ave	Wireless	Minor	Major	Major

4.7.5.2 Communications Design

The communications infrastructure design in the field consists of a wireless based design for the traffic signal intersections located throughout Rosecrans Avenue. Video transmissions would use high-speed DSL to transmit from the field and would share the video server located at the City of Norwalk.

Communication between the Compton LCC and the Norwalk LCC would be over high-speed DSL.

The DSL bandwidth requirements for Compton:

<u>Center-to-Field</u>

- 3 x 384Kbps circuit for three CCTV cameras from the field to the video server located at the City of Norwalk. Exact configuration of these circuits will be defined in the detailed design phase of the project.

<u>Center-to-Center</u>

- 1 x 384Kbps circuit for traffic signal system data communications between the Compton LCCS and the Norwalk LCCS.

The diagram below illustrates the logical, high-level communications system design for the Local City Control (LCC) Site for the City of Compton.

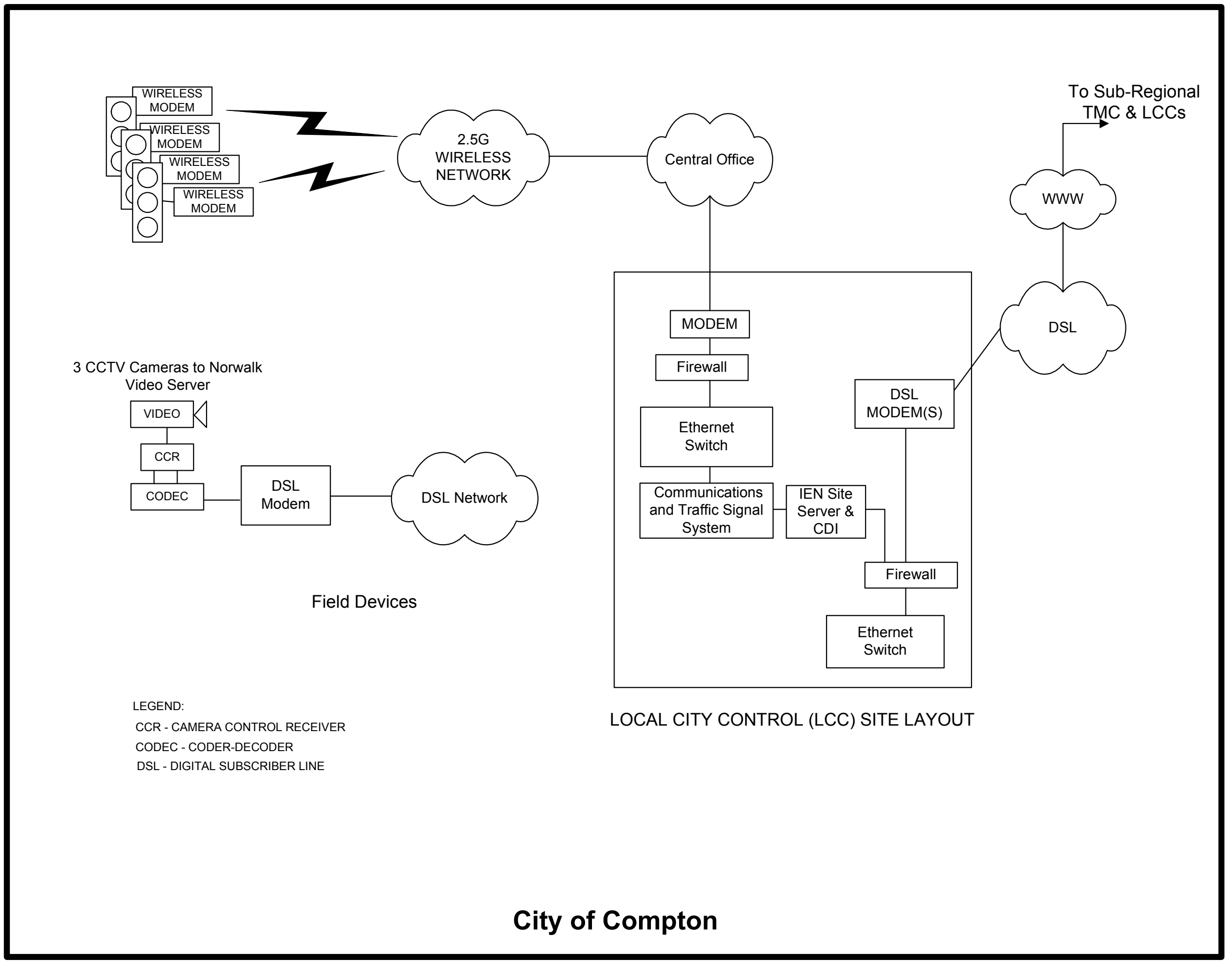


Figure 4-14: City of Compton Communication System Design

4.7.5.3 City of Compton Cost Breakdown

The following section provides a breakdown of the estimated costs associated with the current deployment system design for the City of Compton.

Table 4-19: City of Compton Implementation Estimates

Technology	Unit Cost Installed	Est. Quantity		Total
COMPTON				
Terrestrial Systems				
Fiber Optic Cable in Conduit	$26	0	FT	$0
Fiber Optic Transceiver Pairs	$1,800	0	Unit	$0
Fiber Optic Data Modem	$2,000	0	Unit	$0
Splice Vaults	$1,800	0	Unit	$0
Splice Closures	$1,200	0	Unit	$0
Pull Boxes	$700	3	Unit	$2,100
Field Systems				
CCTV Cameras	$20,000	3	Unit	$60,000
Video Codec Pairs	$9,000	3	Unit	$27,000
Fixed CMS	$60,000	0	Unit	$0
Portable CMS	$23,000	0	Unit	$0
System Detection (Unganging only)	$2,600	14	Apprch	$36,400
Controller Software/Firmware Upgrades	$350	0	EA	$0
Controller Hardware Upgrades	$9,500	18	EA	$171,000
LCCS Systems				
Signal System	$ 0	1	LS	$0
IEN Server Hardware	$8,000	1	EA	$8,000
IEN Workstation Hardware	$3,000	1	EA	$3,000
TSMACS Workstation	$3,000	1	EA	$3,000
Router w/Firewall	$5,000	2	EA	$10,000
Ethernet Switch LAN	$1,500	2	Unit	$3,000
Video Cards	$300	1	Unit	$300
Video Server	$6,000	0	Unit	$0
LCCS racks, cabling, and FF&E	$20,000	1	LS	$20,000
Miscellaneous				
Traffic Control	$30,000	1	LS	$30,000
Communication Systems				
Wireless 2.5G for CMS	$350	0	EA	$0
Wireless 2.5G for VDS	$350	0	EA	$0
Wireless 2.5G for LCCS	$350	1	EA	$350
DSL (C2C) 384/384K	$600	1	EA	$600
DSL (C2F) 384/384K	$600	3	EA	$1,800
Total Construction Costs				**$562,650**
10-Year Wireless Service Totals				**$96,000**
10-Year 2.5G Wireless Service	$960	1	EA	$9,600
10-Year DSL (C2C) 384/384K	$2,160	1	EA	$21,600
10-Year DSL (C2F)384/384K	$2,160	3	EA	$64,800
Total Design Costs				**$150,720**
TOTAL				**$623,270**
Contingncy20%				**$124,654**
GRAND TOTAL				**$747,924**

4.7.6 City of Lynwood

The City of Lynwood would share the traffic signal system with the City of Downey.

The city limits for Lynwood encompasses one of the east/west corridors, Imperial Highway. Figure 4-15 indicates the locations of proposed CCTV cameras and traffic signal controllers for connection to an LCCS.

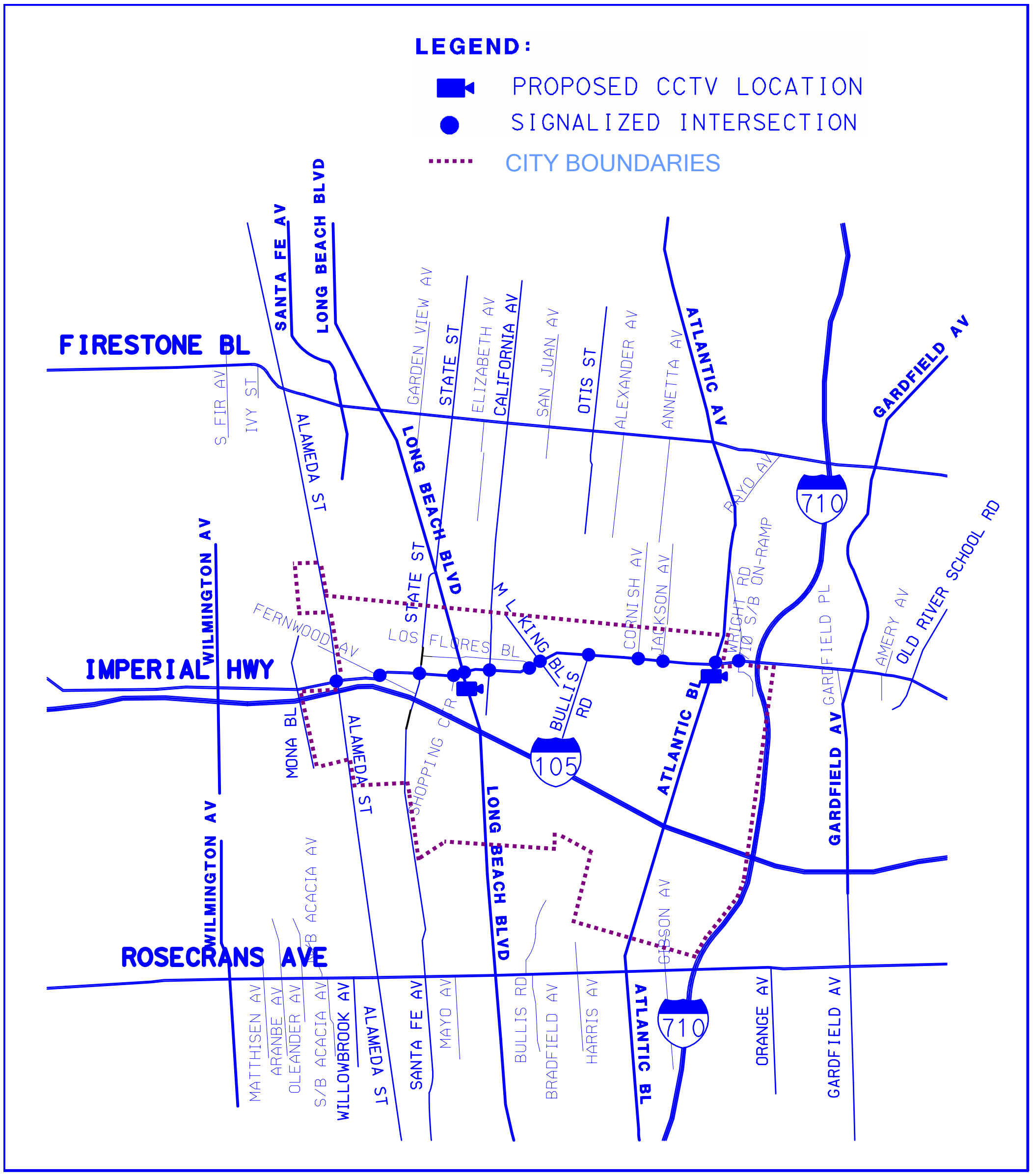


Figure 4-15: City of Lynwood

4.7.6.1 Field Deployment

The I-105 Corridor Project has identified several components as part of the deployment initiative for the City of Lynwood. The table below provides a more detailed view of the deployment initiative targeted for the city.

Table 4-20: City of Lynwood Field Deployment Inventory

Component	Qty	Location(s)	Communication Type
Traffic Signal System	0	Share with Downey LCCS	DSL
Traffic Signal Controllers	13	Various	Wireless
CCTV Cameras	2	Imperial & Long Beach Blvd Imperial & Atlantic Blvd	DSL DSL
Fixed CMS	0	N/A	N/A
Digital Video Server	0	Share with Downey LCCS	DSL

A listing of the existing Vehicle Detection Systems (VDS) for the City of Lynwood is provided in the table below. Each intersection listed represents a field controller that is proposed to be interconnected with the communications infrastructure for the initial deployment to enable that signal to be monitored and controlled from Lynwood City Hall.

Table 4-21: Lynwood VDS Locations

			Existing Detection		
Primary Street	**Cross Street**	**Communications**	**Presence**	**Advanced**	**Ganged?**
Imperial Hwy	Alameda St	Wireless	N/A	N/A	
Imperial Hwy	Fernwood Ave	Wireless	Minor	Major	Major
Imperial Hwy	State St	Wireless	Minor	All	All
Imperial Hwy	Shopping Ctr	Wireless	N/A	N/A	
Imperial Hwy	Long Beach Blvd	Wireless	All	All	Minor
Imperial Hwy	California Ave	Wireless	Minor	Major	All
Imperial Hwy	Los Flores Blvd	Wireless	Minor	Major	All
Imperial Hwy	Martin Luther King	Wireless	Minor	All	Minor
Imperial Hwy	Bullis Rd	Wireless	Minor	Major	Major
Imperial Hwy	Cornish Ave	Wireless	Minor	Major	Major
Imperial Hwy	Jackson Ave	Wireless	Minor	Major	No
Imperial Hwy	Atlantic Blvd	Wireless	All	All	All
Imperial Hwy	Duncan Ave/Wright	Wireless	Minor	Major	Major

4.7.6.2 Communications Design

The communications infrastructure design in the field consists of a wireless based design for the traffic signal intersections located throughout Imperial Highway. Video transmissions would use high-speed DSL to transmit from the field and would share the video server located at the City of Downey.

Communication between the Lynwood LCC and the Downey LCC would be over high-speed DSL.

The DSL bandwidth requirements for Lynwood:

Center-to-Field

- 2 x 384Kbps circuits for two CCTV cameras from the field to the video server located at the City of Downey.

Center-to-Center

- 1 x 384Kbps circuit for traffic signal system data communications between the Lynwood LCCS and the Downey LCCS.

The diagram below illustrates the logical, high-level communications system design for the Local City Control (LCC) Site for the City of Lynwood.

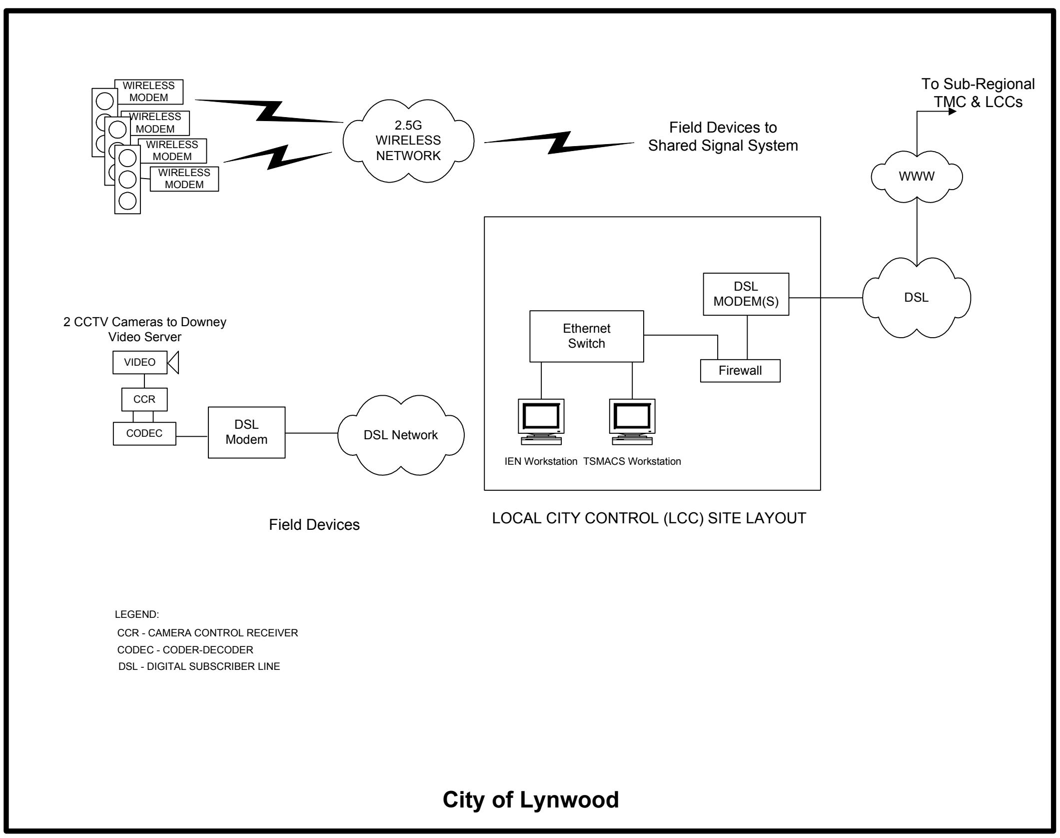


Figure 4-16: City of Lynwood Communication System Design

4.7.6.3 City of Lynwood Cost Breakdown

The following section provides a breakdown of the estimated costs associated with the current deployment system design for the City of Lynwood.

Table 4-22: City of Lynwood Implementation Estimates

Technology	Unit Cost Installed	Est. Quantity		Total
LYNWOOD				
Terrestrial Systems				
Fiber Optic Cable in Conduit	$26	0	FT	$0
Fiber Optic Transceiver Pairs	$1,800	0	Unit	$0
Fiber Optic Data Modem	$2,000	0	Unit	$0
Splice Vaults	$1,800	0	Unit	$0
Splice Closures	$1,200	0	Unit	$0
Pull Boxes	$700	2	Unit	$1,400
Field Systems				
CCTV Cameras	$15,000	2	Unit	$30,000
Video Codec Pairs	$9,000	2	Unit	$18,000
Fixed CMS	$60,000	0	Unit	$0
Portable CMS	$23,000	0	Unit	$0
System Detection (Unganging Only)	$2,600	12	Apprch	$31,200
Controller Software/Firmware Upgrades	$350	7	EA	$2,450
Controller Hardware Upgrades	$9,500	0	EA	$0
LCCS Systems				
Signal System	$0	0	LS	$0
IEN Server Hardware	$8,000	0	EA	$0
IEN Workstation Hardware	$3,000	1	EA	$3,000
TSMACS Workstation	$3,000	1	EA	$3,000
Router w/Firewall	$5,000	2	EA	$10,000
Ethernet Switch LAN	$1,500	2	Unit	$3,000
Video Cards	$300	1	Unit	$300
Video Server	$6,000	0	Unit	$0
LCCS racks, cabling, and FF&E	$15,000	1	LS	$15,000
Miscellaneous Systems				
Traffic Control	$30,000	1	LS	$30,000
Communication Systems				
Wireless 2.5G for CMS	$350	0	EA	$0
Wireless 2.5G for VDS	$350	0	EA	$0
Wireless 2.5G for LCCS	$350	1	EA	$350
DSL (C2C) 384/384K	$600	1	EA	$600
DSL (C2F) 384/384K	$600	2	EA	$1,200
Total Construction Costs				**$149,500**
10-Year Wireless Service Totals				**$74,400**
10-Year 2.5G Wireless Service	$960	1	EA	$9,600
10-Year DSL (C2C) 384/384K	$2,160	1	EA	$21,600
10-Year DSL (C2F) 384/384K	$2,160	2	EA	$43,200
Total Design Costs				**$110,640**
TOTAL				**$334,540**
Contigency 20%				**$66,908**
GRAND TOTAL				**$401,448**

4.7.7 City of La Mirada

The City of La Mirada would share the traffic signal system with the County of Los Angeles.

The city limits for La Mirada encompasses two of the east/west corridors: Imperial highway and Rosecrans Avenue. The north/south arterials are not within the city limits of La Mirada. Figure 4-17 indicates the locations of proposed CCTV cameras and traffic signal controllers for connection to an LCCS.

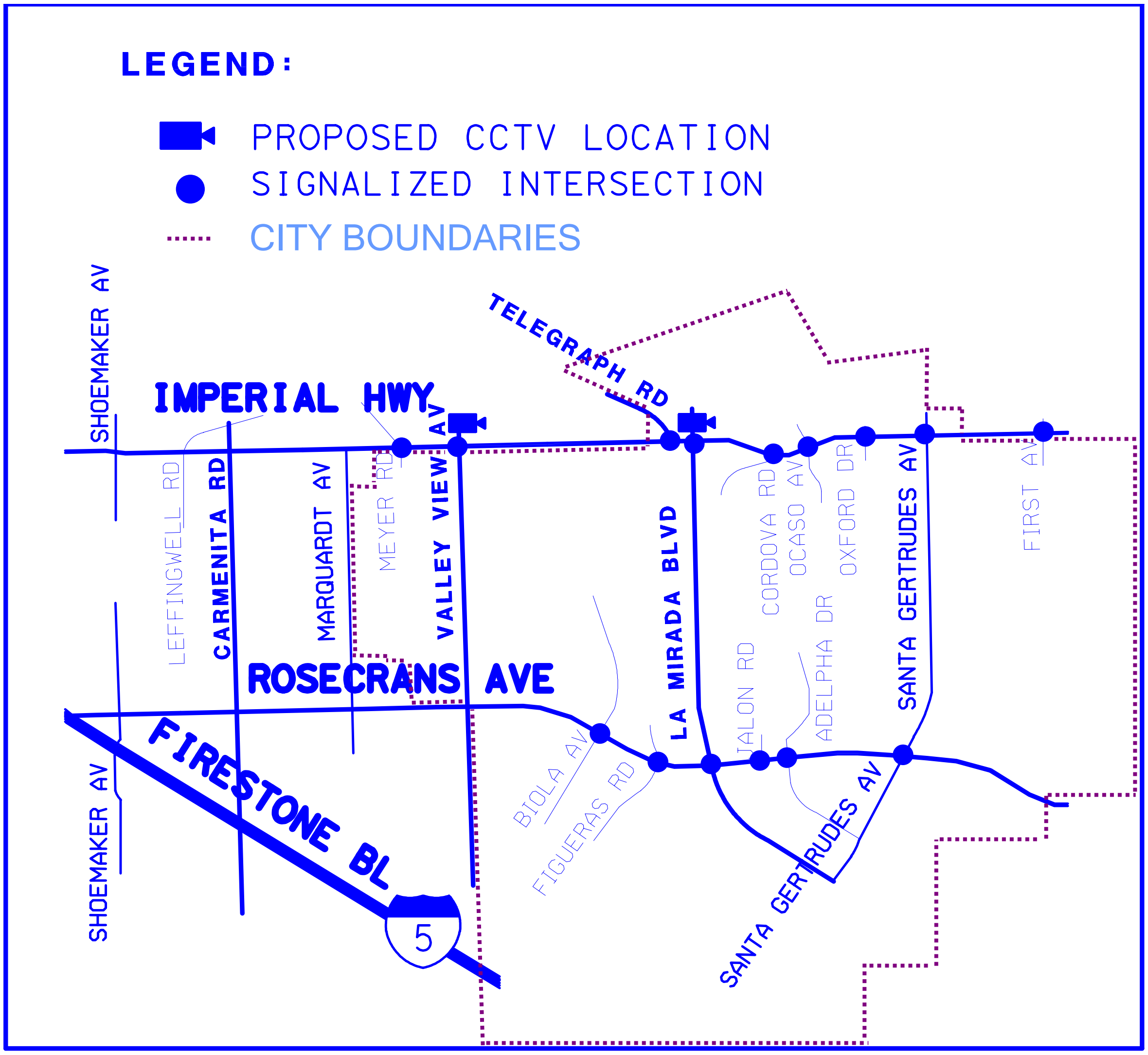


Figure 4-17: City of La Mirada

4.7.7.1 Field Deployment

The I-105 Corridor Project has identified several components as part of the deployment initiative for the City of La Mirada. The table below provides a more detailed view of the deployment initiative targeted for the city.

Table 4-23: City of La Mirada Field Deployment Inventory

Component	Qty	Location(s)	Communication Type
Traffic Signal System	0	Share with LA County	DSL
Traffic Signal Controllers	11	Various	Fiber Optic Cable
Traffic Signal Controllers	4	Various	Wireless
CCTV Cameras	2	Imperial & Valley View Rd Imperial & La Mirada Blvd	Fiber Fiber
Fixed CMS	0	N/A	N/A
Digital Video Server	0	Share with Downey LCCS	Fiber

A listing of the existing Vehicle Detection Systems (VDS) for the City of La Mirada is provided in the table below. Each intersection listed represents a field controller that is proposed to be interconnected with the communications infrastructure for the initial deployment to enable that signal to be monitored and controlled from LA County's TMC.

Table 4-24: La Mirada VDS Locations

			Existing Detection		
Primary Street	**Cross Street**	**Communications**	**Presence**	**Advanced**	**Ganged?**
Imperial Hwy	Meyer Rd	Fiber	N/A	N/A	All
Imperial Hwy	Valley View Ave	Fiber	N/A	N/A	All
Imperial Hwy	Telegraph Rd	Fiber	N/A	N/A	All
Imperial Hwy	La Mirada Blvd	Fiber	N/A	N/A	All
Imperial Hwy	Cordova Rd	Wireless	N/A	N/A	No
Imperial Hwy	Ocaso Ave	Wireless	N/A	N/A	No
Imperial Hwy	Oxford Dr	Wireless	N/A	N/A	No
Imperial Hwy	Santa Gertrudes Av	Wireless	N/A	N/A	All
Imperial Hwy	First Ave	Wireless	N/A	N/A	No
Rosecrans Ave	Biola Ave	Wireless	N/A	N/A	
Rosecrans Ave	Figueras Rd	Wireless	Minor	Major	Major
Rosecrans Ave	La Mirada Blvd	Wireless	N/A	N/A	All
Rosecrans Ave	Jalon Rd	Wireless	N/A	N/A	All
Rosecrans Ave	Adelpha Dr	Wireless	N/A	N/A	All
Rosecrans Ave	Santa Gertrudes Av	Wireless	N/A	N/A	All

4.7.7.2 Communications Design

The communications infrastructure design in the field consists of a combination of a fiber optic cable based design and a wireless based design for the traffic signal intersections along Imperial Highway. For traffic signal intersections along Rosecrans Avenue, a wireless based design would be used. The City of La Mirada would share the traffic signal system located at LA County.

CCTV cameras along Imperial Highway would use fiber optic cable and would share the video server located at the City of Downey.

Communication between the La Mirada LCCS and the Downey LCCS would be over fiber optic cable. Communications between La Mirada and LA County would be through a high-speed DSL connection.

The DSL communication requirements for La Mirada:

<u>Center-to-Center</u>

- 1 x 384Kbps circuit for traffic signal system data communications between the La Mirada LCCS and LA County.

The diagram below illustrates the logical, high-level communications system design for the Local City Control (LCC) Site for the City of La Mirada.

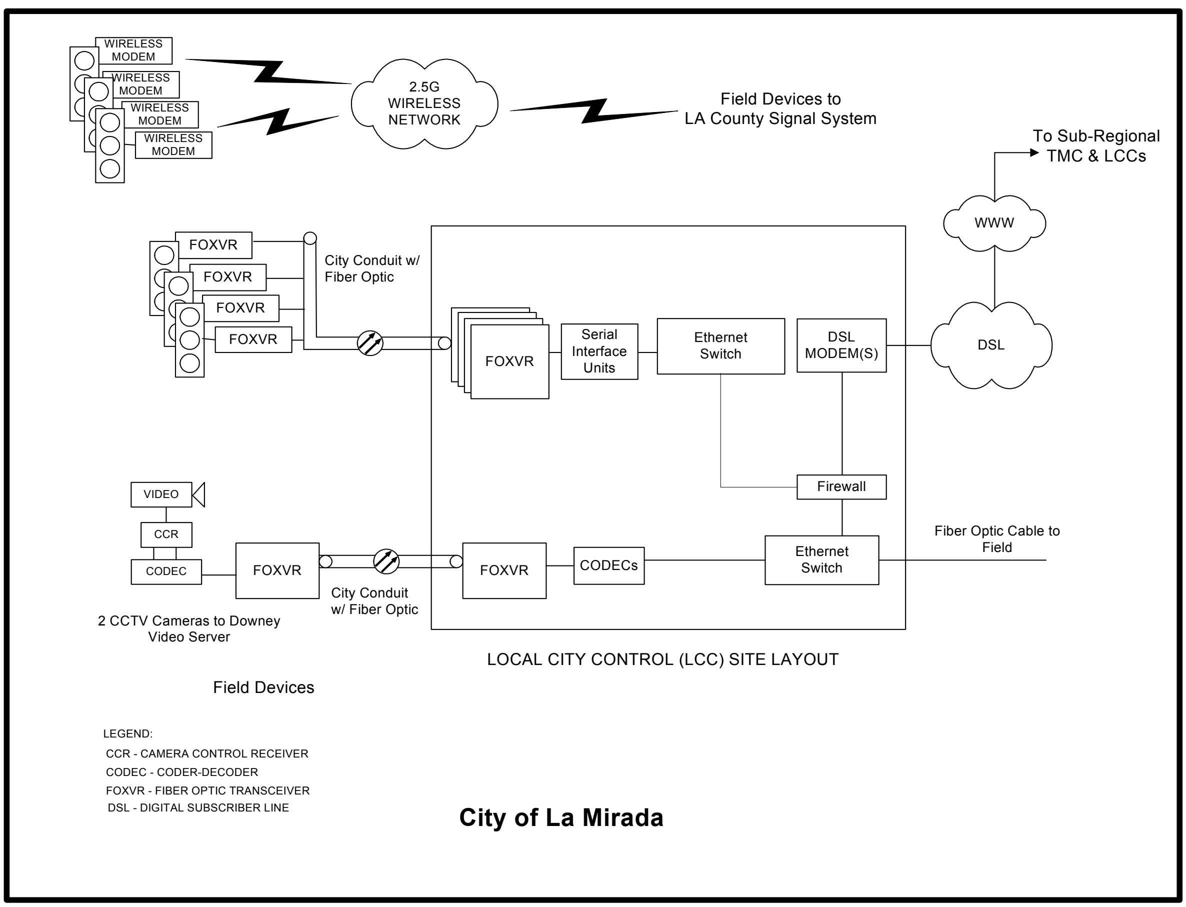


Figure 4-18: City of La Mirada Communication System Design

4.7.7.3 City of La Mirada Cost Breakdown

The following section provides a breakdown of the estimated costs associated with the current deployment system design for the City of La Mirada.

Table 4-25: City of La Mirada Implementation Estimates

Technology	Unit Cost Installed	Est. Quantity		Total
LA MIRADA				
Terrestrial Systems				
Fiber Optic Cable in Conduit	$26	11,460	FT	$297,960
Fiber Optic Transceiver Pairs	$1,800	2	Unit	$3,600
Fiber Optic Data Modem	$2,000	4	Unit	$8,000
Splice Vaults	$1,800	2	Unit	$3,600
Splice Closures	$1,200	2	Unit	$2,400
Pull Boxes	$700	23	Unit	$16,100
Field Systems				
CCTV Cameras	$20,000	2	Unit	$40,000
Video Codec Pairs	$9,000	0	Unit	$0
Fixed CMS	$60,000	0	Unit	$0
Portable CMS	$23,000	0	Unit	$0
System Detection (Unganging Only)	$2,600	20	Apprch	$52,000
Controller Software/Firmware Upgrades	$350	13	EA	$4,550
Controller Hardware Upgrades	$9,500	0	EA	$0
LCCS Systems				
Signal System	$0	0	LS	$0
IEN Server Hardware	$8,000	0	EA	$0
IEN Workstation Hardware	$3,000	1	EA	$3,000
TSMACS Workstation	$3,000	1	EA	$3,000
Router w/Firewall	$5,000	2	EA	$10,000
Ethernet Switch LAN	$1,500	2	Unit	$3,000
Video Cards	$300	1	Unit	$300
Video Server	$6,000	0	Unit	$0
LCCS racks, cabling, and FF&E	$15,000	1	LS	$15,000
Miscellaneous				
Traffic Control	$30,000	1	LS	$30,000
Communication Systems				
Wireless 2.5G for CMS	$350	0	EA	$0
Wireless 2.5G for VDS	$350	11	EA	$3,850
Wireless 2.5G for LCCS	$350	1	EA	$350
DSL (C2C) 384/384K	$600	1	EA	$600
Total Construction Costs				**$497,310**
10-Year Wireless Service Totals				**$136,800**
10-Year 2.5G Wireless Service	$960	12	EA	$115,200
10-Year DSL (C2C) 384/384K	$2,160	1	EA	$21,600
Total Design Costs				**$159,530**
TOTAL				**$793,640**
Contigency 20%				**$158,728**
GRAND TOTAL				**$952,368**

4.7.8 City of South Gate

The City of South Gate would upgrade its existing signal system to a newer version.

The city limits for South Gate encompasses two of the east/west corridors: Firestone Boulevard and Imperial Highway. Only one of the north/south arterials is within the city limits of South Gate, Paramount Boulevard. Figure 4-19 indicates the locations of proposed CCTV cameras and traffic signal controllers for connection to an LCCS.

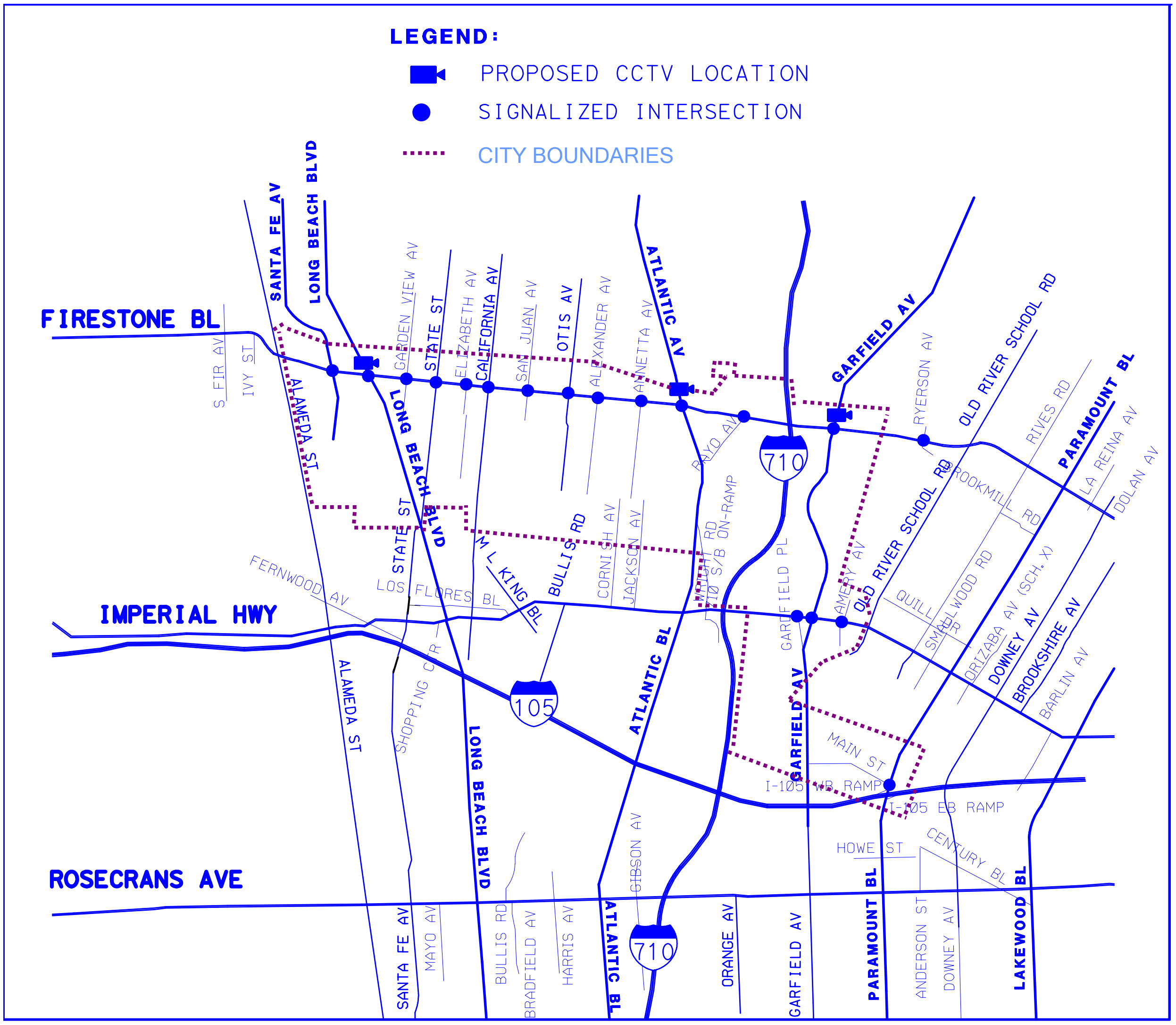


Figure 4-19: City of South Gate

4.7.8.1 Field Deployment

The I-105 Corridor Project has identified several components as part of the deployment initiative for the City of South Gate. The table below provides a more detailed view of the deployment initiative targeted for the city.

Table 4-26: City of South Gate Field Deployment Inventory

Component	Qty	Location(s)	Communication Type
Traffic Signal System	1	South Gate LCC	Network based
Traffic Signal Controllers	14	Various	Fiber Optic Cable
Traffic Signal Controllers	4	Various	Wireless
CCTV Cameras	3	Firestone & Long Beach Blvd Firestone & Atlantic Ave Firestone & Garfield Ave	DSL DSL DSL
Fixed CMS	0	N/A	N/A
Digital Video Server	0	Share with Norwalk	DSL

A listing of the existing Vehicle Detection Systems (VDS) for the City of South Gate is provided in the table below. Each intersection listed represents a field controller that is proposed to be interconnected with the communications infrastructure for the initial deployment to enable that signal to be monitored and controlled from South Gate's City Hall.

Table 4-27: South Gate VDS Locations

Primary Street	Cross Street	Communications	Presence	Advanced	Ganged?
Firestone Blvd	Santa Fe Ave	Wire (TWP)	All	Major	
Firestone Blvd	Long Beach Blvd	Wire (TWP)	All	All	
Firestone Blvd	Garden View Ave	Wire (TWP)	All	Major	
Firestone Blvd	State St	Wire (TWP)	All	Major	
Firestone Blvd	Elizabeth Ave	Wire (TWP)	All	Major	
Firestone Blvd	California Ave	Wire (TWP)	All	Major	
Firestone Blvd	San Juan Ave	Wire (TWP)	All	Major	
Firestone Blvd	Otis Ave	Wire (TWP)	All	Major	
Firestone Blvd	Alexander Ave	Wire (TWP)	All	Major	
Firestone Blvd	Annetta Ave	Wire (TWP)	All	Major	
Firestone Blvd	Atlantic Ave	Wire (TWP)	All	All	
Firestone Blvd	Rayo Ave	Wire (TWP)	All	Major	
Firestone Blvd	Garfield Ave	Wire (TWP)	All	All	
Firestone Blvd	Ryerson Ave	Wire (TWP) and Existing Fiber			No

Primary Street	Cross Street	Communications	Presence	Advanced	Ganged?
Imperial Hwy	Garfield Pl	Wireless	Minor	Major	Major
Imperial Hwy	Garfield Ave	Wireless	All	All	
Imperial Hwy	Amery Ave	Wireless	Minor	Major	Major
Paramount Blvd	Main St - T	Wireless	Minor	Major	No

4.7.8.2 Communications Design

The communications infrastructure design in the field consists of a combination of existing twisted-pair cable design for traffic signal intersections along Firestone Blvd. and a wireless based design for the traffic signal intersections along Imperial Highway and Paramount Blvd. CCTV cameras along Firestone Blvd. would use high-speed DSL and would share the video server located at the City of Norwalk.

Communication between the South Gate LCC and the Norwalk LCC would be over high-speed DSL.

The DSL bandwidth requirements for South Gate:

<u>Center-to-Field</u>

- 3 x 384Kbps circuit for three CCTV cameras from the field to the video server located at the City of Norwalk.

<u>Center-to-Center</u>

- 1 x 384Kbps circuit for traffic signal system data communications between the South Gate LCCS and the Norwalk LCCS.

The diagram below illustrates the logical, high-level communications system design for the Local City Control (LCC) Site for the City of South Gate.

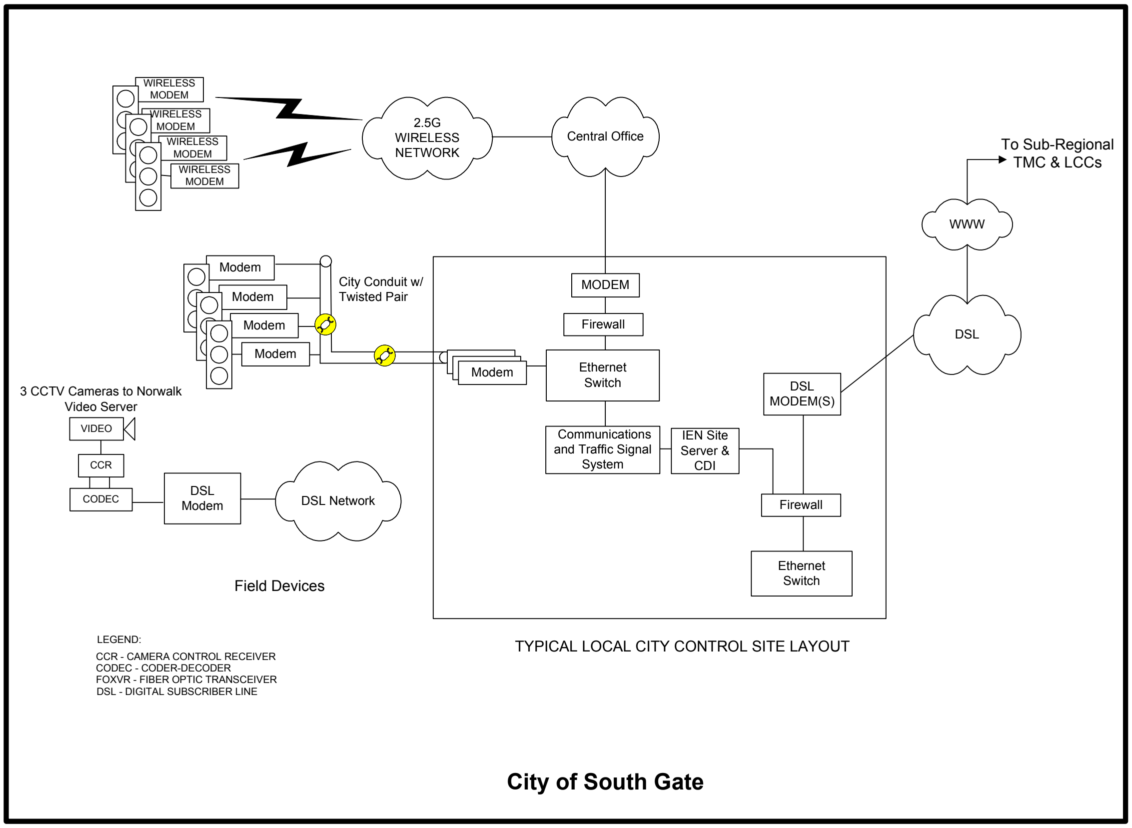


Figure 4-20: City of South Gate Communication System Design

4.7.8.3 City of South Gate Cost Breakdown

The following section provides a breakdown of the estimated costs associated with the current deployment system design for the City of South Gate. The costs shown below are strictly estimates and are subject to change at any time.

Table 4-28: City of South Gate Implementation Expenses

Technology	Unit Cost Installed	Est. Quantity		Total
SOUTH GATE				
Terrestrial Systems				
Fiber Optic Cable in Conduit	$26	1,954	FT	$50,804
Fiber Optic Transceiver Pairs	$1,800	0	Unit	$0
Fiber Optic Data Modem	$2,000	1	Unit	$2,000
Data Modems	$750	14	Unit	$10,500
Splice Vaults	$1,800	0	Unit	$0
Splice Closures	$1,200	0	Unit	$0
Pull Boxes	$700	3	Unit	$2,100
Field Systems				
CCTV Cameras	$15,000	3	Unit	$45,000
Video Codec Pairs	$9,000	3	Unit	$27,000
Fixed CMS	$60,000	0	Unit	$0
Portable CMS	$23,000	0	Unit	$0
System Detection (Unganging Only)	$2,600	3	Apprch	$7,800
Controller Software/Firmware Upgrades	$350	0	EA	$0
Controller Hardware Upgrades	$9,500	1	EA	$9,500
LCCS Systems				
Signal System	$250,000	1	LS	$250,000
IEN Server Hardware	$8,000	1	EA	$8,000
IEN Workstation Hardware	$3,000	1	EA	$3,000
TSMACS Workstation	$3,000	1	EA	$3,000
Router w/Firewall	$5,000	2	EA	$10,000
Ethernet Switch LAN	$1,500	2	Unit	$3,000
Video Cards	$300	1	Unit	$300
Video Server	$6,000	0	Unit	$0
LCCS racks, cabling, and FF&E	$15,000	0	LS	$0
Miscellaneous Systems				
Traffic Control	$3,000	1	LS	$3,000
Communication Systems				
Wireless 2.5G for CMS	$350	0	EA	$0
Wireless 2.5G for VDS	$350	4	EA	$1,400
Wireless 2.5G for LCCS	$350	1	EA	$350
DSL (C2C) 384/384K	$600	1	EA	$600
DSL (C2F) 384/384K	$600	3	EA	$1,800
Total Construction Costs				**$439,154**
10-Year Wireless Service Totals				**$134,400**
10-Year 2.5G Wireless Service	$960	5	EA	$48,000
10-Year DSL (C2C) 384/384K	$2,160	1	EA	$21,600
10-Year DSL (C2F) 384/384K	$2,160	3	EA	$64,800
Total Design Costs				**$78,462**
TOTAL				**$652,016**
Contigency 20%				**$130,403**
GRAND TOTAL				**$782,420**

4.7.9 City of Bellflower

The City of Bellflower would share the traffic signal system with the City of Downey.

The city limits for Bellflower encompasses one of the east/west corridors: Rosecrans Avenue. One north/south arterial is within the city limits of Bellflower, Bellflower Boulevard. Figure 4-21 indicates the locations of proposed CCTV cameras and traffic signal controllers for connection to an LCCS.

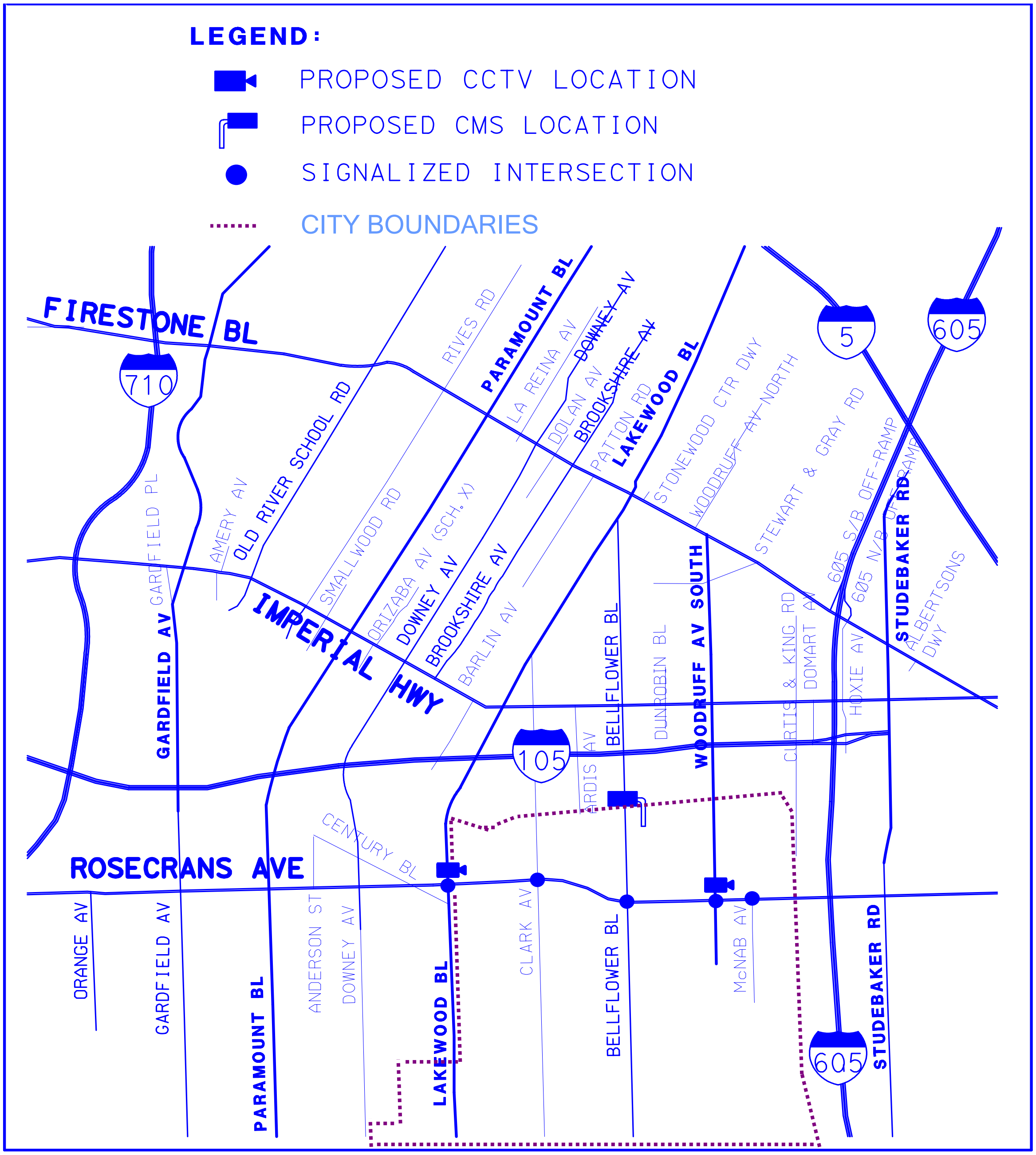


Figure 4-21: City of Bellflower

4.7.9.1 Field Deployment

The I-105 Corridor Project has identified several components as part of the deployment initiative for the City of Bellflower. The table below provides a more detailed view of the deployment initiative targeted for the city.

Table 4-29: City of Bellflower Field Deployment Inventory

Component	Qty	Location(s)	Communication Type
Traffic Signal System	0	Share with Downey LCCS	DSL
Traffic Signal Controllers	5	Various	Wireless
CCTV Cameras	2	Rosecrans & Lakewood Blvd Rosecrans & Woodruff Ave S	DSL DSL
Fixed CMS	1	Bellflower Blvd (northbound in advance of I-105)	Wireless
Digital Video Server	0	Share with Downey LCCS	DSL

A listing of the existing Vehicle Detection Systems (VDS) for the City of Bellflower is provided in the table below. Each intersection listed represents a field controller that is proposed to be interconnected with the communications infrastructure for the initial deployment to enable that signal to be monitored and controlled from Downey's City Hall.

Table 4-30: Bellflower VDS Locations

			Existing Detection		
Primary Street	**Cross Street**	**Communications**	**Presence**	**Advanced**	**Ganged?**
Rosecrans Ave	Lakewood Blvd	Wireless	All	All	
Rosecrans Ave	Clark Ave	Wireless	All	All	No
Rosecrans Ave	Bellflower Blvd	Wireless	All	All	All
Rosecrans Ave	Woodruff Ave	Wireless	All	All	All
Rosecrans Ave	McNab Ave	Wireless	Minor	Major	Major

4.7.9.2 Communications Design

The communications infrastructure design in the field consists of a wireless based design for the traffic signals and the one fixed CMS location. Video transmissions would use high-speed DSL to transmit from the field and would share the video server located at the City of Downey.

Communication between the Bellflower LCC and the Downey LCC would be over high-speed DSL.

The DSL bandwidth requirements for Bellflower:

Center-to-Field

- 2 x 384Kbps circuits for two CCTV cameras from the field to the video server located at the City of Downey.

Center-to-Center

- 1 x 384Kbps circuit for traffic signal system data communications between the Bellflower LCCS and the Downey LCCS.

The diagram below illustrates the logical, high-level communications system design for the Local City Control (LCC) Site for the City of Bellflower.

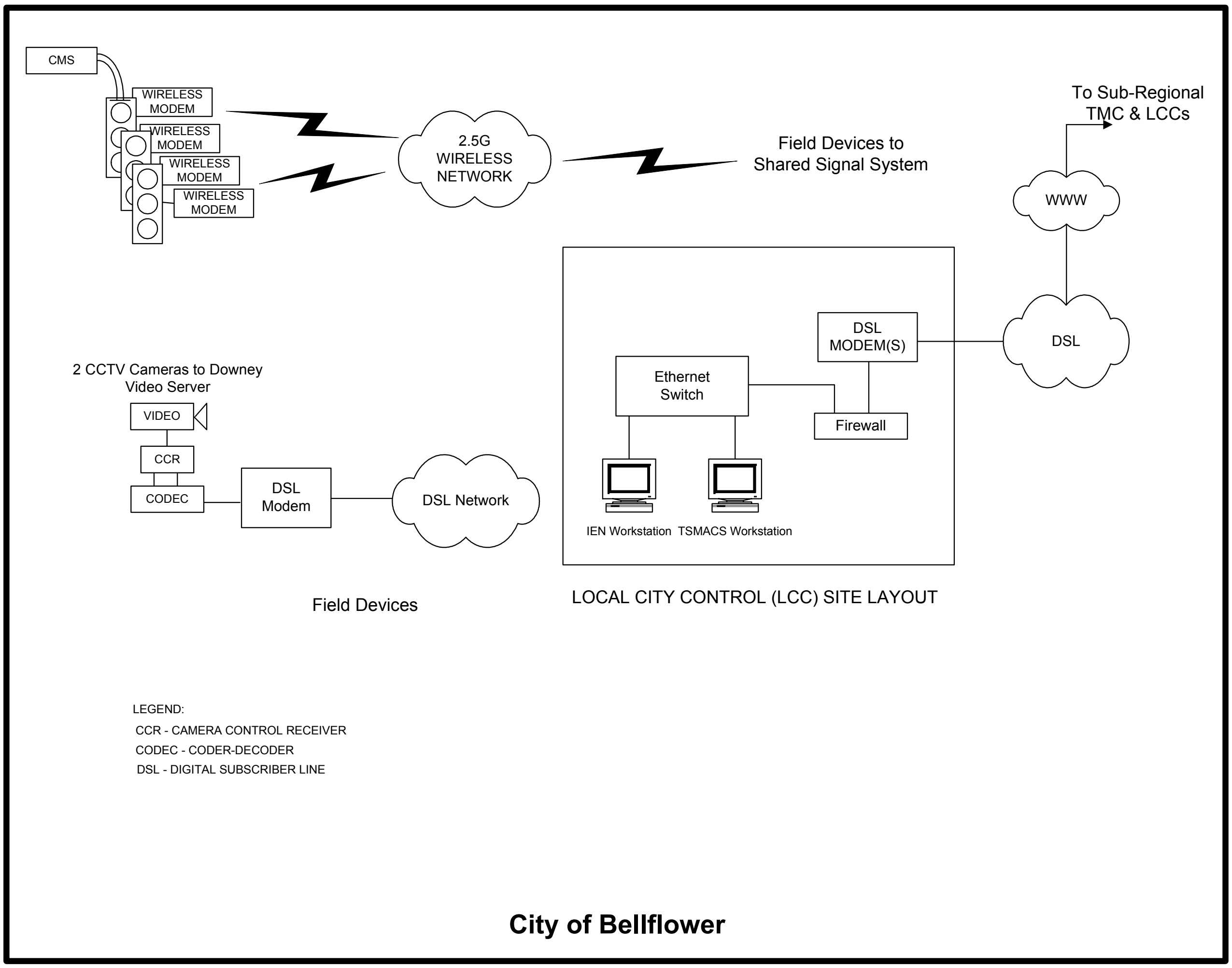


Figure 4-22: City of Bellflower Communication System Design

4.7.9.3 City of Bellflower Cost Breakdown

The following section provides a breakdown of the estimated costs associated with the current deployment system design for the City of Bellflower.

Table 4-31: City of Bellflower Implementation Estimates

Technology	Unit Cost Installed	Est. Quantity		Total
BELLFLOWER				
Terrestrial Systems				
Fiber Optic Cable in Conduit	$26	0	FT	$0
Fiber Optic Transceiver Pairs	$1,800	0	Unit	$0
Fiber Optic Data Modem	$2,000	0	Unit	$0
Splice Vaults	$1,800	0	Unit	$0
Splice Closures	$1,200	0	Unit	$0
Pull Boxes	$700	3	Unit	$2,100
Field Systems				
CCTV Cameras	$20,000	2	Unit	$40,000
Video Codec Pairs	$9,000	2	Unit	$18,000
Fixed CMS	$60,000	1	Unit	$60,000
Portable CMS	$23,000	0	Unit	$0
System Detection (Unganging only)	$2,600	5	Apprch	$13,000
Controller Software/Firmware Upgrades	$350	5	EA	$1,750
Controller Hardware Upgrades	$9,500	0	EA	$0
LCCS Systems				
Signal System	$0	0	LS	$0
IEN Server Hardware	$8,000	0	EA	$0
IEN Workstation Hardware	$3,000	1	EA	$3,000
TSMACS Workstation	$3,000	1	EA	$3,000
Router w/Firewall	$5,000	2	EA	$10,000
Ethernet Switch LAN	$1,500	2	Unit	$3,000
Video Cards	$300	1	Unit	$300
Video Server	$6,000	0	Unit	$0
LCCS racks, cabling, and FF&E	$12,000	1	LS	$12,000
Miscellaneous				
Traffic Control	$2,000	1	LS	$2,000
Communication Systems				
Wireless 2.5G for CMS	$350	1	EA	$350
Wireless 2.5G for VDS	$350	5	EA	$1,750
Wireless 2.5G for LCCS	$350	1	EA	$350
DSL (C2C) 384/384K	$600	1	EA	$600
DSL (C2F) 384/384K	$600	2	EA	$1,200
Total Construction Costs				**$172,400**
10-Year Wireless Service Totals				**$132,000**
10-Year 2.5G Wireless Service	$960	7	EA	$67,200
10-Year DSL (C2C) 384/384K	$2,160	1	EA	$21,600
10-Year DSL (C2F)384/384K	$2,160	2	EA	$43,200
Total Design Costs				**$104,040**
TOTAL				**$408,440**
Contigency 20%				**$81,688**
GRAND TOTAL				**$490,128**

4.7.10 Los Angeles County

The County of Los Angeles would have an existing traffic signal system as part of another procurement.

The limits for LA County include the unincorporated areas of the I-105 Project Area. The unincorporated areas fall within three of the east/west corridors: Firestone Boulevard, Imperial Highway, and Rosecrans Avenue. None of the north/south arterials fall into unincorporated areas of LA County. Figure 4-23 indicates the locations of proposed CCTV cameras and traffic signal controllers for connection to an LCCS.

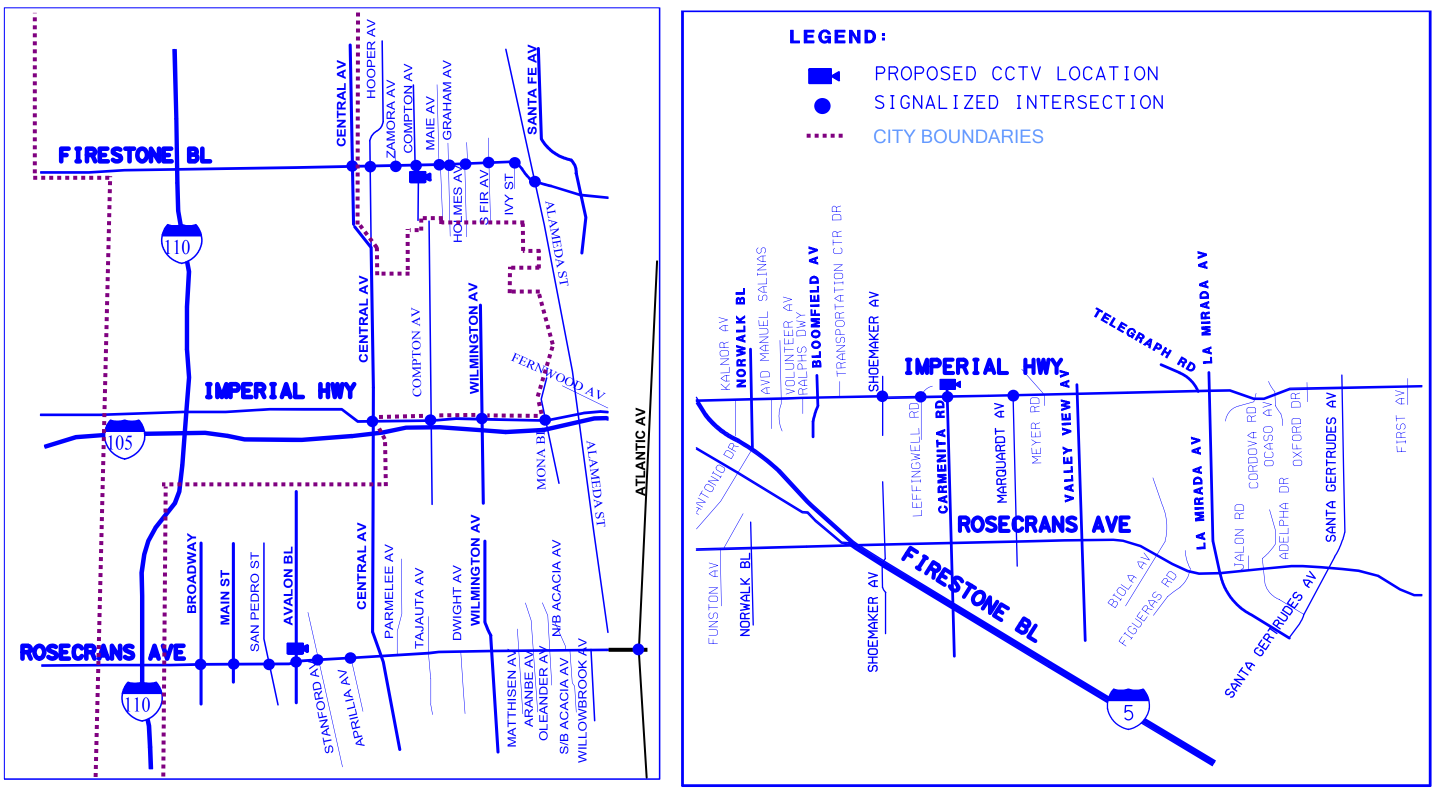


Figure 4-23: County of Los Angeles

4.7.10.1 Field Deployment

The I-105 Corridor Project has identified several components as part of the deployment initiative for the County of Los Angeles. The table below provides a more detailed view of the deployment initiative targeted for the city.

Table 4-32: County of Los Angeles Field Deployment Inventory

Component	Qty	Location(s)	Communication Type
Traffic Signal System	1	LA County	Network based
Traffic Signal Controllers	4	Various	Fiber Optic Cable
Traffic Signal Controllers	20	Various	Wireless
CCTV Cameras	4	Firestone & Compton Ave Imperial & Carmenita Rd Rosecrans & Avalon Blvd Rosecrans & Atlantic Blvd	DSL Fiber DSL DSL
Fixed CMS	0	N/A	N/A
Digital Video Server	0	Share with Downey LCCS	DSL

A listing of the existing Vehicle Detection Systems (VDS) for the LA County is provided in the table below. Each intersection listed represents a field controller that is proposed to be interconnected with the communications infrastructure for the initial deployment to enable that signal to be monitored and controlled from LA County TMC.

Table 4-33: LA County VDS Locations

			Existing Detection		
Primary Street	**Cross Street**	**Communications**	**Presence**	**Advanced**	**Ganged?**
Firestone Blvd	S Central Ave	Wireless	All	Major	
Firestone Blvd	Hooper Ave	Wireless	Minor	All	No
Firestone Blvd	Zamora Ave	Wireless	Minor	Major	No
Firestone Blvd	Compton Ave	Wireless	Minor	All	No
Firestone Blvd	Maie Ave	Wireless	Minor	Major	No
Firestone Blvd	Graham Ave	Wireless	Minor	Major	No
Firestone Blvd	Holmes Ave	Wireless	Minor	Major	No
Firestone Blvd	S Fir Ave	Wireless	Minor	Major	No
Firestone Blvd	Ivy St	Wireless	Minor	Major	No
Firestone Blvd	Alameda St	Wireless	All	Major	All
Imperial Hwy	S Central Ave	Wireless	N/A	N/A	
Imperial Hwy	Compton Ave	Wireless	N/A	N/A	

			Existing Detection		
Primary Street	**Cross Street**	**Communications**	**Presence**	**Advanced**	**Ganged?**
Imperial Hwy	Wilmington Ave	Wireless	N/A	N/A	
Imperial Hwy	Mona Blvd	Wireless	N/A	N/A	
Imperial Hwy	Shoemaker Ave	Fiber	N/A	N/A	All
Imperial Hwy	Leffingwell Rd	Fiber	N/A	N/A	Major
Imperial Hwy	Carmenita Rd	Fiber	N/A	N/A	All
Imperial Hwy	Marquardt Ave	Fiber	N/A	N/A	Major
Rosecrans Ave	S Broadway St	Wireless	N/A	N/A	
Rosecrans Ave	Main St	Wireless	N/A	N/A	
Rosecrans Ave	San Pedro St	Wireless	N/A	N/A	
Rosecrans Ave	Avalon Blvd (consider VIDS)	Wireless	N/A	N/A	
Rosecrans Ave	Stanford Ave	Wireless	N/A	N/A	
Rosecrans Ave	Aprillia Ave	Wireless	N/A	N/A	
Rosecrans Ave	Atlantic Ave	Wireless	N/A	N/A	

4.7.10.2 Communications Design

The communications infrastructure design in the field consists of a combination of a fiber optic cable based design and a wireless based design for the traffic signal intersections along Imperial Highway. For traffic signal intersections along Firestone Boulevard and Rosecrans Avenue, a wireless based design would be used. Two of the three CCTV cameras in the unincorporated areas would be over high-speed DSL and one CCTV camera would be over fiber optic cable.

Communication between the LA County LCCS (Sub-Regional TMC) and the Downey LCCS would be over high-speed DSL.

The Sub-Regional TMC would receive six CCTV video images simultaneously. The DSL bandwidth requirement for Sub-Regional TMC (LA County) includes support for video in the field and data communication for the shared signal system.

The DSL communication requirements for LA County:

Center-to-Field

- 2 x 384 Kbps circuits for two CCTV cameras in the field to the video server located at the City of Downey

Center-to-Center

- 1 x T1 and 1 x 768 Kbps circuits to support a total of 6 simultaneous incoming video signals at 384 Kbps per video signal from the other LCCS.
- 1 x 384 Kbps circuit for symmetric, bi-directional data communications.

The diagram below illustrates the logical, high-level communications system design for the Local City Control (LCC) Site for the County of Los Angeles.

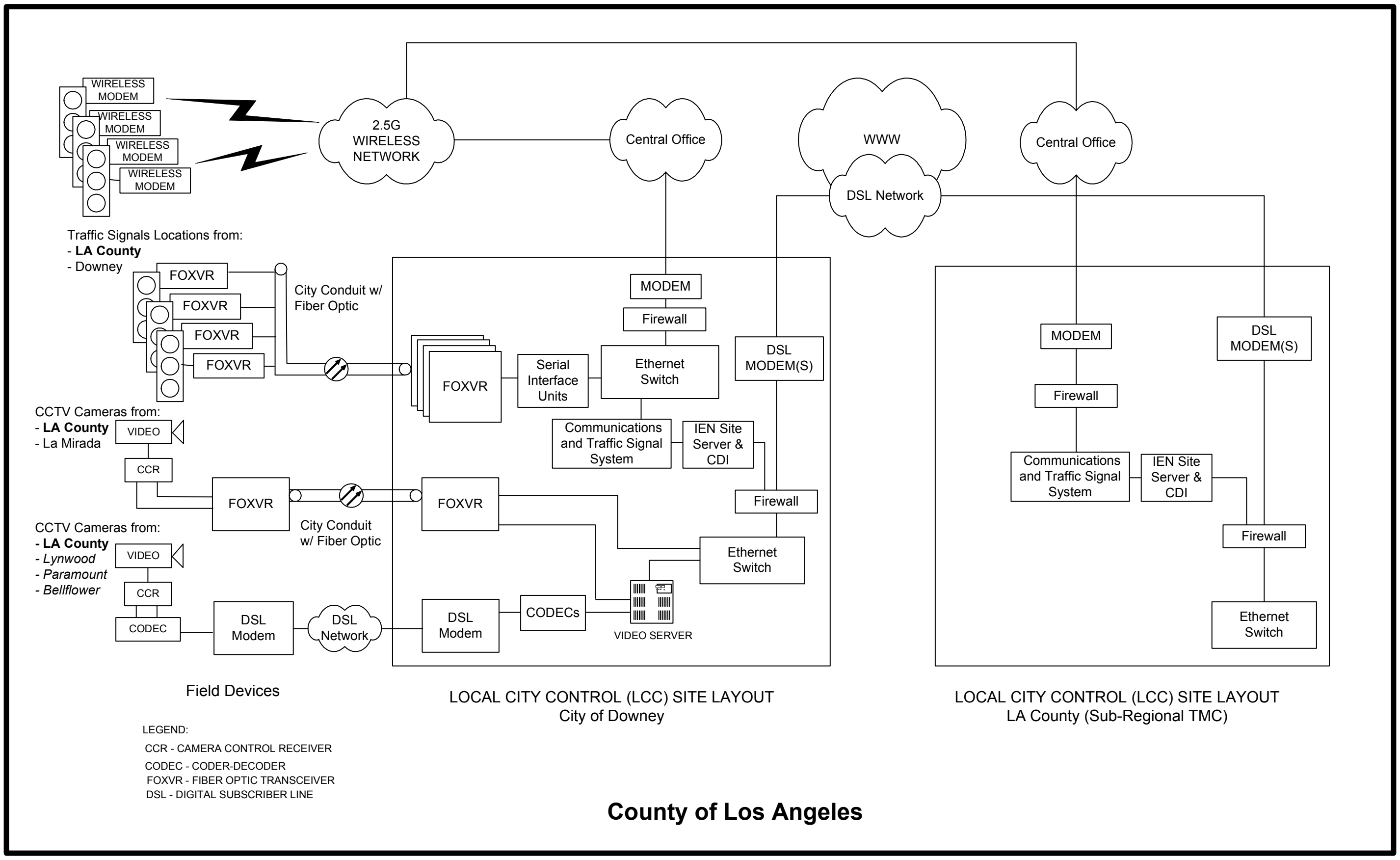


Figure 4-24: County of Los Angeles Communication System Design

4.7.10.3 County of Los Angeles Cost Breakdown

The following section provides a breakdown of the estimated costs associated with the current deployment system design for LA County.

Table 4-34: County of Los Angeles Implementation Estimates

Technology	Unit Cost Installed	Est. Quantity		Total
LA COUNTY (Sub-Regional TMC)				
Terrestrial Systems				
Fiber Optic Cable in Conduit	$26	0	FT	$0
Fiber Optic Transceiver Pairs	$1,800	1	Unit	$1,800
Fiber Optic Data Modem	$2,000	4	Unit	$8,000
Splice Vaults	$1,800	3	Unit	$5,400
Splice Closures	$1,200	3	Unit	$3,600
Pull Boxes	$700	0	Unit	$0
Field Systems				
CCTV Cameras	$20,000	3	Unit	$60,000
Video Codec Pairs	$9,000	2	Unit	$18,000
Fixed CMS	$60,000	0	Unit	$0
Portable CMS	$23,000	0	Unit	$0
System Detection (Unganging only)	$2,600	8	Apprch	$20,800
Controller Software/Firmware Upgrades	$350	10	EA	$3,500
Controller Hardware Upgrades	$9,500	1	EA	$9,500
LCCS Systems				
Signal System	$185,950	1	LS	$185,950
IEN Server Hardware	$8,000	1	EA	$8,000
IEN Workstation Hardware	$3,000	1	EA	$3,000
TSMACS Workstation	$3,000	1	EA	$3,000
Router w/Firewall	$5,000	2	EA	$10,000
Ethernet Switch LAN	$3,000	2	Unit	$6,000
Video Cards	$300	6	Unit	$1,800
Video Server	$6,000	0	Unit	$0
LCCS racks, cabling, and FF&E	$20,000	1	LS	$20,000
Miscellaneous				
Traffic Control	$30,000	1	LS	$30,000
Communication Systems				
Wireless 2.5G for CMS	$350	0	EA	$0
Wireless 2.5G for VDS	$350	20	EA	$7,000
Wireless 2.5G for LCCS	$350	1	EA	$350
DSL (C2C) 1.5/1.5M	$600	1	EA	$600
DSL (C2C) 768/768K	$600	1	EA	$600
DSL (C2F) 384/384K	$600	2	EA	$1,200
Total Construction Costs				**$408,100**
10-Year Wireless Service Totals				**$319,200**
10-Year 2.5G Wireless Service	$960	21	EA	$201,600
10-Year DSL (C2C) 1.5/1.5M	$4,440	1	EA	$44,400
10-Year DSL (C2C) 768/768K	$3,000	1	EA	$30,000
10-Year DSL (C2F)384/384K	$2,160	2	EA	$43,200
Total Design Costs				**$144,920**
TOTAL				**$872,220**
Contigency 20%				**$174,444**
GRAND TOTAL				**$1,046,664**

5 CONFIGURATION MANAGEMENT PLAN

5.1 Purpose of Configuration Management

Configuration Management (CM) of a regional network such as the LA County Arterial ITS (AITS) Architecture, which consists of many systems and organizations, is critical to establishing interoperability and maintaining operations. Definition and control of system interfaces, help facilitate interoperability. For a centralized architecture like the AITS, maintaining configuration management on the deployed infrastructure promotes communication of change throughout the County so that the current system elements are reflected in the operational configuration.

The objectives of a Configuration Management Plan are to identify the system components that fall under the influence of CM, define the agencies to participate in the CM process, define the roles of the participants, and describe the configuration management activities.

The CM needs for the I-105 project are primarily driven by:

- *Keeping track of the existing configuration*. To best assess the impact of making changes to the system, the current system configuration must be understood. This requires that the system configuration be documented and that the documentation be updated as changes occur. A good configuration management system always documents the current system configuration.

- *Facilitate a means for agency communications*. Documenting the current system configuration is not enough. If no one knows that changes are being made, the effect of those changes on other systems and operations may not be considered. Consider an example where a signal is added by one city. If this signal addition is not communicated to the IEN administrator, that signal may not be added to the IEN database and therefore would not be available for view by adjacent jurisdictions. A good configuration management system communicates system changes to key agencies/personnel.

- *Manage the introduction of change to the baseline*. In order to preserve interoperability of a regional system, the behavior of certain system components needs to be documented and controlled. For example, the IEN interface between LCC workstations needs to be well specified in order for the LCC workstations to communicate with other equipment on the IEN. If changes are made to the interface protocols and are implemented by only a portion of the equipment on the network, it is possible that the functionality of some or all of the equipment on the network would degrade. A good configuration management system controls changes to items that affect system interoperability.

5.2 Configuration Identification

Configuration identification refers to listing those elements of hardware, software, communications, or data that fall under the influence of CM. For the I-105 Project, the elements fall into three primary influences: local, regional, and development.

5.2.1 Local

The first are those elements that are of regional interest but not essential to insure interoperability. These elements primarily deal with system configuration and affect the completeness of the information on the regional network. These elements include such things as the number, type, identification, and operating parameters for field equipment. Elements that would be tracked for this purpose include:

- Signals
- CCTVs
- CMSs
- Local Communications Equipment (to the extent that it affects communication with the rest of the I-105 corridor)

5.2.2 Regional

The second sets of elements that fall under the influence of CM are those documents that define the behavior of elements of the network. Control of these elements is very important as uncoordinated change in their definition or the equipment that is built according to them can result in significantly degraded system operation. These elements include interface specifications and network accessibility information. Elements that would be tracked for this purpose include:

- IEN to TSMACS Interface Definition
- County Shared Camera Control Interface Definition

5.2.3 Development

The third sets of elements that fall under the influence of CM are those hardware, software, and communication items that are developed or procured. All hardware, software, and communications configuration items as well as supporting subsystems for the I-105 Project are defined in Section 3.1. It is expected that all these system configuration items that are designed/built custom for the I-105 Project would be done utilizing the configuration management of the developing agency/company.

Once installed, the configuration of the system components is the responsibility of the owning or affiliated cities. While the cities have complete autonomy over making changes to their system configurations, they must communicate configuration changes to the County AITS CM Committee to insure that the changes are communicated throughout the project.

5.3 CM Responsibilities

CM responsibilities for the I-105 Project are primarily split between local CM responsibilities, regional CM responsibilities, and development CM responsibilities. Local CM responsibilities are proposed to be performed by city representatives overseeing the installation and configuration of the local infrastructure. Regional CM responsibilities would be performed by the County AITS CM team. Development CM responsibilities would be performed by those agencies/companies that are developing new or modified hardware, software, and communications systems utilized by I-105 Project partners.

Individuals/organizations assigned with CM responsibilities are responsible for working to establish and maintain a repository of baseline information for those elements of interest. To accomplish this, they are responsible for the following tasks:

- Maintain the configuration management process across the project,
- Identify and establish baselines for the Configuration Items,
- Provide a labeling/numbering mechanism for various baselines/releases,
- ˜ Maintain an archive of previous releases/versions,
- Communicate changes to the configuration baseline as they occur.
- Act as a resource for configuration management issues as they arise.

5.4 Relationship of I-105 Project CM Activities to Other CM Efforts

There are several entities performing configuration management activities related to the I-105 Project. However, since the elements of this project are not wholly managed by this project, this project does not exercise complete control of the CM of its components. The most significant case here is the AITS and IEN. Since IEN is under deployment and its CM organization is not fully in shape yet, AITS play the most important role in the CM effort of I-105 project.

While some of the AITS stakeholders are members of the I-105 Project, not all stakeholders of AITS are members of the I-105 Project. As a result, it is the AITS CM organization that drives the definition of system interfaces, not the I-105 Project team. Each city participating in the I-105 Project should provide a representative to participate in the AITS CM organizations activities to insure continued interoperability and operation.

5.5 Change Control Process

There are two primary tenets to I-105 project configuration management. These are control of changes and communication of changes. Local changes are completely within the purview of the participating city. Once a change is to be made to local infrastructure, the change is to be documented and communicated to other I-105 stakeholders. An example of this type of change would be addition of signals to the City of Bellflower. The city does not need any approval to perform the change, but must coordinate the change with both the City of Paramount and the AITS by submitting a Configuration Change Request so that the TSMACS workstation can communicate with the new signals and the IEN configuration database can be updated. The Configuration Change Request needs to document the following information:

- Name of change
- Description of change
- Rationale for change
- Originator name of agency
- Originator contract information
- Date of origination for change request

Once the change is fielded and tested, and the influenced stakeholders acknowledge the change, the Configuration Change Request can be closed.

Regional changes are controlled through the county and the County's Arterial ITS (AITS) Architecture Configuration Management (CM) Committee. In the "Los Angeles County Arterial Intelligent Transportation System (ITS) Inventory and Architecture Project – Deliverable 11: Arterial ITS Report, 2004", the AITS Configuration Management Process was developed and recommended for the maintenance of any arterial ITS architecture in the County.

The process of the CM Committee's decision-making, involves reviewing and evaluating all proposed changes that affect interoperability throughout the county. The process creates an audit trail of all changes considered, and a document recording decisions of approved, rejected, or deferred. The requester should get feedback regarding the status of the change request. The CM Committee conducts the decision-making through the following discussion:

- Change Request Evaluation: Determination of the change's impact on the Baseline. Affected stakeholders, such as those within the I-105 corridor systems, need to be contacted for their agreement. In the case of a full baseline update, the change evaluation happens through stakeholder consensus as part of the overall update
- Disposition: To approve, defer, or reject the change request. Requester should be notified with an explanation in case of rejection or deferring.
- Update Baseline: To update AITS documentation and Turbo Database. This requires much the same skill and techniques used in creating the initial baseline
- Notify Stakeholders: To notify all stakeholders of the changes and updates.

Finally, the entire process should be maintained in a change database that records the following information in addition to the basic change information in the Configuration Change Request:

- Change Number (some unique identifier)
- Change disposition (Accepted, rejected, deferred)
- Change type (minor or significant)
- Part of baseline affected (could be check boxes for document, database, web site)
- Disposition comment
- Disposition date

The change control process for elements to be developed is the responsibility of the developing companies and their agency client. It is not the responsibility of this document to define that change control process. It is the responsibility of this document to identify that a change control process needs to exist for any developed item used on the project.

6 CONSTRUCTION STAGING PLAN

The implementation of the I-105 Corridor project can be divided into four phases. The phases would overlap but should be completed in sequence.

6.1 Phase One – Infrastructure Design and Construction

The foundation for the I-105 Corridor project is the infrastructure. The infrastructure consists of separation of detectors, firmware/controller upgrades, fiber optic communications, changeable message sign installation, closed circuit television camera installation, and the site improvements at the Local City Control Sites. These items typically take several months to design and construct and should be the first priority.

Within the Order of Work provisions for the contractor, ordering of equipment, especially poles would be identified as the first order of work. Installation of the communications equipment should be installed prior to installing the CCTV cameras to reduce their exposure to the elements and vandals.

Prior to completion of the infrastructure design the signal system should be selected such that the appropriate controller firmware upgrades are included in the infrastructure design.

6.2 Phase Two – Signal System Procurement, Installation and Integration

Simultaneous with the infrastructure design, and while the infrastructure improvements are in construction, the procurement and installation of the signal systems should be completed. The signal system procurement and installation includes:

- Executing MOU with LA County DPW for transfer of funds
- Drafting the procurement documents
- Negotiating the procurement
- Installing the system
- Populating the system and intersection graphics
- Populating the system database
- System Testing

Upon completion of the system testing, intersection controllers can be integrated with the signal system. Each intersection should be brought on line, and database contents tested and modified as needed.

Users of the system should receive training on how to configure the system, diagnose communications and equipment malfunctions and on system functions.

6.3 Phase Three – IEN CDI Development and Integration

Each signal system that is deployed with in the corridor would have an interface to the County's Information Exchange Network through a Command/Data Interface (CDI). The CDI are specific to the type of signal system that they interface. Under various County projects CDI's are underdevelopment for selected signal systems. These CDI's would be available for use on this project. The previously developed CDI's would be integrated to deployed systems of the same type (vendor and version). For systems, which a CDI has yet to be developed, a CDI would be developed and integrated as part of this project.

Development of a new CDI can begin while intersections are being integrated to the signal system. A test copy of the signal system software is proposed to be used during development of the CDI for integration and test. As the CDI development nears completion, the communications link from the City to the Corridor Server located at the LACDPW TMC should be established to enable system testing. The Site Server and IEN Workstations, both previously developed by the County, should then be deployed within the City integrated to the communications network, CDI, and Corridor server. Upon successful integration to the Corridor server, the IEN workstations can then be utilized to populate the Corridor server's database of intersection graphics and data. A programmatic link to populate the database would also be investigated.

6.4 Phase Four – System Testing, Training & Maintenance

The final phase includes overall system testing, IEN User and System training and system maintenance. Upon integration of each signal system and CDI to the IEN the IEN system should be tested to verify that each agency can receive data.

Training on how to use the IEN workstations and how each agency is expected to manage and maintain their information on the network would be conducted.

7 CUTOVER PLAN

Cutover planning is required to facilitate the orderly connection of traffic signals to the newly deployed systems. Nearly all intersections within the corridor are running on time-based coordination and are not connected to a system. For these intersections the following activities should take place:

1. Complete infrastructure improvements (separate detectors and establish communications).
2. Implement firmware changes
    a. Put intersection on flash
    b. Change out firmware
    c. Reestablish database
    d. While intersection remains on flash, verify controller operation in the background
    e. If it is cycling correctly, then allow controller to control the intersection.
3. Deploy signal system.
4. Populate Signal system with intersection graphics
5. Integrate intersection controller, communications and the signal system, one intersection at a time. Verify that intersection status and memory contents can be accessed from the system. Monitor the system for excessive communications dropouts. Remedy excessive communications failures as needed. The remedy may consist of tuning or relocating modems, or replacing the communications with a different technology.
6. With someone stationed at the controller, verify that new timing plans can be down loaded to the controller and implemented. A maximum of 10 controllers should be cutover in a day.

The City of South Gate is the only City within the project area that is currently operating a signal system. The existing system is proposed to be upgraded to a newer version of the same system with this project. Communications, intersection graphics, and database contents are expected to be reused with the upgraded version of the software. The intersections are currently time based coordinated with the central system used primarily for monitoring and occasionally for downloading new plans. It is yet to be determined whether hardware upgrades would be required to support the newer version of the application software. The following cutover activities include alternate steps if hardware is also upgraded:

1. Verify existing system operation; note any intersections with excessive communication failures. This step verifies that the existing system is in good working order. Therefore, if there are difficulties after the system is upgraded, the problems can be isolated.
2. Conduct a full back up of the existing system, application software and database. This copy should be retained for six months following the full integration of the new version.
3. Install the new version of the application software on the server. If the hardware can accommodate, the new version should be installed along side the previous version.
4. Test the new version of the software with the existing graphics and database.
5. Test the intersection communications to the new version.
6. When satisfied that the new version of software performs adequately, the system should again be backed up. Then the previous version can be removed.

If the upgraded system is installed on new hardware the following steps are to be followed:

1. Verify existing system operation; note any intersections with excessive communication failures. This step verifies that the existing system is in good working order. Therefore, if there are difficulties after the system is upgraded, the problems can be isolated.
2. Conduct a full back up of the existing system, application software and database. This copy should be retained for six months following the full integration of the new version. Incremental back-ups for databases, configuration files, and system accounts should be conducted more frequently depending on the operational needs of the system.
3. Install the new version of the application software on the new server(s). The existing database should be replicated on the new hardware.
4. Test the new version of the software with the existing graphics and database.
5. Integrate the intersection communications one at a time to the new version, and test.
6. When satisfied that the new version of software performs adequately and all intersections are integrated, the previous system can be removed.