

SMART TECHNOLOGY AT TRAFFIC SIGNALS FEASIBILITY STUDY

July 2025 Final Report



Executive Summary

The City of Beaumont, located in Riverside County, California, is a rapidly growing community with a population surpassing 55,000 residents. Strategically positioned along the I-10 corridor and serving as a gateway between the Inland Empire and the Coachella Valley, Beaumont has experienced significant residential and commercial development over the past decade. This growth has increased vehicular volumes across the city's arterial roadways and intersections, placing added demand on the existing traffic signal infrastructure.

Beaumont's existing traffic signal infrastructure is a mix of aging equipment and limited connectivity that restricts efficient traffic flow and real-time management. As travel demand increases across key corridors, signal-related congestion, safety concerns, and inconsistent signal operations threaten mobility, air quality, emergency response times and overall quality of life.

To address these challenges proactively, the City has developed this Smart Technology at Traffic Signals Feasibility Study ("Study") as a strategic roadmap to modernize, expand, and optimize its traffic signal system.

The Study will guide the City's future investment and implementation in traffic signal communications systems and smart traffic signal technology. The Study is critical to ensure the City's current and future transportation system needs and objectives are realized. Most importantly, implementation of the Study recommendations will promote the City's vision of sustainability, economic vitality, and high quality of life – through the significant benefits of traffic systems technology and improved traffic management and operations.

Purpose and Objectives

The purpose of the Study is to provide a framework for planning, prioritization, and investment in traffic signal system upgrades. This study identifies current deficiencies, projects future needs, and outlines strategies to enhance system performance, inter-agency coordination, and technology integration across the city.

The Study addresses the following objectives:

- **Modernize Infrastructure** - Replace outdated signal hardware and implement adaptive signal technologies to support dynamic traffic management.
- **Expand Connectivity and Communication** - Deploy a fiber-optic and/or wireless communications backbone to enable centralized signal control and future smart signal technology.
- **Improve Traffic Flow and Safety** - Enhance intersection performance and reduce delays and collisions through AI-based adaptive traffic signal control strategies.
- **Promote Sustainable and Multimodal Mobility** - Accommodate pedestrians, cyclists, and transit users with signal improvements that support complete streets principles.
- **Support Growth and Economic Development** - Align signal system improvements with planned land use, development patterns, and regional transportation strategies.
- **Ensure System Resilience and Maintainability** - Improve capability and practices for asset management, operations, and maintenance.

Existing Systems and Operations

The Study presents a detailed summary of the existing systems and operations of the City's traffic signal system. Information was collected through review of as-built plans, signal timing plans, and extensive field reviews. Multiple needs for improvements are identified either at an intersection or system-wide level. Critical needs include:

- The City of Beaumont currently operates 35 traffic signals, of which approximately half are controlled by legacy, obsolete hardware and software that is no longer supported by the manufacturer.
- The City's communications system is characterized by partial or inconsistent connectivity between signalized intersections, resulting in a fragmented network with no centralized control.
- The City lacks tools, such as a Central Management System (CMS), to monitor and control its traffic signals.

Smart Traffic Signal Technology Evaluation

The Study evaluates modern traffic signal system elements including ATC controllers, ATC cabinets, video detection, Central Management Systems, and AI/Adaptive Signal Control Technologies. The Study considers the suitability of four leading AI/ASCT smart signal technologies for use in the City of Beaumont. AI/ASCT systems can offer the following features and benefits:

- Adaptive signal timing/automated traffic signal plan generation
- Edge computing and machine learning for automated operations
- Vehicle detection and classification, bicycle, and pedestrian detection
- System performance measures
- System health monitoring and alerts

The AI/ASCT systems are analyzed for their ability to provide the desired features. Consideration is given to automation, cost, ease of operability, vendor support, scalability, compatibility with existing infrastructure, and long-term operational sustainability.

Traffic Signal Communications System

This Study outlines a staged approach to upgrade the City's traffic signal communications network considering existing infrastructure, modern technology, installation costs, and ease of deployment. Establishing a reliable and robust communications system is foundational for implementing smart traffic signal technologies citywide. The strategy includes:

- Rapidly establish modern IP based connectivity to all signalized intersections through a combination of cellular wireless, point-to-point wireless, and Ethernet over twisted pair copper technology.
- Utilize existing underground infrastructure where available to implement fiber optic communication cable and technology.
- Migrate to the traffic signal communication system to a fully integrated fiber optic-based network.

This approach implements a high-speed communication network, leveraging existing infrastructure, and ultimately building a fiber-optic network that will ensure future-proof capacity to support advanced smart technologies.

Smart Technology and Deployment Recommendations

To advance toward a fully integrated smart traffic signal system, the Study recommends the following phased implementation strategy:

- Phase 1 (Year One) – Prioritize Highland Springs Ave.
- Phase 2 (Year Two) – Prioritize Beaumont Ave, First St, Second St, and Sixth St.
- Phase 3 (Year Three) – Prioritize Oak Valley Pkwy and Fourth St.

Phases 1 through 3 each include in the respective priority corridors:

- Upgrade traffic signals with modern controllers and AI detection.
- Implement high speed Ethernet communications systems.
- Deploy a central traffic management software platform with real-time monitoring and control and performance reporting capabilities.
- Implement AI-based adaptive signal control on priority corridors.

Phases 4 and 5 graduate to advanced field element technology for subsystems such as battery back-up systems, emergency vehicle preemption systems, and fiber optic communication systems.

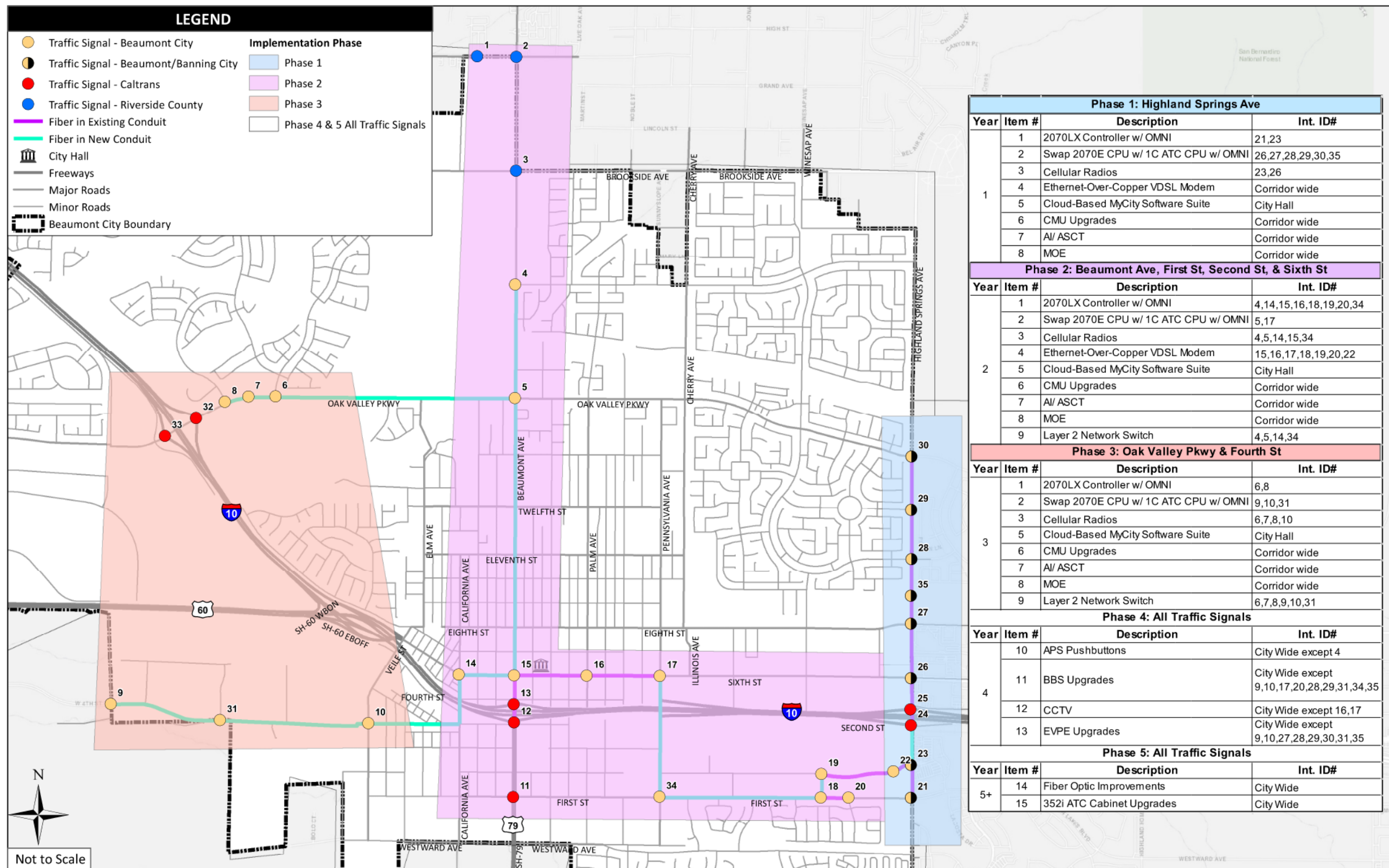
- Phase 4 (Year Four) – All locations Citywide. Prioritize upgrading and implementing field element subsystems including BBS, APS, EVPE, and CCTV.
- Phase 5 (Year Five +) – All locations Citywide. Replace hybrid media network with standardized fiber optic network and upgrade traffic signal cabinets.

The improvements designated for each of the three corridor phases are organized to provide the greatest mobility benefits as quickly as possible. The priority corridor approach targets high-traffic areas first to yield immediate and measurable benefits. It's important to note that system design documents are required prior to procuring contractors and/ or equipment vendors. System design development for phase one is expected to take approximately three months and Caltrans permitting is expected to take approximately six months.

The Study includes rough order-of-magnitude cost estimates by phase for system elements such as controller upgrades, communication systems, and AI detection. A summary of the implementation phases, costs, and total cost for all technology recommendations is shown on the following table. The full implementation phasing plan map is shown on page v.

Phase	Year	Location	Cost
1	1	Highland Springs Ave	\$683,250
2	2	Beaumont Ave, First St, Second St, Sixth St	\$1,018,500
3	3	Oak Valley Pkwy and Fourth St	\$382,500
4	4	Citywide	\$1,613,750
5	5 +	Citywide	\$5,586,250
Total			\$9,284,250

By investing in smart traffic signal technologies and a robust communications infrastructure, the City of Beaumont will position itself to meet growing mobility demands, improve traffic flow, and enhance the overall safety and efficiency of its transportation network. This study provides a strategic foundation for incremental modernization and integration of advanced traffic signals systems to create a state-of-the-art transportation system for the City of Beaumont.



Implementation Phasing by Improvements and Locations

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LIST OF ACRONYMS

ADA	Americans with Disabilities Act
AI	Artificial intelligence
ALPR	Automatic License Plate Reader
APS	Accessible Pedestrian Signal
ASCT	Adaptive Signal Control Technology
ATC	Advanced Traffic Controller
BBS	Battery Backup System
CCTV	Closed Circuit Television
CMS	Central Management Systems
CMU	Conflict Monitor Unit
EVPE	Emergency Vehicle Preemption
GIS	Geographic Information System
GPS	Global Positioning Systems
IP	Internet Protocol
ITS	Intelligent Transportation Systems
NTCIP	National Transportation Communications for ITS Protocol
OTS	Office of Traffic Safety
P2P	Peer-to-Peer
PVC	Polyvinyl Chloride
RMC	Rigid Metallic Conduit
SIC	Signal Interconnect Cable
TEES	Transportation Electrical Equipment Specifications
TOD	Time-of-Day
VDSL	Very-high-bit-rate Digital Subscriber Line

1 Introduction

The City of Beaumont Smart Technology at Traffic Signals Feasibility Study establishes the need, options, and solutions for implementing smart technology to improve traffic flow at signalized intersections throughout the City. The Feasibility Study serves as a guide to City staff and management with specificity on the technological options, the best options to invest in and why, costs to implement in phases over a six-to-10-year period, and priorities in terms of technologies, streets, and intersections. Implementation of the study recommendations will provide a state-of-the-art traffic signal operation and management system that improves service to the Beaumont community and traveling public through increased traffic signal efficiency and safety.

1.1 Purpose and Objectives

The City of Beaumont is making significant capital investments in transportation infrastructure improvements that align with the City's strategy for responsible growth with economic development opportunities and improved services and quality of life for the community. The projects are varied and include interchanges, grade separations, roadway widenings and extensions, police and fire stations, and traffic signal projects.

This initiative to study the feasibility of smart technology at traffic signals complements the "concrete and steel" transportation system capacity improvements. As the City grows and traffic increases, it becomes more critical to manage the transportation system with smart technology to keep traffic moving safely and efficiently. This is especially critical on the City's surface streets and network of 35 traffic signals, which control access for all transportation modes including motor vehicles, pedestrians, bicyclists, transit, and emergency vehicles.

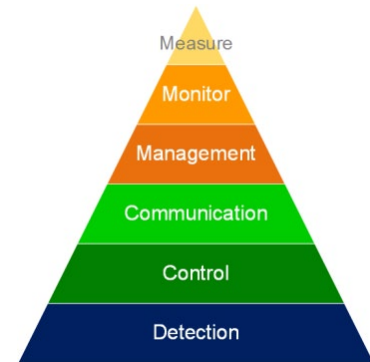
Inefficient traffic signal operations can have a significant impact on all road users. These impacts include:

- Increased travel time and congestion due to unnecessary stops and delays.
- Higher fuel consumption and emissions due to frequent stops and starts, and longer vehicle idling times.
- Increased economic costs including longer commute times for individuals and transit as well as lost productivity for businesses.
- Safety concerns are due to the risks of increased collisions due to poorly timed signals and driver frustration.
- Reduced overall system efficiency and capacity due to inefficient use of the roadway network.

Smart traffic signal technology will enable the City to improve traffic flow by implementing advanced equipment and operation with the capability to monitor traffic signal system health and performance through information and analytics. The applications will provide the ability for an operator to manage the system remotely and/or utilize system automation.

This study will be used as a guide to move the City from an "ad-hoc" approach to implementing traffic signal system technology to a planned approach that will achieve system wide uniformity in both systems and operation.

The approach for the Smart Technology at Traffic Signals Feasibility Study is based on building what we refer to as the traffic signal systems “pyramid.” The pyramid structure is based on lower layers that are built to provide reliable support for the upper layers. As illustrated in the graphic, traffic detection, signal control, and the communications system provide the solid foundation upon which management, monitoring and measurement systems are stacked up to form a solid and integrated structure. The pyramid is an effective model to explain traffic signal operations because a deficiency in a lower layer will cause problems through to the top. That means a detection issue can compromise the ability to control and manage the system resulting in monitoring measurements that reflect poor signal operations.



The objectives of this study to achieve the goal and benefits of a smart technology at traffic signal technology include:

- Identify which streets and intersections could benefit the most from smart technology.
- Identify streets and intersections that could benefit from coordinated signal timing to improve traffic flow.
- Identify and provide recommendations on which types of remote signal control technology, vehicle detection devices, or timing devices could benefit the City.
- Identify and provide recommendations on the best options for remote communication (cellular, radio, etc.).
- Identify and provide recommendations on the types of hardware and software that would be needed including emerging AI technology.
- Summarize options and provide recommendations.
- Provide thorough cost estimates.

1.2 Study Organization

This study is organized into five main sections, which are described below:

1. **Introduction** – Current section that describes the purpose and objectives of the study.
2. **Existing Systems and Operations** – documents the existing traffic signal infrastructure and identifies needs and deficiencies within the existing system. City traffic signal and roadway safety operations are also assessed.
3. **Smart Traffic Signal Technology Evaluation** – Presents traffic signal systems technology, both basic and advanced technologies, and evaluates applicability for Beaumont. This section includes market research and comparison of vendor specific products for integrated AI detection/ ASCT systems.
4. **Traffic Signal Communication System** – Discusses the approach to improve the City’s traffic signal communication system that is a core layer in the build of a smart traffic signal system. A three-stage communication system buildout is included.
5. **Smart Technology and Deployment Recommendations** – Provides recommendations for new signal technology, cost estimates, and implementation phasing strategy. Recommendations to develop new traffic signal system standards and opportunities for delivery are included.

2 Existing Systems and Operations

This section presents a detailed summary of the reviews that were conducted of City traffic signal as-built plans, signal timing plans, and field inventories for the existing traffic signal systems. The information was reviewed to establish the existing traffic signal system technology and its condition, as well as the operational and traffic volume characteristics. The evaluation drives the identification of system and operational needs and prioritization of streets and intersections for improvements. Throughout Section 2 and based on the evaluation, needs (deficiencies) are identified. Section 5, Smart Traffic Signal Systems and Operations Recommendations ties the identified needs to proposed improvements.

2.1 Traffic Signals Jurisdiction, Operations and Maintenance

The Beaumont traffic signal system has been built over several decades, with continuous expansion from development and improvements made to the present day. There are 37 traffic signals within Beaumont, including signals situated at City limits that are co-owned and operated with the City of Banning, Riverside County, and Caltrans. Riverside County operates three traffic signals on the northern City border along Cherry Avenue and Beaumont Avenue. Caltrans operates seven traffic signals for the Interstate-10 (I-10) ramps at Beaumont Avenue, Highland Springs Avenue, Oak Valley Parkway, and the intersection of Beaumont Avenue / 1st Street along State Route 79 (SR-79). The City of Beaumont operates 25 traffic signals, including eight along North Highland Springs Avenue that are cost-shared with the City of Banning.

The Beaumont traffic signal system is primarily operated by the Public Works Department, which is responsible for planning, building, improving, and maintaining the City's roadway network. The Streets Division provides support for physical improvements, such as installing traffic signal poles and foundations. Traffic signal maintenance for electrical and programming support is provided through a third-party contract, which is updated every three years.

2.2 Copper Wire Analog Network

The Beaumont traffic signal interconnect cable (SIC) infrastructure was established decades ago, spanning five corridors and encompassing 16 total signals on roadways classified as urban arterial highways, major highways with raised medians, and downtown streets. The SIC network is comprised of a mix of 19 and 22-gauge six-pair twisted copper cables. The copper interconnect is configured in a daisy-chain of twisted pairs that link traffic signals through cables that enter the traffic signal cabinet and are terminated on dedicated terminal blocks. The SIC network is not currently being utilized to communicate between traffic signals due to disconnected SIC cable either within the controller cabinet or in the adjacent home run pull box and/or missing modems and C-2S plugs on the traffic controllers. Continuity testing did not identify any breaks in the SIC cables.

2.2.1 Conduit and Cable

Field reviews included identifying and visually evaluating SIC conduit between traffic signals for size, type, and fill. The SIC resides in a 2-inch diameter conduit, either polyvinyl chloride (PVC) conduit or rigid metallic conduit (RMC). SIC locations are summarized in **Table 2-1**. Specific copper SIC needs are identified and numbered following Table 2-1 and Sections 4 and 5 provide recommendations.

Table 2-1: Copper Wire Interconnect Locations

Corridor	Segment	SIC Cable	Conduit Size (in)	Conduit Type	Total Signals Connected
Highland Springs Ave	Oak Valley Pkwy to I-10 EB Ramps	1-6PR#22	2"	RMC & PVC	8
Highland Springs Ave	2nd St to 1st St	1-6PR#22	2"	RMC	2
1st St	Commerce Ave to Emory Ave	1-6PR#22	2"	RMC	2
2nd St	Commerce Ave to Highland Springs Ave	1-6PR#22	2"	RMC	3
6th St	Beaumont Ave to Pennsylvania Ave	1-6PR#19	2"	RMC	3
Beaumont Ave	6th St to I-10 WB Ramps	1-6PR#19	2"	RMC	2

An assessment of the copper wire analog network identified the following needs:

- N1. Disconnected SIC either within the controller cabinet or adjacent home run pull box needs connection to the terminal block to enable communications.
- N2. Traffic signal controller missing C-2S plugs needed to enable communications.
- N3. Traffic signal controllers missing modems needed to enable communications.
- N4. No communications link between traffic signals communicating on the copper wire analog network and a Central Management System (CMS).

2.3 Wireless Radios

Broadband wireless radios were installed to provide communication in the absence of copper wire or fiber optic traffic signal interconnect infrastructure. There are three traffic signals along 4th Street adjacent to the Amazon development that have ethernet-compatible wireless radios connected to McCain 2070E controllers through a Cisco IE2000 switch. Field observations confirmed the wireless radios are operational and the intersections are communicating with one another. Wireless radio locations are summarized in **Table 2-2**. Specific wireless needs are identified and numbered following Table 2-2 and Sections 4 and 5 provide recommendations.

Table 2-2: Wireless Radio Locations

ID #	Intersection	Wireless Radio Type
9	4th St & Prime Dr	Single Wireless Radio
31	4th St & Distribution Wy	Dual Wireless Radio
10	4th St & Veile Ave	Single Wireless Radio

An assessment of the wireless radio network identified the following needs:

- N5. There is no communications link between traffic signals communicating on the wireless radio network and a CMS.

2.4 Field Elements

The field elements include the various traffic signal subsystems located at the intersection that provide local operation. These include field detection elements, and control and auxiliary elements housed in the cabinet. Specific field element needs are identified and numbered, and Section 5 provides recommendations.

2.4.1 Traffic Signal Cabinets, Controllers, and Programs

Traffic signal cabinets are type 332L, which is the current City traffic signal cabinet standard for new construction.

Traffic signal controllers are McCain type 170 and 2070, Siemens type 2070, Naztec Series 970, PSI type 170, and Safetran type 170. The most common controller in Beaumont is type 170, and the type 2070 advanced traffic controller (ATC) is the current City standard for new construction.

Traffic signals run 200SA, 2033RV, 233 RV2, 233 RV3, and BiTran200 programs. The most common programs are 2033RV and 200SA, and the 2033RV is the current City standard for new construction.

An assessment of the traffic signal cabinets, controllers, and programs identified the following needs:

- N6. Type 332 traffic signal cabinets are an aging technology and do not natively support the current Advanced Traffic Control standards.
- N7. Type 170 controllers are outdated, no longer supported by manufacturers, or functionality capable of performing advanced traffic operations.
- N8. Traffic signal programs are outdated and not compatible with advanced traffic signal operations.
- N9. The controllers and programs are not compatible with modern communication protocols and do not connect to a CMS.

2.4.2 Conflict Monitor Units

Conflict monitor units (CMUs) in the City include EDI 210, 2010, 2010ECL and IDC 210. The most common CMUs are EDI 2010 and EDI 2010ECL.

An assessment of the conflict monitor units identified the following needs:

- N10. 210 CMUs are outdated, no longer supported by manufacturers, and are not capable of modern Ethernet communications.

N11. EDI 2010 CMUs are supported by the manufacturer but are not capable of modern Ethernet communications.

N12. Ethernet-compatible CMUs are needed to enable remote monitoring, access, and logging capabilities.

2.4.3 Vehicle Detection

Vehicle detection throughout the City is primarily loop detection. Highland Springs Avenue has six traffic signals that utilize ethernet-compatible video detection. Video detection locations are summarized in **Table 2-3**.

Table 2-3: Video Detection Locations

ID #	Intersection	Video Detection Type
21	Highland Springs Ave & First St/Sun Lake Blvd	Iteris Vantage Edge2
27	Highland Springs Ave & Eighth St/Wilson St	Iteris EdgeConnect
28	Highland Springs Ave & Starlight Ave/Atwell Dr	Iteris EdgeConnect
29	Highland Springs Ave & Sundance Dr	Iteris EdgeConnect
30	Highland Springs Ave & Oak Valley Pkwy/Meadowline Wy	Iteris EdgeConnect
35	Highland Springs Ave & Patriot Wy	Iteris EdgeConnect

An assessment of existing vehicle detection identified the following needs:

N13. The ethernet-compatible video detection systems are not connected to a communications network to enable remote monitoring and access of real-time video feeds and logging capabilities.

N14. The City has traditional vehicle detection that is sufficient for standard traffic signal operations but not capable of advanced traffic signal operation, data, analytics, performance, and other functions

2.4.4 Pedestrian detection

Pedestrian detection throughout Beaumont consists of bulldog push button assemblies, except for the intersection of Beaumont Avenue/ Cougar Way which has an ethernet-compatible Polara Accessible Pedestrian Signal (APS) system.

An assessment of pedestrian detection identified the following needs:

N15. The APS push button system is not connected to a communications network to enable remote monitoring, access, logging, and reporting.

N16. Current Americans with Disabilities Act (ADA) and Public Right-of-Way Accessibility Guidelines (PROWAG) standards require pedestrian signals communicate information in non-visual formats to provide accessibility to pedestrians with blindness or low vision. This typically includes audible tones, messages, and vibrotactile indications.

2.4.5 CCTV and ALPR Cameras

The Beaumont Police Department operates fixed closed-circuit television (CCTV) and automated license plate reader (ALPR) cameras that are mounted to traffic signal poles throughout the City. The CCTV cameras have radio antennas. The ALPR cameras are solar powered and utilize a cellular network. None of the CCTV or ALPR cameras are connected to the traffic signal network or are accessible by Public Works staff. CCTV and ALPR camera locations are summarized in **Table 2-4**.

Table 2-4: Camera Locations

ID #	Intersection	Camera Type
5	Beaumont Ave & Oak Valley Pkwy	ALPR
15	Beaumont Ave & 6th St	ALPR
16	6th St & Palm Ave	ALPR & CCTV
17	6th St & Pennsylvania Ave	CCTV

An assessment of CCTV and ALPR cameras identified the following needs:

N17. Lack of video-based monitoring of traffic signals in real-time for Public Works Department staff.

2.4.6 Emergency Vehicle Preemption

Emergency Vehicle Preemption (EVPE) systems throughout the City include Opticom 3M 262, 462, 464, 751, 752, and 764. EVPE emitters throughout the City utilize infrared (IR) technology. All the traffic signals in the City have EVPE systems except the intersection of Highland Springs Avenue/ 6th Street/ Ramsey Street. There are eight signals in the City that have Opticom 764 discriminator cards with Ethernet ports. The locations are summarized in **Table 2-5**.

Table 2-5: Ethernet-Compatible EVPE Locations

ID #	Intersection	EVPE Type
9	4th St & Prime Dr	Opticom 764
10	4th St & Veile Ave	Opticom 764
27	Highland Springs Ave & 8th St/Wilson St	Opticom 764
28	Highland Springs Ave & Starlight Ave/Atwell Dr	Opticom 764

ID #	Intersection	EVPE Type
29	Highland Springs Ave & Sundance Dr	Opticom 764
30	Highland Springs Ave & Oak Valley Pkwy/ Meadowline Wy	Opticom 764
31	4th St & Distribution Wy	Opticom 764
35	Highland Springs Ave & Patriot Wy	Opticom 764

An assessment of emergency vehicle preemption identified the following needs:

N18. All EVP systems except Opticom 764 are not ethernet-compatible.

N19. The existing EVP systems are limited to line-of-sight functionality.

2.4.7 Battery Backup Systems

Battery Backup Systems (BBS) are deployed at 21 traffic signals throughout the City and include Alpha, Dimensions, Marathon, and Myers. The most common BBS models are Dimensions ADI-24M11 and Myers MP 2000E. Most BBS systems are housed in separate cabinets that are piggybacked on the outside of the traffic signal cabinet, except for four intersections that have swing-out battery shelves within the traffic signal cabinet. There are nine intersections that have piggyback BBS cabinets but do not have BBS systems. Field observations identified nine intersections with Alpha FXM 1000, Myers MP2000E, and Marathon (TRTC-2004-N2) BBS systems that are functional and have communications compatibility. There were 12 intersections that were not functional due to outdated equipment that is unsupported by the manufacturer, inactivity, or missing BBS batteries and/or inverters. There are four intersections in the City that do not have BBS. **Table 2-6** provides a summary of BBS locations.

Table 2-6: BBS Locations

ID	Location	BBS (Y/N)	BBS Type	BBS Cabinet	Working/ Functional (Y/N)	Notes	Comm Capability Yes/No
4	Beaumont Ave & Cougar Wy	N	NA	NA	NA	No BBS	NA
5	Beaumont Ave & Oak Valley Pkwy	N	NA	NA	NA	No BBS	NA
6	Oak Valley Pkwy & Oka View Dr	Y	Dimensions (ADI-24Y11)	Swing-Out Battery Shelves in Cabinet	N	No Batteries	N
7	Oak Valley Pkwy & Oak Valley Plaza	Y	NA	Piggyback	N	BBS Batteries, No Inverter	N
8	Oak Valley Pkwy & Golf Club Dr	Y	Dimensions (ADI-24J11)	Piggyback	N	Not Active	N
9	Fourth St & Prime Dr	Y	Alpha (FXM 1100)	Piggyback	Y	-	Y
10	Fourth St & Veile Ave	Y	Alpha (FXM 1100)	Piggyback	Y	-	Y

ID	Location	BBS (Y/N)	BBS Type	BBS Cabinet	Working/ Functional (Y/N)	Notes	Comm Capability Yes/No
14	California Ave & Sixth St	Y	Dimensions (24M11-WBE)	Piggyback	N	Not Active	Y
15	Beaumont Ave & Sixth St	Y	Dimensions (ADI-24Y11)	Swing-Out Battery Shelves in Cabinet	N	Not Active	N
16	Sixth St & Palm Ave	N	NA	NA	NA	No BBS	NA
17	Sixth St & Pennsylvania Ave	Y	Marathon (TRTC-2004-N1)	Piggyback	Y	-	Y
18	First St & Commerce Wy	Y	Dimensions (ADI-24Y11)	Piggyback	N	No Batteries	N
19	Second St & Commerce Wy	Y	Dimensions (ADI-24M11)	Piggyback	N	Not Active	N
20	First St & Emroy Ave	Y	Alpha (FXM 1100)	Piggyback	Y	-	Y
21	Highland Springs Ave & First St/Sun Lake Blvd	Y	Dimensions (ADI-24Y11)	Piggyback	N	Not Active	N
22	Second St & Paseo Beaumont	Y	Dimensions (ADI-24Y11)	Swing-Out Battery Shelves in Cabinet	N	Not Active	N
23	Highland Springs Ave & Second St/Sun Lake Village Dr	Y	Dimensions (ADI-24Y11)	Swing-Out Battery Shelves in Cabinet	N	Not Active	N
26	Highland Springs Ave & Sixth St/Ramsey St	N	NA	NA	NA	No BBS	NA
27	Highland Springs Ave & Eighth St/Wilson St	Y	Myers	Piggyback	N	No Batteries	N
28	Highland Springs Ave & Starlight Ave/Atwell Dr	Y	Myers (MP 2000E)	Piggyback	Y	-	Y
29	Highland Springs Ave & Sundance Dr	Y	Myers (MP 2000E)	Piggyback	Y	-	Y
30	Highland Springs Ave & Oak Valley Pkwy/Meadowline Wy	Y	Myers	Piggyback	N	Not Active	N
31	Fourth St & Distribution Wy	Y	Alpha (FXM 1100)	Piggyback	Y	-	Y
34	First St & Pennsylvania Ave	Y	Marathon (TRTC-2004-N1)	Piggyback	Y	-	Y
35	Highland Springs Ave & Patriot Wy	Y	Myers (MP 2000E)	Piggyback	Y	-	Y

An assessment of battery backup systems identified the following needs:

- N20. There is no connection between compatible BBS to the communications network to enable remote monitoring, logging, and reporting.
- N21. Missing BBS batteries and inverters.
- N22. Outdated BBS systems that are no longer supported by the manufacturer or lack communications compatibility.
- N23. Several intersections do not have BBS systems.

2.4.8 GPS Time Source

McCain Global Positioning System (GPS) time source units are located at four signals in the City and are summarized in **Table 2-7**.

Table 2-7: GPS Time Source Locations

ID #	Intersection	Time Source Type
14	California Ave & Sixth St	McCain GPS
21	Highland Springs Ave & First St/Sun Lake Blvd	McCain GPS
23	Highland Springs Ave & Second St/Sun Lake Village Dr	McCain GPS
26	Highland Springs Ave & Sixth St/Ramsey St	McCain GPS

An assessment of GPS Time Sources identified the following needs:

- N24. The GPS time sources are obsolete given modern ATC controller platforms and communications systems.

2.5 Central Management System

The City does not currently have a Central Management System (CMS) for the traffic signal network and is unable to remotely manage and control the traffic signal network. A CMS requires a working communication network to function. Sections 4 and 5 provide CMS recommendations.

An assessment of central management system and citywide communications for the Beaumont traffic signal network identified the following needs:

- N25. City staff require the ability to remotely view, control, and manage the traffic signal system and the various sub-system elements previously discussed.
- N26. CMS that is capable of monitoring, controlling, and managing existing traffic signal systems and implementing advanced traffic signal operations.

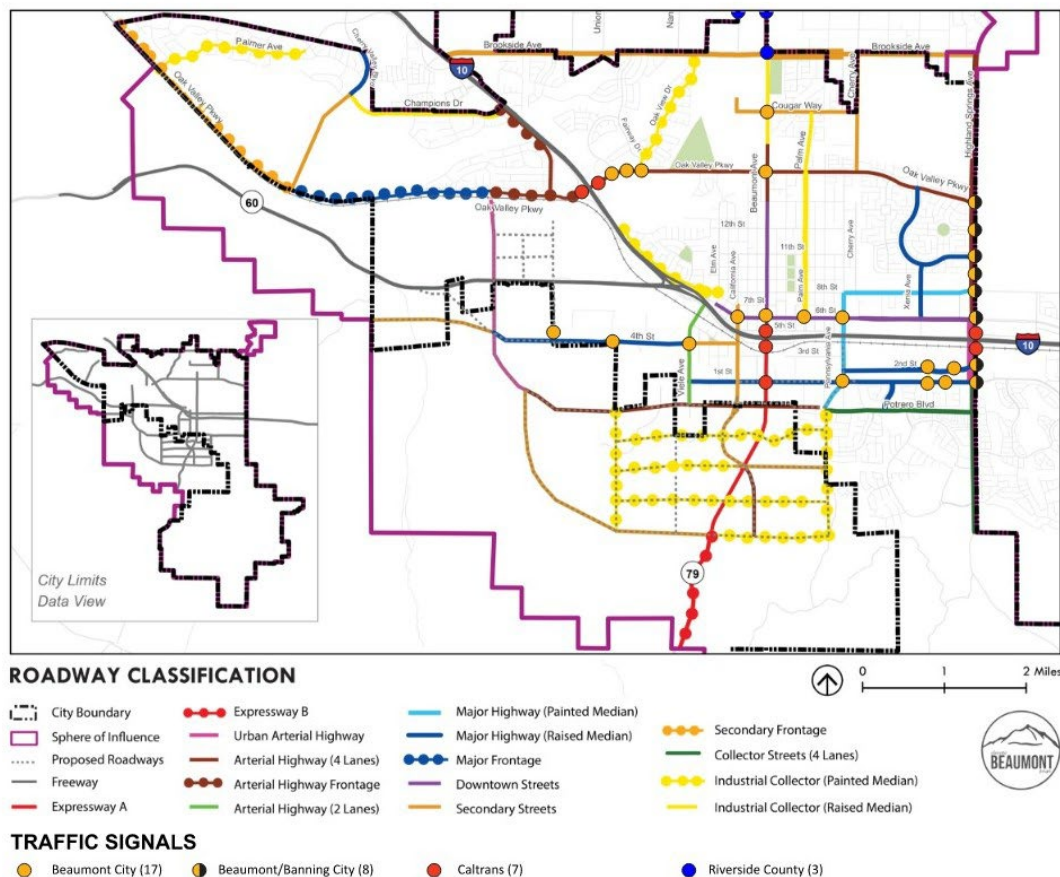
Figure 2-2 provides a map of the existing conditions topology for the City's traffic signal system. **Figure 2-3** illustrates the existing conditions system architecture for the City's traffic signal system. **Appendix A** includes an inventory of traffic signal equipment based on field observations.

2.6 City Street and Traffic Signal Operations

Beaumont's street system is defined by the Interstate 10 (I-10) Freeway. Access to the I-10 is provided at four interchange locations in the City (from west to east): Oak Valley Parkway, 6th Street, Beaumont Ave, Pennsylvania Ave, Highland Springs Ave. The interchanges are typically tight diamonds paralleled by frontage roads. These are closely spaced ramp signals with closely spaced City signals adjacent.

The interchanges provide motorists with access to and from the City to the greater Riverside County region and beyond. In the immediate vicinity of the interchanges are commercial and industrial destinations that transition to residential areas a block or two, and further away. Prevailing peak period traffic flows toward the freeway in the morning and back into the City in the evening. Adjacent to and between peak periods local traffic accesses schools and shopping centers. **Figure 2-1** shows the City's Roadway Classification overlaid with traffic signal locations.

Figure 2-1: Roadway Classifications and Traffic Signals Map



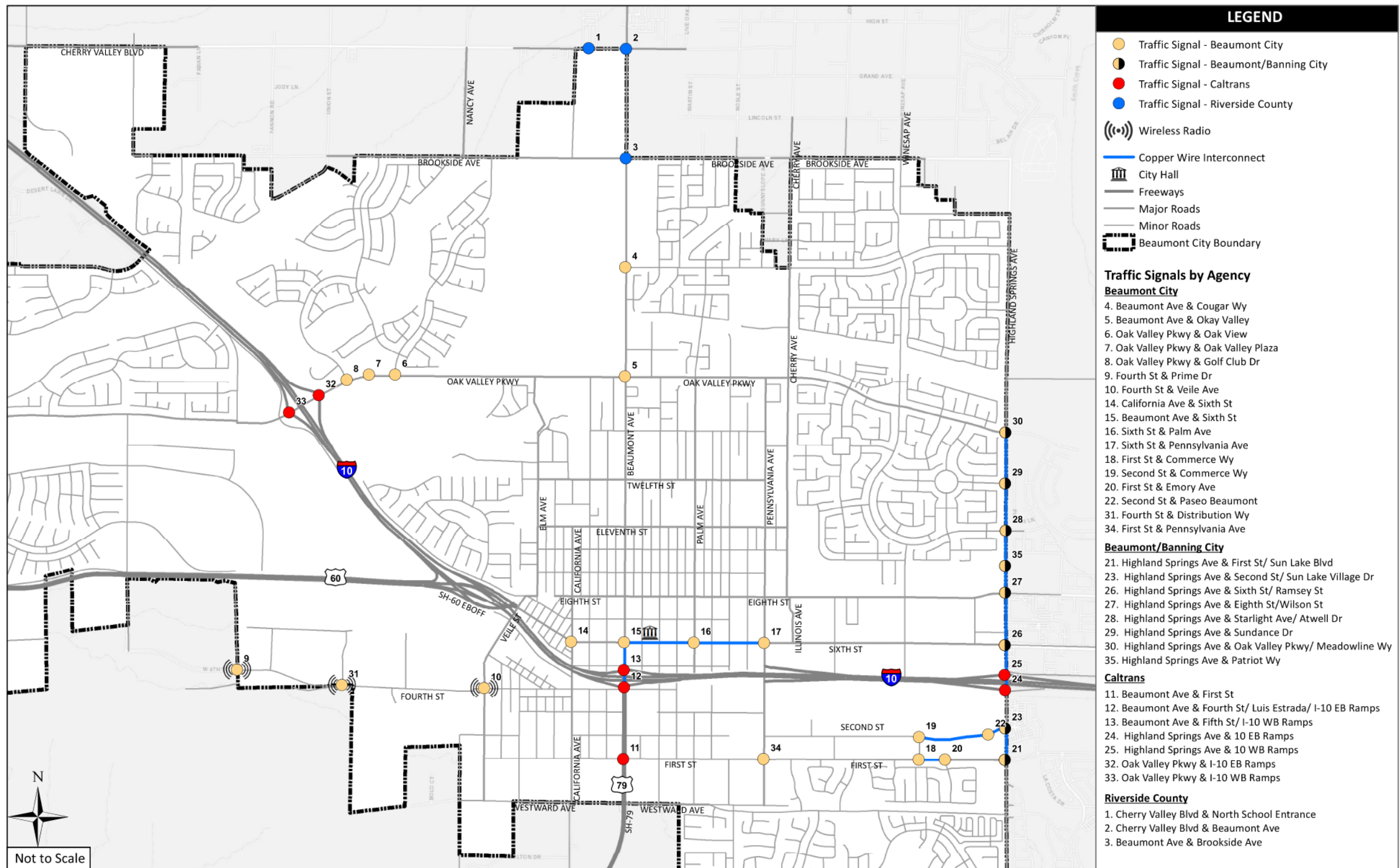
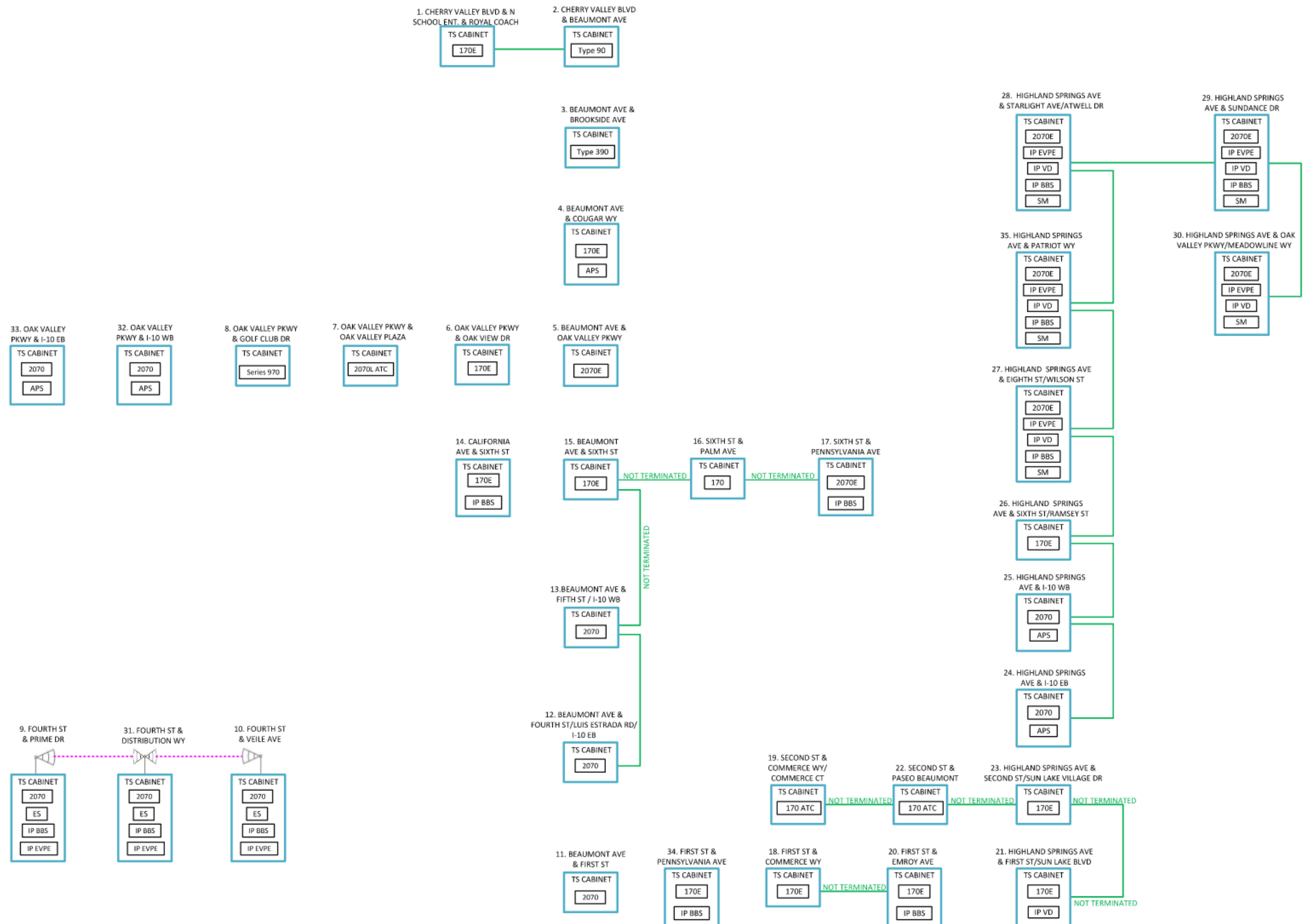
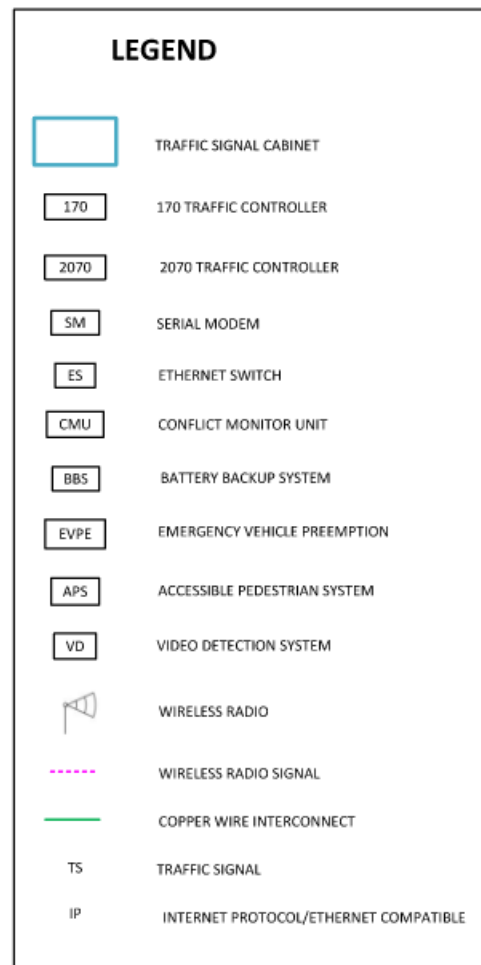


Figure 2-2: Traffic Signal System Existing Conditions Topology Map



High traffic demands and proximity of traffic signals along the freeway access corridors necessitate advanced traffic management and operations techniques that rely on smart traffic signal technology. This becomes increasingly critical as Beaumont continues to develop and grow.

Of the 35 traffic signals in the City: seven are located directly at Caltrans ramp intersections and 17 are located within one-half mile of the ramps. These signals should run in coordination to reduce stops and delays. STC reviewed the City traffic signal timing sheets in the field and received the County and Caltrans traffic signal timing sheets by request. **Table 2-8** shows whether coordination timing is present (intended) and active on the timing sheet.

Table 2-8: Traffic Signal Coordination Status

ID #	Intersection	Coordination Timing (Y/N)	Coordination Timing Days	Cycle Length (sec)	TOD Schedule
7	Oak Valley Pkwy & Oak Valley Plaza	Y	Y (MTWTF)	P1: 100	P1: 7:00-18:00
8	Oak Valley Pkwy & Golf Club Dr	Y	Y (MTWTF)	P1: 100	P1: 7:00-18:00
21	Highland Springs Ave & 1st St / Sun Lakes Blvd	Y	Y (MTWTF)	P1: 100 P2: 100 P3: 110	P2: 6:30-11:00 P1: 11:00-14:30 P3: 14:30-19:00 P1: 19:00-22:00
		Y	Y (SS)	P1: 100	P1: 7:00-22:00
23	Highland Springs Ave & 2nd St/ Sun Lake Village Dr	Y	Y (MTWTF)	P1: 100 P2: 100 P3: 110	P2: 6:30-11:00 P1: 11:00-14:30 P3: 14:30-19:00 P1: 19:00-22:00
			Y (SS)	P1: 100	P1: 7:00-22:00
24	Highland Springs Ave & I-10 EB Ramps	Y	Y (MTWTF)	P1: 100 P2: 100 P3: 110	P2: 6:30-11:00 P1: 11:00-14:30 P3: 14:30-19:00 P1: 19:00-22:00
25	Highland Springs Ave & I-10 WB Ramps	Y	Y (MTWTF)	P1: 100 P2: 100 P3: 110	P2: 6:30-11:00 P1: 11:00-14:30 P3: 14:30-19:00 P1: 19:00-22:00
26	Highland Springs Ave & 6th St/ Ramsey St	Y	Y (MTWTF)	P1: 100 P2: 100 P3: 110	P2: 6:30-11:00 P1: 11:00-14:30 P3: 14:30-19:00 P1: 19:00-22:00
			Y (SS)	P1: 100	P1: 7:00-22:00

ID #	Intersection	Coordination Timing (Y/N)	Coordination Timing Days	Cycle Length (sec)	TOD Schedule
27	Highland Springs Ave & 8th St / Wilson St	Y	Y (MTWTF)	P1: 100 P2: 100 P3: 110	P2: 6:30-11:00 P1: 11:00-14:30 P3: 14:30-19:00 P1: 19:00-22:00
			Y (SS)	P1: 100	P1: 7:00-22:00
28	Highland Springs Ave & Starlight Ave / Atwell Dr	Y	Y (MTWTF)	P1: 120 P2: 110	P1: 6:00-9:00 P2: 15:00-18:00
29	Highland Springs Ave & Sundance Dr	Y	Y (MTWTF)	P1: 120 P2: 110	P1: 6:00-9:00 P2: 15:00-18:00
30	Highland Springs Ave & Oak Valley Pkwy / Meadowline Wy	Y	Y (MTWTF)	P1: 120 P2: 110	P1: 6:00-9:00 P2: 15:00-18:00
35	Highland Springs Ave & Patriot Wy	Y	Y (MTWTF)	P1: 120 P2: 110	P1: 6:00-9:00 P2: 15:00-18:00

Table 2-8 indicates that there are two coordinated corridors within the City, Oak Valley Parkway and Highland Springs Avenue.

- The Oak Valley sub-system consists of two signals coordinated together Monday through Friday from 7:00 AM to 6:00 PM on a single 100 second cycle length.
- The Highland Springs Avenue sub-system comprises eight City signals and two Caltrans signals and is divided into two coordinated groups.
 - The south group includes the Caltrans ramp signals and two City signals on each side of the ramps for a total of six signals. These six signals are coordinated together Monday through Friday from 6:30 AM to 11:00 PM, using three different timing plans for different periods of the day. On Saturday and Sunday, the four City signals are coordinated, but the ramp signals, which are in the middle of the four City signals, are not, resulting in a break in coordination.
 - The north group comprises four City signals coordinated together Monday through Friday from 6:00 AM to 9:00 AM and from 3:00 PM to 6:00 PM using two different timing plans.
 - Between 3:00 PM and 6:00 PM, the cycle length of the north and south groups match-up at 110 seconds, resulting in a continuous coordinated system of ten signals for those three hours.

Due to the lack of communication between signals, coordination is based on each controller's internal clock. Type 170 controllers are susceptible to clock drift, which is when a clock moves (drifts) away from actual time. Controller clocks will drift at different rates and in different directions. Depending on the rate of drift the coordination timing may become ineffective, or even adverse to good traffic flow and progression, within a few days or weeks.

An assessment of traffic signal coordination identified the following needs:

- N27. The Oak Valley subsystem should include more signals and plans based on signal spacing.
- N28. The Highland Springs Ave subsystem south group should have plan continuity on the weekend.
- N29. Other corridors within the City that should be considered for coordinated operation include Beaumont Avenue, First Street, and Sixth Street.
- N30. A CMS and signal communication system is needed to automatically update local controller clocks and eliminate the problem of clock drift.

2.7 Roadway Safety

The California Office of Traffic Safety (OTS) maintains a ranking system to compare traffic safety statistics among similarly sized California cities. Citywide rankings are based on population, daily vehicle miles traveled (DVMT), crash records, and crash trends from data collected by SWITRS, Caltrans, the California Department of Justice, and the Department of Finance. A ranking of one (1) in a category indicates the lowest possible traffic safety performance in relation to other similar sized cities. A comparison of California OTS rankings allows cities to identify local trends relative to their peers.

The City of Beaumont is in “Group C” which consists of cities with populations between 50,001 and 100,000 people. **Table 2-9** summarizes how Beaumont compares to other Group C peer cities from 2019 to 2022. Due to fluctuations in populations, Beaumont was one of 105 Group C cities in 2019 and 2021, one of 106 Group C cities in 2020, and one of 104 Group D cities in 2022.

Table 2-9: City of Beaumont OTS Crash Rankings (2019-2022)

OTS Category	2019 OTS Ranking (1 = Lowest)	2020 OTS Ranking (1 = Lowest)	2021 OTS Ranking (1 = Lowest)	2022 OTS Ranking (1 = Lowest)
Total Fatal and Injury	37/105	55/106	73/105	45/104
Alcohol Involved	34/105	74/106	80/105	70/104
Had Been Drinking Driver < 21	9/105	48/106	56/105	73/104
Had Been Drinking Driver 21 – 34	30/105	86/106	78/105	64/104
Motorcycles	22/105	89/106	43/105	44*/104
Pedestrians	72/105	64/106	98/105	90/104
Pedestrians < 15	76/105	78/106	86/105	24/104
Pedestrians 65+	46/105	93/106	92/105	78/104
Bicyclists	75/105	92/106	94/105	60/104

OTS Category	2019 OTS Ranking (1 = Lowest)	2020 OTS Ranking (1 = Lowest)	2021 OTS Ranking (1 = Lowest)	2022 OTS Ranking (1 = Lowest)
Bicyclists < 15	85/105	83/106	85/105	49/104
Composite	24/105	77/106	81/105	69/104
Speed Related	32/105	61/106	59/105	56/104
Nighttime (9:00pm – 2:59am)	42/105	102/106	85/105	44*/104
Hit and Run	52/105	61/106	80/105	64/104
DUI Arrests	10/105	23/106	26/105	33/104

Bold = Top 3 Lowest Crash Ranking OTS Categories

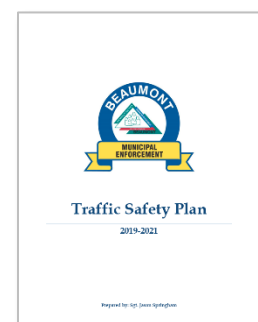
* Tied for being in the Top 3 Lowest Crash Ranking OTS Categories

An assessment of the OTS Crash Rankings identified the following:

- Top three lowest 2019 OTS rankings for Beaumont were: had been drinking driver under 21, driving under the influence (DUI) arrests, and motorcycles.
- Top three lowest 2020 OTS rankings for Beaumont were: DUI arrests, had been drinking driver under 21, and total fatal and injury.
- Top three lowest 2021 OTS rankings for Beaumont were: DUI arrests, motorcycles, and had been drinking driver under 21.
- Top three lowest 2022 OTS rankings for Beaumont were: pedestrians under 15, DUI arrests, and a tie between motorcycles and nighttime (9:00 PM to 2:59 AM)
- DUI arrests were in the top three lowest OTS rankings for Beaumont from 2019-2022.
- Had been drinking driver under 21, and motorcycles were in the top three lowest OTS rankings in Beaumont in three of the four analysis years.
- CA OTS utilizes the “Composite” category as a compilation based on multiple crash ranking factors. Beaumont has experienced improvement since 2019 and has higher rankings than over half of comparable Group C peer cities.

Appendix B includes City of Beaumont California Office of Traffic Safety (OTS) Crash Rankings from 2019 to 2022.

The Beaumont Police Department’s 2019-2021 Municipal Enforcement Traffic Safety Plan (TSP) was developed to improve traffic enforcement based on a data-driven analysis of collisions, injuries, and overall street safety. The TSP analyzed collision and traffic violation statistics from 2017 and 2018 and solicited feedback from peace officers on locations of interest and patrol focus areas. Key TSP findings include:



- Top traffic violations included excess speeding, seatbelts, and distracted driving.

- Top locations of interest are school zones that experience high vehicle congestion and pedestrian volumes and major thoroughfares that experience numerous intersections, high speeds, pedestrians, and school zones.
- Top patrol focus areas are school zones during student arrival and departure times, peak periods during morning and evening commute traffic; weekend and evening patrols of residential and commercial areas; and intersections with high collision incidence.

The TSP Priorities Plan to improve roadway safety throughout Beaumont includes:

WINTER (Dec-Feb)	SPRING (Mar-May)
School Zones Traffic Patrol Abandoned Vehicles Parking Patrol	School Zones Traffic Patrol Parking Patrol
SUMMER (Jun-Aug)	FALL (Sep-Nov)
Traffic Patrol Commercial Vehicles Parking Patrol	School Zones Traffic Patrol Parking Patrol

An assessment of Beaumont roadway safety identified the following needs:

- N31. The Federal Highway Administration (FHWA) Crash Modification Factor (CMF) Clearing House indicates that “Improve signal timing (coordination, phases, red, yellow, or operation)” is a countermeasure that can be used at signalized intersection to reduce collisions by a factor of 15%.
- N32. 2019-2022 OTS crash rankings analysis found that the lowest roadway safety categories in Beaumont involved driving under the influence (DUI), motorcycles, pedestrians under 15, and nighttime collisions.
- N33. The legacy traffic signal management system does not support advanced operations that would enable the City to move from a reactive approach to a proactive approach to roadway safety.

Recommendations to address the crash incidence are provided in Sections 5.

3 Smart Traffic Signal System Technology Evaluation

This chapter provides a review of traffic signal technology including the latest industry advancements and offerings with a focus on how these innovations can support the City in developing a smart and adaptive traffic network. The City is effectively starting with a clean slate in terms of advanced technology. The current traffic signal equipment is sufficient for basic traffic signal operations but is inadequate for advanced traffic management including the ability to monitor, control, and manage traffic in real-time for more responsive, efficient, and sustainable traffic signal operations.

The approach to the smart technology review is to start with the core field control systems, working up the traffic system “stack” from controllers and traditional local detection to “AI” detection and advanced control and management platforms. The basic technical functionality and features of the systems are described followed by “suitability” factors that align with the City’s smart traffic signal system needs. Specific vendor systems are identified to provide examples of industry offerings. This is a sampling of some of the commonly encountered systems in Southern California and not meant to be an exhaustive review of all vendors in this space.

In addition to presenting specific traffic signal systems technology, this section provides recommendations for technologies, standards, and in some instances specific vendor systems. The context and rationale are established by highlighting needs, opportunities, and system characteristics. Specific recommendations are made in this section to provide a solid foundation for the later recommendations in Section 5.

3.1 Controllers

To support advanced traffic signal operations, the City should transition to an Advanced Transportation Controller (ATC)-based system. ATC standards offer an open architecture that can support a wide range of intelligent transportation system (ITS) applications, including traffic management, safety, security, and more. Half of the traffic signal controllers in the City are ATC-based 2070 models. The Type-170 and other legacy controllers that comprise the other half of the controllers

currently installed in the City are no longer supported and are incompatible with adaptive systems, vehicle tracking, performance measurement, machine learning, and centralized management. Upgrading to ATC-based controllers will ensure integration with modern traffic technologies. To ensure compatibility with Caltrans, the City should adhere to the latest Transportation Electrical Equipment Specifications (TEES). Several manufacturers offer controllers that meet or exceed Caltrans’ standards such as the ATC 2070LX model.



Figure 3-1: Example of ATC 2070LX Controller

Source: Swarco McCain

3.2 Cabinets

ATC Cabinets provide enhanced control and efficiency with modular designs, making them ideal for smart city infrastructure and innovative traffic management. These cabinets, designed in compliance with the ITE/ NEMA/ AASHTO ATC standards, meet Caltrans TEES requirements, and offer several advantages over traditional cabinet designs, including greater modularity, compact size, improved safety for both motorists and technicians, LED compatibility, and advanced diagnostic features. They are compatible with advanced traffic operations and can be easily installed on existing 332 cabinet foundations. Smart traffic technology developers are building their applications to integrate with ATC standards. By adopting ATC cabinets as the City's standard for both new projects and upgrades to existing intersections, the City's controller and cabinet platforms will be consistent and compatible with new and future technological advancements.



Figure 3-2: Example of 352i ATC Cabinet

Source: Swarco McCain

3.3 Detection

3.3.1 Traditional Detection Systems

Traditionally, traffic detection systems were designed to identify the presence of vehicles on lanes at signalized intersections, providing data to traffic signal controllers to manage operations. These systems focus solely on identifying the presence of vehicles and bicycles for the specific intersection. Common traditional detection technologies, such as inductive traffic loops and standard video detection, offer this basic functionality. However, these solutions do not provide the depth of data required for advanced system operation. As the City moves toward smart technology solutions, more sophisticated detection methods are necessary to provide high performance traffic signal operations and management.

3.3.2 AI Integrated Detection Systems

With advancements in technology, AI has become a critical component in traffic management systems. Detection systems now incorporate machine learning and AI, enabling them to collect a

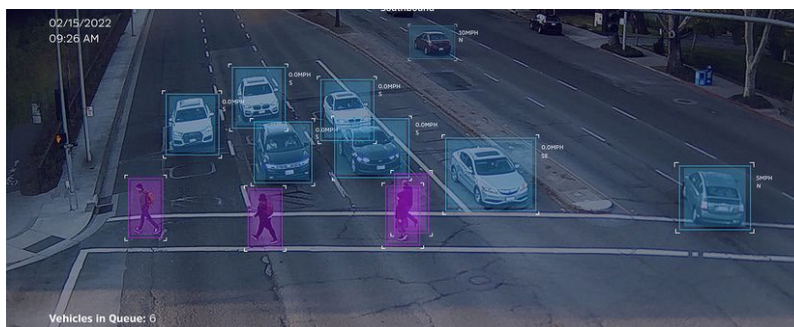


Figure 3-3: Example of AI Detection System

Source: NoTraffic

wide array of data on traffic flow, including vehicle counts, speeds, and presence. This data helps optimize signal timings, alleviate congestion, improve road safety, and provide real-time information to drivers. These systems go beyond basic detection by analyzing vehicle movement and flow, offering a more comprehensive approach to

traffic management. Several vendors provide these advanced solutions, integrating video and

radar detection with AI and machine learning capabilities. These systems offer similar features, which include enhanced traffic flow analysis, predictive analytics, and optimized signal control to improve overall traffic operations. **Table 3-1** below highlights the similar features that these detection systems provide.

Table 3-1: AI Integrated Detection System Common Features

Detection Features	Description
Pedestrian Actuation	Detects curbside pedestrians and sends calls to controllers, which can eliminate the need for pedestrian buttons.
Pedestrian Protection Zone Capability	Detects pedestrians in the crosswalk and extends crossing times, enhancing safety for vulnerable road users.
Dilemma Zone Capability	Detects a driver's trajectory and extends the green time to reduce sudden stops and red-light running risks.
Turning Movement Counts	Continuous count of vehicles, pedestrians, bicycles.
Vehicle Classification	Detects and classifies vehicles like cars, light and heavy trucks, buses, bicycles, and pedestrians.
Signal Performance Measures	Occupancy ratios
	Arrivals on red, arrivals on green, and phase intervals.
	Travel Time Information.
Safety Analytics	Identify high-risk intersections based on analytics from: - Near-Miss Insights. - Red-light running. - Pedestrian Compliance data
Intersection Monitoring	Automatically detects and reports issues, enabling proactive management of the City's traffic signal network.

3.4 Adaptive Signal Control Technology

Adaptive signal control technology (ASCT) dynamically adjusts traffic signal timing in real-time based on actual traffic demand, providing a higher degree of responsiveness to optimize flow in comparison to fixed-time-of-day (TOD) systems.

Traditional TOD signal timing plans are based on a snapshot of traffic volumes typically collected over a representative period and designed to match peak and off-peak traffic conditions. TOD timing plans are best fit to accommodate predictable traffic patterns during peak periods and do not accommodate wide fluctuations in traffic demand that could occur occasionally or due to unique events. With ASCT, traffic volumes are collected, and signal timing is updated continually which typically results in more efficient signal operation over traditional TOD plans. ASCT's greatest advantage over TOD is during the off-peak periods and transition to peak periods when intersections run with lower demands, demand variation, and a greater degree of capacity for adjustment. The City's future traffic signal control system should be capable of both traditional TOD and adaptive operations.

ASCT may be fully integrated with a Central Management System (centralized) or may be implemented as a stand-alone application (decentralized).

- **Centralized ASCT** – Fully integrated CMS application which runs on a dedicated server and compiles and analyzes data and sends commands to local controllers. The ASCT is typically a modular component part of the wider CMS application. Historically these were the dominant and only ASCT system types due to database and processing requirements.
- **Decentralized ASCT** – A stand-alone application on local controllers or as a hardware overlay in the traffic signal cabinet. The data and analysis occur at the local level for an individual intersection and groups of intersections. Typically requires an AI detection system for optimal performance. These have become more prevalent over the past 10 years with advancements in edge computing and Graphical Processing Units (GPU's).

Given the proprietary nature of adaptive systems, careful consideration should be given to whether coordinated operations across agency boundaries can be achieved. This is especially important in the City of Beaumont given the proximity of City signals to Caltrans-owned signals on I-10.

Table 3-2: Adaptive Signal Control Technology Common Features

ASCT Features	Description
Controller hardware and software	Adaptive system runs only on manufacturer's controller or controller software, or runs as an add-on application on any controller platform
Automated plan generation and implementation	Adaptive system uses real time data to generate new timing plans across the network and downloads into the controllers
Second by second control	Determines phase duration, offset adjustments, and cycle length changes on a second-by-second basis.
Signal grouping (sub networks)	Adaptive systems can change coordination sub-networks based on traffic flow, either adding, dropping, or merging signal groups.
Detection requirements	Typically requires AI detection and may need a combination of advance detection, limit line detection, queue detection, or downstream detection.

3.4.1 Peer-to-Peer Communication

Peer-to-peer (P2P) communication allows traffic signal controllers to communicate directly with each other in real time to exchange actionable data. An example of this is where at the end of a green phase, a signal is sent from one controller to another controller downstream. The downstream controller can then use that information to terminate its own main street green phase. This communication happens through a high-speed Ethernet network connecting the controllers network adapters. There is no need to connect to a central system. A P2P network can extend through multiple controllers to help smooth traffic flow and reduce stops.

P2P communication is an approach used to facilitate coordination between City and Caltrans controllers if these are not utilizing the same control system and timing strategies other than time-based coordination are implemented.

3.5 Central Management System

The Traffic Signal Central Management System (CMS) is a software platform used to remotely monitor and control traffic signals across a network from a central location. At a minimum, a CMS will offer the following features:

- Database management: traffic controller timing is stored centrally and can be periodically compared with field timing to identify timing changes. Timing databases may be archived when timing is modified to provide a historical record.
- Data Collection: A CMS can collect traffic data from the controller including traffic counts and phase durations. The data can be used to generate system performance measures and provide reports on system operations.
- Coordination and Synchronization: A CMS can coordinate traffic signals across an area and maintain time synchronization across the network to improve traffic flow.

A central system that provides interoperability and support to third party applications is critical to achieve optimal integration of the controller hardware and software, detection system (both traditional and AI), and adaptive system. The City's local controller software is aligned with the Swarco/ McCain MyCity CMS application which is compatible with NTCIP-compliant local control software and integrates with AI detection and ASCT systems. Below is a list of MyCity modules and compatibility.

- Detection Systems – Compatible with any.
- Controller – 2070, NEMA, 170 running NTCIP-compliant local control software.
- Controller Software – OMNI ex (native) and NTCIP compliant.
- Adaptive Signal Control Technology – MyCity Adaptive (native CMS) and various decentralized ASCT applications
- Performance Measures – MyCity SPM
- Coordinated Plan Generation – MyCity TrafficPlanIQ

Consistent with the recommendation to continue utilizing SWARCO McCain's OMNI controller software, the SWARCO McCain MyCity Traffic Management System software suite is recommended as the preferred CMS solution.

3.6 AI Detection and Decentralized ASCT Objectives and Suitability Factors

In selecting the most appropriate Smart Technology solutions for the City of Beaumont, it is important to define clear and achievable objectives tailored to the City's specific needs. These objectives stem from evaluating the current state of the City's systems; envisioning a modern, scalable, and integrated traffic management system; and enabling the City to track, manage, and message performance metrics effectively. The City's Traffic Signal Smart Technology objectives include:

- Implementing advanced technology to achieve a high-performance system, incorporating AI, edge computing, and machine learning systems with various levels of automation.
- Ensuring technology supports essential system functions such as local presence detection, control applications, system health monitoring, database management, and remote management.

- Providing modular flexibility that allows the City to scale implementation over time, depending on resources such as budget, communication infrastructure, and staffing for maintenance and management.
- Delivering immediate and measurable Return on Investment (ROI), particularly through performance metrics like reduced travel times, fewer traffic signal delays, and shorter stops. All while ensuring system uptime.
- Avoiding untested, cutting-edge technologies; instead, opting for solutions with a broad user base, local user base, and proven reliability.
- Provide control options including traditional TOD, ASCT, and P2P for maximum operational flexibility to apply the most appropriate approach to match traffic conditions and to coordinate with adjacent agency systems, especially Caltrans.

The MyCity CMS platform either achieves or supports many of the listed smart technology objectives. However, it does not on its own, provide the functionality associated with AI detection and decentralized ASCT systems. These systems are the focus of this evaluation.

Multiple vendors in the AI and ASCT space offer products that align with the City's objectives. While these products may differ slightly in terms of hardware and software, their features and functionalities are comparable. The recommended systems leverage both AI detection and ASCT functionality in one complete package. These include NoTraffic, Currux, Rhythm/In-Sync, and Miovision.

3.6.1 AI/ ASCT Suitability Factors

Given that the City currently lacks AI detection and ASCT technology (AI/ ASCT), any new deployment, regardless of the vendor, will yield operational benefits. The most important system provision that the City requires from a capability standpoint is automation. The system must be capable of automated traffic signal timing generation and implementation. Signal timing automation is the foremost functional suitability factor for comparison of each of the recommended AI/ ASCT vendor products and is summarized in **Table 3-3**.

Table 3-3: Automation Summary

Factor / Vendor	NoTraffic	Currux	Rhythm/ In-Sync	Miovision
Manual Processes	Initial detection setup	Initial detector setup	System configuration and initial timing plan development	Initial detection setup
Automated Processes	Adjust signal timing based on real-time traffic conditions	Adaptive split/offset/cycle timings are generated and pushed to controller	Fully automated corridor-wide adaptive signal control	Identify timing issues, recommend optimal solution
System Monitoring	24/7 monitoring. Push alerts to agency	Real-time email/text notifications	Remote access capability	24/7 via AI algorithms

Factor / Vendor	NoTraffic	Currux	Rhythm/ In-Sync	Miovision
Operator Monitoring	Available, not required	Available through desktop application	Yes. Periodic check on system health/status	Yes, through performance dashboard

The remaining suitability factors for the City's AI/ ASCT technology are less focused on functionality and more on other key considerations such as cost, product support, ease of maintenance, user base, interoperability with Caltrans, performance reporting, integration with other subsystems, and long-term sustainability. These factors are detailed in the subsequent sections and tables for the recommended vendors.

Costs

The system costs take into consideration initial purchase, installation, ongoing licensing fees, manufacturer support, maintenance, and warranty / future replacement costs. **Table 3-4** below summarizes the cost as available.

Table 3-4: Cost Summary

Factor / Vendor	NoTraffic	Currux	Rhythm/ In-Sync	Miovision
Purchase Cost (per intersection)	\$23K	\$22K	\$60K	\$20K
License Fees	\$2K – \$12K each additional module (every 5 years)	\$2.5K – \$4.5K each additional module	No Additional Fees	\$3.5K – \$8.5 each additional module
On-Going Support Costs	NOC ¹ & MoS ² included for 5 years NOC & MoS every 5 years for \$10K	No Additional Fees	3 years included	Perpetual support is included
Warranty Support & Replacement Costs	Hardware/Software 5-year warranty	Hardware 1-year warranty with extended options Camera Devices 3-year warranty	Hardware 3-year warranty Software 3-year warranty	Hardware/Software 3 to 5-year warranty

¹ NOC – NoTraffic Operations Center

² MOS – Mobility OS Software provides remote access to video streams, detection zones, performance measures, and alerts.

Support

Support includes manufacturer assistance before, during, and after technology implementation, including training and online resources. **Table 3-5** below summarizes the level of support offered by each vendor.

Table 3-5: Vendor Support Summary

Factor / Vendor	NoTraffic	Currux	Rhythm/ In-Sync	Miovision
Support Through Purchase	Through Local Supplier (JTB)	Through Local Supplier (Western Systems)	Through Operations Team	Through Local Supplier (DDL)
Implementation Support	Through Local Supplier (JTB)	Local and Remote Support	Through Operations team	Through Local Supplier (DDL) Miovision as needed
Post-Install Support	Proactive 24/7 monitoring, remote trouble shooting, and support through the NOC (Kansas)	24/7 Service calls available during the life of the hardware (US based)	24/7 phone support Normal business hours (Kansas City) Outside of normal business hours (Bulgaria & India)	Through Local Supplier (DDL) Additional Support via Miovision as needed Remote Support through cloud-based system
Training	Remote Training Available	Remote/ In-Person Training Available	Remote Training Available	Remote Training Available

Performance Reports

This section describes the end user's return on investment (ROI) in terms of report generation. It addresses how easily system reports can be generated, whether they are user-generated, automatically provided by the system, or vendor-generated. The section also explores whether these reports are easily digestible by traffic engineers, management, and city officials, and whether timing optimizations are available at the intersection or corridor levels. **Table 3-6** below provides a summary of the ROI features.

Table 3-6: Return on Investment Information

Factor / Vendor	NoTraffic	Currux	Rhythm/ In-Sync	Miovision
Automated Report Generation	No – Manual Download Only	Yes – Via Email or text	No - Manual Download Only	No - Manual Download Only
Summary Status Report for Non-Engineers	Yes – Available in ATSPM Module	Yes – Can Separate Reporting	Yes – 35 Data Reports and Charts Available	Yes – Manually Available in Platform
System Health Notifications	NOC will notify agency of faulty conditions	System can notify agency of faulty conditions	System can notify agency of faulty conditions	System can notify agency of faulty conditions

Factor / Vendor	NoTraffic	Currux	Rhythm/ In-Sync	Miovision
System Health Report	Available through MoS	Available through Web UI or through vendor support with Western Systems	Available through Support Contract	Available through Device Diagnostics Page
Timing Optimization	Yes Corridor	Yes Intersection and/or Corridor	Yes Intersection and/or Corridor	In Development

Compatibility

This section describes the compatibility of the vendor's system with existing hardware and equipment that may remain in use, such as video detection, radar detection, mounts, and cables, as well as with City infrastructure, including cabinets and controllers. It also addresses compatibility with Caltrans systems, focusing on relevant Caltrans deployments and inclusion on Caltrans' approved material list of best practice roster. **Table 3-7** below provides a summary of these features.

Table 3-7: Compatibility Summary

Factor / Vendor	NoTraffic	Currux	Rhythm/ In-Sync	Miovision
Use of Existing Detection Equipment	None	Existing Cameras & Equipment	None	Can Leverage Existing Loops or Radar for ATSPM
Compatibility with City Infrastructure	Yes – System is Compatibility with all Controllers & Cabinets	Yes – System is Compatibility with all Controllers & Cabinets	Yes – System is Compatibility with all Controllers & Cabinets	Yes – System is Compatibility with all Controllers & Cabinets
Caltrans Implementations	Implemented in D4 & D12	Implemented in D3, D10, D11 & D12	Implemented in D11	Implemented in D4, D6 & D8
Caltrans Approved Material List	Currently Under Review	Currently Under Review	Currently Under Review	Not currently

Userbase

This section reviews the vendor's system in terms of its widespread deployment across the U.S., within California, and specifically in Southern California. It highlights the importance of reputation and track record when selecting solutions that have proven reliability. **Table 3-8** below provides a summary of these components.

Table 3-8: Userbase Summary

Factor / Vendor	NoTraffic	Currux	Rhythm/ In-Sync	Miovision
US Intersections	500+	650+	31 states / 3,000+ Intersections	6,000+
State-wide Deployments	80 Intersections	15-20 Intersections	10+ Systems	250+
Southern CA Deployments	40 Intersections, 10 Agencies	11 Intersections	100+ Intersections	60+
Relevant SoCal Users	Riverside County City of Riverside Moreno Valley Palm Desert City of Redlands San Diego County Carlsbad Santee Oceanside El Cajon Laguna Niguel Aliso Viejo	El Cajon San Diego County Anaheim Fullerton Arcadia Placentia	San Diego	Anaheim Long Beach San Diego Sacramento Napa San Rafael San Ramon San Jose San Joaquin County

Longevity

This section evaluates the longevity of the company and its software, including how long the company has been in operation and the development timeline. It also assesses the future viability of both the company and the technology, ensuring long-term support and compatibility with hardware and software for the next 5 to 10 years. Key considerations include the sustainability of the solution, backward compatibility with older hardware, and the ability to implement future software updates and modules, including emerging technologies like V2X. **Table 3-9** below provides a summary of these considerations.

Table 3-9: System Longevity Summary

Factor / Vendor	NoTraffic	Currux	Rhythm/ In-Sync	Miovision
Total Years Experience	Founded in 2017	Founded in 2018	Founded in 2005	Founded in 2008
Age of AI-Detection Technology	Developed in 2017	Developed in 2018	Developed in 2010	Ongoing development since 2017

Factor / Vendor	NoTraffic	Currux	Rhythm/ In-Sync	Miovision
Backward Compatibility (Future Modules, Software Updates, V2X)	V2X Ready Software Updates Available (5 Years)	Software Updates Made Available for User to Push Out	Software Updates through Support Contract	Software Updates Over the Air (Lifetime of Unit)

Scalability/ Flexibility

This section assesses the scalability of the system, focusing on its ability to expand in terms of the number of traffic signals deployed overtime. It also evaluates the system's modularity, allowing for the deployment of priority functions first and the gradual addition of more features as familiarity and budget increase. **Table 3-10** below provides a summary of the scalability and modularity capabilities of the system.

Table 3-10: Scalability and Flexibility Summary

Factor / Vendor	NoTraffic	Currux	Rhythm/ In-Sync	Miovision
Scalable Deployment	No Limit on Number of Signals	No Limit on Number of Signals	No Limit on Number of Signals	No Limit on Number of Signals
Scalable Functionality	Yes, additional modules/features are available at anytime	Yes, additional modules/features are available at anytime	Integrated system, no additional modules needed	Yes, additional modules/features are available at anytime

3.7 Recommendations and Comparison Summary

This section outlines recommendations based on the analysis from previous sections, the City's current infrastructure needs, and alignment with future goals. Recommendations include:

- Adoption of ATC standards
 - 2070LX controller.
 - OMNI local controller software.
 - ATC cabinet.
- MyCity CMS from Swarco McCain.

These recommendations ensure compatibility with existing systems and provide essential functions and scalability for future growth. The recommendations are aimed at achieving optimal integration across the City's traffic management infrastructure, including controllers, cabinets, and central systems while providing a platform for integration with AI/ ASCT systems.

Table 3-11 below provides a high-level summary of each recommended AI/ ASCT vendor based on the various suitability factors discussed in the previous section. Each vendor is ranked as high, medium, or low based on how their system compares. The City plans to use this list to communicate with vendors and decide which vendor is most appropriate.

Table 3-11: AI/ ASCT System Vendor Summary

Factor / Vendor	NoTraffic	Currux	Rhythm/ In-Sync	Miovision
Automation	High	High	High	Low
Costs	High	Medium	High	Medium
Support	High	Medium	Medium	Medium
Reporting	Medium	Medium	Medium	Low
Compatibility	High	High	High	Low
Defined Userbase	High	Medium	High	High
Longevity	High	Medium	Medium	High
Scalability/ Flexibility	High	High	Low	High

4 Traffic Signal Communications System

This section outlines a staged approach to upgrade the City's traffic signal communications network considering existing infrastructure, modern technology, installation costs, and ease of deployment. Establishing a reliable and robust communications system is foundational for implementing smart traffic signal technologies citywide. Based on the existing conditions review described in Sections 2, Beaumont's current traffic signal communications infrastructure includes copper SIC links connecting 16 signals and wireless radio links between three intersections. However, several critical deficiencies were identified, such as disconnected SIC cables, missing modems and C-2S plugs, outdated technology, and lack of connectivity between traffic signals and a CMS. These issues limit the City's capability to perform real-time monitoring, remote management, and effective coordination of the traffic signal system.

The strategy outlined in this section adopts a three-stage approach. The stage one strategy involves addressing the critical communication deficiencies by rapidly establishing modern IP based connectivity to all signalized intersections. Stage one also includes upgrading existing traffic signal controllers and implementing the MyCity CMS application on the cloud. This immediate improvement will deliver significant operational benefits to the City, including enhanced signal coordination, improved system reliability, and the ability to monitor intersection health in real-time. In stage two, the existing SIC copper communication media will be replaced with fiber optic cable. This will be accomplished utilizing existing communication conduit which will save significant costs associated with new conduit construction. The third stage will transition the communication system to a fully integrated fiber optic-based network capable of meeting Beaumont's future technological needs.

Within each stage of improvement, initial phases give priority to intersections located near freeway ramps and along major arterial corridors such as Highland Springs Boulevard and Beaumont Avenue. Targeting these priority areas first will provide immediate, measurable improvements in traffic flow, congestion reduction, and roadway safety. Subsequent phases will progressively expand network connectivity throughout the City, laying the foundation for smart technologies at every traffic signal.

4.1 Stage 1, Rapid IP Network Deployment

The first step to improve the communication system is to reestablish communication on copper SIC between signals, as this forms the backbone of the existing infrastructure. Once communication is restored, the 19 signals will connect to the new cloud-based MyCity CMS. The existing traffic signal communication connections form five subsystems:

- N Highland Springs Blvd (Oak Valley Parkway to I-10)
- S Highland Springs Blvd (First St to Second St) and Second St (Highland Springs Blvd to Commerce Way)
- First St (Commerce Way to Emory Ave)
- Sixth St (Pennsylvania Ave to Beaumont Ave) and Beaumont Ave (Sixth St to I-10)
- W Fourth St (Veile Ave to Prime Dr)

The quickest way to provide IP communications to these subsystems is to install a cell radio at one intersection within the subsystem. Cell modems are cost-effective, easy to install within traffic signal cabinets, and will provide 24/7 communication with the CMS. Each cell radio will incur a monthly fee of less than \$100. Additionally, each subsystem will require Ethernet over Copper

network switches at all traffic signals within the subsystem. These switches will manage network data between the cell radio and the other traffic signals within the subsystem. Five cellular radios will be deployed, one for each of the existing five communication subsystems.

For stand-alone intersections without copper SIC, a cell radio will be installed at each intersection, and no network switch would be required. The following seven stand-alone traffic signals require cell radios:

- Beaumont Ave & Cougar Wy
- Beaumont Ave & Oak Valley Pkwy
- Oak Valley Pkwy & Oak View Dr
- Oak Valley Pkwy & Oak Valley Plaza
- Oak Valley Pkwy & Golf Club Dr
- California Ave & Sixth St
- First St & Pennsylvania Ave

Altogether 12 cell radios will be deployed in Stage 1. These improvements are depicted in **Figure 4-1** on page 33.

In addition to the cell radio and network switch upgrades, all 170 traffic controllers in the City will be replaced with 2070 ATC controllers with OMNI software. The 2070 ATC/ OMNI combination is already in use for new installations within the City and is familiar to the City's maintenance staff. A total of 14 controllers are identified for upgrade. Following deployment of the 2070 ATC controllers, cell radios, and Ethernet switches; signal timing standardization and corridor-based signal coordination should be developed and implemented. Signal timing standardization includes signal coordination plans and compliance with guidelines for critical timing parameters such as yellow intervals and pedestrian don't walk intervals.

4.2 Stage 2, Replace Copper Cable with Fiber Optic Cable

In stage two, the existing copper cables will be replaced with fiber optic cables, which will provide a significant upgrade for the City's communication system. Fiber optic technology offers enhanced performance and reliability compared to the aging copper infrastructure, which is limited by bandwidth constraints. By utilizing existing conduits for the installation of fiber optic cables, the City can avoid the high costs and disruptions associated with trenching and excavation work. These extract value from the existing infrastructure for a cost-effective and efficient transition to modern communication technology.

The cell radios that were installed in stage one will continue to serve as the backhaul connection to the CMS. However, one of the key improvements in stage two is the replacement of Ethernet over copper switches with fiber-optic switches. While Ethernet over copper can support data transfer rates of up to 100 MB, the fiber-optic switches will enable a substantial increase in data throughput, supporting speeds of 1 GB and higher. This increased bandwidth capacity will facilitate the integration of advanced IP-enabled technologies such as video monitoring systems and smart detection systems which are critical for real-time surveillance and traffic flow optimization.

Figure 4-2 on page 34 depicts stage two, copper to fiber media improvements.

4.3 Stage 3, Fiber Optic Build-Out

The goal for the City's traffic signal communications system is to transition to a fully fiber-optic infrastructure. In this final stage, the existing cell radios and wireless radios will be removed, and new underground conduits and fiber-optic cables will be installed to connect all traffic signals to the CMS. This all-fiber network will offer high-speed data transmission across the entire City's traffic signal system. The fiber-optic network will provide a robust, scalable platform capable of supporting advanced smart technologies and other future system integrations, ensuring that the City's infrastructure is future-proofed for the growing demands of modern traffic management systems.

Figure 4-3 illustrates the envisioned final configuration of the City's fiber-optic build-out. To facilitate this transition, it is recommended that the City establish and adopt specific design guidelines mandating that all new traffic signals be designed with fiber-optic interconnect. This would also include the necessary switching equipment to connect the new signals to the larger network. Such an approach would help accelerate the deployment of the ultimate system and reduce costs to the City, as it establishes fiber as a standard.

In addition, the City should explore cost-saving strategies for the fiber-optic build-out, such as bundling fiber installation with other Capital Improvement Projects (CIPs) or partnering with private utility companies to include fiber infrastructure as part of their projects. These strategies can help the City achieve a full fiber-optic network while minimizing costs, ensuring that the City's infrastructure continues to evolve efficiently and cost-effectively.

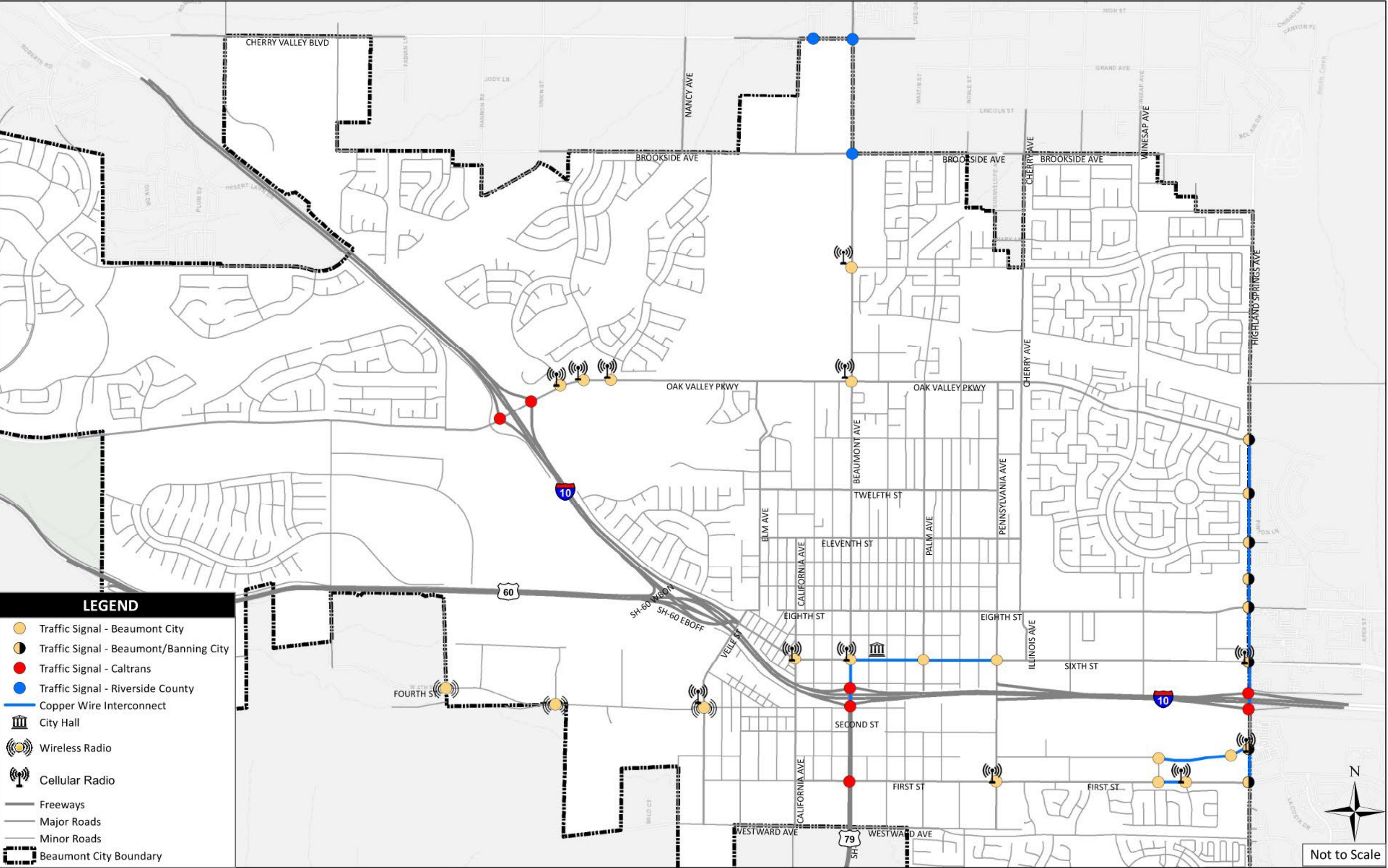
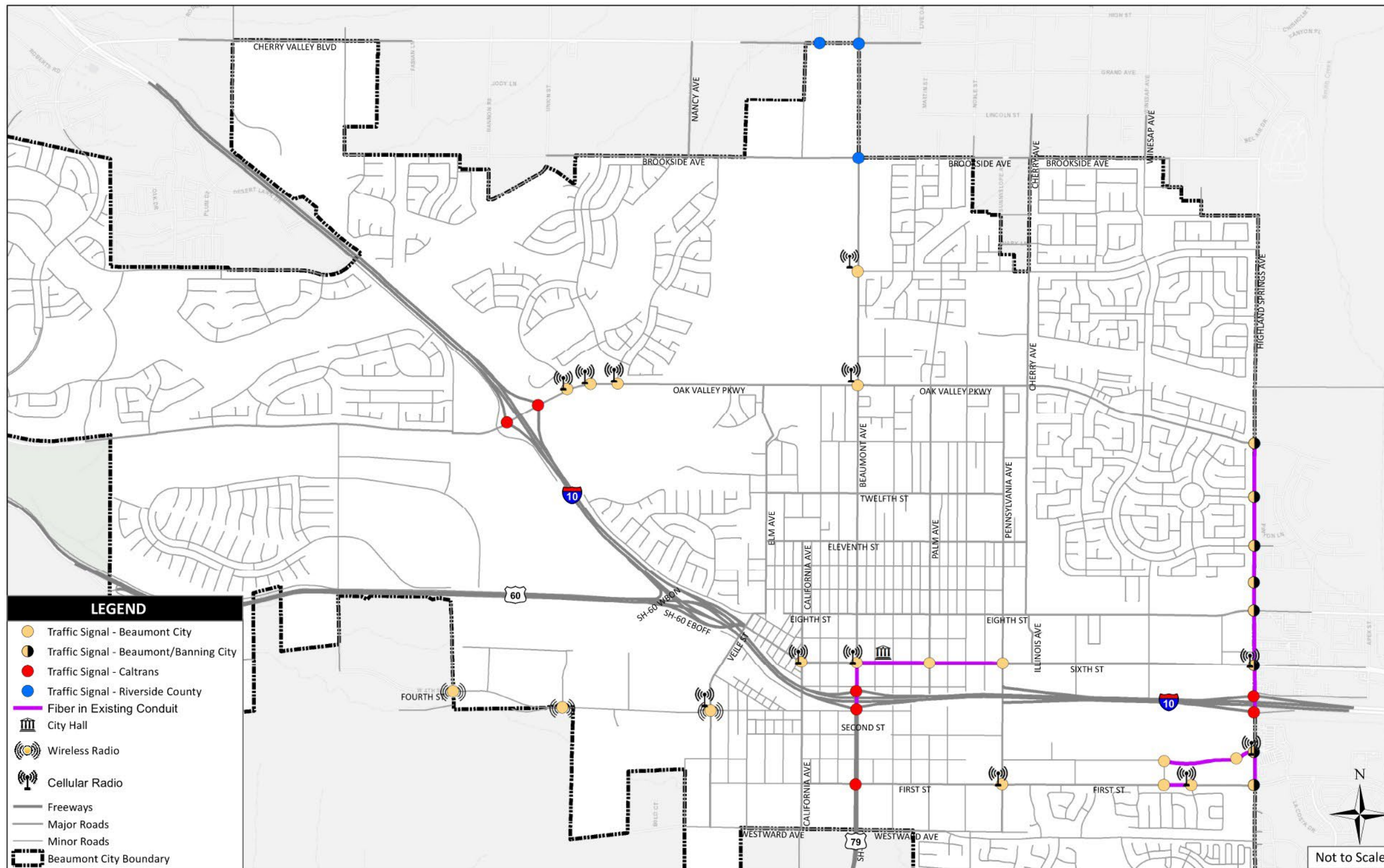
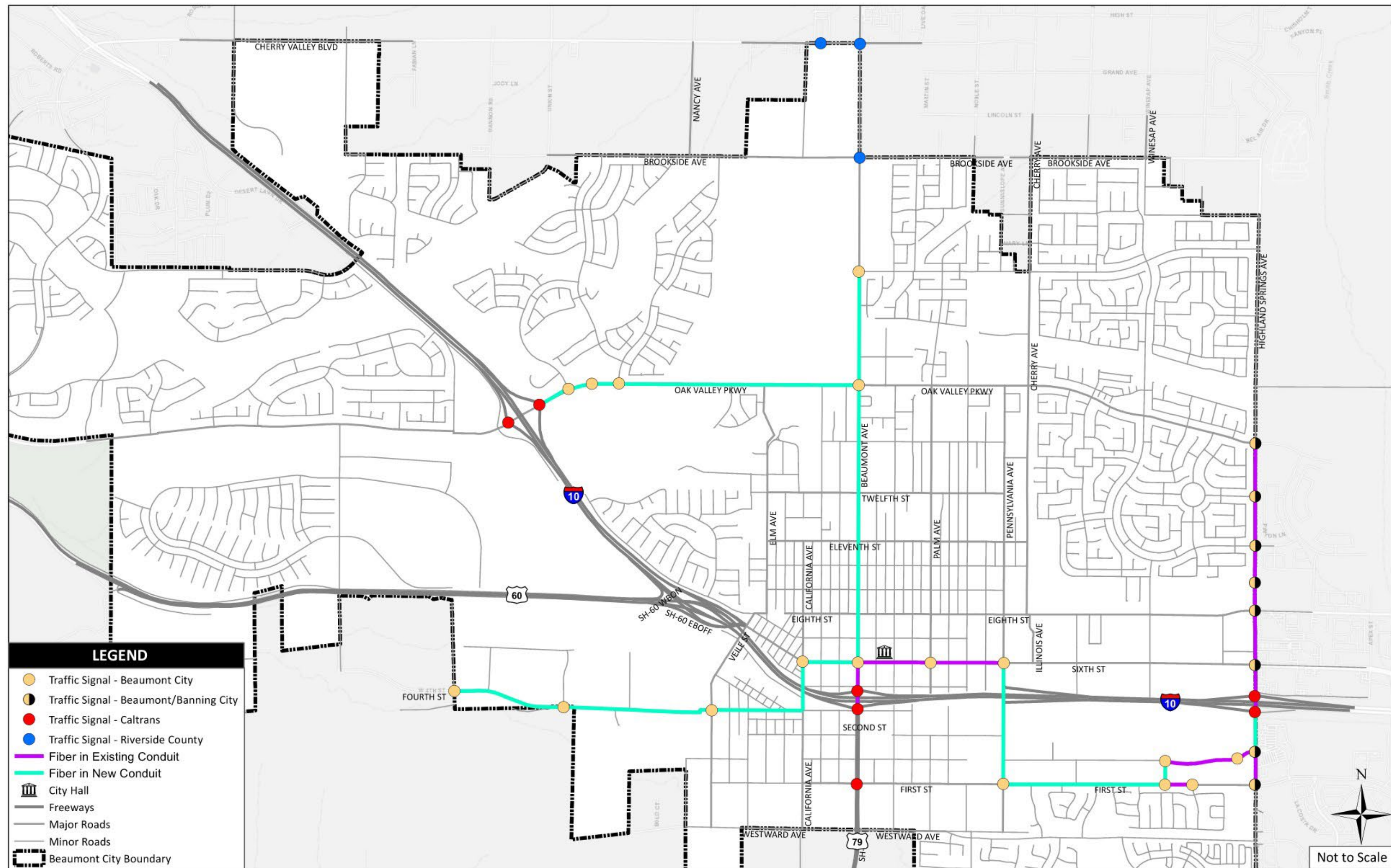


Figure 4-1: Near-Term Improvement Stage 1





5 Smart Technology and Deployment Recommendations

This section caps the building blocks developed in the previous sections and focuses on a strategically phased implementation approach that aligns with the City's immediate and future needs. The recommendations cover vital components such as communication infrastructure upgrades, modernization of basic traffic signal equipment, and AI detection and ASCT tech that provide advanced functions.

The section is comprised of two primary parts: (1) recommendations made in the previous sections are compiled and traced with the aligned need and (2) an implementation phasing plan (IPP) is presented which strategizes deployments. The IPP provides a rough timeline, prioritizes system improvements, prioritizes locations for improvement, and provides a planning level cost for each phase.

5.1 Smart Technology Recommendations

As described in Section 2, the existing system assessment identified critical needs for the City of Beaumont to transition to an advanced traffic control infrastructure and Sections 3 and 4 presented technologies that address the need. Each of the following subsections reference previously identified needs (N) addressed by the recommendation (R) and traced with numerical identification.

5.1.1 Communication Infrastructure

The existing communications infrastructure, primarily copper-based signal interconnect cable (SIC), was found structurally adequate but compromised by missing end equipment, such as modems, C-2 plugs, and cable terminations (N1, N2, N3). In addition, the lack of connection between field infrastructure and a CMS was identified (N4, N5).

To resolve these deficiencies, Stage 1 Improvements will reestablish communications by integrating Ethernet-over-copper VDSL technology and Layer 2 network switches at all cabinets currently equipped with SIC (R1). A cell radio will be installed for each SIC run to provide back haul communication to the traffic control system (R2). The existing three-signal wireless radio network was found to be in good condition and can be retained in Stage 1 and supplemented with a cell radio. For signals without SIC, a cell radio will be installed. Upon completion of Stage 1 of communication infrastructure upgrades, all signals will be connected to the CMS. This phase will establish full system connectivity, addressing needs N1 through N5.

The second stage of communications upgrades, Stage 2 Improvements, consists of the replacement of existing SIC with fiber optic cable and fiber optic termination equipment (R3). It is recommended the City leverage existing conduit infrastructure to minimize trenching costs. Ethernet-over-copper devices will be replaced by advanced fiber-optic switches, increasing data throughput capabilities from 100MB to up to 1GB. This enhanced capacity will support additional intelligent transportation system (ITS) devices, such as CCTV cameras and AI detection technologies.

The third stage of communications upgrades, Stage 3 Build-Out, consists of installation of a fully fiber-optic network (R4). New conduits and fiber optic cables will be installed to provide connectivity between all traffic signals within the City. To reduce costs and facilitate timely implementation, the City is encouraged to coordinate fiber installations with other Capital

Improvement Projects (CIPs), developer-driven infrastructure improvements, or private utility work.

Communication Infrastructure Recommendation Summary:

No.	Description	Need Resolution
R1	Reestablish communications at each cabinet with Ethernet-over-copper VDSL technology and Layer 2 network switches.	N1, N2, N3
R2	Install cell radios at strategic signals to provide necessary backhaul connectivity to the central system.	N4, N5
R3	Replacement of the existing SIC with fiber optic cable and fiber optic termination equipment.	
R4	Installation of a fully fiber-optic network.	

5.1.2 Field Elements

5.1.2.1 Traffic Signal Cabinets, Controllers and Conflict Monitor Units

The existing conditions assessment identified that the signal cabinets, traffic signal controllers, and the controller's software are aging and outdated (N6, N7, N8). Lack of a communications link between field elements and a CMS was also noted as a need (N9). Needs N10, N11, and N12 identify compatibility issues with outdated conflict monitor units (CMUs) and the inability to remotely access and monitor CMUs.

To address these needs, all existing 170 traffic signal controllers should be replaced with 2070LX ATC controllers with OMNI software and any existing 2070E controllers should have the CPU swapped out with a 1C ATC CPU with OMNI software (R5). This is an immediate need to communicate with the CMS. Having all controllers on a common software program will provide uniformity for maintenance and a platform for advanced traffic operations.

Additionally, the existing Type 332 cabinets should be replaced with 352i ATC cabinets (R6) as funding becomes available or as maintenance dictates. The 352i cabinet, installable on existing foundations, offers enhanced diagnostics, modularity, and improved safety features. Updating City standards to specify 352i ATC cabinets as the default will streamline future projects and maintenance efforts.

Existing outdated CMU units should be replaced with ethernet-compatible CMUs with remote access capabilities. The EDI 2010ECLip CMU is ethernet compatible and should be installed wherever existing Type 332 cabinets are to remain. For any proposed 352i ATC cabinets, the CMUip-2212 Series CMU should be installed. City standards for traffic signal equipment should be updated to reflect the 2010ECLip and CMUip-2212 CMUs as the new standard (R7).

Cabinets, Controllers and Conflict Monitor Units Recommendation Summary:

No.	Description	Need Resolution
R5	Replace 170 controllers with 2070LX ATC controllers with OMNI software. Upgrade existing 2070E controller's CPU to a 1C ATC CPU with OMNI software.	N7, N8, N9
R6	Replace 332 cabinets with 352i ATC cabinets.	N6
R7	Replace outdated CMUs with the 210ECLip and CMUp-2212 CMUs.	N10, N11, N12

5.1.2.2 Vehicle and Pedestrian Detection

The existing conditions assessment identified a need to connect existing ethernet-compatible video detectors to the communications network to enable remote monitoring (N13). Current inductive loop detectors meet basic operational needs, but lack advanced features required for advanced operations (N14). The existing pedestrian detection systems are not capable of connecting to a communications network (N15) and most do not include accessible pedestrian features (N16).

Pedestrian detection systems should be upgraded to APS to meet ADA and PROWAG requirements (R8). It is recommended that the City prepare a transition plan that provides priority for upgrades and identifies funding opportunities. For example, priority can be given to requests from the public for APS systems. Any signal modification should include an upgrade of the pedestrian detection to APS. A transition plan may be beneficial to the City in the event of accessibility complaints from the public. Existing APS and new APS should be connected to the communication system as upgrades to the network are completed (R9).

The AI-integrated detection systems described in Section 3 offer multiple advanced traffic management and control options and can connect to create adaptive signal sub-systems. These systems may also offer integration with Caltrans-operated traffic signals. The City should implement AI detection upgrades as funding and opportunities provide (R10). For example, a road resurfacing project may choose to install an AI detection system in lieu of replacing inductive loops. City standards should be updated to reflect the preferred AI detection solution. Additionally, existing video detection systems should be connected to the communications network as upgrades to the network are completed (R11).

Vehicle and Pedestrian Detection Recommendation Summary:

No.	Description	Need Resolution
R8	Upgrade existing pedestrian detection systems to APS.	N16
R9	Connect systems to communication network.	N13, N15
R10	Implement an AI-integrated detection system.	N14

R11	Connect existing video detection systems to the communications network.	N13
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5.1.2.3 Battery Back-up Systems, CCTV, EVPE, and GPS Time Source

Some existing battery backup systems (BBS) were identified with missing components, obsolete technology, or were omitted from some signalized intersections (N20, N21, N22, N23). For consistency and ease of maintenance, the City should standardize BBS selection and installation procedures. New or modified traffic signals should include ethernet-compatible BBS systems in an external cabinet to improve space and access in the controller cabinet (R12). Ethernet-compatible BBS systems should be connected to the communications network as upgrades to the network are complete. Regular maintenance will proactively identify repairs or replacements.

Currently, none of the existing Beaumont Police Department CCTV cameras are available to Public Works for video-based monitoring of the intersection (N17). With upgrades to the communications system comes the ability to install and connect traffic monitoring video cameras for remote access. It is recommended to install a CCTV camera at each traffic signal and connect it to the communications network (R13). In addition, connect video detection systems to the network for additional operational capability. City standards should be updated to require a CCTV PTZ camera at all new and modified traffic signals.

The existing conditions assessment identified that not all the EVPE systems in the City are ethernet-compatible (N18) and are limited to line-of-sight functionality (N19). Existing EVPE systems should be tested as part of a regular maintenance program. Non-functional units should be upgraded to ethernet-compatible equipment like Opticom 764 or equivalent, which should become the City standard (R14). Absent any concerns from emergency service providers, it is recommended that the City continue to use line-of-sight IR technology rather than convert to a GPS based system.

The existing non-functional GPS time sources should be removed (N24). GPS time sources are used to maintain clock time at the intersection to allow for time-based coordination with a common time base. Installation of 2070LX ATC controllers and a functional communications network will make the GPS time source units redundant. GPS time sources should be removed as controller and communications upgrade are completed (R15).

BBS, CCTV, EVPE, and GPS Time Source Recommendation Summary:

No.	Description	Need Resolution
R12	Standardize BBS manufacturer selection and install ethernet-compatible BBS systems in an external cabinet for new or upgraded intersections.	N20, N21, N22, N23
R13	Install a CCTV camera at all traffic signals and connect all existing (and new) CCTV cameras to the communications network.	N17
R14	Upgrade non-functional EVPE units to Ethernet-compatible equipment like Opticom 764 or equivalent.	N18, N19

R15 GPS time sources should be removed as controllers and communications upgrades are completed.

N24

5.1.2.4 Central Management System

The existing conditions assessment identified that City staff lack the capability to remotely manage and monitor the City's traffic signal system and associated field equipment (N25 and N26). The high traffic demands and proximity of traffic signals along the freeway access corridors necessitate coordination and advanced operation. Existing controllers are susceptible to clock drift which renders coordination timing ineffective (N27, N28, N29, N30). Implementing a Central Management System (CMS) will significantly enhance operational efficiency, safety, and system reliability by enabling integrated oversight and management.

Essential functions provided by the CMS include signal coordination, real-time data collection and analytics, status and fault monitoring, comprehensive database management, and performance metric analysis. Consistent with the recommendation to continue utilizing SWARCO McCain's OMNI controller software, the SWARCO McCain MyCity Traffic Management System (TMS) software suite is recommended as the preferred CMS solution (R16). MyCity offers all standard CMS capabilities along with advanced functionalities through optional software modules such as Smart Priority, Adaptive, and Signal Performance Measures (SPM). The MyCity CMS directly addresses the identified operational needs.

Traditional CMS deployment typically involves installing a dedicated server physically located at a City facility, such as City Hall. Communication from traffic signals (via cellular, copper, or fiber-optic connections) would route directly to this server. The CMS server then integrates with the City's existing network infrastructure, allowing staff to access the CMS from a City network-connected computer equipped with the MyCity client software.

As an alternative to a traditional physical-server deployment, it is recommended to implement the MyCity cloud-based CMS solution (R17). Under this configuration, the MyCity server application is hosted securely in the cloud, with CMS access provided via secure web browsers or mobile applications. The cloud-based CMS offers robust cybersecurity measures to protect sensitive data and restrict unauthorized access.

Traffic signal data communications for a cloud-based system will require that the network or sub-networks also be accessible from the cloud. This will be accomplished through cellular radio deployments. Data from each group of signals will be aggregated and delivered to the cloud.

Central Management System Recommendation Summary:

No.	Description	Need Resolution
R16	Utilize SWARCO McCain MyCity Traffic Management System software suite as the City's CMS solution.	N25, N26, 27, 28, 29, 30
R17	Establish a cloud-based server with cellular connectivity for sub-signal groups.	N25, N26, 27, 28, 29, 30

5.1.3 Roadway Safety

The existing conditions assessment identified a critical need to improve signal timing as a key countermeasure for reducing collisions (N31). Crash analysis highlighted DUI, motorcycle collisions, incidents involving school-age pedestrians, and nighttime collisions as priority safety categories for targeted attention (N32). It also recognized the importance of implementing systems capable of supporting advanced operations, analytics, and performance reporting, for the City to transition from a reactive to a proactive roadway safety management approach (N33).

The recommended controller hardware and software upgrades present the City with an opportunity to comprehensively review and refine signal timing parameters, including yellow and red clearance intervals, pedestrian timing, bicycle detection, and vehicle detection intervals (R18). Advanced operational features such as Lead Pedestrian Intervals (LPI) can be programmed into the upgraded controllers, giving pedestrians crossing time prior to vehicle movements, thus enhancing pedestrian safety. Additionally, coordinated signal timing strategies can be developed and implemented along high-volume corridors, effectively reducing vehicle stops and delays, minimizing driver frustration, and decreasing collision potential.

Beyond technical improvements to traffic signals and operational enhancements, the City should continue to engage in engineering, education, and enforcement efforts to address the lowest roadway safety categories that contribute to collisions. Pursuing external grant funding from programs such as Highway Safety Improvement Program (HSIP), Safe Routes to School (SR2S), and the California Office of Traffic Safety (OTS) is recommended to support both infrastructure enhancements and public education campaigns. Grant funding from CA OTS specifically can support increased DUI enforcement patrols, directly addressing the identified safety concerns. Close collaboration between City engineering staff and the Beaumont Police Department is essential to effectively target safety resources and interventions toward identified high-risk locations and behaviors. These combined engineering, education, and enforcement strategies comprehensively address the identified roadway safety needs (R19).

The implementation of an advanced CMS, such as the MyCity, further supports the City's shift toward a proactive traffic management framework. MyCity provides comprehensive operations management, detailed analytics, and sophisticated reporting capabilities, enabling City staff to remotely monitor intersection and corridor performance, identify emerging areas of concern, and proactively implement targeted signal timing strategies for safety improvements. Complementing the MyCity CMS, AI-based detection systems offer enhanced capabilities, such as real-time pedestrian movement tracking, near-miss event detection, and comprehensive vehicle classification and speed monitoring. Data from these advanced detection systems can be analyzed to pinpoint and address potential safety issues before they escalate. The integration of CMS and AI-based detection thus addresses the need for proactive system management (R20).

Roadway Safety Recommendation Summary:

No.	Description	Need Resolution
R18	Utilize controller hardware and software upgrades to refine signal timing strategies to enhance intersection safety and establish more efficient intersection operations.	N31

R19	Maintain a comprehensive and multidisciplinary approach to address the priority roadway safety categories identified in the crash analysis.	N32
R20	Utilize CMS and AI-based detection to remotely monitor intersections and analyze corridor performance metrics to proactively manage the traffic signal network.	N33

5.2 Implementation Phasing Plan

Improvements to the City’s traffic signal network will be implemented in five phases each with the following objectives:

- Phase 1 (Year One) – Prioritize Highland Springs Ave.
- Phase 2 (Year Two) – Prioritize Beaumont Ave, First St, Second St, and Sixth St.
- Phase 3 (Year Three) – Prioritize Oak Valley Pkwy and Fourth St.

Phases 1 through 3 each include on the respective priority corridors: implement upgraded controllers and conflict monitor units, upgrade communications network, implement CMS, implement AI/ ASCT system, and performance reporting system.

- Phase 4 (Year Four) – All locations Citywide. Prioritize upgrading and implementing field element subsystems including BBS, APS, EVPE, and CCTV
- Phase 5 (Year Five +) – All locations Citywide. Replace hybrid media network with standardized fiber optic network and upgrade traffic signal cabinets.

The improvements designated for each of the three corridor phases are organized to provide the greatest mobility benefits as quickly as possible. The priority corridor approach targets high-traffic areas first to yield immediate and measurable benefits. It’s important to note that system design documents are required prior to procuring contractors and/ or equipment vendors. System design development for phase one is expected to take approximately three months and Caltrans permitting is expected to take approximately six months.

Phases 4 and 5 graduate to advanced field element technology for subsystems such as battery back-up systems, emergency vehicle preemption systems, and fiber optic communication systems. The priority corridor approach by phase is shown in **Figure 5-1**. Each of the implementation phases are detailed in the following subsections.

5.2.1 Implementation Phase 1 (Year One)

Phase one improvements are as immediate as possible with systems and technology required to implement an AI/ ASCT system on Highland Sprins Ave in one year. This includes the I-10 Caltrans ramp signals for unified corridor operation. Within this phase the first implementations will be new controllers and CMU’s, high speed Ethernet over copper communications, and the CMS. Once these foundational technologies are implemented the AI detection and ASCT technology will be layered on with MOE applications for performance reporting.

Table 5-1 on page 44 provides a summary of phase one improvements and order of magnitude costs.

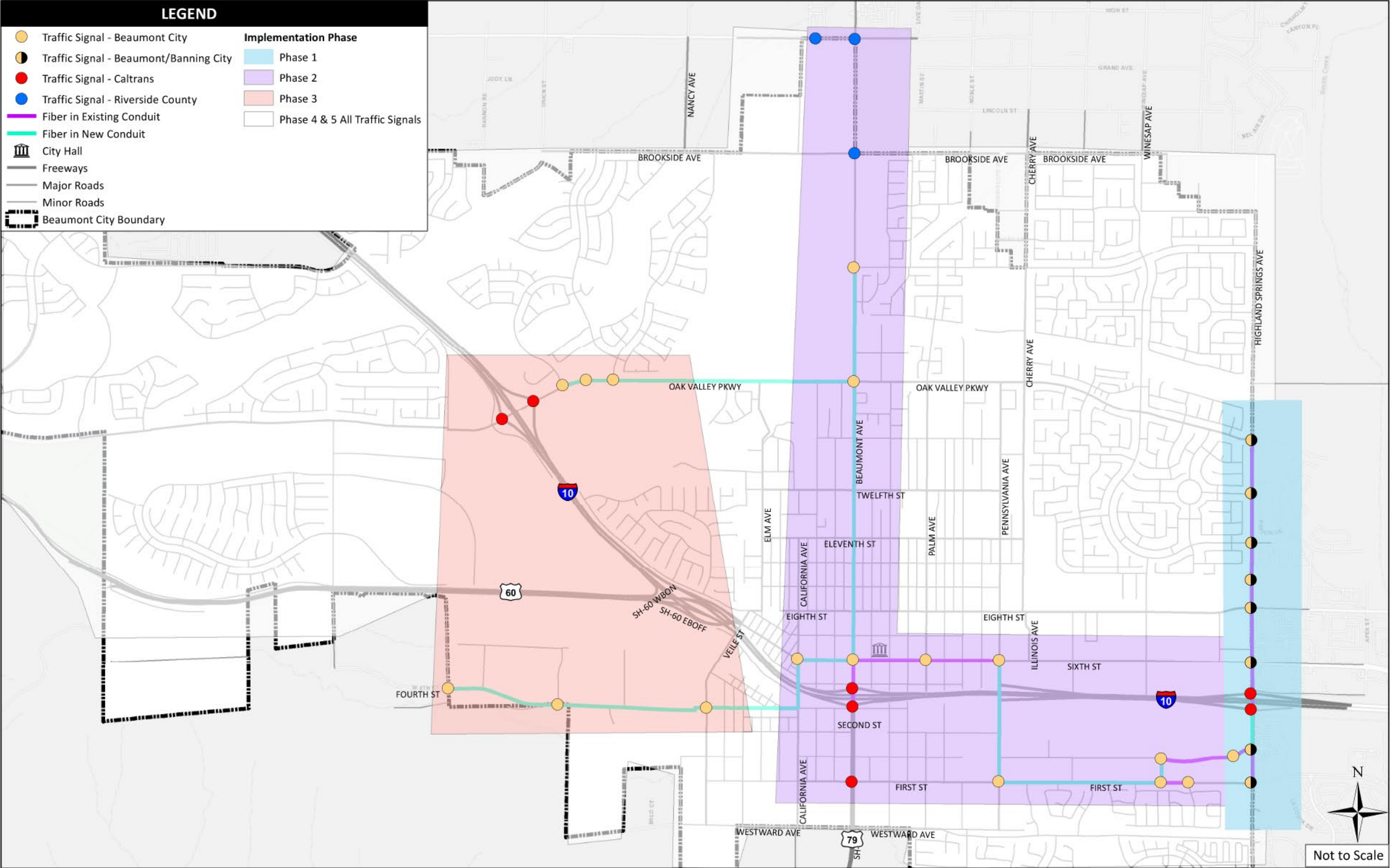


Table 5-1 Implementation Phase 1 Improvements and Costs

Item #	Description	Qty	Unit	Unit \$	Total \$
Year 1: Highland Springs Avenue					
1	2070LX Controller w/ OMNI	2	EA	\$7,000	\$14,000
2	Swap 2070E CPU w/ 1C ATC CPU w/ OMNI	6	EA	\$2,000	\$12,000
3	Cellular Radios	2	EA	\$500	\$1,000
4	Ethernet-Over-Copper VDSL Modem	9	EA	\$5,000	\$45,000
5	Cloud-Based MyCity Software Suite	1	LS	\$30,000	\$30,000
6	CMU Upgrades	9	EA	\$1,500	\$13,500
7	AI/ ASCT Systems	11	EA	\$30,000	\$330,000
8	MOE Modules	1	LS	\$10,000	\$10,000
Subtotal					\$455,500
Engineering, Management, Integration: 50% of subtotals					\$227,500
Total					\$683,250

Note: Order of Magnitude Cost Estimates do not include construction contingency.

5.2.2 Implementation Phase 2 (Year Two)

Upon completion of improvements on Highland Springs Ave under phase one, the City can initiate phase two. This phase focuses on Beaumont Ave, First St, Second St, and Sixth St. The Caltrans ramps signals on Beaumont Ave and SR-79 are included and the County traffic signals on the north side are included. Phase two has similar implementations as phase one, and the associated technologies and system will be expanded to the phase two corridors. Phases two and three will benefit from experience gained on the phase one implementation.

Table 5-2 provides a summary of phase two improvements and order of magnitude costs.

Table 5-2 Implementation Phase 2 Improvements and Costs

Item #	Description	Qty	Unit	Unit \$	Total \$
Year 2: Beaumont Ave, First St, Second St, and Sixth St.					
1	2070LX Controller w/ OMNI	8	EA	\$7,000	\$56,000
2	Swap 2070E CPU w/ 1C ATC CPU w/ OMNI	2	EA	\$2,000	\$4,000
3	Cellular Radios	5	EA	\$500	\$2,500
4	Ethernet-Over-Copper VDSL Modem	6	EA	\$5,000	\$30,000
5	Cloud-Based MyCity Software Suite	1	LS	\$30,000	\$30,000
6	CMU Upgrades	11	EA	\$1,500	\$16,500
7	AI/ ASCT Systems	17	EA	\$30,000	\$510,000
8	MOE Modules	1	LS	\$10,000	\$10,000
9	Layer 2 Network Switch	5	EA	\$4,000	\$20,000
Subtotal					\$679,000
Engineering, Management, Integration: 50% of subtotals					339,500
Total					\$1,018,500

Note: Order of Magnitude Cost Estimates do not include construction contingency.

5.2.3 Implementation Phase 3 (Year Three)

The remaining traffic signals on Oak Valley Pkwy and Fourth St will be upgraded in phase three. The Caltrans ramps signals on Oak Valley Pkwy are included. Phase three is expected to move quickly considering there are fewer locations than previous phases.

Table 5-3 provides a summary of phase three improvements and order of magnitude costs.

Table 5-3 Implementation Phase 3 Improvements and Costs

Item #	Description	Qty	Unit	Unit \$	Total \$
Year 3: Oak Valley Pkwy and Fourth St					
1	2070LX Controller w/ OMNI	2	EA	\$7,000	\$14,000
2	Swap 2070E CPU w/ 1C ATC CPU w/ OMNI	3	EA	\$2,000	\$6,000
3	Cellular Radios	4	EA	\$500	\$2,000
5	Cloud-Based MyCity Software Suite	1	LS	\$15,000	\$15,000
6	CMU Upgrades	6	EA	\$1,500	\$9,000
7	AI/ ASCT Systems	6	EA	\$30,000	\$180,000
8	MOE Modules	1	LS	\$5,000	\$5,000
9	Layer 2 Network Switch	6	EA	\$4,000	\$24,000
Subtotal					\$255,000
Engineering, Management, Integration: 50% of subtotals					\$127,500
Total					\$382,500

Note: Order of Magnitude Cost Estimates do not include construction contingency.

5.2.4 Implementation Phase 4 (Year Four)

Phase four includes traffic signal field element subsystems that will benefit from upgrades and new technology. These include Accessible Pedestrian Signal (APS) pushbuttons, Battery Backup Systems, CCTV cameras, and Emergency Vehicle Preemption equipment.

Table 5-4 provides a summary of phase four improvements and order of magnitude costs.

Table 5-4 Implementation Phase 4 Improvements and Costs

Item #	Description	Qty	Unit	Unit \$	Total \$
Year 4: Citywide					
10	APS Pushbuttons	24	EA	\$20,000	\$480,000
11	BBS Upgrades	16	EA	\$10,000	\$160,000
12	CCTV	23	EA	\$15,000	\$345,000
13	EVP Upgrades	17	EA	\$18,000	\$306,000
Subtotal					\$1,291,000
Engineering, Management, Integration: 25% of subtotals					322,750
Total					\$1,613,750

Note: Order of Magnitude Cost Estimates do not include construction contingency.

5.2.5 Implementation Phase 5 (Year Five +)

Phase five includes year five and subsequent years. This final phase will transition the City's traffic signal communications network into a fully integrated fiber-optic infrastructure and technology. Controller cabinets will also be upgraded to the latest ATC technology.

Table 5-5 provides a summary of phase five improvements and order of magnitude costs.

Table 5-5 Implementation Phase 5 Improvements and Costs

Item #	Description	Qty	Unit	Unit Price	Total Cost
Year 5 +: Citywide					
14.1	Fiber in Existing Conduit	14,400	LF	\$10	\$144,000
14.2	Switches	15	EA	\$5,000	\$75,000
14.3	Splicing	15	EA	\$5,000	\$75,000
14.4	Cabinet Termination, FDU, and Panel	15	EA	\$10,000	\$150,000
14.5	Fiber Optic Trunk Cable in New Conduit	35,000	LF	\$90	\$3,150,000
15	352i ATC Cabinet Upgrades	25	EA	\$35,000	\$875,000
Subtotal					\$4,469,000
Engineering, Management, Integration: 25% of subtotals					\$1,117,250
Total					\$5,586,250

Note: Order of Magnitude Cost Estimates do not include construction contingency.

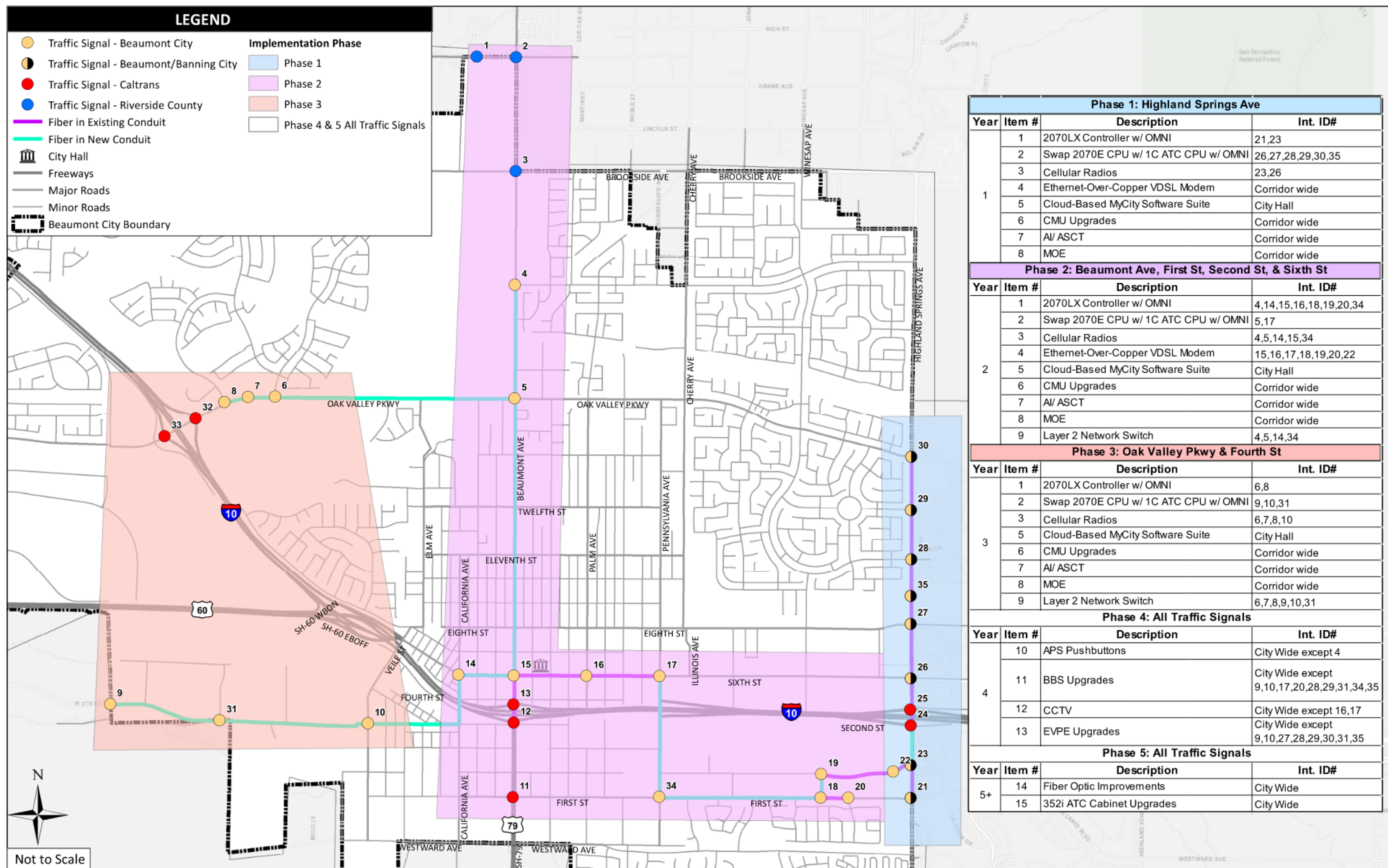
5.2.6 Implementation Summary and Cost

A summary of the implementation phases, costs, and total cost for all technology recommendations is shown on **Table 5-6**.

Table 5-6 Implementation Summary and Costs

Phase	Year	Location	Cost
1	1	Highland Springs Ave	\$683,250
2	2	Beaumont Ave, First St, Second St, Sixth St	\$1,018,500
3	3	Oak Valley Pkwy and Fourth St	\$382,500
4	4	Citywide	\$1,613,750
5	5 +	Citywide	\$5,586,250
Total			\$9,284,250

A map of the implementations by phase and location is shown on **Figure 5-2**.



5.3 Design Guidelines and Special Provisions

To ensure the recommendations outlined in this report are consistently implemented, the City should develop Standard Design Guidelines and Special Provisions. These documents will establish clear standards and ensure that all new or modified traffic signals are integrated into the City's overall traffic management system for consistent equipment procurement and implementation.

Design Guidelines will provide direction to consultants responsible for preparing traffic signal plans. At a minimum, these guidelines should clearly define the City's preferred traffic signal equipment as well as the required communication system requirements. Additionally, detailed specifications for AI-based detection technology should also be incorporated into the guidelines.

Special Provisions will serve as direction for contractors and vendors to ensure compliance with the City requirements throughout the bidding and procurement process. Unlike design guidelines, special provisions will provide more detailed technical descriptions, specifying exact materials, components, workmanship, and construction methods.

5.4 Delivery Methods

The City should actively leverage opportunities arising from Capital Improvement Program (CIP) projects and private development efforts to upgrade traffic signals and provide smart technology recommendations identified in this Study. Any project impacting existing traffic signals should, at minimum, upgrade signal cabinets, controllers, software, CMUs, and EVPE. Depending on available funding, upgrades to detection systems should also be considered. Projects involving significant linear trenching should seek opportunities to include conduit and fiber-optic cable installations to support the communications network.

Additionally, if a private utility proposes installing fiber-optic infrastructure to homes within the City of Beaumont, the City should require connections to nearby traffic signals as a condition of approval. Leveraging private fiber networks will efficiently facilitate communication routing between traffic signals.

State and Federal grant funding opportunities that the City of Beaumont can pursue to supplement local CIP funding for the deployment of the Implementation Phasing Plan are presented below:

- California Advanced Services Fund (CASF) Broadband Infrastructure Grant Account
- California Public Utilities Commission (CPUC) Broadband Equity, Access, and Deployment (BEAD) Program
- California Department of Technology (CDT) Digital Equity Act
- Caltrans Highway Safety Improvement Program (HSIP)
- US Department of Transportation (USDOT) Safe Streets and Roads for All (SS4A)
- USDOT Strengthening Mobility and Revolutionizing Transportation (SMART)

APPENDIX A

Traffic Signal Equipment Inventory

BEAUMONT SMART TECHNOLOGY AT TRAFFIC SIGNALS FEASIBILITY STUDY - TRAFFIC SIGNAL EQUIPMENT INVENTORY

ID	Location	Corridor	Agency	Cabinet	Controller	Timing Sheet Program	Switch	Conflict Monitor Unit (CMU)	Power Distribution Assembly (PDA)	Battery Backup System (BBS)	BBS Cabinet	BBS Working/ Functional (Y/N)	BBS Comm Capability (Y/N)	Existing Communications Media	Conduit	Communications To (1)	Communications To (2)	Communications To (3)	CCTV Camera	ALPR Camera	EVPE Type	EVPE Discriminator Card	Detection	Time Source GPS Unit	RailRoad Interconnect	PPB	Notes
1	Cherry Valley Blvd & N School Ent. & Royal Coach	Cherry Valley Blvd	Riverside County	332L	170E	200SA					Piggyback			Copper	2" RMC	1-6PR #19 to Cherry Blvd & Beaumont Ave	—	—			IR	(2) Opticom 3M 721	All Loops			Buildog	
2	Cherry Valley Blvd & Beaumont Ave	Cherry Valley Blvd	Riverside County	Type P	Type 90	200SA								Copper	2" RMC	1-6PR #19 to Cherry Blvd & N School Ent/Royal Coach	—	—			IR	(2) 3M Opticom 262	All Loops			Buildog	
3	Beaumont Ave & Brookside Ave	Beaumont Ave	Riverside County	Type P	Type 390	200SA										—	—	—			IR	(2) 3M Opticom 262	All Loops			Buildog	
4	Beaumont Ave & Cougar Wy	Beaumont Ave	Beaumont	332L	Safetran 170E	233 RV3		EDI 210	IDC #2	NA	NA	NA	NA	None		—	—	—			IR	(1) Opticom 3M 752	All Loops	None	None	Polara CCL02EN (No RS232)	- Polara Unit
5	Beaumont Ave & Oak Valley Pkwy	Beaumont Ave	Beaumont	332L	McCain 2070E	200SA		EDI 2010ECL	Safetran PDA #2	NA	NA	NA	NA	None		—	—	—		Yes	IR	(2) Opticom 3M M-262	All Loops	None	None	Buildog	
6	Oak Valley Pkwy & Oak View Dr	Oak Valley Pkwy	Beaumont	332L	McCain 170E	200SA		EDI 210	McCain PDA #2	Dimensions (ADI-24Y11)	Swing-Out Battery Shelves in Cabinet	No	No	None		—	—	—			IR	(1) Opticom 3M 752	All Loops	None	None	Buildog	- Damaged Cabinet
7	Oak Valley Pkwy & Oak Valley Plaza	Oak Valley Pkwy	Beaumont	332L	Siemens EAGLE 2070L ATC	2033RV		EDI 2010	McCain PDA #2	NA	Piggyback	No	No	None		—	—	—			IR	(2) Opticom 3M 752	All Loops	None	None	Buildog	- BBS batteries but no inverter
8	Oak Valley Pkwy & Golf Club Dr	Oak Valley Pkwy	Beaumont	332L	Naztec Series 970	2033RV		EDI 2010	McCain PDA #2	Dimensions (ADI-24J11)	Piggyback	No	No	None		—	—	—			IR	(2) Opticom 3M 752	All Loops	None	None	Buildog	
9	Fourth St & Prime Dr	Fourth St	Beaumont	332L	McCain 2070E	2033RV	Cisco IE2000 (8 copper ports + 2 combo ports for copper or SFP)	EDI 2010ECL	McCain PDA 2L	Alpha (FXM 1100)	Piggyback	Yes	Yes	Wireless		Wireless Radio to Fourth St & Distribution Wy	—	—			IR	(1) Opticom 764 (IP)	All Loops	None	None	Buildog	- Radio Communication/ Active link
10	Fourth St & Velle Ave	Fourth St	Beaumont	332L	McCain 2070E	2033RV	Cisco IE2000 (8 copper ports + 2 combo ports for copper or SFP)	EDI 2010ECL	McCain PDA 2L	Alpha (FXM 1100)	Piggyback	Yes	Yes	Wireless		Wireless Radio to Fourth St & Distribution Wy	—	—			IR	(1) Opticom 764 (IP)	All Loops	None	None	Buildog	- Radio Communication/ Active link
11	Beaumont Ave & First St	Beaumont Ave	Caltrans	332L	2070	TSCP 2.21																				Buildog	
12	Beaumont Ave & Fourth St/Luis Estrada Rd	Beaumont Ave	Caltrans	332L	2070	TSCP 2.21																				Buildog	Operates with (13) Beaumont Ave & I-10EB as single intersection
13	Beaumont Ave & I-10EB	Beaumont Ave	Caltrans	332L	2070	TSCP 2.21																				Buildog	Operates with (12) Beaumont Ave & Fourth St/Luis Estrada Rd as single intersection
14	Beaumont Ave & I-10WB	Beaumont Ave	Caltrans	332L	2070	TSCP 2.21																				Buildog	Operates with (15) Beaumont Ave & Fifth St as single intersection
15	Beaumont Ave & Fifth St	Beaumont Ave	Caltrans	332L	2070	TSCP 2.21																				Buildog	Operates with (14) Beaumont Ave & I-10 WB as single intersection
16	California Ave & Sixth St	Sixth St	Beaumont	332L	Safetran 170E	233 RV2		EDI 2010ECL	Safetran PDA #2	Dimensions (24M11-WBE)	Piggyback	No	Yes	None		—	—	—			IR	(1) Opticom 464 (USB)	All Loops	McCain GPS	None	Buildog	- No Modem - McCain GPS
17	Beaumont Ave & Sixth St	Beaumont Ave	Beaumont	332L	McCain 170E	200SA		EDI 210	McCain PDA #2	Dimensions (ADI-24Y11)	Swing-Out Battery Shelves in Cabinet	No	Not	Copper	2" RMC	1-6PR #19 to Beaumont Ave & I-10 WB	1-6PR #19 to Sixth St & Palm Ave	—		Yes	IR	(2) Opticom 3M 752	All Loops	None	None	Buildog	- C-2S Port not connected
18	Sixth St & Palm Ave	Sixth St	Beaumont	332L	Safetran 170	233 RV2		EDI 210	McCain PDA #2	NA	NA	NA	NA	Copper	2" RMC	1-6PR #19 to Beaumont Ave & Sixth St	1-6PR #19 to Sixth St & Pennsylvania Ave	—	Yes	Yes	IR	(2) Opticom 3M 752	All Loops	None	None	Buildog	- C-2S Port not connected - EVP not connected
19	Sixth St & Pennsylvania Ave	Sixth St	Beaumont	332L	McCain 2070E	2033RV		EDI 210	Safetran PDA #2	Marathon (TRTC-2004-N1)	Piggyback	Yes	Yes	Copper	2" RMC	1-6PR #22 to Sixth St & Palm Ave	—	—	Yes		IR	(1) M-202 Opticom 3M (1) Opticom 3M 752	All Loops	None	None	Buildog	- SIC out at pull box - Phase 2&6 off
20	First St & Commerce Wy	First St	Beaumont	332L	McCain 170E	200SA		EDI 210	McCain PDA #2	Dimensions (ADI-24Y11)	Piggyback	No	No	Copper	2" RMC	1-6PR #22 to First St & Emory Ave	—	—			IR	(2) Opticom 3M 752	All Loops	None	None	Buildog	- EVP not Active - No BBS Batteries
21	Second St & Commerce Wy	Second St	Beaumont	332L	McCain 170E	200SA		EDI 210	PSI PDA #2	Dimensions (ADI-24M11)	Piggyback	No	No	Copper	2" RMC	1-6PR #22 to Second St & Paseo Beaumont	—	—			IR	(2) Opticom 3M 752	All Loops	None	None	Buildog	- No C-2S Plug
22	First St & Emory Ave	First St	Beaumont	332L	McCain 170E	200SA		EDI 210	McCain PDA #2	Alpha (FXM 1100)	Piggyback	Yes	Yes	Copper	2" RMC	1-6PR #22 to First St & Commerce Wy	—	—			IR	(2) Opticom 3M 752	All Loops	None	None	Buildog	
23	Highland Springs Ave & First St/Sun Lake Blvd	Highland Springs Ave	Beaumont	332L	McCain 170E	233 RV2		EDI 210	McCain PDA #2	Dimensions (ADI-24Y11)	Piggyback	No	No	Copper	2" RMC	1-6PR #22 to Highland Springs Ave & Second St/Sun Lake Village Dr	—	—			IR	(1) Opticom 754	Video	McCain GPS	None	Buildog	- No Modem/SIC not Terminated - McCain GPS - Iteris Vantage Edge2 (IP)
24	Second St & Paseo Beaumont	Second St	Beaumont	332L	McCain 170 ATC	BI Tran 200		EDI 2010ECL	McCain PDA #2	Dimensions (ADI-24Y11)	Swing-Out Battery Shelves in Cabinet	No	No	Copper	2" RMC	1-6PR #22 to Second St & Commerce Wy	1-6PR #22 to Highland Springs Ave & Second St/Sun Lake Village Dr	—			IR	(2) Opticom 3M 752	All Loops	None	None	Buildog	- No Modem/SIC not Terminated
25	Highland Springs Ave & Second St/Sun Lake Village Dr	Highland Springs Ave	Beaumont	332L	McCain 170E			EDI 210	McCain PDA #2	Dimensions (ADI-24Y11)	Swing-Out Battery Shelves in Cabinet	No	No	Copper	2" RMC	1-6PR #22 to Highland Springs Ave & First St/Sun Lake Blvd	1-6PR #22 to Second St & Paseo Beaumont	—			IR	(2) Opticom 3M 752	All Loops	McCain GPS	None	Buildog	- No Modem/SIC not Terminated - McCain GPS
26	Highland Springs Ave & I-10 EB	Highland Springs Ave	Caltrans	332L	2070	TSCP 2.21																				Polara APS	
27	Highland Springs Ave & I-10 WB	Highland Springs Ave	Caltrans	332L	2070	TSCP 2.21																				Polara APS	
28	Highland Springs Ave & Sixth St/Ramsey St	Highland Springs Ave	Beaumont	332L	PSI 170E	200SA		IDC 210	IDC PDA #2	NA	NA	NA	NA	Copper	2" RMC	to Highland Springs Ave & I-10WB	to Highland Springs Ave & 8th S/Wilson St	—			IR	None	All Loops	McCain GPS	None	Buildog	- No C-2S Plug/ One SIC not Terminated - McCain GPS
29	Highland Springs Ave & Eighth St/Wilson St	Highland Springs Ave	Beaumont	332L	McCain 2070E	2033RV		EDI 2010ECL	IDC PDA #2	Myers	Piggyback	No	No	Copper	2" RMC/2" PVC	to Highland Springs Ave & Patriot Wy	Highland Springs Ave & Sixth St/Ramsey St	—			IR	(1) Opticom 764 (IP)	Video	None	None	Buildog	- Iteris EdgeConnect (IP) - BBS has no batteries
30	Highland Springs Ave & Starlight Ave/Atwell Dr	Highland Springs Ave	Beaumont	332L	McCain 2070E	2033RV		EDI 2010ECL	McCain PDA 2L	Myers (MP 2000E)	Piggyback	Yes	Yes	Copper	2" PVC	to Highland Springs Ave & Sundance Dr	to Highland Springs Ave & Patriot Wy	—			IR	(1) Opticom 764 (IP)	Video	None	None	Buildog	- Iteris EdgeConnect (IP)
31	Highland Springs Ave & Sundance Dr	Highland Springs Ave	Beaumont	332L	McCain 2070E	2033RV		EDI 2010ECL	McCain PDA #2	Myers (MP 2000E)	Piggyback	Yes	Yes	Copper	2" RMC/2" PVC	to Highland Springs Ave & Oak Valley Pkwy/Meadowline Wy	to Highland Springs Ave & Starlight Ave/Atwell Dr	—			IR	(1) Opticom 764 (IP)	Video	None	None	Buildog	- Iteris EdgeConnect (IP)
32	Highland Springs Ave & Oak Valley Pkwy/Meadowline Wy	Highland Springs Ave	Beaumont	332L	McCain 2070E	2033RV		EDI 2010ECL	IDC PDA #2	Myers	Piggyback	No	No	Copper	2" RMC	to Highland Springs Ave & Oak Valley Pkwy/Meadowline Wy	—	—			IR	(1) Opticom 764 (IP)	Video	None	None	Buildog	- Iteris EdgeConnect (IP)
33	Fourth St & Distribution Wy	Fourth St	Beaumont	332L	McCain 2070E	2033RV	Cisco IE2000 (8 copper ports + 2 combo ports for copper or SFP)	EDI 2010ECL	McCain PDA 2L	Alpha (FXM 1100)	Piggyback	Yes	Yes	Wireless		Wireless Radio to Fourth St & Prime Drive	Wireless Radio to Fourth St & Velle Ave				IR	(1) Opticom 764 (IP)	All Loops	None	None	Buildog	- Radio Communication/ Active link
34	Oak Valley Pkwy & I-10 WB	Oak Valley Pkwy	Caltrans	332L	2070	TSCP 2.21																				Polara APS	
35	Oak Valley Pkwy & I-10 EB	Oak Valley Pkwy	Caltrans	332L	2070	TSCP 2.21																				Polara APS	
36	First St & Pennsylvania Ave	First St	Beaumont	332L	McCain 170E	2033RV		EDI 210	McCain PDA 2L	Marathon (TRTC-2004-N1)	Piggyback	Yes	Yes	None		—	—	—			IR	(2) Opticom 462	All Loops	None	None	Buildog	
37	Highland Springs Ave & Patriot Wy	Highland Springs Ave	Beaumont	332L	McCain 2070E	2033RV		EDI 2010ECL	McCain PDA 2L	Myers (MP 2000E)	Piggyback	Yes	Yes	Copper	2" PVC	to Highland Springs Ave & Starlight Ave/Atwell Dr	to Highland Springs Ave & Eighth St/Wilson St	—			IR	(1) Opticom 764 (IP)	Video	None	None	Buildog	- Iteris EdgeConnect (IP)

APPENDIX B

Beaumont 2019-2022 California Office of Traffic Safety (OTS) Crash Rankings

Agency	Year	County	Group	Population (Avg)	DVMT
Beaumont	2019	RIVERSIDE COUNTY	C	51731	253520

Crash Category	VICTIMS KILLED & INJURED	OTS RANKING
Total Fatal and Injury	115	37/105
Alcohol Involved	16	34/105
Had Been Drinking Driver < 21	2	9/105
Had Been Drinking Driver 21 – 34	4	30/105
Motorcycles	7	22/105
Pedestrians	6	72/105
Pedestrians < 15	1	76/105
Pedestrians 65+	2	46/105
Bicycle	4	75/105
Bicyclist < 15	0	85/105
Composite	63	24/105

Crash Category	FATAL & INJURY CRASHES	OTS RANKING
Speed Related	23	32/105
Nighttime (9:00pm – 2:59am)	11	42/105
Hit and Run	7	52/105

TYPE OF ARRESTS	ARRESTS	OTS RANKING*
DUI Arrests	39	10/105

Agency	Year	County	Group	Population (Avg)	DVMT
Beaumont	2020	RIVERSIDE COUNTY	C	54313	242851

Crash Category	VICTIMS KILLED & INJURED	OTS RANKING
Total Fatal and Injury	89	55/106
Alcohol Involved	8	74/106
Had Been Drinking Driver < 21	1	48/106
Had Been Drinking Driver 21 - 34	2	86/106
Motorcycles	2	89/106
Pedestrians	6	64/106
Pedestrians < 15	0	78/106
Pedestrians 65+	0	93/106
Bicycle	3	92/106
Bicyclist < 15	0	83/106
Composite	32	77/106

Crash Category	FATAL & INJURY CRASHES	OTS RANKING
Speed Related	14	61/106
Nighttime (9:00pm - 2:59am)	2	102/106
Hit and Run	5	61/106

TYPE OF ARRESTS	ARRESTS	OTS RANKING*
DUI Arrests	38	23/106

Agency	Year	County	Group	Population (Avg)	DVMT
Beaumont	2021	RIVERSIDE COUNTY	C	54349	302154

Crash Category	VICTIMS KILLED & INJURED	OTS RANKING
Total Fatal and Injury	100	73/105
Alcohol Involved	11	80/105
Had Been Drinking Driver < 21	1	56/105
Had Been Drinking Driver 21 - 34	5	78/105
Motorcycles	8	43/105
Pedestrians	3	98/105
Pedestrians < 15	0	86/105
Pedestrians 65+	0	92/105
Bicycle	3	94/105
Bicyclist < 15	0	85/105
Composite	49	81/105

Crash Category	FATAL & INJURY CRASHES	OTS RANKING
Speed Related	19	59/105
Nighttime (9:00pm - 2:59am)	8	85/105
Hit and Run	5	80/105

TYPE OF ARRESTS	ARRESTS	OTS RANKING*
DUI Arrests	53	26/105

Agency	Year	County	Group	Population (Avg)	DVMT
Beaumont	2022	RIVERSIDE COUNTY	C	56275	297.0976

Crash Category	VICTIMS KILLED & INJURED	OTS RANKING
Total Fatal and Injury	154	45/104
Alcohol Involved	13	70/104
Had Been Drinking Driver < 21	0	73/104
Had Been Drinking Driver 21 – 34	6	64/104
Motorcycles	9	44/104
Pedestrians	7	90/104
Pedestrians < 15	3	24/104
Pedestrians 65+	1	78/104
Bicycle	9	60/104
Bicyclist < 15	2	49/104
Composite	66	69/104

Crash Category	FATAL & INJURY CRASHES	OTS RANKING
Speed Related	22	56/104
Nighttime (9:00pm – 2:59am)	17	44/104
Hit and Run	8	64/104

TYPE OF ARRESTS	ARRESTS	OTS RANKING*
DUI Arrests	55	33/104