2020 ITS STRATEGIC PLAN

for the CITY OF Yuma

In coordination with

ADOT

Yuma San Luis Cocopah Welton Somerton Yuma County ADOT YMPO

YUMA COUNTY ARIZONA

CITY OF SOMERTON ARIZONA 1898

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1. Introduction to the ITS Strategic Plan

The City of Yuma is undergoing the development of a City Intelligent Transportation System (ITS) Strategic Plan. This ITS Strategic Plan will help guide the City's investments in ITS to support traffic management, traveler information, incident management, interagency communications, and coordination with regional stakeholders. The plan will provide a phased approach to implement and integrate existing and new ITS infrastructure, systems, and strategies.

This plan explores and propose a framework for the near- and long-term operations and management of transportation investments in the City. The framework also highlights opportunities where other local, county, regional, and state agencies in the Yuma region may partner or contribute to processes, strategies, or projects that could elevate local and regional traffic operations.

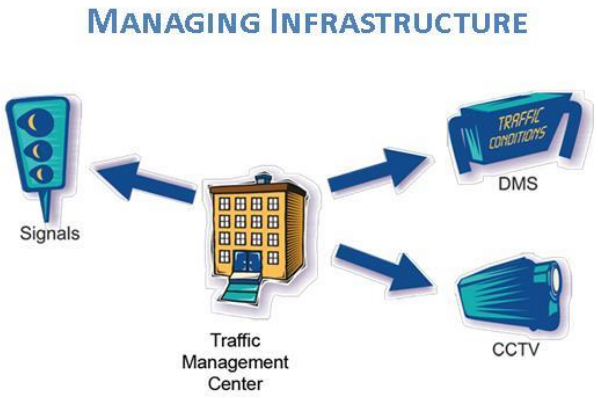
This ITS Strategic Plan is the first phase of a multi-phased effort to define, plan for, and potentially implement advanced traffic management systems and strategies in the City. The ITS Strategic Plan identifies a holistic program of strategies to enable and implement a comprehensive ITS program in Yuma, including infrastructure and systems, policies, programs, staff, and partnerships. To support the City in strategically and efficiently implementing the various strategies, a set of additional, more detailed documents will be developed that identify specific implementation-level details, such as detailed cost estimates or conceptual plans. These more detailed documents will support the City in pursuing funding for implementation, including federal grant funding opportunities that might be available.

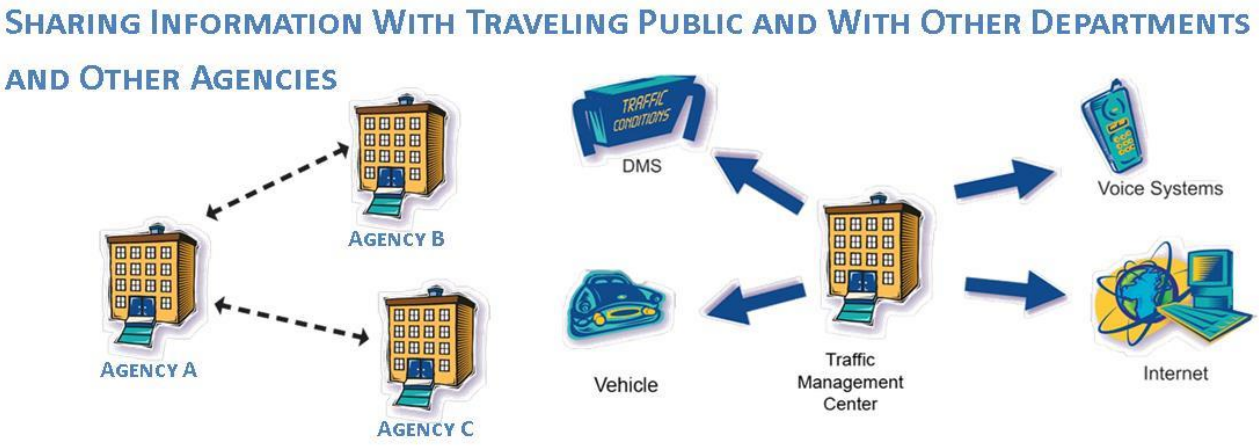
The key project phases of the Yuma ITS Strategic Plan include:

- **Vision and Goals** – Identifies the City vision, goals, and priorities related to traffic operations and management, with a focus on opportunities for transportation technologies and systems.
- **Inventory and Needs** – Identifies and documents existing ITS devices and systems within the region. The document determines gaps in the infrastructure and identifies traffic operations and management needs in the City including some that persist across the region.
- **Integration Recommendations** – Provides general infrastructure integration strategies and high-level phasing. Strategies will include such items as:
  - Projects that need funding to support their implementation, such as device deployment or upgrades to existing equipment.
  - Resources needed to establish a City traffic operations center (TOC) and equipment to maintain the functionality and be able to grow long-term.
  - Opportunities to improve coordination with other agencies in the region along major freeway and arterial corridors for potential regional arterial operations.

2. Introduction to ITS

ITS is a term that encompasses the infrastructure, systems, and data that are used to improve the safety and efficiency of a transportation network. Typical applications of ITS include being able to manage traffic signals and other traffic control devices in real-time from a centralized location, sharing information with travelers and other agencies about the transportation network, and monitoring traffic on corridors and intersections in real-time. Examples of ITS infrastructure includes traffic signals, detection, CCTV cameras, dynamic message signs, and software used to operate and manage the devices.





The foundation of ITS rests on data collection and analysis, and the translation of the data into information. Information helps agencies make decisions on the planning and real-time management of their transportation network, and information is also disseminated to the public to allow travelers to make informed decisions about their trips. It is also shared among agencies to facilitate coordination between agency transportation operations and enable better collaboration for purposes of traffic management, incident management, and future infrastructure planning.

3. ITS Vision and Goals

3.1 City Vision and Goals for ITS

The City of Yuma's vision for ITS is:

Through centralized control of field devices and coordination between transportation agencies, the Yuma region employs advanced traffic operations and provides real-time traveler information to create an efficient and safe transportation network.

City goals for transportation and ITS guided direction and outputs of the ITS Strategic Plan:

- Invest in technology to take transportation system management to the next level and manage the transportation network more effectively, rather than trying to build the way out of congestion.
- Elevate the level of real-time coordination with other agencies for traffic and incident management to provide a consistent and efficient travel experience across municipal boundaries.
- Identify a framework for a TOC that facilitates centralized control of City field devices and provides opportunity to coordinate operations between agencies in the region.

3.2 Regional Vision and Goals for ITS

Stakeholder Input

Meetings were held with the different stakeholder agencies in the region, including the City of Yuma, Yuma County, the City of Somerton, and the Arizona Department of Transportation (ADOT), related to traffic operations and management and transportation technologies. The discussions highlighted the visions and priorities of the individual agencies and helped to form the collective vision for ITS in the region

In general, stakeholders see value in real-time coordination between agencies for traffic management and the use of technology and data to maintain a safe and efficient transportation network. However, the stakeholders identified some additional goals or nuances to the City's goals in relation to ITS:

- Ensure compatibility and functionality of technology to facilitate advanced operations and interoperability.
- Define a multi-agency model for operations and device ownership that is clear, efficient, and logical based on the regional transportation network.
- Deploy technologies that can support multiple functions and responsibilities related to traffic management, performance management, and public information dissemination.

4. Existing Transportation Overview

The Yuma region has seen an increase in population over the last 15 years. The regional economy has a diverse foundation with two major defense facilities, a regional/interstate medical facility, a high-tech agribusiness industry, and a growing industrial sector. The region also hosts more than 60,000 winter visitors annually, according to a recent study conducted by the Arizona Office of Tourism. The Yuma region serves as a gateway to both California and Mexico. State facilities including Interstate 8 (I-8), State Route 195 (SR 195), and State Route 95 (SR 95) all provide important access to these borders and connectivity in the region. Key local facilities, such as 4th Avenue, 16th Street, Avenue B, and 32nd Street are critical for the local movement of people and goods and will experience daily traffic volumes comparable to major regional corridors.

Infrastructure

The City currently operates 77 traffic signals. A majority of City-operated signals are within the western portion of the City, with only 15 signals east of the Marine Corps Air Station (Avenue 3E). **Figure 1** shows existing traffic signals in the region. Additional ITS infrastructure within the City includes the following:

- Currently, all City, County, and Somerton **traffic signals are locally controlled and not connected to a centralized management system via either wireless or fiber backbone** communication networks. City of Yuma does have City fiber infrastructure that connects key City facilities, but not City traffic signals. Figure 1 shows the existing City of Yuma enterprise fiber network.
- **All but two of the existing traffic signals within the City are actuated**, **meaning that they are informed by detection.** The two traffic signals without detection are not actuated, meaning they run on pre-set timing plans, and are located at 3rd Street and Avenue A and 8th Street and Orange Avenue in the north part of downtown, near City Hall.
- Emergency vehicle preemption (EVP) is used to provide emergency response vehicles, such as fire trucks, with priority signal phasing at intersections. **Currently, the City of Yuma has infrastructure to support EVP for City emergency response vehicles at City signals and signals within City boundaries that are owned by Yuma County**.
- **There are no CCTV cameras deployed at intersections, and none of the existing video detectors are connected to a central system**, so there is no real-time intersection monitoring performed in the region.

Table 1 summarizes the existing transportation infrastructure in the City and in surrounding agencies.

Table 1 – Existing Infrastructure by Agency

Device	City of Yuma	Yuma County	ADOT	Somerton	Cocopah
Traffic Signals	77 Signals	22 Signals (one owned by Cocopah)	17 Signals	4 Signals	2 Signals (one maintained by Yuma County)
Communications	None	None	Wireless	None	None
Vehicle Detection	50 Loops 25 Video	16 Loops 6 Video	Loops, Video, or Radar	4 Loops	None
Emergency Vehicle Preemption (EVP)	For City emergency vehicles	At signals within City boundaries	None	None	None

Maintenance and Operations

The City of Yuma Public Works department is responsible for the maintenance of all field equipment, including traffic signals and associated equipment (traffic signal cabinets and controllers, vehicle detection, etc.). There are currently three Traffic Signal Technicians and one Electrician that support maintenance of the City's almost 80 traffic signals. Public Works uses an operating budget to replace and upgrade traffic signal infrastructure as it is deemed necessary. The department has an active program to upgrade three intersections per fiscal year. The project allows the City to bring the infrastructure to current standards and modernize the traffic signal system.

The City of Yuma Engineering department is responsible for the operations of traffic signals in the City. Currently, reviewing and updating signal timing is largely completed in-house by engineering staff.

Table 2 summarizes the existing staff and responsibilities in the City and in surrounding agencies within the region.

Table 2 – Existing Staff by Agency

Staff	City of Yuma	Yuma County	ADOT	Somerton	Cocopah
Signal Technicians	3 Public Works staff	2	3 district staff	Contractor	Maintained by Yuma County
Support/Electrician	1 Electrician	5	-	-	-
Operations	Engineering	Consultant	Supported by statewide staff	City of Yuma Engineering	Yuma County

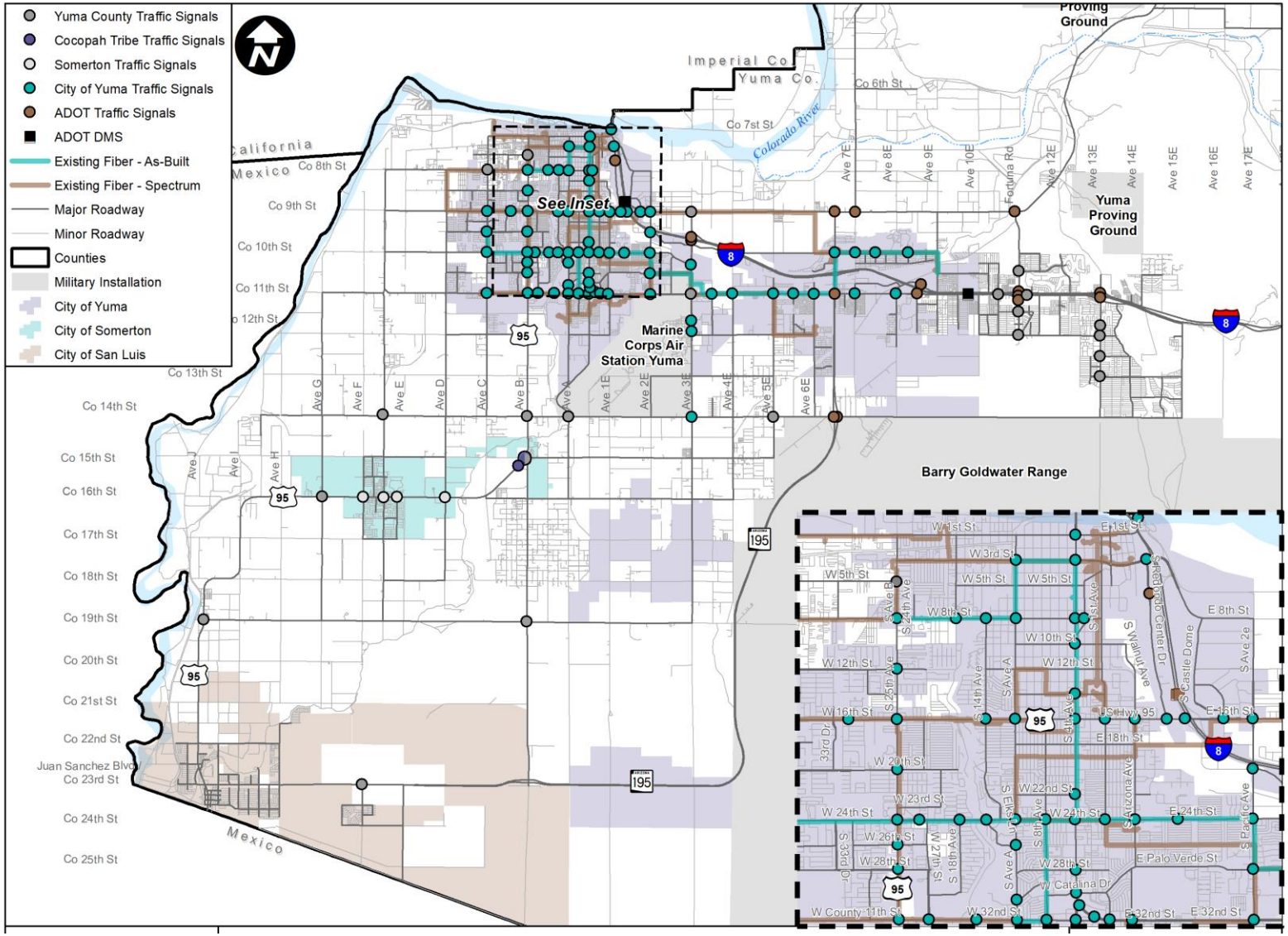


Figure 1 – Existing Traffic Signals

4.1 Funding and Programming

The City of Yuma uses a mixture of several funding sources to fund different types of projects. Many of the construction projects get funded through a combination of federal, state, and local funding sources. These include:

- Highway Safety Improvement Program (HSIP) funds – through YMPO TIP;
- Surface Transportation Block Grant (STBG) funds – through YPMO TIP;
- Highway User Revenue Funds (HURF) – through ADOT; and
- City Road Tax revenue funds – through City CIP.

Currently, the City of Yuma has an operating budget is that is used generally for signals, signing, and pavement marking. The operations budget comes from City road tax and state-allocated Highway User Revenue Funds (HURF). The budget is split between Engineering and Public Works. Field operations and maintenance, as well as any signal timing upgrades, are funded through the Public Works operating budget. Engineering analysis and management is funded through the Engineering budget.

Implementation of many recommended strategies is contingent upon the attainment of additional funding for infrastructure, systems, staff time, and contractor services. Being apprised of funding opportunities and their schedules will allow the City to have time to prepare necessary materials and applications. **Table 3** below shows potential funding opportunities for ITS infrastructure and systems:

Table 3 – ITS Funding Opportunities

Funding Source	Description	Relevant Schedule
YMPO Transportation Improvement Program (TIP)	A regional list of transportation projects selected for local, state, and/or federal funding within with YMPO Yuma County area.	TIP programming covers a period of 5 years.
City of Yuma Capital Improvement Program (CIP)	The City financial plan for local infrastructure improvement projects. Projects included are identified by all City Departments, reviewed by a review committee, and approved by City Council.	CIP programming covers a period of five years, updated each year for the following five-year period.
ADOT Local Public Agency (LPA) Program	A program that allows local agencies to utilize ADOT's on-call services with federal funding. The LPA program follows a four-step process for projects: Planning/Programming; Development/Design; Construction; and Final Acceptance.	The LPA process from planning/program to final acceptance is generally a 40-month to 72-month process depending on the scope of the project.
Development-driven projects	A potential source of project funding is through development driven improvements. Establishing ITS standards for developers to follow within private development projects or half street improvements can aide in the City ITS program buildout.	Infrastructure would be installed as development projects are established.

Funding Source	Description	Relevant Schedule
Federal Funding	Federal funding opportunities are released by the USDOT or other federal agency that can support agencies in planning for, designing, and/or constructing transportation infrastructure investments. Some examples include the Infrastructure For Rebuilding America (INFRA) discretionary grant and Better Utilizing Investments to Leverage Development (BUILD) Transportation discretionary grant. There are also some ITS/technology specific opportunities that area available – some recent examples are the Smart City Challenge, the Advanced Transportation and congestion Management Technologies Deployment (ATCMTD) grant, or the Automated Driving Systems (ADS) grant. Typically, federal funding is acquired by agencies like YMPO or ADOT, with local agencies are partners. Projects that show partnership and cooperation by multiple agencies in a region can elevate the attractiveness of applications for these federal opportunities.	Federal grant opportunities are often dictated by the current transportation legislation that is in place (the FAST Act is the current legislation). Some grants are one-time opportunities, while others occur on a recurring schedule.
State Funding	State agencies, including ADOT, will sometimes have funding available to regions or local agencies to support transportation investments. For example, ADOT's Planning assistance for Rural Areas (PARA) program provided funds to agencies for planning and preliminary scoping for transportation projects. The State Commerce Authority has programs that will support local government investments as they align with economic development and enhanced livelihood; for example, the Arizona Rural Broadband Development Grant makes funds available to act as grant match dollars to leverage additional federal resources to accelerate broadband deployment in underserved areas.	State funding opportunities may be dictated by the current federal legislation in place, while others use sale tax money or other local sources.

4.2 Agency Coordination

The transportation agencies in the region generally partner and coordinate well on transportation-related projects and operations. There are also partnerships with external agencies such as the California DOT (Caltrans) and the US Border Patrol, to support regional transportation.

All stakeholder agencies for this project noted that coordination between agencies for construction closures and detours is done proactively and effectively.

Other examples of traffic-related coordination between agencies or between agency departments are highlighted in

Table 4.

Table 4 – Existing Agency Coordination

Agencies	Coordination Purpose
City of Yuma and Somerton	Starting in 2020, Yuma will provide traffic engineering support to Somerton, including signal timing and other signal operations through an IGA
Yuma County and Cocopah Tribe	Yuma County operates and maintains two traffic signals that are owned by the Tribe along Highway 95 at County 15th Street and at the casino
ADOT and Caltrans	Coordinate for permitting, traffic control, and advanced warning for construction project and for long-term incident closures along I-8 that may have impacts that cross state lines
ADOT and Arizona Department of Public Safety (DPS)	Coordinate to manage incidents on state roadways; A DPS officer sits in the ADOT TOC, which facilitates good communication and information sharing
Somerton and Yuma County	Coordinate for incidents that occur and to implement a detour route for traffic; Somerton Police are included in the coordination to implement the detour
Yuma County Traffic Management Committee	Includes representatives from County Engineering, Public Works, and Sheriff who meet periodically to review issues related to safety and operations, complaints, and suggestions for improvements.
Yuma County and City of Yuma	Coordinate for incidents that require road closures and detours. There is also coordination between the County and the City for EVP equipment on County-owned signals within the City boundaries
Yuma County and ADOT	Coordinate traffic signal operations along the I-8 frontage road and the traffic interchange at Fortuna Road, where an ADOT-owned signal is located between County-owned signals.
Local/District ADOT Staff with ADOT TOC	ADOT TOC assists with incident management on the freeway. Public complaints related to traffic signals are often routed through the TOC and then back to local or district level
ADOT and US Border Patrol	ADOT District coordinates with Border Patrol if a lane or roadway closure impacts the checkpoint on I-8 Eastbound at Milepost 17

5. Needs and Gaps Assessment

This section identifies key needs and gaps related to the existing transportation infrastructure, systems, and processes that this ITS Strategic Plan should address.

> ***Needs*** are being defined as those that were specifically acknowledged by the stakeholder agencies during the inventory and data collection process.
>
> ***Gaps*** are those that identify inconsistencies between the vision and goals for ITS and traffic operations in the region and the existing conditions.

5.1 ITS and Operations Needs

Understanding the different priorities, there were a set of consistent needs for ITS and traffic operations in the region. Stakeholders identified these overarching needs as important for the establishment of a regional ITS Program:

- Upgrading traffic signal infrastructure, including detection, controllers, and cabinets, that are at end of life or not able support advanced operations functions that are desired.
- Standardizing traffic operations infrastructure, including detection, controllers, and cabinets to facilitate maintenance of devices and support compatibility across agencies.
- Determining agency responsibilities for operations and maintenance of traffic signals in the region.
- Identifying programming processes and funding sources that can more quickly and consistently support device replacement, upgrades, and funding for operations.
- Identify funding sources and programming processes for capital investments related to ITS and communications.
- Conducting outreach and education to elected/public officials and the public to garner support for the use of more advanced technologies (such as intersection cameras) to support regional transportation operations.

5.2 Gaps Related to ITS and Operations

The following are gaps in infrastructure and traffic operations and management that will need to be addressed to fully achieve the ITS vision and goals:

- No ability to remotely access and centrally manage traffic signals and associated infrastructure in real-time.
- Lack of availability of real-time data at traffic signals that support day-to-day operations and emergency response as well as planning for operations.
- Limited agency procedures and processes (between departments within an agency and between different agencies) for coordination and joint decision making for day-to-day transportation operations.
- It is not clear if existing staff have the capacity and skill sets to support operations and maintenance of advanced traffic operations strategies, infrastructure, and systems.

6. Method for Strategy Development

Recommendations Based on Needs and Gaps

The needs and gaps are the basis for identifying recommended strategies that the City can pursue to make progress towards achieving their vision. Strategies include not only infrastructure and capital-based projects, but also consider improvements to or implementation of processes, partnerships, and other non-capital investments that will be important to creating a foundation for elevated traffic management and operations in the City.

ITS recommendations for the City of Yuma are organized into four categories:

- Infrastructure Strategies
- Program, Planning, and Policy Strategies
- Data Strategies
- Partnering Opportunities

While most of the strategies outlined for the City's ITS Program will likely be led by the Engineering department at the City, many of them will require coordination and partnerships with other departments or other agencies to successfully implement and sustain. There are also opportunities for ITS strategies to be expanded beyond City borders to provide inter-agency traffic operations benefits, understanding that the expectations of the traveling public related to traffic operations does not stop at or account for jurisdictional borders. The internal and external partnering opportunities are highlighted in the strategy summary tables in this document.

6.1 Priority Corridors

Many infrastructure strategies will be recommended for phased implementation, allowing the City to make feasible and smart investments over time. The recommended phasing is largely based on priority transportation corridors in the City, which are those corridors that carry the greatest amount of traffic and/or provide access to major activity areas or destinations in the City. Some of the priority corridors are also regional priority corridors that are important to regional travel between communities and between major regional destinations and attractions.

Figure 2 identifies the City priority corridors. The corridors are categorized as primary and secondary corridors. In the subsequent sections, the strategy descriptions identify when it is recommended that proposed devices and communications infrastructure should be first deployed along primary priority corridors, over time continue to be deployed along secondary corridors, and eventually to all signalized intersections in the City. The regional corridors identified in **Figure 3** show corridors that require coordination between agencies to be able to implement specific infrastructure strategies.

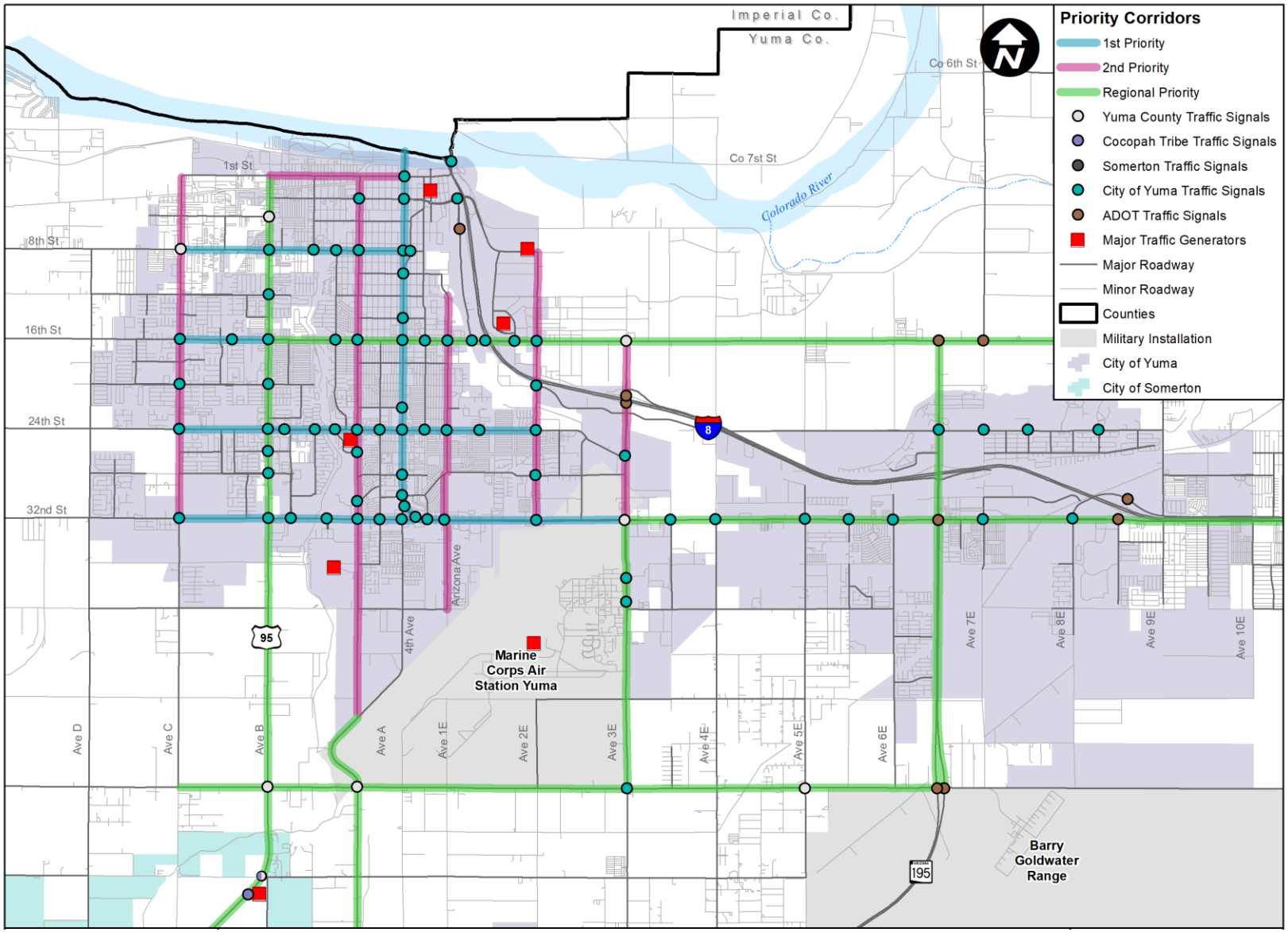


Figure 2 – City Priority Corridors for Transportation Operations

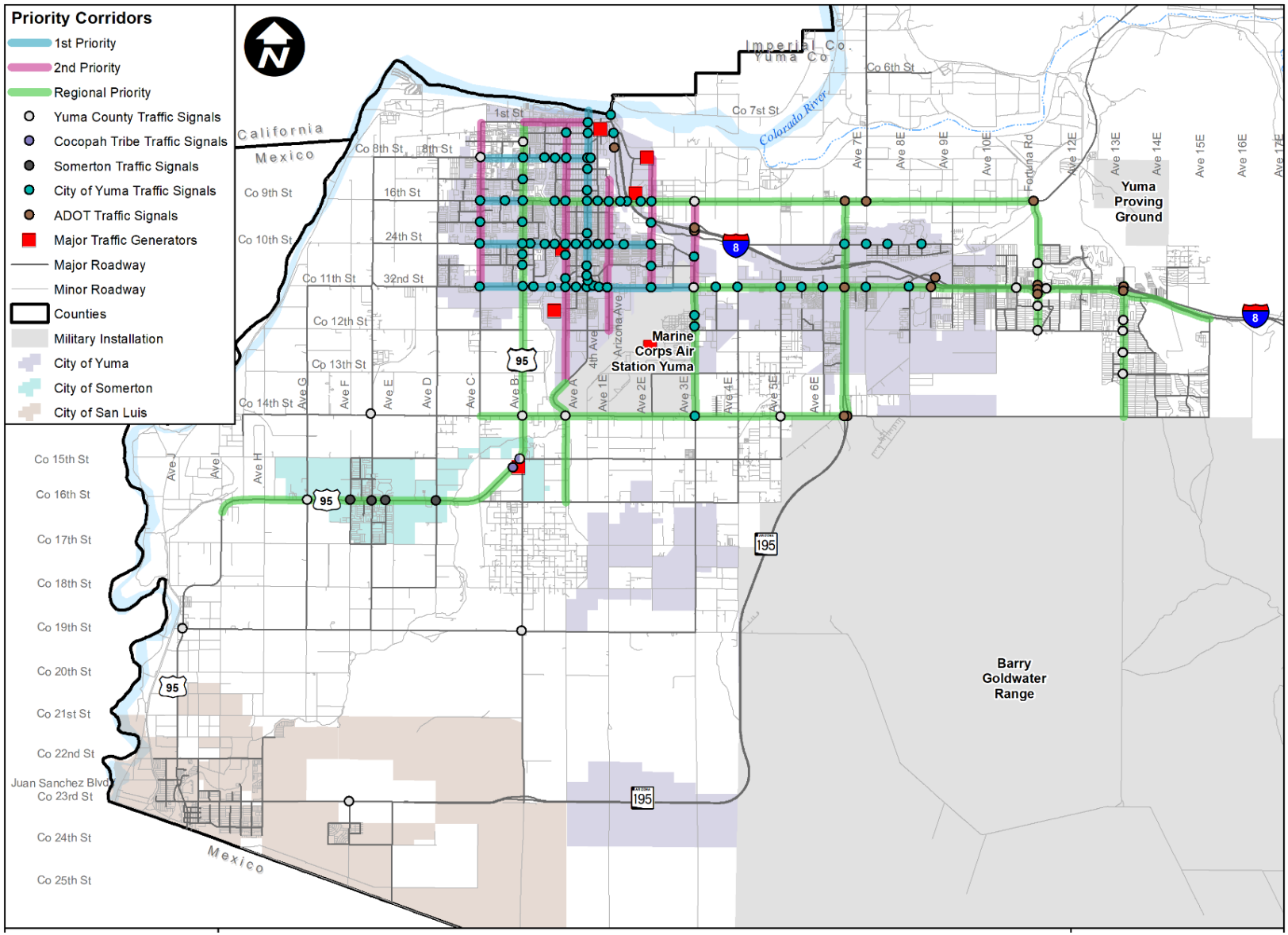


Figure 3 – Regional Priority Corridors for Transportation Operations

7. Infrastructure Strategies

This category recognizes the physical ITS and communications infrastructure that needs to be put in place or connected to build out an ITS program. Currently, the City has traffic signals and some associated infrastructure, such as traffic signal cabinets and controllers, vehicle detection, and emergency pre-emption devices. In order to take traffic management and operations to the next level in the City, there are two major infrastructure buildout strategies that will require significant investment:

1. Deploying transportation communications equipment, (fiber or wireless devices) along key corridors to connect traffic signals to a centralized management system; and

2. Establishing centralized management of ITS infrastructure to provide remote, real-time traffic monitoring and management capabilities.

These two major investment areas are described in the proceeding section. **Figure 4** depicts the relationship between the recommended infrastructure strategies and the sequence in which they should be pursued. Error! Reference source not found. summarizes the recommended infrastructure strategies.

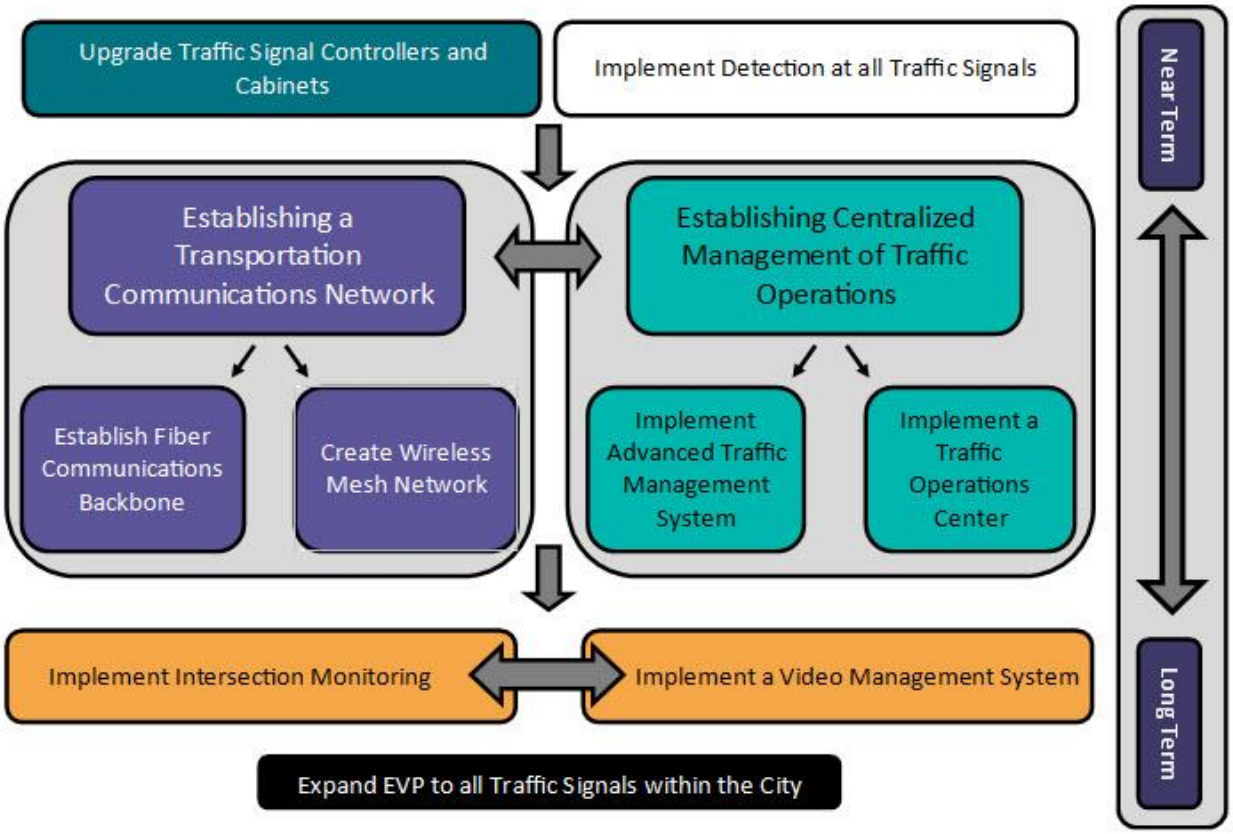


Figure 4 – Relationship and Sequence of Recommended Infrastructure Strategies

Table 5 – Infrastructure Strategies Summary

Infrastructure Strategies	Description	Benefits	Roles and Responsibilities
Establish a Transportation Communications Network	Deploy communications infrastructure, including a fiber backbone and a supportive wireless mesh network to connect traffic signals, other ITS devices, and key City facilities to provide centralized management.	Communications infrastructure allows for real time monitoring and remote operation of signals and for the collection and exchange of data amongst City facilities.	Requires Coordination with: IT
Implement a Traffic Operations Center	A TOC would provide a centralized location where an operator can remotely monitor and manage traffic operations in the City. All ITS systems and software servers will be housed in a location and will be connected to field devices via transportation fiber. Operators are able to access systems to collect data and send back out data or commands from a remote location.	A TOC will allow for remote, real-time management of traffic operations, including incident response, work zone management, and dissemination of traveler information. It can also support increased collaboration on real-time decision making and implementation of operational strategies.	Requires Coordination with: IT and potentially Police Provides opportunity for partnering with other regional agencies.
Implement an Advanced Traffic Management System (ATMS)	An ATMS centralizes collection of data for all traffic signals that are connected to communications and creates a user interface for remote access to and control of traffic signals and other ITS equipment.	An ATMS provides a centralized user interface for the City to remotely monitor and operate the traffic signals once they are connected. Functions of an ATMS may include equipment monitoring and connectivity, monitoring of signal timing and phasing, and collection and reporting on various performance measures related to signal operations.	Requires Coordination with: IT Provides opportunity for partnering with other regional agencies.
Upgrade Traffic Signal Cabinets and Controllers	Use traffic signal cabinets and controllers that enable traffic operations and management functions that the City envisions but may not currently use. Cabinets should have enough space to accommodate additional devices, including connections to a transportation communications network. Traffic signal controllers should support advanced traffic signal operations inputs and data, such as use of adaptive signal control or collection of turning movement count.	In addition to allowing better functionality of other infrastructure, updated cabinets and controllers will work more efficiently and provide the ability for the ITS capabilities at signals to grow beyond planned upgrades.	Requires Coordination with: Traffic Signal Group and external regional agencies
Implement Detection at all Traffic Signals	The City may need to add, upgrade, or replace some existing detection for more advanced traffic operations, such as bicycle detection or the collection of turning movement counts. The City should continue to evaluate new detection technologies as they emerge to make sure that they invest in equipment that enables advanced ITS and data capabilities that the City wants to pursue.	Detection at all traffic signals provides data to support decision-making on real-time traffic signal operations, as well as provide additional data on corridor volumes, queue length, and speed of vehicles.	Requires Coordination with: Traffic Signal Group

Infrastructure Strategies	Description	Benefits	Roles and Responsibilities
Implement Intersection Monitoring	Deploy intersection monitoring (CCTV or VIDs) at signalized intersections or other areas with significant traffic volumes or delays to provide the ability to remotely monitor intersection operations and support improved incident identification and response.	Images from CCTV supports a multitude of real-time operational responses. Images can be useful for data analysis of traffic conditions in response to incidents, events, or other non-recurring congestion. They can also be useful, under appropriate legal circumstances, for public safety to utilize in an investigation or surveillance situation where CCTVs monitoring travel lanes also happen to capture image of public safety incidents.	Requires Coordination with: IT and Police Provides opportunity for partnering with other regional agencies.
Implement a Video Management System	A video management system is the central management system that will allow for centralized management of cameras (if they provide pan-tilt-zoom capabilities) and access to real-time camera feeds.	Unlike detection and communications that can provide some benefits without active management by a staff member, the benefits of CCTVs are based on the availability of a staff member to view, in real time, and utilize the information gathered by actively managing them from a central location. City Police can be given access to the feeds to support incident identification and response after the TMC is in operation	Requires Coordination with: IT and Police Provides opportunity for partnering with other regional agencies.
Expand EVP to all Traffic Signals within the City	The City should make sure that key corridors in the City are completely outfitted with EVP, including at traffic signals that are own or operated by another agencies. The City should continue upgrading their EVP network to be GPS-based.	EVP directs the traffic signal to allow an emergency vehicle to pass through the intersection safely. This improves safety at intersections and reduces the number of stops and delays that the emergency vehicle encounters along its route to/from an incident or emergency situation.	Requires Coordination with: Fire, Traffic Signal Group, and external regional agencies

7.1 Establish a Transportation Communications Network

The City of Yuma does not currently have a communications network associated with Engineering or Public Works. At one time, the City did have a centralized traffic management system to which their traffic signals were connected, but that system has not been in place in many years and the infrastructure and systems are no longer viable.

The City Engineering Department and IT Department, along with other regional entities, are currently embarking on a Regional Fiber Master Plan to determine expansion of fiber communications throughout the region, as well as agreements and processes for installing and maintaining that network. This plan will not identify or include plans for detailed fiber routes nor any connections to traffic signals. However, the City IT department has a vision for what the future fiber ring topology should look like. **Figure 5** shows this City desired proposed fiber ring topology.

To be able to implement many of the infrastructure strategies that are proposed, the City will need to establish a detailed communications network beyond what is shown in **Figure 5** through the development of a Telecommunications Plan. The Telecommunications Plan differs from the Regional Fiber Master Plan because it will specify additional backbone rings or fibers required in addition to other City owned fiber and will identify branch cables or wireless communications to connect all traffic signals to the system. Because the City currently has no dedicated transportation telecommunications, it will be important for the City to have some working knowledge of various aspects of telecommunications (types of devices, configuration of devices, bandwidth considerations, etc.) in order to make informed decisions when pursuing or deploying strategies.

The Telecommunications Plan will need to identify configuration recommendations, the ultimate buildout of the telecommunications network, and near-term connectivity solutions to address.

A Telecommunications Plan should achieve the following objectives:

- *Create network connectivity* – by providing a connection to transportation infrastructure;
- *Increase network connectivity* – by growing geographically to cover a greater percentage of the City;
- *Increase bandwidth capacity* – by balancing the wireless-to-fiber optic cable deployment where bandwidth is needed in the City;
- *Reduce network latency* – by minimizing the number of wireless hops needed within the network; and
- *Increase network reliability* – by achieving the above four objectives, the network will be reliable as the telecommunications infrastructure and capabilities expand.

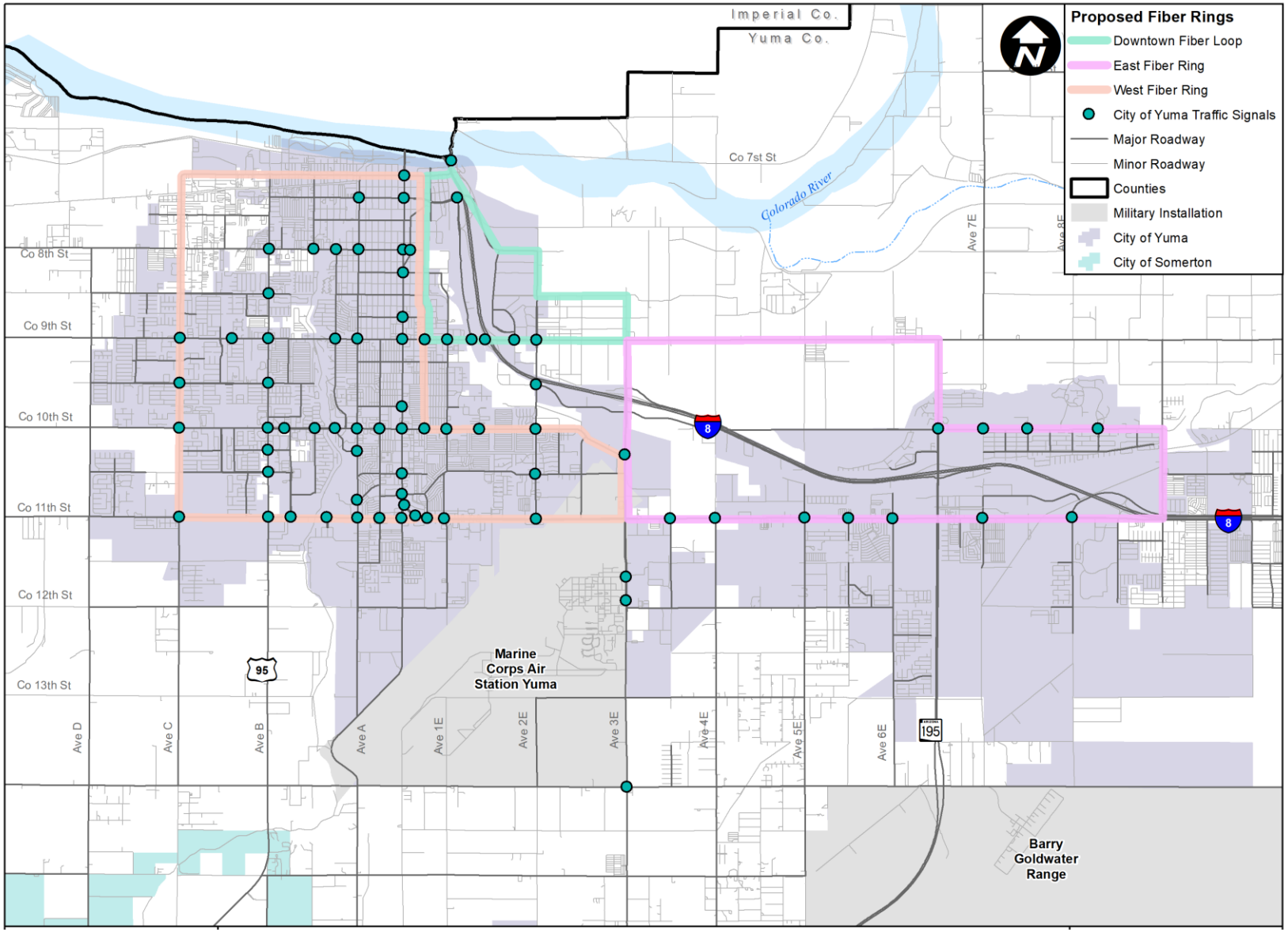


Figure 5 – City Future Fiber Network Plan

7.2 Establish Centralized Traffic Management

Given the size of the City of Yuma's transportation network and number of traffic signals, there could be significant benefits to traffic operations if the City Engineering staff had the ability to remotely monitor and operate traffic signals and other ITS devices in real-time. The communications build-out that was recommended in the previous strategy is a key step towards facilitating this real-time management capability. However, once the signals and devices are connected, the City will need a way to view the data coming in from the infrastructure that should centralize all of the data and information coming from the field devices.

Advanced Traffic Management System (ATMS)

An ATMS system is a central management system for traffic signal equipment. The ATMS system will provide a graphical user interface to allow someone to view data or status of field infrastructure and allow that person to remotely operate and make changes to the infrastructure settings. An ATMS system will also provide centralized data collection and storage.

Traffic Operations Center

The City has a desire to establish a Traffic Operations Center (TOC) to be able to centralize controls of the future ATMS system. Additionally, the TOC can be used to monitor traffic during incidents or work zones or used to observe traffic patterns to adjust signal timing. A TOC allows the City to remotely make those signal timing changes and reduces delay in responding to citizen complaints as it pertains to signal operations. The City may consider building out the TOC to

A Concept of Operations for a TOC will:

- Describe the desired TOC functions and how the TOC will operate from an agency perspective
- Establish a set of requirements that determine the overall size and type of TOC the City would like to implement and the type of functions and equipment and systems they would like included
- Include operational processes for daily operations of the TOC and roles and responsibilities
- Identify training and ongoing operations and maintenance needs of the TOC and its staff

accommodate the possibility for future expansion if other agencies decide to join in the operations.

To establish a TOC, it is recommended that the City first develop a Concept of Operations. This will describe the characteristics for the proposed TOC and what the desired capabilities and objectives are. It will include enough detail to develop a bid package for construction and implementation at a later time.

8. Program, Planning, and Policy Strategies

This category includes systems to implement in order to utilize and maximize the functionality of the physical ITS and communications infrastructure of an ITS program. The recommended systems include standard operating procedures, device standards, training, and scheduled programs.

These system strategy recommendations are described in the proceeding sections. **Table 6** summarizes the recommended program, planning, and policy strategies.

Table 6 – Program, Plans, and Policy Strategies Summary

Infrastructure Strategies	Description	Benefits	Roles and Responsibilities
Create/Update ITS and Communications Approved Product List	Develop a standard list of ITS devices that provide the functionalities desired by the City ITS program and are compatible with other City infrastructure and systems. Include ITS devices as part of traffic signal design standards, where possible.	Standardization improves interoperability of the system and makes sure that all devices provide the functionalities that the City desires. It will also increase maintenance efficiency, as there are fewer variations in the types of devices that need to be maintained and thus fewer maintenance practices to learn. It will also reduce the variation in device inventory that needs to be available.	Requires Coordination with: IT Provides opportunity for partnering with other agencies.
TOC Standard Operating Procedures	Develop standard operating procedures (SOPs) for the TOC and for the use of ITS devices by City staff.	SOPs will document processes and expectations for TOC and device/ system use so that they are agreed-upon and not contingent on the presence of specific individuals. SOPs will also help delineate roles and responsibilities for operations in the City to allow for the most coordinated and efficient operations.	Requires Coordination with: IT and potentially Police Provides opportunity for partnering with other agencies.
Road Closure Playbook	Collaborate with other City (and potentially other agency) traffic and public safety staff to identify and document agreed upon processes for coordinating on and responding to unplanned events that impact traffic on City roadways.	Having pre-determined plans and set notification procedures will allow the City to act faster and in a more coordinated manor in the case of an incident that disrupts traffic operations on City streets. This can help improve incident response and clearance times, improve safety at the scene and on the rest of the network, and	Requires Coordination with: IT and Police Provides opportunity for partnering with other agencies.

Infrastructure Strategies	Description	Benefits	Roles and Responsibilities
		improve traffic operations along impacted routes.	
Formalize Signal Timing Program	Develop and document City traffic signal timing standards and put into place a program that provides staff time and funding to periodically evaluate, and update as necessary, traffic signal timing along key corridors.	Optimizes traffic flow along the corridor based on current conditions. Reduces citizen complaints about red lights. Makes sure that key corridors within the City continue to operate efficiently as traffic increases or travel patterns change.	Requires Coordination with: IT, Police, and external agencies
Maintenance and Lifecycle Management Program	Formalize an asset and maintenance tracking program for new TOC equipment and for all ITS devices and systems. The program should identify expectations for maintenance and lifecycle planning and identify funding streams and staffing to support maintenance and replacement of equipment.	Allows for proactive lifecycle and maintenance planning for ITS Program to identify funding (including external funding opportunities) before device/system end of life	Requires Coordination with: IT and Traffic Signal Group
Operations and Maintenance Training	Identify and create opportunities for training staff on ITS, including for specific devices and systems, but also for operational strategies, such as traffic signal timing, traffic incident management, or technician training.	Providing staff with proper training will allow them to most efficiently and effectively operate and maintain the ITS program, resulting in the most effective traffic operations and maintenance processes.	Requires coordination with Public Works Provides opportunity for partnering with other agencies

9. Data Strategies

A primary benefit to ITS devices and systems put in place is the data that it captures and the information that data can provide. Data can provide situational awareness where there was none before and analysis tools and evaluation metrics that can be used to support decision-making and cost-savings. Data can be used for long-range planning and before-and-after analysis to determine successes and failures associated with growth and development.

New data is growing in scale and breadth as the transportation environment moves toward a Connected Vehicle environment. Data is quickly becoming a driver both locally and nationally for decision-making, and it is in the best interest of this ITS Strategic Plan to acknowledge that the ITS Program can provide a wealth of data to support mobility, efficiency, and economic and community drivers that the City is moving toward.

The key advancement suggested in the Data Strategies is the intentional use of data to support real-time decision-making, investment strategies, and public information dissemination. Error! Reference source not found. summarizes the recommended data strategies.

Table 7 – Data Strategies Summary

Infrastructure Strategies	Description	Benefits	Roles and Responsibilities
Data and Performance Tracking and Reporting – Internal and External	Create a plan to collect, share, track, and report on data and/or performance measures related to traffic operations and ITS. Data can support operational decision making and can be turned into information that can be shared to show the impacts of the ITS Program The City should make a performance report available to the public to show impacts of the City's investments in the transportation system and support public education related to ITS and traffic operations.	Tracking and reporting on data and performance measures will support City departments in sharing data and information and will allow City staff to see how they are progressing towards specific goals or how the City's transportation system is performing over time	Requires Coordination with: IT Provides opportunity for partnering with other regional agencies.
Traveler Information	Building off of the data and performance measure strategy, the City should consider ways to provide travelers with real-time traffic condition information.	Information on traffic conditions allows travelers to make trip planning and route determination decisions, which would support reduced congestion in the City. It will also be a highly visible City service to show that the City is using its resources to support its residents and visitors in ways that no other City is doing so.	Requires Coordination with: IT, POI, and Police Provides opportunity for partnering with other regional agencies.

10. Next Steps

10.1 Implementing the Plan

This ITS Strategic Plan identifies recommended strategies to consider based on the needs at the City. Many of the recommended strategies will require more resources, including funding, staff time and changes to institutional structures or processes in order to implement.

- A Traffic Management Center Concept of Operations will provide more details on the proposed TMC. The document will identify key user needs, detail out the desired functions and operational scenarios, identify key staff roles and responsibilities, and put forth some specific requirements to help pursue a TMC.
- An ITS Deployment Plan will identify the institutional foundation to successfully implement the ITS strategies. It will outline a 10-year implementation plan including summaries of costs, recommended staffing levels, and other key procedural items critical to implement the strategies.

10.2 Updating the Plan

This ITS Strategic Plan is a dynamic plan. To remain up-to-date and relevant amid constantly changing needs and evolving technologies, this Plan should be revisited and reviewed periodically as projects are implemented or expanded, agency priorities change, or other changes occur in the City, State, or at the federal level that impact ITS. **Table 8** are the proposed triggers for revisiting and updating specific components in the ITS Plan.

Table 8 – Proposed Triggers for Updating the ITS Plan

Trigger to Update	Update
Prior to the City CIP call for projects/budget items or YMPO TIP call for projects	Review ITS Recommended and Strategies for potential CIP/TIP projects and links to other departments/agencies to leverage the request for funding
After adoption of City CIP and budget	Update ITS Plan document
After approval of YMPO TIP	Review strategies and prioritization recommendations for updates needed based on recent projects included into YMPO TIP

Some key components of the plan that should be revisited during these updates include:

- GIS Maps – Keeping the infrastructure maps in this Plan up to date will help not only track progress and provide strategic direction, but will be useful as a repository for data. All ITS data, including as-builts, should be aggregated in a centralized location and should be updated as infrastructure and data becomes available. For the ITS Plan, locations of traffic signals, communications infrastructure and other ITS devices that were identified in the Plan should be kept up to date and accessible by City departments and external agencies who request it.
- Priority Strategies – A list of strategies are provided in this Plan, but new, revised, or updated strategies based on the success of strategy implementation should be documented and the next steps for strategy implementation should be identified.

Appendix A

ITS Vision and Needs Assessment Technical Memorandum

2020 ITS STRATEGIC PLAN

for the CITY OF Yuma

In partership with

ADOT

Yuma San Luis Cocopah Welton Somerton Yuma County ADOT YMPO

YUMA COUNTY ARIZONA

CITY OF SOMERTON ARIZONA 1898

Prepared by

Kimley»Horn

ITS Vision and Needs Assessment

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1. Project Overview

The City of Yuma is undergoing the development of a City Intelligent Transportation System (ITS) Strategic Plan. This ITS Strategic Plan will help guide the City's investments in ITS to support traffic management, traveler information, incident management, interagency communications, and coordination with other agencies in the region. The plan will provide a phased approach to implement and integrate existing and new ITS infrastructure, systems, and strategies.

1.1 Project Purpose

This plan will explore and propose a framework for the near- and long-term operations and management of transportation investments in the City. The framework will also highlight opportunities where other local, county, regional, and state agencies in the Yuma region may partner or contribute to processes, strategies, or projects that could elevate local and regional traffic operations.

This ITS Strategic Plan is the first phase of a multi-phased effort to define, plan for, and potentially implement advanced traffic management systems and strategies in the City. Upon completion of this ITS Strategic Plan, an ITS Deployment Plan will be developed to more specifically define recommended projects and propose a plan to implement them over time. The ITS Strategic Plan and the ITS Deployment Plan could be used as inputs to prepare potential grant applications for the City, or the larger region, to pursue funding for infrastructure implementation.

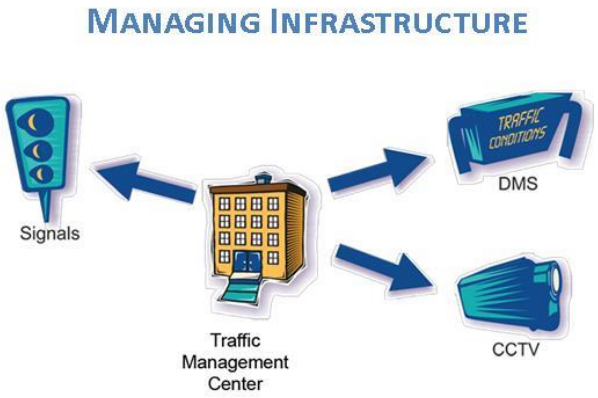
1.2 ITS Strategic Plan Process

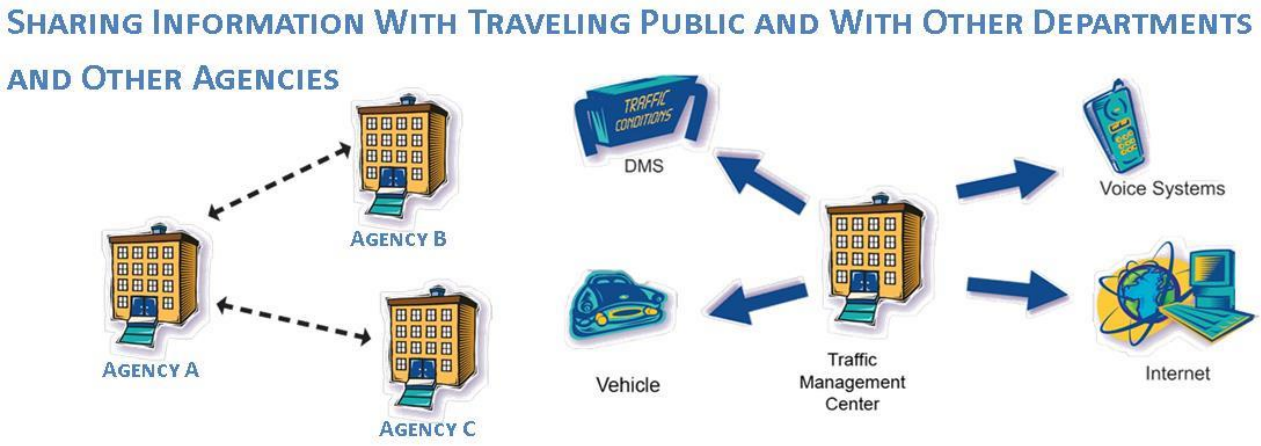
The key project phases of the Yuma ITS Strategic Plan include:

- **Vision and Goals** – Identifies the City vision, goals, and priorities related to traffic operations and management, with a focus on opportunities for transportation technologies and systems. This task also identifies some of the visions and goals of individual stakeholders in the region related to traffic operations and, specifically, any opportunities to coordinate or pursue joint operations.
- **Inventory and Needs** – Identifies and documents existing ITS devices and systems within the City and the Yuma region. This task also highlights existing and near-term projects for the City and other agency stakeholders that could support future ITS in the region. The inventory also explores documents such as agreements or trainings and identifies existing processes in place to coordinate with other agencies, program projects, and track and maintain transportation technology assets. The document determines gaps in the infrastructure and identifies traffic operations and management needs in the City including some that persist across the region.
- **Integration Recommendations** – Provides recommendations for infrastructure and non-infrastructure strategies that address needs and gaps. Strategies will include such items as:
    - Projects that need funding to support their implementation, such as device deployment or upgrades to existing equipment.
    - Resources needed to establish a City traffic operations center (TOC) and equipment to maintain the functionality and be able to grow long-term.
    - Opportunities to improve coordination with ADOT freeway operations and along major corridors for potential regional arterial operations.

2. Introduction to ITS

ITS is a term that encompasses the infrastructure, systems, and data that are used to improve the safety and efficiency of a transportation network. Typical applications of ITS include being able to manage traffic signals and other traffic control devices in real-time from a centralized location, sharing information with travelers and other agencies about the transportation network, and monitoring traffic on corridors and intersections in real-time. Examples of ITS infrastructure includes traffic signals, detection, CCTV cameras, dynamic message signs, and software used to operate and manage the devices.





The foundation of ITS rests on data collection and analysis, and the translation of the data into information. Information helps agencies make decisions on the planning and real-time management of their transportation network, and information is also disseminated to the public to allow travelers to make informed decisions about their trips. It is also shared among agencies to facilitate coordination between agency transportation operations and enable better collaboration for purposes of traffic management, incident management, and future infrastructure planning.

3. ITS Vision and Goals

Setting a vision for ITS in the Yuma region helps identify the conditions that the region is striving to reach and, when compared to the current state, allows identification of the strategies and projects that will be most relevant and effective towards reaching that vision. The vision and

goals look to reflect input from the City of Yuma and the stakeholders within the wider Yuma region.

3.1 Stakeholder Input

Meetings were held with the different stakeholder agencies in the region, including the City of Yuma, Yuma County, the City of Somerton, and the Arizona Department of Transportation (ADOT), related to traffic operations and management and transportation technologies. The discussions highlighted the visions and priorities of the individual agencies and helped to form the collective vision for ITS in the region. The meetings included a joint kickoff meeting with all of the partner agencies to introduce the ITS Strategic Plan process and discuss, as a group, some key needs and opportunities for transportation in the region. Additionally, a series of agency-specific meetings were held to dive deeper into the goals, priorities, and needs of specific agency partners.

3.2 City Vision and Goals for ITS

The City of Yuma's vision for ITS is:

Through centralized control of field devices and coordination between transportation agencies, the Yuma region employs advanced traffic operations and provides real-time traveler information to create an efficient and safe transportation network.

A set of City goals will help drive the direction and outputs of the ITS Strategic Plan:

- Invest in technology to take transportation system management to the next level and manage the transportation network more effectively, rather than trying to build the way out of congestion.
- Work with partner agencies to elevate the level of real-time coordination for traffic and incident management to provide a consistent and efficient travel experience across municipal boundaries.
- Identify a framework for a TOC that facilitates centralized control of field devices and coordination between agencies while allowing each agency to maintain ownership of their infrastructure.

3.3 Regional Vision and Goals for ITS

In general, stakeholders sees value in real-time coordination between agencies for traffic management and the use of technology and data to maintain a safe and efficient transportation network.

However, the stakeholders identified some additional goals or nuances to the City's goals in relation to ITS:

- Ensure compatibility and functionality of technology to facilitate advanced operations and interoperability.
- Define a multi-agency model for operations and device ownership that is clear, efficient, and logical based on the regional transportation network.
- Deploy technologies that can support multiple functions and responsibilities related to traffic management, performance management, and public information dissemination.

4. Existing Transportation Overview

The Yuma region has seen an increase in population over the last 15 years. The regional economy has a diverse foundation with two major defense facilities, a regional/interstate medical facility, a high-tech agribusiness industry, and a growing industrial sector. The region also hosts more than 60,000 winter visitors annually, according to a recent study conducted by the Arizona Office of Tourism. The Yuma region serves as a gateway to both California and Mexico. State facilities including Interstate 8 (I-8), State Route 195 (SR 195), and State Route 95 (SR 95) all provide important access to these borders and connectivity in the region. Key local facilities, such as 4th Avenue, 16th Street, Avenue B, and 32nd Street are critical for the local movement of people and goods and will experience daily traffic volumes comparable to major regional corridors, as shown in **Figure 1** depicting 2015 average daily traffic (ADT) volumes in the region.

This section provides an overview of the existing facilities and the transportation network in the Yuma region, including the existing state of ITS deployment. It also considers processes and coordination that is in place to support transportation operations and maintenance. Understanding the existing state of ITS and transportation as it compares to the conditions described in the vision and goals will help uncover key needs and gaps that need to be addressed.

4.1 Transportation Technologies and ITS

Traffic Signals

The City currently operates 77 traffic signals. A majority of City-operated signals are within the western portion of the City, with only 15 signals east of the Marine Corps Air Station (Avenue 3E). Additional traffic signals in the Yuma region being considered in this ITS Strategic Plan are operated by: Yuma County (22 signals), Somerton (four signals), and ADOT (17 signals).

ADOT signals primarily serve traffic interchanges on I-8 and SR 195, though three of the signals operated by ADOT are on the principal arterial SR 95, north of I-8.

Figure 2 shows the existing traffic signals within in the region.

Communications

Currently, all City, County, and Somerton traffic signals are locally controlled and not connected to a centralized management system via communications. Two ADOT traffic signals in the region, I-8/Fortuna Road and I-8/Foothills Boulevard are connected to the ADOT central system via cellular communications.

City of Yuma does have non-transportation related fiber infrastructure that connects key City facilities. **Figure 3** shows the existing enterprise fiber and key facilities within city of Yuma. Though the fiber does not currently connect to City of Yuma traffic signals, 56 of the 77 City-operated signals are on an existing fiber path.

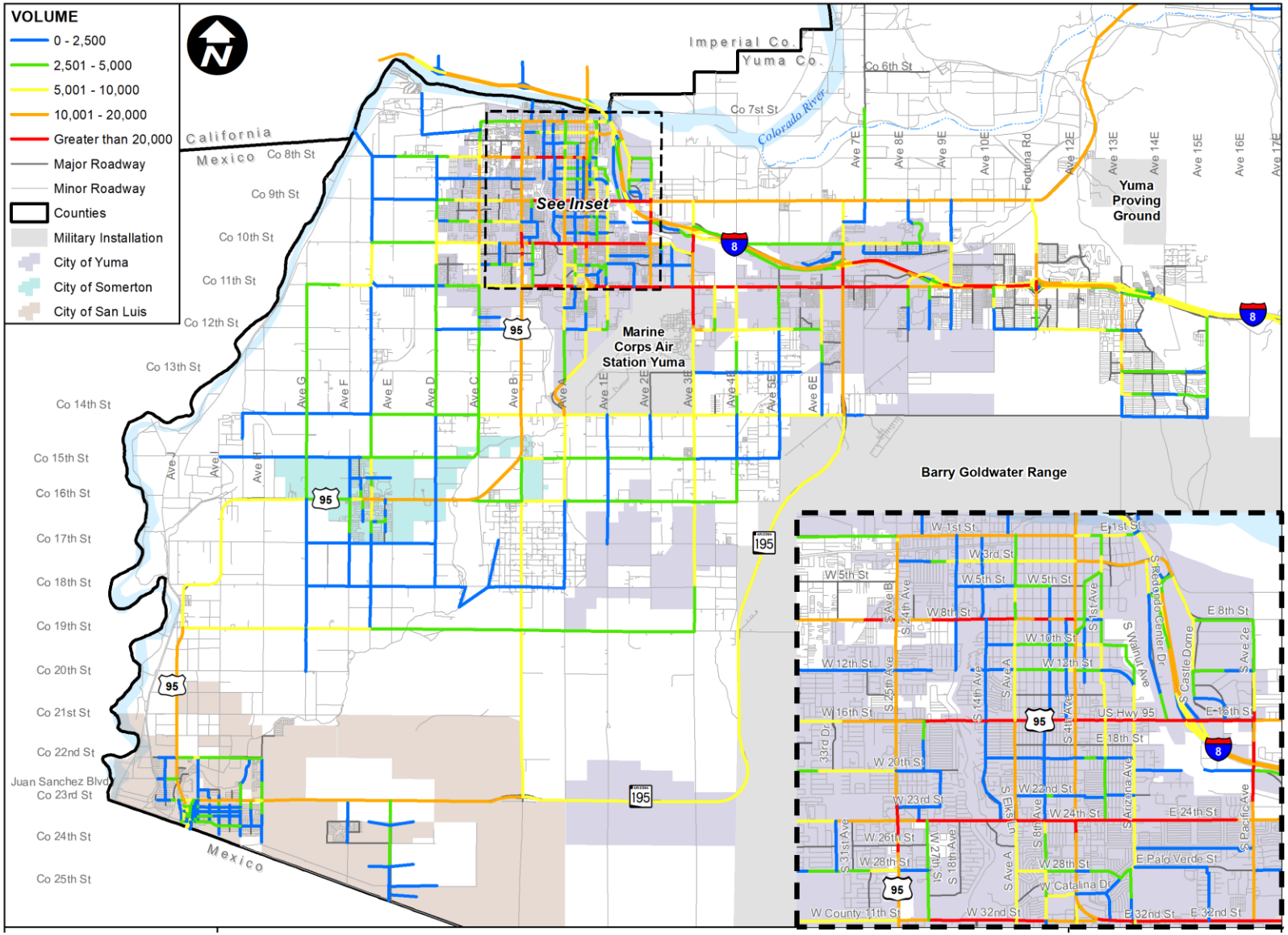


Figure 1 –Traffic Volumes (2015)

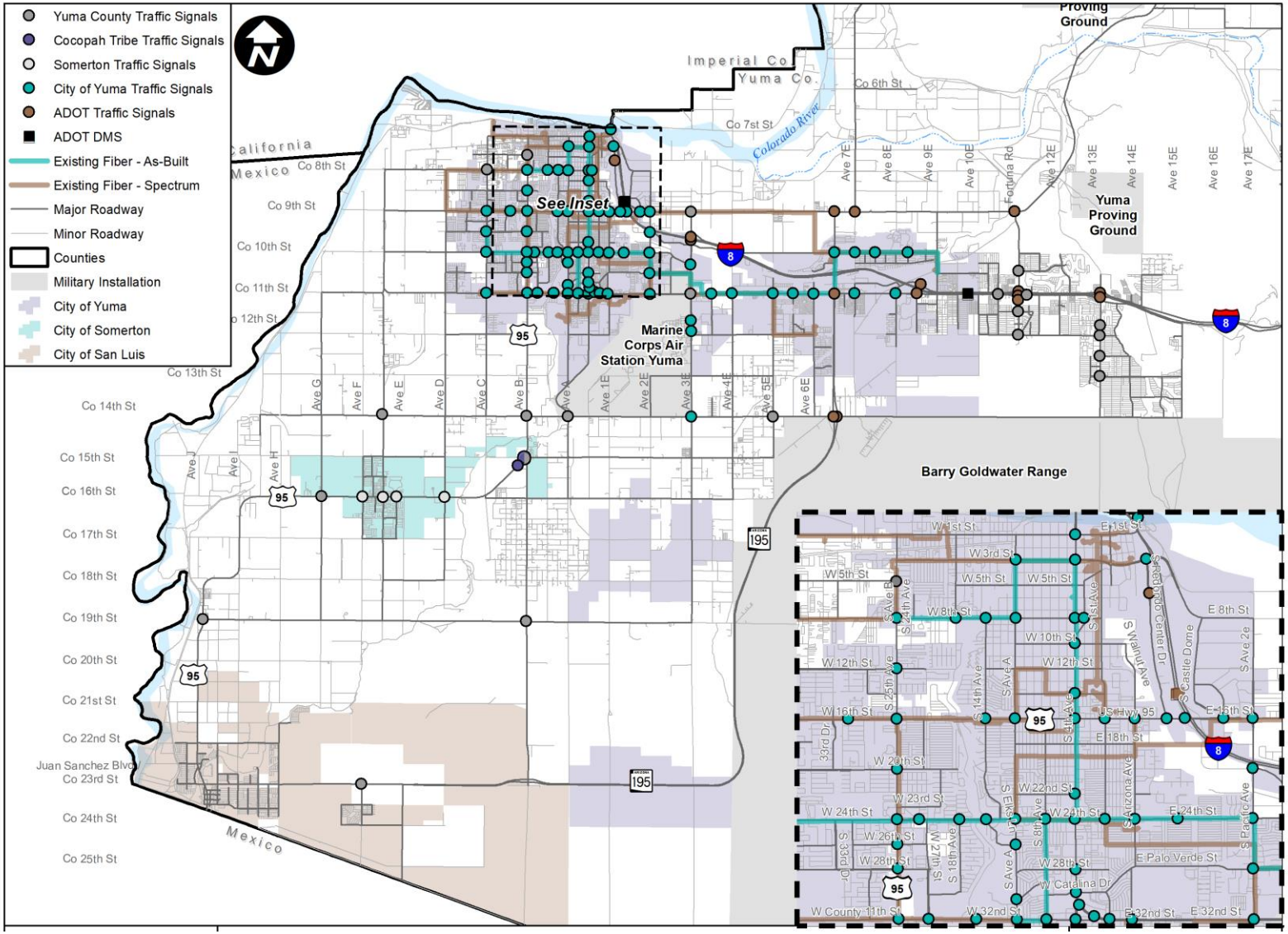


Figure 2 – Existing Traffic Signals

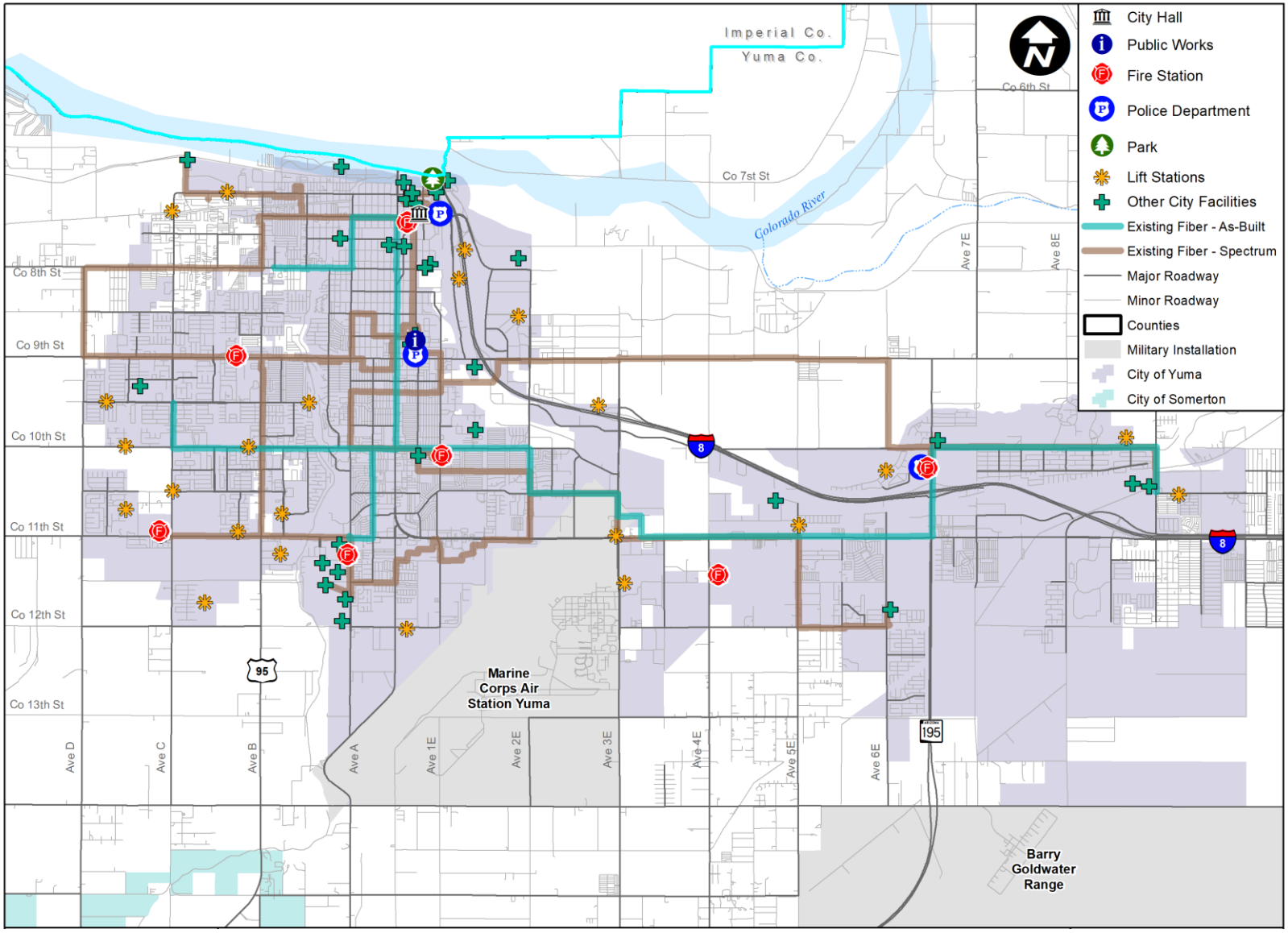


Figure 3 – City of Yuma Existing Fiber and Key Facilities

Vehicle Detection

Figure 4 shows the traffic signals that are equipped with vehicle detection and the type of detection used. All but two of the existing traffic signals within the City are actuated, meaning that they are informed by detection. 50 of the signals are equipped with loop detectors and 25 of the signals are equipped with video detection. The two traffic signals without detection are not actuated, meaning they run on pre-set timing plans, and are located at 3rd Street and Avenue A and 8th Street and Orange Avenue in the north part of downtown, near City Hall.

Yuma County traffic signals are all actuated. 16 of the County-operated signals are equipped with loop detectors and 6 of the signals are equipped with Gridsmart video detection. Four of the six County signals with video detection are within a 1.25-mile segment of Foothills Boulevard.

The four Somerton-operated signals are currently equipped with loop detection.

ADOT traffic signals are all equipped with vehicle detection, which include loops, video detection, and radar detection. Two kinds of radar detection are used by ADOT: Econolite and Wavetronix.

Emergency Vehicle Preemption (EVP)

EVP is used to provide emergency response vehicles, such as fire trucks, with priority signal phasing at intersections. EVP allows equipped vehicles to communicate with the traffic signal to indicate that the vehicle is approaching the intersection which directs the traffic signal to provide a green signal phase in the direction of the emergency vehicle to allow it to pass through the intersection safely.

Currently, the City of Yuma has infrastructure to support EVP for City emergency response vehicles at City signals and signals within City boundaries that are owned by Yuma County. No other agency signals have EVP, and non-City emergency vehicles are not outfitted with the equipment that would support preemption within the City.

Real-time Intersection Monitoring

Real-time monitoring of intersections can help to identify equipment malfunctions (such as a traffic signal in flash) and detect and verify incidents that may occur at an intersection. However, any equipment used for real-time monitoring, including closed-circuit television (CCTV) cameras and video detectors, must be connected to a centralized system to allow for remote monitoring of the streaming images.

Currently, there are no CCTV cameras deployed at intersections, and none of the existing video detectors are connected to a central system, so there is no real-time intersection monitoring performed in the region.

Traveler Information

ADOT owns and operates two dynamic message signs (DMS) along I-8 within the Yuma region. The DMS are connected via cellular communications to the ADOT TOC in Phoenix, which allows the TOC to operate the sign and post messages remotely. The DMS signs are used to provide information to freeway travelers about travel conditions on the freeway, including travel times, unplanned roadway restrictions, work zones, weather impacts, or can be used to post public service messages. The location of the DMS can be seen in Figure 2.

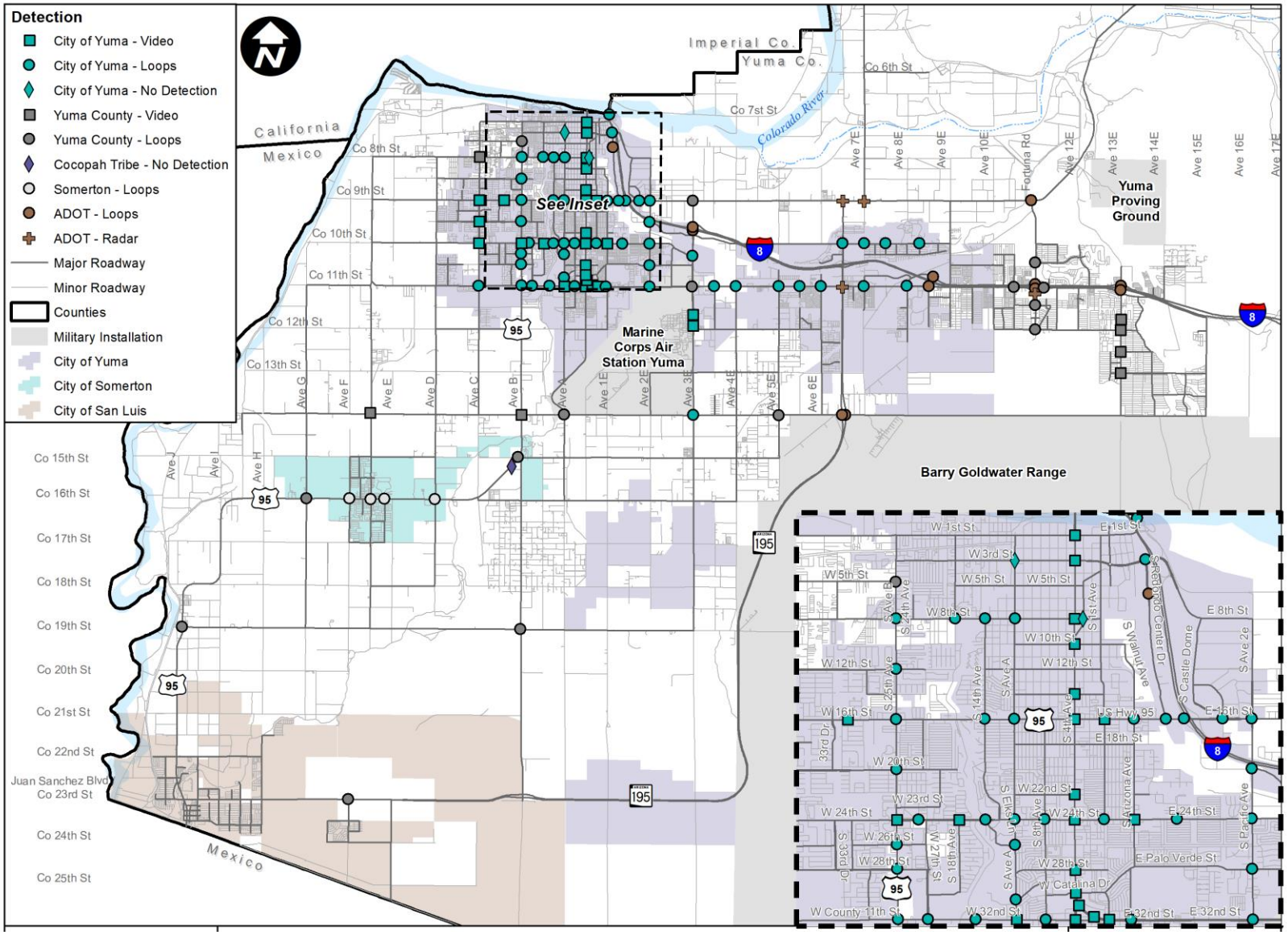


Figure 4 – Existing Detection at Traffic Signals

4.2 Alternative Modes of Transportation

Understanding the operations and network for non-single occupancy vehicles is helpful when taking a holistic view of traffic operations and ITS because: 1) there are technology applications to support safety and operations of these other modes; and 2) it helps identify key corridors in the region for mobility that may be prioritized for ITS and advanced operations strategies.

City of Yuma and surrounding areas are currently served by the Yuma County Area Transit (YCAT) system operated by Yuma County Intergovernmental Public Transportation Authority (YCIPTA). Existing YCAT routes can be seen on **Figure 5**. Currently, there are no existing processes or technologies deployed from the traffic side to specifically support transit operations.

There is a network of bicycle facilities, also shown in Figure 5, that are primarily located within the City of Yuma and the City of Somerton. ITS technologies have the ability to support safety and efficiency of bicycle travel, especially at intersections, if the elevation of this mode is a priority for future mobility in the region.

Another important mode of travel within the City of Yuma is freight travel, both by trucks and rail. The City of San Luis is bordered by Mexico to the south and contains two international ports of entry, and there are two domestic ports of entry along I-8 and Business 8 at the California border. Currently, there is no technology deployed at these port locations, however, ADOT is looking into implementing in a system at the inland ports to support enforcement of weight restrictions as well as licensure or credentials for freight traffic passing through those ports in the future.

There is one railroad company operating in the study area – the Union Pacific Railroad (UPRR), which operates regular rail freight services on its main east-west route. There are at-grade railroad crossings, where the railroad intersections with a surface street, on:

- Avenue 9E between 24th and 28th Street
- Fortuna Road south of County 9th Street
- 24th Street at S Industrial Avenue (see image)
- 1st Street, just north of Rodenbaugh Road

At these locations, there are active traffic control assemblies, including a lowering gate and flashing lights that get activated by an upcoming train. These devices are not currently connected to any centralized system and do not have advanced pre-emption.

Some railroad crossings, at railroad spur locations that do not experience high train traffic, do not have any dynamic controls at the at-grade crossing, as shown in the example below, located at 10th Street, east of 1st Avenue.

Other railroad crossings in the region are grade-separated so that the railroad does not conflict with a roadway or affect traffic operations at intersections.

Truck routes and railroads are shown on Figure 5.

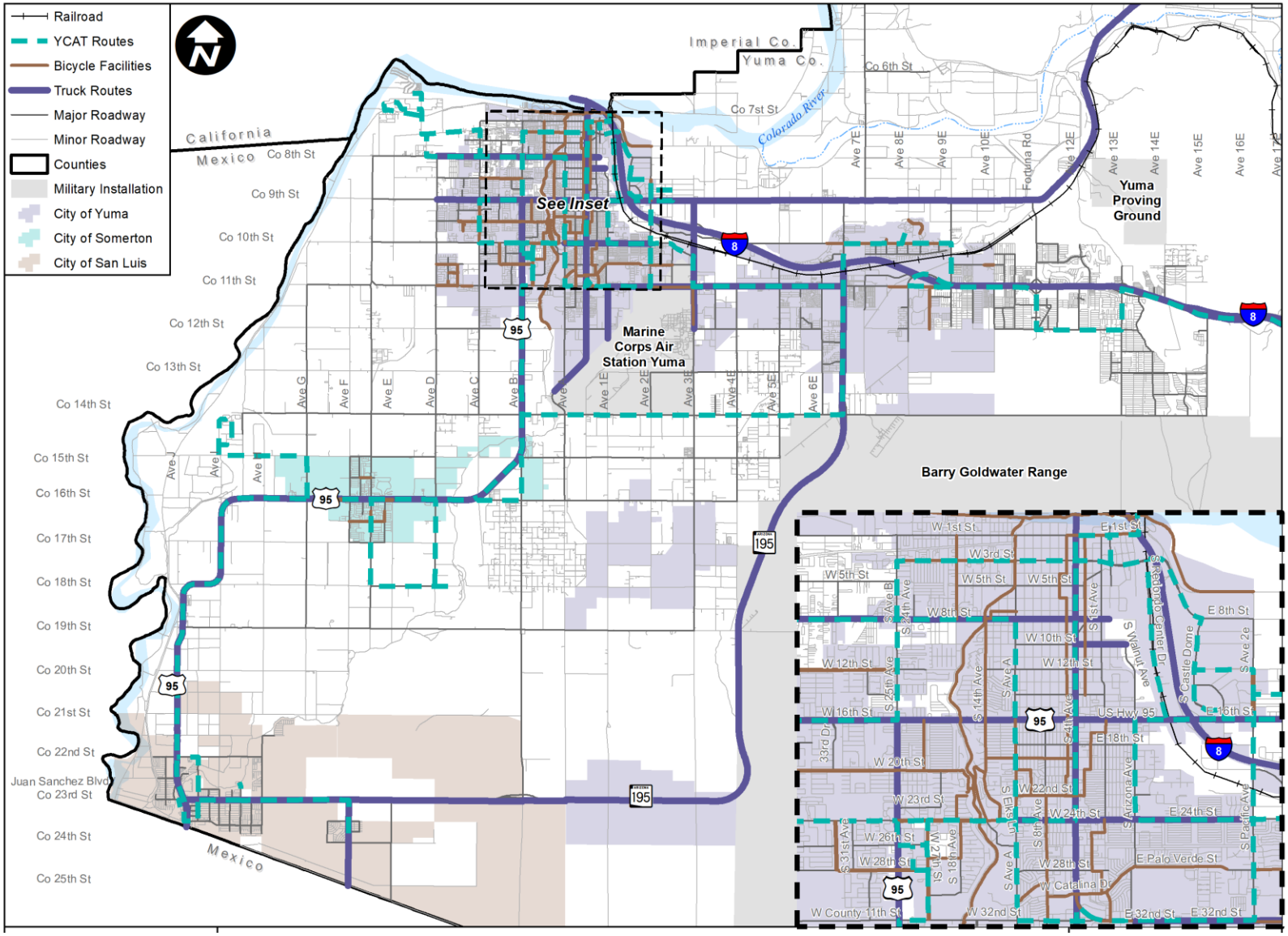


Figure 5 – Alternative Modes of Transportation

4.3 Traffic Operations

The City of Yuma Engineering is responsible for the operations of traffic signals in the City. Currently, reviewing and updating signal timing is largely completed in-house by engineering staff.

All Yuma County traffic signals were re-timed by an engineering consultant in 2018 and new timing plans were implemented at all traffic signals. In Yuma County, traffic signal timing is not updated on a regular basis but is instead updated as a result of one of the following circumstances: a new development is constructed that will change travel patterns along a corridor; multiple cases of public complaints about a traffic signal; or staff/elected official concerns about the level of service at an intersection. The County has an intergovernmental agreement (IGA) with the Cocopah Tribe to operate and maintain Tribe-owned traffic signals along Highway 95 at County 15th Street and at the casino entrance.

Somerton does not have an engineering department and will be partnering with the City of Yuma starting in 2020 for traffic engineering support. This is being facilitated through a formal IGA where Somerton will pay the City of Yuma to support traffic signal timing and other traffic operations functions. Somerton will retain the responsibilities for ownership and maintenance of the signals and associated infrastructure.

ADOT does not have a local traffic engineer for the Yuma region and is instead supported by the traffic engineers of the Central and the Northwest Regions. Any traffic operations needs related to traffic signals in the field are completed by local ADOT staff in the Yuma region. Other ADOT technology, such as the DMS sign on I-8, is operated by the ADOT Traffic Operations Center (TOC), which is located in Phoenix.

4.4 Device Maintenance and Upgrades

The City of Yuma Public Works department is responsible for the maintenance of all field equipment, including traffic signals and associated equipment (traffic signal cabinets and controllers, vehicle detection, etc.). There are currently three Traffic Signal Technicians and one Electrician that support maintenance of the City's almost 80 traffic signals. Public Works uses an operating budget to replace and upgrade traffic signal infrastructure as it is deemed necessary. The department has an active program to upgrade three intersections per fiscal year. The project allows the City to bring the infrastructure to current standards and modernize the traffic signal system.

Yuma County has two full time signal technicians and a total of seven staff who support signing and traffic signal maintenance on County roadways. The existing staffing provides adequate support for the preventative and responsive maintenance needs of County traffic signals. The County has a monthly preventative maintenance program for their traffic signals that has been very successful in reducing equipment failures and malfunctions, and thus has significantly reduced emergency maintenance call-outs for their traffic signal infrastructure.

The County allocates between $75,000 and $90,000 annually from the Public Works operations budget for equipment upgrades and has a separate maintenance budget to support maintenance activities. There has been an initiative to upgrade the vehicle detection at signalized intersections by leveraging development-related work; for example, they have seen significant activity from utility companies who are implementing new infrastructure and impacting

existing in-pavement loop detectors. The County has been using the replacement costs from those loops to instead upgrade the detection to Gridsmart video detection.

The City of Somerton utilizes a contractor to provide maintenance on traffic signals and associated equipment in the City. They utilize a regular maintenance schedule to provide preventative maintenance to equipment a few times per year, but also provide responsive maintenance for when there are unplanned issues.

The ADOT Southwest District is responsible for maintenance and replacement of ITS equipment in the Yuma region. Currently, there are three traffic signal technicians, which is an adequate number of staff for the maintenance needs of the ADOT-owned signals in the region. Planned equipment maintenance, replacements, and upgrades are identified either through the Pecos asset management system, identified by local agency partners, or driven by a concurrent project.

4.5 Funding and Programming

The City of Yuma uses a mixture of several funding sources to fund different types of projects. Many of the construction projects get funded through a combination of federal, state, and local funding sources. These include Highway Safety Improvement Program (HSIP) funds, Surface Transportation Block Grant (STBG) funds, Highway User Revenue Funds (HURF), and City Road Tax revenue. HSIP and STBG funds are allocated through the YMPO Transportation Improvement Program (TIP), and HURF funds are allocated by ADOT. For local City funds, each fiscal year, City departments submit project requests to be considered for inclusion in the Capital Improvement Program (CIP). The CIP Administrator is responsible for collecting the requests and recommending a program of projects that will receive funding based on the available budget.

The City of Yuma has an operating budget is that is used generally for signals, signing, and pavement marking. The operations budget comes from City road tax and state-allocated Highway User Revenue Funds (HURF). The budget is split between Engineering and Public Works. Field operations and maintenance, as well as any signal timing upgrades, are funded through the Public Works operating budget. Engineering analysis and management is funded through the Engineering budget.

Traffic signals in Yuma County are usually programmed for construction through the County CIP process, where each department, including Public Works, has the opportunity to submit projects for inclusion in the County budget for a specific year. County Public Works also has an operating budget and a maintenance budget that can support ITS, although this budget is not dedicated to ITS and also includes signing, striping, signals, pavement management, and other important infrastructure and devices.

Somerton utilizes the YMPO Transportation Improvement Program (TIP) to fund transportation and traffic capital projects, including the construction of traffic signals and implementation of associated equipment. The TIP is used to allocate federal funds provided to the region for transportation.

At ADOT, device replacements and upgrades are funded through the District's annual operating budget. Unplanned replacement needs that arise outside of the annual budgeting process or devices that are installed as part of another project, are funded through the ADOT TSMO Division. Larger capital projects, such as construction of traffic signals or installation of

conduit/fiber, are programmed in the ADOT 5-year program and may utilize a variety of funding sources, including state funds, Highway Safety Improvement Program (HSIP) funds, or other federal funding sources. To get projects included in the 5-year program, the District must submit the project for evaluation, and if the project is selected for funding, it will be included in the program to receive funding five years later.

4.6 Agency Coordination

The transportation agencies in the region generally partner and coordinate well on transportation-related projects and operations. There are also partnerships with external agencies such as the California DOT (Caltrans) and the US Border Patrol, to support regional transportation.

All stakeholder agencies for this project noted that coordination between agencies for construction closures and detours is done proactively and effectively.

Other examples of traffic-related coordination between agencies or between agency departments are highlighted in **Table 1**.

Table 1 – Existing Agency Coordination

Partners	Coordination Purpose
City of Yuma and Somerton	Starting in 2020, Yuma will provide traffic engineering support to Somerton, including signal timing and other signal operations through an IGA
Yuma County and Cocopah Tribe	Yuma County operates and maintains two traffic signals that are owned by the Tribe along Highway 95 at County 15th Street and at the casino
ADOT and Caltrans	Coordinate for permitting, traffic control, and advanced warning for construction project and for long-term incident closures along I-8 that may have impacts that cross state lines
ADOT and Arizona Department of Public Safety (DPS)	Coordinate to manage incidents on state roadways; A DPS officer sits in the ADOT TOC, which facilitates good communication and information sharing
Somerton and Yuma County	Coordinate for incidents that occur and to implement a detour route for traffic; Somerton Police are included in the coordination to implement the detour
Yuma County Traffic Management Committee	Includes representatives from County Engineering, Public Works, and Sheriff who meet periodically to review issues related to safety and operations, complaints, and suggestions for improvements.
Yuma County and City of Yuma	Coordinate for incidents that require road closures and detours. There is also coordination between the County and the City for EVP equipment on County-owned signals within the City boundaries
Yuma County and ADOT	Coordinate traffic signal operations along the I-8 frontage road and the traffic interchange at Fortuna Road, where an ADOT-owned signal is located between County-owned signals.
Local/District ADOT Staff with ADOT TOC	ADOT TOC assists with incident management on the freeway. Public complaints related to traffic signals are often routed through the TOC and then back to local or district level
ADOT and US Border Patrol	ADOT District coordinates with Border Patrol if a lane or roadway closure impacts the checkpoint on I-8 Eastbound at Milepost 17

5. Planned Development and Infrastructure

One of the most efficient methods for deploying ITS infrastructure is to leverage work already being done as part of other projects that impact a roadway, where deployment of devices or installation of communication infrastructure (conduit and fiber) may be included. Projects that involve disturbing pavement, and especially projects that include trenching, provide important opportunities to install conduit that can be used at a later time, given that the most expensive part of a communications project is the costs of trenching to install conduit.

The City of Yuma has established a process to consider the inclusion of communications infrastructure as part of all future transportation projects. Based on the Information Technology (IT) department's plans for a City-wide fiber backbone, any project that is on one of the designated communication backbone rings, or on a roadway that extends from the backbone to a signalized or potentially signalized intersection, are required to include installation of conduit and pull box infrastructure, at a minimum, as part of the project. **Figure 6** depicts the desired fiber backbone, as identified by the IT department.

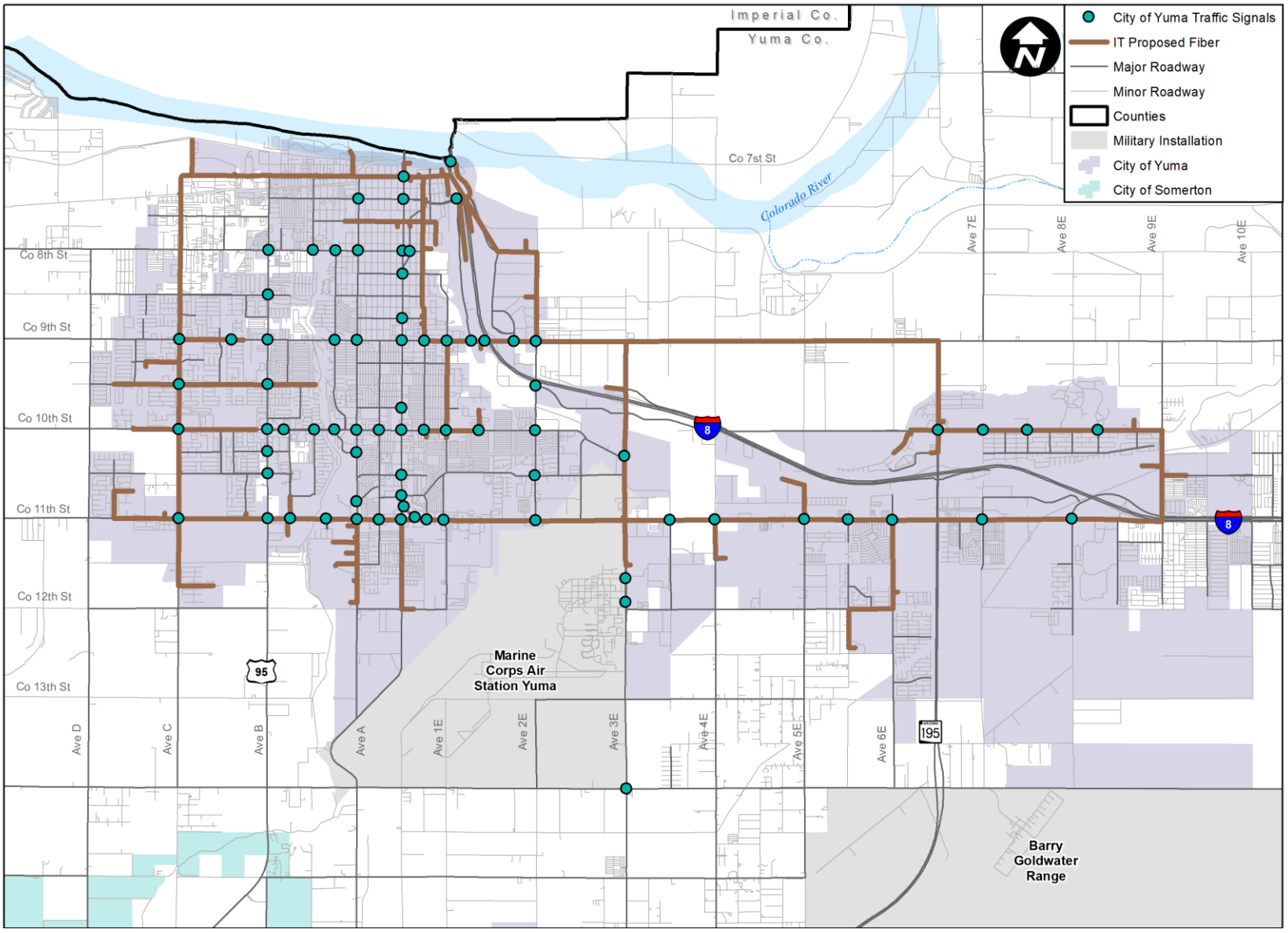


Figure 6 – City of Yuma Proposed IT Communication Backbone

For the other partner agencies in the region, funded projects that are found in the ADOT Statewide TIP (STIP) and the YMPO TIP were reviewed. **Table 2** identifies some projects that are programmed but not completed and the type of ITS improvements that could be included.

Table 2 – Funded Projects and Opportunities to Install ITS Infrastructure

Program	Project Name	Description	Potential ITS Opportunity
ADOT STIP	SR-95; at MP 32-34	Widen from 2 lanes to 4 lanes.	Install conduit and fiber during construction to connect to nearby traffic signals
	SR-95; at MP 35-39	Widen from 2 lanes to 4 lanes.	Install conduit and fiber during construction to connect to nearby traffic signals
	SR-95; at MP 39-48	Widen from 2 lanes to 4 lanes.	Install conduit and fiber during construction to connect to nearby traffic signals
YMPO TIP	Caro St to Fulton St	Construction - Widen from 2 lanes to 3 lanes	Install conduit and fiber during construction to connect to nearby traffic signals
	US 95, Avenue 9E to Fortuna Wash	Design - Roadway widening and reconstruction. Widen from 2 lanes to 5 lanes.	Include conduit and fiber during construction to connect to nearby traffic signals in design
	County 24th Extension	Construction - Ave F to Ave H - Widen from 0 lanes to 2 lanes	Install conduit and fiber during construction to connect to nearby traffic signals
	9th St Corridor	ROW - Giss Pkwy & 6th St to Pacific Ave & 12th St	The beacons are an ITS supported crossing treatment.
	County 14th & Ave 4E Traffic Signal - N/S Turn Lane	Traffic signal - N/S turn lane	Install conduit and fiber during construction
	Flashing Yellow Signals	Design - Flashing yellow arrow at 3 locations	Include upgraded traffic signal controller, EVP, and detection in design

6. Needs and Gaps Assessment

This section identifies key needs and gaps related to the existing transportation infrastructure, systems, and processes that this ITS Strategic Plan should address. *Needs* are being defined as those that were specifically acknowledged by the stakeholder agencies during the inventory and data collection process. *Gaps* are those that identify inconsistencies between the vision and goals for ITS and traffic operations in the region and the existing conditions.

It is important to have a clear connection between the ITS Vision and Goals, the needs and gaps, and the strategies and recommendation that will ultimately be identified in the ITS Strategic Plan. The ability to trace recommended strategies to needs or gaps fosters trust and buy-in from partners and create justification for pursuing the implementation of recommended strategies.

6.1 Agency Priorities

While the safety and efficiency of traffic operations is important to all agencies, the various stakeholder agencies in the Yuma region have different priorities for ITS and traffic operations.

These priorities are influenced by factors such as current traffic conditions, the priorities of executive staff and elected officials, and fiscal constraints, among other factors. Feedback on priorities that were discussed during this ITS Strategic Plan effort are summarized below.

The City of Yuma's main traffic operations priority is to deploy infrastructure and systems to allow for real-time, centralized management of their transportation network. This includes connecting their traffic signals with communications infrastructure for real-time data collection and remote operation of traffic signals through an ATMS system and installing CCTV cameras to allow remote monitoring of intersections. City of Yuma main maintenance priority is to bring the infrastructure to current standards to be able to modernize the traffic signal system to support expanded ITS functions.

The top traffic-related priority for Yuma County is upgrading and standardizing their traffic signal infrastructure and hardware, including upgrading to signal controllers to a standard that can be remotely accessed from a centralized system. They also would like to prioritize upgrading their traffic signal cabinets to be consistent and more compatible with their controllers. Another County priority is establishing agreement on ownership and maintenance of traffic signals, as there are cases where there is a lack of clarity or lack of agreement around who is responsible for the management and maintenance of some traffic signals in the region.

Somerton's traffic priorities are related to addressing congestion at Somerton Avenue and Main Street. This is one of the core intersections in the City's downtown area and the City would like to have the necessary tools and data to manage with congestion during peak times. Somerton is a small city and does not have the budgetary means to have an engineering department or operate their own signals. They have currently partnered with the City of Yuma to conduct their engineering services and intend to keep the agreement in place for the foreseeable future. Somerton would like to adopt ATMS and be part of a regional transportation operations strategy and would benefit from training when systems are in place.

ADOT's priorities for traffic operations and management are to expand the use of technologies to improve traffic management, traveler information, and safety. At a statewide level, ADOT is working towards get 100% of their traffic signals to be connected to the cloud for remote management and data collection. In the Yuma region, ADOT is looking to:

- Deploy infrastructure for the detection and notification of wrong-way drivers to rural areas, as they are currently doing at all urban interchange off-ramps.
- Implement smart work zones at all construction sites where possible, including the use of DMS, vehicle detection, and a centralized software system throughout work zones.
- Install CCTV cameras at their traffic signals to help with quicker response times.

6.2 ITS and Operations Needs

Understanding the different priorities, there were a set of consistent needs for ITS and traffic operations in the region. These overarching needs were identified by the stakeholders as important for the establishment of a regional ITS Program:

- Upgrading traffic signal infrastructure, including detection, controllers, and cabinets, that are at end of life or not able support advanced operations functions that are desired.

- Standardizing traffic operations infrastructure, including detection, controllers, and cabinets to facilitate maintenance of devices and support compatibility across agencies.
- Determining agency responsibilities for operations and maintenance of traffic signals in the region.
- Identifying programming processes and funding sources that can more quickly and consistently support device replacement, upgrades, and funding for operations.
- Identify funding sources and programming processes for capital investments related to ITS and communications.
- Conducting outreach and education to elected/public officials and the public to garner support for the use of more advanced technologies (such as intersection cameras) to support regional transportation operations.

6.3 Gaps Related to ITS and Operations

The following are gaps in infrastructure and traffic operations and management that will need to be addressed to fully achieve the ITS vision and goals:

- No ability to remotely access and centrally manage traffic signals and associated infrastructure in real-time.
- Lack of availability of real-time data at traffic signals that support day-to-day operations and emergency response as well as planning for operations.
- Limited agency procedures and processes (between departments within an agency and between different agencies) for coordination and joint decision making for day-to-day transportation operations.
- It is not clear if existing staff have the capacity and skill sets to support operations and maintenance of advanced traffic operations strategies, infrastructure, and systems.

7. Next Steps

Using the needs identified during the project thus far as a foundation for moving forward, the next task in this project is to identify and develop infrastructure integration strategies to address the needs that have been identified. Strategies will be focused on those that can be implemented by the City of Yuma, but there will be strategies highlighted where there will need to be coordination with other agencies to implement and there will also be strategies where there could be opportunities for other stakeholders in the region to either partner with the City to implement the strategy or where another agency can chose to also implement the strategy in parallel. For each strategy or project, considerations for implementing strategy, such as costs, dependencies, and responsibilities, will be identified. Strategies may include infrastructure projects, process and coordination improvements that partner agencies should consider to improve traffic operations and management.

Appendix B

ITS Strategy Recommendations Technical Memorandum

2020 ITS STRATEGIC PLAN

for the CITY OF Yuma

In coordination with

ADOT

Yuma San Luis Cocopah Welton Somerton Yuma County ADOT YMPO

YUMA COUNTY ARIZONA

CITY OF SOMERTON ARIZONA 1898

Prepared by
Kimley»Horn

ITS Strategy Recommendations

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1. Introduction to the ITS Strategic Plan

The City of Yuma is undergoing the development of a City Intelligent Transportation System (ITS) Strategic Plan. This ITS Strategic Plan will help guide the City's investments in ITS to support traffic management, traveler information, incident management, interagency communications, and coordination with regional stakeholders. The plan will provide a phased approach to implement and integrate existing and new ITS infrastructure, systems, and strategies.

This plan will explore and propose a framework for the near- and long-term operations and management of transportation investments in the City. The framework will also highlight opportunities where other local, county, regional, and state agencies in the Yuma region may partner or contribute to processes, strategies, or projects that could elevate local and regional traffic operations.

This ITS Strategic Plan is the first phase of a multi-phased effort to define, plan for, and potentially implement advanced traffic management systems and strategies in the City. Upon completion of this ITS Strategic Plan, an ITS Deployment Plan will be developed to more specifically define recommended projects and propose a plan to implement them over time. The ITS Strategic Plan and the ITS Deployment Plan could be used as inputs to prepare potential grant applications for the City, or the larger region, to pursue funding for infrastructure implementation.

The key project phases of the Yuma ITS Strategic Plan include:

- **Vision and Goals** – Identifies the City vision, goals, and priorities related to traffic operations and management, with a focus on opportunities for transportation technologies and systems. This task also identifies some of the visions and goals of individual stakeholders in the region related to traffic operations and, specifically, any opportunities to coordinate or pursue joint operations.
- **Inventory and Needs** – Identifies and documents existing ITS devices and systems within the region. This task also highlights existing and near-term projects for the City and other agency stakeholders that could support future ITS in the region. The inventory also explores documents such as agreements or trainings and identifies existing processes in place to coordinate with other agencies, program projects, and track and maintain transportation technology assets. The document determines gaps in the infrastructure and identifies traffic operations and management needs in the City including some that persist across the region.
- **Integration Recommendations** – Provides general infrastructure integration strategies and high-level phasing. Strategies will include such items as:
    - Projects that need funding to support their implementation, such as device deployment or upgrades to existing equipment.
    - Resources needed to establish a City traffic operations center (TOC) and equipment to maintain the functionality and be able to grow long-term.
    - Opportunities to improve coordination with ADOT freeway operations and along major corridors for potential regional arterial operations.
    - Opportunities for coordinating ITS deployment with other capital improvement projects on the City's major arterials.

2. Method for Strategy Development

2.1 Recommendations Based on Needs and Gaps

The needs and gaps are the basis for identifying recommended strategies that the City can pursue to make progress towards achieving their vision. Strategies include not only infrastructure and capital-based projects, but also consider improvements to or implementation of processes, partnerships, and other non-capital investments that will be important to creating a foundation for elevated traffic management and operations in the City.

ITS recommendations for the City of Yuma are organized into four categories:

- Infrastructure Strategies
- Program, Planning, and Policy Strategies
- Data Strategies
- Partnering Opportunities

These strategy categories and the associated strategies are described in detail in this document.

2.2 Strategy Definitions

Individual strategies within the four categories are summarized in tables and further described in their associated sections of this document. An example of the format of the strategy summaries are provided in the following **Table 1**. While strategy identification and description are provided within the text of each section of the document, the summary tables at the end of each section provides additional detail for the steps, costs, and considerations for implementing each strategy.

Table 1: Format for Strategy Tables

Strategies		Description	Implementation Considerations	Benefits	Cost Considerations	Dependency Considerations	Original Need Warranting Strategy
A	Name	Detailed description and purpose of strategy	Things to consider for completing the strategy effectively	Benefits to deploying this strategy	High level unit costs for strategy effort	How this strategy impacts or is impacted by another	List of needs addressed by this strategy
B							
C							
D							

2.3 Cost Considerations

High-level cost estimates implementing each strategy is provided where a cost can be reasonably estimated. The cost information is a planning-level estimate of the capital expenditures needed to deploy the proposed ITS devices and communications to address the ITS and traffic operations needs and gaps in the City. There are many strategies that may not

bear a monetary cost to implement but will require staff time to coordinate or implement. All cost estimates and other cost considerations are included in the strategy tables.

More detailed cost estimates will need to be calculated for infrastructure as part of the next phase of the project, the ITS Deployment Plan, as they are pursued for implementation. Individual cost elements may fluctuate depending upon the current conditions in the construction industry, such as costs for raw materials or labor. The City should also recognize that future project funding may require creative project scoping to fit existing budgeted amounts if costs rise unexpectedly.

2.4 Priority Corridors

Many infrastructure strategies will be recommended for phased implementation, allowing the City to make feasible and smart investments over time. The recommended phasing is largely based on priority transportation corridors in the City, which are those corridors that carry the greatest amount of traffic and/or provide access to major activity areas or destinations in the City. Some of the priority corridors are also regional priority corridors that are important to regional travel between communities and between major regional destinations and attractions.

Corridors with Annual Average Daily Traffic (AADT) volumes greater than 20,000 were automatically considered first priority corridors. We also evaluated major traffic generators in the Yuma region and determined what corridors serve as commuter routes. Corridors with AADT greater than 10,000 were considered second priority corridors. Commuter routes that were also paired with corridors with AADT greater than 5,000 were also reviewed and considered second priority. Routes that serve as conduits to special event locations were also included in our assessment of priority corridors. Any stretch of roadway that included traffic signals from multiple agencies was classified as a regional corridor.

Figure 1 identifies the City priority corridors. The corridors are categorized as primary and secondary corridors. In the subsequent sections, the strategy descriptions identify when it is recommended that proposed devices and communications infrastructure should be first deployed along primary priority corridors, over time continue to be deployed along secondary corridors, and eventually to all signalized intersections in the City. The regional corridors identified in **Figure 2** show corridors that require coordination between agencies to be able to implement specific infrastructure strategies.

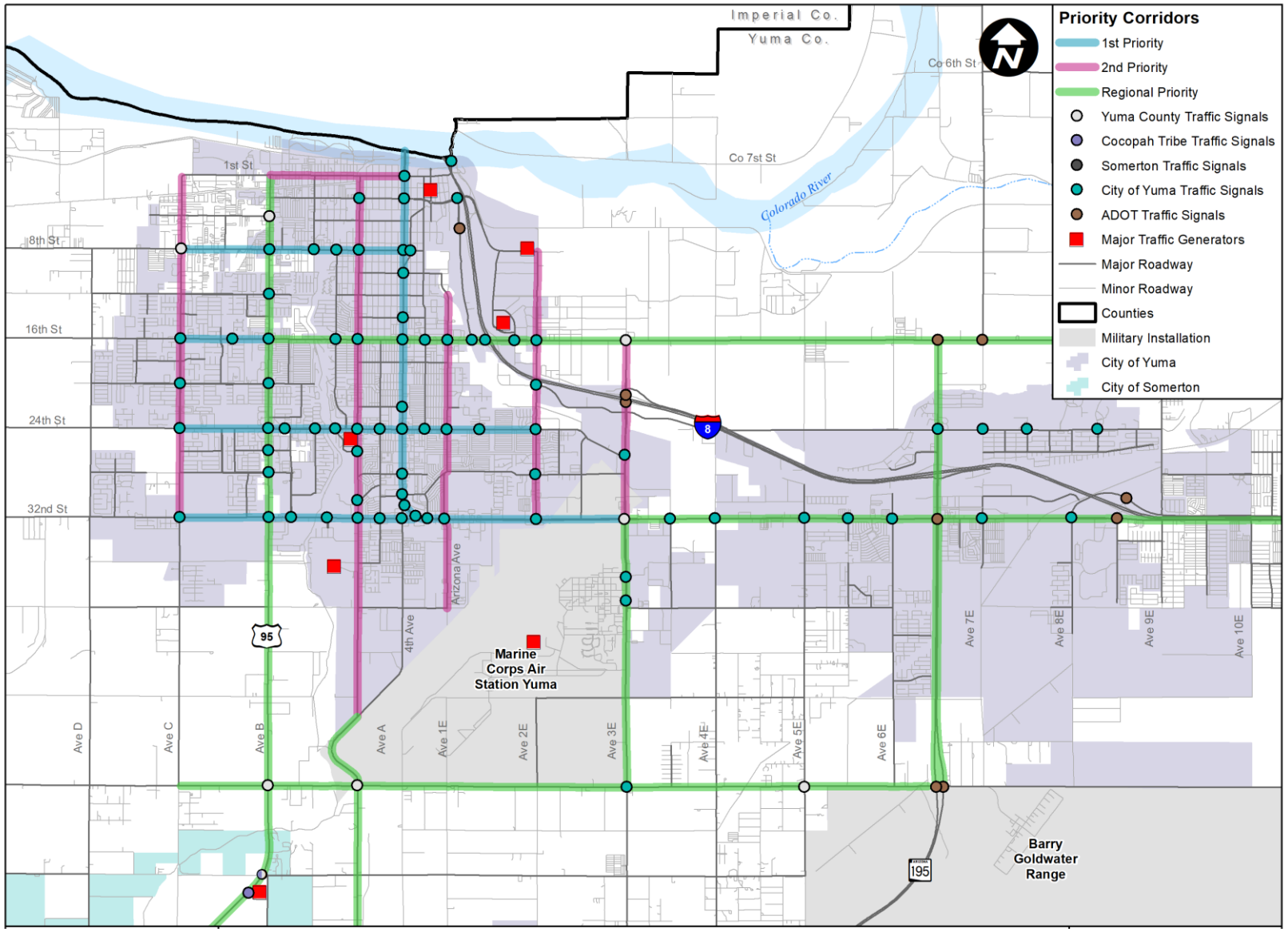

Figure 1 – City Priority Corridors for Transportation Operations

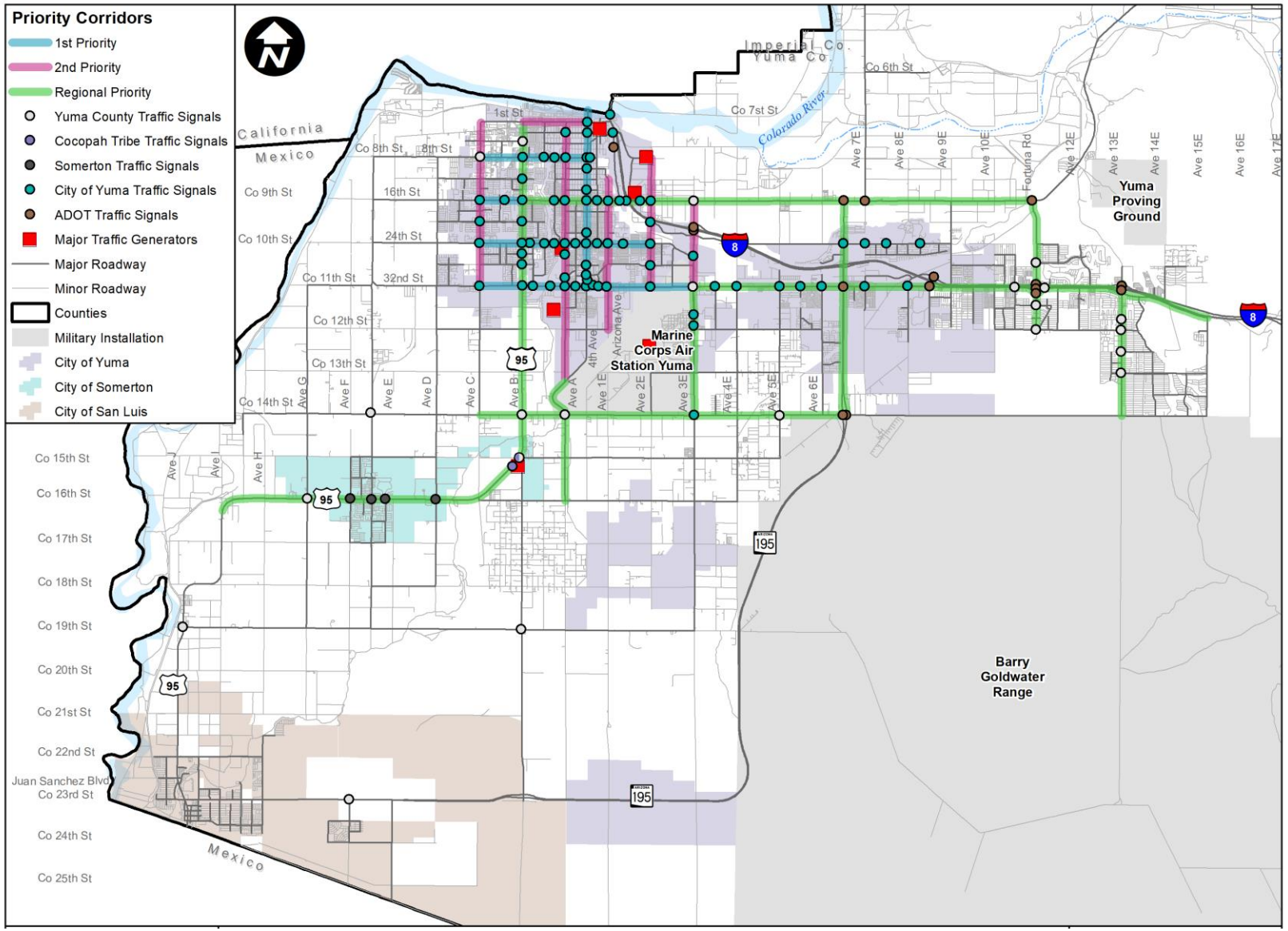

Figure 2 – Regional Priority Corridors for Transportation Operations

3. Infrastructure Strategies

This category recognizes the physical ITS and communications infrastructure that needs to be put in place or connected to build out an ITS program. Currently, the City has traffic signals and some associated infrastructure, such as traffic signal cabinets and controllers, vehicle detection, and emergency pre-emption devices. In order to take traffic management and operations to the next level in the City, there are two major infrastructure buildout strategies that will require significant investment:

1. Deploying transportation communications equipment, (fiber or wireless devices) along key corridors to connect traffic signals to a centralized management system; and

2. Establishing centralized management of ITS infrastructure to provide remote, real-time traffic monitoring and management capabilities.

These two major investment areas are described in the proceeding section. **Figure 3** depicts the relationship between the recommended infrastructure strategies and the sequence in which they should be pursued. **Table 2** summarizes the recommended infrastructure strategies.

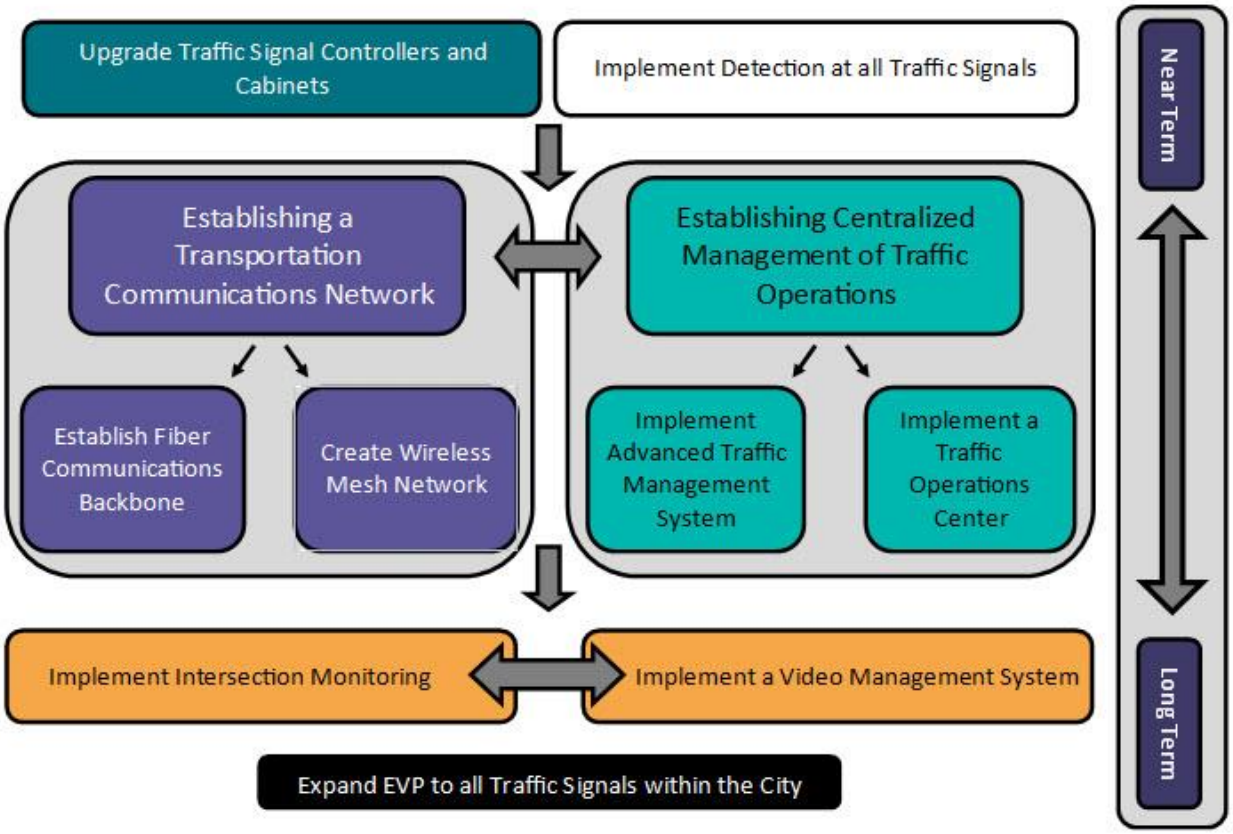

Figure 3 – Relationship and Sequence of Recommended Infrastructure Strategies

Table 2: Infrastructure Strategies Summary

	Infrastructure Strategies	Description	Implementation Considerations	Benefits	Cost Considerations	Dependencies	Original Need Warranting Strategy
A	Establish a Transportation Communications Network	Deploy communications infrastructure, including a fiber backbone and a supportive wireless mesh network to connect traffic signals, other ITS devices, and key City facilities to provide centralized management.	The City IT Department has put forth a framework to create a redundant communications backbone for the City. A transportation-specific communications network can leverage the IT network through an agreement for sharing conduit. Fiber and wireless radios will need to be installed to connect to traffic signals or devices that are not along the IT-supported path. In some cases, communications infrastructure (conduit, at a minimum) can be installed through private development requirements as part of half/street improvements	Communications infrastructure allows for real time monitoring and remote operation of signals and for the collection and exchange of data amongst City facilities.	Fiber unit cost for conduit and cable is $50/LF. Wireless radios are $4,500/EA. Ethernet Switches are $2,000/EA.	Traffic signal controllers or cabinets at or nearing end of life may need to be updated to be compatible with communications infrastructure. Establishment of a communications network within the City is a necessary precursor to the establishment of a TOC. Communications infrastructure is also dependent on the procurement of an ATMS system to manage the connected signals.	• No ability to remotely access and centrally manage traffic signals and associated infrastructure in real-time • Lack of availability of real-time data at traffic signals that support day-to-day operations and emergency response as well as planning for operations.
B	Implement a Traffic Operations Center	A TOC would provide a centralized location where an operator can remotely monitor and manage traffic operations in the City. All ITS systems and software servers will be housed in a location and will be connected to field devices via transportation fiber. Operators are able to access systems to collect data and send back out data or commands from a remote location.	A TOC is often a brick-and-mortar location but could also be done virtually through the cloud hosting. A physical TOC would include staff workstations and potentially equipment like a video wall, server room, or field-testing equipment. In addition to equipment and potentially a physical space, efforts to establish standard operating procedures, staff requirements, and schedules will be needed.	A TOC will allow for remote, real-time management of traffic operations, including incident response, work zone management, and dissemination of traveler information. It can also support increased collaboration on real-time decision making and implementation of operational strategies.	An annual budget for operations and process for maintenance, including tracking of assets and budgeting for necessary lifecycle replacements and upgrades, will be established.	An established communications network and ATMS system is necessary prior to the implementation of a TOC. Staffing requirements, infrastructure requirements and operational procedures must be determined for the TOC.	• No ability to remotely access and centrally manage traffic signals and associated infrastructure in real-time • Lack of availability of real-time data at traffic signals that support day-to-day operations and emergency response as well as planning for operations.
C	Implement an Advanced Traffic Management System (ATMS)	An ATMS centralizes collection of data for all traffic signals that are connected to communications and creates a user interface for remote access to and control of traffic signals and other ITS equipment.	The City needs to identify the functions of an ATMS system that they would like to have to determine the requirements of its new ATMS. This will ultimately determine from the system provider-perspective which modules or customization will be needed to achieve the City functions. Develop a Request for Proposals (RFP) to solicit a variety of system providers and to allow the City to select based on best fit with desired functions.	An ATMS provides a centralized user interface for the City to remotely monitor and operate the traffic signals once they are connected. Functions of an ATMS may include equipment monitoring and connectivity, monitoring of signal timing and phasing, and collection and reporting on various performance measures related to signal operations.	Initial system cost for Yuma signals only is $200,000 but it is important to consider maintenance, upgrades, and staffing when determining cost of the system.	Communications connection to traffic signals and associated ITS devices must be established for an ATMS system to be functional.	• No ability to remotely access and centrally manage traffic signals and associated infrastructure in real-time • Lack of availability of real-time data at traffic signals that support day-to-day operations and emergency response as well as planning for operations.

Infrastructure Strategies		Description	Implementation Considerations	Benefits	Cost Considerations	Dependencies	Original Need Warranting Strategy
D	Upgrade Traffic Signal Cabinets and Controllers	Use traffic signal cabinets and controllers that enable traffic operations and management functions that the City envisions but may not currently use. Cabinets should have enough space to accommodate additional devices, including connections to a transportation communications network. Traffic signal controllers should support advanced traffic signal operations inputs and data, such as use of adaptive signal control or collection of turning movement count.	The City should document which current cabinets and controllers are not compatible with planned ITS infrastructure improvements and functions, and should program for replacement, whether though an asset replacement program or through a near-term project at the intersection.	In addition to allowing better functionality of other infrastructure, updated cabinets and controllers will work more efficiently and provide the ability for the ITS capabilities at signals to grow beyond planned upgrades.	Signal controller and cabinet is $30,000.	Installation of and ATMS system, intersection monitoring, and a transportation communications network is dependent on upgraded cabinets and controllers in areas where the current cabinets and controllers do not support ITS infrastructure.	• No ability to remotely access and centrally manage traffic signals and associated infrastructure in real-time • Lack of availability of real-time data at traffic signals that support day-to-day operations and emergency response as well as planning for operations. • Standardizing traffic operations infrastructure, including detection, controllers, and cabinets to facilitate maintenance of devices and support compatibility across agencies. • Upgrading traffic signal infrastructure, including detection, controllers, and cabinets, that are at end of life or not able support advanced operations functions that are desired.
E	Implement Detection at all Traffic Signals	The City may need to add, upgrade, or replace some existing detection for more advanced traffic operations, such as bicycle detection or the collection of turning movement counts. The City should continue to evaluate new detection technologies as they emerge to make sure that they invest in equipment that enables advanced ITS and data capabilities that the City wants to pursue.	The standard detection equipment that is agreed to provide the functions and data necessary for the City to pursue its ITS goals should be used when detection is being added or upgraded, whether as part of an asset replacement program or as part of a roadway project. For example, in-ground loop detectors are vulnerable to damage when trenching occurs. If a loop detection is damaged as part of a project, the City should replace the detection with the new standard that provides newer and more advanced functionality.	Detection at all traffic signals provides data to support decision-making on real-time traffic signal operations, as well as provide additional data on corridor volumes, queue length, and speed of vehicles.	Video image detection is about $7,500 per unit (need 4 per intersection) and about $25,000 for a single camera intersection detection system.	The value of an ATMS system to provide real-time monitoring and management of signalized intersections would be diminished if the intersection was not equipped with vehicle detection.	• No ability to remotely access and centrally manage traffic signals and associated infrastructure in real-time • Lack of availability of real-time data at traffic signals that support day-to-day operations and emergency response as well as planning for operations. • Standardizing traffic operations infrastructure, including detection, controllers, and cabinets to facilitate maintenance of devices and support compatibility across agencies. • Upgrading traffic signal infrastructure, including detection, controllers, and cabinets, that are at end of life or not able support advanced operations functions that are desired.
F	Implement Intersection Monitoring	Deploy intersection monitoring (CCTV or VIDs) at signalized intersections or other areas with significant traffic volumes or delays to provide the ability to remotely monitor intersection operations and support improved incident identification and response.	Identify signal infrastructure at or near end of life within the priority corridors identified for CCTV installation. Go through project development process to procure and install CCTV.	Images from CCTV supports a multitude of real-time operational responses. Images can be useful for data analysis of traffic conditions in response to incidents, events, or other non-recurring congestion. They can also be useful, under appropriate legal circumstances, for public safety to utilize in an investigation or surveillance situation where CCTVs monitoring travel lanes also happen to capture image of public safety incidents.	Camera with pan/tilt/zoom is $5,500/EA.	Dependent on communications infrastructure in order to transmit data received by cameras remotely. Also dependent on procurement of a video management system to create an operator interface for camera feeds.	• No ability to remotely access and centrally manage traffic signals and associated infrastructure in real-time • Lack of availability of real-time data at traffic signals that support day-to-day operations and emergency response as well as planning for operations.

Infrastructure Strategies		Description	Implementation Considerations	Benefits	Cost Considerations	Dependencies	Original Need Warranting Strategy
G	Implement a Video Management System	A video management system is the central management system that will allow for centralized management of cameras (if they provide pan-tilt-zoom capabilities) and access to real-time camera feeds.	Identify and acquire the preferred video management system. Server location and capacity will need to be determined. The software could be installed on an existing City server or included on servers acquired with the TOC.	Unlike detection and communications that can provide some benefits without active management by a staff member, the benefits of CCTVs are based on the availability of a staff member to view, in real time, and utilize the information gathered by actively managing them from a central location. City Police can be given access to the feeds to support incident identification and response after the TMC is in operation	A video management system may be included as part of an ATMS system - cost may be embedded in the overall system cost or may be a specific system module that can be purchased separately.	Cameras must be connected via transportations communications to the central system for operators to view and operate cameras through the video management system.	• No ability to remotely access and centrally manage traffic signals and associated infrastructure in real-time • Lack of availability of real-time data at traffic signals that support day-to-day operations and emergency response as well as planning for operations.
H	Expand EVP to all Traffic Signals within the City	The City should make sure that key corridors in the City are completely outfitted with EVP, including at traffic signals that are own or operated by another agencies. The City should continue upgrading their EVP network to be GPS-based.	Identify ADOT or County-own signals within City operated corridors that do not have EVP installed. Consider ways to provide EVP benefits at these locations, which may include establishment of an agreement for the City to install and maintain EVP on a non-City-owned traffic signal. Additionally, the City should include EVP infrastructure in signal design standards and should track performance of upgraded EVP to show return on investment.	EVP directs the traffic signal to allow an emergency vehicle to pass through the intersection safely. This improves safety at intersections and reduces the number of stops and delays that the emergency vehicle encounters along its route to/from an incident or emergency situation.	An EVP unit is $3,000/EA.	The traffic signal cabinet must have room for the EVP connection. Agreements between the City and the County and the City and ADOT will likely be necessary in order to expand EVP along key corridors in areas where not all traffic signals are City-owned.	• Lack of availability of real-time data at traffic signals that support day-to-day operations and emergency response as well as planning for operations. • Standardizing traffic operations infrastructure, including detection, controllers, and cabinets to facilitate maintenance of devices and support compatibility across agencies.

3.1 Establish a Transportation Communications Network

The City of Yuma does not currently have a communications network associated with Engineering or Public Works. At one time, the City did have a centralized traffic management system to which their traffic signals were connected, but that system has not been in place in many years and the infrastructure and systems are no longer viable.

There is some non-transportation-related fiber infrastructure that connects to key City facilities and it is recommended that the City coordinate with the current fiber owners to determine what fibers paths are available and if the City can use them. The City Engineering Department and IT Department, along with other regional entities, are currently embarking on a Regional Fiber Master Plan to determine expansion of fiber communications throughout the region, as well as agreements and processes for installing and maintaining that network. This plan will not identify or include plans for detailed fiber routes nor any connections to traffic signals. However, the City IT department has a vision for what the future fiber ring topology should look like. **Figure 4** shows this City desired proposed fiber ring topology.

To be able to implement many of the infrastructure strategies that are proposed, the City will need to establish a detailed communications network beyond what is shown in **Figure 4** through the development of a Telecommunications Plan. The Telecommunications Plan differs from the Regional Fiber Master Plan because it will specify additional backbone rings or fibers required in addition to other City owned fiber and will identify branch cables or wireless communications to connect all traffic signals to the system. Because the City currently has no dedicated transportation telecommunications, it will be important for the City to have some working knowledge of various aspects of telecommunications (types of devices, configuration of devices, bandwidth considerations, etc.) in order to make informed decisions when pursuing or deploying strategies.

A Telecommunications Plan must align the City's goals and objectives with appropriate telecommunications strategies that build a foundation of reliable, redundant, and City-owned communications. The goal of this Telecommunications Plan is to achieve the following objectives:

- Create network connectivity – by providing a connection to transportation infrastructure;
- Increase network connectivity – by growing geographically to cover a greater percentage of the City;
- Increase bandwidth capacity – by balancing the wireless-to-fiber optic cable deployment where bandwidth is needed in the City;
- Reduce network latency – by minimizing the number of wireless hops needed within the network; and
- Increase network reliability – by achieving the above four objectives, the network will be reliable as the telecommunications infrastructure and capabilities expand.

The Telecommunications Plan will need to identify configuration recommendations, the ultimate buildout of the telecommunications network, and near-term connectivity solutions to address.

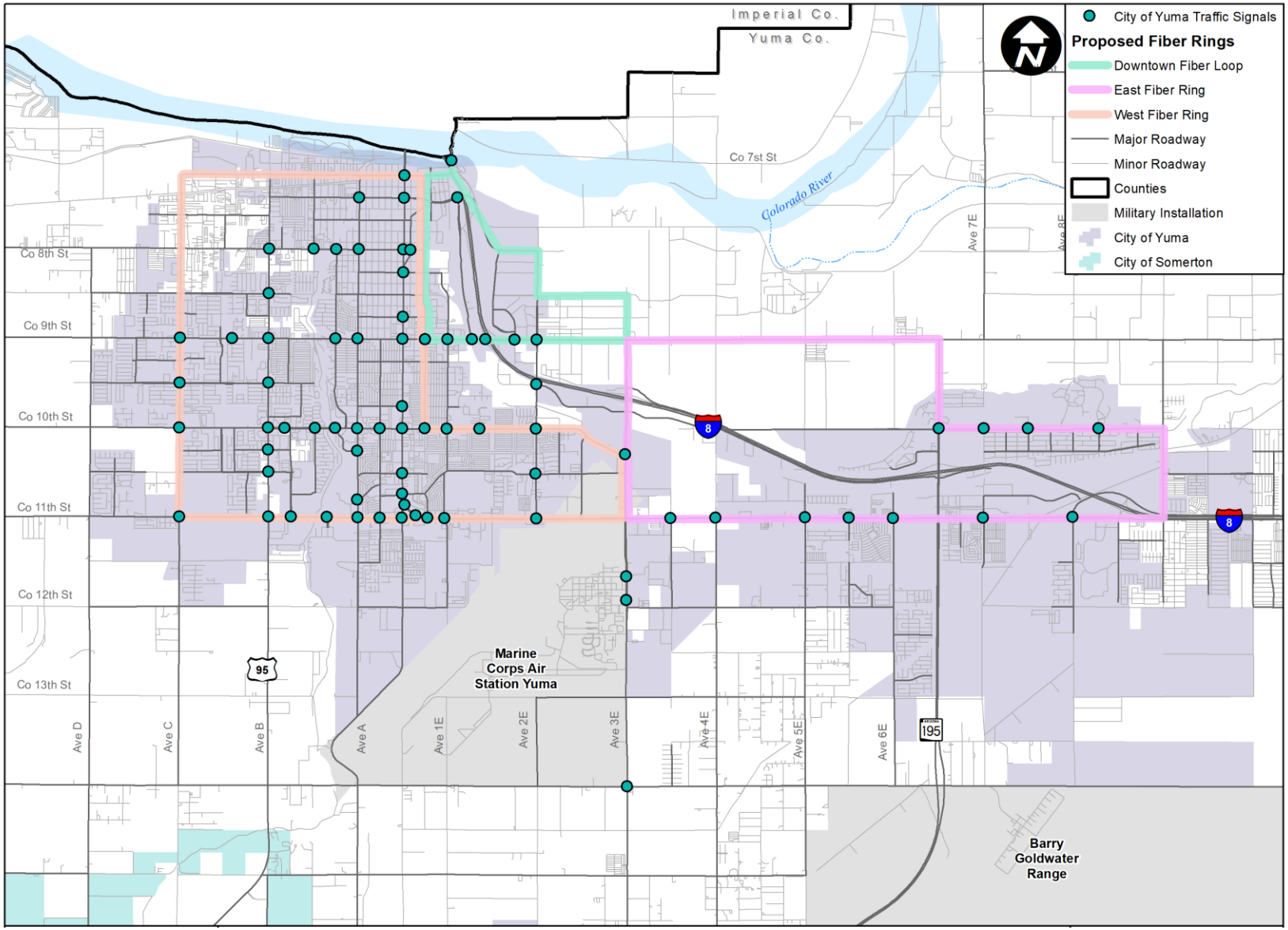

Figure 4 – City Future Fiber Network Plan

Fiber Network

It is recommended that the City consider the following while planning and implementing a fiber network:

- The City should build off the Regional Fiber Master Plan to build the Telecommunications Plan and determine what paths will be necessary for a fiber backbone that will serve near-term and long-term planned ITS infrastructure. Building out a fiber backbone requires having some vision for how many strands of fiber the City will ultimately need and building it out in an effective way that allows for future additional fiber strands.
- In the near-term, the City will need to serve priority corridors first, as shown in **Figure 1**. The City will need to plan where the backbone should be in relation to the priority corridors and how branch cables will be used to connect to infrastructure or facilities off of the backbone path.
- The City will need to deploy fiber infrastructure to connect the existing traffic signals to that fiber on these first priority corridors and make sure the existing traffic signals controller cabinets have the necessary equipment (switches, ethernet transceivers, etc.) to be connected. The City will need to prioritize intersections and phase fiber infrastructure improvements for first and secondary priority corridors.
- The City should also work with the CIP group and developers to require ITS conduit and fiber be installed on all future projects as feasible.

The City currently has specific Standards, Specifications, and Design Details as it relates to traffic signals and ITS equipment. The City should review their current standards to include new technology and compatibility with existing standards and equipment. There are some ITS standards that may want to be considered but not only once more infrastructure and vehicle congestion is realized. Updates to be added to the ITS standards later include:

- Bicycle Detection Equipment;
- Advanced Railroad Preemption; and
- DMS and Structures.

Wireless Mesh Network

Where it is costly or not feasible to install fiber optic conduit and cables, wireless mesh radios can be used to fill in the communications gaps. Wireless mesh radios offer ease of deployment at a relatively low cost and provide a significant amount of path diversity that makes the network highly reliable. There is a limit on the number of these radios that can be deployed within a given area without a backbone fiber optic connection that would provide a high bandwidth backhaul. Wireless radios are a preferred ITS communications technology over cellular devices to connect to ITS infrastructure due to the ongoing costs and potential for lapse in cellular coverage.

As part of the Telecommunications Plan, gaps in communications coverage should be identified, and wireless mesh radios should be planned. There is a practical limit of how much network traffic can be passed via a wireless network without saturating the capacity of the wireless network and introducing latency which reduces the usefulness of the network. The City needs to

create wireless access points which will take the network traffic off of the wireless network and divert it into the fiber optic network because fiber is better suited for transporting large amounts of network traffic over longer distances. That is why it is important for the implementation of wireless communications to be closely planned in conjunction with the fiber optic communication network.

Sharing Responsibility

Both Engineering and IT Departments have an interest in a telecommunications network. The City IT Department is leading the development of a Regional Fiber Master Plan in partnership with the City Engineering Department. There will be a follow-up effort to develop a transportation-specific Telecommunications Plan, and this creates an opportunity for both departments to partner with Public Works and share infrastructure responsibilities. The following are some strategies on shared responsibilities that need to be established in the Telecommunications Plan:

- Both departments should agree to be responsible for “Blue Staking” the fiber conduit pathways and maintaining all the fiber cables.
- Either IT or Public Works (not both) should be responsible for the maintenance of the fiber network path throughout the City. It is recommended that the IT Department has maintenance and uptime responsibilities of the City fiber network because of the multiple potential uses of fiber/conduit infrastructure.
- Either IT or Public Works (not both) should be responsible for the maintenance of the wireless radio communication to ITS devices. Currently, IT is responsible for the management of radio communications, but it is recommended that the Public Works Department has maintenance and uptime responsibilities of the wireless radio communication to ITS devices because of the primary use of wireless radios being for the ITS Program.
- The Traffic Signal Group should be responsible for their branch cable between the traffic signal / ITS device cabinet and the pull box immediately in front of the cabinet that connects the device to the fiber network path.

3.2 Establish Centralized Traffic Management

Given the size of the City of Yuma’s transportation network and number of traffic signals, there could be significant benefits to traffic operations if the City Engineering staff had the ability to remotely monitor and operate traffic signals and other ITS devices in real-time. The communications build-out that was recommended in the previous strategy is a key step towards facilitating this real-time management capability. However, once the signals and devices are connected, the City will need a way to view the data coming in from the infrastructure that should centralize all the data and information coming from the field devices.

Advanced Traffic Management System (ATMS)

An ATMS system is a central management system for traffic signal equipment. The ATMS system will provide a graphical user interface to allow someone to view data or status of field infrastructure and allow that person to remotely operate and make changes to the infrastructure settings. An ATMS system will also provide centralized data collection and storage.

The following considerations should be accounted for when planning for acquisition of an ATMS system for the City:

- Identify the functions that the City would like to be able to operate through the ATMS. This will determine the requirements that the City needs of its new ATMS and will ultimately determine from the system provider-perspective which modules or customization will be needed to achieve the City functions. Functions may include camera management, traffic signal timing plans, performance reporting, specific user interface and display, etc.
- Identify the required maintenance cycle that would need to be included in a selection of a new system such as one year, two years, five years, or more. Typically, a one-year warranty is provided for all new ATMS systems installed, so the City would need to decide how many additional years should be provided within the funding allocation for this initial ATMS implementation.
- Develop a Request for Proposals (RFP) to solicit a variety of system providers and to allow the City to select based on best fit with desired functions or based on cost, depending on the City directive and applicable requirements are at the time of RFP development.

Once an ATMS system is acquired, the following would need to be considered:

- Identify ongoing operations and maintenance costs including periodic software upgrades that will become available and what warranty the ATMS provider will offer.
- The City will have the ability to purchase or acquire additional ATMS modules as the ITS and traffic operations program expands and the City desires to support additional or more advanced functions. The City should work with the ATMS vendor when new or different needs arise to discuss how the ATMS system can most effectively be upgraded or expanded to achieve the desired functionality.

The City will need to develop and pursue each of these considerations in further detail at the time the ATMS system is implemented.

Traffic Operations Center

The City has a desire to establish a Traffic Operations Center (TOC) to be able to centralize controls of the future ATMS system. Additionally, the TOC can be used to monitor traffic during incidents or work zones or used to observe traffic patterns to adjust signal timing. A TOC allows the City to remotely make those signal timing changes and reduces delay in responding to citizen complaints as it pertains to signal operations.

The City will need to evaluate its needs for TOC sizing and workspaces to properly plan for design and construction costs. **Table 3** provides a high-level cost intended to give a comparison of what equipment, furniture, and cabling upgrades would cost per relative size in square footage. These costs do not include the building costs, including architectural, mechanical, electrical, and structural.

Table 3: TOC Size and Cost Comparison

Relative Size	Square Footage	High-Level Cost
Small	2,500	$1,000,000
Medium	3,500	$2,000,000
Large	5,000	$3,500,000

The City will also need to consider staffing requirements for operation of a TOC and maintenance of new infrastructure. **Table 4** provides a comparison of staffing numbers at other cities who have TOCs or traffic management centers (TMCs) and have a similar number of traffic signals as Yuma.

Table 4: ITS Staffing Comparison of Comparable Cities

City	City of Surprise	City of Goodyear	City of Peoria
Total # of traffic signals / # signals connected to a TOC/TMC	49 / 46	88 / 56	118 / 116
# of ITS operations staff	1	1	2
# of ITS / Signal maintenance staff	2	4	5
# of CCTVs	47	53	62
Operations staff per connected signal	1 : 46	1 : 56	1 : 58
Operations staff per CCTV	1 : 47	1 : 53	1 : 31
Maintenance staff per signal	1 : 25	1 : 22	1 : 24
Maintenance staff per CCTV	1 : 24	1 : 14	1 : 13

To establish a TOC, it is recommended that the City first develop a Concept of Operations. This will describe the characteristics for the proposed TOC and what the desired capabilities and objectives are. It will include enough detail to develop a bid package for construction and implementation. The City can also consider building out the TOC to accommodate the possibility for future expansion if other agencies decide to join in the operations.

The Concept of Operations for the TOC will include the following:

1. **Goals and Objectives** – This will identify what the TOC is and what the City hopes to achieve with it.

2. **Operational Processes** – This will outline processes for daily the operations within the TOC, as well as processes when external communications are required such as with IT, Emergency Response, Public Works, the public, etc.

3. **Business Plan** – This will identify buildout and annual costs associated with the TOC, as well as staff (operators, engineers, analysts, etc.) required and their cost.

4. **Functional Requirements** – This will establish a set of requirements that determine the overall size and type of TOC the City would like to implement and the type of functions and equipment they would like included.

    a. **TOC Design Requirements** – This will give specific plan details and specifications for the TOC to be able to be constructed.

    b. **ATMS System Requirements** – ATMS systems will be evaluated and one system that best fit the City needs will be identified. Technical specifications for the ATMS system will be developed.

5. **Agreements** – This will identify specific agreements required to be modified or formed related to the establishment of the TOC and operational partnerships with other department and agencies.

6. **Training** – A training process will be determined, and a manual will be established for training current and future staff. All TOC staff will need to undergo a training program for understanding TOC equipment and operations.

7. **Maintenance Plan** – This will identify ongoing operations and maintenance costs associated with any new TOC equipment. Lifecycle timeframes will be identified for all TOC equipment, and a plan for asset management and replacement will be created.

Once the Concept of Operations is established, the City can use it for establishing funding, as well as for bidding purposes and initiating construction. The City will need to keep up with the ongoing requirements outlined within the Concept of Operations to continue to have a successful TOC.

3.3 Upgrade Existing Technologies

Upgrade Traffic Signal Cabinets and Controllers

Traffic signals rely on controllers and cabinets to operate. A controller provides the inputs and commands to the traffic signal related to signal timing and phasing. The cabinet houses the controller and all the additional infrastructure and components (power, wiring, etc.). As the City expands and advanced its ITS and traffic operations program, both traffic signal cabinets and controllers may need to be upgraded. Controllers will need to accommodate more advanced

traffic signal operations input and data, thus may need upgraded software or data storage capacity/memory. Traffic signal cabinets need to have enough space to accommodate any upgraded or new infrastructure that the City will deploy, including new controllers that may be needed. Cabinets will also need to accommodate infrastructure related to the transportation communications network, through fiber and wireless technologies.

The City currently has a new standard for signal controllers and cabinets that should have the space and functional capabilities to support any new ITS infrastructure and more advanced traffic management capabilities that are envisioned in this plan. As both industry standards and City standards get updated, the equipment should be vetted by all staff who have a stake in the ITS program to make sure it can support the expanded vision of ITS for the City, and all parties should communicate so that new equipment specifications can be added to reflect these changes.

Upgrade Detection

Vehicle detection is essential for the operation of traffic signals. Most City intersections have detection, but it will be important to make sure all existing detection is reliable and functional; thus, the City may need to upgrade or replace some existing detection.

The City has standard type of vehicle detection that is verified to provide the data collection needs and advanced functionalities that are identified in this Plan. The City is currently deploying this standard equipment when detection is being added or upgraded, whether as part of an asset replacement program or as part of a roadway project that allows for upgrading/adding detection. As new and more advanced technologies emerge, the City should continue the process of evaluating these new technologies from a multi-departmental perspective to make sure that any technology they invest in is in line advanced ITS and data capabilities that the City wants to pursue.

3.4 Deploy Newer Technologies

Intersection Monitoring

Devices at intersections that allow for the remote, real-time monitoring of intersection operations can support improved traffic operations, equipment monitoring and maintenance, and emergency and incident management. A useful ITS technology that supports real-time intersection monitoring is closed-circuit television (CCTV) cameras that offer pan-tilt-zoom (PTZ) capabilities. Another technology that could also support this function is video image detection (VID) that is installed at each leg/direction of an intersection that does not move, but at minimum, provides visual confirmation of real-time conditions. VIDs can be provided at any

intersection configuration (signalized intersection, roundabout, or heavily used access point to business or event center) or mid-mile locations to collect and report current traffic conditions.

Camera image observation can be used for verifying the results of traffic management strategies, such as signal timing changes or work zone diversions, and for detection and verification of crashes. Real-time camera images facilitate rapid response to incidents that affect traffic flow. Cameras deployed at intersections have also been used for verifying the conditions of a crash scene, resulting in more effective dispatching of emergency services and clearing of crashes.

Video Management System

Unlike detection and communications that can provide some benefits without active management by a staff member, the benefits of real-time intersection monitoring are based on the availability of a staff member to view and utilize the video information. As CCTVs are deployed, there is a benefit to begin utilizing them right away, and this will require a centralize video management system, which could be part of an ATMS system or could be a standalone system.

Viewing CCTV camera feeds can support traffic operations and maintenance identification, but they could also be shared with other City departments or agencies to support wider City functions. Police and other first responders can be given access to the real-time video feeds to support incident identification and response. Other agencies, including ADOT, may be given access to real-time video streams to support coordinated operations and incident management at jurisdictional borders or along regional corridors that are operated by multiple agencies.

Expand Emergency Vehicle Preemption

EVP is used to provide emergency response vehicles, such as fire trucks, ambulances, and sometimes police, with priority signal phasing at intersections to reduce delay and facilitate a faster response to incidents. In order to be effective, the emergency vehicle and all traffic signals along a corridor must be outfitted with EVP infrastructure, which includes on-board devices and devices installed at traffic signals.

Currently, all City-owned and operated traffic signals are outfitted with EVP field devices, and all City fire and EMS vehicles have the corresponding on-board devices. The City is in the process of upgrading their EVP network to transition to GPS-based EVP, which has been gaining traction as a more reliable and efficient option for emergency responders. As the system is upgraded and operational, the City should make an effort to track the performance of the upgraded system and help show the return-on-investment of more advanced transportation technologies, which can help gain management-level support for additional ITS investments to be made in the City.

While all City-owned signals have existing EVP devices, there are key City corridors where one or more of the intersections are owned or operated by either ADOT or Yuma County. It will be important for the City to partner with these agencies to discuss deploying City EVP at their intersections so that the benefits are continuous along corridors and are not negated due to a non-outfitted intersection. This may be accomplished by an agreement where the City may support the maintenance of the EVP device on another agency's traffic signal.

4. Program, Planning, and Policy Strategies

This category includes systems to implement in order to utilize and maximize the functionality of the physical ITS and communications infrastructure of an ITS program. The recommended systems include standard operating procedures, device standards, training, and scheduled programs.

These system strategy recommendations are described in the proceeding sections. **Table 5** summarizes the recommended program, planning, and policy strategies.

Table 5: Program, Plans, and Policy Strategies Summary

Programs, Plans, and Policy Strategies		Description	Implementation Considerations	Benefits	Cost Considerations	Dependencies	Original Need Warranting Strategy
A	Create/Update ITS and Communications Approved Product List	Develop a standard list of ITS devices that provide the functionalities desired by the City ITS program and are compatible with other City infrastructure and systems. Include ITS devices as part of traffic signal design standards, where possible.	Identify specific ITS devices that will address City needs, including, but not limited to traffic signal controllers and cabinets, vehicle detection, traffic signal heads, fiber and conduit, wireless radios, and network switches. Create or update traffic signal design standards that include desired ITS infrastructure (i.e. detection, controller, communications). Standards for communications equipment should be identified in partnership with the City IT Department Consider engaging other agencies in the region to discuss opportunities to create regional devices standards to support interoperability and combability.	Standardization improves interoperability of the system and makes sure that all devices provide the functionalities that the City desires. It will also increase maintenance efficiency, as there are fewer variations in the types of devices that need to be maintained and thus fewer maintenance practices to learn. It will also reduce the variation in device inventory that needs to be available.	There is no cost associated with establishing a list of standard equipment, with the exception of staff time.	Prior to establishing or updating signal device standards, the City must determine which combination of devices will support the ITS vision and goals. The standards will need to be updated as device needs change and devices are upgraded or replaced with newer technology.	• No ability to remotely access and centrally manage traffic signals and associated infrastructure in real-time • Lack of availability of real-time data at traffic signals that support day-to-day operations and emergency response as well as planning for operations. • Standardizing traffic operations infrastructure, including detection, controllers, and cabinets to facilitate maintenance of devices and support compatibility across agencies. • Upgrading traffic signal infrastructure, including detection, controllers, and cabinets, that are at end of life or not able support advanced operations functions that are desired.
B	TOC Standard Operating Procedures	Develop standard operating procedures (SOPs) for the TOC and for the use of ITS devices by City staff.	SOPs for the TOC may include details about TOC operations (hours of operations, personnel access), general operator expectations (answering phone calls, logging information, monitoring devices/systems), and operator processes for specific conditions (notifications and response to incidents, processes for changing signal timing, work zone management). The SOPs should also include agreed upon processes for inter-departmental use of ITS – such as Police or Fire use of cameras during incidents or special events and agreed upon intra-jurisdictional coordination or sharing.	SOPs will document processes and expectations for TOC and device/ system use so that they are agreed-upon and not contingent on the presence of specific individuals. SOPs will also help delineate roles and responsibilities for operations in the City to allow for the most coordinated and efficient operations.	There is no cost associated with establishing SOPs, with the exception of staff time.	SOPs should be established prior to full operation of a TOC. However, the ATMS and/or video management system should be in place before establishing SOPs and any agreements with other departments/agencies on their sharing and use	• No ability to remotely access and centrally manage traffic signals and associated infrastructure in real-time • Lack of availability of real-time data at traffic signals that support day-to-day operations and emergency response as well as planning for operations. • Standardizing traffic operations infrastructure, including detection, controllers, and cabinets to facilitate maintenance of devices and support compatibility across agencies. • It is not clear if existing staff have the capacity and skill sets to support operations and maintenance of advanced traffic operations strategies, infrastructure, and systems.
C	Road Closure Playbook	Collaborate with other City (and potentially other agency) traffic and public safety staff to identify and document agreed upon processes for coordinating on and responding to unplanned events that impact traffic on City roadways.	Coordinate with police and other responders to identify standard processes for notifying City staff of incidents on City arterials or ADOT facilities that will impact City traffic operations. Identify preferred alternate routes to ADOT-owned roads if they are closed. Identify roles and responsibilities of different responders related to responding to the incident and supporting traffic management. The Playbook processes and plans can be expanded to include other agencies who are interested in coordinating more on incident management.	Having pre-determined plans and set notification procedures will allow the City to act faster and in a more coordinated manor in the case of an incident that disrupts traffic operations on City streets. This can help improve incident response and clearance times, improve safety at the scene and on the rest of the network, and improve traffic operations along impacted routes.	Could be accomplished in-house at no cost with the exception of staff time	Identifying and implementing agreed upon notification processes and roles and responsibilities as part of a Playbook has no dependencies. Identifying signal timing plans to implement in response to an incident requires traffic signals to be connected to a central management system and requires a traffic operations staff person to implement and monitor plans.	• Determining agency responsibilities for operations and maintenance of traffic signals in the region. • Limited agency procedures and processes (between departments within an agency and between different agencies) for coordination and joint decision making for day-to-day transportation operations.

Programs, Plans, and Policy Strategies		Description	Implementation Considerations	Benefits	Cost Considerations	Dependencies	Original Need Warranting Strategy
D	Formalize Signal Timing Program	Develop and document City traffic signal timing standards and put into place a program that provides staff time and funding to periodically evaluate, and update as necessary, traffic signal timing along key corridors.	Identify the staff skill sets and time required to support traffic signal retiming efforts. Determine and allocate annual budget for retiming efforts. Create traffic signal retiming standards that includes City policy on signal timing components (i.e. green time, clearance intervals, reference phase for coordination).	Optimizes traffic flow along the corridor based on current conditions. Reduces citizen complaints about red lights. Makes sure that key corridors within the City continue to operate efficiently as traffic increases or travel patterns change.	Cost associated with maintaining licenses and the current versions of analysis programs (City currently has Synchro and Vissim) and staff time. Contractor signal retiming costs around $1,800 per signal.	Having communications to traffic signals and an ATMS system is highly recommended, although technically not required, prior to implementation of a regular signal timing program. Having detection at intersections to provide accurate data is important for signal timing efforts	• Limited agency procedures and processes (between departments within an agency and between different agencies) for coordination and joint decision making for day-to-day transportation operations.
E	Maintenance and Lifecycle Management Program	Formalize an asset and maintenance tracking program for new TOC equipment and for all ITS devices and systems. The program should identify expectations for maintenance and lifecycle planning and identify funding streams and staffing to support maintenance and replacement of equipment.	Include all TOC equipment and systems in the City's Lucity asset management program to track maintenance, upgrades, and lifecycle planning (install date; anticipated replacement date). Coordination with Public Works will be necessary to ensure proper maintenance and upgrades for ITS field devices. Coordination with IT will be necessary to ensure proper maintenance and upgrades of communications equipment	Allows for proactive lifecycle and maintenance planning for ITS Program to identify funding (including external funding opportunities) before device/system end of life	Establish a reliable and consistent budget for maintenance and replacement; identify staff time necessary to implement desired maintenance program	Staff may require training on proper maintenance of new devices or systems that may be installed. Establishing standards for ITS equipment will support an efficient maintenance and upgrade program.	• No ability to remotely access and centrally manage traffic signals and associated infrastructure in real-time • Lack of availability of real-time data at traffic signals that support day-to-day operations and emergency response as well as planning for operations. •Standardizing traffic operations infrastructure, including detection, controllers, and cabinets to facilitate maintenance of devices and support compatibility across agencies. •Upgrading traffic signal infrastructure, including detection, controllers, and cabinets, that are at end of life or not able support advanced operations functions that are desired.
F	Operations and Maintenance Training	Identify and create opportunities for training staff on ITS, including for specific devices and systems, but also for operational strategies, such as traffic signal timing, traffic incident management, or technician training.	Gather information on existing training programs, such as the American Traffic Safety Services Association (ATSSA) and the International Municipal Signal Association (IMSA), among others Consider where trainings might be useful beyond those immediate to the City ITS program, including other City departments or other agencies. There may be opportunity to collaborate with YMPO or other agencies in the region to put on regional training that may be widely applicable. Consider reaching out to other agencies or MPOs in the state to see if any application trainings are being held that City staff could attend.	Providing staff with proper training will allow them to most efficiently and effectively operate and maintain the ITS program, resulting in the most effective traffic operations and maintenance processes.	Device and system training should be part of some vendor contracts at no additional cost. Other trainings may have an additional cost. Consider partnering with other departments or agencies to share costs	Establishing ITS equipment standards will help identify any device-specific training needs Establishing SOPs for traffic signal timing and for TOC and ITS device use will help identify any device- or system-specific training needs	• It is not clear if existing staff have the capacity and skill sets to support operations and maintenance of advanced traffic operations strategies, infrastructure, and systems.

4.1 Establish Standard Practices

ITS and Communications Standards

As the City implements the Infrastructure Strategies in the document, it is recommended that staff consider identifying device standards for ITS and communications equipment that are deployed in the City, which may include, but is not limited to: traffic signal controllers and cabinets, vehicle detection, traffic signal heads, fiber and conduit, wireless radios, and network switches.

A standard for some of the devices may include multiple vendors or models but documenting some level of standard will help make sure that equipment is procured and deployed that is compatible with other City infrastructure and systems and provides the functionalities that the City needs. Where possible and appropriate, the City may look to create or update traffic signal design standards that include desired ITS infrastructure (such as detection, traffic signal cabinets, or fiber and wireless communications). Standards for communications equipment should be identified in partnership with the City IT Department.

Standardization of devices will also increase maintenance efficiency for the ITS program. There will be fewer variations in the types of devices that need to be maintained and thus fewer maintenance practices or nuances to be trained on. It will also reduce the variation in device inventory that needs to be available to replace a device if it unexpectedly fails.

It is recommended that the City consider engaging with other agencies that operate and maintain ITS devices in the region to discuss opportunities to create regional devices standards to support interoperability and combability between agency networks and systems, which will support any future, regional operations that may be pursued.

Traffic Operations Standard Operating Procedures

TOC Operator SOPs

As the City implements and expands their ITS program to provide more real-time management of the transportation network, it is recommended to develop standard operating procedures (SOP) relative to TOC use and ITS device and systems. SOPs for the TOC may include details about TOC operations (hours of operations, personnel access), general operator expectations (answering phone calls, logging information, monitoring devices/systems), and operator processes for specific conditions (notifications and response to incidents, processes for changing signal timing, work zone management).

The SOPs should also include agreed upon processes for inter-departmental use of ITS – such as Police or Fire use of cameras during incidents or special events and agreed upon intra-jurisdictional coordination or sharing. SOPs will document processes and expectations for TOC and device/system use so that they are agreed-upon and not contingent on the knowledge and understanding of specific individuals. SOPs will also help delineate roles and responsibilities for operations in the City to allow for the most coordinated and efficient operations.

Road Closure Playbook

One specific SOP that should be pursued is the development of a Road Closure Playbook or set of agreed-upon notification and response processes for when there are incidents that will significantly impact City transportation operations. This will be helpful as the City establishes

centralized management of the traffic signal network and eventually pursues a TOC. This may include unplanned closures of City arterials due to incidents or emergency situations, but it might also address conditions when a major regional roadway, including a freeway, is unexpectedly closed and traffic is diverted to City streets.

The Road Closure Playbook would be an inter-departmental and potentially an inter-agency plan that designates:

- Preferred alternate routes based on the location of a closure (with focus on a freeway closure);
- Signal timing plans that would be activated to focus on moving vehicles along the route;
- Notification and coordination processes between public safety, traffic, and maintenance responders; and
- Roles and responsibilities of different responders as part of the incident response and management process and the resulting traffic management needs.

Collaborative development and use of a Playbook could improve coordination for City first responders, such as Police, maintenance crews, and traffic operations staff. An incident response playbook will improve incident response and safety and most efficiently move vehicles around the restriction by optimizing the use of the City roadway network.

Traffic Signal Timing Program

Traffic signal timing coordination and optimization can be one of the most cost-effective methods for improving mobility and traffic flow. Traffic signal optimization is done to:

- Adjust signal timing to account for changes in traffic patterns due to new developments and traffic growth;
- Reduce motorist frustration and unsafe driving by reducing stops and delay;
- Improve traffic flow through a group of signals, thereby reducing emissions and fuel consumption; and
- Postpone the need for costly long-term road capacity improvements by improving traffic flow with existing resources.

The objective is to maximize the progression of traffic along a corridor by coordinating timing plans on all signals based on the speeds and volumes of the corridor. Optimization helps minimize the number of stops, amount of delay, fuel consumption, and emissions experienced by drivers. Further, there is a federal regulation that, when the population of a municipality reaches 50,000, that agency is required to undergo signal optimization projects as part of air quality standards.

Thus, it is recommended that the City of Yuma establish a signal timing program. This should include establishing City signal timing standards and the formalization of a program for City Engineering staff to look at and potentially update traffic signal timing along key corridors in the City on a regular basis. It is recommended that a corridor get reevaluated on average of every two to three years.

There are some corridors in the City where there are traffic signals that are not operated by the City, so these optimization projects will have to be collaborative efforts that involve partnership and support from other agencies, including Yuma County and ADOT.

4.2 Maintenance and Lifecycle Management Program

This set of strategies relates to criteria for a lifecycle management and maintenance program for ITS devices, which highlights the need for on-going support for ITS Program devices and systems after they are initially deployed. The number of devices and systems that need to be maintained throughout the City of Yuma will increase as the City develops and grows ITS infrastructure network within the City. These devices and systems need to be appropriately and effectively replaced, upgraded, and maintained to provide accurate, reliable, and timely information.

Operation and maintenance (O&M) of ITS technologies and systems extends beyond simply keeping the equipment working. Reacting to emergency failure conditions, maintaining accurate maintenance logs, and conducting preventive maintenance programs all require processes in place to plan for and react to needs, and fully train staff to perform them. A comprehensive inventory will help to plan for when device upgrade or replacement should occur and can track the tradeoff costs of maintaining equipment beyond its lifecycle versus replacing the equipment. A maintenance management system may help track maintenance cycles and failures to help with tracking and prevention.

ITS Maintenance Program

The City has funding to support maintenance of traffic signal devices to keep devices in a functional state. Currently, the City is upgrading three-to-four traffic signal intersections every year as part of an asset replacement program. It would be beneficial for the City to have a similar program established for all of the current and new traffic signal and ITS infrastructure based on the projected lifecycles and speed of technology advancement for different technologies.

There are two maintenance types to consider, preventative and responsive maintenance. The following are descriptions of what these two maintenance types entail:

- **Preventive Maintenance** – **What to do to prevent failure** – This encompasses a set of checks and procedures performed at scheduled intervals including: inspection, record keeping, cleaning, and replacement.
- **Responsive Maintenance** – **What to do when something fails** – This is the initial reply by field maintenance staff to an ITS subsystem or malfunctioning device. Response maintenance includes minor maintenance activities, major maintenance activities, and major rehabilitation/upgrade activities.

Recommended maintenance activities are based on device-type general guidelines, rather than required activities. Maintenance programs are limited by resource availability and it is recommended that the City to identify areas where maintenance activities could be introduced based on resource availability.

Preventative Maintenance

Preventive maintenance is a set of procedures that involve repetitive upkeep of ITS devices and system. It is performed to ensure the reliability and longevity of the mechanical and electrical operations of an ITS device or system and will reduce failures in equipment, cost of responsive

maintenance, road user costs, and liability exposure. Preventive maintenance includes minor and major maintenance needs, making the frequency of maintenance an important consideration.

As the City's ITS infrastructure grows over time and maintenance efforts increase, the City will need to expand and formalize their preventative maintenance program to include additional devices, including new types of devices and systems that are deployed. A formalized program, including documented processes and regular training, is particularly important to have in place as new staff is added to support the growth. **Table 6** outlines the preventive maintenance activities and frequencies that vary by ITS device, device components, and systems. This table can be used as a reference or used as a checklist when incorporating new signals, new ITS infrastructure, or new staff. The City should review and revise the preventive maintenance procedures on an annual basis to ensure new issues are being addressed.

Table 6: Preventive Maintenance Recommendations

Intersection Preventative Maintenance	Recommended Interval
Interior Cabinet Check	
Clean cabinet Interior Check controller lamp and door switch Check fan and thermostat Check filter Check door fit and gasket Check locks and hinges Check/verify for cabinet timing and log sheet Check field block terminal connections Check conflict monitor indications	Annually
Check all detectors	Quarterly
Exterior Cabinet and Field Check	
Check condition of cabinet exterior Check all signal indications Check all pedestrian indications Check pole conditions and hand hole covers	Annually
Check all signal head back plates and visors Check alignment of signals and pedestrian heads Check condition of pull boxes and lids	Quarterly
Intersection Field Check	
Visual check of all traffic loops	Quarterly
Visual check of other traffic system related cabinets	Annually
Typical CCTV Check List Items	**Recommended Interval**
Visual check of assembly CCTV receiver Video transmitter Fiber distribution unit Cabinet equipment Pole or exterior condition	Annually

Responsive Maintenance

ITS devices and systems have specific maintenance requirements per the manufacturer's maintenance manual for each device. There are three types of maintenance that ITS devices require to fulfill their intended design for operations and lifecycle:

- *Minor Maintenance* – Minor maintenance includes tasks can be carried out without large scale testing or the use of heavy equipment. It includes visual inspections and checking of many items, elementary testing, cleaning, lubricating and minor repairs that can be carried out with hand tools or portable instruments.
- *Major Maintenance* – As well as all items normally done under minor maintenance, major maintenance also includes extensive testing, overhauling and replacement of components, which may require a scheduled power outage and the use of bucket trucks and other heavy equipment.
- *Major Rehabilitation* – Major rehabilitation or complete replacement is contemplated for devices that experience frequent malfunctions or failures.

Table 7 identifies the typical frequency of minor and major maintenance, major rehabilitation, and lifecycle timeframes for a range of ITS devices. The following are resources that were utilized in the development of recommended ITS device maintenance guidelines for the City of Yuma:

- Recommended Practice for Operations and Management of ITS (ITE Publication); and
- International Municipal Signal Association (IMSA) Preventive Maintenance of Traffic Signal Equipment Program.

The City is encouraged to utilize these guidelines to create their maintenance program, understanding there may be constraints on resources in some situations.

Table 7: ITS Device and Communications Maintenance Guidelines

Equipment Type	Minor Maintenance	Major Maintenance	Major Rehabilitation	Lifecycle Timeframe
Traffic Signal Systems				
Cabinets	26 weeks	2 – 5 years	10 years	10 years
Signal Heads	26 weeks	2 – 5 years	10 years	20 years
Electronics	13 weeks	N/A	N/A	10 years
Poles	26 weeks	5 years	15 years	50 years
CCTV Camera Systems				
PTZ Units	26 weeks	1 year	3 years	10 years
Vehicle Detection Systems				
Loop Detectors and Cables	26 weeks	1 years	5 years	10 years
Cabinets	---	26 weeks	10 years	20 years
Power Supply	26 weeks	5 years	10 years	20 years
Grounding	1 year	5 years	10 years	25 years
Controllers	---	26 weeks	2 years	7 years
ITS Telecommunications Systems				
Fiber Optic Cable Plant	1 year	5 years	25 years	25 years
Fiber Optic Plan Video and Data Equipment	---	26 weeks	3 years	10 years
TOC Equipment				
Servers	26 weeks	1 year	2 years	5 years
Rack Equipment	-	1 year	2 years	5 years

Equipment Type	Minor Maintenance	Major Maintenance	Major Rehabilitation	Lifecycle Timeframe
Workstations	26 weeks	2 years	2 years	5 years
Workstation Displays	26 weeks	1 year	3 years	5 years
Uninterruptible Power Supply	1 year	5 years	10 years	20 years

These guidelines should be updated as information becomes available to incorporate the increased reliability that may be the result as new technologies are implemented or devices are upgraded.

As additional and new types of devices and systems are implemented, including new field devices and the TOC, the departments who are responsible for tracking the various assets should keep a detailed inventory of maintenance activities that have occurred in the Lucity asset management system. The following standard operating procedures should be tracked in Lucity:

- Detection;
- Work order creation;
- Dispatched resources;
- Response activities;
- Diagnosis;
- Interim repairs; and
- Work order close out.

This tracking will allow the ITS Program to identify devices that are not reliable, not accurate or have had frequent malfunctions. The tracking will also allow the City to identify appropriate cases for technology replacements where maintenance of an existing technology may be more costly than upgrading to a newer technology. It is also recommended the City implement a Quality Assurance procedure as part of the program to ensure that the maintenance activities are occurring in a timely manner. The City is also encouraged to find ways for maintenance staff to address both preventative and responsive maintenance concurrently where it is feasible. This can help reduce maintenance cost and maximize staff effectiveness.

Replacement/Upgrades

Replacement of equipment can be suggested if a device has experienced frequent malfunctions, communications or operating failures, irreparable damage, or has exceeded its lifecycle expectancy. Lifecycle timeframe estimates for ITS infrastructure relevant to the City of Yuma are provided in the previous **Table 7** and will be further discussed within the ITS Deployment Plan. While some agencies have replaced various components of a device as it fails, the City of Yuma is encouraged to utilize preventive maintenance to decrease the frequency of ITS device replacement.

Agencies are currently experiencing much shorter replacement/upgrade timeframes because of rapidly changing technology. Occasionally, older technologies do not reach their lifecycle timeframe because of the development and need for newer technology. Emerging technologies such as those for Connected and Automated Vehicles, or real-time congestion information through Bluetooth, Anonymous Re-identification (ARID) devices, or Wi-Fi devices are experiencing a sub-three-year upgrade cycle. Agency's procurement processes and funds may not be able to respond to such rapid technology turnover.

It is recommended that, within the 10-year timeframe, the City focus on deploying a basic level of ITS deployment of communication to signals and detection until there is a comfort-level with

managing and using that infrastructure, prior to extending functionality to newer and lesser-proven technologies.

Institutional Support for Maintenance and Lifecycle Management

Ongoing support for this maintenance and lifecycle planning requires a reliable funding source and an adequate number of skilled and trained technicians to provide maintenance throughout the ITS devices and system lifecycles.

Funding of ongoing support O&M costs will likely need to be built into the Public Works, Engineering, and IT annual budgets based on the equipment. Maintenance for field equipment deployed at intersections is the responsibility of the Public Works department. All equipment related to the TOC will be the responsibility of the Engineering department for maintenance and upgrades. The IT Department will likely play a significant role in the maintenance and tracking of the communications network. Though all of these functions are eligible for funding through HURF, it is recognized throughout the state that HURF may not provide all of the needed funding for this program in addition to all of the other HURF related activities.

It is anticipated that all of the maintenance operations for ITS devices or systems (detection, traffic signals, and CCTV cameras, fiber) are inherently governmental operations; therefore, will be accomplished in-house. The roles and responsibilities, maintenance guidelines, and requirements of various maintenance staff (necessary trainings, certifications, and skills sets) should be included in the official duties for relevant staff positions.

4.3 Operations and Maintenance Training

As the City's ITS program is expanded and enhanced, City staff will need to be trained on a variety of new devices, systems, processes and advanced operations strategies. Trainings should include those specific to devices and systems, but may also include operational strategy training, such as on traffic signal timing or traffic incident management. Providing staff with proper training will allow them to most efficiently and effectively operate and maintain the ITS program, resulting in the most cost-effective traffic operations and maintenance processes.

Device and system training should be part of some specific vendor contracts at no additional cost to the City. There are also online training resources as well as other trainings that the City could investigate bringing, such as Traffic Incident Management (TIM) Responder training, which is provided as part of the Statewide TIM Coalition. As Engineering and Public Works identifies trainings that their staff need or trainings that are available, it may be pertinent and beneficial to reach out to other City departments or other agencies in the region to see if there is larger interest in the training, which might help share costs and could help elevate traffic operations and management in the City or the region. There may also be opportunity to collaborate with YMPO or other agencies in the region to put on regional training in areas that are deemed widely applicable and beneficial.

5. Data Strategies

A primary benefit to ITS devices and systems put in place is the data that it captures and the information that data can provide. Data can provide situational awareness where there was none before. Data can provide analysis tools and evaluation metrics that can be used to support decision-making and cost-savings. Data can be used for long-range planning and before-and-after analysis to determine successes and failures associated with development and economic growth.

New data is growing in the scale, the breadth, and the source as the transportation environment moves toward a Connected Vehicle environment. Data is quickly becoming a driver both locally and nationally for decision-making, and it is in the best interest of this ITS Strategic Plan to acknowledge that the ITS Program can provide a wealth of data to support mobility, efficiency, and economic and community drivers that the City is moving toward.

The key advancement suggested in the Data Strategies is the intentional use of data to support real-time decision-making, investment strategies, and public information dissemination. **Table 8** summarizes the recommended data strategies.

Table 8: Data Strategies Summary

Data Strategies		Description	Implementation Considerations	Benefits	Cost Considerations	Dependencies	Original Need Warranting Strategy
A	**Data and Performance Tracking and Reporting – Internal and External**	Create a plan to collect, share, track, and report on data and/or performance measures related to traffic operations and ITS. Data can support operational decision making and can be turned into information that can be shared to show the impacts of the ITS Program The City should make a performance report available to the public to show impacts of the City's investments in the transportation system and support public education related to ITS and traffic operations.	Identify metrics that would be beneficial to track or report on – both for Engineering as well as for other City departments. Identify the sources of the data and a way to collect it at an appropriate frequency, which may require partnership with other departments. Establish a format and method for sharing data and presenting performance metrics so that that is accessible internally to City staff across all departments. Consider partnering with other agencies who might benefit from the data or who have interest in performance tracking on a regional level	Tracking and reporting on data and performance measures will support City departments in sharing data and information and will allow City staff to see how they are progressing towards specific goals or how the City's transportation system is performing over time	Staff time will be required to collect and analyze data and to create a performance report. Additional costs would arise if the City wanted to create a centralized database for data collection or for automating performance reporting	Deployment of devices and system to collect the desired data is necessary The ability to collect and aggregate data is necessary, which will be facilitated through implementing the recommended transportation communications network and the use of a centralized management system	• Conducting outreach and education to elected/public officials and the public to garner support for the use of more advanced technologies (such as intersection cameras) to support regional transportation operations. • Lack of availability of real-time data at traffic signals that support day-to-day operations and emergency response as well as planning for operations. • No ability to remotely access and centrally manage traffic signals and associated infrastructure in real-time.
B	**Traveler Information**	Building off of the data and performance measure strategy, the City should consider ways to provide travelers with real-time traffic condition information.	Create a publicly available interface for traffic data; at a minimum, provide planned roadway restrictions as a result of planned road work, but, if possible, provide real-time information, such as congestion or traffic incidents (may involve working with public safety for crashes). The interface may be a City-run website, such as a map or could be accomplished through social media. The City may also consider partnering with a third party, such as Google, to integrate City data into an existing platform	Information on traffic conditions allows travelers to make trip planning and route determination decisions, which would support reduced congestion in the City. It will also be a highly visible City service to show that the City is using its resources to support its residents and visitors in ways that no other City is doing so.	Creating and updating a static map with construction restrictions or utilizing social media to provide information would have no cost besides staff time; Providing a real-time condition map may require software development, but may leverage the ATMS investment that Engineering will pursue to reduce costs	The functionality of the map is dependent on data being available and collected by the City. For real-time data, availability is dependent on implementation of communications to connect ITS devices and a central management platform to allow for data collection	• Conducting outreach and education to elected/public officials and the public to garner support for the use of more advanced technologies (such as intersection cameras) to support regional transportation operations. • Lack of availability of real-time data at traffic signals that support day-to-day operations and emergency response as well as planning for operations.

5.1 Data and Performance Tracking and Reporting – Internal & External

ITS Data

Table 9 presents a list of data that can be collected from ITS devices or could be collected by a traffic operations or maintenance log pertaining to the operations of ITS devices. The data types range from data that is inherent in the device (whether it is on or off), to more involved data that may have to be actively created (hours of preventative maintenance).

Some of these data are useful for internal City consumption while others can be turned into information and disseminated into the public. For data targeted for City use, some of it will be most relevant to traffic engineering to support real-time traffic condition monitoring and decision making, while other data could be useful to groups such as IT or signal maintenance related to network performance and uptime.

Table 9: ITS Data Types and Sources

Detection	CCTV
• Status – on/off • Communication transmission success/failure • Volume • Classification of vehicle • Vehicle occupancy • Anonymous ID location and time • Pedestrian actuation and movement • Bicycle actuation and movement • Stopped vehicle notification • Turning movement counts	• Status – on/off • Communication transmission success/ failure • Image speed (frames per second) • Occupancy start/end • Stopped vehicle notification • Queue length
Fiber	**Wireless Radio**
• Status – on/off • Communication transmission success/failure • Bandwidth consumption • Timestamp of bandwidth usage	• Status – on/off • Communication transmission success/ failure • Bandwidth consumption • Location of bandwidth consumption • Timestamp of bandwidth usage
Emergency Vehicle Preemption	**Automatic Vehicle Location**
• Status – on/off • Activation timestamp at location	• Location of vehicle (Fire, Police, Transit, Ambulance)
TOC Operator	**System Activity**
• Incident response initiation of activity • Congestion response initiation of activity • Timestamp of sending notification by any method (email, system note, text, social media, etc.) • Incident location/time • Timestamp of receiving incident or system performance notification (email, system note, text, social media, etc.) • Reason for signal timing change (manual log)	• Signal plan change time • Timestamp of time when camera image is accessed • Number of incidents (Police/Fire Computer-Aided Dispatch (CAD)) • Incident location, start/end time and duration (Police/Fire CAD)

Traffic and ITS Performance Measures

It will be important to keep track of the performance of the ITS program by using the available data from ITS devices to calculate and/or tracking performance measures. Tracking the performance of the system will:

- Increase accountability for the upkeep and performance of the system, because any flaws or areas of low performance will be tracked and visible.
- Identify opportunities for increased investment and expansion of the system (physically and financially).
- Justify past and future investments into the system, both internally and to the public.
- Support public education related to ITS and traffic operations and act as positive publicity for the City.

Performance measures can help the City assess the outputs and outcomes of the ITS program. These measures may provide good indication of how well an ITS Program is performing with respect to some of its main outcomes. The following are examples of performance metrics that could be calculated from ITS data and could help track the performance of the ITS/traffic operations program:

- Travel times along key (regional) corridors
- Incident response time and incident clearance time
- ITS device and communications uptime
- Vehicle delay/queue length at intersections
- Vehicle delay during unplanned traffic events

As the City implements its ITS vision, it will be important to track performance to be able to justify investments and to understand what can be shared with other departments to support their mission and goals. Performance reports can also be shared with the public to provide information on the return on investment of City funds for transportation and to help education the public on ITS and the potential benefits of investing in and using transportation technologies.

5.2 Traveler Information Dissemination

The City should consider using the data and functionalities provided by ITS infrastructure and systems to create a publicly available interface for the data. Considering the robust data set that ITS can provide, there are benefits to providing data to the traveling public to support them in making informed travel decisions. At a minimum, the City should provide planned roadway restrictions that result from planned roadwork, and this data should be kept as up to date as possible. If possible, the City should consider how to also provide real-time condition information, such as congestion or traffic incidents; the latter may involve working with public safety

The public interface for presenting the data may be:

- A City-run website, such as a map on the City Engineering website,

- Use of social media platforms (Twitter, Facebook) managed by the City, either as a traffic-specific account or part of the City's general social media accounts.
- An agreement with a third-party provider, such as Google, to integrate City data into an existing traveler information platform.

6. Coordination and Partnerships for Implementation

While most of the strategies outlined for the City's ITS Program will likely be led by the Engineering department at the City, many of them will require coordination and partnerships with other departments or other agencies to successfully implement and sustain. There are also opportunities for ITS strategies to be expanded beyond City borders to provide inter-agency traffic operations benefits, understanding that the expectations of the traveling public related to traffic operations does not stop at or account for jurisdictional borders.

The next phase of this ITS strategic planning process for the City is to develop a Deployment Plan, which will explore specific details of the recommendations, including more detailed costs, implementation timeframes, operations and maintenance planning, and specific policies or agreements to pursue. The general needs and opportunities for collaboration and partnership on ITS initiatives are described in this section.

6.1 Strategies that Require Coordination

ITS will inherently be a multi-departmental effort in the City of Yuma. At a minimum, traffic operations is the responsibility of City Engineering. The maintenance of traffic signals and other devices at intersections is the responsibility of City Public Works. The City's approach to establishing a comprehensive and redundant communications network is being championed by the City IT department. There are also a variety of other departments and other agencies in the region that will either have stake or a role in an ITS-related strategy.

Strategies that require the Engineering Department to coordinate with *another City Department* include:

- Establish a Transportation Communications Network - IT
- Implement a TOC – IT, Police (if co-location is desired)
- Implement an ATMS – IT
- Upgrade Traffic Signal Cabinets and Controllers – Traffic Signal Group
- Implement Detection at all Traffic Signals – Traffic Signal Group
- Implement Intersection Monitoring – IT, Police
- Implement a Video Management System - IT, Police
- Expand EVP to all Traffic Signals within the City – Fire, Traffic Signal Group
- Create/Update ITS and Communications Standards - IT
- Road Closure Playbook – IT, Police,
- Maintenance and Lifecycle Management Program – IT, Traffic Signal Group

- ITS Performance Measure Tracking and Reporting - IT
- Traveler Information Plan – IT, POI, Police
- Public Education Campaign - POI, Police

Strategies that require coordination with *another agency* include:

- Upgrade Traffic Signal Cabinets and Controllers
- Expand EVP to all Traffic Signals within the City
- Formalize Signal Timing Program

6.2 Strategies that Provide Opportunities for Partnering

The City of Yuma's vision and goals for an expanded ITS program will also benefit and be supported by partnering with other City departments and externally with other agencies. While these partnerships may not be required, partnering and collaboration will both strengthen and elevate ITS strategies and the benefits that can be realized for traffic operations in the City and potentially beyond the City into the larger Yuma metro area.

Some key areas where partnering and coordination would support elevated benefits include incident management, data sharing, and cohesive traffic operations. The strategies that would benefit from partnering and coordination with other agencies include:

- **Implement a TOC** – opportunity for other agencies to participate in establishing and operating a TOC to support regional traffic operations.
- **Implement an ATMS** – opportunity to consider a regional ATMS system that would provide interoperability between agencies.
- **Infrastructure Upgrades** – opportunity to standardize ITS equipment across the region.
- **Implement Intersection Monitoring and a Video Management System** – opportunity to share real-time visual monitoring capabilities between agencies.
- **Create/Update ITS and Communications Standards** – opportunity to standardize ITS equipment across the region.
- **Road Closure Playbook** – opportunity to coordinate notification and traffic management processes for incident and emergency management across the region.
- **ITS Performance Measure Tracking and Reporting** – opportunity to share data and track and report on operational performance measures across the region.
- **Traveler Information Plan** – opportunity to provide traveler information at a regional scale to support traveler decision making.
- **Public Education Campaign** – opportunity to disseminate information and provide education to the public on ITS and traffic management throughout the region.

7. Funding

Implementation of many strategies is contingent upon the attainment of additional funding for infrastructure, systems, staff time, and contractor services. Being apprised of funding opportunities and their schedules will allow the City to have time to prepare necessary materials and applications. **Table 10** below shows potential funding opportunities for ITS infrastructure and systems:

Table 10: ITS Funding Opportunities

Funding Source	Description	Relevant Schedule
YMPO Transportation Improvement Program (TIP)	A regional list of transportation projects selected for local, state, and/or federal funding within with YMPO Yuma County area.	TIP programming covers a period of 5 years.
City of Yuma Capital Improvement Program (CIP)	The City financial plan for local infrastructure improvement projects. Projects included are identified by all City Departments, reviewed by a review committee, and approved by City Council.	CIP programming covers a period of five years, updated each year for the following five-year period.
ADOT Local Public Agency (LPA) Program	A program that allows local agencies to utilize ADOT's on-call services with federal funding. The LPA program follows a four-step process for projects: Planning/Programming; Development/Design; Construction; and Final Acceptance.	The LPA process from planning/program to final acceptance is generally a 40-month to 72-month process depending on the scope of the project.
Development-driven projects	A potential source of project funding is through development driven improvements. Establishing ITS standards for developers to follow within private development projects or half street improvements can aide in the City ITS program buildout.	Infrastructure would be installed as development projects are established.
Federal Funding	Federal funding opportunities are released by the USDOT or other federal agency that can support agencies in planning for, designing, and/or constructing transportation infrastructure investments. Some examples include the Infrastructure For Rebuilding America (INFRA) discretionary grant and Better Utilizing Investments to Leverage Development (BUILD) Transportation discretionary grant. There are also some ITS/technology specific opportunities that area available – some recent examples are the Smart City Challenge, the Advanced Transportation and congestion Management Technologies Deployment (ATCMTD) grant, or the Automated Driving Systems (ADS) grant. Typically, federal funding is acquired by agencies like YMPO or ADOT, with local agencies are partners. Projects that show partnership and cooperation by multiple agencies in a region can elevate the attractiveness of applications for these federal opportunities.	Federal grant opportunities are often dictated by the current transportation legislation that is in place (the FAST Act is the current legislation). Some grants are one-time opportunities, while others occur on a recurring schedule.

Funding Source	Description	Relevant Schedule
State Funding	State agencies, including ADOT, will sometimes have funding available to regions or local agencies to support transportation investments. For example, ADOT's Planning assistance for Rural Areas (PARA) program provided funds to agencies for planning and preliminary scoping for transportation projects. The State Commerce Authority has programs that will support local government investments as they align with economic development and enhanced livelihood; for example, the Arizona Rural Broadband Development Grant makes funds available to act as grant match dollars to leverage additional federal resources to accelerate broadband deployment in underserved areas.	State funding opportunities may be dictated by the current federal legislation in place, while others use sale tax money or other local sources.

8. Next Steps

This document identifies the recommended strategies to consider based on the needs at the City. Many of the recommended strategies will require more resources, including funding, staff time and changes to institutional structures or processes in order to implement.

In the next phase of the project, the ITS Deployment Plan, the procedural, resource and staffing requirements that are needed to undertake the strategies will be explored. It will identify key agreements, partnerships and coordination efforts, programming processes, and recommended staffing and business models for supporting these strategies at the City. It will also involve outlining a 10-year implementation plan including summaries of costs per timeframe per funding source as well as recommended staffing levels needed for effective traffic management and operations and will include coordinating potential ITS projects with planned projects. The plan will provide guidance for the City on how to create the institutional foundation to successfully implement the ITS strategies and reach the desired ITS program that is defined in the vision and goals.