CONCEPT OF OPERATIONS FOR

Yuma Traffic Operations Center

Prepared for

CITY OF Yuma

In coordination with

ADOT

Yuma San Luis Cocopah Welton Somerton Yuma County ADOT YMPO

YUMA COUNTY ARIZONA

SOMERTON ARIZONA 1898

CITY OF SAN LUIS, AZ INC. 1979

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List of Acronyms

ADOT – Arizona Department of Transportation
ATMS – Advanced Traffic Management System
ATSSA –American Traffic Safety Services Association
CAD – Computer Aided Dispatch
CCTV camera – Closed Circuit Television camera
ConOps – Concept of Operations
CPU – Central Processing Unit
EVP – Emergency Vehicle Preemption
IGA – Intergovernmental Agreement
IMSA – International Municipal Signal Association
IT – Information Technology
ITS – Intelligent Transportation Systems
MUTCD – Manual on Uniform Traffic Control Devices
PD – Police Department
PW – Public Works
RMS – Records Management System
TOC – Traffic Operations Center
TSMO – Transportation Systems Management and Operations
UPS – Uninterruptible Power Supply
YMPO – Yuma Metropolitan Planning Organization
YRCS – Yuma Regional Communications System

1. Introduction

The City of Yuma (City) is pursuing the planning and eventual implementation of a Traffic Operations Center (TOC) as a part of the development of an Intelligent Transportation System (ITS) Strategic Plan. The implementation of a TOC is a strategy to elevate the City's ability to operate and manage a safe and efficient transportation network and contribute to the management of the larger transportation network in the Yuma Region.

The City of Yuma has the largest number of traffic signals and other traffic management equipment within the Yuma region but does not have the ability to monitor or actively operate its network. There could be significant safety, efficiency, and public relations benefits if the City Engineering staff, and potentially other regional partners, had the ability to monitor and operate traffic signals and other ITS devices in real-time from a centralized location. A TOC will allow for this centralization and real-time operations for the City of Yuma network and creates an opportunity for multiple agencies to coordinate and collaborate on traffic operations and management strategies at the regional level.

Establishing a TOC in Yuma also supports the City of Yuma's Vision and Strategic Outcomes and will specifically help make progress towards the 'Safe and Prosperous' strategic outcome.

- A TOC will enable implementation of traffic management strategies to reduce delay that travelers experience from congestion and uncoordinated traffic signal timing.
- More efficient traffic management will support travel time savings, reduced emissions, and reduced traveler frustration associated with congestion.
- Having a safe, efficient, and modern transportation network may provide a competitive advantage for the City and the region and incentivize people to live and bring their businesses to Yuma.

1.1 Concept of Operations and Functional Priorities Description

This TOC Concept of Operations (ConOps) will help to answer the critical questions that will define the components of a TOC required to meet the specific traffic management needs of the City of Yuma:

- What are the critical functions that the TOC needs to perform to address needs and gaps, meet the safety and mobility goals, and maximize benefits for the traveling public within the City and as part of the larger Yuma region?
- What are the TOC physical space needs to effectively manage and operate the current and future transportation network within the City and as part of the larger regional transportation network?
- What are the equipment needs that the systems and functions of the TOC will require?
- What are the staffing needs for the TOC to most effectively carry out Yuma's role in traffic management and operations, incident management, information dissemination, both within the City and as part of the larger region?

Functions are defined in this context as transportation or emergency-related services such as operating a traffic signal system, supporting incident management response, and supporting the dissemination of traveler information. TOC functions will be evaluated for their impacts to space requirements within the TOC for personnel, equipment, and access needs. All functions identified for the TOC need to be considered and prioritized for importance in the fundamental responsibilities of the TOC to make certain that the ultimate resource plan and spatial layout fits within the space needs and budget allotted.

1.2 Project Development Process

Figure 1 depicts the process for defining and crafting the overall functional picture of the Yuma TOC. It is important that the process be transparent and traceable back to a set of goals and needs to make sure that resulting capital investment and software system recommendations are consistent with the original intent of the TOC to support efficient and justifiable investments.

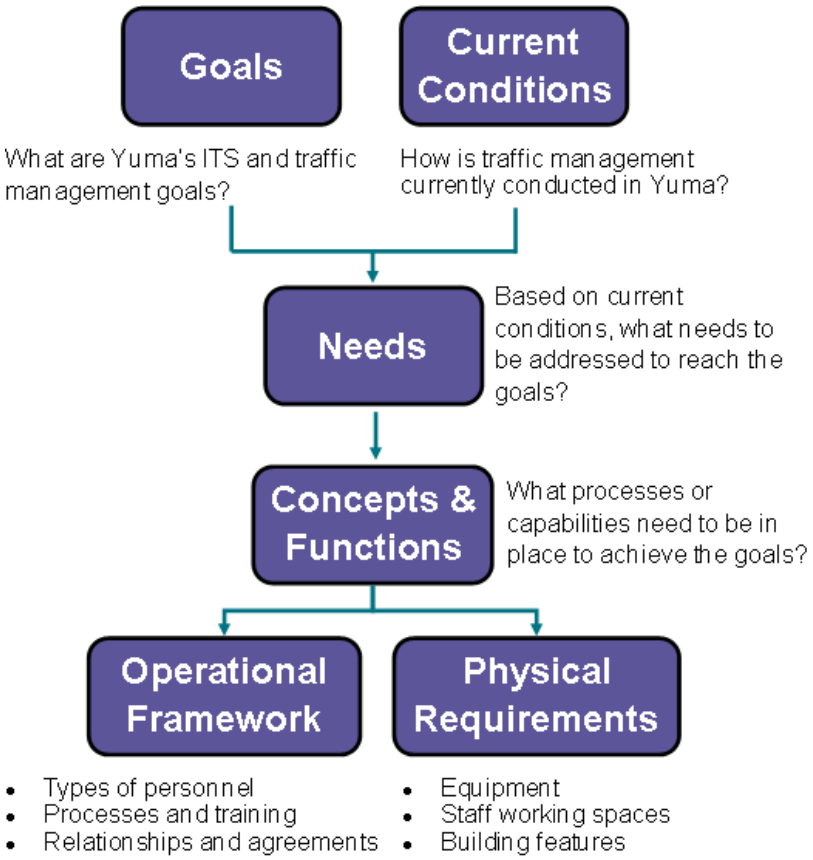


Figure 1 – TOC ConOps Development Process

1.3 Stakeholders

The Yuma Transportation Systems Management and Operations (TSMO) group was the lead for developing this ConOps and defining TOC processes. Because of the potential benefits of the TOC for other departments at the City and for other agencies within the region who are responsible for management of the regional transportation network, a variety of stakeholders were invited to participate in the planning and development process for the TOC concept.

Other City of Yuma departments that participated included:

- City of Yuma Police
- City of Yuma Fire
- City of Yuma Information Technology (IT)
- City of Yuma Public Works (PW)
- City of Yuma Public Affairs/Communications

Other agencies within the Yuma region that participated included[1]:

- Yuma County PW and Sheriff's Office
- City of Somerton PW
- City of San Luis PW
- Arizona Department of Public Transportation (ADOT) Southwest District
- Yuma Metropolitan Planning Organization (YMPO)

2. Goals and Needs

Strategic goals help guide decision making both for day-to-day operations as well as for identifying and justifying investments.

2.1 Intelligent Transportation System and TOC Goals

As part of the Yuma ITS Strategic Plan effort, a set of City ITS goals were identified to help establish a direction for a program that utilized advanced technologies and strategies to support a safe and efficient traffic network. The City ITS Goals are:

- 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 (i.e. technology in lieu of construction).
- 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.

These ITS goals were translated into a set of TOC-specific goals to help guide the process of defining functions and equipment and space requirements through this ConOps. The Yuma TOC Goals are:

[1] Participation and input from the Cocopah Tribe was pursued but not obtained during the development of this ConOps. The input and participation of the Cocopah Tribe will be important for regional operations and connectivity given the location of their traffic signal infrastructure in the middle of regional corridors.

- Elevate the City's ability to manage their transportation network in real-time through improving the City's and traveler's ability to make informed, data-driven decisions.
- Improve inter-agency coordination for traffic management and emergency response within the Yuma region.
- Identify a TOC space and operating concept that is scalable to accommodate current functions, future functions as well as a more regional-role, if desired in the future.

2.2 Traffic Management and TOC Needs

The Yuma ITS Strategic Plan also identified a set of needs and gaps that need to be addressed in order to make progress towards achieving the ITS Goals. From these needs and gaps, a list of specific needs from the perspective of a user of the TOC based on the goals are highlighted in **Table 1** to help guide the concept development for the TOC.

Table 1 – TOC User Needs

TOC User Need	Description
1. Need to have the ability to centrally manage and monitor traffic signals and associated infrastructure	The TOC needs to be connected to an ITS communications network and have a centralized traffic management system that allows an operator to remotely monitor infrastructure status and make changes to the infrastructure operations without having to be in the field.
2. Need improved data and information to support real-time operational decision making and dissemination of traveler information	The TOC needs to have access to real-time data about the transportation network to support real-time decision making about traffic operations and incident response, and to support the City in making real-time condition information available to the public.
3. Need coordination between traffic and first responders for incidents that will impact the City or regional transportation network	There is a need for more intentional coordination and more established processes between traffic and public safety for incident response and management.
4. Need coordination of traffic operations at jurisdictional boundaries and along regionally significant corridors	There is a need for more intentional operational coordination and integrated traffic management strategies between different agencies at jurisdictional boundaries and along multi-jurisdictional corridors.
5. Need to have trained staff to support the TOC functions	Staff need to be designated and trained to support the TOC functions, including the use of new systems, implementation of new traffic management strategies, and participation in inter-departmental and inter-agency coordination for traffic management.

3. Current Operating Conditions

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, State Route 195, and State Route 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.

3.1 Current Infrastructure

Traffic Management Infrastructure

Five agencies within the Yuma region own and operate traffic signal infrastructure. The City of Yuma is responsible for the largest network and currently operates 75 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). In addition to the City of Yuma, Yuma County, ADOT, the City of Somerton, the Cocopah Tribe, and the City of San Luis also operate traffic signals within their jurisdictions.

All but two of the existing traffic signals within the City are actuated, meaning that traffic signal timing is informed by data from vehicle detection. The two traffic signals without detection 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.

There are no closed circuit television (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 2 summarizes the existing transportation infrastructure in the City and in surrounding agencies.

Table 2 – Existing Transportation Infrastructure Summary

Device	City of Yuma	Yuma County	ADOT	Somerton	Cocopah Tribe	San Luis
Traffic Signals	75 Signals	24 Signals	17 Signals	4 Signals	2 Signals (one maintained by Yuma County)	4 Signals (all maintained by Yuma County)
Vehicle Detection	Loops and video	Loops and video	Loops, video, and radar	Loops	None	Loops

Transportation Communications Infrastructure

Currently, all City, County, and Somerton traffic signals are locally controlled and not connected to a centralized management system via an ITS communication network. Without a communications network, any traffic signal timing changes that are needed require someone to go out into the field and manually update traffic signal timing plans. The only way to monitor that the new timing plan is in effect and that it is performing correctly is to wait and observe the traffic signal in the field.

The City of Yuma IT department is partnering with the TSMO group to plan and ultimately implement a City-wide backbone communications network to connect City facilities and traffic signals to communications infrastructure. This backbone fiber would provide dedicated strands for a traffic communications network, allowing for signals along the route of the fiber backbone to connect to the network. The City backbone communications network will not connect to all City traffic signals, so the TSMO group is also identifying additional traffic-specific communications projects to provide communication to signals not in the immediate vicinity of the fiber backbone network. Successful planning and implementation of this communications network will ultimately provide a complete transportation communications network to provide connectivity to all signalized intersections within the City.

3.2 Current Processes and Systems

Traffic Management Processes

Day-to-day traffic operations are managed by each individual agency, with no established processes for coordination between the various agencies within the region. As of 2020, there is an intergovernmental agreement (IGA) between the City and Somerton for the City to provide traffic engineering support to Somerton. Additionally, Yuma County is responsible for the operation and maintenance of two traffic signals owned by the Cocopah Tribe.

All stakeholder agencies for this project noted that coordination between agencies during construction closures and detours is done proactively and effectively. Internally, Public Affairs/Communications coordinates with Engineering and Public Works to provide a weekly newsletter regarding planned events. Externally, Yuma County currently coordinates with the City of Yuma, Somerton, San Luis and ADOT for planned construction activities, while ADOT additionally coordinates with Caltrans and US Border Patrol for regional transportation support.

Incident Management Systems and Processes

Emergency vehicle preemption (EVP) is used to provide emergency response vehicles, such as fire trucks, with signal phase priority at intersections. Currently, the City of Yuma has infrastructure to support EVP for City emergency response vehicles at City signals. The program to install and support EVP infrastructure is a partnership between City Public Works and Fire. Other agencies do not have EVP deployed on their traffic signals.

Incidents are identified by a 911 call sent to a dispatch center who will send out responders right away. Dispatch will also enter incident information into the Computer Aided Dispatch Records Management System (CAD RMS) and also New World, a regional program used to send information between responders and dispatch. The entire County is also part of YRCS (Yuma

Regional Communications System) which has individual radio channels as well as common channels for inter-agency coordination that are accessible to all public safety officers. Additional internal communication includes a Fire exception report to notify their chain of command, including the City Administrator and City Public Affairs/Communications staff. Typically, communications to the public regarding incidents is done by the Police and Fire social media accounts.

If the supervisor on scene for Police determines that Public Works is necessary to help manage traffic at the scene, they will notify the on-call emergency response team. The main priority of Public Works emergency response team is to implement traffic control signs and barricades and potentially detour signage as necessary. Public Works also responds to incidents that involve damage to public infrastructure where staff may need to rectify the issue immediately or put temporary measures in place while the issue can be resolved. Police officers on scene will make the decision to turn off or put a traffic signal in flash and manually manage traffic within an intersection if warranted by the incident conditions.

ADOT is responsible for coordinating incident management on freeways through their TOC in Phoenix and will coordinate with local agencies if they expect significant impacts to arterials as a result of a freeway event. This function of monitoring and coordinating responses for incidents on the state freeway network is the primary function of the ADOT; ADOT TOC does not monitor or manage traffic signals.

4. Proposed TOC Concepts and Functions

This section outlines the conditions that support the development of a TOC and identifies the TOC capabilities that will need to be in place to elevate the current operating environment towards addressing the goals. This section will identify TOC priorities, with emphasis given to functions that can be implemented in a near-term scenario. It also identifies a long-term operational vision and capabilities that could be pursued in the future based on near-term successes.

4.1 Justifications for a TOC

A Yuma TOC was identified as a key strategy in the Yuma ITS Strategic Plan to reach the City's ITS and traffic management goals. There are three main conditions within the City and the larger Yuma region that justifies the need for a TOC – day-to-day traffic management; traffic device maintenance and uptime; and regional traffic and incident management.

Day-To-Day Traffic Management

The City of Yuma and other agencies within the region have made significant investments in traffic infrastructure to support safe, efficient, and seamless travel for residents and visitors. A TOC will allow the City, and potentially other regional agencies, to centrally monitor and manage traffic signals and associated infrastructure. Centralized traffic management abilities will create opportunities for improving traffic flow along key corridors and allow the City to collect and utilize traffic condition data to support more informed decision making both for traffic operations and for infrastructure/capital investment planning purposes. The centralized management and data collection opportunities afforded by a TOC would optimize the use of existing infrastructure investments and capitalize on opportunities to improve efficiency, safety, and data-driven decision making.

Traffic Device Maintenance and Uptime

Infrastructure maintenance and device operational issues, such as having a traffic signal out or in flash, can have negative impacts on traveler mobility, public perception, and public safety. It is important for the City to keep its infrastructure in working order and properly maintained, and TOC system will support that. With traffic signal and other devices centrally connected to a TOC, City staff can be alerted of device malfunctions right when they occur so that they can respond in a timely manner.

Regional Traffic and Incident Management

Travelers in the Yuma region expect a safe and seamless transportation experience regardless of which agency owns and operates a roadway. Currently, there is minimal coordination for traffic operations, such as traffic signal timing strategies, between agencies at jurisdictional borders or along multi-agency corridors. Managing advanced infrastructure and systems from a TOC, and implementing more formalized processes for traffic operations, will support this type of coordination and improve the traveler's experience within the region.

Similarly, a more coordinated approach to incident response and management, within the City and between adjacent jurisdictions, would provide safety and efficiency benefits for travelers and incident responders. The TOC can support more formalized and widespread incident

notifications and data sharing, especially between first responders and those responsible for traffic operations and management. Additionally, the TOC and its centralized systems will be able to support incident response and management; the video feeds from detection will allow responders to assess an incident scene before any responders are on-scene to support a more efficient response, and the TOC can support remote operations of traffic signals to support traffic management around the scene, freeing up first responders to focus on securing and investigating the incident rather than focusing on traffic management.

4.2 Near-Term TOC Functions

This section documents the functions envisioned for the Yuma TOC in the near-term. The TOC functions were derived from the TOC goals, user needs, and stakeholder discussions.

The near-term functions of the Yuma TOC are depicted in **Figure 2** and focus on implementing systems and processes to elevate traffic management within the City to provide a safer and more efficient network and to improve maintenance response time and device uptime of the traffic network.

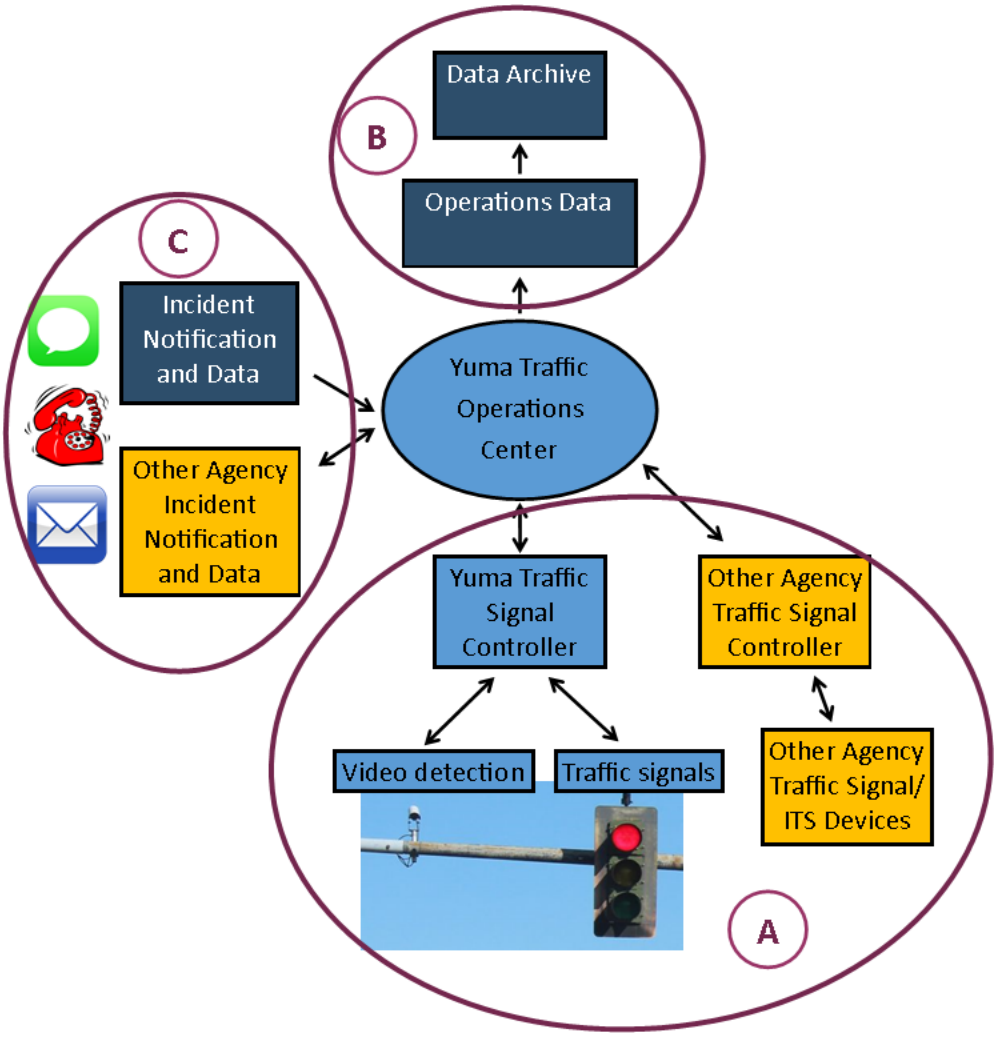


Figure 2 – Near-Term TOC Concept

(A) Connecting and Centrally Managing ITS Devices

One of the primary goals of the Yuma TOC in the near-term is to actively manage and monitor traffic through connected ITS devices. To accomplish this goal, devices in the field must be able to send data to and receive data from the TOC through a communications network. The City plans to deploy a network of video detection cameras, upgraded traffic signal controllers, fiber optic cable, and wireless radios to provide the data and communications to support this goal. Yuma IT will establish technical specifications to create secure connectivity into the infrastructure, including method of access, identity management, duration of connection, and requirements of connecting devices or networks. More information on the communications network and device buildout can be found in the Yuma ITS Infrastructure Implementation Plan, which is a separate document that is being developed as part of the larger ITS Strategic Plan effort.

The TOC will establish base infrastructure and systems to allow the opportunity to connect to and remotely monitor and manage other agency ITS devices if an agency is interested. This will be accomplished and detailed through formal partnerships and agreements. In the near-term, the City of Somerton has expressed interest in connecting their traffic signal infrastructure to a TOC system when a TOC is established[2]. The City of Somerton currently has an IGA with the City of Yuma for traffic operations and management support; this existing IGA provides a foundation to amend or expand the IGA to include connecting and operating Somerton traffic signals from the TOC.

Advanced Traffic Management System (ATMS)

The implementation of an advanced traffic management system (ATMS) will allow for remote monitoring, real-time operations, and data collection for traffic signals and video detection. As traffic signals are outfitted and connected via ITS communications, they can be connected to the ATMS. The ATMS will allow for the following functions to be implemented for the Yuma TOC:

- Utilize real-time traffic operations and condition data from connected devices to inform traffic signal timing strategies and allow implementation of a more dynamic signal timing program to better respond to current traffic conditions.
- Modify and test alternative traffic signal timings and store timing plans in a database;
- Operate the traffic signal system from various points on the city's communications network. It provides flexibility for TOC operators to make adjustments when they are not in the TOC;
- Receive maintenance alerts from field devices and communications equipment that are not functioning properly;
- Support incident management response by remotely operating traffic signals when there is a crash that requires lane restrictions at an intersection. This will allow the Police

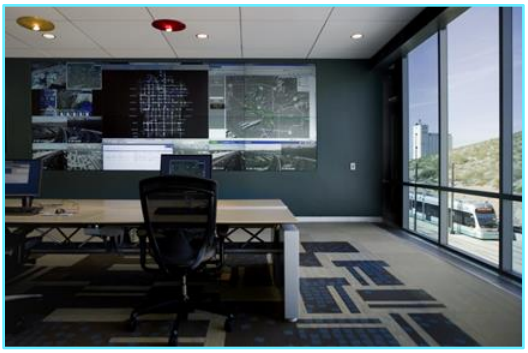
[2] To successfully connect City of Somerton infrastructure to the City of Yuma network, participation and connections to traffic signals owned by the Cocopah Tribe will be necessary, so this concept is also predicated on coordination with the Cocopah Tribe.

Department (PD) officers on-scene to focus on public safety and incident investigation, rather than on traffic management; and

- Support traffic management for planned events like construction or a special event that may require roadway restrictions and traffic detours through pre-planned signal timing strategies. Signal timings will be stored in the database and implemented when appropriate. This will improve existing detour processes by providing ability to adjust signal timing remotely and in-real time, rather than having to go to each controller to update the timing. It will also support signal timing from a corridor level for optimizing timings along a corridor rather than just being able to focus on the signal intersection.

During system design and procurement, a detailed set of ATMS software requirements should be developed to identify the specific requirements that a system must meet for the Yuma TOC. This ConOps should provide the foundation for developing these detailed system requirements.

The TOC will also provide a physical location for staff to work from to actively manage and monitor the real-time traffic conditions. The TOC location will include workstations for staff to manage traffic and signal operations, house the servers for the traffic network and collected data, and provide a video wall for more efficient monitoring.



(B) Collecting and Archiving Operations Data

ITS devices connected to the central system will collect operational data that can be used to inform the active traffic management within the City. Initially, video detectors can provide information on vehicle speeds, vehicle counts, and real-time (not historical[3]) video feeds. This data will allow the TOC to monitor traffic flow to make real-time adjustments to signal timing and to observe intersection conditions during an incident. Police Dispatch can be provided with remote access to video feeds to support incident verification when they receive a 911 call and help make sure that the appropriate response is taken depending on the incident circumstances that may be visible through the cameras.

Additional data that will be available through the TOC is device status information, such as if the device is on or off, if the communication connection is working, and if the device is functioning properly. This will allow the operators to dispatch maintenance crews to address any issues. Providing Yuma Police Dispatch with access to the ATMS for traffic signal status information will also allow them to remotely monitor and better manage and respond to 911 calls related to traffic signal malfunctions. TOC software can improve equipment asset management, tracking equipment repair and maintenance activities, and scheduling routine maintenance.

The central system in the TOC will automatically compile, generate, and archive reports including data and information such as active traffic signal timing, timing plans, operator-driven traffic signal timing changes, equipment malfunctions, and travel speeds. The database of these reports can be utilized to maintain historical records of signal timing plans. The City should pursue both internal City discussions and discussions with other agencies around data retention

[3] At this time, any video feeds that are available will be used for traffic management purposes only and will not have any surveillance purposes. Video feeds will only be available in real-time and will not be recorded or stored.

policies during the development of ATMS requirements to make sure that the equipment and systems are procured can accommodate the data storage and processing functions desired by the City.

The City can use historical data to support traffic studies, review of signal timing plans, and safety studies.

(C) Real-time Incident Data Exchange

Notifications about incidents within the City of Yuma go through the Police Dispatch Center, where the Dispatcher gathers more information about the event and relays the information to appropriate responders who will then respond to the incident. The TOC will be one of those responders who will be able to support the incident response by supporting and coordinating traffic management.

The TOC will receive notification and high level details about an incident through an automated email or text message generated from Yuma PD Dispatch. For concepts where Yuma County or City of Somerton traffic signals are operated from the TOC, this notification would come from the respective jurisdictions dispatch center. To identify freeway events that may impact the City of Yuma network, the TOC will follow the ADOT 511 and social media networks.

Knowing that there is an active incident, the TOC can implement traffic management strategies to support incident-related traffic management, and the TOC can also help provide notifications and information to other traffic management agencies who might be impacted by the event. When the Yuma TOC is notified about an incident that may have multi-jurisdictional impacts, the TOC operator will be responsible for notifying the other agency traffic staff to make sure they are aware of the event and allow them to mobilize to respond if/when it is needed.

4.3 Long-Term TOC Functions

As Yuma and the region grow the functions and capabilities of the TOC may grow as well. Future, long-term focus areas for the TOC include expanding data collection, supporting traveler information dissemination, and elevating interagency coordination at the TOC. Long-term functions for the TOC are depicted in **Figure 3**.

As these long-term functions become relevant, the City and any other partners who are participating in the TOC at that point may need to revisit and update software and hardware reequipments, and understand implications on staffing, systems, and security, to make sure they align with the expanded TOC concepts that are being pursed.

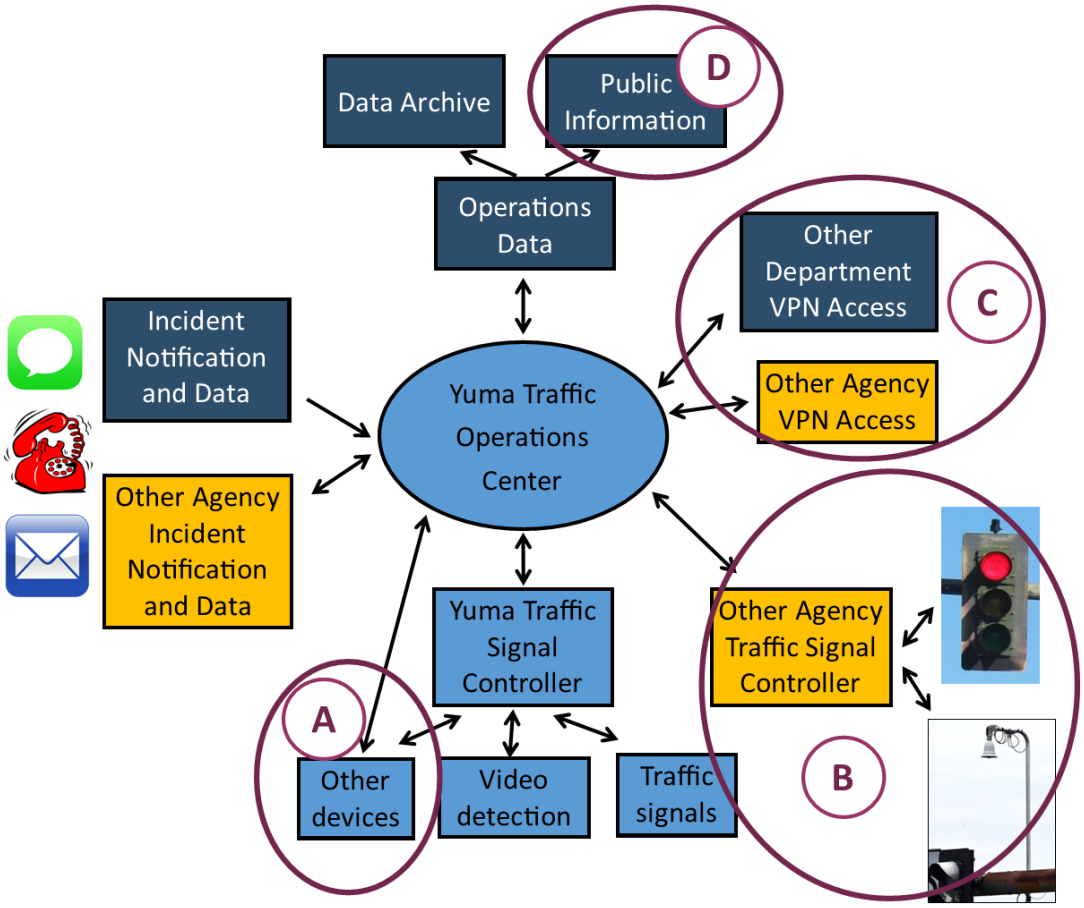


Figure 3 – Long-Term TOC Concept

(A) Expanding City of Yuma Connected Devices

As Yuma's ITS program expands, the TOC will be able to connect to and operate more devices of systems that are deployed within the City. Many other ITS/traffic management devices or more advanced traffic management systems that the City might choose to deploy may be connected to the TOC for centralized management and operations. Future, advanced devices might include traffic-specific CCTV cameras, permanent count stations, bicycle detection, weigh-in-motion systems, or other new devices that can be connected back to the TOC and centrally monitored and managed similar to traffic signals and video detection. Future systems may include more advanced traffic management systems that automatically adapt traffic signal timing based on real-time traffic conditions (known as adaptive traffic signal control) and connected vehicle systems that enable vehicles and roadway infrastructure to communicate and exchange data about traffic conditions. An example of a scenario in a connected vehicle environment is that a traffic signal would broadcast a message about the signal timing and phasing of the signal so that vehicles would know how to react most safely or efficiently; a broadcast message about a traffic light that about to turn red would allow the vehicle to start slowing down in advance to safely stop at the intersection.

There will also be opportunities to connect devices and systems that might not directly support traffic management, but that are important for City safety and mobility. Examples might include

something like a hazardous materials detection system, automated weigh-in-motion, or smart lighting. The deployment of any non-transportation oriented devices or systems will be driven by other departments and will be connected and monitored through a formalized partnership with the TOC.

(B) Expanding Connectivity to Other Agency Devices

In the near-term concept, the City of Somerton has expressed interest in connecting their traffic signals to the Yuma TOC where they will be centrally monitored and managed by the Yuma TOC staff alongside the City of Yuma infrastructure. This capability can be expanded to include additional agencies and additional devices from other agencies if they decide that they would like to participate at any time; other agencies who would have the opportunity to connect to the TOC at any time if they chose to participate would include Yuma County, the Cocopah Tribe, and City of San Luis. Any inter-agency connectivity or joint operations will be formalized and outlined in more detail as part of specific interagency agreements that are developed if the agency chooses to connect their infrastructure to the Yuma TOC.

(C) Inter-Departmental or Inter-Agency System Access

As other City departments and other agencies in the region become more connected with the Yuma TOC and more familiar with the TOC functions, systems, and outputs, there may be interest in providing non-TOC staff with remote access to the Yuma TOC systems through a virtual private network (VPN) or other remote access function. Having remote access would allow someone to view real-time camera feeds from connected monitoring devices; review the real-time status of traffic signals, including signal timing information and device status; review real-time detector data that is being collected; and a variety of other data and system functions that might be available at that time. Partnership with the Yuma IT Department will be important to understand implications of implementing VPN access on City equipment and hardware.

Any non-TOC City department or agency who has equipment or systems that are centrally connected to the Yuma TOC but furnished by the other entity will be provided remote access. This will enable them to view and manage their equipment or systems as part of an agreement that will be established to govern how equipment will be connected and managed from the TOC. Providing remote access to other non-TOC users may either take the form of view-only access, meaning that other users would only be able to view status and would not be able to make any changes, or access could be elevated to provide the VPN user with a level of operational control. The level of access and security that will be pursued at this stage must be discussed and vetted in more detail with the IT departments of the involved agencies.

A reasonable scenario for this concept is a desire by non-TOC staff to view real-time video feeds from video detection or any future intersection monitoring equipment that may be deployed in the long-term. An agreement will need to dictate whether a non-TOC user will only have remote access to view the video feed without being able to change any settings of the device, or if they have the ability to change device settings or position in addition to being able to view the video feed. The decision on level of access for non-TOC users to different systems will be made at the time of implementation and will be governed by an inter-departmental or inter-agency agreement.

Additionally, a center-to-center (C2C) communication may be established between the ADOT central management system and a compatible system at the Yuma TOC. This connection would provide the Yuma TOC with view-only access to ADOT's traffic signal system so that the Yuma TOC will be able to see the traffic signal timing and signal status of ADOT traffic signals and use that input when making decisions about signal timing at Yuma-owned traffic signals.

(D) Traveler Information Dissemination

In the long-term, the City may choose to invest in equipment and systems that allow the TOC to support the dissemination of traveler information. Providing this function could take many different forms, depending on City policy decisions about their role in the traveler information space. In one form, the City could provide a real-time traffic condition website that is publicly accessible and is updated by TOC data in real-time. Another concept would be that the City chooses to make their data available through a data portal so that private sector entities such as Google, Waze, TomTom or vehicle manufacturers, can take the data and use it to populate their own platforms or applications. In either form, there will need to be an additional function built into the data engine of the Yuma TOC systems that will process and make operational data available external to the TOC.

A decision may also be made to have the TOC function as a media point of contact for traffic information. To support this concept, detailed guidelines will have to be developed specifying what information the TOC can divulge versus what information must come through other departments, such as Media & Public Affairs/Communications.

4.4 Summary of TOC Functions

Table 3 provides a summary of the various TOC functions that are envisioned for the near-term and long-term. A level of priority (high/medium/low) is also identified in the table to help prioritize where investments should be made in the case of limited funding and resource availability.

Table 3 – Summary of Yuma TOC Functions and Priorities

Near-term	Long-term	Priority	TOC Function
Real-Time Traffic Management			
X		High	Remotely operate and control traffic signals, including implementing traffic signal timing plans based on conditions
X		High	Coordinate traffic signal timing on City and regionally shared corridors
X		High	View video detection camera feeds
	X	Medium	Operate and control CCTV cameras (if implemented) for traffic management, including incident management
X		High	Collect and archive detector data on City arterials
X		Medium	Coordinate traffic operations and information sharing between TOC and other cities in the region, Yuma County, and ADOT
	X	High	Coordinate joint operations and information sharing between TOC and other non-traffic management entities in the region (ex: border patrol, port of entry, transit)
X		High	Operate TOC during peak hours and planned events

Near-term	Long-term	Priority	TOC Function
	X	High	Operate TOC during extended hours (through AM and PM peak, events, after-hours incidents)
	X	Medium	Establish a C2C system to allow for real-time data exchanges with ADOT or other traffic management agencies
X		High	Undertake signal calibration to perform a variety of test on intersection equipment to ensure that if functions as intended
X		High	Routinely monitor traffic signal data to assist with identifying maintenance, traffic operations, and safety needs
	X	Medium	Disseminate connected vehicle data
Traveler Information			
X		High	Provide road condition, emergency, incident, work zone and special event information with public affairs/communication staff to disseminate to travelers
	X	Medium	Provide road condition, emergency, incident, work zone and special event information directly to the media and public
	X	Low	Maintain and provide arterial traffic speed maps
	X	Low	Provide camera images to the public via City website or social media
	X	Medium	Consolidate arterial work zone information to provide a central point of information
Incident and Emergency Management			
X		High	Use real-time data and video feeds to support more efficient incident response and management from a traffic management perspective
X		Medium	Make data and systems available for first responders to use to gather additional information about incidents
X		Medium	Share video detection camera feeds (if implemented) with public safety agencies

As previously noted, at ATMS is a key component of the future TOC and will facilitate or contribute to many of the above priority functions. During system design and procurement, a detailed set of ATMS software requirements should be developed to identify the specific requirements that a system must meet based on the desired functions and priorities described in this ConOps. Included in these requirements should be exploration of data sharing or integration requirements between the ATMS or other TOC systems and existing City systems, such as the Police CAD system.

5. Proposed TOC Operational Requirements

This section outlines the business-oriented concepts for the TOC that will be needed to support the implementation and day-to-day operations of the TOC.

5.1 TOC Staffing Structure and Roles

A basic staffing structure is needed to support TOC functions. The near-term concepts will necessitate a streamlined staffing structure with only a few key operations staff positions to support management and operations of the TOC.

Proposed Near-term Staffing

For the near-term TOC concept, the following roles will need to be provided. The roles may be accomplished by designated TOC staff positions or a combination of existing staff who take on TOC-specific roles as part of their current position:

- **Management** – Responsible for overseeing and managing the TOC, the ITS network, and general City traffic operations.
- **Analysis** – Responsible for managing and implementing traffic signal timing in the City.
- **Operations** – Responsible for the real-time operation and management all of ITS equipment and systems to support real-time and coordinated traffic operations from the TOC.

ITS device and traffic signal maintenance responsibilities will remain with the Public Works Department, which will be external of the TOC. Similarly, the responsibilities for network administration and maintenance responsibilities will be provided by the City IT Department, which will also be external of the TOC.

Table 4 provides details on specific responsibilities of each function that will be necessary for the near-term implementation of a TOC in Yuma.

Table 4 – TOC Near-Term Staffing Functions Responsibilities

TOC Role	Specific Responsibilities

Management	• ITS Network Management
	  ○ Oversees and manages the planning, design, operations and implementation of the ITS network
	  ○ Assists with creating specifications for ITS related equipment and systems.
	• TOC Management
	  ○ Organizes and supervises daily operation of the TOC.
	  ○ Prepares, reviews, and updates TOC standard procedures and policies
	  ○ Develops annual TOC budget and administration of expenses.
	  ○ Coordinates ITS/TOC asset management and annual programming.
	  ○ Establishes ITS and TOC design and construction projects in the Capital Improvement Program and manages projects and project planning.
	• Traffic Operations
	  ○ Oversees preparation of traffic signal timing and coordination.
	  ○ Oversees resolution of public complaints on traffic signal operations.

TOC Role	Specific Responsibilities
	○ Reviews temporary Traffic Control Plans for construction projects; coordinates the release of information regarding upcoming traffic restrictions to the public for construction or special events. ○ Plans, designs, and coordinates traffic control and transportation activities for special and major events.
Analysis	• Traffic Operations ○ Manages signal timing and coordination, traffic signal studies, and computerized traffic signal programming and control. ○ Gets approval for signal timing plans. • Data Analysis and Reports ○ Creates spreadsheets and provide basic manipulation of data from ITS devices, traffic signals, and other systems. ○ Assists with reports and maps, timing letters, and reviews production statistics and reports trends.
Operations	• Real-time Traffic Operations and Management ○ Monitors traffic signal system and video management system and makes appropriate adjustments to traffic signal timing plans in response to real-time traffic conditions. ○ Implements traffic signal coordination plans using the traffic signal system. ○ Notifies appropriate staff, supervisors, internal and external departments, and authorities of emergency situations. ○ Coordinates real-time traffic management and incident response according to established procedures. ○ Supports documentation of response actions to incidents or special events. ○ Reviews temporary traffic control plans and provides details regarding signals and interconnects for construction projects and special events. ○ Conducts in-field observations to test traffic signal timing programs and related ITS operations. ○ Supports development and updates to TOC operating procedures, manuals and guidelines. • Equipment and System Monitoring ○ Monitors operation status for ITS devices and systems and ITS communications; troubleshoots when needed and escalate issues to appropriate technical staff. ○ Enters new devices and data into the central management system.
Maintenance	• Public Works will be responsible for maintenance of all ITS and traffic signal infrastructure in the field
Networking	• Information Technology will be responsible for the management and maintenance of networking equipment and systems utilized by the TOC. ○ Systems and equipment specification for the TOC and communications network (including the ATMS) ○ Design, configuration, and integration for the TOC and ITS network ○ Systems and equipment maintenance for ITS network (not field devices) ○ System hardware, software, and networking support and troubleshooting ○ Hardware and software asset management and lifecycle replacement ○ Budgeting and programming for replacements and upgrades ○ Database management and backup ○ Network/user security

In the near-term, the above roles and responsibilities will be accomplished by a combination of four existing positions within the TSMO group – the City Traffic Engineer, the Civil Engineer

dedicated to Traffic, and Senior Technicians. There will also be support from City Public Works and IT. The TOC-related responsibilities will represent a portion of the overall responsibilities of each of those positions.

Proposed Long-term Staffing

In the long-term, the TOC will mature, and TOC functions will be added or expanded. More time will need to be dedicated to the near-term responsibilities for the various roles, but it may also result in new functions associated with the core TOC roles.

Operations Role

- Monitoring and operating any new devices that are connected, such as CCTV or dynamic message signs (DMS) if decisions are made by City management that these devices are desired
- Operating any new systems that the City might choose to install, such as an adaptive traffic signal system.
- Supporting traveler information dissemination, depending on prevailing concept.

Management Role

- Manages the continuous and real-time traffic management services provided by the TOC
- Responsible for developing and maintaining partnerships with other jurisdictions to solve regional traffic management issues
- Provides technical advice on traffic operation issues to other City departments and regional partners
- Supervises and evaluates the TOC staff
- Prepares and updates coordination and incident management agreements and processes with law enforcement
- Prepares TOC performance monitoring plans and maintains records

In addition to added functions, a long-term TOC concept may also necessitate additional staff to support the core TOC roles. It is likely that this will be accomplished by identifying additional staff to support the Operations role as part of their job; however, if the amount of infrastructure and operational functions provided by the TOC is great enough, the City may consider establishing staff positions for the Operator role and the Management role that are dedicated to the TOC (i.e. TOC Operator and TOC Manager).

Based on industry trends, including those of other cities in Arizona that have TOCs, a relative threshold for indicating the need for an additional staff person to support the Operator role is when the TOC is responsible for operating more than 100 traffic signals. In the long-term, it is likely the number of City of Yuma traffic signals will reach this 100 signal threshold and warrant an additional staff person to support the Operator role.

In the long-term, new staff roles may also need to be considered. The long-term oriented TOC functions that may be pursued in a more build-out scenario include:

- *IT Liaison/Network Administrator* – While the IT Department is responsible for networking and communications management, there may be a need to identify a specific IT liaison to the TOC that is specifically responsible for supporting the TOC and ITS program. This person would have familiarity with the TOC and its functions, systems, and processes to provide more specific and tailored support for the TOC and traffic management functions. If this role is deemed necessary in the future, there will need to be discussions with the IT Department to make sure that staffing and training is adequate to provide the function.
- *Public Safety Liaison* – As the TOC expands its functionality and proof of concept, there may be a benefit to identify a public safety staff person that understands the TOC functions and provides direct coordination and exchange of information. Initially, this liaison will have a method of real-time communication with the TOC to allow for coordination during incidents or special events. Eventually, it may make sense to co-locate a public safety liaison in the TOC to allow for more direct coordination between the TOC and police dispatch and officers in the field.
- *Public Information Liaison* – It may make sense to eventually partner with Media & Public Affairs/Communications staff to facilitate the exchange and dissemination of information between the TOC and other City departments and the public. The Public Information Liaison would facilitate direct and frequent communication with TOC staff to collect and disseminate information collected by the TOC, as appropriate. Similarly, the identified liaison would follow and manage sources of information, such as social media, and provide relevant information to TOC staff.
- *Other Agency Operations Staff* – The long-term concept includes having other agency devices connected to and operated from the Yuma TOC, including Yuma County and the City of San Luis. Depending on the agreement between the agencies and the City of Yuma, these other agencies may choose to monitor or operate their own network from a dedicated workstation in the TOC. If this is the case, then additional staff from other agencies may be co-located in the TOC alongside the City of Yuma TOC staff.

5.2 TOC Hours of Operation

The City of Yuma departments currently operate from 7:00 AM - 5:00 PM Monday through Friday. In the near-term concept, the TOC will generally operate within those business hours (normal hours), although there may be some special circumstances where extended hours are warranted[4].

Normal Hours: 7:00 AM – 5:00PM Monday through Friday.

Extended Hours: There may be instances where the TOC should be staffed outside of regular operating hours to support traffic management during prolonged incidents or planned special

[4] TOC hours of operation describes hours where someone is physically sitting in the physical TOC space. The ATMS system will be operating 24/7 and staff will have the ability to access and manage the system from a laptop or similar device even when not located physically in the TOC building.

events that require after-hours restrictions or result in unusual off-peak traffic demands. Another condition where TOC hours might be extended is to support traffic management through a construction restriction that is in place during peak hours and whose impacts extend peak hour travel. In these cases, the TOC on-call staff person would be responsible for continuing their monitoring and operational duties either in an in-person capacity or a remote access capacity to make sure that traffic is moving safely and efficiently. For the cases of planned special events or planned construction, the operator would be responsible for monitoring and implementing pre-planned and approved traffic management strategies.

For the long-term concept, the TOC operating hours should be expanded to 7:00AM to 7:00 PM Monday through Friday to cover the morning and evening peak travel times. This would require two operator shifts that operate on an 8-hour a day/5 days per week schedule: 7:00AM to 3:00PM and 11AM to 7:00PM.

5.3 TOC Operating Procedures

A set of TOC Operating Procedures or a TOC Operators Manual will need to be developed to outline and describe processes, responsibilities, and expectations for staff operating the TOC. Suggested section and content for this manual is identified in **Table 5**.

Table 5 – TOC Operating Procedures Overview

Topic	Suggested Contents
General	Area of coverage, services provided, TOC goals, stakeholder roles and responsibilities, general and emergency contact information (TOC staff, Engineering staff, building maintenance, permitting, Police and Fire, other agency traffic/transportation, other agency Dispatch
TOC Responsibilities	Daily shift organization and procedures, after-hours responsibilities, coordination with police and other responders, coordination with other agencies, calls from citizens; TOC reports and logs
ITS Device and System Operations	• ATMS software user guide – start-up/shut down, user interface, alerts/alarms, data retrieval and creating reports • Video management system user guide – start-up/shut down, user interface, guidelines, device IDs and management
Performance Measures	Performance measures for TOC, traffic management, and incident management
Traffic Signal Timing	Guidelines, traffic signal operations, interagency coordination, field device ID and management, citizen reports
Incident Management Procedures	What to do to identify, respond to, and end an incident; responder coordination and notification processes, traffic management, incident activity reporting, public information coordination processes
Roadwork Procedures	What to do when maintenance or construction activity is present – device operations, coordination, public information dissemination
Special Event Procedures	TOC responsibilities for traffic management during special events, departmental coordination

TOC Reports and Logs

As part of operating procedures, TOC operators should be responsible for assembling and filling out different reports or logs depending on circumstances experienced during their shift. The reports and logs that should be created and part of established TOC Operating Procedures are:

- **Incident Reports** – TOC-specific form that documents actions and responses to incidents. Includes date and time, road name, incident description/information, response actions taken (signal timing changed, notification sent, information/data generated and disseminated), ending time, operator who prepared report.
- **Shift Transition Report** – At shift change, the outgoing operators are required to record all active incidents and equipment issues. The form also records shift start times, and outgoing and incoming operators.
- **Device Malfunction Report** – Device malfunctions should be logged to identify device type, device identification number, location, description of the problem, date, time, and the operator that recorded the information.

Examples of these types of reports that are currently used by other agencies can be found in **Appendix A**.

Shift Change Procedures

Processes for shift changes should center around a Shift Transition Form that provides documentation of any recently completed or ongoing activities that occur through a shift transition. The outgoing operator should fill out the Transition Form and complete all Incident Reports and Device Malfunction Forms and review information on the forms with the incoming shift operators, focusing on any active incidents and device malfunctions.

Procedures for Changing Signal Timing

The TOC will need to establish procedures for updating or revising signal timing plans implemented at City signals. These procedures should include timing policies and standard basic timing forms to standardize the process and ensure consistency for all future signal timing changes. They will establish the conditions that would warrant signal timing updates, such as citizen complaints, school drop-off and pick-up times, incident conditions that cause traffic restrictions/impacts, or regularly scheduled periodic timing reviews.

Signal timing procedures will need to identify who in the TOC is responsible for determining the appropriate timing plan, analyzing the effects of updated timings, and implementing the new plans. This chain of command will provide accountability for signal timing adjustments.

In addition to establishing procedures on how to change signal timing plans, the TOC will also need to determine how utilizing an ATMS system will coincide with existing policies regarding signal timing plan file storage and historical records. It will be important to maintain consistent records of signal timing plans across existing platforms and newly implemented platforms as part of the TOC.

Incident Management Procedures

One major role of a TOC is to support traffic management and information exchange during incidents within or directly adjacent to the City of Yuma. Incident management procedures will involve the TOC as well as other departments and agencies. **Table 6** identifies the proposed process and roles for different departments and agencies for incident management

Table 6 – TOC Incident Management Procedures Overview

Agency/Department	Activity
Incident Initiation and Notification	
Yuma PD Dispatch	☐ Yuma PD Dispatch receives initial 911 call or notification from County Dispatch about and event that will impact a Yuma roadway ☐ Dispatch notifies TOC of incident location and conditions through an automated email or text message through the SMTP paging system
Yuma TOC	☐ Receive notification from Yuma PD or Yuma County Dispatch about incident ☐ Verify incident using video feed (if available) by accessing video management system ☐ Notify other departments and agencies of event and impacts via email if necessary given incident conditions: ○ Notify Public Works if infrastructure maintenance is needed ○ Notify Public Affairs/Communications if impacts to travelers will be significant and/or for a long duration ○ Notify other agencies (County PW, Somerton PW, ADOT TOC, or San Luis PW) if event will impact traffic on a regional corridor, another agency traffic signal, or an ADOT ramp)
Yuma PW	☐ Receive email or call from TOC about incident
Yuma Public Affairs/ Communications	☐ Receive email or call from TOC about incident
County, Somerton, San Luis, and ADOT TOC	☐ Receive email or call from TOC about incident
Incident Response and Management	
Yuma PD Dispatch	☐ Arrive on-scene and verify conditions and resources needed ☐ Decide if any long-term traffic management or traffic signal timing changes are needed; if needed, contact TOC to support
Yuma TOC	☐ Monitor traffic conditions through ATMS system and video feeds ☐ If signal timing changes are needed, coordinate with field officer to support signal timing changes ☐ If long-term traffic management or detours are needed, consider corridor-level signal timing strategies to support detour using ATMS ☐ If conditions or status of the incident changes, coordinate with City Public Affairs/Communications to provide them with an update that can be disseminated to the public
Yuma PW	☐ Support any infrastructure maintenance or temporary traffic control needs
Yuma Public Affairs/ Communications	☐ Provide information about the traffic impacts to the public via City social media and website; provide updates, as necessary, as more information is provided by the TOC
County, Somerton, San Luis, and ADOT TOC	☐ Support any infrastructure maintenance or temporary traffic control needs ☐ If traffic signals are connected to the Yuma TOC and there are real-time operational capabilities, coordinate with TOC to update signal timing at impacted intersections or corridors ☐ ADOT may provide traveler information via 511, social media, or other outlets as necessary based on impacts to ADOT roadways.
Incident Close-Out	
Yuma PD Dispatch	☐ On-scene officer will identify when event is considered cleared ☐ Dispatch notifies TOC of the all-clear status
Yuma TOC	☐ Receive notification of all-clear ☐ Provide email notification to Public Affairs/Communications and other agencies of event conclusion

Agency/Department	Activity
	Continue to monitor intersection operations until traffic conditions return to normal; revert to regular signal timing plans when normal conditions are reached
Yuma PW	Support infrastructure maintenance as needed Remove any traffic control that had been placed
Yuma Public Affairs/ Communications	Provide information about conclusion of the event to the public through active information outlets
County, Somerton, San Luis, and ADOT TOC	Support infrastructure maintenance as needed Remove any traffic control that had been placed ADOT will update and close-out any active traveler information outlets for the event.

5.4 Training

Identifying and implementing a formal training program and set of materials will be important to support TOC staff. Training will improve periods of staff transition/turnover and during periods where ATMS software upgrades are expected.

At a minimum, ATMS user manuals and vendor training materials should be incorporated into the TOC Operating Procedures document. A spare workstation with offline access to ATMS software can provide TOC operators an opportunity to practice with the software without effecting any changes to field devices. A hard copy and online version of the operations manual should be available to TOC staff.

The Engineering Department should consider creating and internal training program to help train any new TOC staff as they are hired. Internal training should include training on any TOC systems and devices that an operator will use (this can be accomplished through the TOC Operating Procedures document, the ATMS user manuals, and vendor training materials) as well as any formalized coordination procedures that are in place for the TOC to support Yuma Police/Fire and other agencies with traffic management during incidents, roadwork, or special events.

It is recommended that regular tabletop exercises be conducted between Yuma Police, Fire, and TOC staff to walk through different incident or emergency scenarios and talk through various roles and responsibilities for identifying, verifying, responding to, and eventually closing out the event. These types of activities should occur at least annually but could occur more frequently if deemed necessary based on changing processes or staff turnover.

In addition to City-provided training materials and activities, there are other sources of TOC operator training that are available and may be useful to TOC operators. There is not a formalized or universally required training program for TOC operators and staff, there are training and certification opportunities that provide TOC staff with knowledge and awareness that would help elevate traffic management processes. A full set of certification and training opportunities for transportation operations and management staff can be found in **Appendix B**, but some specific and widely known and used resources include:

- American Traffic Safety Services Association (ATSSA)
  - Temporary Traffic Control Considerations for Work Zones – addresses work zones in more populated and congested areas, particularly the considerations necessary to address work zones in urban environments.
  - Introduction to the Manual on Uniform Traffic Control Devices (MUTCD) – examines the MUTCD, its content, and its applicability to streets open to the public in the United States, including private streets. Emphasis will be given on temporary traffic control.
- International Municipal Signal Association (IMSA)
  - Transportation Center Systems Specialists Level 1 – designed for transportation professionals whose role encompasses control and operation of a road network in a TOC. The program provides an understanding of key concepts and the technology used for devices, equipment, and software that a TOC may utilize in daily operations.
  - Transportation Center Systems Specialists Level 2 – emphasizes material on data collection, vehicle detection, data integrity and integration, C2C protocols, TOC consoles, video and CCTV technologies, stand by power systems, software sub-systems, DMS, field device operations and system administration and troubleshooting

5.5 Stakeholder Roles and Responsibilities

City of Yuma Engineering Staff will be the primary users of the TOC and its associated devices and systems; however, as described in this ConOps, there will be other City of Yuma staff and potentially other agency staff who support traffic management in the Yuma region who may interact with, or eventually connect to, the Yuma TOC. This section summarizes all stakeholder roles and responsibilities for both the near-term and long-term timeframes.

Stakeholders

Table 7 identifies the key stakeholders that will support the operations and coordination with the TOC for traffic management.

Table 7 – TOC Stakeholder Functions and Responsibilities

Stakeholder	Roles and Responsibilities	
	Near-Term	Potential Long-Term
TOC Operations		
City of Yuma Engineering	• Responsible for operations of traffic signals and traffic signal timing in the City of Yuma • Will be primary operator of the TOC systems and connected devices	• Responsible for operations of traffic signals and traffic signal timing for other agencies
City of Yuma IT	• Responsible for maintenance and management of City communications backbone and associated infrastructure • Responsible for maintenance and management of networking equipment, computer equipment, and City-owned systems.	

Stakeholder	Roles and Responsibilities	
	Near-Term	Potential Long-Term
TOC/Traffic Management Coordination		
City of Yuma Police	• Receives initial information about traffic incidents in the City of Yuma • Responsible for initial incident notifications to the TOC • First responder during incidents to provide verification and to coordinate and make decisions for necessary traffic restrictions	• Able to access streaming video from video detection and/or CCTV (if installed) • Law enforcement liaison locates within TOC
City of Yuma Public Works	• Responsible for maintenance of ITS field devices • Provides emergency infrastructure maintenance and emergency traffic management	• Able to access streaming video from video detection and/or CCTV (if installed)
City of Yuma Public Affairs/ Communications	• Responsible for public outreach and information dissemination for planned roadway restrictions • Has a role in public information dissemination for unplanned events	• Utilize traffic condition data collected by the TOC for real-time and planned traveler information dissemination • Able to access streaming video from video detection and/or CCTV (if installed)
City of Yuma Fire	• First responder during incidents in the City of Yuma	• Able to access streaming video from video detection and/or CCTV (if installed)
Yuma County Sheriff's Office	• Receives initial information about traffic incidents in the County and is responsible for initial notifications to other staff and agencies • First responder during incidents to provide verification and to coordinate and make decisions for necessary traffic restrictions	• Able to access streaming video from video detection and/or CCTV (if installed)
Yuma County Public Works	• Responsible for operations and maintenance of traffic signals and associated field equipment at County traffic signals, including those within or adjacent to City of Yuma jurisdiction and along regional corridors	• Able to access streaming video from video detection and/or CCTV (if installed) • VPN access into TOC central system to monitor County devices
City of Somerton	• Responsible for operations and maintenance of traffic signals and associated field equipment at City of Somerton traffic signals, including those along regional corridors	• Able to access streaming video from video detection and/or CCTV (if installed) • VPN access into TOC central system to monitor City of Somerton devices
Cocopah Tribe[5]	• Responsible for operations and maintenance of traffic signals and associated field equipment at City of Somerton traffic signals, including those along regional corridors	• Able to access streaming video from video detection and/or CCTV (if installed) • VPN access into TOC central system to monitor City of Somerton devices

[5] Participation and input from the Cocopah Tribe was pursued but not obtained during the development of this ConOps. The input and participation of the Cocopah Tribe will be important for regional operations and connectivity given the location of their traffic signal infrastructure in the middle of regional corridors.

Stakeholder	Roles and Responsibilities	
	Near-Term	Potential Long-Term
City of San Luis	• Responsible for operations and maintenance of traffic signals and associated field equipment at City of San Luis traffic signals, including those along regional corridors	• Able to access streaming video from video detection and/or CCTV (if installed)
ADOT	• Responsible for operations and maintenance of ADOT facilities (I-8, US 95, and SR 195), including interstate ramp operations, traffic signals located at ramp and along ADOT roadways • Monitors conditions and responds to incidents and hazards from the Statewide TOC and provides real-time information via AZ511 and traveler information via ADOT social media outlets	• Able to access streaming video from video detection and/or CCTV (if installed) • Provides view-only C2C system feed to TOC if Yuma TOC system is compatible with ADOT's MaxView system

Information Sharing

The collection, processing, and exchange of data and information is one of the primary functions of the TOC. **Table 8** outlines flows of data and information that are important for traffic management and operations and highlights where data originates and where data and information should be exchanged. Some foundational data types are:

- ITS field devices will collect traffic condition information and make it available for the TOC to review, share, or archive.
- Law enforcement dispatch is the source of incident notifications and response status updates. However, the TOC will play a role in supporting the wider dissemination of real-time information about incidents as they relate to traffic conditions.
- Device and communications operational and maintenance status will be available through the TOC systems and alerts about malfunctions will be provided through the system. The TOC will be responsible for passing along changes to device or equipment status to the department responsible for maintaining the equipment – for field devices along the roadway, including traffic signals, this is Public Works; for communications equipment and systems, this is IT.
- Information about planned roadwork, including traffic control plans, will be generated by the Design & Construction Management Section of Engineering or the Development Engineering Section of Engineering. It will be important for that information to be shared with the TOC, and ideally provided to the TOC for review and comment during the project development process, given that the TOC will play a primary role in supporting traffic operations and management during construction utilizing the central management system.

Table 8 – Summary of Stakeholder Information Sharing

Data/Info *O = origin of information* *R = receiver of information*	Yuma TOC	Yuma PW	Yuma Utilities	Yuma PD	Yuma Development Engineering	Yuma Public Affairs/ Communications	Yuma IT	County Sheriff	County PW	Somerton	San Luis	ADOT
Traffic Management												
Real-time traffic conditions	O			R		R			R	R	R	
Real-time video feed (view only)	O			R				R				
ITS field equipment status	O	R										
ITS communications equipment status	O						R					
Incident Management												
Initial incident notification	R			O				O				
Incident verification notification	O	R				R			R	R	R	R
Incident response status update	O	R				R			R	R	R	R
Traffic control request	R	R		O				O	R			
Emergency maintenance request	O	R	O	O				O	R	R	R	R
Detour route request	R		O	O				O				
Detour route implementation and status	O			R		R		R	R	R	R	R
Planned Construction												
Traffic control plans	R	O		R	O	R		R	R	R	R	R
Real-time construction restriction status	O			R		R		R	R	R	R	R
Planned Special Event												
Special event-related traffic restrictions or control plans	R	R		O		R		R	R	R	R	R
Special event-related real-time traffic conditions	O			R		R		R	R	R	R	R

5.6 Coordination and Agreements

To accomplish the proposed TOC vision and functions outlined in this ConOps, there will need to be heightened coordination between City departments and between the City and other agencies in the region. Some of this coordination will occur informally, meaning that formal documentation may not be required, but that there is general agreement on processes and roles and responsibilities; these relationships are shown in **Figure 4**. Other functions, especially those that involve the sharing of financial, system, or staff resources, will require formal agreements, such as IGAs to implement; these formalized agreements are shown in **Figure 5**.

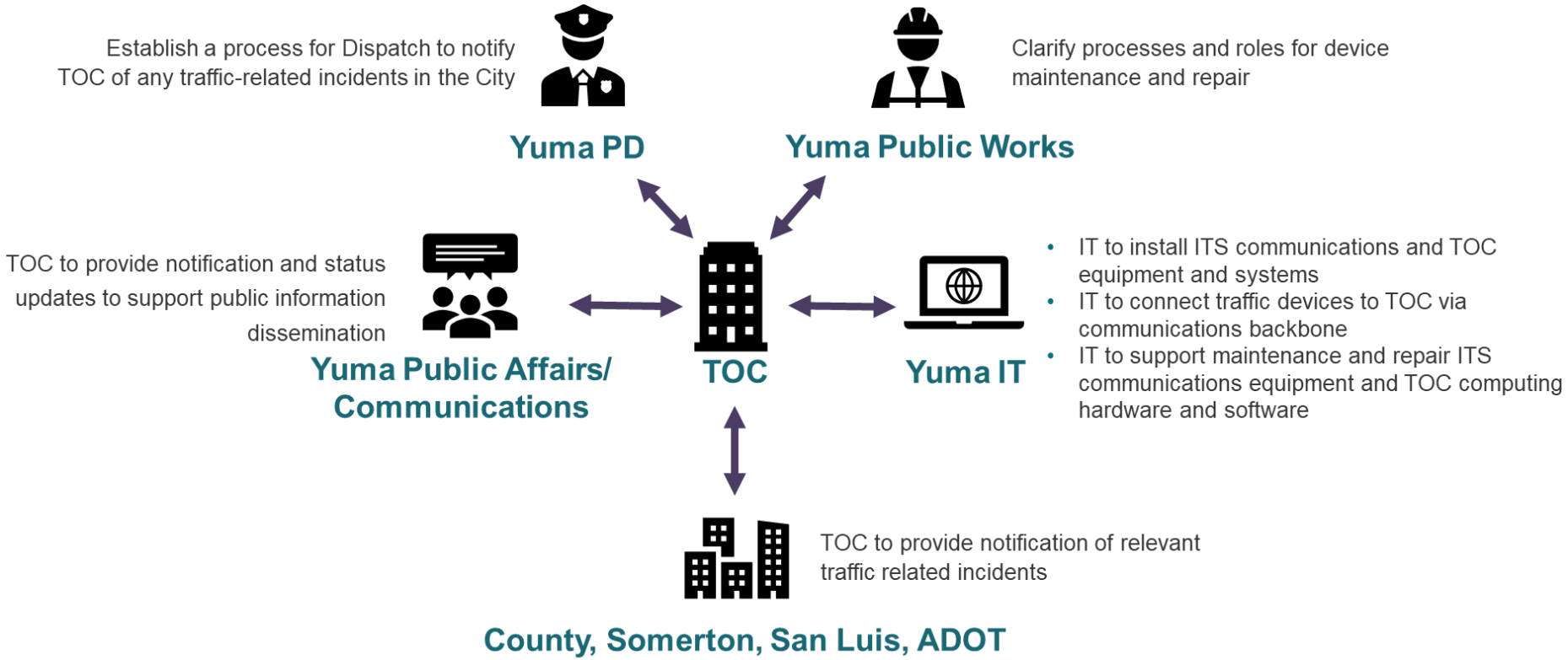


Figure 4 – Recommended Coordination/Operational Procedures

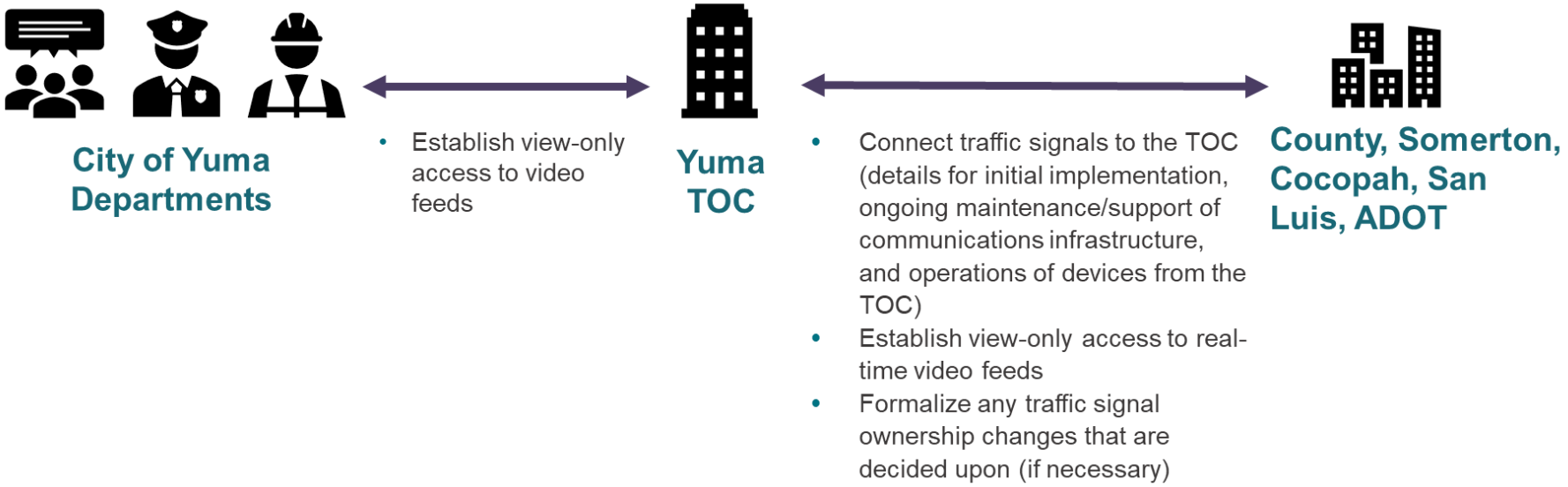


Figure 5 – Recommended Formal Agreements (IGA or Policy)

6. Proposed TOC Physical Requirements

This section outlines the physical attributes and support systems that are necessary to accommodate the TOC functions and operational policies.

A physical TOC space will have five core components:

- **Operations floor workstations** will provide access to TOC-specific systems, such as the ATMS and video management system, and City Enterprise systems for email and other intranet applications. The primary purpose of the operators on the floor is to operate/manage the TOC systems that support real-time traffic management, incident management, and information sharing. Additional workstation monitors may be warranted based on expanded roles of these operators or the participation of other agencies or departments in the TOC.
- **Office space** will be provided for management to allow for closed-door space, if needed, while still having access to TOC system and view of the video wall.
- A **video wall** will enable operators, managers, and other TOC personnel to share a common view of situational information.
- **Common area** items, including storage, library, shelving/filing space, and other amenities that should need to be accessible to all staff in the TOC.
- A **communications/server room** is needed to house the rack and server space needed to support the video wall and all equipment in the TOC.

Each position that is required to be physically in the TOC needs to be considered in the TOC's spatial requirements in the near-term. The long-term vision for the facility needs to be carefully analyzed and prioritized for most efficient use of the allowable expansion budget. Considerations are shown in **Table 9**.

To accommodate staffing needs, especially for operating the TOC, at least two operator workstations are needed; one to support the Operations role and a spare workstation in the case of equipment failure. While the Operations role necessitates the most physical space considerations, the management and analysis functions also have spatial requirements within the TOC.

Table 9 – TOC Functions and Spatial Requirements

TOC Function	Responsibilities	Spatial Requirements
Operations	Real-Time Traffic Management Equipment and System Monitoring	Near-term • Three monitors for display of systems used in TOC operations • Drawers – under mount • Workstation requires view of video wall Long-term • Space for an additional monitor to accommodate any new systems or networks that come online

TOC Function	Responsibilities	Spatial Requirements
Analysis	Traffic Operations Data Analysis and Reports	Near-term • May not require designated space in the TOC but could use available workstation if necessary Long-term • Minimum of three monitors for display of systems for traffic signal operations and real-time and historical traffic data • Drawers – under mount • Plan review space – not necessarily adjacent to workstation space • Vertical storage for manuals/TIAs • Workstation requires view of video wall
Management	ITS Network Management TOC Management Traffic Operations	Near-term • Ideally, this position is provided separated office space • Minimum three monitors for display of systems used in TOC operations • Plan review space • Drawers – under mount • Vertical storage Long-term • If not provided in the near-term, separated office with view of video wall • Minimum three monitors for display of systems used in TOC operations • Plan review space – in office • Drawers – under mount • Vertical storage

There may also be consideration for a **shared workstation** that could be utilized by public safety, a PIO, another agency traffic operations staff member, vendor, or contractor requiring a temporary space in the TOC. This workstation would be equipped with minimal equipment and one monitor, which would provide access to the internet and to the City's Enterprise system.

6.1 Workstation Features

Below is a list of specific equipment that should be considered to be included at each operator workstation:

- Central Processing Units (CPUs) may be either tower, desktop, or laptop – laptops are desired;
- Flat screen monitors are desired—it is anticipated that three monitors will be required – two for monitoring the traffic network and one for the City Enterprise network;
- Articulated monitor stands are desired;
- One standard size panel phone should be at each workstation;

- One standard storage drawer for workstation manuals/materials applicable to the TOC personnel type at that workstation;
- Built-in power strips and cable management; and
- It is desirable to have workstation furniture that would permit the operator to electronically adjust the workstation height, allowing the operator to either sit or stand.

6.2 Office Features

Offices in the TOC will contain much of the same equipment as the operator workstations to provide the same operational functionality as the general workstations. Offices should be equipped with a surface that can accommodate plan review within the office. It is important for the offices to have closed-door privacy as well as unobstructed view of the video wall.

6.3 Video Wall Features

A video wall is a matrix of television or computer monitors used as a single display. Each individual monitor can be used to display a single image or can be used to compose part of a larger display. Typical displays to be provided on the video wall include real-time camera feeds, traffic signal system displays, other mapping displays (such as Google maps), or local and national news media. A centralized video wall allows all those on the floor to view the same camera images during critical coordination efforts.

In the near-term, the video wall should consist of a minimum of four monitors mounted on the wall to create the matrix display. The wall should be configured to permit the expansion of the video wall over time, as more systems and devices come online. The video wall technology, including associated displays and server equipment, should be incorporated into the design of the TOC.

6.4 Control Room Common Area Features

Additional items that should be considered within the common area of the TOC control room are:

- Storage for manuals applicable to all TOC personnel (such as equipment or systems manuals), such as a shelving unit and space to review materials or a layout counter space;
- Individually locking drawers for storage of personal items—drawers will be reserved for each person;
- General work area for a printer/scanner;
- A phone dedicated to the TOC where people can directly call the TOC operations floor for immediate needs;
- A hanging system/coat rack is desired for storage of jackets; and
- Refrigerator/microwave.

As the TOC expands, there may be a need to provide a TOC-specific conference room that could function as a backup Emergency Operations Center for the City or region. The room

would have to be big enough to be occupied by TOC and other responding staff from the City and other agencies, have access to view and manipulate the video wall, and have teleconferencing capabilities. The Infrastructure Implementation Plan, which is a separate but related document to this ConOps, provides conceptual layouts for the Yuma TOC to show how the TOC can be implemented in the near-term based on the spatial requirements ConOps identified in this ConOps.

6.5 Server Room Features

The TOC will need to house a server room that will support communications connections into the TOC and the servers and associated equipment needed to support the TOC equipment and traffic network. This server room should be climate controlled through HVAC to protect the equipment located within the room. Additionally, access to this room should be limited and protected to provide security for the traffic communications network.

6.6 TOC Building Features

The TOC is envisioned to be located within an existing City of Yuma building by retrofitting an existing space. The size of the TOC space is largely driven by the amount of infrastructure that will be operated from the TOC which is the driving factor for the number of operators that will be staffed in the TOC. Based on current practices, TOCs that operate fewer than 400 traffic signals have an average square footage of between 700 and 1,400 square feet[6], which is inclusive of the operations floor and common spaces, offices, and server room.

In addition to square footage, other considerations for the TOC space are:

- **Entry security** – there should be secure entry into the building that houses the TOC and into the TOC space itself.
- **Power backup** – there should be consideration for Uninterruptible Power Supply (UPS) devices to power equipment during power interruptions and, in the long-term, a backup generator may be considered for the TOC.
- **Communications security** – there should be measures taken to protect the communications lines into the TOC.

More detailed information about the equipment and systems of the proposed TOC, including equipment quantities, costs, maintenance and lifecycle considerations, and phasing for implementation will be available in the Infrastructure Implementation Plan, which is a separate document that is being developed as part of the larger ITS Strategic Plan effort.

[6] https://www.dvrpc.org/reports/10044.pdf; Table 13

Appendix A – Example Forms Used by Other Agencies

Example Incident Report

PennDOT – Eastern RTMC
FORM TMC-100: Incident Reporting Form

RCRS Closure ID Number:
(If this incident has been entered into RCRS stop here, save in appropriate P:\ drive folder. Otherwise complete the remainder of the form and save in appropriate P:\ drive folder)

1. SR: _____
2. Direction: _____

3. Cause (Choose one):

☐ Crash ☐ Winter Weather ☐ Flooding ☐ Road Work ☐ Bridge Outage
☐ Down Utility ☐ Down Tree ☐ Debris/Obstruction ☐ Special Event
☐ Other

4. Status: _____ Closed _____ Lane Restriction
5. Police Jurisdiction: _____ PSP _____ Local
6. Beginning County: _____
7. Beginning Location: _____
8. Ending County: _____
9. Ending Location: _____
10. Fatality? ☐ Yes ☐ No
11. School bus? ☐ Yes ☐ No
12. Hazardous Material? ☐ Yes ☐ No
    Placard ID Number: _____ Name of Material: _____
13. Description of Incident

_____
_____
_____

14. Date and Time Closed: _____
15. Estimated Date and Time to Reopen: _____
16. Actual Date and Time Reopened: _____
17. Information reported by: _____
18. Phone Number: _____
19. Date and Time Reported: _____

Example Shift Transition Report

pennsylvania
DEPARTMENT OF TRANSPORTATION

DISTRICT 6 TRAFFIC MANAGEMENT CENTER

SHIFT PASSDOWN REPORT

Date_____ Next Shift Start_____

Outgoing Operators_____ Incoming Operators_____

District 6

Incidents / Roadwork	RCRS (Enter ID)	Equipment Issues

District 5

Incidents / Roadwork	RCRS (Enter ID)	Equipment Issues

District 4

Incidents / Roadwork	RCRS (Enter ID)	Equipment Issues

Comments_____

_____

_____

Example Device Malfunction Report

FORM TMC-120: ITS Device Malfunctioning Reporting Form
Eastern RTMC

DISTRICT -0

Date	Time	Device Type	Device I.D.	County	Location: Roadway/Direction	Description of Problem	Reported By
00-00-00	0:00 XM	HAR	000-00-000				

Appendix B – Training and Certification Resources

Certification Resources

Certification Name	Certification Description and Requirements	Pre-requisites	Certification Course Length	Cost* (Member/ Non-Member Fees)	Access	Certification Process
APPLICABLE FOR OPERATIONS POSITIONS						
American Traffic Safety Services Association (ATSSA)						
Traffic Control Supervisor (TCS)	Second level course designed to train those actively involved in designing or setting up and maintaining temporary traffic control in a work zone.	Passing the Traffic Control Technician Course	16 hours/two days	$355/405	http://www.atssa.com/TrainingCertification/CourseInformation/TrafficControlSupervisorTCS.aspx	• Pass TCT and TCS courses with 80% or greater • Possess two years (4,000 hours) temporary traffic control experience • Compete application and pay fee • Provide two references • Be approved by the ATSSA Certification Board
Traffic Control Design Specialist (TCSD)	Course focused on the entire process of designing, installing, maintaining, and evaluating temporary traffic control in work zones. This course teaches engineering concepts to properly design effective traffic control plans.	TCS Certification	16 hours/two days	$295/$395	http://www.atssa.com/TrainingCertification/CourseInformation/TrafficControlDesignSpecialistTCDS.aspx	• Pass TCSD course with 80% or greater • Possess one year (2,000 hours) temporary traffic control experience • Compete application and pay fee • Provide two references • Be approved by the ATSSA Certification Board
International Municipal Signal Association (IMSA)						
Work Zone Temporary Traffic Control Technician	This course focuses on the principles of design, installation and maintenance of traffic control devices.	None	16 hours/two days	$270	https://www.imsafws.com/training	• Pass the Work Zone course
Transportation Center Systems Specialist Level I	This certification program is designed for transportation professionals whose role encompasses control and operation of a road network in a Transportation Management Center (TMC). The program provides an understanding of key concepts and the technology used for devices, equipment, and software that a TMC may utilize in daily operations.	None	*Contact Florida Section for additional information on this certification* *386-301-5575*		http://www.imsasafety.org/IMSA/Certification/Programs/IMSA/Certification/Certification_Overview.aspx?hkey=960978e7-c6d9-4c71-98ec-c2482334ba4b	• Pass the Transportation Center System I Course
Transportation Center Systems Specialist Level II	This program emphasizes material on data collection, vehicle detection, data integrity and integration, Center-To-Center protocols, TMC consoles, video and closed-circuit television technologies, stand by power systems, software sub-systems, dynamic message signs, field device operations and system administration and troubleshooting	Transportation Center System Specialist Level I	*Contact Florida Section for additional information on this certification* *386-301-5575*		http://www.imsasafety.org/IMSA/Certification/Programs/IMSA/Certification/Certification_Overview.aspx?hkey=960978e7-c6d9-4c71-98ec-c2482334ba4b	• Pass the Transportation Center System I Course • Pass the Transportation Center System II Course
OSHA						
OSHA 10 Hour Training for Construction	OSHA recommends workplace safety training for a safe and healthful work environment, specifically for hazard avoidance on the job site. This training covers specific OSHA regulations and requirements as they apply to the Construction Industry.	None	10 hours	$59	https://www.oshaeducationcenter.com/osha-10-hour-training-construction.aspx *Or other sites*	• Earn OSHA Education Center 10-Hour Card
APPLICABLE FOR MAINTENANCE AND INCIDENT MANAGEMENT POSITIONS						
American Traffic Safety Services Association (ATSSA)						
Traffic Control Technician (TCT)	Introductory course focused on temporary traffic control in work zones for individuals who work in the field installing and removing traffic control devices.	None	8 hours/one day	$180/$205	http://www.atssa.com/TrainingCertification/CourseInformation/TrafficControlTechnicianTCT.aspx	• Pass TCT course with 80% or greater • Possess one year (2,000 hours) temporary traffic control experience • Compete application and pay fee • Provide two references • Be approved by the ATSSA Certification Board
Traffic Control Supervisor (TCS)	Second level course designed to train those actively involved in designing or setting up and maintaining temporary traffic control in a work zone.	Passing the Traffic Control Technician Course	16 hours/two days	$355/405	http://www.atssa.com/TrainingCertification/CourseInformation/TrafficControlSupervisorTCS.aspx	• Pass TCT and TCS courses with 80% or greater • Possess two years (4,000 hours) temporary traffic control experience • Compete application and pay fee • Provide two references • Be approved by the ATSSA Certification Board
Traffic Control Design	Course focused on the entire process of designing, installing, maintaining, and evaluating temporary traffic control in work zones. This course teaches engineering	TCS Certification	16 hours/two days	$295/$395	http://www.atssa.com/TrainingCertification/CourseInformation/TrafficC	• Pass TCSD course with 80% or greater • Possess one year (2,000 hours) temporary traffic control experience

Certification Resources

Certification Name	Certification Description and Requirements	Pre-requisites	Certification Course Length	Cost* (Member/ Non- Fees)	Access	Certification Process
Specialist (TCSD)	control in work zones. This course teaches engineering concepts to properly design effective traffic control plans.	TCS Certification	16 hours/two days		fication/CourseInformation/TrafficControlDesignSpecialistTCDS.aspx	• Compete application and pay fee • Provide two references • Be approved by the ATSSA Certification Board • Pass PMT course with 80% or greater
Pavement Marking Technician (PMT)	Course designed to provide instruction on pavement marking materials, application processes, quality control and pavement marking standards.	None	16 hours/two days	$450/$565	http://www.atssa.com/TrainingCertification/CourseInformation/PavementMarkingTechnicianPMT.aspx	• Possess two years (4,000 hours) pavement marking experience • Compete application and pay fee • Provide two references • Be approved by the ATSSA Certification Board
International Municipal Signal Association (IMSA)						
Work Zone Temporary Traffic Control Technician	This course focuses on the principles of design, installation and maintenance of traffic control devices.	None	16 hours/two days	$270	https://www.imsafws.com/training	• Pass the Work Zone course
Traffic Signal Technician Level I	This course covers the concepts and terminology associated with signalized traffic control systems and devices. This course is designed for entry level technicians that have had some prior training or experience in electrical technology.	IMSA Work Zone Temporary Traffic Control Technician Certification or equivalent as approved by the IMSA Education & Certification Manager.	16 hours/two days	$280	https://www.imsafws.com/training	• Pass the Work Zone course • Pass the Traffic Signal Technician course
Traffic Signal Inspection Level I	This course is designed to ensure public safety by helping individuals to understand fundamental concepts associated with the inspection for construction of traffic signal installations.	IMSA Work Zone Temporary Traffic Control Technician Certification or equivalent as approved by the IMSA Education & Certification Manager.	16 hours/two days	$280	https://www.imsafws.com/training	• Pass the Work Zone Traffic Control Safety Course • **Effective August 1, 2018 IMSA Traffic Signal Technician Level I Certification**
Traffic Signal Inspector for Advanced Technologies	Material covered in this program includes test equipment, control components, power systems, foundations, intersection wiring, detection systems, Intelligent Transportation System (ITS) devices, and communications.	IMSA Work Zone Traffic Control Safety Certification OR equivalent as approved by the IMSA Education & Certification Manager Traffic Signal Inspector	16 hours/two days	$290	https://www.imsafws.com/training	• Pass the Work Zone Traffic Control Safety Course • Pass the Traffic Signal Inspector Course • **Effective August 1, 2018 IMSA Traffic Signal Technician Level I Certification**
Fiber Optics Technician	Fiber Optic Technician for ITS, Traffic, Fire Alarm, and Communication Systems is primarily aimed at installers who need the basic knowledge, skills and abilities to install fiber optic outside plant networks properly.	Attendees will be expected to complete an IMSA online self-study fiber optic course and get a certificate of completion to bring to class (you will get the link when you register). Some experience working in the field of fiber optics and communications networks is recommended.	24 hours/three days	$1,250	https://www.imsafws.com/training	• Completion of the self-study fiber optics course • Fiber optics and networks field experience
Traffic Signal Bench Technician Level II	This course includes programming, application and maintenance of controllers, conflict monitors, vehicle and pedestrian detection systems and the communication and power wiring of the cabinet. This course also explains electronic circuit operation and fault diagnosis, and the test equipment for diagnosis and certification of control cabinet equipment.	IMSA Work Zone Temporary Traffic Control Technician Certification or equivalent as approved by the IMSA Education & Certification Manager. IMSA Traffic Signal Technician Level I Certification	16 hours/two days	$290	https://www.imsafws.com/training	• Pass the Work Zone Traffic Control Safety Course • Pass the Traffic Signal Technician course • Pass the Traffic Signal Bench Technician II course

Certification Resources

Certification Name	Certification Description and Requirements	Pre-requisites	Certification Course Length	Cost* (Member/ Non-Member Fees)	Access	Certification Process
Traffic Signal Construction Technician Level II	Instruction for this course includes traffic signal control system construction, safety, materials, methods, and equipment. Activities covered include: safe operation of construction equipment (from concrete saws to cranes), planning activities, documentation, and installation of conduits, poles, mast arms, signal heads, cabinets, and inductive loops.	IMSA Work Zone Temporary Traffic Control Technician Certification or equivalent as approved by the IMSA Education & Certification Manager IMSA Traffic Signal Technician Level I Certification	16 hours/two days	$290	https://www.imsafws.com/training	• Possess two years of experience in the traffic signal field • Pass the Work Zone Traffic Control Safety Course • Pass the Traffic Signal Technician course • Pass the Traffic Signal Construction Technician II course
Traffic Signal Senior Bench Technician Level III	This certification includes topics such as NEMA traffic signal equipment functions and specifications for controllers, flashers load switches and conflict monitors.	Must the an IMSA Traffic Signal Bench Technician Level II	Exam Only	$300	https://www.imsafws.com/training	• Possess two years of experience in the traffic signal field • Pass the IMSA Traffic Signal Senior Bench Technician Level III exam • Pass the IMSA Microprocessors In Traffic Signals Technician exam • Five years of experience as a Traffic Signal Bench Technician • Certification as a Traffic Signal Bench Technician Level II
Traffic Signal Senior Field Technician Level III	This certification includes topics such as NEMA Standards, 170/2070 Standards, detection methods, lightening protection, video detection, wire and cable specifications.	Must the an IMSA Traffic Signal Field Technician Level II	Exam Only	$300	https://www.imsafws.com/training	• Pass the IMSA Traffic Signal Senior Field Technician Level III exam • Five years of experience as a Traffic Signal Bench Technician • Certification as a Traffic Signal Field Technician Level II
Signs and Pavement Markings Technician Level I	This course provides an introduction to the latest technology, materials, and rules and regulations that are used for the installation and maintenance of signs and pavement markings on today's roadways.	Work Zone Temporary Traffic Control Technician Certification or equivalent as approved by the IMSA Education & Certification	16 hours/two days	$280	https://www.imsafws.com/training	• Pass the Work Zone Traffic Control Safety Course • One year of field traffic operations experience
Signs Technician Level II	An advanced certification program designed to build upon the fundamental of the Signs & Markings Level I program. The Level II program covers an advanced level of knowledge and skill sets required specifically for sign design, installation, and maintenance. In this program the sign technician will expand their understanding of the criteria for the application of signs in accordance with the MUTCD and other references.	Work Zone Temporary Traffic Control Technician Certification or equivalent as approved by the IMSA Education & Certification Manager, and have the Signs and Pavement Markings Technician Level I Certification.	16 hours/two days	$290	https://www.imsafws.com/training	• Pass the Work Zone Traffic control Safety Course • Certification as a Signs and Marking Technician I • Possess two years of field traffic operations experience
Signs Senior Technician Level III	This certification tests the knowledge and skill sets that are specifically required for sign design, installation and maintenance.	Work Zone Temporary Traffic Control Technician Certification or equivalent as approved by the IMSA Education & Certification Manager, and have the Signs	Exam Only/one day	$300	https://www.imsafws.com/training	• Certification as a Signs Technician Level II • Possess five years of field experience related to the design, installation and maintenance of signs
Pavement Markings Technician Level II	This certification gives an advanced understanding of pavement marking materials, installation, and maintenance	Work Zone Temporary Traffic Control Technician Certification or equivalent as approved by the IMSA Education & Certification Manager Signs and Pavement Markings Technician Level I	16 hours/two days	$290	https://www.imsafws.com/training	• Possess two years of field traffic operations experience

Certification Resources

Certification Name	Certification Description and Requirements	Pre-requisites	Certification Course Length	Cost* (Member/ Non-Member Fees)	Access	Certification Process
Pavement Technician Level III	This certification is designed to test the knowledge and skill sets that are specifically required for pavement markings design, installation and maintenance.	IMSA Work Zone Temporary Traffic Control Technician Certification or equivalent as approved by the IMSA Education & Certification	Exam Only	$300	https://www.imsafws.com/training	• Certification as a Pavement Markings Technician Level II • Possess five years of related field experience
Roadway Lighting Technician Level I	Certification review program for qualified personnel designed to cover the fundamental knowledge and skill sets required for individuals working on Roadway Lighting. The material addresses electrical safety and codes, basic electricity, laws, jurisdictional requirements and basic construction and maintenance.	IMSA Work Zone Traffic Control Safety Certification or equivalent as approved by the IMSA Education & Certification Manager	16 hours/two days	$280	https://www.imsafws.com/training	• Pass the Work Zone Traffic Control Safety Class
Roadway Lighting Technician Level II	An advanced certification program that is designed to build upon the fundamentals of the Roadway Lighting Level I program. The Level II program covers an advanced level of knowledge and skill sets required specifically for roadway lighting design, installation, management and maintenance.	Work Zone Temporary Traffic Control Technician Certification or equivalent as approved by the IMSA Education & Certification Manager and Roadway Lighting Technician Level I	16 hours/two days	$290	https://www.imsafws.com/training	• Pass the Work Zone Traffic Control Safety Course • Certification as a Roadway Lighting Technician Level I • Two years of roadway lighting field experience
OSHA						
OSHA 10 Hour Training for Construction	OSHA recommends workplace safety training for a safe and healthful work environment, specifically for hazard avoidance on the job site. This training covers specific OSHA regulations and requirements as they apply to the Construction Industry.	None	10 hours	$59	https://www.oshaeducationcenter.com/osha-10-hour-training-construction.aspx *Or other sites*	• Earn OSHA Education Center 10-Hour Card

*Costs in this version are current as of September 2018

Training Resources

Training Course Name	Course Description and Requirements	Pre-requisites	Course Length	Cost* (Member/Non-Member Fees)	Access
APPLICABLE FOR OPERATIONS POSITIONS					
American Traffic Safety Services Association (ATSSA)					
Temporary Traffic Control Considerations for Urban Work Zones	This course addresses work zones in more populated and congested areas, particularly the considerations necessary to address work zones in urban environments.	None	16 hours/two days	$355/$405	http://www.atssa.com/TrainingCertification/CourseInformation/TemporaryTrafficControlUrbanWorkZones.aspx
Temporary Traffic Control for Utility Operations	This course provides an introduction to temporary traffic control for utility work.	None	8 hours/one day	$180/$205	http://www.atssa.com/TrainingCertification/CourseInformation/TemporaryTrafficControlUtility.aspx
Introduction to the MUTCD	This course examines the Manual on Uniform Traffic Control Devices (MUTCD), its content, and its applicability to streets open to the public in the United States, including private streets. Emphasis will be given on temporary traffic control.	None	2 hours	$65/$65	http://www.atssa.com/TrainingCertification/CourseInformation/IntroductiontotheMUTCD.aspx
Consortium for Innovative Transportation Education (CITE)					
Data Archiving and Analytics for Planning, Operations and Safety	This course is designed to explain the benefits of creating an open and accessible data archive.	None	8 hours	$399	http://www.citeconsortium.org/cite-courses/blended-courses/
Improving Highway Safety with ITS	This course is an introduction to ITS-based strategies and tools available for improving highway safety. This course is intended for ITS, transportation operations, and safety professionals, including, but not limited to, planners, operators, designers, emergency management, and maintenance personnel.	None	10 hours	$250	http://www.citeconsortium.org/cite-courses/blended-courses/
Network Design and Deployment Considerations for ITS	The overall goal of this course is to provide a system-level understanding of the operation of modern broadband transportation communications networks. This course focuses on how to plan and implement telecommunications networks to support a major Intelligent Transportation System (ITS) infrastructure.	None	10 hours	$239	http://www.citeconsortium.org/cite-courses/blended-courses/
Traffic Signal Operations	This course provides an understanding of both the theory and practice of traffic signal timing and its impact on traffic operations. It gives students an overview of the terms associated with signal timing; discusses the concepts of cycle length, split, offset, midblock friction, phase sequences, the signal timing process, and signal timing optimization; and looks at the types of actuated controllers, passage time, extension, and the coordination of actuated and pre-timed controllers.	None	10-15 hours	$239	http://www.citeconsortium.org/cite-courses/blended-courses/
ITS Awareness	This course presents an overview of Intelligent Transportation Systems (ITS) and discusses their role in Transportation Systems Management and Operations (TSMO). In general, it covers how systems (ITS) are applied (through TSMO) to achieve a wide range of benefits.	None	4 hours	$199	http://www.citeconsortium.org/cite-courses/individual-courses/
Pavement Marking	This course is an introduction to pavement marking standard practices and defines the functions and characteristics, materials, manufacturing, application, installation and evaluation.	None	6 hours	$150	http://www.citeconsortium.org/cite-courses/individual-courses/
TSMO 101: What is this TSMO Thing Anyway?	This course discusses congestion and its continued spread and intensify; the levels of incidents, delays, and disruptions; and the level of service and reliability of the roadways in many areas as it continues to decline.	None	2 hours	$70	http://www.citeconsortium.org/cite-courses/individual-courses/
Federal Highway Administration (FHWA)					
Advancing Transportation Systems Management and Operations through Scenario Planning	The intent of this session is to inform planners, operators, and other transportation systems management and operations (TSMO) practitioners on the use of scenario planning to advance TSMO, including why and when to use it and how to apply the phases of scenario planning to TSMO. This session will provide a general understanding of scenario planning and a framework for applying scenario planning to advance TSMO.	None		Free	https://ops.fhwa.dot.gov/plan4ops/resources/traing.htm
Applying Archived Operations Data in Transportation Planning	The purpose of this web-based informational session is to assist transportation planners and their operations partners in effectively using archived operations data for developing, analyzing, and evaluating transportation plans and programs.	None		Free	https://ops.fhwa.dot.gov/plan4ops/resources/traing.htm
National Highway Institute (NHI)					
Strategies for Developing Work Zone Traffic Analyses	This course provides the participants with practical experience in developing a transportation modeling approach in a collaborative process that considers issues ranging from work zone characteristics, performance measurement, technical risk assessment, and resource constraints.	None	4 hours	$50	https://www.nhi.fhwa.dot.gov/course-search?tab=0&typ=3&cat=22%2C5%2C8%2C23%2C11&sf=0&course_no=133110

Training Resources

Training Course Name	Course Description and Requirements	Pre-requisites	Course Length	Cost* (Member/Non-Member Fees)	Access
Maintenance Training Series: Basics of Work Zone Traffic Control	This course offers an overview of the MUTCD's structure and requirements regarding traffic control devices and their applications, flagging operations and procedures, and pedestrian and worker safety.	None	1 hour	$25	https://www.nhi.fhwa.dot.gov/course-search?tab=0&typ=3&cat=22%2C5%2C8%2C23%2C11&sf=0&course_no=134109
Transportation Asset Management Overview	This training explains the basics of asset management and why asset management is important. After you complete this training, you'll have new terms, and new ways of thinking about what you're already doing.	None	2 hours	$25	https://www.nhi.fhwa.dot.gov/course-search?tab=0&typ=3&cat=22%2C5%2C8%2C23%2C11&sf=0&course_no=136113
Introduction to Performance Measurement	This course is one in a series of introductory courses that fall within the subject area of Transportation Performance Management. Transportation Performance Management is a strategic approach that uses system information to make investment and policy decisions to achieve national performance goals.	None	2 hours	$25	https://www.nhi.fhwa.dot.gov/course-search?tab=0&typ=3&cat=22%2C5%2C8%2C23%2C11&sf=0&course_no=138003
Webinars					
National Operations Center of Excellence (NOCoE)	Design to offer a suite of resouces to serve the TSMO community including technical services such as peer exchange workshops and webinars, ongoing assessments of best practices in the field, and on-call assistance. Regular webinars are hosted by NOCoE.	None	1 to 4 hours	Free	https://transportationops.org
ITS Joint Programs Office ITS Professional Capacity Building Program - Talking Technology and Transportation (T3) Webinars	T3 webinars are designed to help agencies feel confident about deploying and operating ITS technologies as a means to address challenges in their transportation systems. Includes such topics as ITS planning, design, procurement, deployment, and operations. Standard webinars are 90 minutes. T3 Lite webinars are 30 minutes followed by a question and answer period.	None	30-90 minutes	Free	https://www.pcb.its.dot.gov/t3_webinars.aspx
APPLICABLE FOR MAINTENANCE AND INCIDENT MANAGEMENT POSITIONS					
American Traffic Safety Services Association (ATSSA)					
Temporary Traffic Control Considerations for Urban Work Zones	This course addresses work zones in more populated and congested areas, particularly the considerations necessary to address work zones in urban environments.	None	16 hours/two days	$355/$405	http://www.atssa.com/TrainingCertification/CourseInformation/TemporaryTrafficControlUrbanWorkZones.aspx
Temporary Traffic Control for Utility Operations	This course provides an introduction to temporary traffic control for utility work.	None	8 hours/one day	$180/$205	http://www.atssa.com/TrainingCertification/CourseInformation/TemporaryTrafficControlUtility.aspx
Introduction to the MUTCD	This course examines the Manual on Uniform Traffic Control Devices (MUTCD), its content, and its applicability to streets open to the public in the United States, including private streets. Emphasis will be given on temporary traffic control.	None	2 hours	$65/$65	http://www.atssa.com/TrainingCertification/CourseInformation/IntroductiontotheMUTCD.aspx
Consortium for Innovative Transportation Education (CITE)					
Traffic Signal Operations	This course provides an understanding of both the theory and practice of traffic signal timing and its impact on traffic operations. It gives students an overview of the terms associated with signal timing; discusses the concepts of cycle length, split, offset, midblock friction, phase sequences, the signal timing process, and signal timing optimization; and looks at the types of actuated controllers, passage time, extension, and the coordination of actuated and pre-timed controllers.	None	10-15 hours	$239	http://www.citeconsortium.org/cite-courses/blended-courses/
National Highway Institute (NHI)					
Maintenance Training Series: Basics of Work Zone Traffic Control	This course offers an overview of the MUTCD's structure and requirements regarding traffic control devices and their applications, flagging operations and procedures, and pedestrian and worker safety.	None	1 hour	$25	https://www.nhi.fhwa.dot.gov/course-search?tab=0&typ=3&cat=22%2C5%2C8%2C23%2C11&sf=0&course_no=134109
Maintenance of Traffic for Technicians	The Maintenance of Traffic for Technicians Web-based training presents information about the placement of, field maintenance required for, and inspection of traffic control devices.	None	5 hours	$50	https://www.nhi.fhwa.dot.gov/course-search?tab=0&typ=3&cat=22%2C5%2C8%2C23%2C11&sf=0&course_no=133116
Maintenance of Traffic for Supervisors	The Maintenance of Traffic for Supervisors Web-based training presents information about the placement of, field maintenance required for, and inspection of traffic control devices.	None	5 hours	$50	https://www.nhi.fhwa.dot.gov/course-search?tab=0&typ=3&cat=22%2C5%2C8%2C23%2C11&sf=0&course_no=133117
Transportation Asset Management Overview	This training explains the basics of asset management and why asset management is important. After you complete this training, you'll have new terms, and new ways of thinking about what you're already doing.	None	2 hours	$25	https://www.nhi.fhwa.dot.gov/course-search?tab=0&typ=3&cat=22%2C5%2C8%2C23%2C11&sf=0&course_no=136113

*Costs in this version are current as of September 2018