CONTRACT # 2015-1001103

FINAL REPORT FOR

TR 154 CENTRAL TRAFFIC CONTROL SYSTEM PROJECT

Prepared for the Mobile Source Air Pollution Review Committee (MSRC) under the AB 2766/MSRC Signal Synchronization Partnership Program under SB 2766 Discretionary Fund Work Program

WORK COMPLETED MARCH 3, 2018

ACKNOWLEDGMENTS

DISCLAIMER

PROJECT BACKGROUND AND RATIONALE

In 2014, the City of Chino submitted a grant application to the South Coast Air Quality Management District's (SCAQMD) Mobile Source Air Pollution Reduction Review Committee (MSRC) funding program, to implement a central traffic control system and associated design and equipment through San Bernardino Associated Governments, now SBCTA. The MSRC is established under state law (AB 2766) whose sole mission is to fund projects that reduce air pollution from motor vehicles within the South Coast Air Quality Management District (SCAQMD) in Southern California. MSRC allocates Clean Transportation Funding from a $4 surcharge on vehicle license fees, specifically to be used for local projects designed to reduce air pollution from motor vehicles. Per agreement number 15-1001103, the City of Chino was awarded the "Central Traffic Control System Project" with $305,000 of AB 2766 funds, and $110,00 of local funds, for a total project cost of $415,000.   On December 16, 2014 City Council approved the acceptance of these grant funds. The City proceeded to write a request for proposals for design of the system and backbone infrastructure, integration of the central system software and traffic signals, and procurement of related equipment. On February 10, 2016 the City released a Request for Proposals for the project to eleven (11) qualified firms. On March 31, 2016 the City received two proposals from highly qualified firms, Advanced Transportation Concepts Group (ATC), Irvine CA and Aegis ITS, Anaheim, CA. The two competing consultant firms, consistent with the State of California Government Code Section 4526, and the City's Purchasing Ordinance Chapter 3.32 were evaluated based on technical merit. ATC received the highest ranking in the proposal evaluation, thereby deemed as the most qualified firm to provide the service. In addition, ATC, Inc. provided the lowest cost in the amount of $344,000. In addition to the base proposal, the City wished to exercise Optional Bid Items Task 2B, Phases 1-3 in the amount of $97,500 which connected much of major arterial intersections, in addition to the base project, for a total contract amount of $441,500. The additional project costs were funded by local funds.

 A central traffic control system provides traffic engineers with the tools to synchronize traffic signal controllers through a common reference time clock and to change traffic signal operational strategies should an unplanned event occur, e.g. a freeway diversion to city arterials. When used with a robust intelligent transportation system (ITS) and communications infrastructure, the central traffic control system is an exceptionally cost-effective tool to manage daily traffic congestion and special events.   The "Central Traffic Control System Project" procured new traffic signal master system software and equipment. The central system software will allow staff to monitor the current status of connected traffic signals throughout the City from the traffic signal management center at City Hall, and enhance the optimization and signal coordination with the software.

The City had planned a phased approach to updating its traffic signal control infrastructure and central traffic control system. In 2013, the City initiated a project to update its low-bandwidth

copper communications network to a high-bandwidth fiber optic network now capable of handling traffic signal communications, closed-circuit television network, ITS devices and Connected-Vehicle/Automated Vehicle (CV-AV) technologies. The Signal Interconnect Project completed in 2015 provides a robust fiber backbone along Central Avenue, a major thoroughfare in the City that links the Traffic Management Center (TMC) located at City Hall with the rapidly developing Preserve Area.
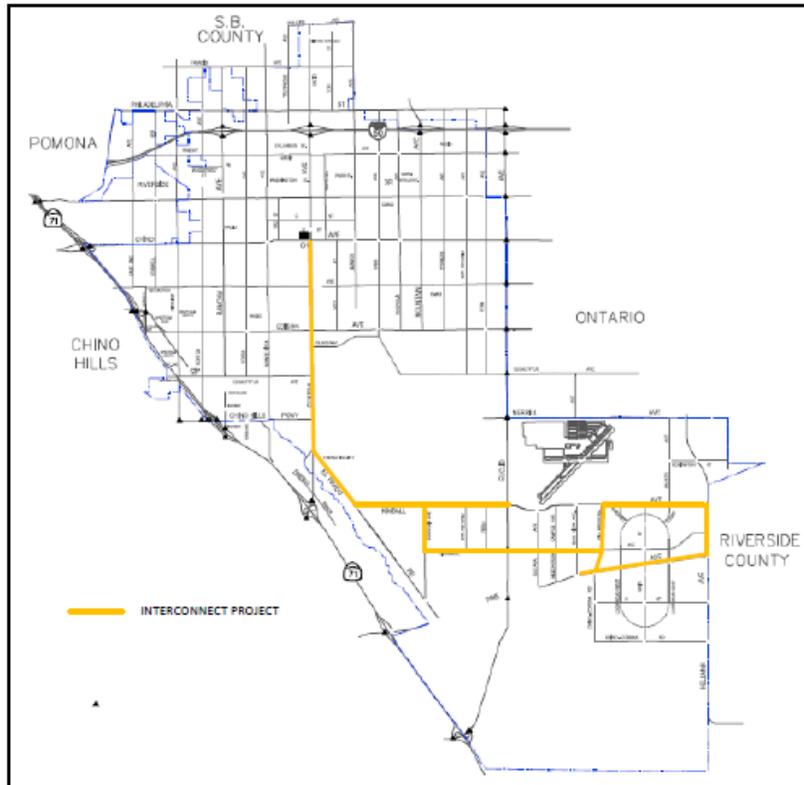
Interconnect Project (2013-2014)

Building on the success of the fiber backbone from the Interconnect Project, the City decided to pursue an updated central traffic control system to replace its outdated Aries System with the intent of further restoring more communications to its traffic control infrastructure for implementing real-time traffic signal operations.

PROJECT WORK SCOPE AND DEVELOPMENT

The proposed project consisted of four main tasks: repairing/restoring communications to 49 traffic signal controllers in the field, evaluating, procuring and implementing a central traffic control system that is compliant to national standards, and finally, integrating the 49 signal controllers and the controllers from the Interconnect Project to the new central traffic control

system, and providing computers and monitors to view the new software. The City developed an extensive matrix to evaluate the software proposals submitted. Some of the sections included in the software matrix were Security, Configuration, Access, Communications to Controllers, Graphical User Interface, Dynamic Objects, System Maps, Intersection Maps, Detection, Time-Space Diagrams, Split Monitoring, Operations, Alarms, Logs, Reporting, Traffic Response, CCTV, Battery Back-up, etc. The matrices submitted with the proposals defined whether the software complied to the required mandatory requirements, or not.

Within the Proposal Tasks, a Work Plan defined the requirements of the project, including furnishing and installing the central management software and licenses, designing plans, furnishing, installing and configuring software and hardware, computers, monitors and a laptop, connecting central system software to the TMC, warranty, maintenance, upgrading traffic signal controllers and switches with updated firmware, testing, preparing graphics, training staff, and public outreach.

Field Communications

Phase 1 of communications repairs to 23 signal controllers began by capitalizing on the 24-strand single mode fiber optic cable (FOC) and 12-pair #19-gauge signal interconnect (SIC), implemented as part of the Interconnect Project, from the TMC to the Preserve where the FOC path as follows:

- On Central Avenue from Chino to El Prado
- On El Prado from Central to Kimball
- On Kimball from Mill Creek to Hellman
- On Hellman from Kimball to Pine
- On Mill Creek from Kimball to Pine
- On Pine from Mill Creek to West Preserve
- On Bickmore from Euclid (at vault) to Mill Creek

In Phase 2, fiber communications were established to 18 signals as follows:

- On Chino from the TMC to Pipeline
- On Pipeline from Chino to Edison
- On Edison from Pipeline to Monte Vista

In Phase 3, the City has plans to integrate the signals locations in the Spectrum Area (future project) as follows:

- On Chino from the TMC to Pipeline
- On Pipeline from Chino to Edison
- On Edison from Norton to Monte Vista
- On Grand Avenue from Spectrum West to Spectrum East

As part of the Central System Software and city-wide license procurement for all signals and on-going maintenance, the project purchased and installed the following equipment at the Traffic Management Center (TMC): new server with MaxView software integrated with the City's network, fiber optic communication equipment in the controller cabinets and at the TMC for traffic signal controller communications. In addition, the City integrated graphics to allow viewers and operators to see the entire traffic signal system in real time for all traffic signals communicating back to the signal master system on an existing flat screen located in Chino City Hall's existing TMC.
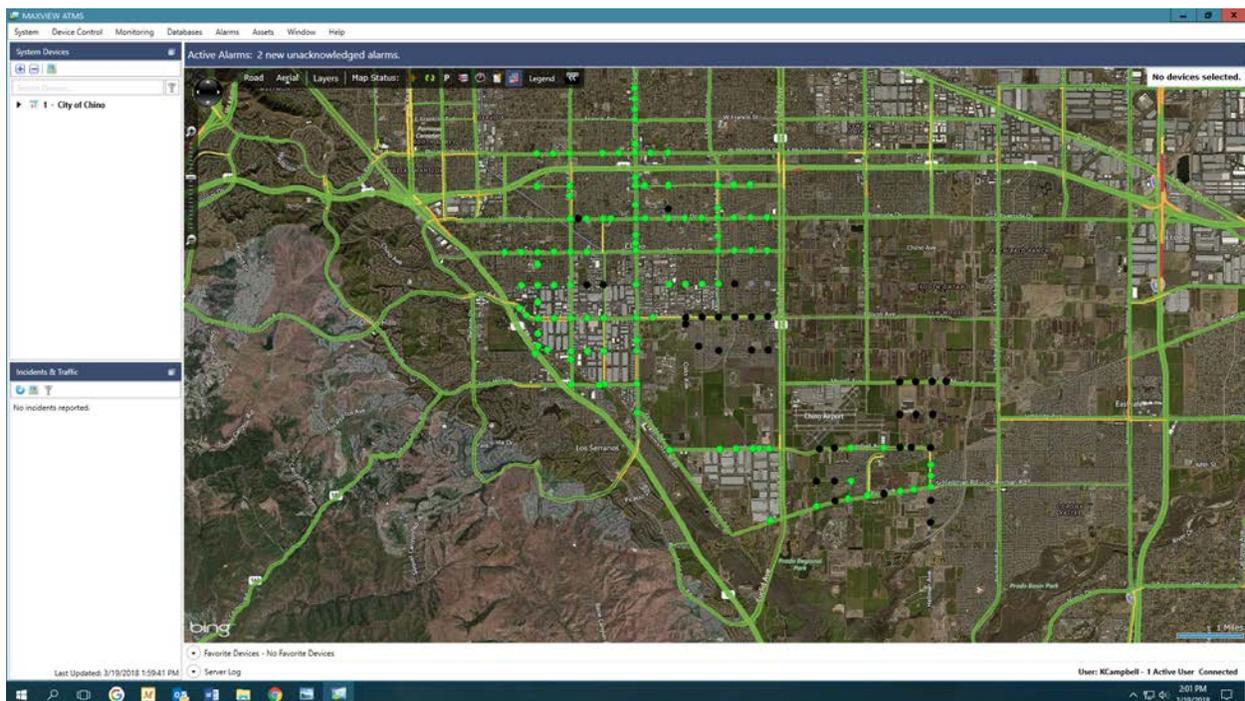
Citywide Map of Chino with MaxView

A benefit of MaxView's use of Bing Maps is that Bing Maps are automatically updated by Microsoft as part of MaxView's central system license, and that Bing Maps automatically shows the arterial congestion status based on average traffic flow.

In addition, MaxView also provides expanded views for signal synchronization at the arterial and intersection levels. Engineers use these views to hone their signal timing parameters such as cycle length, green interval utilization and offset balancing along critical arterials such as Central Avenue.

Central @ Columbus — □ ×
Intersection Controller
10 - Central @ Columbus   More...

Central @ Walnut — □ ×
Intersection Controller
11 - Central @ Walnut   More...

Central @ Washington — □ ×
Intersection Controller
12 - Central @ Washington   More...

Central @ Riverside — □ ×
Intersection Controller
13 - Central @ Riverside   More...

Central @ C — □ ×
Intersection Controller
14 - Central @ C   More...

Central @ D — □ ×
Intersection Controller
15 - Central @ D   More...

Signal Phase Status in MaxView

Finally, the role of a central control system is simply to provide operators with the ability to control traffic signal controllers in the field and monitor in real-time field conditions. Without these fundamental functions, active traffic management services are virtually non-existent. These functions require careful analysis and consideration of both the reliability of the traffic communication infrastructure (to transmit and receive data with minimal latency) and the breadth of features in the central traffic software (to control and monitor signal controllers).

The City's traffic engineers are now able to monitor and diagnose their communications to their traffic signal controllers and ITS devices with the signal monitor tool. This critical feature enables engineers to visualize communications quality and trace patterns for communications failure to quickly restore communications.

Device Communication Status

Refresh | Export ▾ | Print

Report Time Range

Report Start Time: 3/19/2018 1:22 PM   Report End Time: ☑ Use Current Date/Time
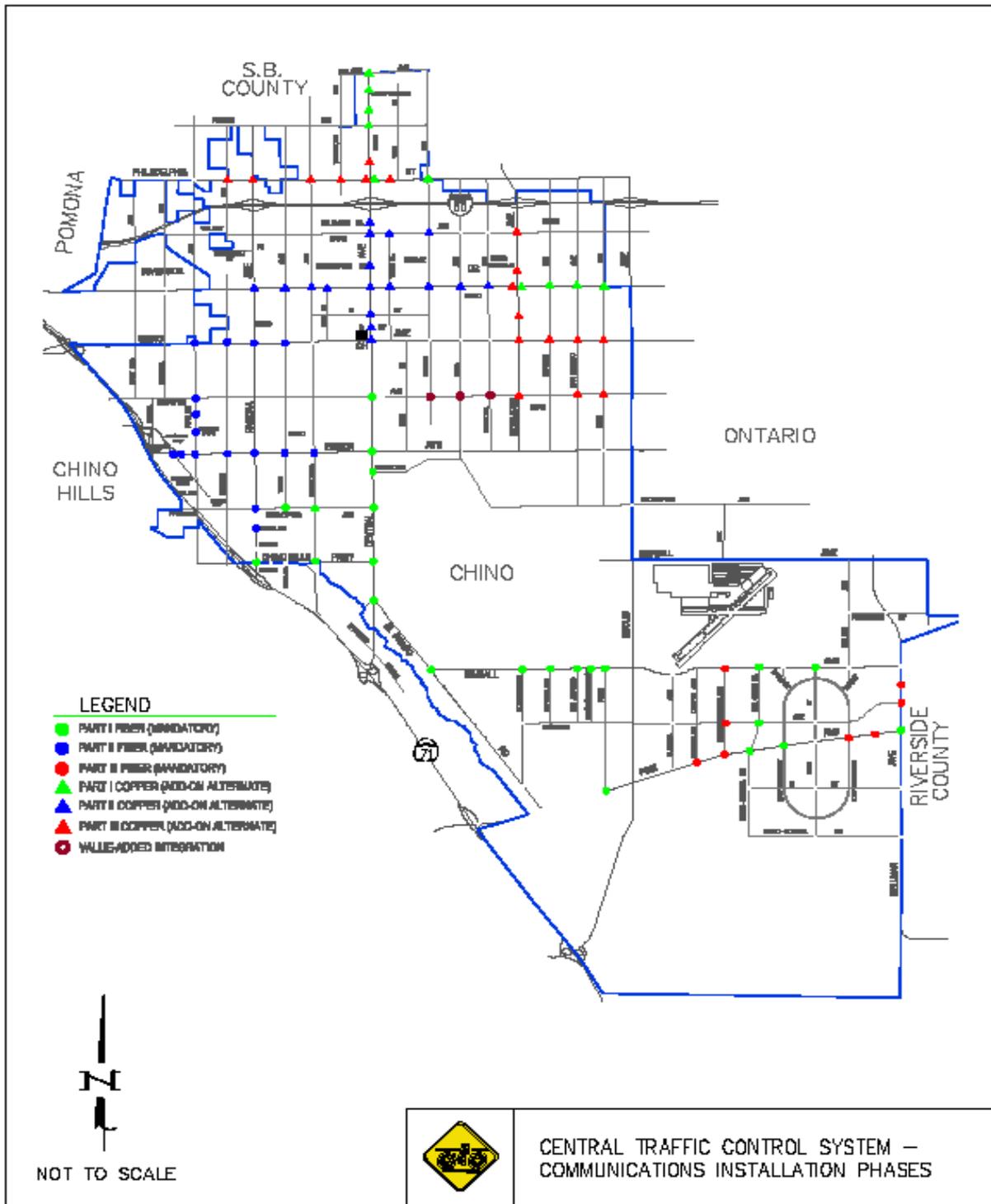
Equipment Communication Status

Drag a column header and drop it here to group by that column

| Type	Number	Name	Device Group	Online	Resp.(ms)	% Loss	Succ.	Fail	Reqs.	Note
Intersection Controller	5	Central @ Phillips	Central Avenue	■	8	0	3570	0	3570	
Intersection Controller	6	Central @ Victory	Central Avenue	■	4	0	3570	0	3570	
Intersection Controller	7	Central @ Francis	Central Avenue	■	3	0	3569	0	3569	
Intersection Controller	8	Central @ Country Fair	Central Avenue	■	1	0	3569	0	3569	
Intersection Controller	9	Central @ Philadelphia	Central Avenue	■	2	0	3569	0	3569	
Intersection Controller	10	Central @ Columbus	Central Avenue	■	1	0	3570	0	3570	
Intersection Controller	11	Central @ Walnut	Central Avenue	■	1	0	3570	0	3570	
Intersection Controller	12	Central @ Washington	Central Avenue	■	1	0	3569	0	3569	
Intersection Controller	13	Central @ Riverside	Central Avenue	■	1	0	3571	0	3571	
Intersection Controller	14	Central @ C	Central Avenue	■	1	0	3570	0	3570	
Intersection Controller	15	Central @ D	Central Avenue	■	0	0	3570	0	3570	
Intersection Controller	16	Central @ Chino	Central Avenue	■	7	0	3570	0	3570	
Intersection Controller	17	Central @ Schaefer	Central Avenue	■	0	0	3569	0	3569	
Intersection Controller	18	Central @ Edison	Central Avenue	■	64	0	3570	0	3570	
Intersection Controller	19	Central @ College Park	Central Avenue	■	0	0	3570	0	3570	
Intersection Controller	20	Central @ Eucalyptus	Central Avenue	■	1	0	3570	0	3570	

Done

Communications Diagnostic Screen in MaxView

By the end of the central system integration task, the City had established communications to the traffic signals, CCTV and BBS at the aforementioned locations, shown below.

LEGEND
- 🟢 PART I FIBER (MANDATORY)
- 🔵 PART II FIBER (MANDATORY)
- 🔴 PART III FIBER (MANDATORY)
- 🔺 PART I COPPER (ADD-ON ALTERNATE)
- 🔺 PART II COPPER (ADD-ON ALTERNATE)
- 🔺 PART III COPPER (ADD-ON ALTERNATE)
- ⊙ VALUE-ADDED INTEGRATION

N

NOT TO SCALE

CENTRAL TRAFFIC CONTROL SYSTEM —
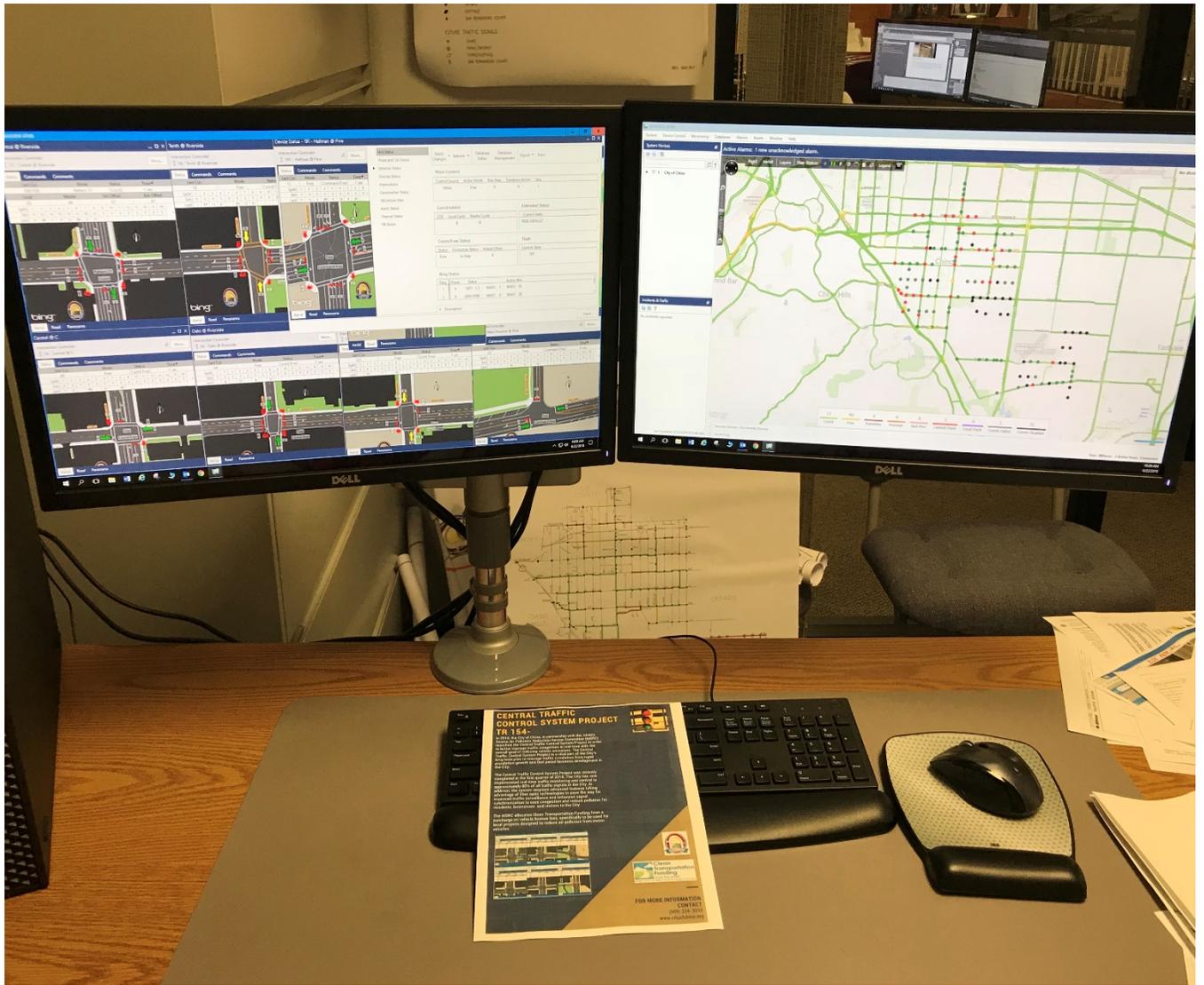COMMUNICATIONS INSTALLATION PHASES

On the following pages are photos of one of the computer stations with the Maxview software showing on the monitoring screens, monitoring various intersections and parameters in real time.
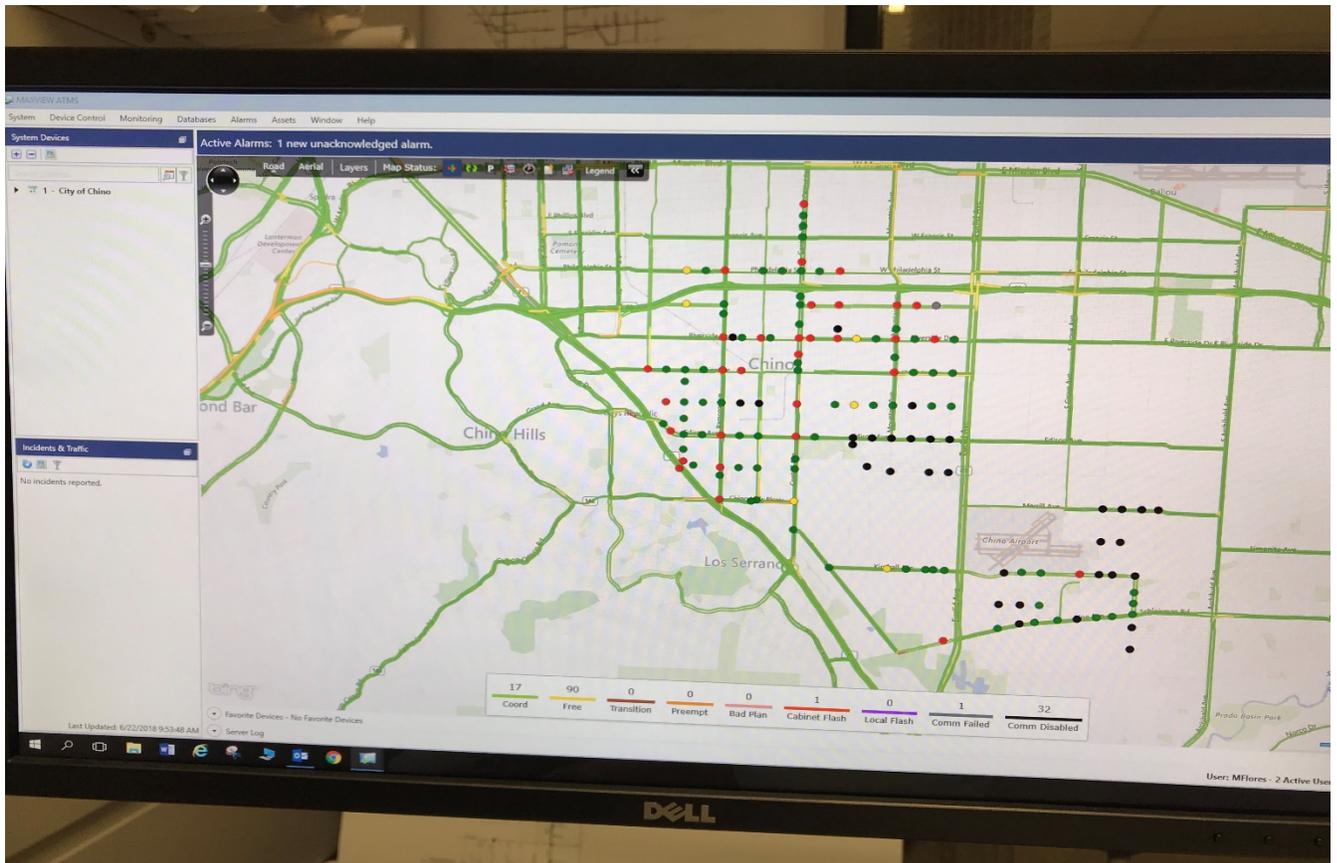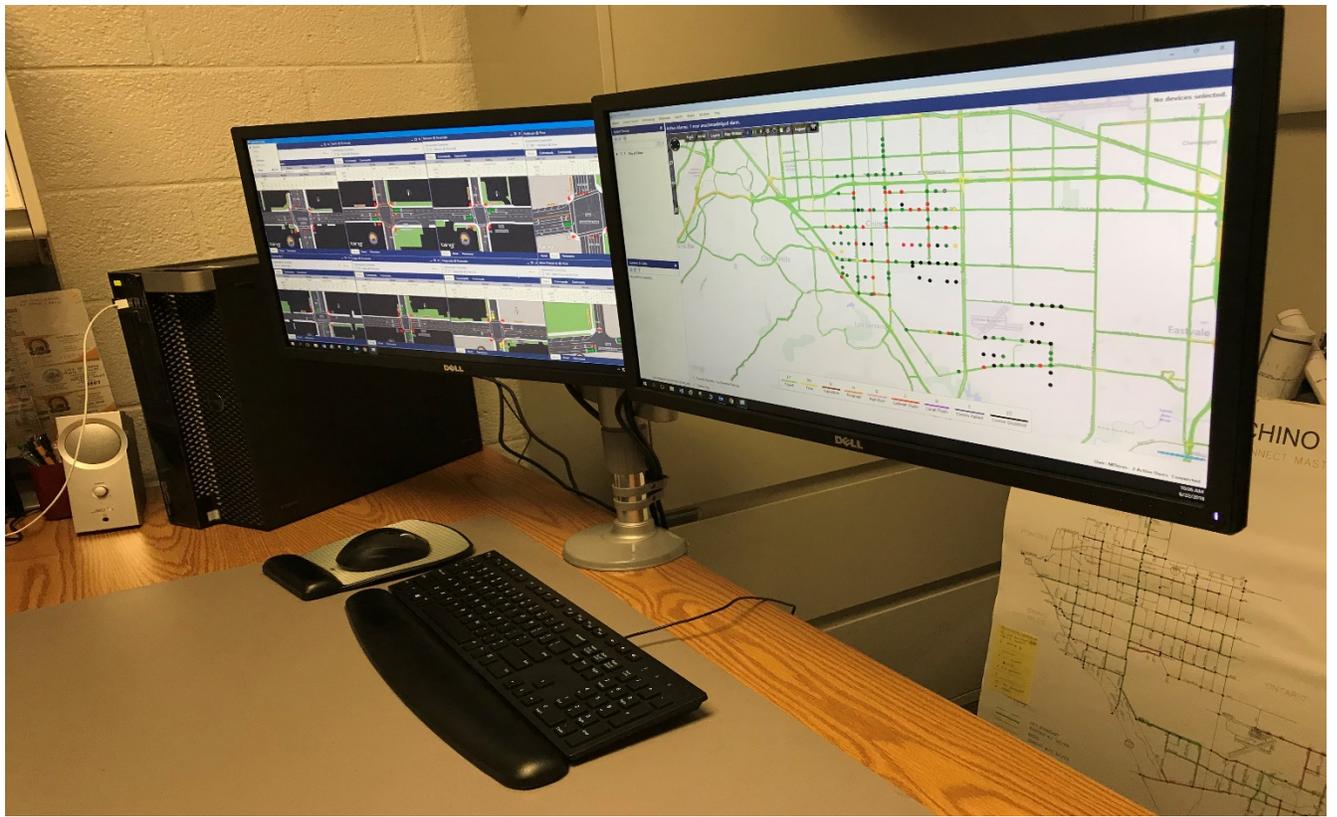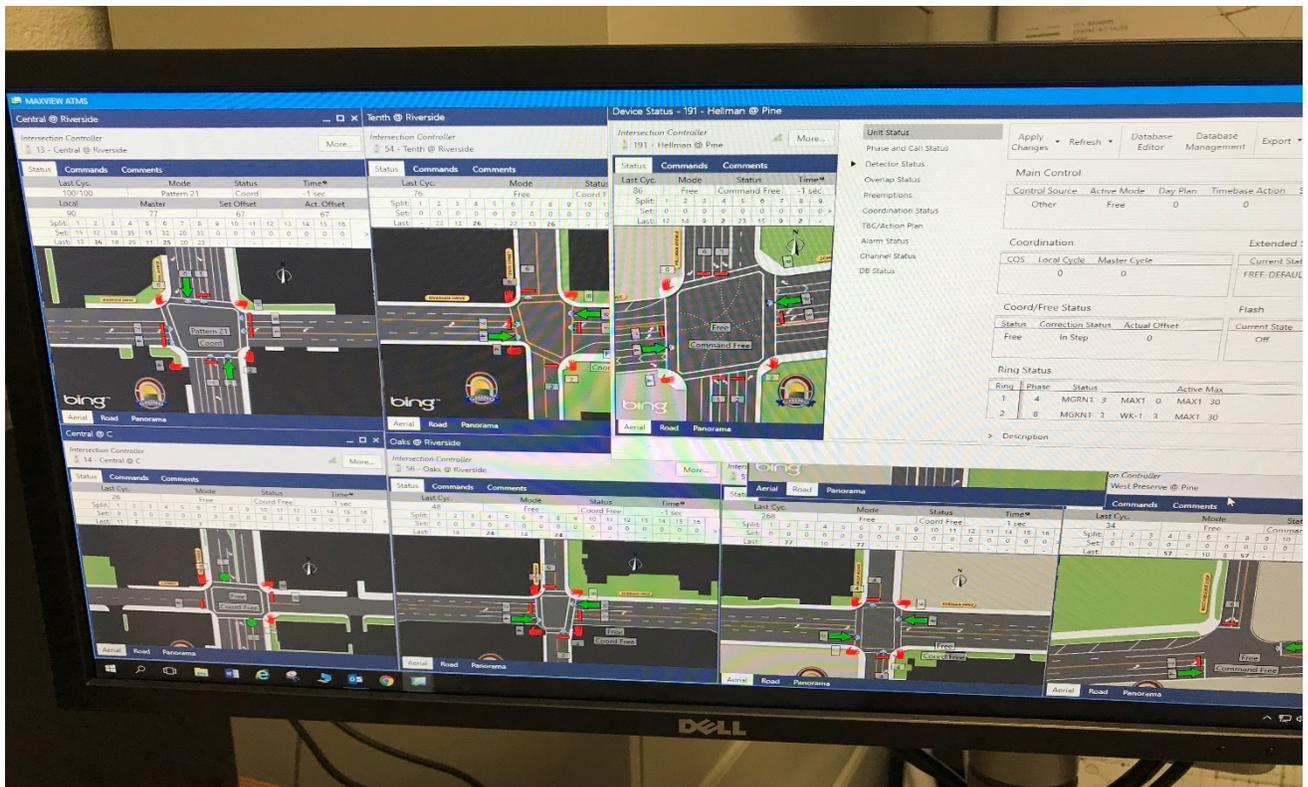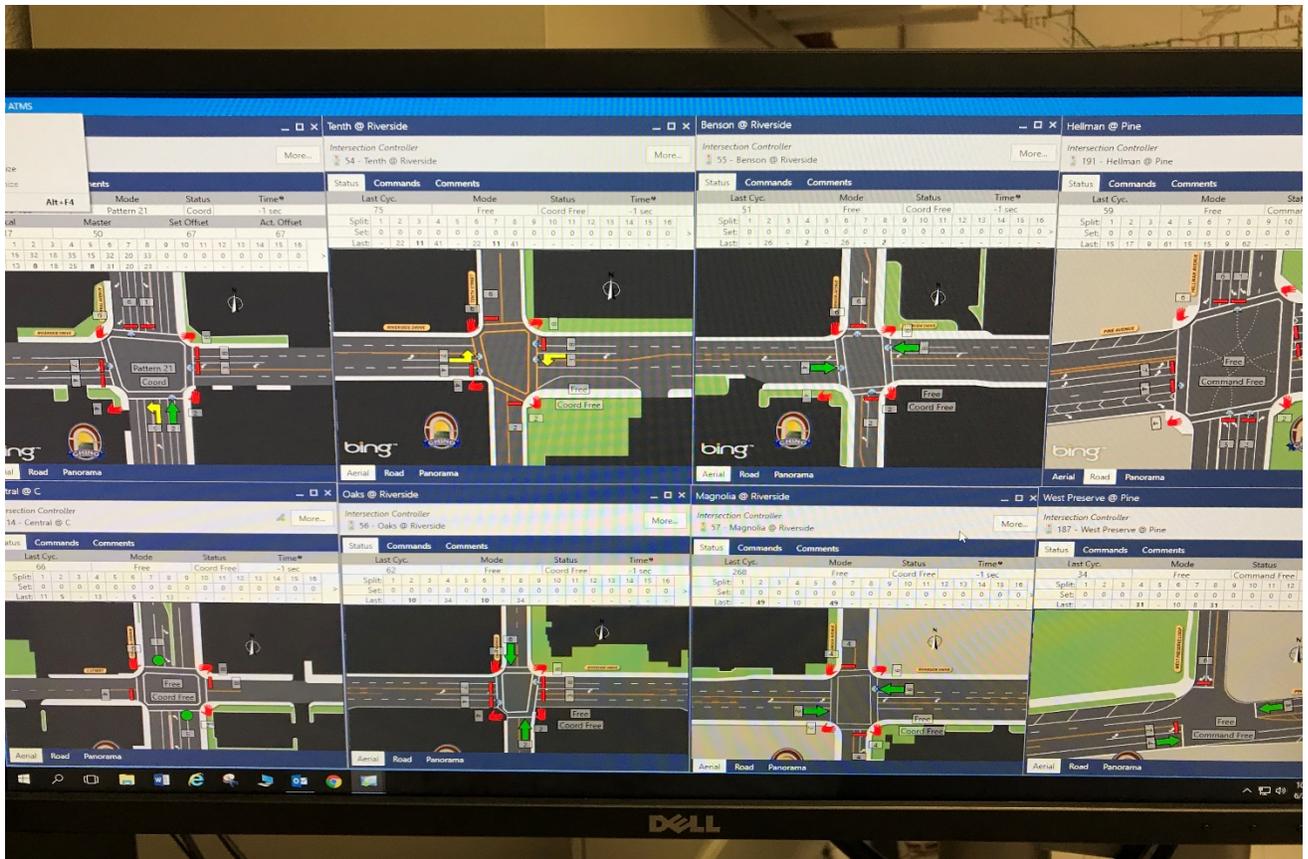
BUDGET

The project was completed within the allocated budget, with no additional contingency funds expended that were allocated to the project.
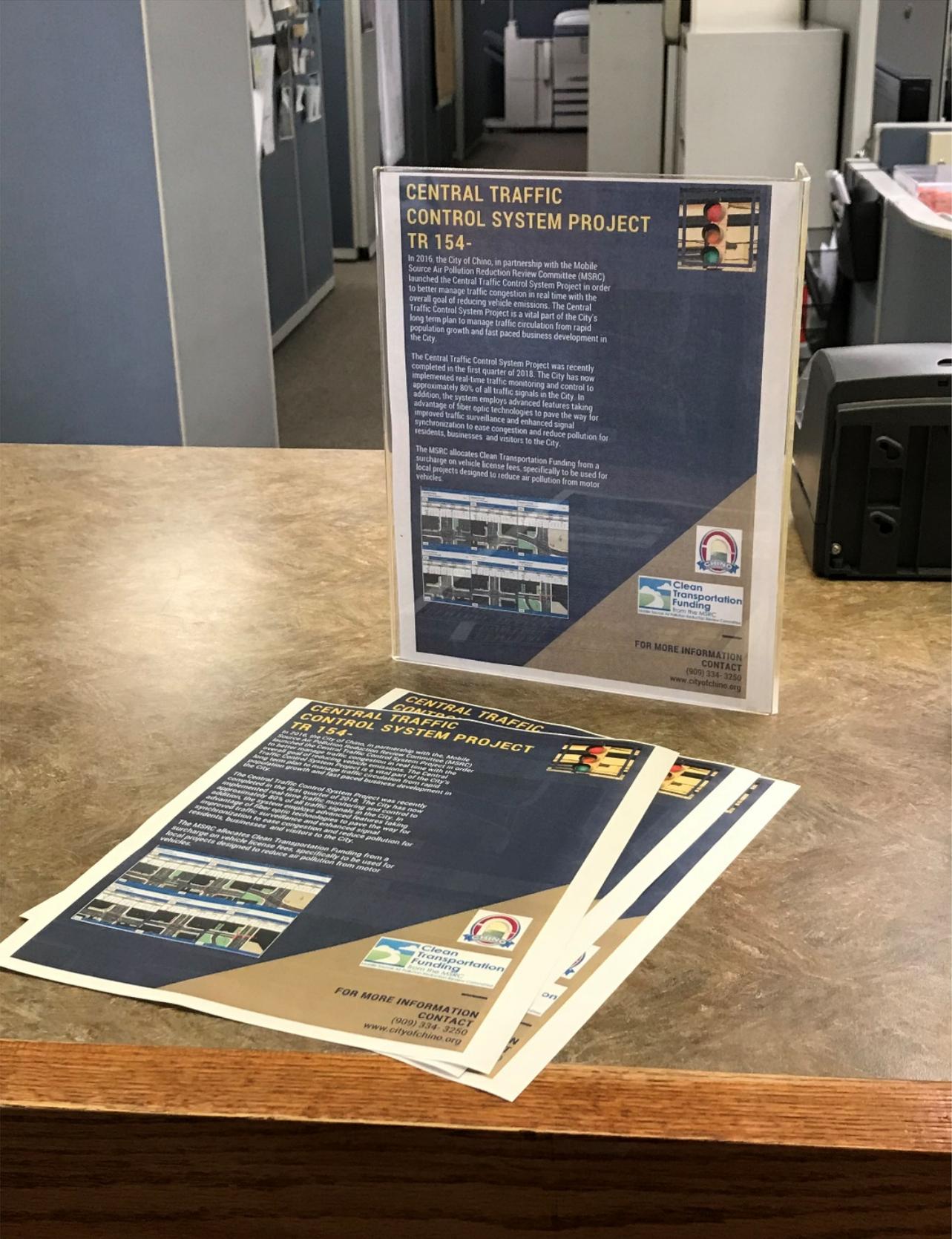
PROBLEMS ENCOUNTERED

No significant problems were encountered during the project. There was adequate lead time to plan the central system integration and acquire all equipment and software to meet the contract timelines established. The consultant provided detailed plans based on tasks identified in the comprehensive RFP. Developing mandatory requirements in the software matrix enabled staff to objectively compare the proposed software packages, and team's proposals. Preparing the technical proposal was time-consuming on the front end of the project, but remove ambiguity and set expectations for the consultants proposing on the project.

EMISSIONS BENEFITS

A July 2012 issue of <u>Environmental Modeling and Software</u> paper reports on a computational study in which a microscopic traffic simulation model (Paramics) is combined with submodels for the emission of noise (Imagine) and air pollutants (VERSIT+). "Through the simulation of a range of scenarios, the model was used to investigate the influence of traffic intensity, signal coordination schemes and signal parameters on the noise, carbon dioxide, nitrogen oxides and particulate matter emissions along an arterial road equipped with a series of traffic lights. Through the simulation of a range of scenarios, the model is used to investigate the influence of traffic intensity, signal coordination schemes and signal parameters on the noise, carbon dioxide, nitrogen oxides and particulate matter emissions along an arterial road equipped with a series of traffic lights. It was found that the introduction of a green wave could potentially **lower the emissions of the considered air pollutants by 10%–40%** in the most favorable conditions, depending on traffic flow and signal timing settings. Sound pressure levels were found to decrease by up to 1 dB(A) near the traffic signals, but to increase by up to 1.5 dB(A) in between intersections. Traffic intensity and green split were found to have the largest influence on emissions, while the cycle time did not have a significant influence on emissions." This study suggests that by upgrading the central system software, and implementing signal coordination through interconnect and fiber optic communication, the City may achieve similar results to the study outcome.

PHOTOGRAPHS AND OUTREACH

The City of Chino has prepared a notification flyer (attached), announcing the completion of TR154 to Chino residents available in public areas. In addition, the City will announce to elected officials when the Notice of Completion is filed at a City Council meeting, the completion of an implemented central traffic control system. The photo below is taken at the City of Chino Public Works Engineering Counter, displaying the flyer with handouts available to the public and contact phone numbers if residents would like additional information on the project.
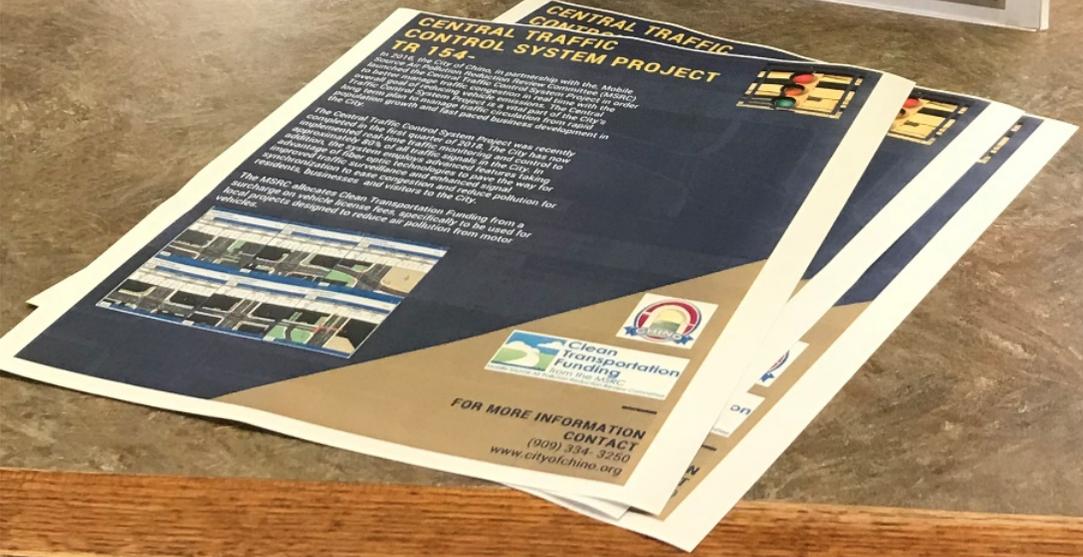
CENTRAL TRAFFIC CONTROL SYSTEM PROJECT TR 154-

In 2016, the City of Chino, in partnership with the Mobile Source Air Pollution Reduction Review Committee (MSRC) launched the Central Traffic Control System Project in order to better manage traffic congestion in real time with the overall goal of reducing vehicle emissions. The Central Traffic Control System Project is a vital part of the City's long term plan to manage traffic circulation from rapid population growth and fast paced business development in the City.

The Central Traffic Control System Project was recently completed in the first quarter of 2018. The City has now implemented real-time traffic monitoring and control to approximately 80% of all traffic signals in the City. In addition, the system employs advanced features taking advantage of fiber optic technologies to pave the way for improved traffic surveillance and enhanced signal synchronization to ease congestion and reduce pollution for residents, businesses and visitors to the City.

The MSRC allocates Clean Transportation Funding from a surcharge on vehicle license fees, specifically to be used for local projects designed to reduce air pollution from motor vehicles.

Clean Transportation Funding
from the MSRC

FOR MORE INFORMATION
CONTACT
(909) 334- 3250
www.cityofchino.org

CENTRAL TRAFFIC CONTROL SYSTEM PROJECT TR 154-

In 2016, the City of Chino, in partnership with the Mobile Source Air Pollution Reduction Review Committee (MSRC) launched the Central Traffic Control System Project in order to better manage traffic congestion in real time with the overall goal of reducing vehicle emissions. The Central Traffic Control System Project is a vital part of the City's long term plan to manage traffic circulation from rapid population growth and fast paced business development in the City.

The Central Traffic Control System Project was recently completed in the first quarter of 2018. The City has now implemented real-time traffic monitoring and control to approximately 80% of all traffic signals in the City. In addition, the system employs advanced features taking advantage of fiber optic technologies to pave the way for improved traffic surveillance and enhanced signal synchronization to ease congestion and reduce pollution for residents, businesses and visitors to the City.

The MSRC allocates Clean Transportation Funding from a surcharge on vehicle license fees, specifically to be used for local projects designed to reduce air pollution from motor vehicles.

Clean Transportation Funding
from the MSRC
Mobile Source Air Pollution Reduction Review Committee

FOR MORE INFORMATION CONTACT
(909) 334- 3250
www.cityofchino.org

SUMMARY AND CONCLUSIONS

This project is important on a regional basis as Chino is a hub for employment, warehousing, distribution, and commuters gain access to the SR-60 and SR-71. Implementing a City-wide master central traffic control system has increased overall local and regional mobility and decreased emissions by enabling staff to implement traffic signal synchronization and manage daily commuter traffic thereby benefiting the region as a whole.