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Is a Traffic Control System (TCS) necessary for a small city?
Case study Culver City, California

Elaine H. Jeng and Max Paetzold, Culver City

ABSTRACT
Is a traffic control system necessary for a small city? Does the technological implementation benefit a small city as it does with a larger city?

A primary example of a successful traffic control system is the City of Los Angeles Automated Traffic Surveillance and Control (ATSAC). The City of Los Angeles has utilized the system since 1984 for the Olympic Games and through its growth has piecemealed the necessary infrastructure to maximize the benefits of the Intelligent Transportation System (ITS) technology. Due to Los Angeles' dense population and wide area of coverage, it was a primary candidate to implement this technology.

While the ITS components have been successful, implementation is a costly enterprise. Further, the technology components require equally advanced expertise in operators, maintenance staff and industry personnel. There is a general lack of ITS knowledge in the traffic engineering industry today able to take advantage of the advanced innovation.

As urbanized areas become overpopulated, widening existing roadways is no longer a viable option to solve traffic congestion relief, even for a small city. Alternative solutions such as the promotion of mass transit and implementation of traffic, event and incident management tools are emerging as today's solutions. These ITS components allow real time traffic monitoring and control. These individual components are then brought together at a centralized location to compose the traffic control system.

This paper presents a case study of the benefits, drawbacks and jurisdictional reaction to acquiring a traffic control system for the City of Culver City in California, a daytime population of approximately 80,000.

INTRODUCTION
Traffic Control System (TCS) technology is intended to monitor and control traffic flow. The system brings together Intelligent Transportation System (ITS) components such as Closed Circuit Television (CCTV), Changeable Message Signs (CMS), and video image detectors so that real time data such as volumes, speeds, queues and delays can be used to determine how to most efficiently manage traffic flow.

The Metropolitan Planning Organization for Los Angeles County, Los Angeles County Metropolitan Transportation Authority (Metro), recognizes TCS as a tool demonstrating effectiveness in traffic monitoring and management that results in marked improvements in traffic flow. In Metro's 2003 Short Range Transportation Plan (SRTP) for LA County, ITS technology is proposed to "squeeze additional people-carrying capacity out of the arterials by allowing for improved traffic management through the sharing of traffic and other types of information both within and outside the subregion."[1]

[1] 2003 Short Range Transportation Plan for Los Angeles County – Technical Document

Metro supports the County of Los Angeles' deployment of the Information Exchange Network (IEN). The IEN[2] is characterized by the SRTP as a system that "allows for the sharing of traffic signal data across jurisdictional boundaries to allow for improved traffic management." The deployment of the IEN would require the sub-regions to implement a TCS. As such, in the last 8-10 years, Metro has funded the implementation of local TCS through the Call for Project grant program. Small jurisdictions comprising of approximately 70 to 100 signals like the City of Downey, City of Diamond Bar, and City of Culver City are all recipients of a grant from the Call for Project program to acquire a TCS.

Culver City is unique compared to other Los Angeles County jurisdictions in that majority of its traffic signals were already part of the Los Angeles Department of Transportation ATSAC system. Traffic signal data can be viewed from the ATSAC control center as well as at a work station in the City of Culver City. In principal, the City already had a TCS. Thus the question: "What benefits can a small city like Culver City expect from an independent TCS?"

To accurately assess the benefits and drawbacks on an independent TCS, it was necessary to research available publications, conduct interviews with Culver City signal maintenance staff, TCS Commercial Off The Shelf (COTS) consultants, funding agencies, the Los Angeles County Department of Public Works, and project managers of other jurisdictions that have either acquired or are in the process of acquiring a system. The conclusion of the findings is that a TCS is essential for a small city. In the case of Culver City, an independent TCS is very beneficial. Aside from the proven benefits of traffic monitoring and control capabilities, other TCS benefits include staff time savings, preventive maintenance measures, and traffic data collection capabilities that are particularly valuable to a small city with limited staffing. The combination of these benefits surpasses the initial capital improvement costs

CULVER CITY BACKGROUND

Culver City encompasses 5 square miles. It is bounded by I-10 and I-405 Freeways, two of the most congested segments of freeways in the nation. Immediately surrounding the city is the City of Los Angeles. Culver City has 104 signalized locations, almost all utilizing 170 or 170E controllers running on a modified Bi-trans 172.3 firmware. Five additional locations are proposed to be signalized in the next 3 years. The City has 15 Pelco brand CCTVs and has installed 3M Opticom devices for Fire Department vehicle preemptions. The City's communications infrastructure is robust with three 50 pair cables of twisted copper wires interconnecting all traffic signals. The existing CCTVs are transmitted to the City's hub in City Hall using fiber optic lines.

The completeness in the city's ITS components and communication infrastructure is in part attributed to the city's participation in the ATSAC system since 1993 and in part due to the foresight of previous Culver City traffic engineer managers.

PARTICIPATION IN LADOT ATSAC SYSTEM

Culver City traffic signals are connected to the LADOT ATSAC system. While being a part of the ATSAC system theoretically allows for greater monitoring and control, it also causes some difficulties.

In preparation for the 1984 Olympics, LADOT implemented the ATSAC system to better manage event traffic. ATSAC is a centralized traffic control system built on an enhanced version of the

[2] The IEN project will establish a network for sharing information and control of the various traffic control systems in the region using a common network backbone. The IEN primarily focuses on Intersection Traffic Control as oppose to freeway management. The System will establish a common system interface definition language (IDL) so that any traffic control system can connect to the IEN. The IEN will have the capacity to share information on a second-by-second basis. The sharing of information is intended to improve response management in the event of a problem with special events or incidents along the freeway or surface streets in the corridor. IEN also will allow smaller agencies to share limited control of their control system with another agency for off-hours support.

Federal Highway Administration (FHWA) Uniform Traffic Control System (UTCS) installed in the City of Los Angeles by LADOT staff and their consultants.

In 1993, LADOT approached Culver City to participate in the ATSAC system because Culver City is located in a pocket of the City of Los Angeles. Participation in the system would provide coherent and transparent traffic signal operations crossing jurisdictional lines. In the initial participation, only 34 locations were added to ATSAC. Today, all signalized locations have the capacity to be added to the ATSAC system but only half are actually on-line at ATSAC. Participation in the system required Culver City to interconnect all the signals and implement the type of controller and firmware used by LADOT. The interconnection of the infrastructure and switching out of controllers and firmware was accomplished over a period of 15 years through grant funding.

Recognizing this joined at the leg relationship, LADOT initially provided 100 hours of staff time for supporting the original 34 Culver City traffic signals. However, subsequent agreements that brought more Culver City signals on-line did not include additional support hours. The provided support put in place more than a decade ago is insufficient to meet the current operational needs.

CURRENT PROBLEMS PARTICIPATING IN THE LADOT ATSAC SYSTEM

Although Culver City's signalized locations are on the ATSAC system, the agreement retained autonomy between the two jurisdictions. Culver City is equipped with two workstations that display traffic signal vital signs, but lack control capabilities. Since signal control capabilities lie within LADOT who themselves don't own the signals, a hands-off approach to signal management is taken. Meanwhile, Culver City, the owner of the signals, has the right to manage the signals, but doesn't have hands on control over them. The current arrangement between the two jurisdictions does not provide for traffic control and or monitoring of Culver City traffic signals.

ATSAC has since evolved into a more sophisticated system than the initial deployment in 1984. Current traffic control at ATSAC includes adaptive control, and transit priority. Through its evolution, ATSAC has moved away from Bi-Trans 172.3 firmware. LADOT now utilizes 2070 controllers running on its own proprietary firmware developed by ATSAC staff. Of the 4,000 plus signalized locations within the City of Los Angeles, approximately 3,200 are on-line in ATSAC. Over half of all the signalized locations are equipped with 2070 controllers while the remainders are utilizing 170 controllers.

This leads to the question of how the relationship with ATSAC will continue once LADOT completes its upgrade at all signalized locations. Will Culver City need to switch to the 2070 controllers in order to continue participating in the ATSAC system? At an approximately $6,000 upgrade per controller, it would cost Culver City at least $600,000 alone to replace all controllers. Further, since ATSAC runs on it own proprietary firmware, additional technical support would be needed from LADOT staff. Because the firmware is proprietary to the Department, technical support can only be provided by LADOT. Will the required support be available and if so, at what cost to the City?

It's easy to dismiss TCS as a tool exclusively intended to improve traffic flow by monitoring and real time control. At a cursory glance, it may appear that due to Culver City's participation in the ATSAC, Culver City's traffic flow is being adequately monitored and controlled. This is not the case. Proponents of staying with ATSAC view Culver City as a smaller entity that benefits from the innovative advancements in traffic control by the larger entity. Thus, the perceived sentiment is that Culver City should not break itself away from the umbrella of LADOT. What is not readily apparent is that while Culver City may be the recipient of the advancements, it is also subjected to the operational policies and priorities set by LADOT, thereby making Culver City a dependent agency that has no control over its own transportation infrastructure from the operations and choice of equipment standpoint.

It took Culver City approximately 15 years to change all of its controllers to 170s to catch up to the technology that ATSAC required. By the time Culver City "catches up," LADOT is already moving on to newer and better technology. While the added features of 2070 controllers and ATCS benefits Los Angeles County, its features are not necessary for Culver City. For the type of traffic activities Culver City experiences, it can more than adequately meet the needs with the present capabilities of the 170 series controllers.

BENEFITS OF AN INDEPENDENT TCS

An independent TCS is the answer to Culver City's predicament. Culver City already has a robust communication infrastructure and consistency in its field equipment to support an independent TCS. Because of its readiness, the City will achieve the benefits immediately upon implementation. Historically, implementations of TCS across the nation have been proven to reduce travel time, delay, fuel consumption and emissions.

A traffic control system was implemented in the South Bay, a 9 square mile area encompassing portions of seven cities in southwestern Los Angeles County in 1973. In its initial deployment the system achieved approximately 5 percent reduction in delay.[3] In 1992 "An early evaluation of the [ATSAC] system produced the following results: travel time reduction, 13.2 percent; reduction in number of stops, 35.2 percent; increase in operating speeds, 14.8 percent; delay reduction, 20.3 percent; savings in fuel consumption, 12.5 percent; and emissions reduction – hydrocarbons, 10.2 percent and carbon dioxide, 10.3 percent."[4] In a more recent evaluation of the ATSAC system, the Fuel Efficient Traffic Signal Management Program study showed a 14% reduction in delay, a 13% reduction in stops, and an 8% reduction in travel time.[5] Orlando, Florida implemented the UTCS developed by the FHWA in 1988. Assessment of the benefits from the initial implementation of 113 signals showed the system reduced travel time by 23%, reduced delays and stops by 56%, and resulted in fewer accidents.[6]

An independent TCS will allow Culver City to also achieve similar traffic benefits realized by other jurisdictions across the nation, but at what cost? Arlington, Virginia's cost of implementing an adaptive signal control system for 65 intersections was $2.43 million, with approximately $2.12 million devoted to initial capital costs.[7] Orlando's initial deployment included 113 signalized locations at a cost of $2.35 million; the majority of the expenditure being for equipment procurement and field construction. In 1990 implementation of the UTCS in Washington D.C. for an initial deployment of approximately 1,300 intersections cost $35 million. The expenditure comprised of construction, replacement of controllers, twisted pair interconnects, control firmware, and the central system.

COST OF TCS

The cost associated with these historical cases of deployment is staggering even before adjusting for inflation to translate them into today's dollars. However, an immense portion of the capital cost was used to build the necessary infrastructure with a customized system design.

For instance, in Washington D.C., $35 million included the material and labor for the construction of 416 miles of traffic signal cable, 280 miles of communication cable, 33 miles of underground conduits, replacement of 1,249 traffic controllers (170) and addition of 502 system loop detectors. Portions of the original UTCS code were revised to reduce processor time requirements; and custom local controller software was developed for use with the UTCS software.

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[3] Stanford, M.R. and H. Parker, "The South Bay Traffic Control System," ITE Journal, April 1977.
[4] Judycki, D.C., "Innovative Safety and Operations Highway Projects in the United States," ITE Journal December 1992.
[5] Skabardonis, A., "ITS Benefits: The Case of Traffic Signal Control Systems," presentation to the 80th Annual Meeting of the Transportation Research Board, Washington, DC, January 7-11, 2001
[6] Aleman, F.R. and T.M. Allen, "Metropolitan Orlando Area Computerized Signal System," ITE Journal June 1990.
[7] US Department of Transportation, *Intelligent Transportation Systems for Traffic Signal Control,* Washington, DC: 2006

TCS technology has advanced and in the present day there are more deployment choices than 20 years ago. Readily available on the market solution are QuicNet 4 by Bi Trans System, Icons by Econolite, KITS by Kimely-Horn, i2TMS by Siemens ITS and TransSuite by Transcore.

All these systems share some common functionality driven by the minimum needs for traffic management and signal operations. For example, these systems are all capable of time-based coordination, Local Area Network (LAN) / Wide Area Network (WAN) communication, VPN access, inclusion of 4,000 plus system detectors, controller upload/download, unattended system operation, time of day/day of week/traffic responsive plan selection, override capability, data logging features, error/failure logging on diagnostics, alarms, reports, real time display of intersection operation, display GIS based map, advanced detectors, preemption, multi jurisdictional access, Synchro upload/download[8]. Each of these systems can be customized with added features at an additional cost.

The increase in choices and standardization of components has reduced the base cost of implementing each of the COTS system to between $80,000 and $290,000. Implementation includes license fee for the software, computer hardware, third party programs, and system integration.[9] Though additional costs may surface for a turn key operation, the costs are far lower today than in years past, making it far more affordable for nearly any city.

The City of Downey is also in the process of implementing a TCS. Unlike Washington D.C., Orlando and the City of Diamond Bar, the City of Downey has a complete communication infrastructure with already deployed ITS components. It recently selected the i2TMS system by Siemens ITS. The cost to implement the selected system is approximately $270,000.[10]

Of the historical and recent deployments researched, Culver City identifies most intimately with the City of Downey. Both cities have approximately 100 plus signals with a good communication infrastructure with working/up to date controllers, preemption devices and CCTVs. The City of Downey will be changing its current controller firmware. Culver City will have to change its current controller firmware if it will be implementing an independent TCS. Given the similarities, a fair assessment concludes that the cost to implement an independent TCS for Culver City would be in the neighborhood of the cost to implement the City of Downey's system.

Despite the lower costs, a reliable, update to date and working ITS/communication infrastructure is absolutely necessary for TCS implementation.

INADEQUATE TRAFFIC SIGNAL MAINTENANCE PROGRAM

On field side of the picture, Culver City struggles to keep up with the traffic signal maintenance log. "System benefits can be realized only when system components are working and properly maintained."[11] Culver City Department of Public Works currently has two signal technicians for 100 plus signals resulting in a ratio of 1 technician to 50 signals, slightly above the optimum 1 technician to 40 signals ratio.[12] To provide regular and adequate maintenance current staff must be experienced and solely dedicated to the welfare of the traffic signals and operation.

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[8] San Gabriel Valley Traffic Forum ATMS Improvement Project, April 5, 2005, "ATMS Alternatives Analysis Document (Deliverable 2.5.1.1) Draft, Exhibit 3.1" Prepared by TransCore and Meyer, Mohaddes Associates, Inc.

[9] San Gabriel Valley Traffic Forum ATMS Improvement Project, April 5, 2006, "ATMS Alternatives Analysis Document (Deliverable 2.5.1.1) Draft, Exhibit 3.2" Prepared by TransCore and Meyer, Mohaddes Associates, Inc.

[10] Correspondence with Jane Keely, City of Downey, May 2007

[11] Hange, W.A.,"A Central Traffic Control Computer Can Save Money," ITE Journal February 1991.

[12] Giblin, J. M. and W. H. Kraft, *Traffic Control System Operations: Installation, Management, and Maintenance*, Washington, DC: 2000

Being a "small" city it is difficult to have the resources to have specialized staff. Thus, a majority of the staff takes on multiple roles and in the case of the signal technicians, in addition to signal maintenance and repairs, they also are asked to hang banners for City Hall events, help with fixing street lights, air condition units at city buildings and a variety of other tasks that takes away their time from proper signal maintenance.

Presently, Culver City technicians struggle to perform structured maintenance due to the lack of time. The majority of the maintenance performed comprises of response to a malfunctioning location or flashing status, knock downs by traffic accidents, and or by contractors working within the city. In some of these instances, technicians can easily provide repairs and fixes to obvious problems. However, with less apparent problems technicians are out in the field for hours or days identifying the source of the malfunction. At times, Culver City has determined the problems stem from LADOT changing protocols in the communication area or the signal computer control operation aspect that resulted in traffic signal malfunctions that are transparent to the motoring public.

Repairs and fixes performed by the technicians are not always logged, often due to the lack of time and a standardized protocol in place. The numerous layers of patchwork fixes does not have an immediate impact for the individual signal, however over time, the lack of adequate records results in the city's inability to comprehensively understand and monitor the current traffic signal operations.

Based on the experience of Harris County, Texas, "Deficiencies in maintenance have serious impacts on equipment life, road-user costs of additional stops and delays, safety, fuel consumption and pollutant emission. The cost effectiveness of good maintenance is without question."[13]

While the expertise / dedication of staff to signal care may be improved in part through departmental policy changes and additional LADOT support, the implementation of a City owned and operated TCS will cut staff time dramatically by providing the capacity to perform off-site diagnostic of problems and resolve specific problems off-site. Implementation of a TCS will aid technicians in conducting preventive maintenance.

TCS: STAFF TIME SAVINGS AND PREVENTIVE MAINTENANCE BENEFITS

COTS systems like the KITS, Transuite and i2TMS are capable alarming staff of malfunctioning signals and in some instances would be able to self-diagnose problems, allowing technicians to proceed directly to repairs and fixes.

Examples of the types of intersection status detection by a TCS include: detector failure, cabinet door open, status of plan selected, keyboard data entry, cabinet flash, conflict flash, cycle failure, cabinet stop time, coordination failure, overlaps, vehicle calls and active phase. "When the system detects a communications failure, the system signals the operator via an audible alarm. Each type of failure is associated with an audible alarm that has a user-selectable tone. In the default configuration, the tone selected to signal a communications failure is unique. The operator is able to turn the audible alarm associated with each type of failure on or off independent of the others.[14]

COTS systems are capable of multiple reports, recording various events, activities, and controller and detector information. Under a user activity log, TCS records each operator request and the system's response to that request. Under the event log, the TCS records each controller's action including transition, plan start end, conflict, door open, etc. Intersection reports comprise of on-

[13] Clark, C.E. and A.C. Mao, "Harris County's Traffic Signal Contract Maintenance Program," ITE Journal March 1990.

[14] "Deliverable 2.2(b) LACO KITS Software Functional Specification Final," August 2005, Prepared by Kimley-Horn and Associates, Inc.

line status, operational status, timing plan, local timer, master cycle timer, cycle length, offset, phase splits and real-time phase returns. The system acknowledgement report provides each alert (location, event type, event date-time, user name, and acknowledged date-time) that is acknowledged by a user.

Washington D.C.'s experience in the aftermath of implementing a TCS is characterized as follows: "The ability to monitor controller operation has reduced the amount of time needed to identify and respond to system malfunctions, thus improving overall system performance. The ability to modify controller operation via the central computer improves the District's ability to respond to changes in traffic conditions in a timely manner and to verify field maintenance activities."

The capability to monitor and send commands to all traffic signals on the network from one centralized location combined with the capacity to be notified in real time of events experienced by field equipment, make a TCS system ideal for small staffs. Add to that the ability to immediately diagnose problems, record events and activities, Culver City signal technicians will be able to accomplish many more tasks much more efficiently. Increased efficiency will allow Culver City the option of reducing staff hours, and allowing traffic technicians to perform the necessary maintenance to assure traffic equipment outlive their product life-cycles.

TCS: TRAFFIC DATA COLLECTION CAPABILITY

The City conducts traffic Average Daily Traffic (ADT) counts along particular corridors (major, secondary, and collector) and at specific zones within the City every 5 years when school is in session. Presently, the collected traffic counts are used to identify growth trends for citywide planning purposes. The data is also used to assess the adequacy of the existing traffic controls. The cost of these basic counts historically ranges between $20,000 and $30,000 for each occurrence.

TCS has the ability to collect a variety of traffic data: ADT, turning movement, speed, and occupancy. The collection and management of data are automated. Further, the collection of data can be conducted at any time of the day, of the week and or of the year without incurring extra cost to the City.

Availability of the variety of traffic data gives City staff the capacity to make knowledgeable engineering judgments. Utilizing the TCS data collection has the immediate impact of saving outside consulting fees. This data is instrumental to insure the city makes timely capital improvement decisions.

CONCERN WITH "CLOSET" TECHNOLOGY

One point of contention that has often be brought up in reference to purchasing new technologies is the fear of acquiring "closet technology The term "closet" technology was coined characterizing instances when newly purchased system gets placed in the closet literally because no knowledgeable operators can put the system to use.

This particular concern of "closet" technology is an important one to address particularly in a smaller city like Culver City where staffing is already short handed. In the case of the "closet" technology, the issue cannot be resolved by adding staff alone. The added staff must have an equal knowledge in order to put the purchased technology to use.

Going back to the advanced of TCS technology, many developers of a TCS have already recognized that users need a self-operating system, as most jurisdictions like Culver City don't have the capacity to provide a full time traffic engineer or dedicated operator to be physically present to conduct the monitor and controls of traffic signals. Further, TCS developers have incorporated Graphics User Interface (GUI) that allows the operator to use a point-and-click windowing environment, resembling typical Windows based programs. This familiarity in the interface would not require operators to learn new menus and or command line operators to operate most commands of a TCS.

Recognizing that any system changes require additional staff training, nearly all COTS TCS implementations are accompanied by training. Training is a standard and typical component offered by TCS developers that comes with the purchase of their system. Despite the large amount of consideration given to self-operating parameters and intuitive interfaces, a TCS will not and is not, intended to replace a live person with the capacity to make engineering judgments. To take advantage of TCS capabilities like the integration of Synchro, an operator must be qualified to optimize traffic signals and have prior training in Synchro. Likewise, the TCS can collect a variety of traffic data but to utilize the data, qualified personnel is necessary to make the connection between the AADT counts and roadway improvements.

From lessons learned, the US Department of Transportation (USDOT) says, "Without the proper knowledge, agencies can find themselves in a quagmire of software, hardware, maintenance, and communication problems. A 2002 synthesis of best practices reveals the tremendous need to hire knowledgeable employees and to keep them current in the ever advancing technologies that influence the design, deployment, and operation of traffic signal systems. Without proper staffing and training, agencies will be hard pressed to exploit the additional capabilities gained through a successful ITS deployment.[15]

As evidenced by the USDOT findings, understaffing of specialized personnel is not a unique challenge and it is faced by jurisdictions across the country. The City of Culver City is facing this challenge with the lack of dedicated signal maintenance personnel. The City is also faced with this challenge in other areas; the lack of a traffic engineer since 2005. Historically, Culver City has addressed a staff shortage by hiring specialized consultants. In this fashion, the consultants are paid on an as-needed basis to cut cost from having to support a full time staff. To fill the void of a traffic engineer, the City contracted two half-time retired traffic engineers.

Utilizing the services provided by an outside consultant for a few hours a week can certainly be a feasible option for Culver City while the traffic engineering position remains vacant. This is a viable solution to combat against "closet technology," particularly since the regular day to day operations of signal monitoring and management can be handled by regular traffic signal maintenance staff. Likewise, the TCS data collection component can function without an operator. Combined with the "self-operating" aspect of today's available TCS and utilization of specialized consultants as the TCS operator/manager, the issue of the "closet" technology can be temporarily be addressed. A long term solution is one that would require the support and backing of a jurisdiction by making a commitment to provide the necessary resources for a specialized and dedicated staff: hiring of a qualified traffic engineer. Given the far-reaching benefits of a TCS system, the hiring for a qualified traffic engineer is a small price to pay.

CONCLUSION

The investigation into Culver City's necessity for a TCS was an 11 month effort. As part of the process, Culver City listened to multiple presentations by COTS TCS developers, utilized a demonstration version of the Transuite by Transcore, and visited multiple sites at other jurisdictions with new TCS deployments. The conclusion of this investigative effort was that implementation of an independent TCS would be beneficial to Culver City. Signal maintenance staffs were in support of an independent TCS from the onset, realizing that they would a primary beneficiary from the deployment of a system aside from the motoring public.

Deployment of a system requires the building of a communication infrastructure (i.e., interconnection of all signalized locations). This task alone is a large and costly undertaking. Furthermore, the deployment of a TCS also requires updated and working field equipment. In

[15] US Department of Transportation, *Intelligent Transportation Systems for Traffic Control, Deployment Benefits and Lessons Learned*, http://www.its.dot.gov/jpodocs/repts_te/14321.htm

densely populated areas like Los Angeles, effective traffic control and efficient incident management are just about the only possible solution to improve traffic flow. Roadway widening involving acquisition of right of way is becoming increasingly more difficult, if not impossible. Although differing in size and in density, the benefits of a TCS realized by the City of Los Angeles can also be realized by Culver City. Aggregate travel time, delay reduction, and vehicle speed improvements are all proven results for deployed systems of either 100 signals or 1,000 signals. Regardless of jurisdictional size, the cost to upgrade a controller is the same for a city of 50 signalized locations or a city of 2,000 signalized locations.

While the deployment of a system would allow the City realize many benefits, the City needs to address the need for a dedicated, knowledgeable traffic engineer to take advantage of the full power of a TCS.

In support of these findings, Culver City gave the blessing to go forward with the acquisition effort by approving the advertisement of a configuration manager in March 2007. The configuration manager will aid the City in identifying the system requirements for a TCS and prepare a Request for Proposal for the selection of a COTS system. The City expects to make a TCS selection in August 2007 and fully implement a TCS system in 2008.