



DATE: March 1, 2018

TO: Council Technology Applications Committee (CTAC)

FROM: Interim Director of Public Works

SUBJECT Traffic Management System Practices and Procedures – Review and Comment

RECOMMENDATION

That the Committee receives the report on the City's Traffic Management System Practices and Procedures and provides feedback.

SUMMARY

During the September 2017 CTAC meeting, Committee members expressed interest in understanding the City of Hayward's traffic management system and the upcoming improvements. This informational report provides an overview of Hayward's traffic management system policy and associated practices and procedures. It also includes recommendations to address existing and future needs for an efficient and effective traffic signal system.

BACKGROUND

Hayward is uniquely located at the heart of Alameda County and the Bay Area. Several major freeway networks either run through or are accessed through the City, including I-580, I-880, SR-238 and SR-92. The transportation system in Hayward serves both regional and local travel needs. A significant portion of the traffic volume on the City's local streets are attributable to regional traffic passing through the City.

According to the Metropolitan Transportation Commission (MTC) regional traffic in the Bay Area has grown over 80% between 2010 and 2016. The result has been increasingly congested conditions on freeways, which in turn, increases congestion on local roadways as motorists look for alternative routes. Unlike freeways which are intended to solely serve auto traffic, local roadways must accommodate multiple road users (e.g. vehicles, bicycles and pedestrians), while managing access in and out of businesses, side streets and residential neighborhoods.

Traffic signals are a valuable tool for managing access on local roadways. Traffic signals work by assigning right-of-way to various traffic movements depending on traffic flow. The City currently has 146 traffic signals. To varying degrees, traffic signals can be coordinated to provide better traffic flow by reducing stops and delays experienced by motorists. However, care must be taken to control speeds, accommodate side street vehicular, pedestrian and bicycle traffic and to prevent neighborhood cut-through traffic.

Motorists often get frustrated when they must stop at multiple traffic signals, or when they must wait a long time, especially when there appears to be no traffic on side streets. Traffic signal coordination partly addresses this by synchronizing multiple signals along the same corridor to prioritize through traffic. Typically, traffic on the primary street is given preference over side streets. While this minimizes stops on the primary street, it impacts the side streets where motorists must stop for longer periods of time. Less stopping time on the primary street results in more stopping time on the side streets.

DISCUSSION

The goal of traffic signal coordination is to get the greatest number of vehicles through the system with fewest stops in a comfortable manner. Often the primary street traffic that is being coordinated has constant traffic volumes that require significant amount of green time to pass through the intersection. It would be ideal if every vehicle entering the system could proceed through the system without stopping. This is not possible even in a well-spaced, well-designed system. There are many reasons that vehicles must stop at traffic signals that have been coordinated. Signal coordination is influenced by the amount of time needed to adequately balance the needs of the primary roadway, fluctuations in traffic volume, distance between intersections, driveways and side streets and pedestrian and bicycle demand. The following are key challenges associated with traffic signal coordination:

- Side street traffic and Left Turns - Adequate amount of green time must be allocated to clear side street traffic. Coordination becomes more challenging when the side streets also have heavier traffic. This results in less time available for allocation between both the primary and secondary directions. Similar to side street traffic, heavy left turn movements need enough green time to safely pass-through the intersections.
- Pedestrians and Bicycles - Adequate amount of time must be allocated for pedestrians to cross the street. During this time, none of the vehicle phases that conflict with the pedestrian phase can be served. The pedestrian clearance time also depends on the width of the intersection and presence of senior housing or schools in the proximity. Longer times are needed to allow sufficient time for elderly and school kids to cross the intersection. This affects the amount of green time that can be allocated to major corridors without significantly delaying side streets, pedestrian or bicycles.

- Fluctuations in traffic volumes - Major corridors such as Mission Boulevard, Foothill Boulevard, and Hesperian Boulevard are often affected by accidents or incidents that happen on freeways. These incidents often result in diverting traffic through the City streets, and thereby increasing traffic to a level that is over capacity, causing congestion and delay. Coordinated systems are designed to handle traffic patterns that are predictable. Performance of the coordinated system diminishes when the traffic volume fluctuates along a corridor due to incident or other factors.

Each of the above factors limits the amount of green time that can be allocated to the coordinated direction. Coordination is often complicated and needs to delicately balance the interests of all road users. Most of the signals on north-south and east-west arterials such as Hesperian Blvd, Tennyson Rd, Harder Rd, Mission Blvd, Industrial Blvd, and Foothill Blvd have been coordinated to various degrees. The coordination plans on these arterials is either based on time of day or based on traffic volume fluctuations. City staff proactively secured Transportation Fund for Clean Air (TFCA) grant funding from the Bay Area Air Quality District to implement the coordination plans along the corridors.

Plans based on Time of Day:

Signal timing is pre-programmed to coordinate and provide preference to the traffic on major streets during peak travel hours. Time of day systems work well in reducing the number of stops if the traffic volume along the corridor is consistent and doesn't vary from day to day. Currently, 47 out of 146 signals are equipped with a software called Advanced Traffic Management System (ATMS) that allows remote access, signal coordination based on time of day plans and monitoring capabilities.

Plans based on Traffic Volume Fluctuations:

Traffic signals with timing plans that adjust dynamically based on traffic volume fluctuations are called Adaptive Traffic Control Systems (ATCS). ATCS signals are more effective and efficient in managing the inflow of traffic. Recently, the City has implemented ATCS at 31 signals along Mission Boulevard, Foothill Boulevard, and the downtown area. The City is currently in the process of designing and adding 12 more signals along Mission Boulevard and Jackson Street to the ATCS. In addition, as part of an MTC funded project, ATCS with capabilities to prioritize transit vehicles will be implemented along the 13 signals on Hesperian Boulevard corridor. With the completion of the projects, 51 traffic signals would be operating on adaptive signal operations strategy.

Adaptive traffic control systems have many advantages over traffic signals that operate on Time of Day plans, especially on corridors with heavy and fluctuating traffic volumes. The following are the additional advantages of operating adaptive systems:

- ATCS is Self-Calibrating, i.e., no signal timing adjustments required after implementation
- Reduces accidents, both vehicular and pedestrian.
- Reduces fuel consumption, delay and number of stops.
- Increases the capacity of the intersection.
- Improves point to point travel time.

In addition to the overall traffic flow improvements, an adaptive system provides the following additional features:

- Real-Time Alarm Monitoring & Notifications
- Real-Time Detection Status Monitoring
- Collection and Storage of Traffic Volumes for Future Use

Apart from coordination, for a signal system to operate seamlessly, it is critical to have an updated traffic detection system, communication media, and signal controller.

- Detection - Currently in Hayward, in-pavement sensors or cameras mounted on the traffic signal mast arms are used to detect vehicles and activate the signals. Cameras or video detection offers several advantages over in-pavement sensors, including less intrusive installation, and maintenance, high flexibility in detection configurations, a real-time video stream of traffic conditions, and low overall maintenance cost.
- Connectivity - The extent of traffic signal coordination depends on how well the traffic signals are connected on a corridor. Fiber and copper-based Signal Interconnect are two modes that can help signals communicate with each other. Fiber provides several advantages over copper with respect to performance, speed and features. The expandability of copper is limited unless it is upgraded to include Ethernet connections.
- Signal Controllers - Typically, every traffic signal is controlled by a controller mounted inside the signal cabinet. Currently, multiple types of controllers are in use in Hayward. Some of these controllers are no longer supported by the vendors and need to be upgraded. All new installations are being upgraded to advanced controllers that are modular and ethernet ready.
- Traffic Management Center(TMC) - As part of Mission Boulevard, Foothill Boulevard, and Jackson Avenue Corridor Improvement project, a centralized system that enables real time monitoring of the signals called a traffic management center was established. TMC not only enables staff to monitor multiple signals at the same time but also allows to dispatch resources or trouble shoot traffic signal failures and

maintenance issues effectively. Currently more than fifty percent of Hayward's signals are not yet connected to the TMC.

Near Term Improvements:

Staff continues to investigate and explore transportation technologies and market driven solutions that will have positive benefits such as reducing traffic accidents and enhancing the productivity of our existing signal assets. Staff was recently successful in obtaining an Innovative Deployment to Enhanced Arterials (IDEA) grant from MTC. With the help of this grant, staff will be able to leverage advanced technologies and processes to improve the operations of the traffic network. This grant will focus on Tennyson Road, Foothill Boulevard, Mission Boulevard and Second Street.

Most of the jurisdictions in the Bay Area are moving towards fiber-based connectivity, video detection, advanced ethernet ready controllers, and adaptive traffic control system technologies that enable real-time and performance monitoring capabilities. These high-powered tools will improve travel time reliability along major corridors, enhance safety for all modes of transportation, and reduce transportation related greenhouse gases.

STRATEGIC INITIATIVES

This agenda item supports the Complete Streets Strategic Initiative. The purpose of the Complete Streets initiative is to build streets that are safe, comfortable, and convenient for everyone regardless of age or ability, including motorists, pedestrians, bicyclists and public transportation riders. This item supports the following goal and objective:

Goal 2: Provide Complete Streets that balance the diverse needs of users of the public right-of-way.

Objective 1: Increase walking, biking, transit usage, carpooling, and other sustainable modes of transportation by designing and retrofitting streets to accommodate all modes.

SUSTAINABILITY FEATURES

The adaptive traffic signal systems that are being implemented reduce vehicle idling and improve traffic flow which in turn reduces greenhouse gases. Traffic signal systems also improve pedestrian and bicycle safety at intersections to promote alternate modes of transportation. In addition, the mobility goals established as part of the City's 2040 General Plan, includes the goal of improving local circulation, which is largely dependent on the operations of the traffic signal system network within the City. By operating and maintaining an advance traffic signal system, the local circulation goal (Goal M-4) "enhance and maintain local access and circulation, while protecting neighborhoods from through traffic" can be achieved.

FISCAL IMPACT

This agenda item is a routine informational item and has no additional fiscal impact.

NEXT STEPS

To prepare the City's traffic signal system to handle the existing and future needs to address traffic operations, including traffic congestion, intersection delays, and travel speeds, while balancing neighborhood safety concerns, current and future projects are to address the following:

- **Connectivity** – Prepare the infrastructure for the future by upgrading the controllers and expanding the fiber optics/wireless network to provide reliable communication. City of Stockton, Santa Clara County, Roseville, and many other cities have fiber optic/ethernet based connectivity to all traffic signals.
- **Responsiveness** – Implement data driven tools that would enable staff to dynamically analyze changes in traffic patterns, understand true reason for congestion, identify issues and complaints from residents and resolve it in an efficient and responsive manner. This would enhance the resident centric focus of the City. Hayward's IDEA grant would allow implementing data driven tools for the City. Many cities, including the City of Dublin and Walnut Creek, have deployed similar data drive tools and have experienced benefits from the system.
- **Mobility** – Prepare a plan to identify expansion of City's Adaptive Signal System to other corridors that require an adaptive system. City of Hayward is in the process of implementing Adaptive Signal System with transit signal priority. A similar system was recently implemented at the City of Dublin along the Dublin Boulevard corridor. An adaptive system with transit signal priority increases the passenger throughput along the corridor.
- **Safety** – Develop a plan to identify sharing opportunities with the City's police department or identify other opportunities to increase safety. Improve on pedestrian and bicycle safety at the intersections. Santa Clara County has installed pedestrian sensors to implement pedestrian adaptive signal timing, which would automatically extend the pedestrian crossing green time when pedestrians are in the crosswalk.
- **Transparency** – Various cities are sharing traffic signal timing data to the public and application developers. This would enable application developers to build tools that are useful to the residents and tools that could improve intersection safety. City of Walnut Creek opened their signal data, which was utilized to create a phone app for motorists, which would provide audible cues on how many seconds the motorist has before the light they are facing is turning green. Similar applications will be included for all future cars. However, the signal data needs to be available from all agencies to make this system more effective.

- Forward thinking - Prepare the corridors for the future Connected/Automated Vehicle needs. Implement the latest technologies that are available to prepare the City for the future. City of San Ramon is implementing Shared Autonomous Vehicles in the Bishop Ranch area as the first-mile/last-mile solution. The autonomous shuttles are coming soon, and our signal system needs to be prepared to share/exchange data with autonomous vehicles in a fast, secured, and reliable way.

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Approved by:

A handwritten signature in dark ink, appearing to read 'K. McAdoo', is positioned above a horizontal line.

Kelly McAdoo, City Manager