Internal Audit Analysis

Adaptive Signal Control Technology: Decreasing traffic delays and reducing societal costs by $891 per day due to fewer accidents

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City of Sioux Falls
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ADAPTIVE SIGNAL CONTROL TECHNOLOGY
INTERNAL AUDIT ANALYSIS

INTRODUCTION

This is an analysis of the City's use of adaptive signal control technology. It is not an audit in that it is neither an examination of risks and controls nor a comparison of actual performance to established criteria.

BACKGROUND

Use of ASCT in other cities

Conventional traffic signal systems use pre-programmed, daily signal timing schedules. Adaptive signal control technology (ASCT) adjusts the timing of red, yellow and green lights to accommodate changing traffic patterns and ease traffic congestion. This technology involves the use of cameras and computer hardware and software.

The Federal Highway Administration identified a number of benefits associated with the conversion from conventional traffic control systems to adaptive signal control technology:

- Improving traffic flow.
- Faster responses to traffic conditions.
- Cutting costs.
- Kinder to the environment.

A before and after study of ASCT deployment in Pinellas County, Florida for 2004-2012 showed a typical travel time improvement of 7% to 20%. The number of rear-end accidents was reduced to a range of 5% to 12%. A review of results from several United States and Canadian cities with ASCT showed improvement in travel time of 7% to 25% and reduced traffic stops of 10% to 77%.

The City of Texarkana, Arkansas installed ASCT at three intersections on two intersecting arterials. A study performed showed that the technology reduced stops at all three intersections, resulting in less time wasted stopped at red lights, less fuel consumed during idling and acceleration, fewer emissions from less fuel burning, and less opportunity for rear-end accidents. Crashes were reduced from 17% to 30% and travel time improved by up to 50%.

ASCT is not considered a cure-all for oversaturated traffic conditions. Additionally, public expectations must be managed by local governments considering deployment of ASCT. Some citizens may expect that they will be getting green lights wherever they go on streets with the technology installed.

Use of ASCT in Sioux Falls

The East 26th Street corridor is the only location where the adaptive traffic control system is installed and operational. In 2017, Minnesota Avenue from 18th Street to I-229 will receive the technology as will 41st Street from Norton Avenue to Marion Road. The Minnesota Avenue equipment is expected to be operational by May 2017. The 41st Street equipment should be operational by June 2017.

What the City has spent for ASCT

The City entered into an agreement (A130160) with Rhythm Engineering in October 2013 to provide ASCT at ten locations on the 26th Street corridor. The equipment provided by Rhythm Engineering is an InSync® adaptive traffic control system.

The vendor provided the equipment, training, and the on-site integration of the InSync® adaptive system in order to maximize the performance of InSync®. City crews performed the installation. Management decided to use City crews for installation so they would become familiar with the "nuts and bolts" of the system.

The City paid $371,000 on 12/30/2013 to Rhythm Engineering for their services and equipment on the 26th Street corridor. The 2nd penny sales/use tax fund paid for this.

The City entered into a contract in November 2016 with Rhythm Engineering for ASCT along 41st Street and Minnesota Avenue. The City will pay for the Minnesota Avenue corridor. Equipment for Minnesota Avenue will cost the City $287,950. Action Electric will provide the installation on Minnesota Avenue for $44,804. Total cost for the City is $332,754. The State of South Dakota Department of Transportation (SD DOT) will pay for the 41st Street corridor. Equipment will cost $455,250 and installation by Action Electric will cost $72,806.50 for a total cost of $528,056.50.

Lessons learned about ASCT and complaints

The 26th Street system was installed in January 2014. A lesson learned was that there were weather related challenges to the installation. Electrical conduits froze up as a result of ice jams. Additionally, some of the electrical connections broke in the cold and City crews found it necessary to use hair dryers or similar equipment in the aerial bucket so that electrical connections could be worked on without shattering in the cold.

The cameras used by the system to monitor traffic can store video. However, the City chooses not to store video streams as this requires significant server storage capacity and is not necessary for the purposes of the system which is to optimize traffic flow and reduce congestion for drivers. The Traffic Engineer's office regularly receives calls from drivers wanting to see video from a crash or to assist in challenging a traffic ticket.

The biggest complaint from the public is that the pedestrian cross walk signals at 26th Street and Van Eps Avenue and the signal at 26th Street and Bahnson Avenue are not working when the button is pushed for the walk signal. The Traffic Engineer stated that in these cases City staff need to know what time the button was pushed by the pedestrian

so the data can be reviewed. The average time it takes for the 'walk' signal to appear after the button is pushed is about 30-40 seconds. The longest time the Traffic Engineer has seen in the data reviewed is 65 seconds. The system will respond to the pushing of the button. However, it does this on a variable basis depending upon the amount of vehicle traffic. Therefore, the system is working as intended but some pedestrians may need to be more patient when traffic is heavy.

The second biggest complaint is that the system is not working. Again, the Traffic Engineer attempts to find out exactly when the situation causing the complaint occurred. When the Engineer reviews the data on the system, it is most often a case in which a train has recently held up traffic on 26th Street and the traffic flow is still recovering from that congestion. The complaining driver had arrived a few minutes after the train cleared 26th Street and may not be aware of this fact.

Camera lenses can ice up in the winter; however, this rarely happens. Usually, icing occurs only during extreme winter weather such as blizzard conditions. In those situations, there is usually a decrease in traffic on 26th Street because of the weather and traffic congestion is not an issue.

OBJECTIVES

The objectives of this analysis were to:

1. Determine if ASCT is reducing traffic congestion.
2. Determine if ASCT is increasing safety.

SCOPE AND METHODOLOGY

The scope of this analysis included the ASCT installed on the ten intersections on the East 26th Street corridor from Van Eps Avenue to Highline Avenue. Methodology involved the following:

- Reviewing research reports on deployment of ASCT in the United States and Canada.
- Reviewing contract documents for ASCT purchased by the City of Sioux Falls.
- Interviewing City Engineering management to better understand and observe how ASCT works and how safety and traffic congestion improvements are measured.
- Reviewing data and analysis compiled and performed by City Engineering for accuracy and methodology.

RESULTS

Traffic congestion

Traffic Engineers drove the 26th Street corridor before ASCT installation and after installation. Global positioning system technology (GPS) was used to accurately measure time and location. 75 trips were done before installation and 93 trips were done after installation. We reviewed the analysis performed by Traffic Engineers in regard to travel

time, number of stops, and number of delays. We determined that the analysis performed was accurate when we reviewed the data and that the methodology for analysis was sound.

Westbound traffic improved during morning peak, afternoon peak, and off peak hours. Eastbound traffic improved during morning peak and off peak hours. It got worse during the afternoon peak hours. A likely reason that traffic delays got worse for eastbound traffic during the afternoon peak after installation of the ASCT is due to the fact that eastbound traffic before installation was heavily skewed to favor eastbound traffic in the afternoon peak (4-6 PM) at the expense of side street traffic such as Southeastern Drive and Bahnson Avenue. Following installation of ASCT in January 2014, the traffic flow for all streets on the 26th Street corridor was balanced better during the eastbound afternoon peak.

Travel time after installation

Eastbound	Westbound
7-9 AM: 11% decrease in travel time	7-9 AM: 5% decrease in travel time
Off peak: 8% decrease	Off peak: 11% decrease
4-6 PM: 11% increase	4-6 PM: 10% decrease

Number of traffic stops after installation

Eastbound	Westbound
7-9 AM: 53% decrease in number of stops	7-9 AM: 6% decrease in number of stops
Off peak: 23% decrease	Off peak: 25% decrease
4-6 PM: 27% increase	4-6 PM: 39% decrease

Number of delays in traffic

Eastbound	Westbound
7-9 AM: 41% decrease in delays	7-9 AM: 16% decrease in delays
Off peak: 63% decrease	Off peak: 66% decrease
4-6 PM: 106% increase	4-6 PM: 46% decrease

The City's Traffic Engineer stated that the equipment to be installed on the 41st Street and Minnesota Avenue corridors in 2017 will provide data on travel time and delays without the need for Traffic Engineers to drive the routes with GPS technology. The cameras and computers in the system will be set up to gather data automatically thus facilitating analysis of reduction in travel time and delays.

In general, ASCT technology is reducing traffic congestion on the 26th Street corridor.

Safety

We reviewed the analysis performed by Traffic Engineers in regard to number and severity of accidents along the East 26th Street corridor both before and after ASCT installation. We also reviewed the analysis of societal costs of accidents. We determined that the analysis performed was accurate when we reviewed the data and that the methodology for analysis was sound.

Since installation of ASCT on the 26th Street corridor there has been a 21% reduction in crashes and a 15% reduction in societal costs. Before installation of ASCT there was an average of 0.32 crashes per day on the 26th Street corridor. After installation of the technology there was an average of 0.25 crashes. Societal costs have decreased $891 per day.

Societal costs of traffic accidents are calculated by the National Highway Traffic Safety Administration and include the following costs:

- Property damage
- Lost earnings
- Medical costs
- Emergency services
- Vocational rehabilitation
- Lost time at work
- Travel delays
- Legal costs
- Reduced quality of life

Costs of accidents are based upon the severity of the accidents on a scale from 1 to 6:

Crash Severity	Description	Societal costs
1	Fatality	$4,008,900
2	Incapacitating injury	216,000
3	Non incapacitating injury	79,000
4	Possible injury	44,900
5	Property damage only	7,400
6	Property damage below state threshold for reporting	2,000

$371,000 tax dollars were spent to purchase and install the ASCT technology on 26th Street. Based upon a daily savings of $891 in societal costs from crash reductions alone, it will take just 416 days to recover the cost of investment in this technology.

We concluded that ASCT is increasing safety on the 26th Street corridor by reducing the number of crashes.

CONCLUSION

The results so far of the installation of adaptive signal control technology are promising. Traffic congestion can be expected to improve on the 41st Street and Minnesota Avenue corridors with this technology installed. Safety should improve as well with fewer rear-end collisions. Drivers should benefit from reduced fuel costs as traffic flow improves and there should be less pollution from cars delayed in traffic.

AUTHORIZATION

The Sioux Falls City Council approved this project by resolution in January 2016 as part of the 2016 Annual Audit Program. The Internal Audit Division operates under the authority of an Internal Audit Charter adopted by City Council resolution 11-13.

STATEMENT OF INDEPENDENCE

Internal Audit is administratively and operationally independent of the programs and departments it audits or analyzes, both in appearance and in fact. The Internal Audit Manager is accountable to an Audit Committee appointed by the City Council per section 32.022 of the Code of Ordinances of Sioux Falls, SD.

DISTRIBUTION OF REPORT

This report is intended for the information and use of the Mayor and City Council, management, and others within the City of Sioux Falls. However, the report is a matter of public record and its distribution is not limited.

PERFORMED BY

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