Executive Summary, Research Readiness Level Assessment, and Technology Transfer

Evaluating ASCT Operations for Dodge Street Corridor

Research Objectives

This study was to determine the efficiency of the ASCT on Dodge Street. The following benefits of the Dodge Street were studied in detail:

- Operational Efficiencies during normal conditions
- Operational Efficiencies during anomalous situations
- Performance during over-saturation
- Safety concerns

Research Benefits

Nebraska has two of the top 15 biggest Midwest cities, Omaha and Lincoln, located in close proximity which have very high and fluctuating traffic. ASCT seemed to be an option to handle such traffic. However, the ASCT had also been seen to malfunction under certain situations in the past. This project highlighted whether ASCT could handle the different variations of traffic on Dodge Street, Omaha. Owing to improvements in the traffic, the Traffic Division of Nebraska DOT can now extend ASCT across other critical regions.

Principal Investigator

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Background

Maintaining arterial corridors that has a high volume of traffic and high density of intersections, is a matter of primary importance to the Traffic Division of any city. Traditionally Traffic Division maintained these traffic signals in three ways - entirely pre-programmed (pre-timed signals), partially based on actuations (partially actuated), or entirely based upon sensor actuations (fully actuated) (Koonce et al. 2010). However, all these types of signals need some retiming every three to five years which involves a lot of human effort in solving complicated optimization problems (Gordon 2010). In order to circumvent the effort of retiming, Adaptive Control Signal Technology (ASCT) was developed. ASCT tends to maximize the capacity of the existing system which reduces the cost to both the users and the system operating agencies. ASCT has been seen to reduce the number of stops by 28%-41% (Hicks and Carter 1997), reduce crashes by 35% (Anzek, Kavran, and Badanjak 2005), and reduce the travel time on the corridors by 35%-39% (Sims and Dobinson 1980). However, the agencies implementing ASCT ends up spending $6,000 to $65,000 per intersection. Further, one-third of the agencies find ASCT to malfunction in over-saturated conditions (Stevanovic 2010). Also, the initial set-up has also been found to be labor intensive.

The City of Omaha has planned to set up the ASCT the Dodge Street corridor. This will involve setting up adaptive signals along 9 intersections of the corridor and 6 along other major roads along the corridor as shown in Figure 1.A detailed evaluation of the performance of the ASCT is to be studied in this project to determine its benefits to the City of Omaha.

Conclusion

As Adaptive Traffic Control (ATC) is increasingly being implemented by various traffic agencies, careful evaluation is needed of the degree to which a given ATC implementation improves traffic signal performance. The present study details the evaluation of ATC for two arterial corridors in the City of Omaha, Nebraska. Several performance measures were used across two stages of ATC implementation as well as during the unanticipated COVID-19 lockdown stage.

The average travel time and variability in travel time showed that Stage 1 of ATC implementation in Omaha did not improve traffic signal performance for the study's main corridor, Dodge Street. This led to Stage 2 ATC implementation, in which there were slight improvements compared to Stage 1. However, travel time was still found to be higher as compared to the base scenario, though this increase was in most cases within 10%. The city shut down ATC operation during the PM peak period on the Dodge Street Corridor because of its poor performance. ATC was also found to negatively impact side-street delay in most scenarios. However, Omaha's ATC implementation successfully reduced and adjusted signal cycle length in response to COVID related demand changes thus showing some responsiveness to changing demand.

In essence, the ACT system does provide adjustments during atypical conditions but cannot outperform static timing patterns during recurring traffic demand.

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NDOT Research Website

NDOT Recommendations Based Off Research Project

The performance of the intersection under the Bus Rapid Transit (BRT) will be evaluated. The BRT, which is expected to be complete by the end of October 2019, will bring about certain operational changes to the corridor. The adaptability and the operational performance of the ASCT during this condition is to be determined. Another study will be the effect of ASCT one preemption calls along the corridor.

Based up on the performance of the above two categories, an overall assessment of the impact of ASCT on the Dodge Street will be performed. A before-after comparison will also be conducted to determine the improvements achieved by the ASCT.

The City of Lincoln is looking to add this system on the 27th street corridor. It may be several years for the full implementation plan to occur given remaining investigation of these system benefits and its associated costs.

- *As provided by Matt Neemann, Lead TAC Member*

Research Readiness Level (RRL) Assessment

RRL 3

Level: Development – Field Level

Research/Technology developed in an operational environment (real-world situation). The before and after comparison will be reviewed in 2025.

Technology Transfer

Principal Investigator did not have any technology transfer for this research project.

This brief summarizes Project SPR-P1 (20) M096
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