Texas A&M Transportation Institute

PROJECT SUMMARY

Texas Department of Transportation

0-6934: Optimum Traffic Signal Settings to Improve Safety and Efficiency when Using Modern Detection Devices

Background

Traffic signal settings have historically been developed using inductive loops as the predominant detection device. Detection technology has changed significantly over the years. The advent of video detection has provided flexibility to Texas Department of Transportation's (TxDOT's) engineers in detector design. In the past few years, additional detection technologies have been developed, namely radar, hybrid of video and radar, wireless detectors, and infrared detectors.

There is a need to develop traffic signal controller settings that are appropriate for the detector technology selected (radar, hybrid, wireless, infrared) and the specific objective of the detection (high speed, low speed, trucks, bicycles, pedestrians). Having a unique set of traffic signal controller settings that are appropriate to the detection technology being used will significantly improve the safety and efficiency of traffic signals operated by TxDOT and other agencies in Texas.

This research studied the impact of controller settings on design and operations of a signalized intersection where traditional detection technology is not used. Moreover, researchers created guidelines based on the findings of this research that will aid practitioners in choosing the controller settings at: 1) new intersections where the detection needs require that a non-traditional detection technology (i.e., loop detection) be used, and 2) at intersections where a particular type of detection technology has already been deployed but the intersection is not operating at its optimum operational or safety performance.

What the Researchers Did

Researchers sent a questionnaire to various traffic agencies in Texas to understand the typical detector types, design, and controller settings used by them at an intersection. The questionnaire focused on detector types, design, and controller settings for slow speed through and left turn lanes and high speeds through approaches. In addition, researchers reviewed TxDOT's Traffic Signal Operations Handbook and other research reports on new detection technologies to understand the capabilities and layout used for new detector technologies.

Researchers conducted simulation studies to assess different controller settings. The study design was based on the information gathered from above activities. The aim of simulation was to find settings suitable for various detection needs, the detection technologies, and operational scenarios. Researchers studied the

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effect of controller settings such as maximum green time, passage time, and detector switching for an actuated signal. Moreover, researchers analyzed the operation differences on a signalized intersection with radar, video, and induction loop detectors. Researchers also studied the differences in performance between detection using detectors zones at fixed distances and continuous tracking of vehicles using radars at high speed approaches.

What They Found

Researchers developed insight on controller settings for different scenarios based on this research. Following are a few of the salient findings of this research:

- A passage time of 1.5 seconds was found to be appropriate for optimum intersection delay. Low and moderate volumes are not sensitive for the passage times.
- An increase in passage time causes an increase in queue lengths.
- For high speed approaches, a higher delay was experienced when the stop bar and upstream detectors are on the same channel.
- For high speed approaches, a larger number of vehicles was trapped in the decision zone and a larger number of maxouts was experienced when the stop bar and upstream detectors are on the same channel.
- Detector switching results in lower delay **only** at high left turn volumes.
- Radar detectors with continuous vehicle tracking perform better than induction loops.

What This Means

This project contributed to an improved understanding of controller settings and detector design for modern detectors. TxDOT is better prepared for managing intersections with new detector technologies based on the guidelines from this research.

For More Information

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