



Project Summary

Texas Department of Transportation

0-6177: Portable Traffic Signal Monitoring and Evaluation Toolbox to Improve Signal Operations and Safety

Background

Engineers from the Texas Department of Transportation (TxDOT) use all available means to improve and maintain signal operations. However, they are constantly challenged in their quest by limited resources such as available time, personnel, and data to monitor and maintain traffic signal operations. Signal engineers develop signal timing plans for an intersection based on traffic counts conducted during various time periods. Engineers then implement these timings and observe them for a few hours. They do not have the resources to monitor the effectiveness of these timings over a longer period of time and hence are unable to verify the timings' suitability over a longer portion of the day.

Engineers frequently receive complaints from motorists about signal operations. However, in many instances engineers are unable to reproduce the problem, as it may be a temporary phenomenon. Problems can be due to a surge in traffic or occasional phase and/or detector failure. Engineers are looking for simple and easy to use tools to provide them accurate information about the health of their traffic signal operations.

What the Researchers Did

Researchers from the Texas Transportation Institute (TTI) developed two versions of a portable tool consisting of a field-hardened computer interfacing with a traffic signal cabinet through special enhanced Bus Interface Units (BIUs). The toolbox consists of a monitoring tool and an analysis tool. The monitoring tool monitors and logs relevant events that provide input to analyze intersection operations. These inputs include signal status, detector status, preempt status, and coordination status. The user has to provide the basic signal timing data and coordination data as input data. The analysis tool then analyzes the log files for each day and produces easy to understand reports. The reports are available either in an hourly average format or individual cycle format for a selected time period. The measures of effectiveness (MOEs) data include phase time, phase failures, queue clearance time, time to service, as well as counts on green, yellow, red, and split utilization during coordinated operations. Preempt data include the type of preempt, time of preempt, and the duration of preempt for each day. Detector failure data include type of detector failure and the time at which the detector failure occurred.

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What They Found

The researchers found that the toolbox they developed can accommodate most of the operational applications of a typical TxDOT signal cabinet. The toolbox primarily works in a TS-2 environment. The toolbox includes the enhanced BIUs, and hence the engineers and technicians do not need to procure any additional equipment. The toolbox is portable and can be installed very easily in a signal cabinet in under 30 minutes. The desktop-based version requires the user to carry a monitor. However, the laptop-based version is more convenient and is very easy to transport.

The toolbox was implemented in a signal cabinet at a diamond interchange having more than eight phases and sixteen detector channels thus requiring four enhanced BIUs. The toolbox was also implemented in a signal cabinet with eight phases and eight detector channels along with preemption, which required only two BIUs. Both of these deployments produced data that was very easy to analyze.

What This Means

The portable signal monitoring and evaluation toolbox resulting from this project provides tools that enable signal engineers to get a better understanding of intersection operations over an extended period of time. The toolbox can be installed in a traffic signal cabinet to collect data for a week or two. Intersection operations monitored include signal operations, detector failures, and preemption data. Instead of a fixed format for a report, users have the flexibility to generate reports of their choice. The reports are generated in Microsoft Excel® format, which provides an opportunity to conduct further analysis of the data that has been reduced. It is expected that this toolbox will significantly improve the tools available to the districts to evaluate their intersection operations.

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