



Project Summary

Texas Department of Transportation

0-5629: Best TxDOT Practices for Signal Timing and Detection Design at Intersections

Background

The Texas Department of Transportation (TxDOT) maintains and operates approximately 6,200 traffic signals in Texas. Differences have appeared in the design and operation of traffic signals across the state. These differences are due, in part, to the limited amount of statewide guidance available on traffic signal operation.

As a result of limited statewide guidance, each district has tended to develop its own guidelines for signal operation. The result is that many different signal operating philosophies have emerged among TxDOT districts. This flexible approach to traffic signal operations has served Texas reasonably well in the past; however, the consequence of having different operating philosophies is a lack of uniformity among districts and less than optimal signal operation. As traffic grows on Texas highways, sub-optimal performance of traffic signals may result in increased delay and fuel consumption.

The objective of research project 0-5629 was to develop traffic signal operations guidance suitable for statewide application and document it in the *Traffic Signal Operations Handbook*. This handbook provides guidance on signal timing and detection design for isolated signalized intersections and interchanges as well as coordinated signal systems. The handbook describes alternatives, discusses differences between these alternatives, and defines conditions where each alternative is most appropriate.

What the Researchers Did

The project objectives were achieved through a series of research tasks. These tasks included:

- reviewing signal timing guidelines of other transportation agencies,
- interviewing TxDOT engineers and technicians to identify effective signal timing practices,
- identifying issues or differences in practice and conducting research to resolve issues and reconcile differences, and
- developing a draft handbook and refining it through a series of workshops with TxDOT engineers and technicians.

The research was structured as a two-year program of field investigation, data analysis, and guideline development.

Research Performed by:

Texas Transportation Institute (TTI),
The Texas A&M University System

Research Supervisor:

James A. Bonneson, TTI

Researchers:

Michael P. Pratt, TTI

Srinivasa Sunkari, TTI

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What They Found

A review of signal timing guidelines for several state departments of transportation indicated a general lack of information on effective signal timing practices. Of particular note was a lack of guidance related to establishing effective yellow change intervals, red clearance intervals, minimum green settings, or maximum green settings. Also noted was a lack of guidance describing criteria for determining when a left-turn phase is needed, how to avoid the potentially unsafe “yellow trap” that is inherent to a lagging left-turn phase, and where to locate detectors on high-speed intersection approaches.

Interviews with TxDOT engineers and technicians indicated a need for guidance on the topics of minimum green and maximum green settings. Useful guidelines were identified in a review of the literature but there were some questions about their applicability to Texas conditions. Researchers evaluated these guidelines using simulation, and TxDOT engineers further reviewed them. Based on this process, recommended guidelines were developed for establishing minimum green and maximum green settings for intersections in Texas. A similar process was followed in the development of guidelines for setting the yellow change and red clearance interval durations.

Research evaluated alternative detection layouts used in Texas for high-speed intersection approaches. A detection layout in use by many TxDOT districts was found to provide effective service and was recommended for use throughout the state.

Several software tools were noted to be available to TxDOT engineers for developing optimal signal timing plans; however, these tools often require the engineer to invest a significant amount of time to collect input data, develop alternative plans, and implement the best plan in the field. A need was identified for guidelines that could be applied quickly with minimal resources. The guidelines developed for this project are intended to meet this need.

What This Means

The main product of this research project is the *Traffic Signal Operations Handbook*. This handbook provides guidelines for timing traffic signals at intersections that operate in isolation or as part of a coordinated signal system. The guidelines describe best practices, as identified through interviews with TxDOT engineers and technicians, and identify conditions where alternative practices are equally workable. The handbook is intended to make resource investment in signal timing maintenance cost-effective and signal operation more consistent on a statewide basis. It is likely to be most useful to engineers that desire quick-response methods for maintaining or improving the operation of existing signalized intersections.

For More Information:

Research Engineer - Wade Odell, TxDOT, 512-465-7403
Project Director - Henry Wickes, TxDOT, 512-506-5125
Research Supervisor - James A. Bonneson, TTI, 979-845-9906

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Research and Technology
Implementation Office
P.O. Box 5080
Austin, Texas 78763-5080
512-465-7403

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