



0-6670: Synthesis Study of Texas Signal Control Systems

Background

Traffic control signal systems have evolved so much that they serve as the critical components of traffic management systems for various traffic agencies. Advancements in traffic control systems enable signal systems to operate with greater efficiency. Traffic control system technology now provides engineers with a wide range of control techniques as both hardware and software are significantly improved to provide such flexibility.

These new systems are equipped with functions that enable traffic engineers and technicians to effectively manage delays on roadways. The drawback, though, is how to effectively and efficiently utilize these advances to manage traffic delay and its attendant issues.

Transportation professionals recognize the need to be abreast with new technology and standards since knowing them will culminate in the effective management of traffic at signalized intersections, thereby reducing congestion, delay, vehicle stops, and fuel consumption, and lessening the impacts on air quality. There is a growing need to identify the various versions of these systems that exist, including the system hardware components and communications. Such an effort will also help identify operational successes, deficiencies, cost-effectiveness, and other attributes of the various traffic signal system components.

What the Researchers Did

This one-year project was a joint collaboration of researchers from Texas A&M University–Kingsville (TAMUK) and the Texas A&M Transportation Institute (TTI). A literature review to identify and obtain exhaustive information on current traffic signal control systems across the United States and relevant systems from international examples was conducted.

A nationwide survey comprising 14 questions and administered to traffic operations divisions in four selected states was conducted through phone, email, and online to determine the existing control systems as well as communication systems, maintenance types (outsourced or in-house), centralized software, and information technology support being utilized. Questions were tailored to differentiate between systems being used in rural and urban areas. Also, questions were developed with important findings from the literature review.

After responses were received from the nationwide survey, a state-level survey was conducted. The survey comprised 19 questions and was administered to 16 Texas Department of Transportation (TxDOT) districts and 16 local agencies. The list of interviewees was built based on the researchers' knowledge and experience, the recommendations of the Project Monitoring Committee, and a review of media and agency reports documenting the implementation of traffic signal improvement projects. Efforts were made to reflect a range of area types (rural, mid-sized, and urban) in the group of contacts.

In-person interviews were also conducted with selected local agencies and TxDOT districts to clarify and confirm some of the information obtained through the thorough literature review and online survey. These interviews helped researchers better understand and expand the responses provided online.

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What They Found

Researchers developed a synthesis of traffic control practices from the survey responses received. The following bullets summarize the state of the practice:

- Agencies are moving away from old systems to new systems since new systems provide additional functionalities. The choice of controller type depends on compatibility and ease of use, especially in reference to the type of controllers already in use. Control operations employed were invariably coordinated, with the minimum being the time-based coordination. Adaptive systems are being utilized but require more education and investment.
- Factors influencing the choice of detection technology include installation cost (including both the detector itself and the necessary wiring and control components), site-specific constraints (e.g., view occlusion, sun glare, and pavement condition), and the existence of adequate space in conduits and cabinets for various components.
- Many agencies prefer fiber-optic cables as compared to any other communication mediums since fiber-optic cables allow large sizes of data to be transferred at a faster rate. The challenges, however, are the cost of fiber and the nonexistence of a dedicated communication system to monitor traffic. Agencies responsible for managing traffic signal systems often have to wait for fiber to be installed for other reasons, and then obtain permission to use the fiber network.
- IMSA certification and on-the-job training are the most commonly provided types of training for traffic signal technicians in Texas. There is an unmet need for Texas traffic signal technicians to obtain training on cabinet troubleshooting (e.g., the former TEEEX course) and training with fiber or wireless Ethernet communications equipment.
- Most agencies are equipped with IT personnel who possess adequate skills to handle traffic-signal-

control-related issues, but traffic operations departments do not receive the expected/prompt response from their IT departments when they call on them. Due to this, some agencies would like to have a separate IT department/personnel dedicated to traffic signal control issues.

- Most agencies depend on public complaints to assess efficiency of traffic control systems, and few utilize level-of-service analyses/simulations.
- Many agencies have done some signal coordination across jurisdictional boundaries, but the number of sites at which they do this is small. In Texas, the two most common situations for coordination across jurisdictional boundaries are (1) diamond interchanges and (2) major arterials that pass through several jurisdictions, if the signal spacing lends itself to effective coordination.

What This Means

This research project served to develop a synthesis of traffic control system practices that can be utilized by various TxDOT districts in the pursuance of improved traffic signal operations and reduction in traffic signal system inefficiency and related costs. Project usefulness includes the following:

- This project should help researchers and practitioners better understand the different types of signal systems in use in Texas, including the type of signal controller, detection systems, surveillance and monitoring, communications and cost-effectiveness, etc.
- This project should help TxDOT districts and transportation agencies to decide on the kind of training/IT support requirements best suited for their engineers and technicians who maintain and operate traffic signal control systems.
- Efforts at signal coordination could be improved by recommendations from this research.

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