Project Summary

Texas Department of Transportation

0-4772: Methods and Guidelines for Evaluating Dynamic Message Sign Performance

Background

Dynamic message signs (DMSs), also referred to as changeable message signs and variable message signs, have been utilized for almost 40 years to communicate traffic information to motorists. DMS systems are an essential element of many advanced traveler information and traffic management systems and a primary component of intelligent transportation systems architecture. While the majority of DMS deployment and application has been in urban areas, the last 10 years have seen extensive implementation in rural roadway environments. Despite the significant progress realized in recent years with regard to DMS design and deployment, a critical issue that has received less attention and about which much less is known is the actual influence of DMS systems either during periods of congestion or incidents, or under normal traffic conditions.

The goal of this research study was to provide the Texas Department of Transportation (TxDOT) with objective guidelines and a methodological framework for evaluating DMS performance. These guidelines include a range of conditions to address all contingency scenarios including application locations (urban-rural), traffic flow conditions (incident-normal), level of assessment (quantitative-qualitative), time period of analysis (before-after), and availability of data. These guidelines enable TxDOT engineers to measure the effectiveness of existing DMS systems and to validate the implementation and efficient operation of future systems.

What the Researchers Did

To accomplish the goal of this project, researchers:

- reviewed previous literature regarding DMS evaluation methodologies and results;
- conducted surveys of TxDOT and other state transportation agency personnel regarding DMS evaluation practices;
- identified and categorized the various possible performance measures that have been or can be used to evaluate DMS performance;
- proposed an evaluation framework for evaluating DMS benefits;
- explored the functionality of this proposed framework through a set of case study analyses of DMS implementations in Amarillo and Houston; and
- revised the framework based on the case study experiences.

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Project Completed:
8-31-06

What They Found

One of the main objectives in conducting this research was the identification of DMS benefits that can be quantified in economic terms (i.e., reduced road user costs via decreased delays, stops, and crashes). Those terms would make it possible for TxDOT to compare such benefits to the costs of DMS deployment in a traditional benefit-cost analysis. Unfortunately, despite the efforts of the research team, it is clear that significant practical and conceptual limitations still exist to accomplishing this type of analysis.

The practical limitations are in regards to the application of available traffic simulation models or combined simulation/route choice analysis tools to effectively represent driver diversion responses to DMS information. Practical limitations also exist with respect to analyzing the safety effects of DMS operations in a corridor.

What This Means

At the individual driver level, the behavioral responses to DMS are quite complex and not fully understood. Existing analysis tools do not yet appear to have the computational rigor needed to effectively replicate the real-time situational decision-making that appears to occur on the road. Consequently, the efforts to utilize more complicated analysis tools do not appear warranted at this time. Furthermore, the transportation profession believes that DMS effects should be evaluated on the basis of driver satisfaction and usage statistics. Given that the goals and objectives of DMS use are oriented around customer (driver) service rather than operational effects, it can be argued that it is the customer service aspect of operations that should be assessed.

Certainly, it is possible that more sophisticated analysis tools and safety models could eventually be developed and applied to the task of quantifying operational effects of DMS. Appropriate data collection is important in order to quantify DMS impacts in the future with these types of tools. While deployment of DMS systems in Texas is extensive, the evaluation of these systems has been minimal. Operations of any individual DMS were initiated under a given protocol at a specific time and evolved through the years. Collection and preservation of the data necessary for rigorous pre-post installation evaluation have been sporadic and lacking in consistency. Situational and operational factors associated with DMS implementation and operation inhibit the ability to conduct viable quantitative evaluations of DMS performance while increasing the importance and value of benefits associated with qualitative assessments of DMS.

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