Project Summary

Texas Department of Transportation

0-6427: Integration of Rural Work Zone ITS into the Statewide ITS Architecture

Background

The use of intelligent transportation system (ITS) technology to monitor traffic conditions in work zones and provide real-time information to motorists has been an area of emphasis within the Federal Highway Administration (FHWA) and many state Departments of Transportation for several years. Most existing Transportation Management Centers (TMCs) in urban areas will support work zone operations, collecting information on planned or current lane closures and disseminating that information to drivers via traveler information websites, dynamic message sign messages, highway advisory radio, or even through 511 telephone systems. However, TxDOT has not pursued the integration of work zone data into TMCs until now.

What the Researchers Did

Gathering data and information involved a literature and Internet search, and a survey of TxDOT personnel to determine the optimum research approach. The search for one or more sites to conduct field studies to evaluate Smart Work Zones (SWZs) was unsuccessful, so the Project Monitoring Committee agreed with researchers that simulation would be a viable alternative in this case. Investigation of the appropriate work zone architecture describes how a third party ITS system might operate in a TxDOT work zone either with or without a TMC involved and provide the needed functions at the work zone. Researchers used VISSIM to investigate two work zone systems: queue warning and travel time using Bluetooth®. Simulation was also instrumental in determining when SWZs would be justified based on a benefit/cost analysis.

What They Found

The research team found that two levels of architecture were appropriate for work zones—one for integration into a TMC, called Integrated, and another for less demanding environments (without TMC integration) called Stand-Alone. Simulation of queue warning systems used speed detection systems placed strategically at no more than 1 mile apart (desirably ½ to ¾ mile) to estimate the end of the queue. The maximum queue length is a determinant of the number of speed detection devices and portable changeable message signs.

Simulation of travel time using Bluetooth led to the discovery of errors in travel time predictions, requiring correction based on a new algorithm from this research.

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Figure 1 shows the comparison of travel time information provided versus actual travel time experienced by the travelers. In the left figure, standard Bluetooth-based travel time exhibits a shifting pattern with respect to the actual (experienced) travel time due to congestion delay. The right figure shows a significant improvement in travel time estimate using the proposed algorithm.

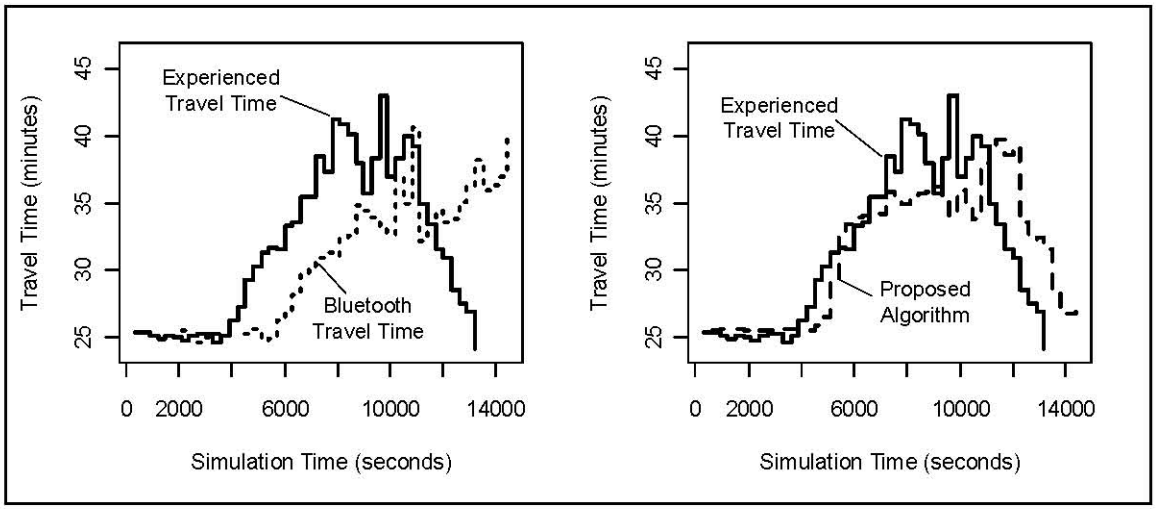

Figure 1. Comparison of Travel Time Information.

Research findings indicate that, at low reductions in crashes (e.g., 5 percent to 10 percent), SWZs will not likely meet the desired benefit/cost criterion exceeding 1.0 without relatively high traffic demand, long queues, and duration of more than one year. For rural areas, the conditions would not be likely except on high-volume Interstate Highways—possibly on segments near urban areas. This finding excludes travel time savings, which could also be substantial at higher volume rural work zones.

What This Means

TxDOT should actively pursue the use of Smart Work Zones under the appropriate conditions. The missing component (and therefore research need) in the proposed methodology is the amount of crash reduction (and thus cost savings) that should be associated with work zones based on traffic volume, daytime vs. nighttime work, work zone length and duration, and local features. Researchers also recommend an Implementation Project Recommendation to demonstrate both types of work zone architecture: an integrated architecture using TxDOT's LoneStar system and C2C interface and a stand-alone architecture with oversight by a local Area Office.

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