Project Summary

Texas Department of Transportation

0-6462: Evaluation of Modern Traffic Control Devices to Improve Safety at Rural Intersections

Background

In Texas, about one-third of all crashes on rural highways occur at intersections. The combination of high speed and multiple, complex guidance and navigational choices at rural intersections complicate the driving task and increase the potential for a severe crash. Various design and traffic control device (TCD) improvements are implemented to decrease the likelihood of a crash. For example, Texas Department of Transportation (TxDOT) engineers make improvements to sign conspicuity to decrease Stop sign violations. This research evaluated different alternatives for rural stop-controlled intersections. It focused on Stop signs with supplemental characteristics such as beacons and light emitting diodes (LEDs). Specifically the prime objective of project 0-6462 was to obtain a better understanding of modern TCDs capabilities.

What the Researchers Did

Researchers conducted the following research tasks to achieve the project objectives.

Identified Traffic Control Device Alternatives for Rural Stop-Controlled Intersections **-** In this task, researchers reviewed the literature to establish the state-of-the-knowledge on traffic control alternatives for rural stop-controlled intersections.

Determined Crash Characteristics for Texas Rural Stop-Controlled Intersections **-** Researchers reviewed the Texas crash data from 2003 to 2008 to identify characteristics of crashes at these intersections. For 3-leg intersections, especially if one of the approaches has a horizontal curve, countermeasures that address the following are appropriate: nighttime, speeding, and single-vehicle crashes. A general conclusion for the 4-leg intersections is to identify countermeasures that focus on angle crashes with an emphasis on communicating to drivers the presence of the stop-controlled condition.

Expand Knowledge of Selected TCD Alternatives and Develop Research Approach for Studying Selected TCD Alternatives **-** Researchers conducted a survey of TxDOT districts to collect additional information such as TCD costs, and maintenance and safety experiences by TxDOT personnel. Vendors were also contacted to supplement information collected from TxDOT districts.

Identified Driver Reaction to Selected Alternatives **-** A lab survey was conducted in TTI's Visibility Laboratory. Participants viewed signs sometimes directly (looking straight ahead) and sometimes peripherally. Based on the results of the lab survey, devices were selected for the field study conducted at the Riverside Campus of Texas A&M University. The objective for the closed-course study was to evaluate the impact of beacons or LEDs on the detection of signs and on the ability to read the words or symbol on a sign.

Research Performed by:

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

Research Supervisor:
Kay Fitzpatrick, TTI

Researchers:
Sue Chrysler, TTI
Joel Cooper, TTI
Laura Higgins, TTI
Byung-Jung Park, TTI
Srinivasa Sunkari, TTI

Project Completed: 8-31-11

Developed Guidelines and Document Findings - Based on the findings of prior tasks, TTI researchers developed guidance regarding the use of TCDs at rural stop-controlled intersections. Consideration in the guidelines included the visibility, attention value, and readability of these TCDs.

What They Found

Adding flashing lights to signs, either through beacons or embedded LEDs, serves two purposes: to attract attention and to convey a message. The findings of this research demonstrate that while the lights do improve detection distance, legibility distance of the message suffers at night due to the glare of the lights. Cautious engineering judgment should be used when adding lights to any word message sign beyond a Stop sign because the legibility distance for the words will be shorter than when lights are not present. For Stop signs, the unique color and shape of these traffic control devices prompts drivers' responses to them long before the word "Stop" is actually read. The driving study found no difference in sign detection at night between those with an overhead flashing beacon and those where the ground-mounted sign has embedded LEDs. The detection distances observed for signs with lights in the current study were extremely long, over 2000 feet in most cases. The other general observation regarding the magnitude of the results is that for all of the Stop signs, both lit and unlit, the detection distance for sign recognition was always greater than stopping sight distance. So the existing static Stop signs are sufficiently visible for an alert driver under clear weather. The research project found that there appears to be a benefit to detection from dimming the LED brightness at night. The LED sign set on the high brightness setting was detected farthest during the day while the lower setting was detected best at night.

When selecting alternatives to enhance Stop signs, the following guidance is suggested for consideration:

- Select treatment to address conditions at the site.
- Select treatment that is best suited to the visual environment.
- Review the available evidence on treatment effectiveness.
- Conform to local policies and practices.
- Use traffic control devices with beacons or LEDs sparingly.
- Choose the lower cost option.

What This Means

The conditions at the intersection need to be identified, and characteristics of the treatments selected must be understood to ensure the treatment's effectiveness. For example, if the Stop sign is obscured because of terrain or other visual clutter, moving the sign's mounting position may improve conspicuity better than other improvements. Selection of the treatment should consider the overall costs (capital as well as maintenance). Stop signs with beacons or LEDs offer increased conspicuity over static signs; however, due to the potential to be distracting and to decrease the effectiveness of similar static signs, signs with beacons or LEDs should be limited. More research needs to be conducted regarding the use of modern LED signs, for example, appropriate settings for different light conditions.

For More Information:
Research Engineer - Wade Odell, TxDOT, 512-416-4730
Project Director - Carlos Ibarra, TxDOT, 903-799-1480
Research Supervisor - Kay Fitzpatrick, TTI, 979-845-7321

Technical reports when published are available at:
http://library.ctr.utexas.edu/index.html

www.txdot.gov
keyword: research

Texas Department of Transportation
Research and Technology Implementation Office
P.O. Box 5080
Austin, Texas 78763-5080
512-416-4730