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LRRB
LOCAL ROAD RESEARCH BOARD

TECHNICAL SUMMARY

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LRRB PROJECT COST:
$74,667

TOTAL PROJECT COST:
$112,000

Flashing LEDs make stop signs more conspicuous.

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Impact of Flashing LED Stop Signs on Crash Reduction and Driver Behavior

This project evaluated the impact of flashing LED stop signs on right-angle crash rates and driver behavior. Statistical analysis estimated declines in crash rates at intersections where flashing LED signs had been installed, although more data is needed to assess the precise magnitude of crash rate reduction with statistical confidence.

What Was the Need?

To improve safety at stop sign-controlled intersections, Minnesota cities and counties have installed stop signs enhanced with flashing light-emitting diodes at selected intersections. The hope is that if stop signs are made more noticeable, the frequency of right-angle crashes will be reduced.

Given the statewide interest in this strategy, the Local Road Research Board needed to conduct research to determine whether these flashing LED stop signs were actually improving traffic safety.

What Was Our Goal?

This project attempted to evaluate the impact of flashing LED stop signs on safety and driver behavior.

What Did We Do?

Investigators first attempted to estimate a crash modification factor associated with the installation of flashing LED stop signs. The CMF is simply the ratio of the expected number of crashes when a flashing LED sign is installed to the expected number of crashes without it. However, a simple before-after analysis would be misleading because the relatively small number of crashes at any one intersection can make statistical noise appear to be a significant trend. Investigators instead conducted an empirical Bayes analysis, which uses the crash rates at other, similar intersections to build a more reliable baseline for crash rates before installing a flashing LED stop sign.

To calculate the CMF, investigators used three statistical models, each with a slightly different set of variables. These models used data on crash history, traffic volumes, speed limits and other features at 15 Minnesota locations where flashing LED stop signs had been installed for at least three years as well as at 240 intersections without LED signs, which served as a reference group.

In addition to the statistical study, investigators conducted a field study to compare how drivers behave at flashing LED stop signs and at traditional stop signs. A portable, pole-mounted video recorder provided by the Minnesota Traffic Observatory was used to collect 64 hours of data at the intersection of Trunk Highway 95 and County State-Aid Highway 9 in Chisago County. Half of this video was from June and July 2012, before installation of a flashing LED stop sign, and half was from September and November, after sign installation.

What Did We Learn?

This study yielded mixed results. On the one hand, limitations in the available source data (few crashes) meant that the results displayed a 95 percent confidence interval ranging from essentially no change to a 71 percent decrease in right-angle crashes when LEDs are added to stop signs. However, the reported result was positive for the safety effects of adding LEDs, with an approximately 42 percent decrease in right-angle crashes

continued

"These flashing LED stop signs were gaining popularity from the public, and as a department we were getting requests from various cities. People wanted them installed in the name of safety but we weren't sure if they actually reduced crashes."

—Brad Estochen,
MnDOT State Traffic Safety Engineer

"We're fairly certain there was a reduction in crashes after installing flashing LED stop signs even though it's difficult to say the precise magnitude due to the limited amount of data available. The flashing signs do have a positive safety impact, which makes them another tool in the safety engineer's toolbox."

—Gary Davis,
Professor, University of Minnesota Department of Civil Engineering

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In the field test, a pole-mounted video recorder and VideoPoint software tracked vehicles' trajectories and speeds as they approached a stop sign, and identified whether they stopped at the sign.

when LEDs were installed. This decrease was consistent across all three statistical models. Consequently, while this study suggests that there is some decrease in the number of right-angle crashes associated with flashing LED stop signs, it is impossible to state the magnitude of crash reduction with statistical certainty.

Using the statistical data, researchers developed a spreadsheet-based decision support tool to help engineers decide where to install flashing LED stop signs. This tool assists engineers in identifying intersections where right-angle crashes are more frequent than expected based on traffic volume, speed limits and whether the intersection is four-legged or a T. The tool computes the number of crashes a flashing LED stop sign could prevent, which can be used as an input for the cost-benefit analysis.

An interesting discovery from the field test was that at intersections made more visible with LEDs, drivers were significantly more likely to stop when opposing traffic was present. The direct comparison was 10.6 clear stops for every clear nonstop after installation compared with 4.2 stops for every nonstop before installation. When no opposing traffic was present, however, there was no change in behavior after installing the flashing LED sign; approximately four drivers clearly did not stop for every driver who did stop.

What's Next?

This research confirms at least some safety benefit to the signs, even though it could not establish the magnitude of benefit with statistical certainty or provide clear-cut answers about when to use these signs. City and county traffic engineers should be able to use the research and the decision support tool to make better decisions relating to safety in their road systems. MnDOT is taking steps to update its policies based on the information learned in the report.

While no further research is planned, MnDOT will continue to monitor locations where flashing LED stop signs have been installed to collect more data about their impact on safety. There may also be opportunities to evaluate other forms of illuminated signs.

This Technical Summary pertains to the LRRB-produced Report 2014-02, "Estimating the Crash Reduction and Vehicle Dynamics Effects of Flashing LED Stop Signs," published January 2014. The full report can be accessed at http://www.lrrb.org/PDF/201402.pdf.