What Was the Need?

Like other Midwestern states, Minnesota has many unsignalized rural intersections where high-speed major highways are crossed by lower-speed secondary roads. Recent crash data indicates that a majority of Minnesota’s intersection-related fatal crashes occur at these rural through/stop intersections.

Vertical and horizontal curves can make it difficult for drivers crossing or turning into the high-speed lane to identify a safe gap in the oncoming traffic, and communicating intersection conditions to drivers approaching this type of intersection can be challenging. Static advance warning signs do not appear to be effective. Realigning intersection approaches can improve safety, but this countermeasure is expensive and difficult to justify at low-volume rural intersections, particularly given the limited budgets of local agencies managing rural roadways.

What Was Our Goal?

The objective of this research is to improve the safety of rural blind intersections by developing a low-cost, easy-to-install advance warning sign system that can be implemented as modifications of existing static signs.

What Did We Do?

Researchers developed the Advanced Light-Emitting Diode Warning System, or ALWS, using three Intelligent Transportation Systems technologies: a low-power light-emitting diode signaling scheme; wireless technology for vehicle detection; and solar panels to power the system. In October 2009, after building and testing components in the lab, researchers installed the ALWS at a rural Duluth, Minnesota, intersection with a severe vertical curve on the approach of the main highway.

The field installation included three signs with LEDs on the perimeter of the sign panels:

- One CROSS TRAFFIC WHEN FLASHING sign, installed 525 feet from the intersection in the westbound lane of traffic on the main highway.
- Two signs with the message VEHICLE APPROACHING WHEN FLASHING, installed on the secondary road opposite the STOP signs.

Researchers modified wiring on commercial signs that continuously blink so that the signs only blink when a vehicle is detected on the opposing approach. Blinking time for the sign on the main highway varies based on the time a vehicle is detected at the STOP signs on the secondary road. The signs on the secondary road blink for 10 seconds when a vehicle is detected on the main highway. If the wireless signal to the signs ceases for more than 10 minutes (that is, if the system is offline), then the LEDs blink continuously.

Four non-intrusive vehicle detectors mounted on STOP signs and posts transmit wireless signals to the signs to initiate blinking. Communication between the vehicle detectors...
“Overall, the ALWS was effective at reducing vehicle speeds on the main highway, increasing the wait time and altogether stopping roll-throughs for vehicles on the secondary road when a conflict exists at the intersection.”

—Taek Kwon, Professor, University of Minnesota Duluth Department of Electrical and Computer Engineering

“I believe low-cost Intelligent Transportation Systems like those used in the ALWS will play a larger role in the future as a strategy to reduce unsignalized intersection crashes and to contribute to Minnesota’s Toward Zero Deaths effort.”

—Victor Lund, Traffic Engineer, St. Louis County Public Works Department

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