Rural Intelligent Transportation Systems

In a technical session at the 2011 NACE conference, Dennis Foderberg of SEH Inc. discussed intelligent transportation systems (ITS) developed by SEH in collaboration with Network Transportation Technologies, Inc. These systems address the problem of crashes on low-volume roads. Foderberg noted that, nationally, about two-thirds of fatalities due to crashes occur on rural roads and that most of these are caused by unsafe speed, failure to yield, or some form of driver inattention. In response, he discussed four types of systems that have been deployed since 2007 to warn drivers with flashing lights built into otherwise typical MUTCD-approved signs:

- **Intersection Warning System**—activates lights on a “Look For Traffic” sign when a vehicle approaches on the crossroad.
- **Stop Sign Warning System**—activates lights on a STOP sign as a vehicle approaches the sign.
- **Curve Warning System**—activates lights on curve signs when vehicles are being operated above safe speed.
- **Driver Behavior Evaluation System**—records data on vehicle behavior that can be analyzed and used as a design input.

**Design characteristics**

“The systems we’re developing are all made of commercial off-the-shelf components,” Foderberg said. “The only proprietary component is the software containing algorithms that we’re developing.” He described several major characteristics of the systems:

- They are dynamic in the sense that lights flash in direct response to vehicle behavior. He said this is their most important characteristic and added that “if something is always the same like a rumble strip, sooner or later people begin to ignore it.” All the dynamic lights in these systems are triggered by Doppler radar.
- They are solar/battery-powered because in most rural places AC power is unavailable. This also makes the systems relatively portable. He noted that one of the few design issues is keeping moisture away from the batteries.
- Their modular design and small size make the systems relatively easy to install and maintain by county staff. Compact size is important because there is limited right-of-way in many places where the systems are needed.
- They are relatively low cost. Foderberg noted that a typical traffic light system...
costs about $250,000, whereas these systems cost about an order of magnitude less. For example, he said three intersection warning systems installed in Wright County, Minnesota, cost about $46,000 each. “As with any technology,” he added, “the first few are costly, but the next 1,000 are much less expensive.”

- Each system has a fault indicator that becomes visible when power has been interrupted.

**System configuration**

Figure 1 shows the basic components common to all the systems. Each system is made up of detection nodes that trigger the sign nodes.

![Detection Node](image1.png) ![Sign Node](image2.png)

*Figure 1: Detection node (left) and sign node (right)*

**Results**

Foderberg discussed the system that has been deployed the longest—about four years. This is an intersection warning system at County Road 47 and Lawndale Lane in a rural part of Hennepin County, Minnesota—a location where there had been a significant number of crashes. An evaluation of the system conducted by SRF Consulting Group, Inc. showed that, since deployment, there had been a reduction from 3.9 to 1.8 “conflicts” per 1,000 vehicles—and no fatalities related to the system. Drivers who used the intersection judged the system to be “reliable and effective at warning [them] of approaching cross-street traffic.”

Other results:

- 94.2% were aware of the sign.
- 88.5% understood the meaning of the sign.
- 79.4% had improved awareness of approaching traffic.
- 65.2% are more likely to stop when the sign is flashing.
- Half indicated they pay more attention when the sign is flashing.

In addition, the system was found to be operational 98.6% of the time during a six-month test period.

**Driver Behavior Evaluation System**

The Driver Behavior Evaluation System (DBES) is different from the other three systems, all of which are designed to warn drivers. Foderberg said the DBES “was developed in response to county engineers who told us they really don’t know what drivers are doing.” A prototype DBES that is now deployed in Olmsted County, Minnesota, records exactly what vehicles are doing: slowing down, stopping, etc., and outputs data to a spreadsheet.