Lighting Research Center

Advancing the effective use of light for society and the environment.

LRC News

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Engineering the Roadway Visibility Information System

By Mary Cimo

Crosswalk with in-pavement LED system

Modern roadway transportation would not be possible without all the developments in roadway safety and lighting that provide illumination and information about your vehicle, nearby and approaching vehicles, and the surrounding environment.

These continuous streams of data help motorists assess driving situations and make driving decisions. For instance, brake lights may indicate to a driver that there is an accident or a stop light ahead. Inclement weather conditions may prompt a driver to turn on the vehicle's headlamps to increase visibility or become more visible to other drivers.

In these scenarios and countless others, the common denominator for safety is lighting—a key factor in providing roadway information. The Kentucky Transportation Center reported a 45 percent reduction in nighttime crashes after the addition of roadway lighting to intersections. In addition, a 1992 International Commission on Illumination publication, *Road Lighting as an Accident Countermeasure,* reported that in 85 percent of 62 case studies, lighting was beneficial to increased safety.

LRC rendering of proposed LED marking system for a complex intersection

However, despite advances in safety and lighting, the total number of fatal crashes has not diminished in the last 30 years.

Scientists at the Lighting Research Center have recast this problem, examining roadway safety from a new perspective. Rather than viewing it solely as an issue with transportation lighting, transportation researchers at the LRC are working to re-engineer what they call "the roadway

visibility information system."

The group is focused on providing visual information as cues that the driver can use to evaluate risk when making decisions, based on the theory that a variance between perceived risk and actual risk can result in incorrect behavior adjustment and increased crashes, according to John Van Derlofske, Ph.D., head of the transportation lighting program at the LRC.

Evaluating new technology

“The current roadway system is often inefficient,” said Dr. Van Derlofske. “For example, headlamps and streetlamps combined can reduce visibility by reducing contrast. Glare off of road signs continues to cause visibility problems, and too much light can be a waste of energy and cause light pollution.”

Recent technology developments such as light-emitting diodes (LEDs), electrodeless lamps, and in-pavement warning lights provide new potential solutions for guiding motorists around increasingly complex traffic patterns, minimizing glare and sky glow, and improving pedestrian safety. The LRC is currently examining these new technologies to re-engineer the roadway visibility system to improve safety and efficiency.

Shedding light on complex traffic patterns

The LRC has been working in concert with the New York State Department of Transportation (NYSDOT) and the New York State Energy Research Development Authority to study possible safety solutions for complex interchanges involving traffic signal controls and multiple lane crossovers. To ensure safety, these intersections must provide lighting and marking systems to enable drivers to maneuver accurately through the interchange.

To aid in the development of such complex intersections, the LRC has developed interchange designs that incorporate in-pavement LED marking devices for a future test site in New York.

The LRC also recently assisted the New York State Thruway Authority and NYSDOT by reviewing lighting plans and suggesting locations for supplemental lighting for a new interchange between Interstate 84 and Interstate 87. The LRC identified locations where shielding should be considered to minimize potential light pollution and trespass, as well as new technologies including fluorescent highway sign lighting to minimize sky glow.

Judging glare recovery

Glare from headlamps remains a major problem on roadways. Recent headlamp technologies are presenting new oncoming appearances for drivers, which have resulted in increased complaints of glare to the National Highway Transportation Safety Administration (NHTSA).

To help NHSTA assess the issues, the LRC conducted research to examine the intensity, color, and size of oncoming headlamps and determine the effects of these parameters on visibility, as well as impressions of visual discomfort.

According to Van Derlofske, glare can be deceiving in that discomfort from oncoming headlamps does not always equate to poor visibility caused by oncoming headlamps, particularly with regards to recovery from glare after an oncoming vehicle has passed. “In

fact, you can seem unaffected by oncoming glare, when actually your visibility has been impaired," he explains.

"We are conducting ongoing research studies to determine what new aspects should be examined for potential headlamp regulation, such as glare dosage and duration," said Van Derlofske.

Pedestrian crosswalk safety

Accidents involving pedestrians in crosswalks are common, according to LRC researchers. In a project sponsored by the New Jersey Department of Transportation, Van Derlofske and his group studied in-pavement flashing warning lights as a means to increase pedestrian safety in crosswalks, as opposed to the traditional painted stripes often used to identify a crosswalk.

The test sites included traditional crosswalks where the stripes had eroded, freshly painted crosswalks, and a combination of freshly painted crosswalks with in-pavement flashing LED warning lights.

The study showed that adding an in-pavement flashing warning system to a clearly striped crosswalk did reduce the mean speed at which vehicles approach the crosswalk, as well as the mean number of vehicles that pass over the crosswalk while a pedestrian is waiting, as compared to a clearly striped crosswalk without in-pavement lighting.

"Although the in-pavement light enhanced the conspicuity of the crosswalk to drivers, the systems are more expensive to install than traditional striping and require cost justification," says Van Derlofske. "Such systems are probably most suitable in areas where there is competition for drivers' attention."

For more information on the LRC transportation group, or to learn how to become a member of the Transportation Lighting Alliance (TLA), a cooperative research group focused on vehicle forward lighting and visibility, please visit the TLA website.

About the LRC

The Lighting Research Center (LRC) is part of Rensselaer Polytechnic Institute and is the leading university-based research center devoted to lighting. Founded in 1988, the Lighting Research Center has built an international reputation as a trusted and reliable source for objective information about lighting technologies, applications, and products. Its mission is to advance the effective use of light and create a positive legacy of change for society and the environment.

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