

SAFETY RESEARCH 2018

INNOVATIONS FROM STATE DOTs

Blue and White Lights Enhance Snowplow Visibility

IOWA

Winter maintenance vehicles plow snow and spread materials on the roadways at a much slower speed than the normal flow of traffic. During the 2013-14 winter season in Iowa, snowplows were hit 39 times, resulting in \$770,000 in damage and seven injuries.

An Iowa DOT research study sought to increase the visibility of snowplows by installing blue and white rear-facing lights in addition to the amber warning lights already on vehicles. The lights were to be used only during winter events when snowplows were moving slowly within the normal traffic flow and vulnerable to collision. Iowa DOT equipped all the trucks in central Iowa with blue and white lights, as well as a few trucks in other districts.

Over a two-winter period, Iowa snowplows equipped with these lights were hit only 10 times, with motorists usually rear-ending or sideswiping them. This is a dramatic reduction from the 29 crashes over the previous two winters. Iowa's governor signed a bill in March 2018 authorizing the continued installation of blue and white lights on snowplows. The increased visibility will enhance winter safety for all drivers and help avoid the high costs of crashes. [Article](#).

Source: Iowa DOT



Visibility of snowplows is increased with blue and white lights (top) compared with traditional amber lights (bottom).

The eight safety research projects

highlighted on these pages were selected by the Research Advisory Committee of the American Association of State Highway and Transportation Officials (AASHTO). They comprise two high-value projects from each of the four AASHTO regions, funded primarily through the State Planning and Research (SPR) Program.

As the nation's cornerstone state research program, SPR provides Federal Highway Administration (FHWA) funding to the states to address top concerns and identify solutions at the state level. States further address areas of common concern through the Transportation Pooled Fund Program.

This publication and its companion featuring high-value pavement research complement *Research Makes the Difference 2018*, a compilation of award-winning transportation research across all fields. All of these publications may be found at research.transportation.org.

Safety Tool Tracks and Analyzes Road Improvement Projects

LOUISIANA

Louisiana Department of Transportation and Development needed a tracking method to improve decision-making for highway safety projects. A literature search revealed that buying and customizing an off-the-shelf software package was not feasible, so the agency decided to develop its own software system in-house.

The resulting Louisiana Safety Evaluation Tool (LaSET) is a web-based data management application. It allows detailed tracking of low-cost road safety enhancements—including signage and pavement marking improvements—and gives engineers the ability to analyze the projects' safety benefits (such as crash reductions).

Because LaSET is web-based, it is accessible on desktop computers as well as on tablets in the field, and does not require software installation. Standardization of project data entry and validation rules help ensure data accuracy and consistency. Moreover, LaSET's dual functionality allows users to both collect project data and perform analyses without access limitations.

Project data will grow over time as new safety improvements are implemented on Louisiana's roadways. As the state gains data on the crash reduction effectiveness of different safety treatments, LaSET will become an increasingly valuable tool to help engineers make accurate and cost-effective safety improvement decisions. [Final report](#).

Site Improvements

Project: H.009791 / Site: 16-1-1 AND 61-0429-28

Signs:

Sign	Sign name	Sign code	Sign height(inch)	Sign width(inch)
	ADVISORY SPEED (ENGLISH)	W13-1	24	24
	CHEVRON ALIGNMENT	W1-8L	30	24
	CHEVRON ALIGNMENT	W1-8R	30	24

Source: Louisiana Department of Transportation and Development

LaSET allows users to track low-cost roadway improvements over time and analyze their effectiveness.

Motorists Yield More to Pedestrians with In-Street Signs

MICHIGAN

Pedestrian safety is a top priority for Michigan DOT, but consistently getting drivers to yield to pedestrians in crosswalks is an ongoing challenge. Highly effective countermeasures that encourage drivers to yield include rectangular rapid-flash beacons (\$20,000 per installation) and pedestrian hybrid beacons (\$100,000 per installation)—both too expensive for widespread use. Michigan DOT needed an effective but less expensive solution.

A series of studies evaluated a gateway configuration of in-street pedestrian crossing signs, designated as R1-6 signs by FHWA. The gateway arrangement consisted of an R1-6 on the centerline, on both edges of the roadway, and on the lane lines for multilane roads. This treatment was installed at a variety of sites, including nonsignalized intersections, traffic circles, midblock crossings, and interstate ramp entrances.

Without the gateway treatment, many locations had driver yield rates of less than 10 percent. After installation, yield rates increased to more than 90 percent in some circumstances. The gateway also had a traffic calming effect, slowing overall speeds.

Michigan DOT published a user guide to aid in implementation of the gateway treatment in different traffic configurations. This innovative signage approach is highly cost-effective, with a price of \$1,200–\$1,800 per installation, and is appropriate with speed limits of 30 mph or less, or 35 mph with annual daily traffic counts below 12,000. [Research brief](#).

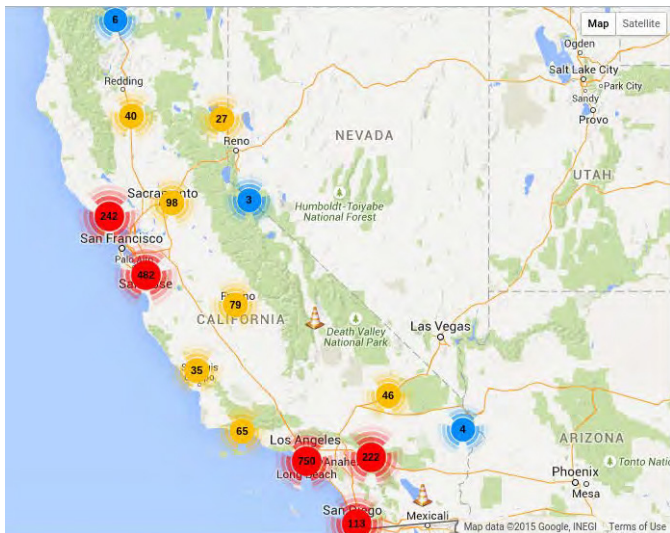


Source: Michigan DOT

Four in-street signs comprise one version of the gateway pedestrian crossing configuration.

Data Tools Address Work Zone–Related Injuries and Fatalities

CALIFORNIA



Source: California Department of Transportation

The work zone accident database includes a mapping tool to visualize data.

for a period of five years (2006-2010). Extracted data from these reports was codified in terms of factors and outcomes. These were made part of a decision support system designed to allow analysis of the data that can be used for planning and management of work zone operations to improve worker and motorist safety. [Research brief](#).

Developing mitigation measures is vital in improving work zone safety both for roadway workers as well as the traveling public in California and nationwide. Developing such measures, however, requires detailed data on the characteristics of these accidents and injuries produced in them, as well as injury cost models that can be used for cost-benefit assessments.

Although there are existing databases and data sources, such as California’s Statewide Integrated Traffic Records System, the National Highway Traffic Safety Administration’s Fatality Analysis Reporting System database, and California Department of Transportation’s Traffic Accident Surveillance and Analysis System, none can provide the information that would justify particular mitigation measures or allow cost-benefit analysis.

Caltrans initiated a research project to develop such data, codify and classify it in terms of factors and outcomes, and provide analysis tools in terms of injury costs. The effort involved collecting, codifying, and classifying all traffic collision reports for accidents occurring near a work zone from 12 Caltrans districts

Alternatives to Raised Pavement Markers May Improve Safety

NEW JERSEY

New Jersey DOT uses raised pavement markers (RPMs) along all centerlines and skip lines. Because of the widespread use of RPMs, the agency was interested in better understanding their safety benefits and whether other treatments were equally effective.

Researchers examined safety benefits of RPMs for different road classifications and traffic factors. They also investigated lower-cost alternatives and modifications as well as ways to optimize installation, monitoring, and maintenance for cost-effective safety improvement.

A comprehensive literature review showed a range of outcomes for how RPMs impact safety. Researchers explored alternatives to RPMs, such as rumble strips and traffic tape, finding that rumble strips had an estimated 19 percent crash reduction capability, while RPMs showed only an estimated 6 percent. RPMs also had a high cost per crash reduction (\$277), where shoulder rumble strips' cost per crash reduction was minimal (\$34).

The next phase of this project will develop methods for quantifying cost-effectiveness of RPMs and identifying alternatives for specific road and traffic characteristics, providing better information to inform safety decisions for New Jersey DOT.

[Program website.](#)



Source: FHWA

Edge line rumble strips are a cost-effective safety countermeasure.

Data Recorders Provide Information About Serious Vehicle Crashes

CONNECTICUT

Traffic crash investigations collect extensive data from vehicle collision sites, but precrash data and information about some driver actions cannot be gathered through the standard investigation approach. A Connecticut DOT study focused on enhancing crash data collection for serious and fatal crashes using data from a vehicle's event data recorder (EDR)—often called the “automotive black box”—which can provide a comprehensive snapshot of the entire crash, including certain driver actions and vehicle dynamics.

Researchers facilitated two 40-hour EDR training courses for law enforcement officers, who then became certified EDR technicians. Sixty officers across the state were trained to provide regional EDR support for crash investigations.

Researchers then worked with law enforcement to perform a detailed analysis of the original crash reports of several serious crashes and supplement those reports using EDR data to more accurately describe the contributing factors. This data produced valuable information that was unavailable through traditional crash reconstruction techniques; it even affected how one driver was eventually charged. The information and EDR download kits made available from this research will allow Connecticut to develop a more comprehensive database for in-depth crash analysis, helping to improve overall highway safety. [Final report.](#)



Source: Connecticut DOT

A download kit allows trained technicians to collect a vehicle's event data after a crash.

Safety Training Guides Prepare Researchers for Working Near Live Traffic

OREGON

Departments of transportation across the country engage higher education institutions to conduct research, and many projects involve student researchers whose work may include collecting data and conducting tests in or near live traffic. As a result, students are frequently exposed to safety hazards, often with little or no experience on active roadways. Oregon DOT saw that training resources were needed to provide student transportation researchers with knowledge and skills to work safely on roadways.



Reflective apparel helps reduce risk of injury for workers on active roadways.

Researchers developed a [safety video](#) called “Goal One: A Safe Return Each and Every Day” and a companion manual for researchers working on and near active roadways. This resource will provide student researchers with an understanding of the types of hazards present in roadway work areas, how to prepare for working on roadway work sites, and how to conduct roadway work safely.

These tools, together with continued reinforcement of roadway safety principles and procedures, will help student researchers engage in safe practices. The lessons and good habits will serve them in the future as well as in their roles as professional researchers and transportation practitioners. [Final report.](#)

New Protocols Improve Responses to Traffic Incidents

SOUTH CAROLINA

Studies show that every minute a freeway lane is blocked due to an incident creates four minutes of traffic delay, and the likelihood of a secondary crash increases the longer the primary crash remains a hazard. Of the 219 fatal crashes on South Carolina interstates from 2012 through 2014, about half took more than six hours to clear.

South Carolina DOT conducted research to examine how to enhance its use of Incident Command System (ICS) protocols and incorporate Traffic Incident Management (TIM) best practices to effectively clear incidents on the interstate. The study found that states using enhanced ICS and TIM procedures consistently clear major incidents in 90 minutes or less. Research identified four areas in need of improvement in South Carolina: towing, hazardous materials, coroner procedures, and crash investigation.

Investigators examined other states’ TIM best practices, and the state plans to implement new ICS protocols in each area. The effort also included a partnership between South Carolina DOT and the South Carolina Department of Public Safety to conduct TIM training sessions for about a third of the state’s first responders. South Carolina DOT will continue to explore ways to implement this research to quickly clear traffic incidents. [Final report.](#)

Incident Response Level	Assessment Criteria					Agency Responsible for Establishing Unified Command
	# of Lanes Blocked?	Injuries?	HAZMAT Spill?	Fire?	Multiple Agency Reponse Needed?	
Level 1	None	None (O)	No	No	No	Law Enforcement
Level 2	1	Minor (C)	Vehicle Fluid Spill Only	No	No	Law Enforcement
Level 3	2 (or more)	Severe (A,B)	Vehicle Fluid Spill Only	Threat	No	Fire Rescue
Level 4	ALL	Fatality (K)	Yes	Yes	Yes	Fire Rescue

Source: South Carolina DOT

Quick assessment based on a few important criteria helps clear an incident and restore traffic operations.

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Access the electronic edition of this document with project links, as well as more high-value state DOT research projects, at AASHTO’s research website, research.transportation.org.