

# SAFETY

## Research 2019

### Innovations from State DOTs

#### Priority Hotspot Maps and Mitigation Actions Reduce Animal-Vehicle Collisions

##### NEVADA

A combination of human population growth, additional roads, and increased traffic in Nevada has led to more than 500 reported annual animal-vehicle collisions—a threat to motorist safety that costs the state between \$19 and \$21 million a year. A Nevada Department of Transportation (NDOT) study therefore sought ways to mitigate this crash risk to travelers, wildlife, and livestock.



Wildlife overpass at Pequop Summit over I-80.

Using a dynamic geographic information system tool, researchers analyzed 10 years of crash data to generate georeferenced maps of priority “hotspot” locations, ranked by where collisions are most likely to occur. In addition to highlighting areas that still need mitigation, the maps validated NDOT efforts that were already underway, such as a Pequop Summit (#1 hotspot location) project that installed 10 miles of wildlife fencing and overpasses/underpasses for animal crossings.

The research project also produced a valuable report describing which animal species pose the biggest threat to motorists, as well as an implementation plan with near- and long-term actions NDOT should take to protect Nevada’s roads against animal-vehicle collisions. This report will not just be a product that sits on a shelf, but will instead serve as a long-range tool that NDOT can use early in its planning processes to integrate wildlife mitigation into future roadway projects—thereby reducing engineering and construction costs. The agency anticipates the study findings will be valid for the next 10 years and that implementation and adoption of these mitigation efforts will reduce the number of animal-vehicle collisions by as much as half, saving Nevada an estimated \$10 million annually. **Final report.**

#### The five 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 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 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 bridges/structures and hydraulics research complement *Research Makes the Difference 2019*, a compilation of award-winning transportation research across all fields. All of these publications may be found at [research.transportation.org](http://research.transportation.org).

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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](http://research.transportation.org).

# Pre-Task Safety Tool Helps Protect Highway Workers

## KENTUCKY

Although highway construction and maintenance crews work in dangerous environments, existing safety standards and practices have not adequately addressed the unique risks they face. To improve the safety of its highway employees, the Kentucky Transportation Cabinet (KYTC) decided to develop a data-driven, electronic pre-task safety tool that maintenance crews can use before conducting common workday operations. Not only does the tool increase workers' awareness of potential worksite hazards, but it also provides safety controls that can reduce their risk of encountering these hazards altogether.

The foundation for the safety tool is an in-depth study that analyzed 10 years (2005–2015) of data on KYTC workplace incidents to identify frequent hazards and the reasons they occur. The findings showed that human factors and ergonomics—two hazards that currently lack robust guidance or safety standards—pose significant risks to highway workers.

With its simple interface, the pre-task safety tool is ideal for KYTC foremen or supervisors who must brief employees on specific workday activities, including anticipated hazards and measures to mitigate against them. An evaluation showed that workers who participated in a pre-task safety tool talk engaged in 33 percent safer behaviors than those who did not. Moreover, these briefings resulted in a 22 percent improvement in worker's safety knowledge, 23 percent improvement in hazard identification skills, and 22 percent improvement in hazard prevention knowledge. As data become available, KYTC plans to expand the tool to include all maintenance operations. [Research report.](#)



*KYTC's Pre-Task Safety Tool provides maintenance task information and injury statistics for safety talks.*

# Virtual Reality Enhances Highway Worker and Public Safety

## IOWA



*The public experiencing distracted driving situations in an immersive virtual reality environment at an Iowa State Fair booth.*

Innovative virtual reality technology is helping the Iowa Department of Transportation (DOT) drive home the life-saving aspects of work zone safety and seat belt use—a feat that not even decades of research has been able to fully accomplish. The agency worked with Iowa State University's Virtual Reality Application Center and the University of Iowa's Center for Computer-Aided Design to create two virtual reality scenarios: "Work Zone Safety Demonstration" and "Buckle Up for Life."

The first scenario places viewers in a work zone and exposes them to heavy traffic conditions and construction noises. Immersed in this environment, viewers gain awareness of the safety issues that highway workers must contend with every day on the job.

The second scenario simulates low- to moderate-impact crashes. *(continued...)*

## Virtual Reality Enhances Highway Worker and Public Safety

*(...continued)*

In the role of Santos—a virtual human who has been featured in previous vehicle analysis, ergonomic, and military simulations—viewers get a firsthand look at how seat belts are critical for properly positioning a driver to sustain airbag impacts during a crash. The simulation also demonstrates how a severe head-on collision affects a belted versus unbelted driver.

Iowa DOT deployed its virtual reality applications at multiple venues, including the 2018 Iowa State Fair, Farm Progress Show, and Innovations in Transportation Conference. The agency has also already scheduled future deployments at events throughout the state. Utilizing virtual reality environments to engage the public and reinforce traffic safety messages could help save lives by providing a controlled experience of the consequences of distracted driving. Thanks to the success and lasting impression of its current efforts, Iowa DOT is developing several new virtual reality scenarios. [Article](#).



*A distracted driver in a work zone as represented in an immersive virtual reality environment.*

Source: Iowa DOT

## Cross-Border Connected and Automated Vehicle Use Could Save Lives

### NEW ENGLAND

Two innovative transportation technologies are gaining traction nationally for their ability to enhance roadway safety and efficiency: connected vehicles (CVs) and automated vehicles (AVs). CVs are equipped with wireless devices that allow drivers to warn others about hazards on the road, while AVs do not require manual driver input for some or all safety-critical functions. CVs/AVs could lead to fewer collisions, fatalities, and injuries, and connected automated vehicles equipped with both technologies present an opportunity for even greater risk reductions.

Given these potential benefits, New England is actively pursuing CVs/AVs. However, rolling out these technologies in the region is no easy task. Every year, over 1 million vehicles cross state borders via New England's 22 limited-access highways. Cross-border travel, data sharing, and vehicle standards were concerns to the six New England transportation agencies as they explored CV/AV deployment in their respective states—which each have their own governing structures, constituents, and priorities, as well as varying levels of executive buy-in and public interest. So they came together on a New England Transportation Consortium (NETC) project to identify the best path forward for widespread CV/AV use.

After determining multi-state issues and preliminary actions for CV/AV testing and deployment, NETC researchers hosted a stakeholder workshop to identify challenges and collaborative opportunities in New England. The research results informed the creation of a roadmap of actions the states should take to facilitate CV/AV implementation, including a list of potential regional initiatives.

In addition to promoting policy changes and cost savings in New England, this project could provide safer roadways and much-needed public education about the benefits of CV/AV implementation. Moreover, the six states will continue to meet regularly and plan to conduct five more projects identified during this research. [Project web page](#).



Source: NETC

*NETC stakeholders meet to compare efforts between states and identify areas where states benefit from cross-border collaboration.*

# Sidepath Design Guidebook Reduces Bicycle Crash Risks

## MICHIGAN

Given their severe vulnerability to collisions with vehicles, bicyclists and pedestrians in Michigan expressed high demand for sidepaths they could use to safely travel next to state roads. A Michigan Department of Transportation (MDOT) research study—consisting of a public survey and in-depth crash analysis—focused on understanding these residents’ concerns about sidepath usage and how designs could be improved to increase public safety.

Researchers analyzed six years of bike-crash data from sidepaths in two Michigan counties, assessing the impact of variables such as design, land use, traffic volume, and speed on bicyclist crash risks. The findings showed that riding against traffic or through signalized intersections increases risks, and that intersection collisions with left- or right-turning vehicles are more likely. In response to the survey, more than 300 residents shared their safety concerns, behaviors, and attitudes toward bicycling, as well as their preferences for bike infrastructure designs.

Equipped with these research results, MDOT developed the *Sidepath Intersection and Crossing Treatment Guide*. This straightforward guide provides planners, designers, and engineers with best practices for creating high-quality sidepaths, as well as a methodology for integrating them into existing roadway projects. In addition to explaining how to select a sidepath that best fits a specific roadway or highway, the guide also includes principles that should be applied to reduce the major bicyclist risks identified during the crash analysis. MDOT will use the materials created through this project to develop, implement, and evaluate targeted bicycle safety campaigns throughout Michigan. **Final report.**

### Common Sidepath Crash Types

**CRASH ANALYSIS FINDINGS**

A statistical analysis of sidepath crashes in Michigan found two statistically significant patterns in crashes.

**RIDING AGAINST THE DIRECTION OF TRAFFIC**

- Sidepaths are two-way facilities, yet bicyclists riding against traffic are at higher risk of a crash than those riding with traffic.
- Specifically, bicyclists riding against traffic have a higher risk of crashing with right-turning vehicles than those riding with traffic.
- Bicyclists riding against traffic have a higher crash risk at commercial driveways and signalized intersections than those riding with traffic.

**AT INTERSECTIONS**

- Bicyclists riding through signalized intersections—which generally have higher amounts of vehicle traffic—have a higher crash risk than at intersections with other types of traffic control.
- At intersections, sidepath bicycle crashes tend to occur with turning vehicles.

See more information, including tips on how to avoid these types of crashes: [www.michigan.gov/mdot-sidepathresearch](http://www.michigan.gov/mdot-sidepathresearch)

MDOT Michigan Department of Transportation

A statistical analysis of sidepath crashes in Michigan found that riding against the direction of traffic and at intersections increases crash risks.

### Sidepath Design Best Practices

**HIGHLIGHTS**

Designers may reduce crash risk for bicyclists by raising the visibility of bicyclists going in both directions, establishing priority, and reducing speed. Following are some examples of how this can be achieved through treatments such as signs, truck aprons, and raised crossings.

- STANDARD SIGNS**  
Providing clear signs and pavement markings warns motorists of a bicycle conflict. The guide shows applicable regulatory, sign, and warning signs related to sidepaths and provides suggestions on when they should be used.
- NON-STANDARD SIGNS**  
An option for warning motorists of conflict is the R10-12b sign, which is usually found at signalized locations. Use of this sign at unsignalized intersections will require FHWA approval.
- RAISED CROSSINGS**  
Creating a raised crossing encourages drivers to slow down and pay more attention to the crossing, helping to achieve the desired vehicle speed and driver awareness.

**EXAMPLE INTERSECTION**

There are many designs for roads and sidepaths that improve safety for bicyclists. This example intersection graphic shows several treatments that designers may employ.

- In this example, the **stop sign** for drivers gives bicyclists the priority through the intersection. At signalized intersections, this can be achieved using a **dedicated bicycle signal phase or leading interval**, depending on vehicle volumes.
- A **sign** warns motorists to look for sidepath users ahead.
- The **curb radii** entering and exiting the intersection are reduced to slow vehicles and increase motorist yielding. The truck apron shown allows for truck movements. The **offset distance** between the sidepath and the motorist travel lane is increased to slow vehicles.
- The **raised crossing** is designed to slow motorists by requiring them to ramp up to the sidepath. This design also provides a level crossing for the sidepath users.
- While **intersection pavement markings** are provided to alert drivers of the potential for crossing bicyclists.

See more information: [www.michigan.gov/mdot-sidepathresearch](http://www.michigan.gov/mdot-sidepathresearch)

MDOT Michigan Department of Transportation

Drivers and bicyclists find the sidepath to roadway separation to be more comfortable.

### Sidepath Intersection & Crossing Treatment Guide

MICHIGAN DEPARTMENT OF TRANSPORTATION  
June 2018

Prepared by:  
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MDOT  
Michigan Department of Transportation

MDOT’s Sidepath Intersection and Crossing Treatment Guide.

Source: MDOT