



## TECHNICAL SUMMARY

### Technical Liaison:

Todd Haglin, MnDOT  
Todd.Haglin@state.mn.us

### Project Coordinator:

Deb Fick, MnDOT  
Deb.Fick@state.mn.us

### Principal Investigators:

Nichole Morris and Curtis Craig,  
University of Minnesota

### LRRB COST:

\$59,158

### TOTAL PROJECT COST:

\$200,638



In a common type of close call, the dark car shown here fails to merge until it is too close to the work zone, forcing the silver car out of its lane.



DEPARTMENT OF  
TRANSPORTATION

RESEARCH SERVICES & LIBRARY

# A New System for Reporting Driver Intrusions into Work Zones

## What Was the Need?

Nationwide from 2005 to 2010, 733 highway crew workers lost their lives, with approximately half of these deaths resulting from motorists intruding into work zones. Motorists are also injured and killed in intrusion crashes. Reducing work zone intrusions is an important step toward meeting Strategic Highway Safety Plan priorities and Toward Zero Deaths goals in Minnesota.

A [2015 MnDOT research synthesis](#) revealed that while data is widely collected on work zone intrusions that result in injuries or deaths, only three states collect data on near misses that do not result in crashes. Minnesota transportation agencies had a clear need for an effective reporting system to collect near-miss data that could be used to improve the design and operation of work zones. An existing online crash reporting form, [MNCrash](#), provided a starting point for designing a work zone intrusion report.

## What Was Our Goal?

The goal of this research project was to develop and test an efficient, comprehensive and user-friendly reporting system for intrusions into work zones. It was essential for the system to be accepted by highway workers. The information collected from the system, which was modeled after the existing MNCrash report, would then be used to examine risk factors to reduce intrusions and danger to workers. Safety data would be relayed back to workers and to MnDOT managers, providing an empirical basis for design changes to work zones, as well as future policy recommendations to the state government.

## What Did We Do?

To design a usable system for reporting work zone intrusions, research designers had to:

- Understand the characteristics of the typical system user (in this case, the work zone supervisors and crew).
- Develop common or typical intrusion scenarios to realistically test the system.
- Conduct iterative testing with typical users (supervisors and crew members) and incorporate revisions based on test results.

The research team interviewed work zone supervisors from rural and urban truck station locations across the state: in Baxter, St. Cloud and Duluth and at Cedar Avenue near Minneapolis-St. Paul. Researchers sought to learn what crews and supervisors considered an intrusion and what they thought should be reportable elements of the intrusion, such as the work zone layout, weather, location, time, visibility, road conditions and maneuvers of the intruding vehicle.

Researchers used information gathered from the interviews to develop four typical intrusion scenarios—which were reviewed and revised by MnDOT supervisors—and used these scenarios to test the prototype reporting interface. Then they conducted usability tests with these scenarios and with actual intrusions that crews had experienced. Users suggested changes to the report format throughout the process.

*Researchers developed a comprehensive, user-friendly system for road crews to report motorists' intrusions into highway work zones that do not result in injury or death. Data from the system may be used to change work zone design and policies, reducing the risk of injury and death from intrusion crashes.*

*“To reduce work zone intrusions and make work zones safer, we need to track and analyze the intrusions. This reporting system will generate the data we need to make smart changes and possibly to influence legislative policy.”*

—Todd Haglin,  
Emergency Management  
and Safety Manager,  
MnDOT Office of  
Administration

*“This collaboration resulted in a fast, efficient and easy-to-use system because crews and supervisors let us know throughout the process exactly what they needed to consistently report work zone intrusions.”*

—Nichole Morris,  
Director, University of  
Minnesota HumanFIRST  
Laboratory

**Produced by CTC & Associates for:**

Minnesota Department  
of Transportation  
Research Services & Library  
MS 330, First Floor  
395 John Ireland Blvd.  
St. Paul, MN 55155-1899  
651-366-3780

[www.mndot.gov/research](http://www.mndot.gov/research)



A challenge in designing a work zone layout is to clearly guide motorists around or through the zone with sufficient approach to allow drivers to reduce speed and understand where to go.

Crews and supervisors collaborated with researchers during three rounds of testing, revising the reporting interface after each round. An online beta version had been supplemented with a paper version. Both versions were revised through this iterative design process.

### What Did We Learn?

This design approach allowed the research team to produce a report interface incorporating the very specific needs of the work zone crews and supervisors:

- The third major revision split the report decision flow into two options—a shorter report and a comprehensive report—based on whether the intrusion presented a risk to the crew. Without this revision, intrusions that workers considered minor were not likely to be reported.
- Researchers surveyed users of the system with each revision. Supervisors liked the drop-down menus, the comprehensiveness of the system and its ease of use. They rated the final revision as good in terms of usability, ease of use and time to completion (five to six minutes on average).
- The final design version was tested using a laptop, tablet and paper. Multiple reporting options made it more likely that workers and supervisors would quickly report data about a work zone intrusion before details were forgotten.

### What's Next?

Supervisors and workers involved in the design process gave high marks to the final version of the reporting system. The design is considered complete. Researchers had created the interface as a free-standing program, using the University of Minnesota's digital resources to build and evaluate their design. For this reporting system to be made available for use by MnDOT and other agency workers, MnDOT must engage MNIT, the state's information technology professionals, to determine where the system will reside and to integrate it into the state's existing computer platform.

---

*This Technical Summary pertains to LRRB-produced Report 2018-09, “Work Zone Intrusion Report Interface Design,” published February 2018. The full report can be accessed at [mndot.gov/research/reports/2018/201809.pdf](http://mndot.gov/research/reports/2018/201809.pdf).*