



RESEARCH PROJECT CAPSULE [16-5SA]

September 2016

TECHNOLOGY TRANSFER PROGRAM

Highway Work Zone Construction Safety Research and Training: A Driving Simulator Study

JUST THE FACTS:

Start Date:
July 1, 2016

Duration:
30 months

End Date:
December 31, 2018

Funding:
SPR: TT-Fed/TT-Reg

Principal Investigator:
Yimin Zhu, Ph.D.
Professor, Department of Construction
Management
Louisiana State University

Administrative Contact:
Tyson Rupnow, Ph.D., P.E.
Associate Director, Research
225-767-9124

Technical Contact:
Elisabeta Mitran, Ph.D.
Research & Technical Assistance Manager
225-767-9129

Louisiana Transportation
Research Center
4101 Gourrier Ave
Baton Rouge, LA 70808

Sponsored jointly by the Louisiana
Department of Transportation and
Development and Louisiana State
University

POINTS OF INTEREST:

*Problem Addressed / Objective of
Research / Methodology Used
Implementation Potential*

PROBLEM

According to the National Work Zone Safety Information Clearing House (<https://www.workzonesafety.org/>), a total of 7,344 nationwide motor vehicle fatalities in highway construction or maintenance work zones were reported from 2005 to 2014. In Louisiana, 155 motorists were killed in work zones during the same period of time. Between 2003 and 2014, a nationwide total of 1,438 construction worker fatalities occurred in highway work zones, of which 21 were in Louisiana. If non-fatal injuries are also considered, the social and economic impact of work zone safety is much broader and more significant.

A work zone is defined as an area of roads or highways where maintenance, construction or utility-work activities take place. Regardless of how well traffic control is planned, construction workers in highway work zones are particularly vulnerable because of the changing work environment, driver errors, weather and many other factors.

Highway work zone safety issues related to motorists or workers have been studied extensively, but often separately, in different contexts. Examples of research on motorist safety in work zones include identification of factors contributing to crashes (e.g., lane closures, construction intensity, length/duration of work zones, traffic conditions, driver behavior, and crash severity). Current studies on worker safety in work zones are focused on implementing effective traffic control plans/devices, and providing better safety training.

Work zone safety analysis and prevention rely on data from crash reports. However, it is often difficult to generalize findings based on such data, due to inconsistent reporting of crash information. Often, the cause of work zone fatalities or injuries is a combination of many factors including driving behavior, work zone configuration, worker safety awareness, and weather. Considering that putting human subjects in potentially dangerous in-situ conditions for work zone safety research and training is risky and unethical, the project team proposes an integrated virtual environment for highway work zone safety research and training.

OBJECTIVE

The objectives of this project are to determine the effectiveness of an integrated virtual environment as a means for studying highway work zone safety, and to evaluate the potential for incorporating the integrated virtual environment in Louisiana's safety training. The effectiveness of the integrated virtual environment will be determined by surrogate safety measures evaluating workers in work zones.

METHODOLOGY

To achieve the stated objectives, the research team will integrate a driving simulator from the LSU Department of Civil Engineering with head mount display (HMD) devices and a treadmill for testing selected virtual work zone environments. The tests will be designed to observe and study the behaviors of drivers and workers simultaneously in different contexts (e.g., varied work zone configurations or weather conditions). The driving simulator will be used to evaluate driver behavior and the HMD device/ treadmill will be used to evaluate worker behavior in the virtual environment. Subjects of both the driver role and the worker role will share the same virtual environment and respond to the same work zone situation.

Analysis of collected data will help the research team to better understand what factors contribute to the effectiveness of an integrated virtual environment for safety training and enhancement of safety awareness.



Conceptual Integrated Virtual Environment

IMPLEMENTATION POTENTIAL

The successful implementation of the proposed virtual integration will provide a promising platform for work zone safety training. This is a critical step for improving safety of drivers and workers, given the high rate of fatalities and injuries in work zones.