The Exploratory Advanced Research Program Fact Sheet

Driving Simulation Forward

Making Driving Simulators More Useful for Behavioral Research

Exploratory Advanced Research . . . Next Generation Transportation Solutions

It is often difficult for highway and traffic engineers to consider complex driver behavior in their designs, but failing to do so can cost lives and, if roadways must be rebuilt, millions of dollars. The aim of "Making Driving Simulators More Useful for Behavioral Research," an Exploratory Advanced Research (EAR) Program project, is to make driving simulators a more reliable tool for highway engineers. The 32-month study, launched by the Federal Highway Administration (FHWA) in 2009, is being conducted by the University of Iowa.

The State of Simulation

The project team believes that whereas existing simulators are valuable research and highway design tools, they are under utilized because of concerns about the sometimes weak relationship between simulator data and on-road data. There is also significant concern about the reliability of simulator data, given that different simulators often produce differing results for similar scenarios and design situations. "There is a problem of mistrust in driving simulators because simulator-based studies frequently produce results that do not match driver performance on actual roads, and even conflicting results at times," explains Chris Monk at FHWA. "This project aims to provide a systematic, design-centered approach to matching simulator data to on-road data and between simulators, filling a longstanding knowledge gap recognized by the driving simulation research community. This is the kind of persistent challenge faced by a research community that can be addressed by the EAR Program. The project is ambitious in its goal to produce mathematical transformation functions relating simulator characteristics to expected on-road performance," continues Monk. "Using this approach will enable the team to address the overwhelming variety of road situations and simulator configurations."

Driving Simulators: Technical Approach

Making driving simulators useful for highway designers requires a system-orientated approach to the design issues that highway engineers face. This project begins with the design issue, relates simulator capabilities to these issues, and recognizes that simulator choice depends on the operational and budgetary demands of the engineering context. The project team began by gathering input from roadway designers to aid in defining necessary simulator characteristics. The next steps will be building common scenarios in a range of simulators so the team can collect data to compare driver performance in a range of simulators to existing on-road performance data. Finally, the team will develop model-based transformations for relating simulator and on-road data. Multiple, converging methods will be applied to assess how the research improves highway engineers' use of driving simulators.

Simulation Challenges

According to the team, a fundamental challenge of this project is its overwhelming scope. "A general understanding of how driver performance in simulators relates to situations experienced in the real world represents one of the 'grand challenges' of driving performance research," explains Monk. This project provides engineers with a method to match simulator capabilities to design issues. Not all simulators can be used to address all design issues—some issues cannot be addressed with simulation at all. The Iowa team is addressing this issue by developing a matrix that relates design issues to appropriate simulator platforms and providing engineers with a method to transform simulator results to match on-road data.

U.S. Department of Transportation
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Future Efforts

"Technological advances are quickly changing the nature of driving," says Monk. "These changes can have either positive or negative effects on traffic safety, driver acceptance, and transportation efficiency. To strive towards technology having a positive effect, experiments are needed to investigate the impact of technologies on driver and roadway safety. These experiments are often only possible in a driving simulator." The Iowa team's goal is to make simulators more practical and useful for design by creating a system to select simulators and reconcile their results. "The outcomes of this project will help researchers to identify and support a range of simulator applications, including vehicle safety system design, highway design evaluations, vehicle driver assessment , and training," continues Monk. "The transformation functions that reconcile simulator data will be a significant step forward in understanding the perceptual and motor control processes that govern driving performance."

Learn More

For more information on this EAR Program project, contact Chris Monk at FHWA, 202-493-3365 (email: chris.monk@dot.gov).

EXPLORATORY ADVANCED **RESEARCH**

What Is the Exploratory Advanced Research Program?

FHWA's Exploratory Advanced Research (EAR) Program focuses on long-term, high-risk research with a high payoff potential. The program addresses underlying gaps faced by applied highway research programs, anticipates emerging issues with national implications, and reflects broad transportation industry goals and objectives.

To learn more about the EAR Program, visit the Exploratory Advanced Research Web site at www.fhwa.dot.gov/advancedresearch. The site features information on research solicitations, updates on ongoing research, links to published materials, summaries of past EAR Program events, and details on upcoming events. For additional information, contact David Kuehn at FHWA, 202-493-3414 (email: david.kuehn@fhwa.dot.gov), or Terry Halkyard at FHWA, 202-493-3467 (email: terry.halkyard@fhwa.dot.gov).

Image other side:
"Night drive in the city"
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