Texas A&M Transportation Institute

Saving Lives, Time and Resources

tti.tamu.edu

TTI DRIVING SIMULATOR

The TTI Center for Transportation Safety is home to a Realtime Technologies, Inc. (RTI) driving simulator that provides measurements of drivers' responses to roadway situations, in-vehicle technologies, and driving-related tasks. RTI's SimCreator® and SimVista® software tools provide a library of different roadway cross-sections and interchanges, as well as a variety of roadway objects, buildings, and ambient traffic. In addition, custom roadway tiles can be programmed to match a specific roadway segment. This allows for in-house development of a wide range of rural and urban roadway scenarios, making it possible to inexpensively test multiple variations and placements of roadway devices or in-vehicle signals and displays. Using the driving simulator, researchers can test a wider variety of roadway geometries and traffic conditions than are typically possible in a test-track study or fiscally practical in a field study.

The driving simulator's hardware includes a quarter-cab buck system with an adjustable driver's seat, accelerator and brake pedals, and steering wheel. Three 48-inch LCD displays (screen resolution 1920 x 1080) provide a 153-degree field of view horizontally and nearly 30 degrees vertically. An Altia configurable display allows for rapid development of customized user interfaces that interact with the RTI simulator software, and additional touch-screen displays can be configured to simulate in-vehicle interactive systems.

The simulator can collect a range of driving data, including vehicle speed and acceleration, lane position, proximity to specified objects or roadway elements, and inputs to the steering wheel, brake, and accelerator pedal. Driving data can be collected at a maximum rate of 60 Hz. Other data collection systems can be used in conjunction with the simulator to provide additional information about driver behavior and responses:

- Eyetracking to record the driver's glance patterns;
- Infrared thermal camera and physiological monitors (heart rate, galvanic skin response) to measure stress responses; and
- Face, hand, and foot cameras to see driver responses that may not be captured by the simulator.

The simulator's automation module can be programmed to simulate varying levels of vehicle automation, from single functions (lane-keeping, adaptive cruise control) to full automation. The steering wheel torque motor can provide a range of force feedback levels to provide the driver with vibration (haptic) alerts, assisted steering, or automated steering.

The driving simulator provides a safe and controlled environment, which is ideal for exploring a wide variety of research questions.

Evaluating Distraction Potential in Connected Vehicle Systems

This project developed test procedures that can be used with production vehicles and nomadic technologies to assess distraction potential and usability of connected vehicle interfaces, and provided guidelines for interpretation and decision making about the testing outcomes. Several in-vehicle displays were incorporated into the simulator environment to replicate potential connected vehicle functions, and researchers recorded and analyzed their effects on driver performance.

Comprehension of Low Bridge Warning Signs

This study examined signing strategies for a low clearance condition that may not be immediately visible to drivers, such as can occur when a low bridge is hidden behind a nearer, higher bridge that is within view of the driver. A simulator study tested drivers' responses to seven warning signs, including their decisions to exit or enter the highway based on the vertical clearance shown on the signs. Participants were also asked the distance to the low clearance point and whether the exit immediately downstream from the warning sign was the last opportunity to exit prior to the low clearance.

Driver Response to Graphical Route Information Panels (GRIP)

The driving simulator was used to test GRIP electronic roadside signs, proposed as a way to provide real-time graphical information about travel time and locations of roadway congestion to drivers. Several different GRIP panel designs were presented to drivers as they drove on a simulated urban freeway. Besides testing participants' ability to process the route information on the signs, the study used eye-tracking cameras to measure the length of time that drivers looked at each sign (and away from the road).

Measuring Driver Responses to Stress

TTI is collaborating with the University of Michigan Transportation Research Institute, University of Houston, and Texas Tech University to conduct a series of studies for the Toyota Economic Loss Settlement Project. The goal of the project is to understand how driver-based and vehicle-based data may be used to detect higher risk driving scenarios that might lead to motor-vehicle crashes. The driving simulator is providing the initial test environment for a variety of driving scenarios designed to induce either sustained or sudden-onset stress in drivers, while their physiological responses are measured using the thermal infrared camera, heart rate monitor, Shimmer galvanic skin response, and eye-tracking.

About TTI

TTI is recognized nationally for its expertise in all modes of transportation and has been extensively involved in mobility research for more than 60 years. The agency's researchers have developed a wide range of solutions to mobility issues, including managed lanes, improved public transportation services and intelligent transportation systems. These studies have successfully assessed potential improvements, enhanced evaluation and prioritization processes, and resulted in the cost-effective implementation of numerous projects to improve mobility and quality of life.

TTI'S MISSION

To solve transportation problems through research, to transfer technology and to develop diverse human resources to meet the transportation challenges of tomorrow.

Contact

Mike Manser
Program Manager
Texas A&M Transportation Institute
College Station, TX 77843-3135
(979) 845-1605
m-manser@tti.tamu.edu
http://tti.tamu.edu

TTI1615.2752.1015