



TTI DRIVING SIMULATOR

TTI's Center for Transportation Safety is home to a Realtime Technologies, Inc. (RTI) driving simulator that provides researchers with a tool to examine driver performance, perceptions and attitudes quickly and in a safe environment. RTI's SimCreator® and SimVista® software tools and library of roadway cross-sections, roadway objects, buildings and ambient traffic allow researchers to develop generic driving worlds in addition to specific roadway segments, such as prototype interchanges. This allows for in-house development of a wide range of rural and urban roadway scenarios, making it possible to inexpensively and quickly 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 structure with an adjustable driver's seat, accelerator and brake pedals, as well as a steering wheel to provide realistic driving controls. 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 dashboard allows for the rapid development of customized user interfaces that interact with the RTI simulator software, and additional touch screens can be configured to simulate in-vehicle interactive systems such as automated driving systems.

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

- Eyetracking to be used as a measure of driver attention and stress;
- Infrared thermal camera and physiological monitors (e.g., heart rate, galvanic skin response) to measure driver stress levels; and
- Face, hand and foot cameras to see driver responses that may not be captured by the simulator.

The simulator's automation driving system can be programmed to simulate varying levels of automation, from Level 1 (lane-keeping, adaptive cruise control) to full automation (Level 4/5). 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 driver-, vehicle- and infrastructure-related research questions.

Evaluating How to Train Drivers on the Use of Automated Driving Systems

A critical issue associated with the increased deployment of automated driving systems is how drivers should be trained on their use to optimize understanding and safety. This project compared the effectiveness of traditional instructor-led and novel video-based training protocols for a Level 2 system against a no-training condition; both methods represent realistic future training deployments. Drivers responded to typical Level 2 system changes including takeover requests when the system no longer effectively detected poor quality lane lines. The project findings informed the development of training guidelines to be used by state and commercial training agencies.



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, a proposed medium 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. The study evaluated drivers' ability to process the route information on the signs and examined their driving reactions.



Measuring Driver Responses to Stress

TTI collaborated 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 was to understand how driver-based and vehicle-based data could be used to detect higher risk driving scenarios that might lead to motor-vehicle crashes. The driving simulator provided 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 such as stress were measured using the thermal infrared camera, heart-rate monitor, Shimmer galvanic skin response, and eye-tracking.

TTI's Mission

TTI delivers practical, innovative and sustainable solutions to improve the movement of people, data and goods through research, education and technology transfer.

Contact

Mike Manser

Human Factors Program Manager
Center for Transportation Safety/Human Factors Program
Texas A&M Transportation Institute
The Texas A&M University System
TAMU 3135
College Station, TX 77843-3135
(512) 407-1172
m-manser@tti.tamu.edu
tti.tamu.edu/facilities/driving-simulator/