



# HUMAN CENTERED SYSTEMS LABORATORY FACT SHEET

*Research that is Essential, Indispensable, and Connected to our Customers.*

## PURPOSE

The Human Centered Systems (HCS) Laboratory aids the design of a safe and efficient roadway infrastructure through the analysis of driver and pedestrian behavior.

## DESCRIPTION

Using a wide range of testing facilities, the laboratory conducts research into a broad spectrum of geometric, traffic control, and operational issues, as well as the effects of these elements on drivers and pedestrians. This range of facilities allows researchers to choose the technically appropriate and most cost-effective tool to meet a particular study need. Participant behavior in challenging roadway conditions is observed and documented in specialized environments to elicit user preferences, gather baseline data, analyze complex roadway issues, and test hypotheses in safe, controlled settings. The HCS team works with transportation engineers to define and implement a research approach for specific roadway issues.

## MAJOR COMPONENTS

- The **SignSim** employs back-projected slide projectors with zoom capability to investigate how roadway users recognize, interpret and respond to signs and other traffic control devices.
- The **Part-Task Simulators** include driving simulators, VidSim and RoadSim,

which display video-generated imagery of roadway environments. VidSim uses three large screen television monitors placed around a driving buck and allows examination of a wide range of situations and devices including navigation displays, skewed intersections, and curve-headway perception. RoadSim provides an interactive driving experience with a PC-based desktop driving console, a monitor display, steering wheel, and foot controls. Most standard or customized driving scenarios can be quickly programmed in RoadSim. Scenarios range from residential and business areas to multi-lane highways.

- The recently updated **HySim** provides fully interactive driving simulation with a full car cab positioned in front of a 120-degree curved screen. The projected image of the roadway responds to the driver's steering and accelerator/brake pedal inputs. The simulation is enhanced using vehicle motion, vibration, and sound.
- The **Field Research Vehicle** is a self-contained automobile that provides researchers with the ability to take their experiments on the road. It is equipped with a reconfigurable dashboard that incorporates LCD display panels in lieu of conventional displays for speed, fuel, turn signals, etc. The LCD panel also provides navigation information that is updated by a differential global positioning system satellite receiver located

in the vehicle. Multiple camera views of the driver and the roadway are recorded, in addition to acceleration and steering wheel movement.

## SPECIAL CAPABILITIES

A distinguishing feature of the laboratory is that the major components complement each other and provide the means to study complex issues in a sequential, progressive manner. The facilities are cost-effective because initial investigations are conducted in the less costly facilities (e.g., SignSim, VidSim), and are then refined for further iterations in the HySim or Field Research Vehicle. Each of the facilities has unique capabilities to investigate particular aspects of driver performance. For example, the VidSim can be used for a variety of purposes, including as a test bed for prototyping in-vehicle displays; the HySim obtains measures of driver performance under varying, but safe, conditions; the Field Research Vehicle extends research to a real driving environment.

## PRODUCTS/SERVICES

### Recent Activities

- Evaluated signs for the 2000 edition of the *Manual on Uniform Traffic Control Devices* (MUTCD).
- Investigated and analyzed driver perceptions of horizontal curves.
- Examined the comprehension of alternative pedestrian signal lenses.

*The Turner-Fairbank Highway Research Center (TFHRC) has more than 24 laboratories for research in the following areas: safety; operations, including intelligent transportation systems; materials technology; pavements; structures; and human centered systems. The expertise of TFHRC*

*scientists and engineers covers more than 20 transportation-related disciplines. These laboratories are a vital resource for advancing this body of knowledge created and nurtured by our researchers. The Federal Highway Administration's Research, Development, and Technology*

*Service Business Unit operates and manages TFHRC to conduct innovative research to provide solutions to transportation problems both nationwide and internationally. TFHRC is located in McLean, Virginia. Information on TFHRC is available on the Web at [www.tfhrc.gov](http://www.tfhrc.gov).*

- Compared the responses of older and younger driver to emergency driving events.
- Compared visual and auditory route guidance displays.

#### ***Current Activities***

- Analyzing path and speed in two-lane roundabouts.
- Comparing timing sequences for pedestrian countdown signals.
- Analyzing detection and recognition of fluorescent traffic signs.
- Determining acceptable speeds from the non-motorist's perspective.
- Analyzing speed hump warning signs and markings.
- Examining luminance versus intensity for the measurement of LED traffic signals.

#### ***EXPERTISE***

The laboratory is staffed by the HCS Team, which comprises research psychologists, transportation engineers, and technical/test engineers.

#### ***LAB PARTNERS***

- ***FHWA Field Offices*** The Human Centered Systems Laboratory provides information to field personnel.
- ***Intelligent Vehicle Initiative (IVI) Program*** The laboratory has provided input to driver-centered guidelines for a variety of in-vehicle devices.
- ***Operations Core Business Unit (CBU)*** The laboratory regularly investigated driver

comprehension and recognition distance for alternative versions of signs at the request of the Operations CBU for input into the MUTCD process. Laboratory personnel, in support of the Operations CBU, also review and comment on experimental plans from States.

- ***Pedestrian and Bicycle Program*** The laboratory performs research on road-user understanding of pedestrian signal designs.
- ***Run-Off-the-Road Program*** The laboratory performed a series of experimental and analytical tasks to help define and understand factors in curve design as they relate to driver perception of and response to curves.

