

## TTI FACILITIES FOR HUMAN FACTORS RESEARCH



### Driving Simulator

The Texas A&M Transportation Institute (TTI) Human Factors Group is home to a portable desktop driving simulator that provides measurements of driver responses to roadway situations. The Real Time Technologies system allows in-house development of new roadway scenarios. The desktop setup allows testing of drivers with a wide variety of driving experience. Most simulators are in a fixed location

so research participants can only be attracted from the city where the simulator resides. The portability of the new simulator allows researchers to gather data from geographically and demographically diverse locations.

A driving simulator provides a safe and controlled environment to further explore comprehension and compliance in response to traffic control devices. In the simulated environment it is possible to inexpensively test multiple variations of the design and placement of a new device. In addition, a wider variety of roadway geometries and traffic conditions can be tested than are typically available in a test-track study or fiscally practical in a field study.

The simulator also provides a platform to evaluate driving distraction and driver interaction with in-vehicle technologies.

### Closed-Course Driving Facilities

#### Riverside Facility

Human factors and safety studies are conducted at the Proving Grounds Research Facility at the Texas A&M University Riverside Campus, a 2,000-acre complex of research and training facilities situated 10 miles northwest of the university's main campus. The site has large expanses of concrete runways and parking aprons that are ideally suited for experimental research and testing in the areas of vehicle performance and handling, visibility, distracted driving, and driver training.

The Riverside Campus also houses the TTI rain course. This 2,000-foot section of paved, flat roadway is equipped to provide two realistic levels of rainfall across one travel lane and has been used to test pavement-marking visibility in wet weather.



#### Pecos Research and Testing Center

The Pecos Research and Testing Center is a collaboration between TTI, Applied Research Associates and the Pecos Economic Development Corporation.

The site contains a 9-mile, circular high-speed track and a 10-mile, two-lane roadway for lower speeds. Other buildings on the property include a 30-bay garage, administrative offices and storage space. The center is located 22 miles southeast of Pecos and about 80 miles from the Midland-Odessa International Airport. The dry, seasonable climate of Pecos enables year-round research and testing.



### Highlander Instrumented Research Vehicle

A 2006 Toyota Highlander serves as TTI's on-road research vehicle. The principal system within the instrumented vehicle is the Dewetron DEWE5000 data-acquisition integration system. Essentially a large portable computer, the DEWE5000 serves as the data-acquisition device for all the peripheral systems in the vehicle. The data collection is performed in a virtual environment within Dewesoft version 6.2, an acquisition and post-processing software package made by Dewetron.

A Trimble DSM232 global positioning system (GPS) is used to track the position of the subject vehicle. It employs a differential GPS antenna, which is mounted on the roof of the vehicle directly over the driver's seat.

An Assistware SAFETRAC system tracks the lateral lane position of the vehicle, as well as the lane width and lateral velocity, through the combination of a forward-looking video camera and sophisticated image-processing software. Three potentiometers are used to monitor the position of the brake pedal, gas pedal and steering wheel.

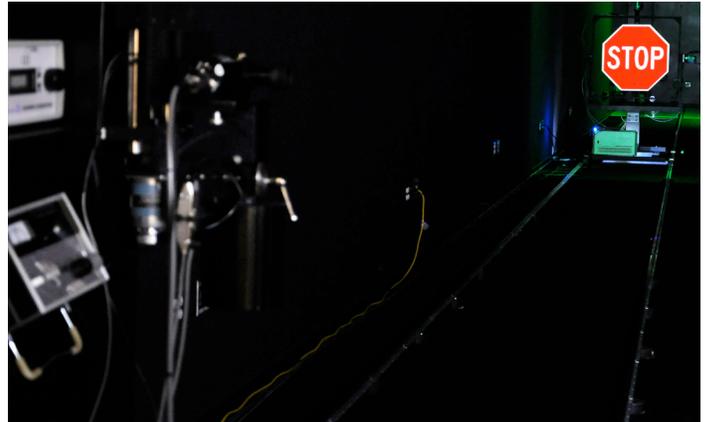
## Eye-Tracking Equipment

The faceLAB® eye-tracking system is driven by software, which is installed on a portable laptop host computer. The faceLAB® system is desktop or dashboard mounted, rather than the more traditional head-mounted.

The faceLAB® hardware uses a small pod aimed at the subject's face to illuminate the face and eyes with infrared light. The amount of light is well within the safe limits of exposure and is almost indiscernible. The image of the subject's face is captured by two small cameras equipped with filters designed to allow only infrared light to pass through. The images from each of these cameras are transmitted to the faceLAB® software for processing, where a calibration process allows the software to mathematically map the pupil's location and unique facial features to determine the subject's point of gaze. TTI has two faceLAB® eye-tracking systems that can be linked together to expand the field of view that the eye-tracking cameras can capture.

The ViewPoint EyeTracker® uses small infrared cameras and infrared lights attached to the EyeFrame™ hardware. Similarly to the faceLAB® system, the cameras detect the reflection of infrared light from the irises of the eyes and the contrasting lack of reflection at the pupil. A calibration process allows the ViewPoint software to map the pupil's location to determine the point of gaze. This eye-tracking system is particularly useful to view long distances in nighttime driving studies.

A 45-foot-tall calibration grid on the exterior of a former airplane hangar at the Texas A&M Riverside Campus allows the eye tracker to be calibrated to each subject from a longer distance, vastly increasing the long-range accuracy of the predicted point of gaze. Previous research has detected lateral glances relating to accuracies lower than 0.5 from as far away as 1,000 feet in nighttime conditions.



## Visibility Research Laboratory

TTI has a wide array of photometric equipment that can be used for visibility and photometric research with human subjects.

TTI's State Headquarters and Research Building in College Station, Texas, includes a Visibility Research Laboratory range measuring 15 feet by 125 feet. The laboratory can be used to perform photometric and color measurements of sign sheeting, pavement markings, retro-reflective raised pavement markings and other retroreflective devices. This laboratory is equipped with a four-axis photogoniometer to rotate devices to specific measurement geometries. These instruments also allow photometric characterization of vehicle lighting systems.

The room was built for future installation of rain-making equipment to allow assessment of visibility of devices under wet conditions. The 125-foot tunnel-shaped facility also allows researchers to run human-subject night simulation studies under controlled conditions at any time during the day.

### 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

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## ABOUT TTI

The Texas A&M Transportation Institute, established in 1950, seeks solutions to the problems and challenges facing all modes of transportation. The Institute works on over 700 research projects with over 200 sponsors in the United States and abroad at all levels of government and in the private sector. TTI is recognized as one of the finest higher-education-affiliated transportation research agencies in the nation. TTI has saved the state and nation billions of dollars through strategies and products developed through its research program. TTI research has a proven impact — resulting in lives, time and resources saved.