



# TRAFFIC RESEARCH LABORATORY FACT SHEET

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

## PURPOSE

The Traffic Research Laboratory (TReL) is a unique combination of advanced hardware and software systems that can be used by researchers and practicing traffic engineers to assess and evaluate the impact of various combinations of advanced technologies, strategies, and policies prior to field installation. State-of-the-art traffic research and development of these systems are conducted in the laboratory. Additionally, the laboratory provides an experimental test bed and analysis toolbox to facilitate the Federal Highway Administration's (FHWA's) Research and Development (R&D) program in Intelligent Transportation Systems (ITS).

## DESCRIPTION

TReL contains the visualization, simulation, communication, and control capabilities needed to effectively conduct traffic engineering R&D. The laboratory affords researchers the ability to conduct innovative real-time, hardware-in-the-loop evaluations and studies. Researchers at TReL develop and evaluate prototype adaptive traffic control systems that are being evaluated and demonstrated in field trials.

The Turner-Fairbank Highway Research Center (TFHRC) Intelligent Intersection is connected to TReL via a fiber optic communications link that supports full integration of the two research facilities. This is an example of how TReL uses a controlled environment to test prototype systems prior to field trials. The Intelligent

Intersection's advanced sensors and simulated Dedicated Short Range Communications (DSRC) wireless communications provide powerful tools enabling the TReL staff to assist in the integration and testing of vehicle-infrastructure integration, advanced infrastructure-based sensing technology, infrastructure-based safety threat assessment processing, and integration of the Cooperative Intersection Collision Avoidance System (CICAS) systems with both legacy and emerging traffic control technology.

In addition to the Intelligent Intersection, a Road Weather Information Station (RWIS) and a Global Positioning System Surface Observation System (GSOS) are being integrated with TReL allowing the staff to expand and initiate research in support of the Road Weather Management program.

The Traffic Software Integrated System (TSIS) is a suite of traffic analysis tools used to assess the impact of transportation improvements to a network. The traffic simulation model CORSIM, contained within the TSIS suite, is the core of the studies and evaluations conducted at TReL. CORSIM simulates traffic and traffic control conditions on combined surface streets and freeway networks. It generates a wide range of operational and environmental measures of effectiveness to quantify the performance of a traffic network.

Researchers at TReL utilize CORSIM to evaluate traditional and advanced traffic management systems and strategies, geometric design

alternatives, and the effect of traffic incidents and events. They also refine, develop, and evaluate CORSIM algorithms.

TReL provides the simulation tools needed to test and evaluate Real-Time Adaptive Traffic Control Systems (ACS) algorithms under a wide range of geometric and traffic conditions. Results of the TReL evaluations have been used to select, refine, and finalize the adaptive control strategies used in the field-testing and implementation of ACS.

Collectively, these activities and capabilities enable the Office of Operations R&D to effectively conduct research and provide guidance for the integration and deployment of advanced traffic operations and management systems, as well as other ITS components.

Developing and maintaining the enabling technology is the key to the Operations R&D program. TReL makes it possible.

## MISSION

- To conduct ITS/Operations investigations, develop solutions, refine concepts, and facilitate the transfer of R&D products from the laboratory to the field.
- To fulfill the research, development, testing, and evaluation initiatives in support of the ITS/Operations R&D program.

*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 Office of Research, Development, and Technology*

*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).*

- To advance the state-of-the-art and the state-of-the-practice in ITS/Operations through the use of an advanced traffic research laboratory.

### **SPECIAL CAPABILITIES**

- Integrates the TFHRC Intelligent Intersection and its advanced sensors, communications, and processors to enable vehicle and infrastructure components to work cooperatively.
- Allows development and testing of emerging traffic control technology with legacy equipment.
- Provides the ability to model the impacts of diverse weather conditions on traffic and driver behavior and to assess the effectiveness of possible operational countermeasures on traffic movements through RWIS and GSOS installation next to TReL.
- Applies hardware-in-the-loop concepts, where real traffic controllers are interfaced (physically connected) with simulated traffic in real time. Through this controller interface device (CID), TReL researchers can verify that the desired controller features are operating as expected.
- Assists with the development and evaluation of dynamic traffic assignment (DTA) systems.
- Assists with the development and evaluation of Traffic Estimation and Prediction Systems (TREPS).

### **LABORATORY COMPOSITION**

TReL is a computer simulation lab outfitted with a collection of advanced traffic analysis software (traffic simulation, signal optimization, adaptive control, etc.), integrated with a system of traffic control and other hardware.

### **PRODUCTS AND SERVICES**

- Onsite support of the FHWA Operations R&D program.
- Evaluation and development of new and existing traffic software systems.
- Application of the CORSIM traffic simulation model and related tools.
- Application of the CID hardware-in-the-loop system.
- Evaluation of DTA prototypes.
- Development of simulation algorithms (ramp metering, signal preemption, etc.).
- Evaluation of Adaptive Control Software (ACS), ACSLite and development of traffic controller interface.
- Identification and assessment of key weather-related parameters and their impacts on traffic operations using simulation.
- Utilization of CID in the Signal Preemption Study on State Route 7 in Virginia.

### **EXPERTISE**

TReL combines the expertise of traffic engineers, system engineers, and computer science professionals with experience in traffic research, highway safety, algorithm development, traffic simulation, system design, model development, and ITS.

### **CONTACT**

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