HumanFIRST Program

www.humanfirst.umn.edu

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Research Focus
As implied by its name, the program’s research strategy is based on a driver-centered approach, considering the “human first” within the transportation system. Research seeks to propose, design, and evaluate innovative methods to improve transportation safety based on a scientific understanding of driver performance and the psychological processes associated with traffic crashes. It considers how a driver will accept and use a proposed system while also considering the possibility of its producing undesirable driver responses and adaptation (e.g., distraction, complacency, fatigue, risk-taking). Specific research topics include:

- Driver distraction from in-vehicle technology and cell phones
- Driver-assist systems to reduce teen-driver crashes
- Interventions for crash reduction at rural intersections
- Intelligent driver-support technologies such as vision-enhancement, collision-avoidance, hazard-awareness, and lane-keeping systems for passenger and special-purpose vehicles
- Motorcycle safety

Capabilities
- Access to a variety of test track and operational research settings in which

The Human Factors Interdisciplinary Research in Simulation and Transportation (HumanFIRST) Program applies human factors principles to improve the scientific understanding of driver behavior and supports the design and evaluation of usable intelligent transportation systems.
participants can drive the program’s fleet vehicles in a wide range of normal driving situations.

- A state-of-the-art driving simulator engineered specifically for human factors research in surface transportation. This versatile simulator consists of a full-cab Saturn SC2 vehicle and software capable of creating virtual environments that precisely reproduce any geospecific location. With multiple sound systems, configurable touch panel displays (including head-up displays), haptic feedback through the seat and accelerator pedal, and a head-free eye-tracker that can detect in real time what a driver is looking at, this simulator supports the investigation of a wide range of interface options for ITS development, design, and assessment.
- Access to a bus driving simulator where program staff can test and evaluate bus driver-support systems and bus driver training protocols.
- Equipment for basic research on driver psychological functioning, including a vision tester, DOT-certified breath alcohol analyzer, mobile psychophysiological recording system, mobile eye-tracking system, video editing and behavior analysis suite, and a comprehensive psychometric test battery validated for traffic psychology.
- A core staff of transportation research specialists, made up of psychologists and engineers, providing a well-established base of content expertise. This core group is linked to a broad interdisciplinary network of experts in advanced, basic, and applied sciences throughout the University to provide a flexible and comprehensive research capacity.
- Close ties with the Minnesota Departments of Transportation and Public Safety, private industry, traffic engineering consultants, and other related entities—connections that provide support for implementing research that will influence transportation policy in response to real-world problems both regionally and nationally.

**Partners**
- United States Department of Transportation
- Federal Highway Administration
- National Highway Traffic Safety Administration
- Research and Innovative Technology Administration
- Minnesota Department of Transportation
- Minnesota Local Road Research Board
- Minnesota Valley Transit Authority
- Other local and regional agencies
Minnesota Traffic Observatory
www.mto.umn.edu

Staff
John Hourdos, Director
Stephen Zitzow, Manager
Chen-Fu Liao, Educational Systems Engineer

The Minnesota Traffic Observatory (MTO), a joint effort of the ITS Institute and the Department of Civil Engineering, supports a wide range of research in safety, monitoring, management, and simulation of traffic systems. The observatory combines real-time traffic data with state-of-the-art simulation systems, giving researchers and engineers the ability to analyze existing conditions and compare real-world observations with the results of simulated conditions.

Research Focus
MTO research focuses on testing and evaluating new transportation management and operational strategies and traveler information technologies. Specific focus areas include traffic data collection, microscopic simulation, traffic model calibration, and incident detection and prevention.

Capabilities
• A fiber-optic connection to MnDOT’s Regional Traffic Management Center, allowing the MTO to capture up to 16 live feeds at a time from any of the 400 cameras the agency uses to monitor the metropolitan freeway system.

• A dedicated system of cameras overlooking the I-94/I-35W Commons interchange in Minneapolis—turning one of the most crash-prone intersection areas in the state into a real-world laboratory for the study of traffic flows and vehicle crashes.

• Five portable traffic data stations, consisting of a 28-foot mast with data-collection devices, which can be deployed virtually anywhere there is a light pole or traffic light.

• Computer image-processing algorithms developed by University of Minnesota researchers that enable the observatory to track and analyze complex traffic patterns for areas that are difficult to study using other data sources.

• A powerful hardware-in-loop simulation tool enabling researchers to examine system performance under a variety of conditions.

• Several traffic simulation packages—primarily AIMSUN-NG for microscopic simulation based on individual vehicles and the KRONOS 9 package, developed at the University of Minnesota, for macroscopic (platoon-based) simulations.

• A GIS/MAP table that combines the large horizontal working surface of a traditional drafting table with the interactive capabilities of geographic information systems technology. Two ceiling-mounted digital projectors create a seamless image covering the entire conference-table-sized surface, so users can comfortably survey the entirety of a large traffic system and quickly focus in on areas of interest.

Chen-Fu Liao, John Hourdos, and Stephen Zitzow at the MTO’s GIS/MAP table
Staff
Eil Kwon, Director

The Northland Advanced Transportation Systems Research Laboratories (NATSRL) is a faculty-based transportation research program at the University of Minnesota Duluth (UMD). The primary mission of NATSRL is to develop innovative technologies that can be directly applicable in making the transportation systems in northern areas safe, efficient, and sustainable.

Research Focus
The current research focus areas in NATSRL include:

• Advanced sensing technologies for detecting and measuring traffic, driver, pedestrian, and pavement condition.
• Traffic and driver safety technologies through vehicle and infrastructure integration with wireless communication.
• Winter road snow and ice management decision-support strategies.
• Advanced traffic operations and management strategies under various traffic and weather conditions.

Capabilities
• A driving simulator and an outdoor laboratory where new prototype detection systems for traffic, snow, and ice can be tested under real conditions.
• Cooperative research activities in transportation with foreign research institutes and universities, including a visiting researcher and graduate student exchange program and joint research projects. Currently one international graduate student is working at NATSRL as a visiting scholar.

Partners
NATSRL has formed a partnership with its key stakeholders by developing a Research Advisory Panel (RAP) and Advisory Board (AB) structure whose membership includes experts from the following partnership agencies:
• Minnesota Department of Transportation
• St. Louis County, Minnesota
• City of Duluth, Minnesota

Outreach and Education
MTO facilities are used by faculty and students in civil, mechanical, and electrical engineering; computer science; and affiliated disciplines. MTO staff work with faculty to develop interactive laboratory modules that help students understand advanced topics in traffic management. The MTO also hosts training events for transportation professionals, covering topics such as the effective use of traffic simulations for capacity analysis and planning.

Partners
• U.S. Department of Transportation
• Federal Highway Administration
• Research and Innovation Technology Administration
• Minnesota Department of Transportation
• University of Vermont
• National Park Service
• Next Generation SIMulation (NGSIM) Community
• Other local and regional agencies