

Motorcycles and alcohol: Research examines a dangerous combination



Deputy Secretary of Transportation Thomas Barrett (in helmet) discusses motorcycle safety with researchers Craig Shankwitz and Janet Creaser.

This summer, with gas prices at an all-time high and warm weather beckoning riders to hit the road, motorcycles and scooters are more popular than ever. But statistics from the National Highway Traffic Safety Administration (NHTSA) show that while motorcycles account for only three percent of motor vehicle registrations, they make up 11 percent of total motor vehicle fatalities.

Researchers from the HumanFIRST Program and the Intelligent Vehicles Laboratory recently collaborated to study the effects of alcohol on motorcyclists, taking advantage of the programs' access to unique research facilities and expertise in monitoring driver performance.

Deputy Secretary of Transportation Thomas Barrett, during a recent visit to the University of Minnesota, had the opportunity to take a close look at the specially equipped motorcycle at the heart of the project. On hand to brief Barrett were principal investigator Janet Creaser of the HumanFIRST Program and Intelligent Vehicles Lab director Craig Shankwitz.

Most testing of alcohol impairment has been done in passenger vehicles and has not focused on the unique skills required to ride a motorcycle, according to Creaser. However, due to the increased number of motorcycle riders and the known crash risk for alcohol impaired riders, it is important to study the effects of alcohol on riding skills.

With funding from NHTSA, the

Minnesota study aimed to fill a significant gap in research on the effects of alcohol consumption.

Studying safety, safely

While a large body of research has been devoted to detailed analysis of how alcohol interferes with automobile operation, relatively little work has been completed on the question of how alcohol affects the skills required to operate a motorcycle. One factor in this discrepancy is the difficulty in accurately evaluating motorcycle operation skills without endangering the safety of the rider. Realistic driving simulators based on motorcycles rather than four-wheeled vehicles are virtually unknown, and in-vehicle testing is restricted by the obvious hazards facing an impaired rider, as well as strict laws prohibiting vehicle operation while intoxicated.

To overcome these restrictions, the Minnesota team incorporated three critical components into their research methodology: a purpose-built mechanical safety system to safeguard the test subjects; a remote data-acquisition system to gather detailed information on all relevant aspects of the subjects' performance; and a testing facility that could legally and safely accommodate inebriated riders.

The motorcycle selected for research use, a model typical of the bikes chosen by many riders today, was first equipped with a system of mechanical outriggers capable of preventing it from falling sideways in

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ITS Institute labs in the news

The Minnesota Traffic Observatory (MTO) and the HumanFIRST Program have been featured in news stories broadcast by Fox 9 News in Minnesota.

John Hourdos, director of the MTO, was interviewed by the station for a story on the perils of highway merging broadcast in May. Hourdos explained the traffic dynamics affecting one area that has become notorious for merge-related crashes: the I-94/35W Commons area near downtown Minneapolis. Research by Hourdos, and civil engineering professor Panos Michalopoulos, and MTO Lab Manager Ted Morris led the Minnesota Department of Transportation to change the lane markings in one part of the Commons to discourage problematic merging behavior; preliminary results indicate that the change has reduced the number of crashes and near misses. The story, titled "Merge Madness," is available for viewing on the Fox 9 Web site.

The HumanFIRST Program's immersive driving simulator was featured in a segment examining the dangers of sleepy drivers. In a report prompted by the recent crash of a bus driven by a sleep-deprived driver, newscaster Trish Van Pilsum participated in a sleep-deprivation protocol similar to that used by HumanFIRST researchers to study the effects of fatigue, and then got behind the wheel of the simulator for a virtual drive. "In-Depth: Sleep Deprived Bus Drivers" is available for viewing on the Fox 9 Web site.

Federal visitors briefed on technologies under development

The ITS Institute welcomed a delegation of Congressional staffers gathering information on transportation issues in May and a group of visitors from the federal government's Research and Innovative Technology Administration (RITA) in June. Both groups of visitors had the opportunity to tour the Institute's research facilities and see first-hand how new technologies are being developed and deployed to improve the nation's transportation system.

RITA, a division of the U.S. Department of Transportation, is charged with administering the University Transportation Centers program, under which the ITS Institute operates. RITA representatives carry out periodic site visits to UTC locations around the country to review their operations and consult with researchers about new and ongoing initiatives in research, education, and outreach.

In addition to presentations by ITS Institute staff, the visitors toured the HumanFIRST Program's advanced driving simulator and the Minnesota Traffic Observatory, and rode a transit bus equipped with driver-assistive systems developed by the Intelligent Vehicles Laboratory. They also met with Professor Demoz Gebre-Egziabher of the Department of Aerospace Engineering, who presented his current work on uninhabited aerial vehicles for traffic surveillance and remote sensing.



Intelligent Vehicles Laboratory director Craig Shankwitz (left) talks with Congressional staffers during a demonstration of driver-assistive technologies for Bus Rapid Transit.

RITA staff members also accompanied the congressional staff delegation on a one-day tour of Institute facilities May 29. Intelligent Vehicles Lab director Craig Shankwitz led a demonstration of the Institute's driver-assistive systems for Bus Rapid Transit (BRT), and explained the motivation for developing new technologies that can provide better transit options to urban and suburban residents.

Staff members experienced some of the bus's systems first-hand by sitting in a second driver's seat equipped with haptic feedback devices that transmit vibration when the bus deviates from its lane. The onboard wireless access point proved to be equally impressive, allow-



RITA representatives meet with CTS staff.

ing the busy staffers to check their e-mail while riding—a feature that will be included on the "Bus 2.0" vehicles rolled out in the coming year by the Minnesota Valley Transit Authority.

CTS Research Conference presentations show diverse research agenda

The annual Center for Transportation Studies Transportation Research conference brought together researchers and practitioners from diverse academic and professional disciplines to share new knowledge about the transportation system. This year's ITS-related presentations demonstrated the wide range of topics that ITS researchers are taking on.

Ajay Joshi, a graduate student in the Artificial Intelligence, Robotics, and Vision Laboratory (AIRVL), described the development of a robust machine-vision system to identify potentially dangerous actions in public spaces using video cameras. Led by Nikolaos Papanikolopoulos, AIRVL develops advanced computer and robotic systems for video surveillance, remote sensing, and other applications. Joshi showed how the current system is capable of identifying an object that has been abandoned in a public space, as well as tracking multiple individuals moving around a scene.

The human brain's ability to rapidly and accurately assess complex situa-

tions is a key part of the system design. To assist human operators, machine-vision algorithms monitor incoming video for situations that may require further attention and raise an alert when a situation requiring human attention is detected.

Rajesh Rajamani of the University of Minnesota's mechanical engineering department has led or contributed to numerous projects in the area of intelligent vehicle control systems. Recently, he has been interested in the problem of measuring friction between vehicle tires and the road surface—an important issue for winter road maintenance vehicles that apply de-icing chemicals—and has been developing new ways to produce accurate measurements in real time.

The system described by Rajamani employs a small redundant wheel mounted near a plow's front tires as a friction sensor. To overcome the problem of data noise produced by constant vibration, researchers developed several filtering algorithms to clean up the incoming data. The system is also

designed to interface with an onboard Geographic Information System (GIS) that provides information about the road ahead and road segments that have been previously identified as problem areas.

Peter Easterlund, a member of the Institute's HumanFIRST Program staff, gave an overview of Rapid Prototype Visualization—an emerging approach to transportation project planning that relies heavily on recently developed simulation and visualization technologies—during a session devoted to design and analysis tools. Simulation, he explained, should be distinguished from techniques such as street-view and flyover animations; it is a user-controlled, dynamic, real-time, and immersive approach to looking at transportation projects.

As Geographic Information Systems and 3D modeling technologies become more familiar and affordable, Easterlund said, rapid prototype visualization is becoming more feasible and attractive for today's complicated transportation projects.

New features, designs enhance ITS web sites

Finding information on Intelligent Transportation Systems research at the University of Minnesota just got easier. The ITS Institute's Web team recently introduced the ability to search for project information by topic, giving site visitors an intuitive and user-friendly navigation option that will improve access to the hundreds of active and completed projects tracked and archived on the Web at www.its.umn.edu.

A diverse research program has been a hallmark of the ITS Institute since it was founded in 1999. As the roster of research projects funded through the Institute has grown, so has the challenge of making information about them easily available to researchers, transportation practitioners, and the general public.

Another new feature visitors will notice on the ITS Institute Web site is a "Meet a Researcher" sidebar appearing on many research-related pages.

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the event that a rider lost his balance. During normal operation, the outriggers are free to move up and down as the cycle turns; if the cycle leans too far to either side, however, they prevent it from tipping over completely.

Capturing the complex data needed to characterize driver performance was the task of the Motorcycle Data Acquisition system, or MoDAQ. Based on a system developed by the Intelligent Vehicles Lab for automotive research, the MoDAQ is an onboard, mobile system that integrates data from a range of sensors. The system includes sensors that monitor the operation of the cycle's controls—throttle, brakes, and steering; accelerometers that measure forward and lateral movements; and a helmet equipped with a miniature video camera and inertial measurement units. Synchronizing the outputs from all these sensors gives researchers a complete picture of driver performance and vehicle response.

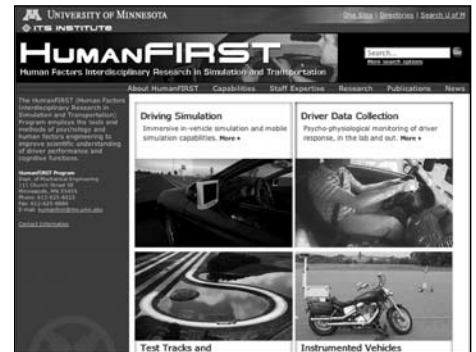
Even with its added safety features, operating the motorcycle with alcohol-impaired research participants would still have been prohibited by Minnesota law, which applies to private driving courses and tracks as well as to public roads. Fortunately, one driving course

Featuring photos and brief descriptions of the work done by many talented researchers is a new way of highlighting the diversity of ITS research at the University of Minnesota.

HumanFIRST Program launches new Web site

A redesigned HumanFIRST Web site featuring expanded information on research capabilities and projects is now available at www.humanfirst.umn.edu. HumanFIRST Program director Michael Manser said he believes the new site will help reach a wider audience of researchers who can benefit from the unique simulation and data collection capabilities available in the program's laboratory.

The HumanFIRST Program is the ITS Institute's primary human factors research facility, boasting one of the most advanced immersive driving simulators



at any academic research facility in the United States as well as a wide variety of other research tools. The program actively seeks research collaborations inside and outside the University of Minnesota.

"The new site is going to continue to develop, as we add more information about new research projects and tools," said Manser. "We have a lot going on now, and we want to reflect that online."

in Minnesota is specifically exempt from the state law: the Minnesota Highway Safety and Research Center in St. Cloud. The facility is one of several closed courses used in HumanFIRST research.

The research team recruited 24 male study participants who had a minimum of five years of motorcycling experience and drank alcohol at least once a week but had no history of alcohol dependence. After training designed to familiarize the riders with the research motorcycle, the riders participated in three half-day test sessions during which they drank alcohol to reach a blood-alcohol concentration of .02, .05, or .08 g/dL (the legal limit in all 50 states), or were given a placebo (alcohol applied to the rim of a glass containing a non-alcoholic beverage).

After consuming the alcoholic beverage or the placebo, the participants rode through a test course developed in collaboration with motorcycle instructors from the Minnesota Motorcycle Safety Center. The course included a variety of tasks, ranging from routine riding situations to emergency maneuvers. Data from both baseline (non-alcohol) rides and rides after consuming alcohol were gathered for each participant, enabling the researchers to compare the



The research motorcycle, showing outriggers deployed to protect the rider.

effects of different amounts of alcohol consumption.

Analysis of data from these tests revealed that some impairment was evident in motorcycle riders at the .05 blood-alcohol level, below the .08 level that constitutes intoxication in the eyes of the law. And while self-reports by the test subjects indicated that many riders may realize when alcohol is affecting their riding performance, the researchers caution that the evidence does not mean that self-regulation is sufficient to mitigate the increased crash risk due to riding after drinking.

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High school students experience ITS research

Twelve students from the Blaine High School Center for Engineering, Math, and Science enjoyed a first-hand look at the kind of research and educational opportunities available to University of Minnesota students during a tour of transportation-related labs and facilities April 23. The Center is a specialty program within Blaine High School offering an integrated and rigorous, in-depth program in mathematics, science, and engineering.

The visit was structured to give students a perspective on potential careers in transportation engineering and transportation. Students spent time learning about uninhabited aerial vehicles in the Department of Aerospace Engineering, traffic monitoring and



Blaine High School students learn about an experimental uninhabited aerial vehicle.

simulation research in the Minnesota Traffic Observatory, and earthquakes and structures in the civil engineering department.

Shawn Haag, program coordinator for CTS, said the students' reactions were

enthusiastic. "The visit really opened their eyes," he said, referring to the variety of work and research in transportation. When asked who would consider transportation as a potential career, more than half raised a hand.

RECENTLY PUBLISHED RESEARCH

Available at www.its.umn.edu/publications/researchreports/

Multi-Camera Monitoring of Human Activities at Critical Transportation Infrastructure Sites

June 2008 Report no. CTS 08-08

Access to Destinations: Twin Cities Metro-wide Traffic Micro-simulation Feasibility Investigation

May 2008 Report no. Mn/DOT 2008-15 1381

The Effectiveness and Safety of Traffic and Non-Traffic Related Messages Presented on Changeable Message Signs-Phase II

August 2008 Report no. Mn/DOT 2008-27

UPCOMING EVENTS

For event details, see www.its.umn.edu/events/

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| September 3-5 | National Rural ITS Conference, Anchorage, Alaska. Information at http://www.nritsconference.org |
| October 7-8 | Toward Zero Deaths Conference, Rochester, Minnesota. Information at www.tzd.state.mn.us |
| November 16-20 | Intelligent Transportation Society of America's 15th World Congress, New York City. Information at http://www.itsworldcongress.org/ |

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