USDOT officials hear local researchers comment on transportation policy

University researchers and other expert witnesses testified at a field hearing convened by the National Surface Transportation Policy and Revenue Study Commission April 18 and 19 on the University of Minnesota campus.

The commission, chaired by Secretary of Transportation Mary Peters (pictured at left), conducted a series of field hearings around the country to hear testimony from transportation experts and members of the public. Over the past year, we have provided tours and demonstrations of our research and facilities, sponsored seminars, published printed pieces, and redesigned and updated our Web site. But perhaps the most direct method of transferring technology has been to send graduating students out into the workforce.

This section of the annual report highlights some of our technology transfer activities over the past year.

The Institute could not accomplish its goals without the transfer of its expertise and research results to local, national, and international audiences for use in real-world applications. Technology transfer also communicates to the world who we are, raising the profile of the Institute and its research, and serves to educate students, policymakers, and the general public about ITS issues and solutions.

Our efforts in this area are far-ranging in order to reach a broad and diverse audience of researchers, students, practitioners, policymakers, and others among the general public. Over the past year, we have provided tours and demonstrations of our research and facilities, sponsored seminars, published printed pieces, and redesigned and updated our Web site. But perhaps the most direct method of transferring technology has been to send graduating students out into the workforce.

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specific problems and needs of high-risk groups, including teen drivers and the elderly.

Members of the commission also toured the I-394 MnPASS system and visited Mn/DOT’s Regional Transportation Management Center, a state-of-the-art facility that integrates traffic operations control, State Patrol dispatch, and maintenance dispatch.

The commission is now preparing recommendations for a new national transportation policy, which it expects to present to Congress in December 2007.

**ITS Institute research leads to new lane markings on I-94**

Based on findings from researchers at the ITS Institute, the Minnesota Department of Transportation painted new markings on a stretch of westbound I-94 in Minneapolis in October 2006. The double white lines are intended to reshape the flow of merging traffic, thus reducing driver conflicts and preventing accidents.

The findings came from the first phase of research by civil engineering professor Panos Michalopoulos and MTO director John Hourdos. Their goal is to develop real-time algorithms needed to create a driver-warning system that will help prevent crashes in high-risk areas.

Their first step was to study the reasons for, and mechanics of, crashes. The researchers designed and assembled a set of unique sensors and surveillance equipment, with assistance from MTO manager Ted Morris, and collected individual vehicle speeds, headways, and lengths at 52 points along the freeway. In addition, they simultaneously recorded video 12 hours a day for two years, capturing all of the crashes and near misses occurring during that time.

As they reviewed the collected data, the researchers pinpointed the entire sequence of events leading to each crash and identified three specific elements contributing to nearly all crashes in this area: congestion shock waves that propagate backward from the merge area of a downstream entrance ramp; the large difference in driving speeds between the right and middle lanes, which makes changing lanes difficult and therefore dangerously distracting for drivers; and last, the fact that in the area where the shock waves begin, vehicles are simply too close to each other to allow drivers time to take evasive actions.

Researchers also verified that the same elements contributing to crashes also cause near-miss events. With these findings, the team developed an algorithm capable of accurately detecting the presence of crash-prone conditions nearly 70 percent of the time.

The project was featured in an article in the October 16 Minneapolis *Star Tribune*.

**MVTA explores deployment of ITS Institute technology**

Also in October, Minnesota Valley Transit Authority (MVTA) board members saw first-hand how technologies developed by the ITS Institute could help bus drivers navigate freeway shoulders used as part of a Bus Rapid Transit (BRT) sys-
Technology Transfer

tem and improve system operations. MVTA, which in 2006 donated a bus to the IV Lab, has expressed interest in field-testing a fleet of instrumented buses on the Cedar Avenue corridor.

Following the board’s October meeting, Shankwitz and IV Lab research fellow Bryan Newstrom demonstrated the technologies to approximately 25 board members in a half-hour trip along the corridor.

**Updated Web, publications highlight Institute work**

In May, the ITS Institute Web site (www.its.umn.edu) was redesigned to incorporate better navigation and organization as well as a new graphic design. Among the improvements made to the site was a reorganization of research project information to make finding it faster and easier.

“Because intelligent transportation systems research moves fast, the Web is a key communications tool for us,” says Institute director Max Donath. “These improvements really enhance our ability to reach a worldwide audience of researchers and transportation professionals.”

Nine ITS-related research projects were featured in articles in the Center for Transportation Studies’ *Research E-news* electronic newsletter, which is mailed to about 4,000 subscribers and is available on the Web at www.cts.umn.edu/news/renews. These stories also provided links to more information about the project.

Electronic mail announcements were used to publicize upcoming events, including Advanced Transportation Technologies Seminars, conferences, luncheon presentations, and other ITS-related events.

In print communications, Institute publications continued to raise awareness of the ITS Institute’s work in academic and professional communities and disseminate the results of research.

Beginning with the summer 2007 issue, the *Sensor* newsletter was redesigned and expanded in scope and size. To meet new requirements of the Research and Innovative Technology Administration and SAFETEA-LU funding, the newsletter, which had previously focused primarily on the Institute’s research activities, expanded its scope to include coverage of educational and technology transfer activities as well as upcoming ITS-related events and recently published research reports. The publication also doubled in size, from two to four pages.

The *Sensor* is available in print and online and reaches about 2,100 subscribers three times each year. It continues to be one of the primary vehicles for increasing the visibility of the ITS Institute, and its high circulation represents a broad knowledge of and interest in ITS research activities among academic and professional audiences.

The seventh ITS Institute annual report (fiscal year 2005–06), with photos and coverage of researchers, their students, and their projects, was published and mailed to more than 1,600 individuals and was made available as a PDF file for download from the Institute’s Web site.

**Institute researchers address traffic safety issues at national, local events**

Institute researchers discussed traffic safety issues at the annual Toward Zero Deaths conference, held in November in Duluth. The event, which drew more than 500 attendees, serves as a forum for exploring ways to reduce the number of fatalities and injuries on Minnesota’s roads.

In one session, Nicholas Ward, director of the ITS Institute’s HumanFIRST Program, discussed some possible avenues for intervention to change people’s attitudes toward safety. These include social approaches based on family and community and technological approaches such as cameras to detect speeding and red light running.

In another session, Max Donath, the Institute’s director, highlighted rural intersection decision support (IDS) systems that may reduce intersection fatalities. The Institute’s IDS research focuses on giving drivers better information about gaps between vehicles when crossing a rural highway.

Kathleen Harder spoke about her work with fellow human factors researcher John Bloomfield evaluating the results of Minnesota’s Highway Enforcement of Aggressive Traffic...
Harder and Bloomfield used speed data gathered by automated traffic detectors inside and outside enforcement zones to look for changes in driver behavior as a result of the year-long federally funded effort.

Janet Creaser, another researcher with the HumanFIRST Program, analyzed the effects of Minnesota's Nighttime Concentrated Alcohol Patrol (NightCAP) program. Creaser and her team found that increasing the number of “saturation” enforcement actions in a given year resulted in a marginally significant decrease in the fatal alcohol-related crash rate.

On the conference’s final day, Lee Munnich and Tom Horan, with the State and Local Policy Program (SLPP) at the Humphrey Institute of Public Affairs, introduced the newly established Center for Excellence in Rural Safety, which was created from a directive in the SAFETEA-LU federal transportation legislation.

Institute researchers were among those who presented their work at the Transportation Research Board’s 86th annual meeting, held January in Washington, D.C. University faculty, staff, and student presenters included:

- ITS Institute: Max Donath, Chen-Fu Liao, Ted Morris
- HumanFIRST Program: Nic Ward, Janet Creaser, Arvind Menon, Bryan Newstrom
- Intelligent Vehicles Program: Craig Shankwitz, Pi-Ming Cheng, Alec Gorjestani
- Northland Advanced Transportation Systems Research Laboratories (NATSRL): Eil Kwon
- Department of Civil Engineering (faculty and researchers): Gary Davis, David Levinson, Henry Liu, Panos Michalopoulos, Rania Wasfi
- Department of Civil Engineering (graduate students): Xiaozheng He, Saif Jabari, Woosung Kim, Xinjun Li, Wenteng Ma, Raul Andres Velasquez, Rania Wasfi, Qiang Wang, Thomas Westover, Ryan D. Wilson, Xinkai Wu, Feng Xie, Wuping Xin, Shanjian Zhu, Adam Zofka
- Hubert H. Humphrey Institute of Public Affairs (staff and students): Frank Douma, Ahmed El-Geneidy, Michael Iacono, Adam Kokotovich, Kevin Krizek, Lee Munnich

Several Institute researchers provided an overview of rural traffic safety issues at the first meeting of what is planned to be an annual CERS (Center for Excellence in Rural Safety) Summer Institute, held in July 2006, to develop strategies for improving rural safety. Nic Ward probed the behavior of rural drivers and the relationship to traffic safety. Max Donath added a technological perspective to the research panel, updating attendees on the latest tools and systems to help drivers avoid crashes. Tom Horan presented his research into rural emergency response systems.

In November, the Northland Advanced Transportation Systems Research Laboratories (NATSRL) held its fifth annual Research Day, which gave ITS researchers at the University of Minnesota Duluth a chance to present their ongoing work in transportation. The event was held at Mn/DOT District 1 headquarters in Duluth. Eil Kwon, director of NATSRL, opened the half-day event.

Among the UMD presenters and topics were:

- Taek Kwon, Electrical and Computer Engineering, “Portable Wireless Mesh Sensor Networks for Traffic Movement Detection and Data Collection”
- Richard Lindeke and David Wyrick, Mechanical and Industrial Engineering, “Impending Box Impact Warning System for Prevention of Snowplow-Bridge Impacts”
- Peter Willemsen and Umesh Maitipe, Computer Science, “Snow Rendering for Interactive Snow Plow Simulation”
- John Evans, Chemistry and Biochemistry, “Installation and Performance Evaluation of SafeLane Overlay on Bridge Decks”
- Hua Tang, Electrical and Computer Engineering, “Feasibility Study on Development of a SMOS Vision Processor for Pedestrian/Vehicle Tracking”
- Rich Maclin, Computer Science, “Automatic Detection of RWIS Sensor Malfunctions (Phase II)”
- Ron Moen and Gerald Niemi, Natural Resources Research Institute, “A Self-Powered Video Camera Observation System for Monitoring Roadway Crossings”
Institute facilities toured by national and international visitors

In April, Denali National Park representatives were on campus to meet with Institute staff working on a project for the Alaskan park. The traffic-modeling project is aimed at helping manage transportation demand from the park’s visitors while protecting wildlife. John Hourdos and Ted Morris, with the Minnesota Traffic Observatory (MTO), and Institute director Max Donath gave assistant superintendent of parks Philip Hooge, ecologist Laura Philips, and wildlife biologist Tom Meier a tour of the MTO in addition to discussing the program and plans for the coming year.

Representatives from the Rubenstein School of Environment and Natural Resources Park Studies (University of Vermont) and Montana Fish and Wildlife were in attendance as well.

In May, representatives from the Swedish Roads Administration toured the MTO and the Intelligent Vehicles Laboratory as part of a career training program. The Minnesota segment of the program, which lasted approximately five weeks, was organized by Mn/DOT to help the transportation professionals-in-training learn more about ITS, safety, public involvement, planning, maintenance, and information technology.

HumanFIRST director testifies before state Transportation Committee

In January, Nic Ward, HumanFIRST Program director, along with Robert Johns, Center for Transportation Studies director, testified before the Minnesota Senate Finance Transportation Budget and Policy Division Committee. Ward discussed the latest ITS technology designed to reduce traffic fatalities, especially those caused by high-speed rural collisions. He explained that understanding how people drive and supporting them is key to advancing traffic safety as fatality rates continue to decline. Ongoing development of collision and lane-departure warning systems will aid drivers who are fatigued or distracted, Ward said, while intersection decision support technology will allow drivers to act with more information of the traffic patterns around them. Lawmakers were particularly interested in technologies to reduce crashes due to impaired or inexperienced drivers.

Media feature Institute researchers

Institute research that led Mn/DOT to paint new markings on the state’s most crash-prone stretch of freeway was featured in a Minneapolis Star Tribune article in October. “Drawing a new line against I-94 crashes” described the three-year study by John Hourdos, director for the Institute’s Minnesota Traffic Observatory, in which he monitored the area through video surveillance and made recommendations for improving a trouble spot by redirecting merging traffic.

Hourdos was also quoted in a Star Tribune article in May on how area road construction might affect commuters’ driving behavior and patterns.

Professor Stephen Simon of the Law School was featured in the Brief, the University of Minnesota staff and faculty weekly news digest, for his work with the DWI legal process. Simon is the founder and director of the Minnesota Criminal Justice System DWI Task Force and has recently led ITS Institute research on development of a Teen Driver Support System, which is aimed at reducing risky driving behavior (e.g., speeding, driving while impaired) common among new drivers.

Institute researchers distinguished with honors, awards

Professor Nikolaos Papanikolopoulos of the Department of Computer Science and Engineering (CSE) was a recipient of the 2007 Distinguished McKnight University Professorship.
The professorship recognizes and rewards the University’s most outstanding mid-career faculty. Recipients are honored with the title Distinguished McKnight University Professor while at the University of Minnesota and a $100,000 five-year grant.

Papanikolopoulos, who has led numerous ITS Institute research projects, is a leading figure in robotics and automation, with groundbreaking contributions in distributed robotics, computer vision algorithms, and transportation systems. In addition, transportation safety has been greatly influenced by his work on vision-based monitoring of traffic and humans.

A paper coauthored by Rajesh Rajamani, a professor in the Department of Mechanical Engineering, was selected for the 2007 O. Hugo Schuck Award, given by the American Automotive Control Council. The paper was titled “Algorithms for Real-Time Estimation of Individual Wheel Tire-Road Friction Coefficients.” The award was presented during the 2007 American Control Council Awards Luncheon in July in New York City.

Demoz Gebre-Egziabher, an assistant professor in the Department of Aerospace Engineering and Mechanics, was named a 2006 McKnight Land-Grant Professor by the Office of the Provost and the Graduate School. Along with the year’s other recipients, Gebre-Egziabher was honored by the Board of Regents in March.

Finally, Max Donath received the 2007 Richard P. Braun Distinguished Service Award. Donath has been the ITS Institute’s director since 1997 and is also a professor in the Department of Mechanical Engineering. He was recognized for creating one of the most successful ITS research programs in the world, leveraging ITS Institute funds to attract major projects on lane-keeping, human-machine interfaces, bus rapid transit, and intersection control technologies.

Donath also received the George W. Taylor Award for Distinguished Service from the University’s Institute of Technology in May. Established in 1982, the award recognizes outstanding service to the University and voluntary public service to governmental or other public groups.

Transportation researchers among U’s ‘greatest minds’

Two Institute researchers are among 92 University of Minnesota faculty and alumni represented on the Wall of Discovery—a 253-foot-long artistic mural depicting the great moments of discovery—that was unveiled in September on campus.

Civil engineering professor Panos Michalopoulos is on the wall for his patented Autoscope artificial vision system, which integrates miniature video cameras and microprocessors for traffic sensing and measurement extraction to control congested street and highway networks, detect incidents, improve safety and security, and manage traffic efficiently.

Max Donath is noted for a patented system using GPS, a digital map database, obstacle detection radar, and a head-up display to provide drivers with a virtual reality represen-
tation of the road when driving conditions make it almost impossible to see. Coinventors Craig Shankwitz, Heon Min Lim, Bryan Newstrom, Alec Gorjestani, Sameer Pardhy, Lee Alexander, and Pi-Ming Cheng are also mentioned.

Both displays include handwritten notes, sketches, or drawings to illustrate the inscribed text upon a metaphorical blackboard.

Visiting researchers bring expertise, build partnerships

During the past year, the Institute continued to work with visiting researchers and instructors, allowing for an exchange of information and dissemination of research results to the visitors’ students and colleagues.

The Advanced Transportation Technologies Seminar Series provided an opportunity to host two national researchers. Rob Foss, senior research scientist and manager of alcohol studies at the University of North Carolina’s Highway Safety Research Center, shared his work on the driver’s role in motor vehicle crashes. Ron Heft, senior principal engineer with Nissan Technical Center–North America, gave an overview of the U.S. Vehicle and Infrastructure Integration (VII) program, including its objectives, participants, content, and current status.

Thomas Horan, an associate professor at Claremont Graduate University and visiting scholar at the Humphrey Institute of Public Affairs, is part of the Sustainable Technologies Applied Research (STAR) Initiative and the new TechPlan research program. Horan is investigating wireless EMS and telecommunication network planning and access in a rural context.

Other visiting researchers, all working with the Institute’s HumanFIRST Program, include Nobuyuki Kuge of Nissan, Erwin Boer of the University of California, Jeff Caird of the University of Calgary, Andras Kemeny of the College de France, Jason Laberge of Honeywell, and Dick de Waard of the University of Groningen.