Technology Transfer

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 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.

Speed adaptation is low-cost, high-benefit technology to save lives, speakers says

Intelligent speed adaptation (ISA) technology can act “like a medicine that gets people to stop speeding,” said Oliver Carsten at the CTS Winter Luncheon on February 11.

The luncheon was sponsored by the ITS Institute. Institute director Max Donath introduced Carsten, who is a professor in the Institute for Transport Studies at the University of Leeds in the United Kingdom (UK).

“ISA is speed management with 21st century technology,” Carsten explained. Its components include a GPS-based satellite navigation system, a digital road...
map with speed limits, and a human-machine interface that displays the speed limit on the dashboard (or on a cell phone). ISA can also take control of the vehicle through a link to the drive train.

The European Union has identified rule violation—including speeding—as the major factor in injury and fatal crashes, Carsten said. Studies using actual crash data have shown that injury crashes go up with the proportionate change in speed squared; serious injury crashes with speed cubed; and fatal crashes with speed to the fourth power. “Small changes in mean speed will give you very dramatic changes in accidents,” he said.

ISA initially faced resistance in the UK, and opponents warned of a “nanny state” or a “spy in the sky,” he said, but popular opinion is now favorable. To advance ISA here, he urged the transportation community to make its case and educate the public, particularly through the press.

‘Smart Signal’ research receives award
A system to monitor the performance of urban arterials and improve traffic flow received this year’s CTS Research Partnership Award. The system—known as SMART-Signal (short for “Systematic Monitoring of Arterial Road Traffic Signals”)—is a real-time arterial performance monitoring system that uses traffic data from existing signal systems. The project was a joint effort of the University, Hennepin County, Mn/DOT, and the private sector. The research was funded by the ITS Institute, the Minnesota Local Road Research Board, and Mn/DOT with significant in-kind support from Hennepin County.

Henry Liu, an assistant professor in the Department of Civil Engineering, accepted the award on behalf of the project partners. Although traffic engineers have tools to measure real-time freeway performance, he said, similar approaches for urban arterials do not exist but are urgently needed. The development of SMART-Signal fills this gap. “We can do much better to manage traffic...if we have the right tools.”

The University is currently in the patent application process to protect the intellectual property, Liu said. He also noted that his team has received a grant from the National Cooperative Highway Research Program to extend its work on SMART-Signal, and that the system is used as an education module in a civil engineering course at the University.

IV Lab technology in Alaska featured on Discovery Channel
Minnesota winters are known for heavy snowfall and gusty winds, so it’s no surprise that researchers at the IV Lab have created technology to aid snowplow operators as they work to clear the roads in less-than-ideal conditions. The driver-assist system, which combines lidar and radar sensors with head-up display technology and onboard geospatial databases, helps snowplow operators keep an eye on where they are and what else is around—even when they can’t see the actual road.

The driver-assist technology has been installed on two snowplows and two airport rescue and firefighting vehicles operating in Alaska, where high snowfall rates and dry, blowing snow routinely create whiteout conditions and zero visibility. Because of the success to date, the state of Alaska has ordered three new driver-assist systems and two upgrade kits for current systems.

Alaska DOT employee Dwight Dietrich has been operating snowplows and blowers since 1998 and says the GPS system has helped him tremendously. The system is especially helpful when visibility is poor, as it provides him with a sense of direction as he plows through intense
storms. “It’s like running on autopilot; it makes the job a lot less stressful…I wonder what we did before we had this technology,” he says.

In April, the Discovery Channel highlighted some of the equipment on a television show called “Alaska: Most Extreme.” During a segment about heavy snowfalls along Alaska’s central coast, the camera shows Dietrich using the GPS vision-enhancement technology as he plows the road during a dangerous storm. The system allows him to work quickly and efficiently to clear the road in time for morning traffic.

Researchers’ work in media spotlight

Dramatic reductions in pollution could be achieved simply by retiming traffic lights, said several local experts in a story aired by Minnesota Public Radio in June. Many signals in the metro area haven’t been retimed for years because of a lack of staff and money, the story stated.

John Hurdos, Minnesota Traffic Observatory (MTO) director, said another problem is that most Twin Cities road signals are controlled by the cities and counties that install them, and they are not coordinating with each other. Hurdos predicted that in 20 years, vehicles will talk with one another via computer as they approach an intersection, modifying their speeds so they don’t have to stop.

KUWS Radio (Wisconsin) aired a story in May about the installation of traffic safety equipment near Minong, Wisconsin, that was developed by ITS Institute researchers. IV Lab director Craig Shankwitz said the idea is to make rural highway intersections safer without having to use traffic signals that back up traffic.

Lee Munnich, director of the State and Local Policy Program at the Humphrey Institute, told WCCO-TV News in March that about one-third of the people driving in the high-occupancy vehicle lane on Interstate 35W are violating the rules of use. Munnich’s research tracks how well HOV lanes work.

Another Institute researcher, Elizabeth Wilson, weighed in on an old concept receiving renewed interest—that of children walking to school. The article on organized “walking school buses” meant to abate car emissions, childhood obesity, and local traffic jams appeared in the New York Times in March.

In September, KARE-11 TV News featured assistant civil engineering professor Henry Liu commenting on Mn/DOT’s addition, and possible removal, of an extra lane on the I-94 detour route following the collapse of the I-35W bridge. Liu said his research would help Mn/DOT make a decision about the lane.

In a WCCO–TV news story that aired in August 2008, IV Lab director Craig Shankwitz was asked, “Can Tire Pressure Solve [the] Oil Crisis?” Shankwitz pointed to tire inflation as one of three factors that influence fuel economy (the other two are engine efficiency and speed) and explained the physics behind tire pressure.

In the summer of 2008, the Institute and the Center for Transportation Studies worked with University News Services and associate professor of civil engineering David Levinson to create an “Expert Alert” video related to traffic patterns following the I-35W bridge collapse. (Levinson is one of three researchers who received a grant from the National Science Foundation to study the issue.) The resulting video generated stories airing on KARE-11 TV News, “Twin Cities Live,” and Minnesota Public Radio and appearing in print in the St. Paul Pioneer Press. Levinson discussed findings from the study—in particular, how most drivers were able to adapt to detours within two months after the collapse, showing
that the transportation system is robust.

John Hourdos, director of the MTO, was also interviewed by FOX 9 News 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, civil engineering professor Panos Michalopoulos, and MTO lab manager Ted Morris led Mn/DOT 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 HumanFIRST Program’s immersive driving simulator was featured in a FOX 9 segment examining the dangers of sleepy drivers. In “In-Depth: Sleep Deprived Bus Drivers,” 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 affects of fatigue, and then got behind the wheel of the simulator for a virtual drive.

Researchers receive honors, awards

Professor Panos Michalopoulos received the 2007 IEEE Outstanding Intelligent Transportation Systems (ITS) Application Award for his development of Autoscope”, a video detection sensor. He was presented the award at the 2008 IEEE ITS Conference held in China in October 2008.

Michalopoulos has been a professor of traffic and transportation engineering at the University of Minnesota since 1977. His research led to the development of Autoscope, the first and most widely used machine-vision-based vehicle detection and surveillance system, with more than 20,000 installations worldwide since 1993. To commercialize the technology, Michalopoulos founded Image Sensing Systems, Inc., for which he served as chairman, chief scientific adviser, and board member. The video imaging system is patented by the University of Minnesota.

IEEE, formerly the Institute for Electrical and Electronic Engineers, is a nonprofit organization and a leading professional association for the advancement of technology.

ITS Institute director Max Donath received the 2009 ITS Minnesota Public Sector Recognition Award at ITS Minnesota’s annual meeting on March 10. Donath is also a professor of mechanical engineering at the University of Minnesota. He was recognized for his “outstanding contributions” to intelligent transportation systems in Minnesota, according to ITS Minnesota president Ray Starr, who presented Donath with the award.

Visitors view Institute research through tours, demos

As part of the ITS Institute’s Fall 2008 Advanced Transportation Technologies seminar series, Shelley Row, director of the U.S. Department of Transportation’s ITS Joint Program Office, shared her views on the state of ITS and the directions for the future. Rowe also toured the Minnesota Traffic Observatory (MTO).

In December, Paul Brubaker, former administrator of the USDOT’s Research and Innovative Technology Administration (RITA), toured Institute facilities; met with Max Donath, program directors, and other Institute staff; and watched demonstrations of current research. Among those projects were the IV Lab’s driver-assist system on buses, the HumanFIRST Program’s Cooperative Intersection Collision-Avoidance System...
dynamic sign and Teen Driver Support System (TDSS), and the MTO’s SMART-Signal system.

Scott Belcher, president and CEO of ITS America, visited the ITS Institute in June 2009 and toured the HumanFIRST program facilities, MTO, and IV Lab. Belcher also met with lab directors and took part in demonstrations of the TDSS and the HumanFIRST driving simulator.

I nstitute researchers share thoughts on transportation at national, local events

TZD Conference
The Institute was well-represented at the annual Toward Zero Deaths (TZD) conference October 7–8 in Rochester, Minnesota. The conference serves as a forum for sharing information on how to reduce the number of fatalities and injuries on Minnesota roads.

In a general session, Tom Horan, with the Humphrey Institute of Public Affairs, spoke about his work focusing on technological developments that affect rural safety and the issues surrounding their deployment (see page 25 for related article). In a concurrent session on intersection collision prevention, Institute director Max Donath discussed research efforts to develop infrastructure-based technologies capable of reducing driver error at unsignalized rural highway intersections. Mike Manser, director of the HumanFIRST Program, talked about a study that is using video feedback as a coaching tool for beginning drivers. And another researcher with the HumanFIRST Program, Janet Creaser, shared results from a study on the effects of alcohol on motorcycle riding skills during a concurrent session on motorcycle safety.

TRB
Institute researchers were among those who presented their work at the Transportation Research Board (TRB) 88th Annual Meeting, held in January in Washington, D.C. Presentation topics covered traffic monitoring and signal control techniques, privacy law and ITS technologies, safety research, congestion pricing, and traffic simulation. University of Minnesota faculty, staff, and student presenters included:

- Kathleen Harder: Center for Human Factors Systems Research and Design
- Gary A. Davis, Nikolas Geroliminis, David Levinson, Chen-Fu Liao, and Henry Liu: Civil Engineering
- Frank Douma, Keith Knapp, Lee Munnich, and Carissa Schively Slotterback: Humphrey Institute of Public Affairs
- Michael Rakauskas: HumanFIRST Program
- Max Donath: ITS Institute
- Xun Yu: Mechanical and Industrial Engineering, University of Minnesota Duluth (UMD)
- John Hourdos: Minnesota Traffic Observatory
- Eil Kwon: Northland Advanced Transportation Systems Research Laboratories

Research Day
On March 12, the Northland Advanced Transportation Systems Research Laboratories (NATSRL) held its annual Research Workshop on Intelligent Transportation Systems at Mn/DOT District 1 headquarters in Duluth. NATSRL director Eil Kwon gave opening remarks.

The event featured presentations by faculty and students on a diverse set of current research projects under way on the Duluth campus, including:

- “Real-Time Nonintrusive Detection of Driver Drowsiness,” Shan Hu, Ye Gu, and Xun Yu, Mechanical and Industrial Engineering
- “Intelligent Pavement Sensor for Traffic Detection,” Baoguo Han and Xun Yu, Mechanical and Industrial Engineering
- “Development of Novel Hydrogen Storage Materials...”
for Road Traffic Related Applications,” Venkatram Merddy, Chemistry and Biochemistry

- “Development of a Low-Cost Interface Between Cell Phones and DSRC-Based Vehicle Unit for Efficient Use of V2I Infrastructure,” M. Imran Hayee, Electrical and Computer Engineering
- “Snow Rendering for Interactive Snowplow Simulation: Supporting Safety in Snowplow Design,” Peter Willemsen, Computer Science
- “Improving Safety and Efficiency of Roadway Maintenance Using Robotics—Feasibility Study,” Ryan Rosandich, Mechanical and Industrial Engineering
- “Detection of Water and Ice on Bridge Structures by Time Domain Reflectometry/Dielectric Relaxation Spectroscopy,” John Evans, Brian Finstrom, and Lucas Busta, Chemistry and Biochemistry
- “Development of a New Tracking System based on CMOS Vision Processor Hardware,” Hua Tang, ECE
- “Identifying Methods and Metrics for Evaluating Interagency Coordination in Traffic Incident Management,” Robert Feyen, Mechanical and Industrial Engineering
- “Exploring Effective Methods to Evaluate and Optimize the Systematic Implementation of Proactive ITS Safety Strategies,” Hongyi Chen, Mechanical and Industrial Engineering

**CERS Summer Institute**

Presenters explored the connections between rural transportation safety and community health at the annual Summer Institute of the Center for Excellence in Rural Safety (CERS), held last July in Santa Rosa, California. The two-day gathering of leading state and national transportation officials, researchers, policymakers, and professionals is aimed at sharing information, setting research priorities, and developing strategies for improving rural transportation safety. Speakers included Institute researchers Tom Horan, who discussed his research into rural emergency response times and the quality of health care outcomes, and Mike Manser, director of the HumanFIRST Program, who moderated a panel discussion about the role communication tools play in advancing rural traffic safety issues.

**CTS Research Conference**

ITS Institute research projects presented at the CTS 20th Annual Research Conference in St. Paul, Minn., included

- “Development of the Next Generation Stratified Ramp Metering Algorithm for Minnesota Freeways Based on Density,” Nikolas Geroliminis, Civil Engineering
- “Smart Signal Theory,” Henry Liu, Civil Engineering
- “Bus Rapid Transit Technologies for Cedar Avenue and I-35W,” Craig Shankwitz, Mechanical Engineering
- “Counting Empty Parking Spots at Truck Stops,” Pushkar Modi, Computer Science and Engineering
- “Substitution Between E-shopping and Travel: Evidence from the Twin Cities,” Frank Douma, Humphrey Institute of Public Affairs
- “Snow Rendering for Simulation,” Peter Willemsen, Computer Science (Duluth)
- “Impending Box Impact,” Richard Lindeke, Mechanical and Industrial Engineering (Duluth)
- “Wireless Mesh Sensor Network for Vehicle Tracking in an Intersection,” Taek Kwon, Electrical and Computer Engineering (Duluth)
- “Portable, Low Cost Intersection Traffic Measurement and Surveillance Station,” Ted Morris, Civil Engineering
Publications, new Web services highlight Institute work

Over the last year, the Intelligent Vehicles Laboratory launched a new Web site to provide information about research capabilities and projects. The IV Lab focuses on developing and testing innovative, human-centered technologies that improve the operational safety, mobility, and productivity of vehicles.

Two new featured study pages for the SMART-Signals and Rural Unsignalized Intersections research projects were developed to highlight advances in these high-impact research areas. The Education section of the ITS Institute Web site was enhanced and expanded to display the wide variety of educational activities conducted at the Institute, from participating in a variety of K-12 student camps to the development of a traffic simulation game called Gridlock Buster.

Another new feature visitors will notice on the ITS Institute Web site is a “Meet a Researcher” sidebar appearing on many research-related pages. Showing photos and brief descriptions of the work done by the many Institute researchers is a new way of highlighting the diversity of ITS research at the University of Minnesota.

Work is under way to create a blog for managing news on the Web site (expected to go live in fall 2009). The blog will give the Institute flexibility in communicating more frequent updates and news to its audience and to drive more users to the site. A companion project and ongoing effort is search engine optimization, which will improve the ability of search engines to find information from the Institute in response to search terms related to its work.

In addition to ongoing work on the Institute’s Web sites, electronic communications continue to play an important role in quickly disseminating information. Electronic mail announcements were used to publicize upcoming events, including Advanced Transportation Technologies Seminars, conferences, luncheon presentations, and other ITS-related events. The seminars and luncheon presentations are now regularly broadcast live on the Web as well as recorded for later viewing.

Eleven ITS-related research projects were featured 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/Publications/ResearchENews. These articles also provide links to more information about each project.

Institute print publications continued to raise awareness of ITS work in academic and professional communities and share the results of research. The Sensor newsletter covered Institute research activities, education, and technology transfer activities; upcoming ITS-related events; and recently published research reports. The Sensor is available in print and online and reaches about 2,100 subscribers four times each year. It has been one of the primary vehicles for increasing the visibility of the ITS Institute, and its high circulation testifies to a broad interest in ITS research activities among academic and professional readership.

The tenth ITS Institute annual report (fiscal year 2007–08), highlighting work by the Institute’s researchers and students, received an American Graphic Design Award from Graphic Design USA in the annual report category. This is the second consecutive award for the Institute’s annual report and graphic designer Cadie Wright Adhikary. The report was mailed to more than 1,400 individuals and is available as a PDF file downloadable from the Institute’s Web site.

Visiting researchers bring expertise, build partnerships

During the past year, the Institute continued to work with visiting researchers and instructors, allowing for an
The 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. During the spring series, visiting professor Nigel Wilson presented an overview of technological and policy issues related to transit fare collection. Wilson is a professor of civil and environmental engineering at the Massachusetts Institute of Technology and the director of major research and education collaborations between MIT and transit agencies in Chicago and London. In the fall, Hesham Rakha, a professor in the Department of Civil Engineering and director of the Center for Sustainable Mobility, Virginia Tech, described a study that estimates the safety benefits of deploying a forward-collision warning system across the national fleet of heavy vehicles.

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.

Yorgos Stephanedes, a visiting professor from the University of Patras, Greece, worked with civil engineering professor Gary Davis and MTO director John Hourdos during spring semester. Stephanedes used the MTO’s facilities to collect information on freeway crashes and analyze the potential of using neural networks for the detection of crash-prone conditions.

Other visiting researchers, all working with the Institute’s HumanFIRST Program, include Nobuyuki Kuge and Tomohiro Yamamura of Nissan, Jeff Caird of the University of Calgary, and Dick de Waard of the University of Groningen.

TechPlan projects were featured at an annual forum held June 18 at the University’s Hubert H. Humphrey Institute of Public Affairs. “TechPlan: New Frontiers in Transportation Policy, Technology and Planning” allowed researchers to present their current findings, followed by a discussion with transportation experts, thought leaders, and policymakers about the research and its possible implications.

TechPlan is a federally funded research program partnering the ITS Institute with the Humphrey Institute to investigate how new technology can be used to solve transportation planning and infrastructure challenges.

One project featured at the forum is investigating the effects of e-shopping on travel. In discussion before
the presentation, forum participants talked about the impacts they believed e-shopping might have—including a reduction in trips and sales tax revenue. Some were surprised to learn that researchers found e-shopping actually results in more local shopping trips, and that e-shopping and retail shopping actually have a complimentary relationship.

“The shopping process is really complicated. It is not just simple substitution,” said assistant professor Jason Cao, who is leading the project. “You go to a number of places to research and investigate, you may look for information online, you may go to look at a product in the store, and then buy it at home.”

Other featured TechPlan projects were those on improving emergency response in rural areas through data system integration, a tool for assessing the impacts of school choice policies on school transportation, and a comparison of the Urban Partnership Agreement programs in Minnesota, New York City, and Miami.