ITS INSTITUTE

Annual Report 2011 – 2012

**CENTER FOR
TRANSPORTATION STUDIES**

UNIVERSITY OF MINNESOTA

Director's Message

This coming year will mark 10 years since the Toward Zero Death program was started as a partnership between the Minnesota Departments of Transportation (MnDOT), Public Safety, and Health. During that decade, the number of road fatalities decreased from 655 in 2003 to 368 in 2011—a remarkable drop that far outpaced the drop in fatalities at the national level.

In the beginning, this initiative received considerable push-back. Few believed that "zero deaths" was a viable target, but those who did kept preaching to the unconverted: If not zero, then what other target was appropriate?

Those advocates—leaders of Minnesota's state agencies and an Institute board member, among others—were certainly right. We at the University have supported the TZD effort during these 10 years by advancing a variety of research projects focused on reducing road fatalities—research funded by MnDOT and the USDOT as well as many other sources. Targeting approaches that help at-risk driver populations and reduce crash-prone conditions became our mantra. Many of the projects described in this annual report testify to our efforts.

Max Donath

There are several other unique features of our work at the ITS institute. These include our push to take research to deployment. Ocie Adams of the Alaska Department of Transportation and Public Facilities, Michael Abegg of the Minnesota Valley Transit Authority, and Steve Misgen of MnDOT are some in the user community who have been delighted with the results and are quoted in our report. These transportation professionals have become some of our strongest advocates.

And the end-user community extends well beyond the transportation professionals with whom we interact. We have for some time been advocating for helping the blind navigate through our complex transportation maze. We are encouraged that some of those affected by our work have been pleased with the results. Their testimony is also included in these pages.

We are not only about research; we serve as a resource in many other areas. Our development of the popular games "Gridlock Buster" and "Distraction Dodger" has explored non-traditional approaches to education, attempting to attract a new generation of student into tackling the transportation problems and challenges that we still face. We strongly believe that we need a diverse workforce to tackle the transportation problems of the day and have instituted a summer internship so students can gain valuable work experience within a state transportation department.

And last but not least, let me thank those departing Institute board members who have made contributions to our efforts over the years and have now moved on: Beverley Miller, Mary Ellison, and Mark Hoisser. Their support of our work will be missed.

Max Donath, Director
ITS Institute

Mission Statement

The ITS Institute plans and conducts activities that advance U.S. technology and expertise in the many disciplines that make up transportation through education, research, and technology transfer activities at university-based centers of excellence. To help us accomplish this, we coordinate the work of researchers from multiple disciplines to **advance the state of the art in the core ITS technologies of computing, sensing, communications, and control systems** to solve today's challenging transportation problems.

Our focus is on **human-centered technology that enhances the safety and mobility of road- and transit-based transportation.** To that end, we bring together technologists and those who study human behavior from the University with our partners—the U.S. Department of Transportation, Minnesota Department of Transportation, other government agencies, and private industry—to ensure that Institute-developed technologies become tools that help us understand and optimize human capabilities as they relate to transportation.

Additionally, the Institute addresses issues related to transportation in a northern climate, investigates technologies for improving the safety of travel in rural environments, and considers social and economic policy issues related to the use of core ITS technologies.
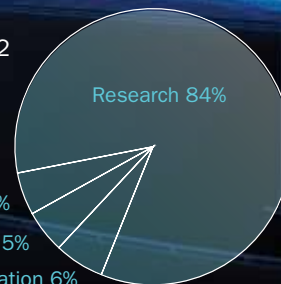
Financial Report

Expenditures for
Year 12: July 1, 2011–June 30, 2012

Total Expenditures:
$7.8 million

Research 84%

Technology Transfer/
Information Services 5%

Education 5%

Development & Administration 6%

RESEARCH

ITS Institute research is centered on safety-critical technologies and systems for efficiently moving people and goods in the following areas:

- Human performance and behavior
- Technologies for modeling, managing, and operating transportation systems
- Computing, sensing, communications, and control systems
- Social and economic policy issues related to ITS technologies

The Institute's diverse research program joins technologists with those who study human behavior to ensure that new technologies adapt to human capabilities, rather than requiring drivers to adapt to technology.

The Institute's geographic location gives it a unique advantage for developing research applicable to transportation in a northern climate and transportation in rural environments in addition to the metropolitan Twin Cities area. The ITS Institute research program includes research projects funded by partners such as the USDOT Research and Innovative Technology Administration's University Transportation Center program, the Federal Highway Administration, the Federal Transit Administration, the National Highway Traffic Safety Administration, the National Park Service, and the National Science Foundation. Local partners include the Minnesota Department of Transportation (MnDOT) and the Minnesota Local Road Research Board. Additional funding and in-kind support are provided by the Metropolitan Council, various Minnesota counties, Metro Transit, Minnesota Valley Transit Authority, City of Duluth, and other local governments, agencies, and private companies.
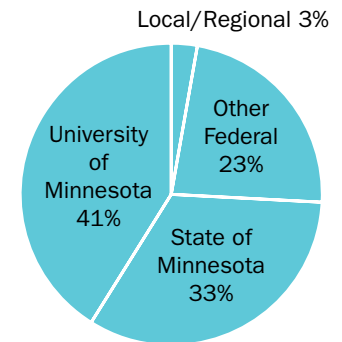
A selection of research projects under way is highlighted in the pages that follow.

Research funding sources for all ITS-related research projects
New funding for ITS-related projects was approximately $6.2 million in FY12. The sources for these new FY12 research project revenues are shown in the chart, on right.

During this period, 50 faculty and research staff and 65 students were involved in ITS-related research.

Local/Regional 3%
University of Minnesota 41%
Other Federal 23%
State of Minnesota 33%

Keeping drivers on the road and in their lane

More than
60 percent
of bus drivers said the driver-assist system made driving in the shoulder
safer and less stressful.

A driver-assist system (DAS) developed by the ITS Institute aims to increase driver safety in difficult driving conditions through the use of vehicle-guidance and collision-avoidance technologies. The system combines centimeter-level differential global positioning systems (DGPS), high-accuracy digital mapping systems, vehicle-mounted sensors, a windshield head-up display (HUD), a virtual mirror, and haptic and tactile feedback. Deployed in buses and snowplows, these systems help drivers operate more safely and efficiently in heavy traffic and low-visibility conditions.

Cutting through congestion

The DAS has been in use on 10 Minnesota Valley Transit Authority (MVTA) buses operating in the Cedar Avenue bus rapid transit (BRT) corridor since 2010 and is the first deployed system of its kind. The system monitors a bus's position on the roadway and provides visual and tactile alerts to quickly deliver critical information to the driver.

A recent evaluation published by the Federal Transit Administration (FTA) found that the DAS is improving bus operations and reducing driver stress for those driving on these

bus-only shoulders. The FTA evaluation measured the performance of the DAS in six areas, including efficiency/productivity, rider satisfaction, and driver satisfaction. It was conducted by researchers at the National Bus Rapid Transit Institute at the University of South Florida.

Overall results indicate that drivers stayed in the shoulder lanes 10 percent longer and drove 3 miles per hour faster while the DAS was active, indicating an increase in driver confidence.

For bus passengers, the DAS was a positive but invisible presence. More than 80 percent of riders rated the ride quality in the shoulder highly, and more than 95 percent were satisfied with travel time reliability. Most people, however, were unaware that the DAS had been installed on the buses.

"The fact that passengers didn't really notice the system is in fact a good result," says MVTA transit planning manager Mike Abegg, a leader of the Cedar Avenue project. "The system should function in the background for passengers, with the results only felt in that their trip is faster and more reliable."

Results from drivers were also positive, with 32 percent reporting greater confidence while driving in the shoulder with the DAS. More than

60 percent of drivers said the DAS made driving in the shoulder safer and less stressful.

The installation of the system was funded by the FTA through the U.S. Department of Transportation's Urban Partnership Agreement with match from the Twin Cities Metropolitan Council. The ITS Institute's Intelligent Vehicles Laboratory and HumanFIRST Program collaborated with the MVTA and Schmitty and Sons Transportation on the installation.

"I'm pleased that the evaluation documented a measurable improvement in driver performance," Abegg says. "The fact that bus operators had a positive reaction overall is also encouraging for the adoption not only of this specific technology, but the wide spectrum of connected-vehicle technologies that are on the near horizon."

Working through whiteouts
Record snowfalls pummeled much of Alaska

during the 2011–12 winter—and served as a good test for the DAS installed on Alaska Department of Transportation & Public Facilities vehicles. The technology helps vehicle operators keep an eye on where they are and what else is around them—even when they can't see the actual road.

In Alaska, the driver-assist technology is currently installed on four snowplows, one blower, and two airport rescue and firefighting vehicles. The system is helping operators clear snow in the Thompson Pass area, a 2,800-foot-high gap in the mountains northeast of Valdez, which receives more than 700 inches of snow annually and routinely experiences whiteout conditions and zero visibility.

"Maintaining the Richardson Highway through Thompson Pass presents a difficult challenge for the Alaska DOT. The driver-assistive system helps us to meet that challenge," says Ocie Adams, maintenance and operations

The Twin Cities area has more than

300 miles
of bus-only shoulders,
more than the rest of the U.S. combined.

specialist in ITS with the Alaska DOT.

Along with Adams, Mark Hanson and Pete Carter of the Thompson Pass Maintenance Station enthusiastically attest to how the system has made for more efficient and less stressful road clearing.

"During a whiteout storm, it's easy to get confused where you are on the road—not side to side, but what mile marker you're at," Hanson says. "Speed can be deceiving, [and] you can't see any landmarks." Because the DAS displays virtual landmarks and mile markers, he explains, "It really makes your stress level go down. You can see so much better. You have much better confidence of where you're at on the road, and you can plow the road straighter. It's really a nice tool."

Hanson says that when the DAS was first installed in the vehicles, some operators were uneasy using it. "But now that it's

been in the trucks for a while, and people are realizing how versatile it is …Everybody up here is on board with it."

"It's really the issue of new technology and your level of confidence in it," Adams adds. Since the technology was initially installed, the Institute's IV Lab team has made some improvements based on feedback from the drivers using it. "The thing that impresses me the most is the [IV Lab] staff's willingness to listen to us," says Adams. "They're one of the best we've ever used as far as it being a partnership."

Besides easing driver stress, Adams notes other benefits: snowplow operators can stay on the highway even when it's closed to traffic, allowing emergency vehicles to get through and the traveling public to get back

on the road quickly once it reopens. The system also gives drivers the ability to clear the shoulder right next to the guardrail (which is often completely buried) without hitting it. Further, the technology can help prevent collisions with other vehicles on the road that may not be visible to the eye but show up on the head-up display.

Carter says the system has improved public service in two ways. "We're much more efficient. We don't have to do second passes like before, when we were blind and couldn't find the road, so we're actually on the road doing the job better," he says. And second, there's less danger that plow drivers will go off the road and end up stuck. "You don't have to worry about that because you know exactly where you are."

In the Alaska plows, lane boundaries, turnouts, and other landmarks are indicated on the head-up display.

Helping blind pedestrians using smartphone app

Crossing a street isn't risk-free for any pedestrian, but it's especially challenging for the blind or visually impaired.

Chen-Fu Liao, senior systems engineer in the ITS Institute's Minnesota Traffic Observatory, led a research team that developed a prototype Mobile Accessible Pedestrian Signal (MAPS) system using a smartphone, GPS, and other technologies to help people with limited or no eyesight cross signalized intersections safely.

For their work (initially funded by the ITS Institute), the researchers interviewed 10 blind and low-vision people to better understand what types of information they use at intersection crossings and to identify what could help them. "Engineers can design great, fancy stuff, but if nobody wants to use it, it's not useful at all," Liao says.

Ken Rodgers, president of the American Council of the Blind of Minnesota, was one of the study participants who provided input and helped test the prototype. "I think the whole system and the whole concept is so beautiful," he says. "It just works well."

Blind or visually impaired pedestrians face a

number of challenges, such as difficulty locating the edge of the street or crosswalk and interpreting signal and traffic patterns. Current crossing systems, which use audio warnings, have shortcomings for municipalities, including the cost of equipment and maintenance. And because there is no standard location for push-button signals, visually impaired pedestrians must deviate from their preferred travel paths to request a crossing signal, which can make navigating the intersection more difficult.

The MAPS system goes above and beyond existing crosswalk aids. While standing at an intersection, the user can point a smartphone in the direction he or she wants to cross and call up information about the intersection and the signal phase by tapping the unit's touchscreen once. Tapping twice confirms the desired crossing direction and sends a request for a crossing signal to the traffic signal controller. The user gets feedback from the text-to-speech interface.

Because it's an app, it's easy and inexpensive for users. And MAPS puts the assistive technology directly in the hand of the user, avoiding many of the drawbacks associated with conventional infrastructure-based systems while offering greater flexibility and ease of use. [A video explaining MAPS is at www.its.umn.edu/Research/FeaturedStudies/maps/index.html.]

The prototype has been field-tested at intersections in Minneapolis and Golden Valley, Minnesota. Work continues to refine the accuracy, resolution, and usability of the system. In addition, the researchers have recently begun a new project funded by the Minnesota Department of Transportation. This project aims to enhance the system to help the visually impaired travel safely around work zones.

Liao also received a 2012 Access Achievement Award from the University of Minnesota's Disability Services, which recognizes individual outstanding achievement in support of access to the University.

Chen-Fu Liao, right, worked with occupational and mobility specialist Linda Spalding on the app to assist visually impaired pedestrians.

Henry Liu (on left) and his team worked with MnDOT to install the system in traffic control cabinets.

The system has benefits for the traveling public: less congestion, less delay, and improved travel times throughout the corridor.

Using SMART Signal for smart congestion relief

One of the primary obstacles to improving the performance of signalized arterials has been the difficulty of gathering accurate and reliable data to assess arterial traffic conditions. The need to manually collect the data and then calculate performance metrics for individual intersections or arterials has made assessing performance a time-consuming and expensive process for transportation agencies.

Institute researchers in the Department of Civil Engineering and Minnesota Traffic Observatory (MTO) have developed a new system that automatically collects data and assesses performance in real time. It then creates performance measures, including information on the times and locations of congestion on a given roadway. Because it can also refine the traffic signal parameters intelligently using archived data, the system has been dubbed "SMART Signal," for Systematic Monitoring of Arterial Road Traffic Signals.

Civil engineering associate professor Henry Liu led the research team that developed SMART Signal, which has been deployed at more than 30 intersections in Minnesota and six intersections in Pasadena, California. Chen-Fu Liao, a senior systems engineer at

the MTO, also contributed to the project.

The Institute researchers worked with Minnesota Department of Transportation (MnDOT) operations staff for about five years, says Steven Misgen, metro traffic engineer with MnDOT. "I think it's a good relationship between the U of M theoretical researchers and the real-world traffic operations personnel. We've [provided] input into the device so that we get exactly what we want."

The SMART Signal system is intended to be installed at a series of intersections along an arterial road. A dedicated microprocessor module is installed in the signal control cabinet at each intersection, interfacing directly with the cabinet electronics without interfering with signal operations. SMART Signal collects two types of event data: signal-phase change events and vehicle-detector actuation events. Event data are then packaged and transmitted in real time to the server located at the MTO.

"The device is very important to us because it takes all the data that we have in the traffic signal cabinet and turns it into usable information—performance measures—for traffic engineers to use to assess how their signals are doing."
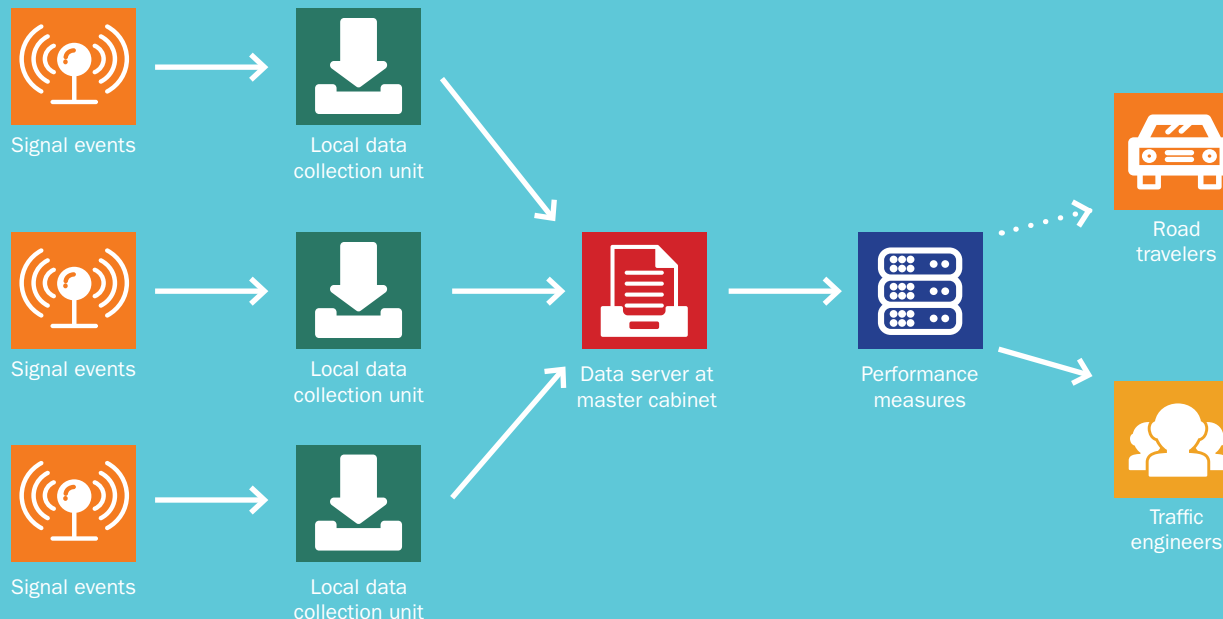
Misgen says the system also has benefits for the traveling public: less congestion, less delay, and improved travel times throughout the corridor. "As a result, they will have a better quality of life, [and] less time sitting in congested intersections."

In 2011, the University of Minnesota's Office of Technology Commercialization signed a licensing agreement with startup company SMART Signal Technologies Inc. to commercialize the system.

Funding and in-kind support for the SMART Signal system have been provided by MnDOT, the ITS Institute, the Minnesota Local Road Research Board, Hennepin County, the City of Pasadena, and the National Cooperative Highway Research Program.

A video from the ITS Institute highlighting the SMART Signal system is available on the Institute website (www.its.umn.edu/Research /FeaturedStudies/smartsignals/index.html).

SMART Signal system design

Signal events → Local data collection unit

Signal events → Local data collection unit → Data server at master cabinet → Performance measures ⋯⋯> Road travelers

Signal events → Local data collection unit

Performance measures → Traffic engineers

Advance and stop-line detectors record vehicle actuators as they move through the intersection. A computer in the signal controller cabinet archives the high-resolution traffic signal data and automatically generates real-time performance measures. This information is sent continuously to a database in the MTO, which traffic engineers can analyze to learn which signals may need re-timing. Ultimately, related traffic information will be available to drivers as well through a web interface.

Only one-third of traffic crash victims die immediately; another one-third take 10 to 90 minutes to die. During that so-called "golden hour," there is the highest likelihood that prompt medical intervention will prevent death.

In an ongoing effort to facilitate communication and improve patient care following traffic crashes, researchers with the University of Minnesota's ITS Institute and Center for Excellence in Rural Safety (CERS) have been conducting pilot studies of the prototype CrashHelp system.

With CrashHelp, emergency responders use a mobile smartphone on-scene to collect multimedia data about crash victims—including digital pictures, audio recordings, and videos—as well as other basic patient and incident information. These data are sent directly into the emergency/trauma department to a web-based interface practitioners can view on demand. This information gives hospitals advance notification of crash severity and related information that can be used to best prepare for a patient's arrival.

Access to emergency medical services (EMS) is a long-standing rural safety problem in the United States; since EMS service is based

"CrashHelp holds the potential to significantly improve the notification of and the communication between prehospital care providers and emergency departments."

— Scott Tucker, Canyon County Paramedics

Improving survival odds for crash victims

on population density, rural areas are often underserved, resulting in higher fatality rates per rural mile traveled.

To help ready CrashHelp for deployment in rural regions throughout the country, researchers conducted one pilot study in Idaho and have launched a second in central Minnesota. Institute researcher and CERS research director Tom Horan and his colleague Ben Schooley, now an assistant professor at the University of South Carolina, have been leading the studies.

The Idaho pilot was conducted from July through October 2011 in the Boise area and included participants from six hospitals and two ambulance providers. Overall results were positive, with a total of 801 incident transmittals completed during the study period—including more than 400 images and nearly 450 audio recordings.

The study included follow-up focus groups with personnel from participating hospitals and ambulance providers, state EMS agencies, and the Idaho Department of Transportation. Results indicate that CrashHelp allowed for the efficient collection of usable information. Seeing hospitals use that information spurred medics to use the system more, and hospital personnel said it particularly helped them prepare for the arrival of patients coming from farther away.

"CrashHelp holds the potential to significantly improve the notification of and the communication between prehospital care providers and emergency departments," says Scott Tucker, deputy director of Canyon County Paramedics

in Idaho. Tucker also says information collected and transmitted using CrashHelp "could significantly impact patient care decisions made in the emergency department."
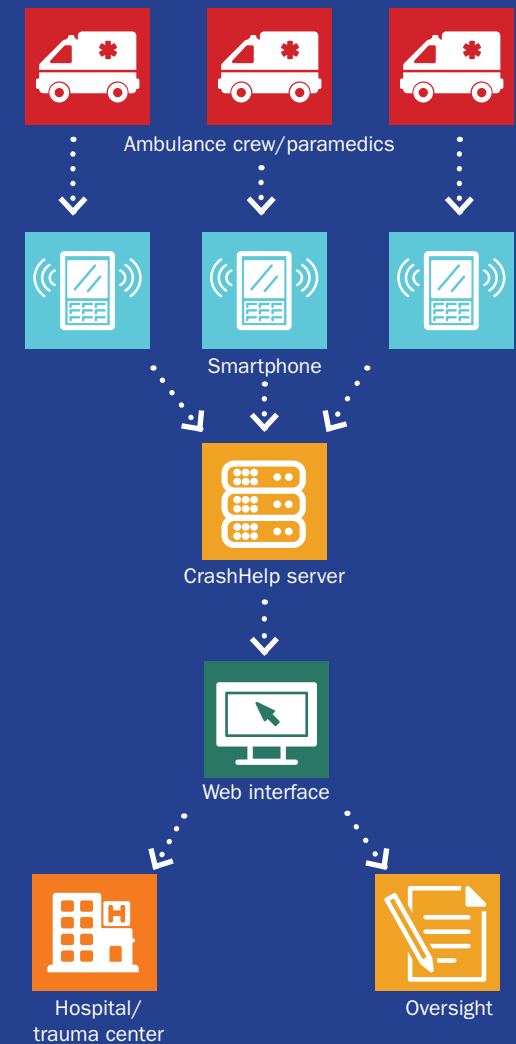
The second pilot study, currently under way in Crosby, Minnesota, is being conducted in partnership with the Central Minnesota Regional Trauma Advisory Committee (CENTRAC) and funded by the Minnesota Departments of Transportation and Health as part of the Minnesota Toward Zero Deaths program.

In preparation for the Minnesota study, the CrashHelp system was adapted to meet the specific needs of rural EMS and emergency practitioners. The enhanced system has been implemented at the Cuyuna Regional Medical Center (CRMC) and its ambulance service provider in Crosby.

Following the initial trial period at CRMC, the research team will evaluate the feasibility of expanding the system throughout the CENTRAC region, which includes 14 counties in central Minnesota. The Minnesota pilot also will include an evaluation of CrashHelp's effects on EMS communications, EMS decision making, and medical outcomes that could result from using the system in a regional setting.

How CrashHelp improves emergency response: from crash scene to hospital

Ambulance crew/paramedics

Smartphone

CrashHelp server

Web interface

Hospital/ trauma center

Oversight

"The [research] offers information worth considering for those looking to construct roundabouts with pedestrian/bicycle movements." —Kristin Asher, Richfield city engineer

Evaluating pedestrian and bicyclist risk in roundabouts

Once rare in the United States, roundabouts are becoming more common in Minnesota and across the country. Although research has shown that roundabouts can successfully ease congestion and reduce serious crashes, there are concerns about roundabout accessibility and safety for pedestrians and bicyclists.

In a study funded by the Minnesota Department of Transportation, researchers from the Institute's Minnesota Traffic Observatory (MTO) examined the experience of pedestrians and bicyclists at two roundabouts in the Twin Cities. Led by MTO director John Hourdos, the team used video surveillance equipment to collect data on driver and pedestrian behavior at each site.

The researchers deployed the video equipment at a two-lane roundabout in suburban Richfield and a one-lane roundabout in a residential area of Minneapolis. Between the two locations, the team captured video of more than 6,900 pedestrian crossings and 7,500 bicycle crossings.

Among the thousands of crossing events captured by the study, there were only three cases that could marginally be termed close calls. However, study findings do highlight the existence of friction between pedestrians and drivers at roundabout crossings.

MTO researchers install the system at the test site in Richfield.

There are about **2,000** roundabouts in the U.S., compared to **20,000** in France, **15,000** in Australia, and **10,000** in the U.K.

One concern is that many drivers fail to yield to pedestrians and bicyclists, even though Minnesota law requires them to do so. In fact, findings show that drivers at the Richfield roundabout yield only about 45 percent of the time. The yielding rate in Minneapolis was higher, averaging about 83 percent.

The research team identified several factors that influence drivers' yielding behavior. Study results indicate the following trends:

- Drivers are more likely to yield to pedestrians or bicyclists beginning their crossing in the center island.
- Vehicles exiting the roundabout are less likely to yield than those entering it.
- Drivers are more likely to yield to larger groups.
- Vehicles entering the roundabout at the immediate upstream entrance are more likely to yield than those coming from other entrances.

- Drivers are less likely to yield if they encounter another vehicle merging into the roundabout immediately before the exit where the pedestrian is trying to cross.
- Yielding probability decreases with more vehicles present in the roundabout.

The team also examined the delays experienced by pedestrians waiting to cross at roundabouts, and results indicate that their wait times are actually shorter than at signalized intersections. For example, a signalized intersection with daily traffic comparable to the Richfield roundabout has an average pedestrian delay of 30 seconds. The average delay at Richfield was nine seconds. At Minneapolis, the wait was even shorter—less than two seconds. However, the researchers suggest that the non-yielding behavior of drivers at roundabouts may intensify the experience of delay, making it seem longer than it actually is.

In addition, drivers' failure to yield creates a significant safety risk, particularly for pedestrians who are visually impaired. Although the researchers did not observe any visually impaired pedestrians in this study, the observed yielding rates demonstrate that such pedestrians cannot assume drivers see them or are willing to stop.

Kristin Asher, city engineer for Richfield and a member of the project's technical advisory panel, says the research helped answer questions about roundabout safety. "It was reassuring to find out that there were no safety-compromising situations observed in all the…thousands of pedestrians and bicyclists observed using the crossings," she says. And results also showed that delays are much improved when compared to signalized intersections, which is "information worth considering for those looking to construct roundabouts with pedestrian/bicycle movements," she adds.

13

Minnesotans are "overwhelmingly supportive" of using ASE in construction zones where workers are endangered and on roads near schools.

Exploring public support for automated speed enforcement

Automated speed enforcement (ASE) has proven to be an effective strategy for reducing speeding and improving road safety. Its use in the United States, however, has been limited in part because of a perception by policymakers that it is unpopular and controversial. As part of a recent study, U of M researchers asked Minnesotans what they think of ASE. They found strong support—particularly for ASE in work zones and school zones and if revenues from fines are dedicated for road safety programs.

ASE uses radar and cameras to identify a speeding vehicle and capture images of the license plates, and, in some systems, the driver. Citations are then mailed to the vehicle's registered owner or, alternatively, the identified driver. ASE has been deployed in 14 states and in many countries, especially in Europe.

An ITS Institute research team led by Frank Douma, director of the State and Local Policy Program in the Humphrey School of Public Affairs, surveyed more than 600 Minnesotans this past spring as part of the study. The team found that a majority (56 percent) either are very supportive (20 percent) or somewhat supportive (36 percent) of the concept of ASE, which is in line with national surveys. They also found that Minnesotans are "overwhelmingly supportive" of using ASE in construction zones where workers

are endangered (83 percent net support), on roads near schools (82 percent net support), on roads where many have died (77 percent net support), and on Minnesota roads where many people violate speed limits (69 percent net support). The level of support for using ASE on all roads falls just below the majority threshold, at 48 percent net support.

In addition, about seven in ten Minnesotans indicated they would be more likely to support ASE if the money raised from speeding tickets were used for local road safety improvements or if tickets were issued only to those driving at extreme speeds, Douma said.

The researchers also examined the legal and related political obstacles for deploying ASE in Minnesota, including a state supreme court ruling that invalidated a Minneapolis red-light photo enforcement ordinance. The court's ruling was narrow, Douma explains, and did not bar automated enforcement generally or the concept of owner liability.

Moving forward, Douma said deploying ASE in Minnesota would require authorizing legislation, particularly to clarify liability issues and the role of local authorities. The researchers recommend that if legislation were drafted, it would authorize pilot testing of ASE in school zones and MnDOT work zones. Though authorizing only pilot projects, the legislation should include the full set of ASE program design

elements used in other jurisdictions to further increase the public's acceptance of ASE as well as to reduce the risk of legal challenges.
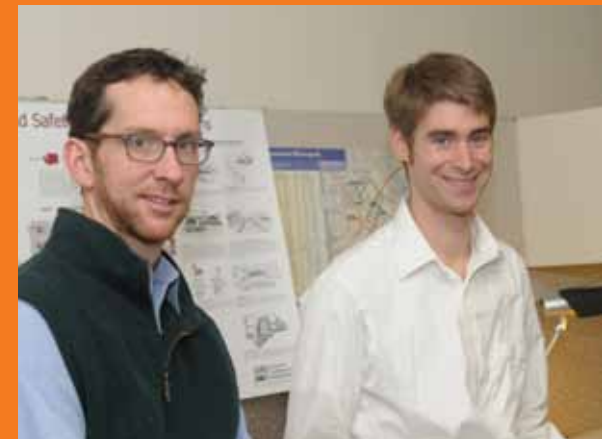
At the 2012 Toward Zero Deaths conference, during which Douma and others discussed the issue, State Senator Kathy Sheran said the research findings and recommendations provide the groundwork for shaping potential legislation. "We're beginning to work on the design of legislation in order to do what we need to do [to authorize a pilot]," she said. "We're exploring, and we're learning from other states."

The study was funded by the Institute and the Minnesota Department of Transportation.

Researchers Frank Douma and Lee Munnich (above), and Tom Garry and David Thorpe (right)

EDUCATION

To solve tomorrow's transportation problems, we need to prepare future researchers and other professionals. Our education efforts aim to develop a critical transportation knowledge base and a transportation workforce that is prepared to design, deploy, operate, and maintain the complex transportation systems of the future. Activities in this area consist of a multidisciplinary program of coursework and experiential learning that supports the Institute's theme. The educational program includes the disciplines of computer science and engineering, electrical and computer engineering, civil engineering, mechanical engineering, human factors, public policy, and others.

We're aided by strong connections—to educators at high schools focused on science, technology, engineering, and mathematics (STEM); transportation faculty at established degree-granting transportation programs; transportation agencies; and professional organizations—in delivering a relevant, well-rounded education program.

By supporting and sponsoring a variety of educational initiatives for students, we are generating interest in core ITS science and technologies. These initiatives include developing new curriculum and courses, involving undergraduate and graduate students in research projects, sponsoring students to attend national conferences, giving awards that recognize outstanding students, and offering research assistantships to help attract more students to the study of transportation.

Highlighted activities

"The internship involved a lot of learning experience and exposure to the real-world environment."
—Sam Lamichhane, intern with the Summer Transportation Internship Program

Summer intern Sam Lamichhane from Howard University demonstrates pavement-testing technology with Bernard Izevbekhai of MnDOT.

Students gain experience through new internship program

When the summer began, Samrakshak Lamichhane wasn't certain what a typical workday might look like after graduation. But thanks to a new internship program, Lamichhane and three other undergraduates got a taste of real-world operations and gained insight for their future career paths.

The eight-week Summer Transportation Internship Program was developed in partnership by the ITS Institute, Center for Transportation Studies, Howard University, and the Minnesota Department of Transportation (MnDOT). Its purpose was to provide an opportunity for students to gain professional experience and skills that will complement their academic coursework.

Through the program, the students gained practical knowledge about MnDOT, learned about its operations, and worked on transportation-focused projects.

Out of 34 applicants, four students were selected: Lamichhane, majoring in structural and transportation engineering at Howard University; Chelsey Palmateer, majoring in civil engineering at the U of M; Autumn McDowell, majoring in urban studies at the U of M; and Yusuf Abdi, majoring in electrical engineering at the U of M.

"The internship involved a lot of learning experience and exposure to the real-world environment," Lamichhane says. "I have learned that on-the-job learning, with college education as a background, is the way to success."

During his internship, Lamichhane worked with Bernard Izevbekhai, MnDOT research operations engineer, at the MnROAD pavement research facility. They submitted a paper

High school students toured the Minnesota Traffic Observatory as part of an engineering and science summer camp.

The Institute participated in an event promoting safe teen driving, in partnership with State Farm Insurance and others.

about their work—"2011 Low-Volume Road Construction Cell 28 Stabilized Partial Depth Reclamation Construction Quality Assurance Testing"—to the Transportation Research Board, and Lamichhane presented the paper in August to MnDOT staff.

Institute promotes transportation careers at summer camp

About 50 high school students learned about transportation-related degrees and careers during the CSE Exploring Careers in Engineering and Physical Science Summer Camp, hosted by the University's College of Science and Engineering. The annual day camp is designed to introduce students to careers in science, engineering, and math.

The students toured the HumanFIRST Program's human factors research laboratory and the Minnesota Traffic Observatory. They also had time to play Gridlock Buster, an online educational game created by the ITS Institute. The game incorporates tools and ideas that traffic control engineers use in their everyday work to give players an idea of what it's like to manage traffic flow. Students also listened to a presentation by HumanFIRST researchers about the dangers of distracted driving.

More about the labs and Gridlock Buster is at its.umn.edu.

State Farm-funded project to help Institute educate teen drivers

Distracted driving is dangerous for everyone—especially for teens and other new drivers.

Under a grant from auto insurance provider State Farm, the Institute and the Center for Transportation Studies (CTS) are working with several partners to increase awareness about the risks of distracted driving with preteens, teens learning to drive, and newly licensed drivers. The goal is to change teen driver behavior and reduce serious and fatal crashes due to distractions.

In the year-long project, the Institute and CTS are creating and disseminating educational

materials and expanding the marketing of the online game Distraction Dodger (www.its.umn .edu/DistractionDodger). The award-winning game, developed with guidance from Institute researchers, is designed to help teens and young adults understand the importance of concentrating on driving.

The first activity under the grant was an exhibit at the "Celebrate My Drive" event at a metro-area mall in September. State Farm joined with the Institute, CTS, the Minnesota State Patrol, Hennepin County Medical Center, and others to host the event—one of 13 similar national events sponsored by the insurance company. Eighteen local high schools participated, and many teens tried *Distraction Dodger* and other activities to help experience the danger of distracted driving. Local media covered the event.

Brian Davis, a master's degree candidate in mechanical engineering, was named the 2012 ITS outstanding student of the year—an award sponsored by the USDOT's Research and Innovative Technology Administration.

TECHNOLOGY TRANSFER

Sharing our expertise and research results with local, national, and international audiences for use in real-world applications is essential to achieving our goals. Technology transfer also raises the profile of our research and educates students, practitioners, policymakers, and the general public about ITS issues and solutions.

Our efforts in this area are far ranging to reach a broad and diverse audience. Over the past year, we have provided tours and demonstrations of our research and facilities,

sponsored seminars, created videos showcasing our research, sent electronic newsletters and announcements, published printed pieces, and enhanced our website.

The use of our research results and products by practitioners is critical to improving the transportation system and to ensuring public- and private-sector support for future research. Our collaboration with a variety of state, local, federal, and private-sector partners maximizes the potential for adoption of innovative research developed through our programs.

Agencies recently implementing Institute research results include the Minnesota Valley Transit Authority and Alaska DOT (driver-assist technology on buses and snowplows), Denali National Park (traffic simulation tools), and the startup companies SMART Signal Technologies Inc. (arterial performance monitoring) and Drive Power LLC (smartphone-based driver support systems).

But perhaps the most direct method of transferring technology has been to educate students who join the workforce.

Highlighted activities

Max Donath and Ted Morris work with participants in the ITS technologies short course.

Practitioners learn about vehicle-based ITS technologies at short course

One of the ways the ITS Institute helps put research into practice is to incorporate new findings into courses and training. An example of this was a short course offered by the Institute in July.

The new daylong course—ITS Technologies for Improving Highway Vehicle Safety and Crash Prevention—provided a detailed overview of the latest vehicle-based ITS technologies for improving highway safety and preventing crashes.

Practitioners from MnDOT, the City of St. Paul, and several consulting firms learned how sensing and control technologies keep vehicles in their lanes, help avoid collisions, and prevent rollovers; how such technologies are being deployed; and what impact they will likely have

on road safety and mobility. Attendees also used 3-D graphic simulations to experience the direct effects of these sensing and control technologies.

Mechanical engineering professors Max Donath (who is also the Institute's director) and Rajesh Rajamani led the course, with support from Ted Morris. The course met the continuing education requirements for Professional Development Hour (PDH) units for engineers.

Innovations in road safety are focus of forum with national leaders

Technology and policy innovations have helped reduce traffic fatalities in recent years, but even more can be done. On August 23, national and state leaders gathered at a forum in Minneapolis to discuss innovations in road safety, including research at the University of Minnesota.

Victor Mendez, FHWA, learns about the HumanFIRST simulator from Mike Manser, the research program's director.

"Safety is the number one priority of the USDOT…Minnesota research will make us safer."

—Victor Mendez, Federal Highway Administration

"Safety is the number one priority of the USDOT," said Victor Mendez, administrator of the Federal Highway Administration. "Minnesota research will make us safer." Mendez praised what he called Minnesota's "outstanding" safety record, noting that the state's fatalities have fallen at a rate twice that of the national average. He attributed this in part to the collaborative efforts of Minnesota's Toward Zero Deaths (TZD) program as well as work by the University of Minnesota "to bring new thinking to old problems." Despite these positive trends, however, Mendez also warned against complacency.

U.S. Senator Amy Klobuchar echoed Mendez. "Too many people are dying on our roadways," she said. "We need to do everything we can to improve safety." MnDOT commissioner Tom Sorel reported that momentum is building around the country and the world to reduce serious injuries and fatalities. The national TZD program is modeled after Minnesota's, and about 30 states have similar programs, he added.

The forum also included presentations of U of M research by Institute director Max Donath and Tom Horan, research director with the University's Center for Excellence in Rural Safety (CERS). The forum was hosted by former Congressman James L. Oberstar and sponsored by CERS, CTS, and MnDOT.

New startup companies arise from transportation research

Innovative technologies developed by Institute researchers were used to launch two new start-up companies over the last fiscal year: Smart Signal Technologies Inc. and Drive Power LLC.

The SMART Signal (Systematic Monitoring of Arterial Road Traffic Signals) system reduces congestion on roads controlled by traffic lights. It automatically collects and processes data from traffic signal controllers at multiple intersections and then creates performance measures, which traffic engineers can use to determine whether signals are properly timed. Civil engineering associate professor Henry Liu led the research team that developed SMART Signal, which has been deployed at more than 30 intersections in Minnesota and six intersections in Pasadena, California. Funding and in-kind support for the SMART Signal system have been provided by MnDOT, the ITS Institute, the Minnesota Local Road Research Board, Hennepin County, and the National Cooperative Highway Research Program.

Drive Power makes web- and smartphone-based products that leverage emerging measurement technologies and predictive analytics to help people make more informed driving decisions. For example, a mobile app—DriveScribe—blocks calls, e-mails, and text messages while the vehicle is in operation and provides real-time coaching to novice drivers. The app was developed by U of M mechanical engineering department researchers.

Researcher Alec Gorjestani now serves as Drive Power's vice president for technology. The research behind DriveScribe was funded by the Minnesota Department of Transportation and the ITS Institute.

Media coverage brings Institute research to wider audience

Institute research was featured numerous times in national media, including the *New York Times* and the History Channel, as well as in local television news, print, and radio outlets. News stories help the traveling public understand how research can positively affect their daily lives. Among the headlines:

- Distracted-driving video game aims to teach teens WCCO 4 TV, August 29, 2012
- Smart snowplows keep the highway to Valdez, Alaska, clear *Government Technology,* March 15, 2012
- App to help parents track their teen's driving habits KARE 11 TV, March 7, 2012
- "Modern Marvels: Alaska" (episode featuring ITS Institute and Intelligent Vehicles Lab technology) History Channel, February 27, 2012
- U of M researchers tap into smartphones to help visually impaired KARE 11 TV, February 16, 2012
- U-M transit research leads to biz *Minneapolis/St. Paul Business Journal,* February 10, 2012
- New video game aims to scare young drivers safe Minnesota Public Radio, February 1, 2012
- Interstates fastest during snowy commute —or not *Star Tribune,* January 29, 2012
- Collision in the making between self-driving cars and how the world works *New York Times,* January 23, 2012
- University researcher presents at conference on self-driving cars *Mercury News,* January 19, 2012

HumanFIRST staff, clockwise from left: Chris Edwards, Nichole Morris, Peter Easterlund, Janet Creaser, Mike Manser, and Ensar Becic

HumanFIRST Program

www.humanfirst.umn.edu

Staff
Michael Manser, Director
Ensar Becic, Research Associate
Janet Creaser, Research Fellow
Peter Easterlund, Simulator Manager
Chris Edwards, Research Fellow
Nichole Morris, Research Associate

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.

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

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

The program's simulator software can create virtual environments that precisely replicate any geospecific location.

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

- The DEN (Digital Immersive ENvironment), a high-fidelity 3-D interactive immersive display system that allows researchers to observe and explore traffic flow scenarios within any environmental context and from any fixed or moving perspective.

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

NATSRL
www.its.umn.edu/ProgramsLabs/NATSRL

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

The RAP, which meets every semester, plays a major role in managing and guiding NATSRL research activities. Further, it has been working as the ongoing communication channel between NATSRL faculty and local transportation practitioners by addressing the research needs from the field as well as the needs of the researchers in terms of data and testing platforms.

ITS BOARD AND MANAGEMENT STRUCTURE

ITS Institute board members (as of June 30, 2012)

Laurie McGinnis (Chair)
Director, Center for Transportation Studies, University of Minnesota

Deb Bloom
City Engineer, Roseville, Minnesota

Mostafa Kaveh
Associate Dean, College of Science and Engineering, University of Minnesota–Twin Cities

Richard Rovang
Director, Central Corridor Project, Metro Transit

Mike Abegg
Transit Planning Manager, Minnesota Valley Transit Authority

Mark Dunaski
Assistant Commissioner, Minnesota Department of Public Safety

Dan Murray
Vice President of Research, American Transportation Research Institute

Rich Sanders
County Engineer, Polk County

Bernie Arseneau
Deputy Commissioner and Chief Engineer, Minnesota Department of Transportation

Monique Evans
Director, Office of Safety Research and Development, Federal Highway Administration

Marthand Nookala
Assistant County Administrator, Hennepin County, Minnesota

Linda Taylor
Director, Research Services Section, Minnesota Department of Transportation

Michael Baltes
Director, Office of Technology, Federal Transit Administration

Tim Johnson
Director, Crash Avoidance and Electronic Controls Research, National Highway Traffic Safety Administration

Susan Mulvihill
Division Director, Employee and Corporate Services, Minnesota Department of Transportation

Nick Thompson
Division Director, Policy, Safety and Strategic Initiatives, Minnesota Department of Transportation

Mike Barnes
Division Director, Operations, Minnesota Department of Transportation

Anthony Kane
Director, Engineering and Technical Services, American Association of State Highway and Transportation Officials (AASHTO)

James Riehl
Dean, College of Science and Engineering, University of Minnesota–Duluth

Derrell Turner
Minnesota Division Administrator, Federal Highway Administration

Management Structure

The ITS Institute is located on the Twin Cities campus of the University of Minnesota and is part of the Center for Transportation Studies (CTS); facilities are housed within multiple colleges and departments as well as at the University's Duluth campus.

Much of the Institute's successful leadership in intelligent transportation systems and technologies results from its state and national partnerships, including those with CTS, the Minnesota Department of Transportation, transit agencies, private industry, and county and city engineers. Our partnerships with a variety of state, local, federal, and private-sector partners maximize the potential for the adoption and implementation of innovative research developed through our programs.

The Institute director leads its operation, implements its strategic plan, and directs Institute programs, personnel, and funds.

The Institute's board guides and oversees the implementation of the Institute's work.

Institute staff and University researchers, drawing from various areas of expertise, help create and spread knowledge related to intelligent transportation systems through research, education, and technology transfer activities. In addition, the leadership and staff of CTS provide connections and access to an extensive transportation research and education network. The Institute's affiliation with the Center allows it to work seamlessly with CTS staff and benefit from its diverse outreach, administration, and communications capabilities.

Faculty and Research Staff 2012

College of Design
John Bloomfield
Kathleen Harder

College of Science and Engineering

Aerospace Engineering and Mechanics
Demoz Gebre-Egziabher

Civil Engineering
Gary Davis
John Hourdos
David Levinson
Chen-Fu Liao
Henry Liu
Julian Marshall
Panos Michalopoulos
Stephen Zitzow

Computer Science and Engineering
Vassilios Morellas
Ted Morris
Nikolaos Papanikolopoulos
Shashi Shekhar

Mechanical Engineering
Lee Alexander
Eddie Arpin
Ensar Becic
Pi-Ming Cheng
Janet Creaser
Max Donath
Peter Easterlund
Chris Edwards
Alec Gorjestani
Michael Manser
Arvind Menon
Nichole Morris
Bryan Newstrom
Rajesh Rajamani
Craig Shankwitz

Hubert H. Humphrey School of Public Affairs
John Bryson
Jason Cao
Barbara Crosby
Frank Douma
Yingling Fan
Thomas Horan
Greg Lindsey
Lee Munnich
Melissa Stone

Northland Advanced Transportation Systems Research Laboratories (NATSRL)

Faculty and research staff conducting ITS-related research for NATSRL include the following:

University of Minnesota Duluth, Swenson College of Science and Engineering

Chemistry and Biochemistry
John Evans
Venkatram Mereddy

Civil Engineering
Eil Kwon

Chemical Engineering
Steven Sternberg

Computer Science
Peter Willemsen

Electrical and Computer Engineering
M. Imran Hayee
Taek Kwon
Hua Tang
Jiann-Shiou Yang

Mechanical and Industrial Engineering
Hongyi Chen
Ryan Rosandich
Debao Zhou

ITS Institute Staff

Max Donath
ITS Institute Director
612-625-2304
donath@me.umn.edu

Research Programs

Frank Douma
Director, TechPlan
612-626-9946
douma002@umn.edu

John Hourdos
Director, Minnesota
Traffic Observatory
612-626-5492
hourdos@umn.edu

Eil Kwon
Director, Northland
Advanced Transportation
Systems Research
Laboratories
218-726-8651
eilkwon@d.umn.edu

Michael Manser
Director, HumanFIRST
Program
612-625-0447
manse003@umn.edu

Craig Shankwitz
Director, Intelligent
Vehicles Laboratory
(As of FY12; now in
private industry)

Research and Contract Management

Joe Barbeau
Program Coordinator
612-626-2862
barb0092@umn.edu

Kate Bartelt
Manager of Financial
Strategy and Contract
Coordination
612-626-2308
bartelt@umn.edu

Penny Harris
Contract Coordinator
612-625-9246
harri163@umn.edu

Jan Lucke
Manager of Research
Administration
612-625-8401
jlucke@umn.edu

Linda Preisen
Director of Research
Administration
612-626-1808
lpreisen@umn.edu

Dawn Spanhake
CTS Assistant Director,
Program and Financial
Management
612-626-1536
spanhake@umn.edu

Outreach, Education, and Publications

Cadie Wright Adhikary
Graphic Designer
612-624-05461
cwright@umn.edu

Christine Anderson
Editor
612-624-1572
ande4255@umn.edu

Gina Baas
CTS Assistant Director,
Education and Outreach
612-626-7331
baasx001@umn.edu

Amy Friebe
Senior Editor
612-626-7330
frieb003@umn.edu

Shawn Haag
Program Coordinator
612-625-5608
haag0025@umn.edu

Stephanie Malinoff
Manager of Events and
Outreach Services
612-624-8398
malinoff@umn.edu

Arlene Mathison
Digital Information and
Library Services Director
612-624-3646
amathison@umn.edu

Toni Prekker
Web Coordinator
612-626-1023
prekk003@umn.edu

Pamela Snopl
Managing Editor
612-624-0841
snopl001@umn.edu

Marilee Tuite
Assistant Librarian
612-626-1077
tuite003@umn.edu