



CENTER FOR TRANSPORTATION STUDIES

UNIVERSITY OF MINNESOTA

# Center for Transportation Studies

2005 Annual Report



## **CENTER FOR TRANSPORTATION STUDIES**

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# Center for Transportation Studies

## 2005 Annual Report

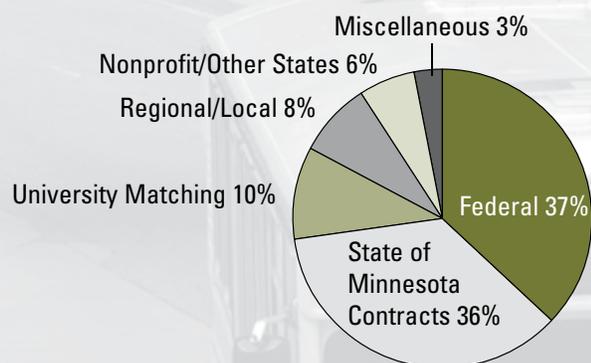
This publication is a report of transportation research, education, and outreach activities conducted by the Center for Transportation Studies and its affiliated programs for the period July 2004 through June 2005 (fiscal year 2005).

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As one of the few comprehensive universities around the world that engages in responsibilities that range broadly from medicine to land grant-oriented agriculture and extension services, our vision is to continue our preeminent role as a publicly engaged university that integrates research, teaching, and public engagement.

—University of Minnesota President Robert Bruininks  
*Strategic Positioning Report, January 2005*



**CTS total annual revenues  
FY2005: \$14,081,177**



University of Minnesota President Robert Bruininks is leading an ambitious strategic positioning effort to renew and transform our University into one of the top three public research universities in the world within the next decade, with the overarching vision “to improve the human condition through the advancement of knowledge.”

CTS contributes to this effort by advancing transportation research and education within the University, through the entrepreneurial efforts of our affiliated faculty and researchers and the committed work of our staff. A significant and increasing share of the \$14.1 million CTS helped attract to the University this past year—37 percent—comes from federal funding, which has helped raise the University’s profile as a national and world research leader. We feature several of our research projects in this annual report.

In addition to research leadership, an important component of President Bruininks’s vision is that our University be publicly engaged. This is consistent with the unique responsibility of our University’s land-grant mission to serve the people of Minnesota with research and extension services. Our researchers are able to tackle important state issues thanks in large part to resources provided by the Minnesota Department of Transportation (Mn/DOT), the Minnesota Local Road Research Board (LRRB), and Hennepin County. The outreach and training activities described in these pages are proactive efforts to transfer knowledge to Minnesota professionals and decision makers.

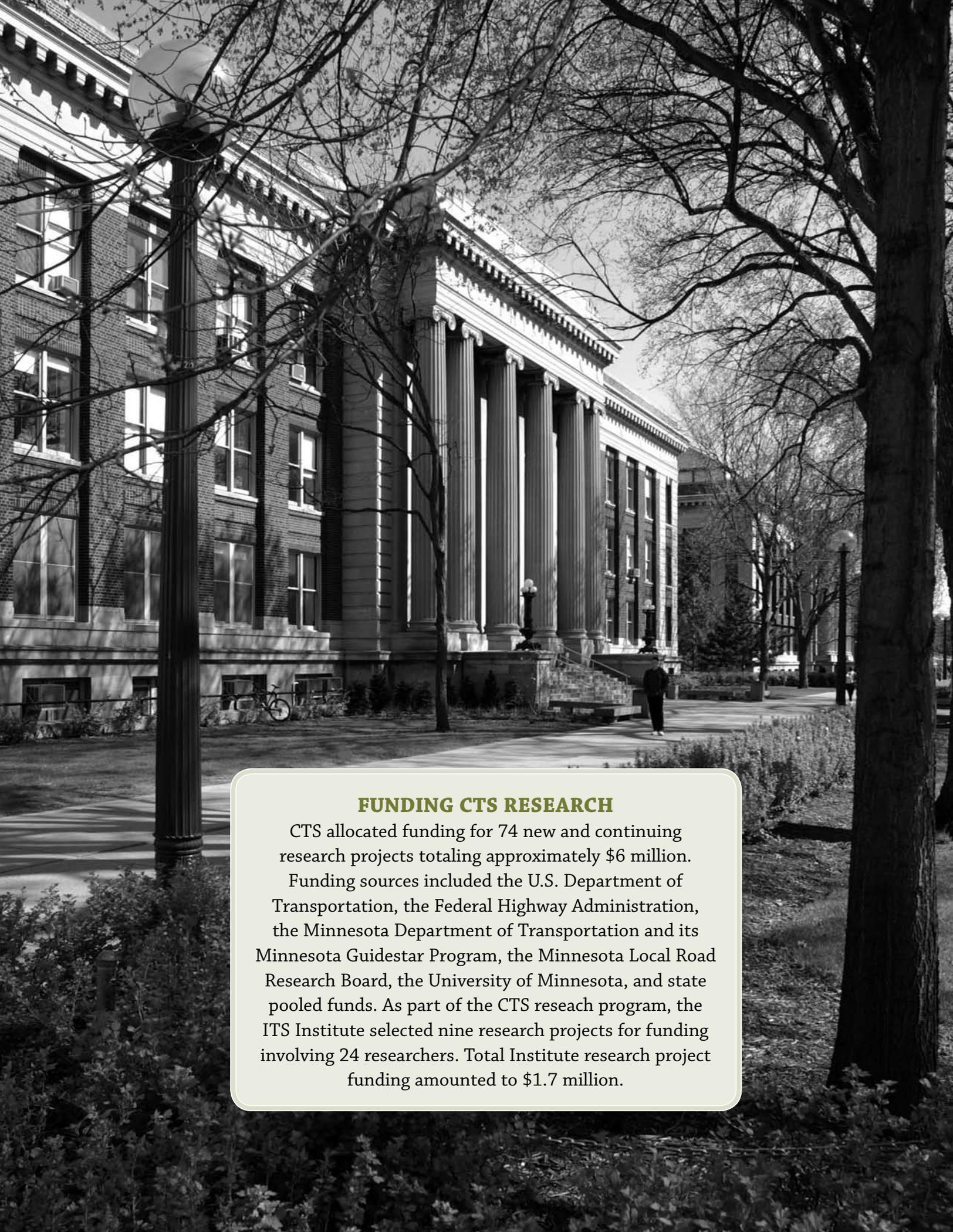
We applaud our congressional leaders who significantly increased research funding with the passage of SAFETEA-LU, the federal transportation act. This legislation will bring new resources to our University and further strengthen our transportation research, education, and outreach efforts. We also are enthused about the Federal Highway Administration’s initiative to develop an advanced research program to complement its applied research activities, and about Mn/DOT and LRRB efforts to identify long-term knowledge-building priorities in addition to problem-solving activities to help guide their research programs.

Still, transportation lags behind the investment of other sectors in research and education. Our medical school, for instance, relies on the National Institutes of Health, which is a catalyst for long-term, path-breaking basic research. While transportation accounts for a similar proportion of the GDP as health care, the federal investment in health care research is more than 10 times greater than its investment in transportation research.

Our society faces many transportation challenges. All of us involved in transportation research need to communicate to our national and state leaders that we could do more to address these challenges. Investments in research and education advance the expertise of our future work force, create new approaches for transportation professionals and policy leaders, and foster innovations in technology—helping realize the worthy vision “to improve the human condition through the advancement of knowledge.”

A handwritten signature in black ink that reads "Robert C. Johns". The signature is fluid and cursive, with a long horizontal stroke at the end.

Robert C. Johns, Director  
Center for Transportation Studies



### **FUNDING CTS RESEARCH**

CTS allocated funding for 74 new and continuing research projects totaling approximately \$6 million.

Funding sources included the U.S. Department of Transportation, the Federal Highway Administration, the Minnesota Department of Transportation and its Minnesota Guidestar Program, the Minnesota Local Road Research Board, the University of Minnesota, and state pooled funds. As part of the CTS research program, the ITS Institute selected nine research projects for funding involving 24 researchers. Total Institute research project funding amounted to \$1.7 million.

# Ideas and Knowledge Development

## CTS Area of Excellence

Foster the development of new ideas and knowledge through faculty-led research programs and interdisciplinary teams that the Center administers and supports

### Measuring ‘Access to Destinations’

Access to Destinations, a new interdisciplinary research and outreach study, began with five research projects receiving funding from the Minnesota Department of Transportation and Hennepin County. The new study builds on the results of the five-year Transportation and Regional Growth Study ([www.cts.umn.edu/trg](http://www.cts.umn.edu/trg)) by CTS. This research has attracted broad interest due to the growing issue of traffic congestion in the Twin Cities.

#### Measuring accessibility

Though the TRG study has influenced transportation policy directions by professionals and policy leaders, it has also raised new questions and issues for further research. The additional interdisciplinary research efforts outlined in the Access to Destinations framework will create a greater understanding of traffic congestion and develop new methods for evaluating our transportation system through the use of accessibility measures.

People travel to reach destinations for many activities, such as work, shopping, education, and recreation. The assumption guiding this research is that measures of accessibility will help us better understand how our transportation and land use system is performing, how it has changed, and how future investments and policies will impact that system.

#### Research objectives

This study will include three major research objectives:

- To improve our understanding of travel on freeways, arterials, and other roadways and of travel by non-auto modes, including transit, bicycling, and walking;
- To develop measures of accessibility using travel and land use data, resulting in a series of maps and documents that present accessibility measures by mode for each destination activity. This will be done for various locations in the Twin Cities region, showing how accessibility has changed from 1990 to 2000;
- Using these new tools and information, to assess how our existing transportation and land use system meets alternative policy goals, and evaluate policy options related to investments in different transportation modes or changes in land use practices.

#### Research and outreach

The Access to Destinations Study interdisciplinary research team includes

The Access to Destinations framework will create a greater understanding of traffic congestion and develop new methods of evaluating our transportation system through the use of accessibility measures.

### Inside transportation research at CTS

This page and the following 10 describe selected research efforts that reached milestones this year. Projects are grouped according to the Center’s four research emphases:

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Kevin Krizek from the Humphrey Institute of Public Affairs; David Levinson, Gary Davis, Ahmed El-Geneidy, Panos Michalopoulos, and John Hourdos from the Department of Civil Engineering; and Taek Kwon from UMD’s Department of Electrical and Computer Engineering.

Additional research phases could focus specifically on freight transportation or on accessibility in other Minnesota regional centers. Research efforts will be combined with extensive outreach activities to stimulate public discussion of the research findings and their implications for public policy.

*More information about Access to Destinations is on page 27 and online at [www.cts.umn.edu/access-study](http://www.cts.umn.edu/access-study).*

### New tool helps Minnesota airports prove their worth

One way an airport can justify the need for improvement projects is to show its economic impact on the surrounding community. Doing so will illustrate how the community as a whole benefits from having an airport nearby, regardless of the airport's size.

#### Calculating economic impact

To meet that need, applied economics professor William Gartner and a team of University of Minnesota researchers embarked on a study sponsored by

with airport managers and operators and gathering financial data. They note that smaller airports without regularly scheduled commercial service are actually involved in numerous economic activities that affect rural areas, but that the impacts of these activities are often difficult to calculate.

The economic model used to develop the online tool divides economic impacts into three categories: direct effects created by the airport or businesses related to it; indirect effects arising from

between businesses or other entities that can be directly traced to the presence of an airport. Rather than measuring revenue or profitability, the tool measures the amount of money and number of jobs that have been created as a result of the economic activity occurring at the airport.

To develop the economic impact calculator, the researchers looked at the type of economic activity taking place at the state's airports. The team also developed standards that could be applied to the various economic contributors, based on data they had collected and analyzed as well as data from the University of Minnesota Tourism Center. In addition, the team created algorithms and selected multipliers for use in calculating economic impact. To accurately calculate the economic impact of each airport, the researchers created unique descriptive impact models for each of Minnesota's 87 counties.

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CTS and the Minnesota Department of Transportation (Mn/DOT) to determine the economic impact small and medium-sized commercial and general aviation airports have on their local communities. From that information, they developed an interactive Web-based tool that airport personnel can use to calculate a specific airport's economic impact.

Gartner, Daniel Erkkila, and Jo Hyankuk visited 51 of the state's 134 general aviation airports during the development of the new tool, meeting

the airport or related businesses buying goods from other businesses; and induced effects stemming from workers' increased spending in the local community. The researchers note that the economic impact values produced by the calculator should be considered estimates rather than exact figures.

#### Counting money and jobs

In the context of the assessment tool, economic impact refers to the result of expenditures or sales transactions

*The economic impacts calculator is available on the Mn/DOT Office of Aeronautics Web site at [dotapp1.dot.state.mn.us:8080/aeic/main.htm](http://dotapp1.dot.state.mn.us:8080/aeic/main.htm). A research report on the development of the calculator is online at [www.lrrb.org/pdf/200519.pdf](http://www.lrrb.org/pdf/200519.pdf).*

### Reconsidering spring load restrictions

Across the northern United States and Europe, spring thaws bring vehicle weight restrictions on many highways because ground saturated with water from melting snow and ice weakens the structure of roads and makes them more vulnerable to damage from heavy vehicles. These restrictions are imposed on county and municipal state-aid roads as well as some municipal roads, and

primarily affect commercial trucks that carry the majority of freight in rural areas.

#### Debating costs and benefits

The efficacy of spring load restrictions (SLR) continues to be debated by many transportation professionals and members of the freight and logistics community. A research project, sponsored

by the Minnesota Local Road Research Board and the Minnesota Department of Transportation (Mn/DOT) and led by David Levinson and Mihai Marasteanu of the University of Minnesota's Department of Civil Engineering, aims to assist policymakers by examining the benefits and costs of spring load restrictions.

The project produced two reports: a

technical research report on the costs and benefits of removing spring load restrictions, and a summary analysis that presents a background on the research issues and findings, along with concerns put forward by Mn/DOT experts.

University researchers set out specifically to estimate the potential benefits to industry if posted limits were lifted, and to compare those benefits with the costs associated with marginally greater damage to pavements during the thaw period. The resulting analysis produces a ratio of benefits to costs. This research defines the benefits as the value to (mostly private) industry of lifting the seasonal restrictions. The costs refer to what the (public) owners of roads will likely bear to maintain the roads if restrictions are lifted.

Researchers focused analysis on three sample Minnesota counties—Lyon, Clay, and Olmsted—selected for intrastate geoclimatic diversity as well as for differences in commercial commodities transported over the roads.

### **Economic benefits outweigh road costs**

Under any scenario of lifting seasonal restrictions, the predictable result is shorter pavement life. Pavement life for most road segments studied in the three counties was longer under an SLR policy

than without such a policy. (A few road segments benefit from the absence of SLR as traffic patterns change.) Without SLR, most roads would require that the next overlay during the pavement life would come sooner, thus driving up maintenance costs.

Even with those added costs, researchers essentially concluded that the benefits to industry from lifting restrictions significantly outweighed the costs of marginally higher damage to local roads.

In the Lyon County example, the economic benefits of lifting the restrictions to shippers and carriers considerably exceed the costs, regardless of which method of estimating benefits is used. The results in Lyon County were replicated in the other study areas. Under all the scenarios examined in the sample counties, this ratio ranged from close to a break-even level to levels as high as 22:1.

Behind the debate on spring load restrictions is the reality that road maintenance budgets are often stretched extremely thin. The challenge for Minnesota lawmakers is to debate the

prospects of lifting these longstanding restrictions along with a practical mechanism to generate revenue from the increased economic benefits to cover the costs of pavement damage.

*The report and summary are available from the Mn/DOT Web site at [www.lrrb.org/pdf/200515.pdf](http://www.lrrb.org/pdf/200515.pdf) (report) and [www.lrrb.org/pdf/springloadrestrictions.pdf](http://www.lrrb.org/pdf/springloadrestrictions.pdf) (summary).*

Peer-reviewed articles by CTS-affiliated faculty and researchers appeared in a record 102 publications.



### Cell phone use more dangerous to drivers than alcohol

Distracted driving—whether the result of cell phones, the car stereo, or any number of other factors—is commonly assumed to increase the danger of driving. But, according to a recent University study, using a cell phone may impair drivers more than alcohol intoxication.

The research, led by Nic Ward, director of the ITS Institute's HumanFIRST Program, assessed the risk of cell phone use while driving compared to commonly accepted in-vehicle tasks, as well driving while intoxicated. The study, sponsored by the Minnesota Guidestar Program and the ITS Institute, included the work of HumanFIRST research scientist Mick Rakauskas along with Ed Bernat, Meredith Cadwallader, and Professor Chris Patrick of the

In short, the drunk driver doing nothing but driving was less impaired than the sober drivers on a cell phone or playing with the radio.

University of Minnesota's Department of Psychology.

#### Hands-free no safer than hand-held phones

Because evidence suggests that cell-phone use while driving may be a significant risk factor in traffic crashes, some states have responded by imposing restrictions on the use of hand-held phones. But Ward's research team, citing research that shows hands-free use is no safer than hand-held, has focused instead on the cognitive aspect of talking

on a cell phone while driving.

In particular, the two-part study is probing the risks of using cell phones to access new advanced traveler-information systems (ATIS) recently introduced in many states (e.g., 511 Traveler Information Services). Phase I of the study examined how the performance impairment from cell-phone use compares to other types of impairment risks, such as driving while intoxicated (.08 blood-alcohol content) and while operating common in-vehicle controls like a radio, fan, or air conditioning. For the first time, researchers also examined the combined effects of being distracted and being intoxicated, given that many crashes result from a combination of risk factors. Phase II will examine the design of 511 services in order to make them less distracting for drivers.

Use of a cell phone and other typical in-vehicle tasks are considered secondary to the primary tasks of driving and driving safely. The increased mental demand of cell-phone use causes impairment—and an increased crash risk. By Ward's definition, impairment means exceeding the limit of one's ability to apply the necessary resources toward a particular task. When that task is driving, impairment may, for example, cause speed inconsistency and slower reaction toward unexpected events.

#### Alcohol vs. driving distractions

Researchers gathered data from test subjects outfitted with a device to measure brain activity and seated behind the wheel of the Virtual Environment



for Surface Transportation Research (VESTR) driving simulator in the HumanFIRST lab. Half the test subjects drank alcohol to near intoxicating levels (just under .08 blood-alcohol content) as measured with a Breathalyzer.

Drivers completing either cell phone or in-vehicle tasks during a car-following scenario showed worse performance than those driving without a task in terms of time headway, maintaining a consistent speed profile with respect to the lead vehicle, and steering. In short, the drunk driver doing nothing but driving was less impaired than the sober drivers on a cell phone or playing with the radio.

### Understanding the risks

Some industry efforts are aimed at locking out cell-phone and ATIS functionality during high workload periods, but until those technological developments are implemented, a driver's discretion is all that limits his or her cell-phone usage. Though he believes legal sanctions against cell phones need enforcement and education, Ward emphasizes that driver education is necessary to understand the risks and to learn when it is safe to engage in secondary tasks.

*More information about this research is online at [www.cts.umn.edu/research/projectdetail.pl?id=2003040](http://www.cts.umn.edu/research/projectdetail.pl?id=2003040).*

Two licensing agreements were approved for Max Donath and his team for their development of a geospatial database and a mobile-assist device.

### Chromatic perception effects on collisions with snowplows

When it comes to clearing snow from roadways, poor-visibility conditions come with the territory. But in the process of clearing roads, snowplows can temporarily create even worse conditions for the drivers behind them. Under these "low-luminance contrast" conditions, drivers often can see the presence of a snowplow ahead, but are unable to tell how far away it is or even that they are approaching it. Some recent experiments also indicate that under low-luminance contrast conditions, people perceive themselves to be traveling significantly slower than they actually are. To compensate, they speed up. Together, these issues constitute some of the most hazardous conditions drivers in Minnesota commonly experience and are why snowplows are particularly vulnerable to rear-end collisions.

### Understanding our perception of motion and space

Through a series of simulated and real-world experiments sponsored by the ITS Institute, Professor Albert Yonas,

with the Institute of Child Development, Lee Zimmerman, an adjunct professor in the Department of Electrical and Computer Engineering at Duluth, and a team of University researchers are testing how people perceive motion and space under low-luminance contrast conditions and how these relate to chromatic contrast conditions. Understanding whether these two phenomena are governed by the same neural mechanism could lead to a variety of solutions for reducing some of the hazards drivers face in poor-visibility conditions and possibly decrease the likelihood of rear-end collisions with snowplows.

Using a simple computer driving simulator to replicate the effects of blowing snow and fog, Yonas and his team monitored test participants who were asked to decide whether a simulated truck approached or withdrew as the luminance contrast of the simulator display was varied. This experimental setup enabled the researchers to study snowplow designs and color characteristics that influence a driver's detection



## Ideas and Knowledge Development: Transportation Safety and Traffic Flow

of approach and impending collision. Through these efforts, the team found that lowering the luminance contrast between the image of a vehicle and the background greatly reduces one's ability to perceive approach. They also discovered that flashing lights, such as those mounted on snowplows to attract attention, interfere with motion perception.

### Developing new snowplow designs

These findings will be incorporated into a second phase of research in which the team will use more realistic driving-simulator methodology to develop new markings and lighting designs for snowplows. One new design approach may be to ensure that rear-facing lights and markings on snowplows create optimal

luminance contrast while reducing the offending chromatic contrasts. A second possibility involves structuring rear-facing markings to help drivers better tell when they are approaching a snowplow. In the future, Yonas hopes to team up with the Minnesota Department of Transportation to further test the effectiveness of new markings and lighting designs on minimizing the effects of blowing snow on drivers' ability to properly perceive both their speed when moving toward a snowplow and their distance from it.

The overall findings of this work will likely result in improvements in driving safety through the careful choice of color warning markings, chromatically controlled lighting, and special fog tints

on snowplows, as well as through better public education.

*More information about this research is online at [www.cts.umn.edu/research/projectdetail.pl?id=2003037](http://www.cts.umn.edu/research/projectdetail.pl?id=2003037).*

A patent was granted for a video camera-based atmospheric visibility measurement system developed by Taek Kwon from the Department of Electrical and Computer Engineering at UMD.

## Intersection Decision Support: Improving Safety on Rural Highways

Many people don't realize how dangerous driving can be in rural areas, where an alarming 70 percent of all fatal crashes occur. Intersection Decision Support (IDS) represents an innovative new approach to preventing crashes at rural through-stop intersections, where secondary roads intersect high-speed rural expressways. Instead of traditional, regulatory signals, which disrupt mainline traffic flow and may lead to higher rear-end collision rates, IDS uses technologies that give stopped drivers better information about vehicles approaching the intersection at high speed.

In the prototype system currently under development, a computerized sensor network tracks vehicles approaching a specific intersection and determines when gaps between approaching vehicles are too small to allow safe crossing by a driver waiting on the secondary road. An

electronic display mounted beside the road communicates this information to drivers.

Human factors research to develop an optimal infrastructure-based driver interface is a crucial component of this project. By using a wrap-around driving simulator, researchers can test multiple interface configurations in a safe yet realistic environment, under a wide range of virtual traffic and weather conditions.

The research team, led by Intelligent Transportation Systems (ITS) Institute director Max Donath, HumanFIRST Program director Nic Ward, and Intelligent Vehicles Laboratory director Craig Shankwitz, hopes to develop a reliable, cost-effective system that can

be widely deployed in rural areas. The project is sponsored by the Federal Highway Administration and the Minnesota Department of Transportation.

*More information about IDS and a research report covering rural intersection crash data are available at [www.its.umn.edu/research/applications/ids](http://www.its.umn.edu/research/applications/ids).*



### Ensuring the health of older bridges

As we age, we become aware of signs of wear and tear. We're still basically healthy, of course, but we do need to pay more attention to that sore elbow or trick knee.

Bridges, like humans, also change as they age. Take, for example, Bridge 69832, which carries northbound Interstate 35 into Duluth. The 38-year-old bridge, which is located just before the exit onto 27th Avenue West, has multiple fatigue cracks in areas where the girders are integral with the steel pier caps.

#### Fatigue cracks

The four girders of Bridge 69832 are supported by a concrete abutment at each end. In between, the girders are supported by pier columns. The columns are topped by pier caps, which are perpendicular to the girders. The pier caps transfer vehicle loads and weight of bridge components from the bridge to the pier columns.

Some of the pier caps supporting Bridge 69832 are concrete, and some are steel. These "steel-box" pier caps are of two types: The first is designed so that

the girders sit on top of the pier cap. The second is designed so that the girders are integral with the pier cap — in other words, the girders go through the pier cap.

When heavy trucks pass over the bridge, the girders move downward. Because the girder is integral with the pier cap, this movement twists the pier cap. This causes deformations and stresses, which create fatigue cracks in the complicated steel connection details within the pier cap. Because steel pier caps are "fracture critical," it's important to learn more about these cracks.

#### Analyzing the problem

To learn whether these fatigue cracks threaten the structural integrity of the bridge, researchers from the Department of Civil Engineering investigated Pier Cap 5. Clifford Youngberg, the late Robert Dexter, and Paul Bergson installed sensors within and near the pier cap to see what happened when Minnesota Department of Transportation (Mn/DOT) three-axle dump trucks crossed the bridge. They also collected data from live traffic.

To help with their analysis, the researchers developed several computer models. Both the field data and the results obtained from the models confirmed that the cracks were due to twisting of the pier caps.

#### Self-limiting cracks

The researchers also discovered that most of the cracks were self-limiting. They recommended that the cracks be inspected every two years, and repairing them is not necessary. A few cracks, however, did need to be repaired as soon as possible. Researchers recommended a simple repair method: drilling a hole at the crack tip, which effectively stops further cracking.

This research, sponsored by Mn/DOT, helps engineers understand how older bridges respond to stress and displacement. It also underscores the need for continued inspections and maintenance to help older bridges stay healthy and strong.

*A detailed report describing this research is online at [www.lrrb.org/pdf/200318.pdf](http://www.lrrb.org/pdf/200318.pdf).*

### Modeling cold-weather cracking in pavements

Minnesota winters can make even the hardest souls feel like cracking. It turns out our pavements crack even more easily than we do. According to the Minnesota Department of Transportation, 69 percent of the state's highways have a low-temperature crack at least every 50 feet.

In an effort to predict the occurrence and spacing of low temperature cracks, a University research team, led by civil engineering professors Mihai Marasteanu and Vaughan Voller and sponsored by the Minnesota Local

Road Research Board, tested a model developed as part of the American Association of State Highway and Transportation Officials pavement design guide. The researchers discovered that this model does not reasonably predict crack formation and spacing in hot-mix asphalt pavements. But a new model they developed during their research did give a reasonable prediction of crack spacing.

The team also created an experimental protocol to test the fracture properties of asphalt mixtures and incorporated the properties in

a "cohesive crack model." Though not yet suitable for use in designing pavements, this model is a first step toward a truly comprehensive method for predicting the low-temperature behavior of asphalt pavements.

Their work will serve as a foundation for further research at the University's newly established Pavement Research Institute (PRI), online at [www.pri.umn.edu](http://www.pri.umn.edu).

*A detailed report describing this research is online at [www.lrrb.org/pdf/200423.pdf](http://www.lrrb.org/pdf/200423.pdf).*

### Taconite tailings: What are they good for?

To motorists exiting highway 169 on to highway 53 just north of Virginia, Minnesota, the interchange seems like any other. But the roadbed was constructed with a seldom-used resource—more than a million and a half tons of recycled coarse taconite tailings, a byproduct of iron mining operations on the Iron Range.

#### Needed: More aggregate

Every year, Minnesota uses about 55 million tons of crushed rock, or aggregate, for construction projects, including roads. This amounts to about 11 tons per person—and the quantity needed increases each year.

Most aggregate comes from sources such as quarries and gravel pits. But current reserves are being depleted, and it's becoming harder to open new areas for aggregate mining due to environmental concerns and urban development. As a

Market forces, the cost of transportation, and the logistics of distribution are key factors in the widespread and long-term use of taconite aggregates beyond northern Minnesota.

result, some areas face looming shortages of aggregate.

Fortunately, researchers at the University of Minnesota's Natural Resources Research Institute (NRRI) in Duluth have identified a new source of materials for road construction and maintenance. Lawrence Zanko, Julie Oreskovich, and Harlan Niles evaluated coarse taconite tailings from five mines in Minnesota's Iron Range. Their study—sponsored by the Minnesota Local Road Research Board—is the most comprehensive source of information about this form of taconite aggregate.

#### An abundant resource

Nearly one ton of coarse tailings are

generated for every ton of finished taconite pellets produced. That adds up to millions of tons of coarse tailings every year. Although the mining companies do recycle many of the tailings for construction within their own operations, the rock has not been widely used elsewhere, and excess tailings are available at the mines.

The crushed and angular coarse tailings are equivalent in size to fine aggregate. They are hard and strong: for example, a mine road made of coarse tailings and other crushed taconite rock can withstand a 250-ton truck. The tailings also compact and drain well.

These qualities make the tailings suitable for use as fill material underneath

### MAST Lab holds grand opening

A crowd of 250 turned out in September 2004 for the grand opening of the University's newest large-scale structural testing facility, the Multi-Axial Subassembly Testing (MAST) Laboratory. The event drew dozens of local engineers, as well as University president Robert Bruininks, Minneapolis city councilman Paul Zerby, and Dennis Martenson, president-elect of the American Society of Civil Engineers. Visitors traveled from as far away as Washington, D.C., Boulder, Colorado, and St. Louis, Missouri to attend the event.

The \$11.6 million MAST Lab, housed in a building just east of campus, is part of a nationwide network of seismic engineer-

ing facilities. Researchers from academia and industry will use the lab to test everything from bridge bearings to multi-story buildings.

The Network for Earthquake Engineering Simulation (NEES) is the first major research equipment program in engineering funded by the National Science Foundation and includes a range of test facilities, from shake tables and tsunami wave basins to the MAST system, which uses giant actuators and an overhead crosshead to apply force or deformations to the test specimen. A University of Minnesota team, led by civil engineering professors Catherine French, Jerry Hajjar,

and Carol Shield, has helped develop collaborations between NEES sites.

*More information about the MAST Lab is online at [nees.umn.edu](http://nees.umn.edu).*



University civil engineering professor Cathy French describes features of the MAST Lab.

roadbeds. The tailings also make an excellent pavement when mixed with asphalt. And because taconite has good skid-resistance, the tailings enhance road safety when used in top coatings.

To address potential concerns about the composition of tailings, chemical and specialized mineralogical analyses were performed. State-of-the-art microscopic testing methods showed that neither asbestos nor amphibole minerals were detected in the tailings samples.

### Continuing research

Market forces, the cost of transportation, and the logistics of distribution are key factors in the widespread and long-term use of taconite aggregates beyond northern Minnesota. An anticipated three-year continuation of NRRI's taconite aggregate research will investigate the potential of rail and other transportation modes as cost-effective options for moving taconite aggregates to new markets in the state and elsewhere.

NRRI researchers will also work with the University's Department of Civil Engineering, the Minnesota Department of Transportation, and other state agencies to evaluate the quality and performance of taconite aggregate used in demonstration projects.

*A detailed report describing this research is online at [www.lrrb.org/pdf/200406.pdf](http://www.lrrb.org/pdf/200406.pdf).*



### Minnesota transportation leaders form research alliance

Minnesota transportation leaders have formed a new research governance structure to foster a comprehensive transportation engineering and road research program. The Transportation Engineering and Road Research Alliance (TERRA) was created after a task force of government, industry, and academic representatives investigated transportation engineering and road research governing structures and evaluated ways to broaden use of the unique MnROAD facility and associated resources. The task force, staffed by CTS, was formed at the request of Mn/DOT Deputy Commissioner Douglas Differt.

TERRA's mission is to develop, sustain, and communicate a comprehensive program of research on pavement, materials, and related transportation engineering challenges, including issues related to cold climates, with the intent to take advantage of the MnROAD test facility parallel to Interstate 94 near Monticello. TERRA's strategic directions aim to expand productive research partnerships, provide effective transportation engineering and road research, and communicate trans-

portation engineering and road research activities, benefits, and results

#### TERRA Board

**Co-Chair:** Richard Stehr, Engineering Services Division, Mn/DOT

**Co-Chair:** Fred Corrigan, Aggregate and Ready Mix Association

John Bukowski, Federal Highway Administration

John Gulliver, Civil Engineering, University of Minnesota

Robert Johns, CTS

Mark Maloney, City of Shoreview (LRRB)

Al Schenkelberg, Office of Investment Management, Mn/DOT

Keith Shannon, Office of Materials, Mn/DOT

Mike Sheehan, Olmsted County (LRRB)

Julie Skallman, State Aid Division, Mn/DOT

Tom Sorel, Federal Highway Administration

Gerald Voigt, American Concrete Pavement Association

Rich Wolters, Minnesota Asphalt Pavement Association

Matt Zeller, Concrete Paving Association of Minnesota

### Making fly ash safer for road building

You can't judge a road just by its pavement—it's only as good as what lies beneath it. Fly ash, a byproduct from coal combustion, has become a valuable resource for stabilizing poor soils. Each year, American power plants and other sources produce approximately 70 million tons of fly ash, making it a cheap replacement for more expensive approaches. But fly ash can retain toxic elements, so road builders haven't known how much to use while still meeting environmental requirements. Only about 40 percent of all fly ash produced is utilized as concrete additives, flowable fill, or stabilizers for road subgrades. The remainder has typically gone into landfills.

#### Addressing environmental concerns

To address environmental concerns and make a greater percentage of fly ash available, University of Minnesota professor Paul Bloom, of the Department of Soil, Water, and Climate, and a team of researchers developed a computer-based tool to screen fly ash for 21 potentially harmful contaminants, based on concentration limits defined by the Minnesota Pollution Control Agency (MPCA).

Working with the MPCA, the Minnesota Department of Transportation, and many other partners, Bloom's research team developed a worksheet to analyze the risk to human

The program, known as Screening Tool for Using Waste Materials in Paving Projects, offers guidance to public agencies for using fly ash without contaminating the soil or ground water with harmful levels.

health from different exposure scenarios. The program includes a database of information for much of Minnesota and for various ash choices. Users can do an initial evaluation of their project and then add their own specific data.

#### Safely recycling waste materials

The program, known as Screening Tool for Using Waste Materials in Paving Projects, offers guidance to public agencies for using fly ash without contaminating the soil or ground water with harmful levels. Though this computer-based screening tool does not give permission for the use of fly ash and was not designed to predict the effects of fly ash on surface waters, it does provide straightforward assessments of the associated hazards.

Maximum concentration levels are defined for both residential and industrial applications since inhabitants of a residential area—notably children—might be in the area 24 hours a day, while exposure in industrial areas is likely to be limited to 8–10 hours per day. Harm may come either directly from the soil used on a site (through ingestion) or

from water that has leached contaminants from soil. Therefore, the new tool employs two screening levels.

#### Analyzing risks to soil and water

The first tier of testing assumes a worst-case scenario: that a road constructed with fly ash in the subgrade has been abandoned at some time in the past, and that the subgrade soil is then recovered and spread on the surface of land where housing is built. This level uses risk analysis to define soil concentrations that would protect human health when soil has been ingested. The second tier of testing contains standards for drinking water and mitigating factors that take into account rainfall, soil type, and distance to the water table to prevent contamination.

In this way, fly ash—previously a wasteful burden—can be safely recycled, improving paving projects without environmental sacrifices.

*A detailed report describing this research, sponsored by the Minnesota Local Road Research Board, is online at [www.lrrb.org/pdf/200503.pdf](http://www.lrrb.org/pdf/200503.pdf).*

Newly developed CTS Research Web pages include ongoing research abstracts, project personnel, funding sources, and final research reports. These new Web pages are serving as a key resource for researchers, students, transportation managers, policymakers, and members of the general public who want to know more about transportation research.

### Benefits of bicycling

Most of us are familiar with the pleasures of biking. But despite the popularity of cycling, bicycle facilities—such as bike paths and on-street bike lanes—have often been ignored in the general transportation planning process. Highway and transit investments are evaluated and justified using standard methodologies to estimate benefits and costs. But until recently no equivalent tools have existed for bicycle-related investments.

To remedy this situation, researchers Gary Barnes and Kevin Krizek of the Humphrey Institute of Public Affairs set out to learn the basic facts about bicycling in Minnesota and to develop a framework for evaluating and measur-

ing its benefits. The study was sponsored by the Minnesota Department of Transportation.

Researchers calculated that the annual recreational value of cycling is about \$240 million.

ing its benefits. The study was sponsored by the Minnesota Department of Transportation.

#### Small benefit from commuting

The researchers found that at least 50 percent of the population rides a bike at least occasionally, but probably less than 5 percent ride as often as once a week. Because most people ride so infrequently, only about 1.5 to 2 percent of adults in the Twin Cities ride on any given day—although this is still much higher than the national average of 0.9 percent.

The researchers also found that only 8 percent of bicycle use is for commuting. And of those who do commute on a bicycle, only 40 percent substitute a bike for a car. Others bike instead of carpooling, walking, or using mass transit. This

#### Big benefit from recreation

means that bicycle commuters contribute only minimally to reducing congestion and pollution. But cycling has other, more important, benefits for both individuals and society. Eighty percent of cyclists ride because they enjoy both the activity and the improved sense of well-being and health that comes from it.

Using recognized methods for estimating the value of recreational activities and facilities, researchers calculated that the annual recreational value of cycling is about \$240 million.

Society also benefits from the good health of bicyclists. Using conservative

estimates, researchers calculated that bicycling saves Minnesota about \$24 million per year in reduced health care costs. And because bicycling helps individuals maintain or improve their general health, it increases productivity by \$8 million to \$24 million annually.

The significant benefit from recreational bicycling means that riders' preferences have important implications for public investment in bike facilities. Studies show, for example, that less experienced cyclists generally prefer riding on off-road trails. Because most cyclists fall into

this category, these types of facilities are especially important.

#### A new measurement tool

With additional funding from the National Cooperative Highway Research Program, the research team worked with others from the University and around the country to develop a Web-based tool that provides guidelines for communities considering investments in bicycle facilities.

The tool estimates the costs of proposed bike facilities, the demand in terms of new cyclists, and benefits to cyclists and society more generally.

*The benefit-cost analysis tool is online at [www.bicyclinginfo.org/bikecost](http://www.bicyclinginfo.org/bikecost).*





**TRANSPORTATION STUDIES**

In FY2005, 3,245 undergraduate students were enrolled in 54 transportation-related courses at the University.

# Formal Education

## CTS Area of Excellence

Champion formal credentialed education initiatives by supporting the development of more University education programs in transportation-related areas

### Graduate Certificate: Traffic Engineering and Operations Concentration

In response to a need for more specialized training in the traffic discipline, CTS, in cooperation with program faculty and the Minnesota Department of Transportation (Mn/DOT), developed a customized concentration of the Graduate Certificate in Transportation Studies for traffic engineering and operations.

The Graduate Certificate in Transportation Studies: Traffic Engineering and Operations Concentration is designed to meet the needs of professionals who want to expand their skills and knowledge base

with an additional transportation credential.

The traffic engineering and operations certificate program is built around a core set of graduate-level courses in civil engineering, planning and public policy, and supply-chain management. Participants are required to complete four core courses (14-credit minimum), as well as a seminar in transportation technology. Participants also must select at least one additional course from a list of three in civil engineering to round out a program requirement of 17 graduate-level credits.

John Adams (Geography), Gary Davis

(Civil Engineering), Karen Donohue (Operations and Management Sciences), David Levinson (Civil Engineering), Kevin Krizek (Humphrey Institute), and Gerard McCullough (Applied Economics) served as faculty advisors for the Graduate Certificate in Transportation Studies. Davis also serves as the certificate director of graduate studies.

*Application materials and additional information about the Graduate Certificate in Transportation Studies are online at [www.cts.umn.edu/certificate](http://www.cts.umn.edu/certificate).*

### Transportation career expo

Approximately 80 college students from Minnesota and neighboring states gathered on campus in March for the 10th Annual Transportation Career Expo. The event provided students an opportunity to learn about transportation careers,

ask questions, receive seasoned advice, obtain feedback on their resumes, and network with more than 20 employers.

Employers promoted their organizations with booth displays, and several company representatives led informa-

tional sessions on transportation-related careers in engineering, policy and planning, intelligent transportation systems (ITS), and logistics management. An opening panel discussed several key aspects of career preparation, from networking to getting an edge during the job search process.

CTS hosted the event in cooperation with the Minnesota Local Road Research Board, the Minnesota Local Technical Assistance Program, WTS Minnesota, and the ITS Institute.



## Formal Education

### CTS Research Seminars

During the 2004–2005 academic year, CTS continued to host research seminars to provide University researchers from a variety of disciplines an opportunity to share their findings. In a number of instances, research seminars were held in conjunction with meetings of the CTS Transportation Research Councils (Environment, Safety and Traffic Flow, Economy, and Infrastructure).

#### Fall semester presentations

“Behavior of Concrete Integral Abutments,” Carol Shield, Civil Engineering

“Soil Erosion and Sediment Control From Highway Construction,” Bruce Wilson, Biosystems and Agricultural Engineering

#### Spring semester presentations

“Development of an Economic Impact Measurement Tool for Small/Medium Size Commercial and Public Use Airports in Minnesota,” William Gartner, Applied Economics

“Using ITS to Serve Diverse Populations: Car Sharing in the Twin Cities,” Frank Douma, Humphrey Institute of Public Affairs

“Rheological Characterization of Asphalt Emulsion Residues,” Mihai Marasteanu, Civil Engineering

“Design and Safety Implications for ATIS Use with Cell Phones,” Nic Ward, HumanFIRST Program, ITS Institute



### Interdisciplinary Transportation Student Organization

Following the 10th Annual CTS Transportation Career Expo, the Interdisciplinary Transportation Student Organization (ITSO) held its first annual research conference. Several students presented their research to an audience of approximately 50 graduate and undergraduate students.

CTS research assistant and University geography undergraduate student Adam Rolstad was one of two to receive the Kasia Winiarczyk Memorial Student Award at the conference luncheon. The award and a \$500 scholarship are given to the student with the best original class project or paper featuring transportation issues that cross traditional academic boundaries. Rolstad's winning class paper is titled “Effects of Light Rail Transit in

Fully Developed Areas.” Civil engineering doctoral student Lei Zhang also received the award.

ITSO (pronounced “it-so”) was created with support from CTS by University of Minnesota students pursuing degrees in transportation-related fields. The group's main purpose is to promote interdisciplinary connections with transportation professionals through monthly meetings and other events and learn about careers in transportation. During the past year, ITSO membership rose to 215 students, up from 65 in FY2004.

ITSO has affiliated itself with several professional organizations including the Minnesota Chapter of Women's Transportation

Seminar (WTS Minnesota), the North Central Section of the Institute of Transportation Engineers (NCITE), and the Intelligent Transportation Society of Minnesota (ITS Minnesota).

Membership in ITSO is free. Students interested in becoming involved in this organization may visit the ITSO Web site at [www.tc.umn.edu/~itso](http://www.tc.umn.edu/~itso).



## Advanced transportation technologies seminars

During the 2004–2005 academic year, the Intelligent Transportation Systems (ITS) Institute, housed within CTS, continued its multidisciplinary seminar series at the University. These advanced transportation technologies seminars included a diverse set of presentations by local and national researchers addressing different areas of ITS research, such as traffic management and modeling, human factors, sensing, and intelligent vehicles as they relate to road- and transit-based transportation. The seminars are offered for credit and required as a course in the Graduate Certificate Program in Transportation Studies at the University of Minnesota. Seminars are videotaped and available for loan.

### Fall semester presentations

“Evacuation Planning,” Qingsong Lu, Computer Science and Engineering

“Maintaining Safe Headways While Driving,” David Shinar, Industrial Engineering and Management, Ben Gurion University of the Negev, Israel

“Inexpensive Attitude-Determination Systems for UAV Applications,” Demoz Gebre-Egziabher, Aerospace Engineering and Mechanics

“Finding the Fountain of Youth for Snowplows and Other Fleet Assets,” David Wyrick, Mechanical and Industrial Engineering, UMD

“The Minnesota Comprehensive Highway Safety Plan,” Bernie Arseneau, Minnesota Department of Transportation

“Investing in Robustness and Reliability in Transportation Networks,” David Levinson and Lei Zhang, Civil Engineering

“Proactive Crash-Prevention Solutions,” John Hourdakakis, Civil Engineering

## GPS Web module for high school students

The Intelligent Transportation Systems (ITS) Institute developed a set of curriculum materials for high school students on the topic of Global Positioning Systems (GPS). The GPS Web module is a structured learning opportunity in which high school students investigate the topic of GPS and its impact on travel. The students’ assignment, while using the research cycle, is to search out information from given sources and demonstrate what they have learned.

The GPS Web module was developed by the Institute’s K-12 coordinator, Mark Tollefson, an area high school science teacher. A CD-ROM containing the GPS module and a poster explaining ITS were distributed to Twin Cities metro-area high schools.

*K-12 Web modules are online at*  
[www.its.umn.edu/education/modules.html](http://www.its.umn.edu/education/modules.html).

## Intelligent Ground Vehicle Competition

With funding and guidance from the ITS Institute, a University of Minnesota team competed in the 13th Annual Intelligent Ground Vehicle Competition held in Traverse City, Michigan, in June 2005.

The team was advised by ITS Institute director Max Donath, research scientist Vassilios Morellas of Honeywell, and Don Krantz, vice president of MTS Systems. The University hadn’t com-

peted since 2001.

This year was also the first in which students at the University’s Duluth campus attempted to build a vehicle for the competition.

Thirty-seven teams from universities across the U.S. participated in three different segments of the competition: the autonomous challenge, vehicle design, and navigation.



## Formal Education

### 2005 CTS Student Affiliates

#### Student Researchers

- Ian Alexander**, MA, Public Policy and JD, Humphrey Institute and Law School [Lee Munnich]
- Piyush Agrawal**, MS, Civil Engineering [Rajesh Rajamani]
- James Andrew**, MURP, Humphrey Institute [Frank Douma]
- Brian Ashman**, MS, Biosystems and Agricultural Engineering [Bruce Wilson]
- Stefan Atev**, PhD, Computer Science [Nikolaos Papanikolopoulos]
- Nathan Aul**, MS, Civil Engineering [Gary Davis]
- Praveen Balachoudrun**, MS, Computer Science [Nicholas Ward]
- Eray Baran**, PhD, Civil Engineering [Catherine French]
- Adi Beegala**, MS, Civil Engineering [Panos Michalopoulos]
- Charles Bell II**, MS, Civil Engineering [Catherine French]
- Kelly Betteridge**, MURP, Humphrey Institute [Frank Douma]
- Fred Beukema**, MS, Civil Engineering [Arturo Schultz]
- Mathew Bevilacqua**, MS, Mechanical Engineering [Max Donath]
- Elena Beyhaut**, PhD, Soil, Water, and Climate [Peter Graham]
- Dan Billings**, BS, UMD, Electrical and Computer Engineering [Jiann-Shiou Yang]
- Nathaniel Bird**, PhD, Computer Science [Nikolaos Papanikolopoulos]
- Robert Bodor**, PhD, Computer Science [Nikolaos Papanikolopoulos]
- Joshua Brand**, BS, Civil Engineering [John Gulliver]
- Shawn Brovold**, MS, Mechanical Engineering [Max Donath]
- Charles Carlson**, MURP, Humphrey Institute [Frank Douma]
- Wei Chen**, MS, Civil Engineering [David Levinson]
- Benjamin Chihak**, PhD Cognitive Psychology [Kathleen Harder]
- Amid Chohan**, MS, Mechanical Engineering [Nicholas Ward]
- Daniel Cinnamon**, BS, UMD, Electrical and Computer Engineering [Taek Kwon]
- John Cirilli**, BS, UMD, Mechanical Engineering [David Wyrick]
- Michael Corbett**, MS, Civil Engineering [David Levinson]
- ReAnn Dargus**, MS, Mechanical Engineering [Will Durfee]
- Timothy Delf**, BS, UMD Electrical and Computer Engineering [Stanley Burns]
- Fadel Digham**, PhD, Electrical and Computer Engineering [Mohamed-Slim Alouini]
- Heather Dolphin**, MURP, Humphrey Institute [Frank Douma]
- Marcus Drayton**, PhD, Mechanical Engineering [David Kittelson]
- Kari Eichenstadt**, MS, Agronomy and Plant Genetics [Donald Wyse]
- Andrew Erickson**, MS, Civil Engineering [John Gulliver]
- Joseph Erickson**, MS, UMD, Mathematics and Statistics [Harlan Stech]
- Stephanie Erickson**, MURP, Humphrey Institute [Gary Barnes]
- Bulent Erkmen**, PhD, Civil Engineering [Carol Shield]
- Santiago Erquicia**, MS, UMD, Engineering Management [David Wyrick]
- Michael Etheridge**, BS, Mechanical Engineering [Craig Shankwitz]
- Baichun Feng**, MS, Civil Engineering [Panos Michalopoulos]
- John Fredrickson**, BS, UMD, Electrical and Computer Engineering [Taek Kwon]
- Noa Funk**, MS, Civil Engineering [Mihai Marasteanu]
- Vishnu Garg**, MS, Civil Engineering [Panos Michalopoulos]
- Betsy George**, PhD, Computer Science [Shashi Shekhar]
- Kimberly Green**, MURP, Humphrey Institute [Lee Munnich]
- Kim Grosenheider**, MS, Soil, Water and Climate [Paul Bloom]
- Sailaja Gurram**, MS, Biosystems and Agricultural Engineering [Bruce Wilson]
- Curtis Hammond**, PhD, Kinesiology [Michael Wade]
- Nathan Hemming**, MS Biosystems and Agricultural Engineering [Jonathan Chaplin]
- Yuying Hu**, PhD, Civil Engineering [Carol Shield]
- Shariq Husain**, MS, Civil Engineering [Lev Khazanovich]
- Chaudhry Foad Hussain**, MS, Civil Engineering [John Gulliver]
- Jo Hyunkuk**, MS, Applied Economics [William Gartner]
- Michael Iacono**, MURP, Humphrey Institute [Adeel Lari]
- Basil Iannone**, MS, Horticulture [Susan Galatowitsch]
- Bennett Jackson**, MS, Computer Science [Nikolaos Papanikolopoulos]
- Marilyn Johnson**, MS, Soil, Water and Climate [Paul Bloom]
- Sam Johnson**, MS, Biosystems and Agricultural Engineering [John Nieber]
- Hamed Kebriaie**, MS, Mechanical Engineering [David Kittelson]
- Woosung Kim**, MS, Civil Engineering [Joseph Labuz]
- Saiyam Kohli**, MS, UMD, Computer Science [Donald Crouch]
- Dan Krzmarzick**, MS, Civil Engineering [Jerome Hajjar]
- Eva Lassemo**, MS, Applied Economics [Jerry Fruin]
- Huijuan Li**, MS, Civil Engineering [Arturo Schultz]
- Ning Li**, MS, Civil Engineering [David Levinson]
- Xinjun Li**, PhD, Civil Engineering [Mihai Marasteanu]
- Xue Li**, PhD, Civil Engineering [Mihai Marasteanu]
- Brian Linder**, BS, UMD, Electrical and Computer Engineering [Taek Kwon]
- Qingsong Lu**, PhD, Computer Science [Shashi Shekhar]
- Emmanuel Magisson**, MS Biosystems and Agricultural Engineering [Jonathan Chaplin]
- Adam Marksteiner**, BS, UMD, Industrial Engineering and Mechanical Engineering [David Wyrick]
- Arvind Menon**, MS, Mechanical Engineering [Craig Shankwitz]
- Emily Milde**, MS, Civil Engineering [Catherine French]
- Art Miller**, PhD, Mechanical Engineering [David Kittelson]
- Dave Miner**, BS, Biosystems and Agricultural Engineering [John Nieber]
- Paul Mogush**, MURP, Humphrey Institute [Kevin Krizek]
- Kristine Moncada**, MS, Agronomy and Plant Genetics [Nancy Ehlike]
- Norah Montes de Oca**, MS, Civil Engineering [David Levinson]
- Paul Morris**, MS, Civil Engineering [Gary Davis]

<i>Megan Mowday</i> , MURP, Humphrey Institute [Lee Munnich]	<i>Jake Savstrom</i> , MS, Mechanical Engineering [David Kittelson]	<i>Sarah Trainor</i> , BS, UMD, Industrial Engineering [David Wyrick]	<i>Wuping Xin</i> , PhD, Civil Engineering [Panos Michalopoulos]
<i>Richard Nicholson</i> , BA, Geography [John Adams]	<i>Matt Sellner</i> , BS, Mechanical Engineering [David Kittelson]	<i>Stephen Ulrich</i> , MURP, Humphrey Institute [Lee Munnich]	<i>Archna Yadav</i> , MS, UMD, Electrical and Computer Engineering [Jiann-Shiou Yang]
<i>Lalit Nookala</i> , MS, UMD, Electrical and Computer Engineering [Taek Kwon]	<i>Illya Shydlovskyy</i> , MS Biosystems and Agricultural Engineering [Jonathan Chaplin]	<i>Harini Veeraraghavan</i> , PhD, Computer Science [Nikolaos Papanikolopoulos]	<i>Ling Yang</i> , PhD, Electrical and Computer Engineering [Mohamed-Slim Alouini]
<i>Eric Otto</i> , MS, Biosystems and Agricultural Engineering [John Nieber]	<i>Jeffrey Sharkey</i> , BS, UMD, Computer Science [Carolyn Crouch]	<i>Raul Velasquez</i> , PhD, Civil Engineering [Mihai Marasteanu]	<i>Nan Yang</i> , BS, UMD, Electrical and Computer Engineering [Jiann-Shiou Yang]
<i>Jianping Pei</i> , MS, Civil Engineering [Gary Davis]	<i>Colbey Sullivan</i> , MA, Public Policy, Humphrey Institute [Lee Munnich]	<i>Becky Vick</i> , MA, Geography [Francis Harvey, Principal Investigator]	<i>Iliia Yut</i> , MS, Civil Engineering [Lev Khazanovich]
<i>Andrew Poppe</i> , MS, Aerospace Engineering [Nicholas Ward]	<i>Senthil Swaminathan</i> , PhD, Mechanical Engineering [Will Durfee]	<i>Fenghuan Wang</i> , MS, UMD, Mathematics and Statistics [Harlan Stech]	<i>Lei Zhang</i> , PhD, Civil Engineering [David Levinson]
<i>Feng Qian</i> , BS, UMD, Electrical and Computer Engineering [Jiann-Shiou Yang]	<i>Katie Swanson</i> , MS, Civil Engineering [Carol Shield]	<i>Qiang Wang</i> , PhD, Civil Engineering [Lev Khazanovich]	<i>Nan Zhang</i> , MS, UMD, Electrical and Computer Engineering [Jiann-Shiou Yang]
<i>Ryan Rohne</i> , BS, Civil Engineering [Arturo Schultz]	<i>Joel Swenson</i> , MS, Civil Engineering [Joseph Labuz]	<i>Sarah Watters</i> , MA, Public Policy and JD, Humphrey Institute and Law School [Gary Barnes]	<i>Justin Zimmerman</i> , MS, Civil Engineering [Arturo Schultz]
<i>Troy Roth</i> , BS, Biosystems and Agricultural Engineering [John Nieber]	<i>David Thompson</i> , MS, Civil Engineering [Joseph Labuz]	<i>Susanna Wilson</i> , MURP, Humphrey Institute [Frank Douma]	<i>Adam Zofka</i> , PhD, Civil Engineering [Mihai Marasteanu]
<i>Brian Runzel</i> , MS, Civil Engineering [Carol Shield]	<i>Nebiyou Tilahun</i> , MS, Civil Engineering [David Levinson]	<i>Jason Wollak</i> , BS, UMD, Electrical and Computer Engineering [Jiann-Shiou Yang]	<i>Ewa Zofka</i> , MS, Civil Engineering [David Levinson]
<i>Edward Sanderson</i> , MURP, Humphrey Institute [Kevin Krizek]	<i>Derek Tompkins</i> , PhD, Civil Engineering [Lev Khazanovich]	<i>Feng Xie</i> , MS, Civil Engineering [David Levinson]	
<i>Kim Sangho</i> , PhD, Computer Science [Shashi Shekhar]	<i>Walter Trach, Jr.</i> , MS, Mechanical Engineering [Craig Shankwitz]		

*Note: Principal investigators noted in brackets*

## Graduate Certificate Students

### Enrolled

*Jose Fischer*, Minnesota Department of Transportation (MS, Agricultural/Applied Economics)  
*Eric Marquardt*, Minnesota Department of Transportation (MS, Geographic Information Sciences)

*Damon Sather* (MS, Geographic Information Sciences)  
*Andrew Schlack* (MURP, Humphrey Institute)  
*Jeremy Stahl*, Land O' Lakes (Graduate Certificate)

### Graduates

*Andrew Gillett*, Hennepin County (Graduate Certificate)  
*Heidi Hamilton*, City of Northfield (MS, Infrastructure Systems Engineering)

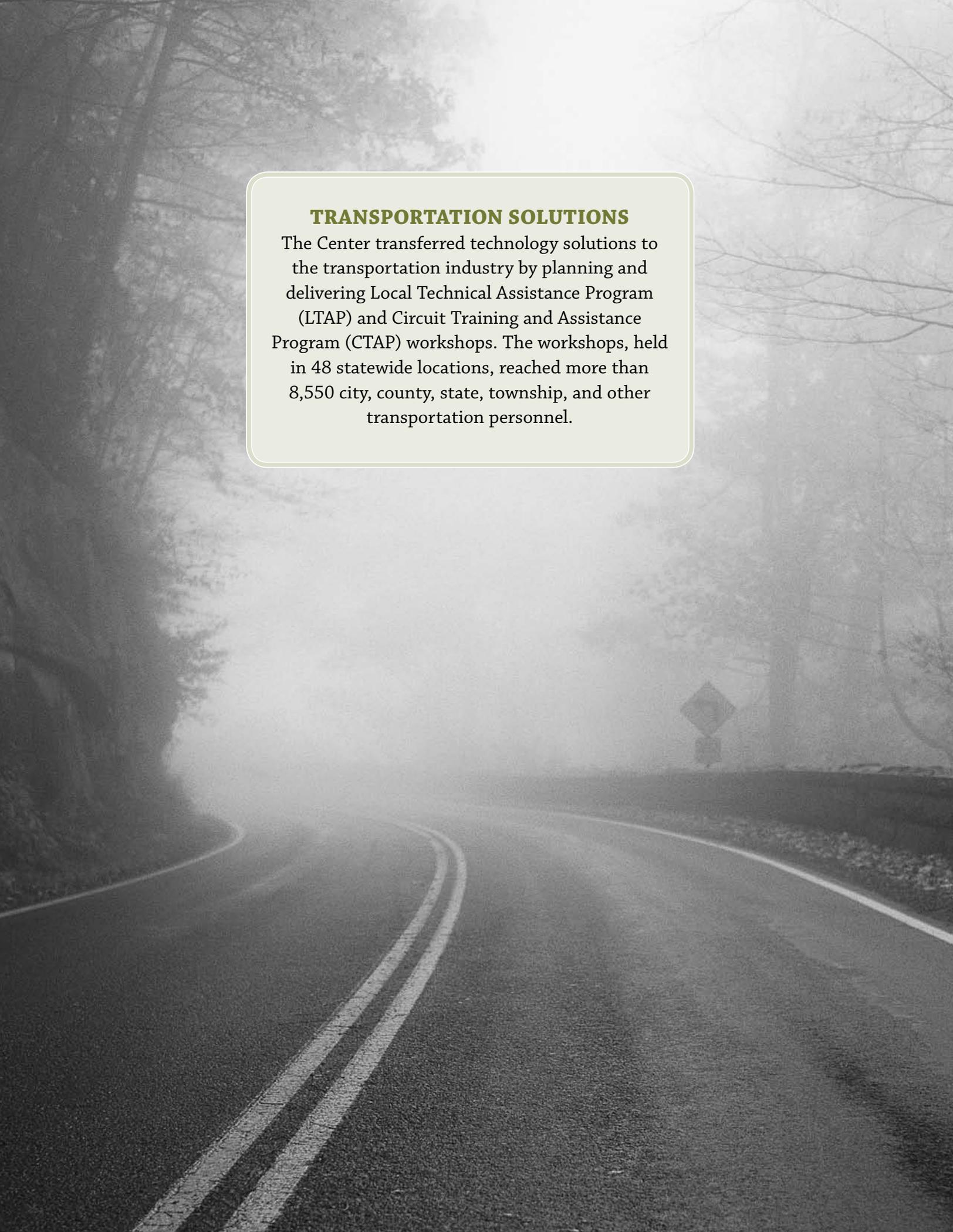
## Student Awards

**Matthew J. Huber Award for Excellence in Transportation Research and Education**  
*Wuping Xin*  
*Nathaniel Bird*

**ITS Institute Travel Award Recipients**  
*Mathew Bevilacqua*  
*Michael Corbett*  
*Vivek Deshpande*  
*Baichum Fing*  
*Nebiyou Tilahun*  
*Feng Xie*  
*Lei Zhang*

**ITS Institute Outstanding Student of the Year**  
*Nathaniel Bird*

**CTS Travel Award Recipients**  
*Eray Baran*  
*Bulent Erkmen*  
*Xue Li*  
*Xinjun Li*  
*Paul Mogush*  
*Ed Sanderson*  
*Raul Velasquez*  
*Sarah Watters*

A grayscale photograph of a winding road through a wooded area. The road curves to the right and is shrouded in a thick fog. In the distance, a diamond-shaped road sign is visible on the right side of the road. The overall atmosphere is misty and quiet.

## **TRANSPORTATION SOLUTIONS**

The Center transferred technology solutions to the transportation industry by planning and delivering Local Technical Assistance Program (LTAP) and Circuit Training and Assistance Program (CTAP) workshops. The workshops, held in 48 statewide locations, reached more than 8,550 city, county, state, township, and other transportation personnel.

### Minnesota Local Technical Assistance Program

The Minnesota Local Technical Assistance Program (LTAP), housed at CTS, is all about sharing transportation knowledge, improving skills, and putting research and new technology into practice. Minnesota LTAP, established by the Federal Highway Administration (FHWA) in 1992, is part of a network of 58 centers nationwide that support city, county, township, and tribal personnel. State DOT's, industry, and consultants to local agencies also rely on LTAP resources.

Minnesota LTAP receives funding from FHWA, the Minnesota Local Road Research Board (LRRB) and the Minnesota Department of Transportation (Mn/DOT).

Minnesota LTAP offers a statewide workshop program and partners with other organizations to cosponsor events.

LTAP offered the following workshops in FY2005:

- Best Pavement Design Practices for City Streets and County Roads
- Bridge Maintenance
- Culvert Installation and Maintenance
- Design, Construction, and Maintenance of Storm Water Treatment Basins and Erosion Control Measures
- Design and Maintenance Considerations for Erosion Control on Local Roads
- Gravel Road Maintenance and Design
- Mechanic Training
- Motor Grader Operator Training

Minnesota LTAP cosponsored the following events:

- Tenth Annual Transportation Career Expo

- Ninth Annual Minnesota Pavement Conference
- Fourth Annual Road Salt Symposium
- Spring and Fall State Maintenance expos
- APWA "Click, Listen, and Learn" online courses
- Work-Zone Traffic-Control Seminar
- Traffic Engineering Fundamentals workshop
- Minnesota Truck-Weight Compliance Training

*Register for Minnesota LTAP workshops and events, read the latest news and research about a wide variety of transportation-related topics, or contact qualified professionals for training or service needs on the Web at [www.mnltap.umn.edu](http://www.mnltap.umn.edu).*



### Local Operational Research Assistance (OPERA) Program

The LRRB's Local Operational Research Assistance Program, or the Local OPERA Program, helps to develop innovations in the construction and maintenance operations of local government transportation organizations.

Minnesota LTAP, which administers the Local OPERA Program, produced the first OPERA annual report for the Minnesota Local Road Research Board (LRRB). The report is a compilation of FY2005 projects by local government transportation organizations receiving OPERA support. Ten maintenance

The program encourages maintenance employees from all cities and counties to get involved in operational or "hands-on" research.

research projects—ranging from dust reduction on gravel roads to solar-powered flashers—take center stage.

The program encourages maintenance employees from all cities and counties to get involved in operational or "hands-on" research. In particular, OPERA—which funds up to \$10,000 for projects—helps to develop maintenance workers' ideas

locally and share those ideas statewide.

*More information about the Local OPERA Program, including an application for OPERA funding and the 2005 OPERA annual report, is online at [www.mnltap.umn.edu/opera](http://www.mnltap.umn.edu/opera).*

### Roads Scholar Program

Minnesota LTAP honored its first Roads Scholar graduate at the 2005 Spring Maintenance Training Expo in St. Cloud. Student enrollment in the Roads Scholar program has increased by 50 percent during the last fiscal year, bringing the total of enrollees to 400.

The Roads Scholar Program, which began in 2003, awards a Minnesota LTAP certificate to maintenance personnel who are committed to learning new skills and expanding their knowledge in the latest road and bridge innovations. To complete the program, students must complete eight credits within five years by attending LTAP workshops, maintenance expos, and Circuit Training and Assistance Program (CTAP) work-

shops. LTAP sponsors 25 sessions annually that meet the program's certification requirements.

*More about the Roads Scholar Program is online at [www.mnltap.umn.edu](http://www.mnltap.umn.edu).*



CTS associate director Cheri Marti honors Mn/DOT maintenance research project manager John Tarnowski as the first graduate of the Minnesota LTAP Roads Scholar Program.

### Circuit Training and Assistance Program

CTAP, or the Circuit Training and Assistance Program, is a mobile outreach effort providing training, technical assistance, and technology transfer to city, county, state, and related personnel. Workshops may be scheduled for a range of topics upon request.

CTAP has consistently increased the number of workshop participants over the last few years. In FY2005, CTAP instructor Kathy Schaefer, a former maintenance supervisor with Mn/DOT, conducted training sessions for 4,429 employees from cities, townships, counties, and the state. Among the several workshops offered, a new addition is a class on work-zone traffic control and flagger safety.

CTAP is sponsored by Minnesota LTAP, Mn/DOT's Maintenance Research and Operations Office, and the Minnesota Local Road Research Board.

*More about CTAP is online at [www.mnltap.umn.edu/ctap](http://www.mnltap.umn.edu/ctap).*

University professor Paul Bloom developed and deployed a fly ash screening tool to find safe levels when using fly ash as a soil stabilizer. Bloom also conducted a number of training sessions for city and county engineering staff. (see page 12 for more)

## State maintenance expos

Minnesota LTAP partners with the Minnesota Department of Transportation, the Minnesota Local Road Research Board, the Minnesota Public Works Association, and the Minnesota Street Superintendents Association to hold annual spring and fall maintenance research expos.

The fall 2004 maintenance expo, held October 6–7 in St. Cloud, attracted approximately 1,500 attendees from state, county, city, and township governments. The fall expo again emphasized winter operations, with much of it related to safety, security, and reducing the environmental impact of winter maintenance operations.

The spring maintenance training expo drew more than 500 attendees April 20–21, 2005, also in St. Cloud. The spring expo included sessions about illegal disposal of waste products from meth labs, skin cancer, work-zone safety, and West Nile virus—topics that reflect



new health and safety issues for today's maintenance worker.

These events allow transportation professionals, especially those in the maintenance area, to exchange ideas and information; learn about new tech-

nologies, practices, and materials; and improve communications within the workplace. Also included are half-day outdoor equipment demonstrations and indoor equipment displays of exhibitors' technology.

## AirTAP

AirTAP—the Airport Technical Assistance Program—is a statewide assistance program for aviation personnel that offers practical instruction by knowledgeable, experienced trainers and also provides a range of helpful information, materials, and resources.

One of AirTAP's primary goals is to offer aviation personnel a network of colleagues they can go to with questions about the operation, administration, and maintenance of their airport. To that end, a list of key contacts within Minnesota and the Midwest region in specific aviation-related topic areas has been added to the AirTAP Web site.

As an experimental departure from

AirTAP's one-day, one-topic training workshops traditionally held several times a year at various airports around the state, AirTAP held its first-ever fall forum November 3 and 4 in St. Cloud. Participants heard from aviation experts on topics that ranged from attracting business to airports, setting rates and charges, and meeting FAA minimum standards to controlling wildlife, keeping runways safe, and using the AirTAP marketing toolkit. In addition, University applied economics professor William Gartner introduced a new interactive Web-based economic impact measurement tool for small/medium sized commercial and public use airports. (*For more*

*about the airport economic impact calculator, see page 4.*)

AirTAP is sponsored by the Mn/DOT Office of Aeronautics, in partnership with CTS and the Minnesota Council of Airports, or MCOA.

*Electronic versions of all AirTAP publications may be downloaded from the AirTAP Web site along with other useful information, materials, and resources at [www.airtap.umn.edu](http://www.airtap.umn.edu).*



### **RAISING PUBLIC AWARENESS**

A presentation at the CTS Transportation Research Conference on cell phone use while driving was covered in local print, television, and radio media and was mentioned in a story in *USA Today*.

# Public and Stakeholder Participation

## CTS Area of Excellence

Serve as a catalyst for focusing the public debate on transportation-related issues while maintaining the role of an objective neutral facilitator

### 2005 Annual Transportation Research Conference

In April 2005, CTS held its 16th Annual Transportation Research Conference in St. Paul. The event focused on cutting-edge alternatives in the areas of mobility, finance, infrastructure, and technology. Highlights include:

- A plenary presentation titled “Building Consensus for Transportation Funding” by Bill Elfenbein, chair of the Denver Regional Transit Board, and panel discussion with State Rep. Mary Liz Holberg, Jay Cowles of the Itasca Project, and Rick Krueger of the Minnesota Transportation Alliance
- University research findings of a recent study on distracted driving that ask if cell phones and driving are deadlier than driving under the influence of alcohol (*For more about the project, see page 6.*)

- A luncheon presentation in which David Luberoff, professor and executive director of Harvard University’s Institute for Greater Boston, shared his views on large-scale, urban public projects (*For more about Luberoff’s presentation, see page 27.*)
- Nearly two dozen concurrent sessions included such topics as lengthening commute times, social and economic issues raised by the new MnPASS high-occupancy toll lane, and methodologies and tools for researching bicycle use in suburban and urban areas across the country.

*More coverage of the 2005 CTS Transportation Research Conference is online at [www.cts.umn.edu/news/report/2005/06](http://www.cts.umn.edu/news/report/2005/06).*



Bill Elfenbein



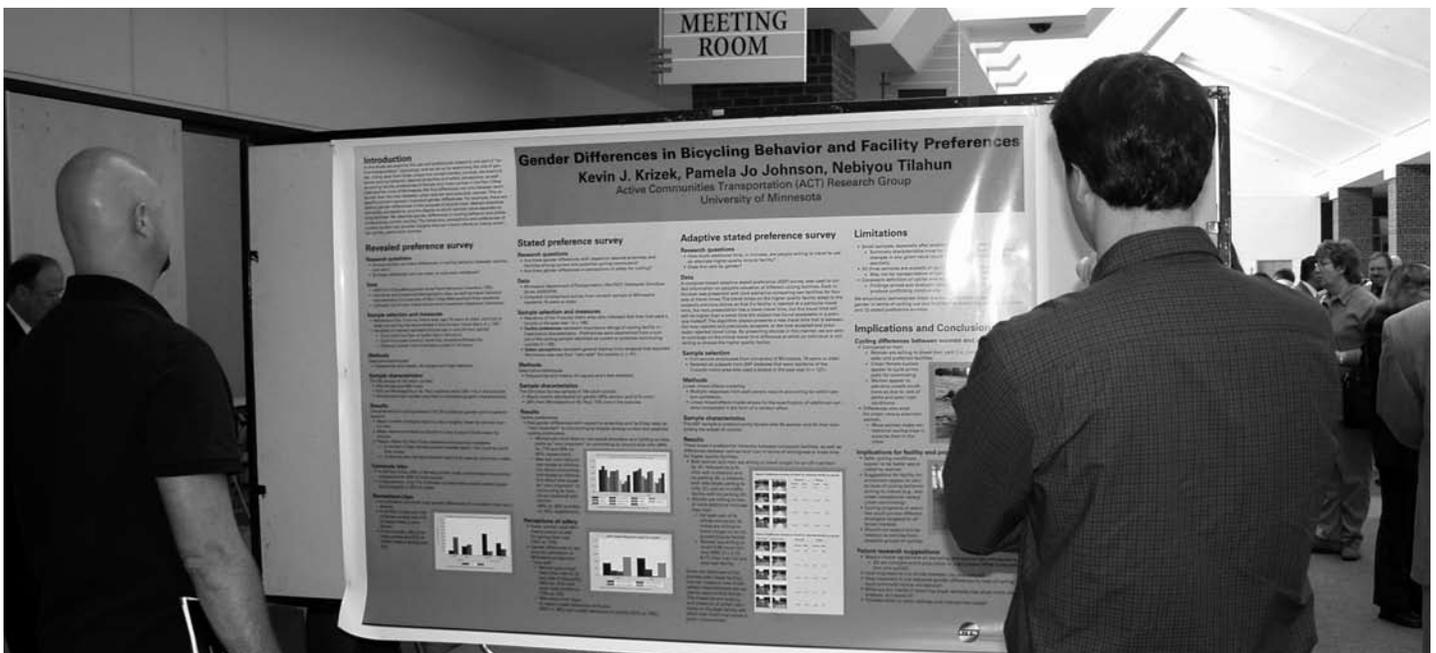
Rick Krueger



Mary Liz Holberg



Jay Cowles



## Public and Stakeholder Participation

### CTS annual meeting and awards luncheon

In March 2005, CTS presented annual awards to recognize significant contributions to the field of transportation.



Catherine French  
and the lead investigator in the creation of the Multi-Axial Subassemblage Testing (MAST) Laboratory

**Richard P. Braun Distinguished Service Award:** *Catherine French*, professor in the Department of Civil Engineering

and the lead investigator in the creation of the Multi-Axial Subassemblage Testing (MAST) Laboratory



Michael Sheehan

**Ray L. Lappegaard Distinguished Service Award:**

*Michael Sheehan*, county engineer in Olmsted County and a past president of both the Minnesota County Engineers Association and the Minnesota Society of Professional Engineers



William Goins

**William K. Smith Distinguished Service Award:**

*William Goins*, worldwide account manager at Federal Express and an adjunct faculty member at the University's Carlson School of Management



Elliot Perovich

**Distinguished Public Leadership Award:**

*Elliot Perovich*, a transportation analyst for Anoka County and chair of the Regional Transit Board in the 1980s

**CTS Research Partnership Award:** *Fly Ash Screening Tool Investigation 795 Implementation*

In the project, University researchers worked with the Minnesota Pollution Control Agency (MPCA) and many other partners to develop a worksheet to analyze the risk to human health from different exposure scenarios to fly ash,

a byproduct from coal combustion valuable for stabilizing poor soils when building roads. The program includes a database of information for much of Minnesota and for various ash choices. Users can do an initial evaluation of their project and then add their own specific data. (For more about the project, see page 12.)



(From left) Project partners Kim Grosenheider (University of Minnesota Department of Soil, Water, and Climate), John Siekmeier (Mn/DOT), Paul Bloom (University of Minnesota Department of Soil, Water, and Climate), Roger Olson (Mn/DOT), Richard Sanders (Polk County), James Klessig (Mn/DOT), with CTS associate director Laurie McGinnis

*Not pictured:* Tim Andersen, Robert Edstrom, Bruce Johnson, John Jones, Barbara Loida, and Ruth Roberson (Mn/DOT), Thomas Halbach (University of Minnesota Department of Soil, Water, and Climate), Jeff Blue (Waseca County), Chuck Donkers (Xcel Energy), Greg Felt (Scott County), Matt Herman and Mike Trojan (MPCA), Steve Juhlin (Barr Engineering), John Rodeberg (City of Hutchinson), Fred Salisbury (City of Waseca), Mark Sehr (Rock County)

### CTS luncheon presentations

The Center's luncheon presentations provide a setting for transportation professionals, faculty, and students to interact as they listen to presentations of national issues. The spring luncheon is held in conjunction with the annual CTS transportation research conference.

#### Fall luncheon

At the CTS fall luncheon in November 2004, Dave Wetzel, vice chair of Transport for London, discussed London's success with congestion charges. To combat severe traffic congestion, the city crafted an integrated transport system using congestion charging as well

as improved transit and bicycle facilities. Among the lessons learned from the charging program are that people will make better use of a scarce resource if charged for it and that people need adequate public transport alternatives.

#### Winter luncheon

At the CTS winter luncheon in February 2005, Hani Mahmassani, a leading intelligent transportation systems (ITS) researcher and director of the Maryland Transportation Initiative at the University of Maryland, delivered a wide-ranging presentation titled "In Real Time, Virtually: Evolving Paradigms and Methodologies for Intelligent Transportation Systems." He said rapid advances in communications technology are changing how transportation systems are used and managed, creating a new paradigm in which travel

behavior, transportation systems management, and information access are interacting and changing each other.

#### Spring luncheon

At the spring luncheon in April 2005, David Luberoff, professor and executive director of the Institute for Greater Boston at Harvard University's Kennedy School of Government, discussed the politics of urban investment in light of recent mega-projects like Boston's \$15 billion "Big Dig" and the new Los Angeles subway line. He reviewed the history of public works projects from pre-World War II through the protest era of the late 1960s and early 1970s before concluding that investment in transportation infrastructure—even for mega-projects—has continued, but with a number of new characteristics.



Dave Wetzel



Hani Mahmassani



David Luberoff

### Access to Destinations Conference

In November 2004, researchers from the University of Minnesota and other organizations presented findings in a new field of study that examines the access people have to a range of destinations. "Access to Destinations: Rethinking the Transportation Future of Our Region," part of the University of Minnesota President's 21st Century Interdisciplinary Conferences series, attracted more than 150 researchers and practitioners during two days in Minneapolis. The event was sponsored by CTS in cooperation with the Center for Urban and Regional Affairs, the College of Continuing Education, the Humphrey Institute of Public Affairs,

and the Institute of Technology.

The conference also marked the beginning of a new University of Minnesota research program studying accessibility in the Twin Cities area. Traditional measures of mobility, such as commute length and travel time, are just part of the equation. Accessibility research takes a different tack and looks instead at individuals' ability to conduct activities—or in other words, get to the places they want or need to go.

The conference featured presenters representing seven countries and 15 U.S. universities. An event proceedings was published and distributed as part of the follow-up to the conference, and a peer-

reviewed book of the conference papers is being published.

*More information about the Access to Destinations study is on page 3 and online at [www.cts.umn.edu/access-study](http://www.cts.umn.edu/access-study).*

Visitors to the CTS Web site ([www.cts.umn.edu](http://www.cts.umn.edu)) increased from 225,566 (FY2004) to 266,552 (FY2005).

## Public and Stakeholder Participation

### Oberstar Forum on Transportation Policy and Technology

Regional and national transportation officials, policymakers, and professionals joined U.S.

Rep. James L. Oberstar in April 2005 to discuss

the future of trans-

portation financing,

including the gas tax and possible alter-

natives. This was the fourth meeting of

the transportation policy and technology

forum named in honor of Oberstar and

hosted by the Center for Transportation

Studies at the University of Minnesota.

Oberstar headlined the two-day event,

which featured USDOT acting assis-

tant secretary for transportation policy

Tyler Duvall, Surface Transportation

Policy Project president Anne Canby,



James L. Oberstar

American Association of State Highway and Transportation Officials engineering and technical services director Tony Kane, American Public Transportation Association president Bill Millar, and Oregon DOT innovative partnerships and alternative funding manager James Whitty. Many other state and national leaders also attended.

In addition, University of Minnesota researchers presented findings from their transportation financing-related studies and a panel of transportation leaders discussed short-term directions in transportation finance from a variety of perspectives.

*More about the Oberstar Forum is online at [www.cts.umn.edu/oberstarforum](http://www.cts.umn.edu/oberstarforum).*

CTS published a study for the National Cooperative Highway Research Program (NCHRP) on *Engagement of State DOT CEOs in Discussing Strategic Issues and Sharing Best Practices*.

The study's results included recommendations for a menu of options in the areas of information resources, forums and discussions, and information exchange.

### Freight and Logistics Symposium

Freight and logistics professionals, researchers, and policymakers examined forces of change affecting the future of the freight industry—from trucking to rail, air, and marine transport—at the 8th Annual Freight and Logistics Symposium hosted by CTS in December 2004. Topics included the changing landscape of transportation, public- and private-sector views of the future of trucking, the effects of those challenges on other transportation modes, and the implications of technology on the future of trucking.

The symposium's main sessions included a keynote address on the changing landscape of the freight transportation industry, a panel discussion about forces of change affecting the future of trucking, a panel focusing on other modes of transportation and technology, and a brief tutorial on government regu-

lations and the Federal Motor Carrier Safety Administration, which oversees road safety in relation to carrier vehicles.

CTS sponsored the event in cooperation with the Minnesota Department of Transportation (Mn/DOT), Minnesota Freight Advisory Committee, Council of Supply Chain Management Professionals Twin Cities Roundtable, and Twin Cities Metropolitan Council.

*A summary report detailing the entire event is available online at [www.cts.umn.edu/publications/proceedings](http://www.cts.umn.edu/publications/proceedings).*



### Minnesota Pavement Conference

In February 2005, participants of the Ninth Annual Minnesota Pavement Conference received the latest news in pavement research and technology from a variety of practitioners and researchers. Presentation topics ranged from pavement noise and Mn/DOT's MnROAD facility to hot-mix asphalt computer design tools, warranties in highway construction, and a fly ash screen tool (*see related research article on page 12*).

CTS hosted the event, which was sponsored by Mn/DOT, Minnesota LTAP, and a number of other organizations, and facilitated by the University's College of Continuing Education.

*More about the Minnesota Pavement Conference can be found in the spring 2005 issue of Minnesota LTAP's Technology Exchange newsletter, or online at [www.mnltap.umn.edu/publications](http://www.mnltap.umn.edu/publications).*

### Toward Zero Deaths conference

In September 2004, the Toward Zero Deaths: Integrating Minnesota's Traffic Safety Agenda Conference, held in St. Cloud, drew about 450 attendees and served as a forum for sharing information on how to reduce the number of fatalities and injuries on Minnesota roads.

Beth Alicandri, director of the Federal Highway Administration (FHWA) safety programs office, urged a better public understanding that vehicle crashes are a serious public health problem. Other conference sessions gave updates on progress made to date as well a glimpse of potential future initiatives—for example, the use of intelligent transportation systems (ITS) such as adaptive cruise control—to improve safety. Several sessions addressed the current challenges in reduc-

ing crashes, from getting the media's attention to enforcing speed limits, and offered ideas for overcoming those.

One of the concurrent sessions featured two University of Minnesota researchers who provided insights into various driver behaviors and ideas on how to best deal with these from a human factors standpoint. Janet Creaser, with the University's HumanFIRST program, discussed the various characteristics of younger and older drivers. Kathleen Harder, with the University's Center for Sustainable Building Research, reported that driver aggression (not including road rage) is one of the major threats to safety in future roadway environments.

Toward Zero Deaths is a multi-agency partnership that includes representa-

tives from the Minnesota Department of Transportation (Mn/DOT), Minnesota Department of Health, Minnesota Department of Public Safety, Minnesota State Patrol, Minnesota County Engineers, FHWA, local community coalitions, and the Center for Transportation Studies. The conference was hosted by CTS and sponsored by Mn/DOT, the Department of Public Safety, and the Minnesota TZD program. It included the Minnesota Department of Public Safety Safe and Sober and Child Passenger Safety Conferences.

*More information about the TZD program can be found at [www.tzd.state.mn.us](http://www.tzd.state.mn.us).*

### Transportation finance roundtables

CTS and the Humphrey Institute of Public Affairs held four roundtables during the year to discuss transportation finance. The roundtable series is intended to stimulate open discussion among transportation leaders about a wide variety of transportation viewpoints.

#### Bus rapid transit and road pricing

Policymakers, researchers, and community leaders came together in October 2004 to share information about bus rapid transit (BRT) and road

pricing. Featured: Robert W. Poole Jr. (director of transportation studies for the Los Angeles-based Reason Public Policy Institute), Ed Regan (senior vice president at Wilbur Smith Associates), and David Schumacher (San Diego Association of Governments).

#### Inside federal transportation funding

David Heymsfeld, minority staff director with the U.S. House Committee on Transportation and Infrastructure, shared his insider perspective on finance and the reauthorization of federal transportation funding legislation at a December 2004 event. Also featured: Betsy Parker (director of Mn/DOT's Office of Governmental Affairs).

#### Evaluating MnPASS

Plans for evaluating the first MnPASS express lane, including an independent

survey sponsored by the Humphrey Institute of Public Affairs, were the topic of a March 2005 roundtable. Featured: Nick Thompson (MnPASS project manager), Johanna Zmud (president of independent research firm NuStats), and Doug Sallman (senior associate with Cambridge Systematics).

#### Comparing approaches to value pricing

Later in June 2005, another roundtable drew Minnesota, Texas, and Colorado tolling officials to St. Paul to discuss Colorado's approach to value pricing. Featured: Peggy Catlin (director of the Colorado Tolling Enterprise).

Approximately 17,650 people receive CTS print and electronic newsletters, a number which has nearly doubled in the past five years.

## Public and Stakeholder Participation

### NASTRL annual research event

In November 2004, the Northland Advanced Transportation Systems Research Laboratories (NATSRL) held its third annual research day at Mn/DOT District 1 Headquarters in Duluth. Transportation practitioners, researchers, students, and community members attended the day-long event. NATSRL, located at the University of Minnesota Duluth, is a program of UMD and the Intelligent Transportation Systems (ITS) Institute at CTS.

Project teams presented detailed updates on their research efforts, including:

- Stanley Burns (UMD Electrical and

Computer Engineering): magneto-resistive sensors

- Richard Maclin (UMD Computer Science): traffic data warehousing
- Taek Kwon (UMD Electrical and Computer Engineering): vehicle inductance signatures
- David Wyrick (UMD Mechanical and Industrial Engineering): life cycle for Mn/DOT fleet vehicles and other fleet assets
- Harlan Stech (UMD Mathematics and Statistics): sensor technology applications for non-destructive evaluation methods of timber bridges
- Taek Kwon (UMD Electrical and

Computer Engineering): developing a probe using weigh-in-motion diagnostic equipment

- Emmanuel U. Enemuoh (UMD Mechanical and Industrial Engineering): deicing methods used for winter road maintenance
- Stacey Stark (UMD Geographic Information Systems Laboratory): state-wide roadway data resource system for Mn/DOT

*More information about NASTRL is online at [www.its.umn.edu/labs/natsrl.html](http://www.its.umn.edu/labs/natsrl.html).*

### International Conference on Accelerated Pavement Testing

Researchers and practitioners from around the world shared the latest accelerated pavement testing (APT) news and findings at the Second International Conference on Accelerated Pavement Testing, held in September 2004 in Minneapolis. Organized under the auspices of the Transportation Research Board, the conference was sponsored by Mn/DOT, CTS, and a number of organizations from across the nation. Several University researchers participated.

The conference included a field trip to the MnROAD site, one of the most sophisticated, independently operated pavement testing facilities of its type in the world. Many of the concurrent sessions at the conference featured MnROAD research.

### National Rural ITS Conference

Speakers from across the nation discussed the latest technological solutions to rural, multimodal transportation challenges at the 2004 National Rural ITS Conference, held in August 2004 in Duluth. The nearly 350 attendees heard dozens of presentations on a wide range of intelligent transportation systems (ITS) applications—including University of Minnesota research—and toured University research facilities.

At the opening session, Neil Schuster, president of ITS America, gave welcoming remarks and introduced keynote speaker Mike Freitas of the USDOT's ITS Joint Program Office. Concurrent

sessions then followed on topics such as automated closure systems, emergency response, and safety. Max Donath, ITS Institute director, also discussed Minnesota research initiatives at a special session on Minnesota Guidestar, the state's ITS program.

The conference was sponsored by ITS Minnesota (the state chapter of the Intelligent Transportation Society of America), with the assistance of ITS America, the U.S. Department of Transportation, the Minnesota Department of Transportation, and CTS. CTS is one of the founding members of ITS Minnesota.

### CTS Library

The Center for Transportation Studies library can provide assistance in obtaining CTS publications and research, as well as transportation-related research and publications from other organizations. Please call 612-624-3646 or e-mail [library@cts.umn.edu](mailto:library@cts.umn.edu).

## Midwest Transportation Knowledge Network

CTS is one of the founding members of the Midwest Transportation Knowledge Network (MTKN), an 11-state network of transportation libraries in the Midwest. The National Transportation Library funded the development of the MTKN in December 2001 as a pilot project. Its main purpose is to improve access to transportation research and information by transportation professionals in the region.

The MTKN has graduated to the next level of institutionalization, becoming incorporated with formal bylaws and other agreements. MTKN has also been instrumental in strengthening libraries at the state DOTs of Kansas, Michigan, and Missouri.

The MTKN has been supporting and promoting the Transportation Library Connectivity pooled fund study, led by

Wisconsin DOT. Eleven states, including Minnesota, are working together to establish transportation library networks in other regions of the country as well as strengthen the Midwest network.

The MTKN has continued its participation in and contributions to the Transportation Libraries Catalog—or TL Cat—an online database of the holdings of 20 of the leading transportation libraries in the United States. TL Cat's rich set of often rare or unique transportation content, combined with a powerful search interface from the Online Computer Library Center, Incorporated (OCLC), allows researchers and professionals to quickly find the best and most relevant information.

The Transportation Libraries Catalog can be viewed through a link on the CTS Library Web site [www.cts.umn.edu](http://www.cts.umn.edu)

CTS published and distributed a 2005 update to the *CTS Publications Catalog*, which includes an order form and is also available online.

/libraries or the MTKN Web site at [www.mtkn.org](http://www.mtkn.org).

If you would like more information about the Midwest Transportation Knowledge Network or the Transportation Libraries Catalog, please visit [www.mtkn.org](http://www.mtkn.org), or contact Arlene Mathison, CTS Librarian and MTKN Executive Committee Chair at 612-624-3646, [amathison@cts.umn.edu](mailto:amathison@cts.umn.edu).

## New online

### Research Database

CTS has taken a major step forward in disseminating information on transportation-related research by linking the contents of its research database directly to the CTS Web site. The new feature allows you to browse research reports online by broad

topic area, year, title, and author, as well as search by title, author, or keyword. In addition, research reports are available for download in PDF format at [www.cts.umn.edu/research/database.html](http://www.cts.umn.edu/research/database.html).

### Pavement Research Institute

The Pavement Research Institute (PRI) has launched a Web site to provide information about pavement-related research projects at the University. In addition, the site features information on faculty and researchers associated with the PRI, research capabilities and facilities, and news about pavement-related findings and events. The PRI Web site is at [www.pri.umn.edu](http://www.pri.umn.edu).

### Community transportation

CTS and Hennepin County, with support from the Federal Transit Administration,

have developed a new Web site and electronic newsletter for promoting innovations in community transportation. The site serves as a clearinghouse for information on research and developments in transportation services for communities in need. *Community Transportation E-news* is a periodic electronic newsletter with the latest research, published reports, and information on community transportation services. The Community Transportation Web site is at [www.cts.umn.edu/ct](http://www.cts.umn.edu/ct).

CTS publishes a variety of print and electronic newsletters, now available through an online subscription form as well as by contacting CTS by phone or mail. More information, including the new subscription order form, may be found online at [www.cts.umn.edu/publications](http://www.cts.umn.edu/publications).





### **CTS SCHOLARS**

CTS works with 24 CTS Faculty Scholars and 17 CTS Research Scholars from a variety of University of Minnesota departments to address transportation issues.

# University Expertise

## CTS Area of Excellence

Strengthen the research and education expertise in transportation-related fields among the faculty and staff within the University

### CTS Faculty and Research Scholars Program

Under the CTS Faculty and Research Scholars Program, begun in 2003, scholars have joint appointments at CTS as well as in their own departments. The program provides an ongoing forum for faculty and researchers to meet with CTS staff to provide feedback, discuss interdisciplinary research opportunities, develop new education initiatives, and discuss ways to improve expertise in response to external demands. The program also addresses how to provide support and guidance to new faculty.

The researchers listed below were selected as scholars because of the transportation focus in their research and education activities, their ongoing involvement with CTS, and their successful relationships with transportation research sponsors. Their two-year appointments may be renewed or rotated to other candidates.

*Learn more about CTS Faculty and Research Scholars at [www.cts.umn.edu/scholars](http://www.cts.umn.edu/scholars).*

### 2005 Faculty and Research Scholars

#### Transportation Planning & Policy



**John Adams**  
Professor and Chair,  
Geography



**Gary Barnes**  
Research Associate,  
Humphrey Institute of  
Public Affairs



**Frank Douma**  
Research Fellow,  
Humphrey Institute of  
Public Affairs



**Ann Forsyth**  
Professor and Director,  
Metropolitan Design  
Center



**Kevin Krizek**  
Assistant Professor,  
Humphrey Institute of  
Public Affairs



**Barbara Lukermann**  
Senior Fellow, Humphrey  
Institute of Public Affairs



**Lee Munnich**  
Director, State and  
Local Policy Program,  
Humphrey Institute of  
Public Affairs



**Lance Neckar**  
Professor, Landscape  
Architecture



**Thomas M. Scott**  
Professor and Director,  
Center for Urban and  
Regional Affairs



**Barbara VanDrasek**  
Research Associate,  
Geography



**Mary Vogel**  
Co-Director, Center for  
Changing Landscapes

#### Traffic Engineering & Management



**Gary A. Davis**  
Associate Professor,  
Civil Engineering



**John Hourdos**  
(formerly Hourdakis)  
Research Fellow,  
Civil Engineering



**David Levinson**  
Associate Professor,  
Civil Engineering



**Panos Michalopoulos**  
Professor,  
Civil Engineering

#### Vehicle Design & Fuels



**Max Donath**  
Professor and Director,  
Intelligent Transportation  
Systems Institute

# University Expertise



**David Kittelson**  
Frank B. Rowley  
Distinguished Professor of  
Mechanical Engineering



**Craig Shankwitz**  
Program Director,  
Intelligent Vehicles  
Program, ITS Institute

## Economics & Management



**Jerry E. Fruin**  
Associate Professor,  
Applied Economics



**Robert Johns**  
Director, Center for  
Transportation Studies



**Alfred A. Marcus**  
Professor, Strategic  
Management and  
Organization, Carlson  
School of Management



**Gerard McCullough**  
Associate Professor,  
Applied Economics



**Barry Ryan**  
Research Fellow, Applied  
Economics

## Pavement Engineering



**Andrew Drescher**  
Shimizu Professor,  
Civil Engineering



**Lev Khazanovich**  
Associate Professor,  
Civil Engineering



**Erland Lukanen**  
Director, Pavement  
Research Institute



**Mihai Marasteanu**  
Assistant Professor,  
Civil Engineering

## Bridge Engineering



**Catherine French**  
Professor, Civil  
Engineering



**Jerome Hajjar**  
Associate Professor,  
Civil Engineering



**Steven A. Olson**  
Director, Multi-Axial  
Subassembly  
Testing System (MAST)  
Laboratory



**Carol Shield**  
Associate Professor, Civil  
Engineering

## Human Factors



**John Bloomfield**  
Research Associate,  
Architecture and  
Landscape Architecture



**Kathleen A. Harder**  
Research Associate,  
Architecture and  
Landscape Architecture



**Michael Manser**  
Research Associate,  
HumanFIRST Program,  
ITS Institute



**Nicholas Ward**  
Director, HumanFIRST  
Program, ITS Institute

## Data Systems



**Taek Kwon**  
Professor and Director,  
UMD Transportation Data  
Research Laboratory



**Osama Masoud**  
Research Associate,  
Computer Science and  
Engineering



**Nikolaos  
Papanikolopoulos**  
Professor, Computer  
Science and Engineering



**Shashi Shekhar**  
Professor, Computer  
Science and Engineering

## Environmental Impacts



**David Biesboer**  
Professor, Plant Biology



**Bruce Wilson**  
Professor, Biosystems  
and Agricultural  
Engineering

## Affiliated researchers and departments

### Aerospace Engineering and Mechanics

Demoz Gebre-Egziabher

### Agronomy and Plant Genetics

Roger Becker  
Nancy Ehlke  
Donald Wyse

### Applied Economics

Jerry Fruin\*  
William Gartner  
Gerard McCullough\*  
Barry Ryan\*  
Tom Stinson  
Douglas Tiffany

### Architecture and Landscape Architecture

John Bloomfield\*  
John Carmody  
Kathleen Harder\*  
Lance Neckar\*  
Robert Sykes  
Mary Vogel\*

### Biosystems and Agricultural Engineering

Jonathan Chaplin  
John Nieber  
Gary Sands  
Bruce Wilson\*

### Carlson School of Management

Fred Beier  
Karen Donohue  
Alfred Marcus\*  
Mahmood Zaidi

### Child Development

Herbert Pick  
Albert Yonas

### Civil Engineering

Paul Bergson  
Gary Davis\*  
Robert Dexter  
Andrew Drescher\*  
Ahmed El-Geneidy  
Cathy French\*  
Ted Galambos  
John Gulliver  
Bojan Guzina  
Jerome Hajjar\*  
Miki Hondzo  
John Hourdos\*  
Lev Khazanovich\*  
Joseph Labuz  
David Levinson\*  
Henry Liu  
Mihai Marasteanu\*  
Panos Michalopoulos\*  
Arturo Schultz  
Carol Shield\*  
Gene Skok  
Karl Smith  
Henryk Stolarski  
Vaughan Voller

### Computer Science and Engineering

Mats Heimadahl  
Ravi Janardan  
Osama Masoud\*  
Nikos Papanikolopoulos\*  
Shashi Shekhar\*  
Jim Slagle  
Richard Voyles

### Electrical and Computer Engineering

Mohamed-Slim Alouini  
Vladimir Cherkassky

### Geography

John Adams\*  
Francis Harvey

Barbara VanDrasek\*

### Horticultural Science

Susan Galatowitsch

### Humphrey Institute of Public Affairs

Gary Barnes\*  
Richard Bolan  
Frank Douma\*  
Kevin Krizek\*  
Barbara Lukermann\*  
Lee Munnich\*  
Carissa Schively

### Kinesiology

Thomas Smith  
Michael Wade

### Law School

Stephen Simon

### Mechanical Engineering

Lee Alexander  
Saifallah Benjaafar  
Pi-Ming Chen  
Janet Creaser  
Max Donath\*  
William Durfee  
Alec Gorjestani  
Diwaka Gupta  
David Kittelson\*  
Michael Manser\*  
Arvind Menon  
Rajesh Rajamani  
Mick Rakauskas  
Craig Shankwitz\*  
Patrick Starr  
Nic Ward\*

### Metropolitan Design Center

Ann Forsyth\*

### Pavement Research Institute

Erland Lukanen\*

### Plant Biology

David Biesboer\*  
Iris Charvat

### Public Health

Judith Garrard

### St. Anthony Falls Laboratory

Jeff Marr  
Omid Mohseni

### Soil, Water, and Climate

Paul Bloom  
Peter Graham  
Satish Gupta  
Thomas Halbach  
Mark Seeley  
Dong Wang

### Urban and Regional Affairs

William Craig  
Thomas Scott\*

### Wood and Paper Science

Bob Seavey

### University of Minnesota-Duluth

#### Computer Science

Carolyn Crouch  
Richard Maclin

#### Electrical and Computer Engineering

Stan Burns  
Donald Crouch  
Mohammed Hasan  
Taek Kwon\*  
Jiann-Shiou Yang

#### Industrial Engineering

Ryan Rosandich  
David Wyrick

#### Mathematics and Statistics

Zhuangyi Liu  
Harlan Stech

#### Natural Resources Research Institute (NRRI)

Brian Brashaw  
Lawrence Zanko

CTS-affiliated researchers received \$4.2 million in funding for transportation-related research, due to entrepreneurial efforts beyond the CTS funding process.

\* denotes CTS Faculty and Research Scholars

## Research reports published in FY2005

### Transportation and the Economy research

Barnes, G., *The Benefits Of Bicycling In Minnesota*, Mn/DOT 2004-50

Cidell, J., *Scales of Airport Expansion: Globalization, Regionalization, and Local Land Use*, CTS 04-01

Douma, F., *Using ITS to Better Serve Diverse Populations*, Mn/DOT 2004-42

Gartner, W., Erkkila, D., and Hyunkuk, J., *Development of a Web-Based Economic Impact Calculator for Small and Medium Size Airports*, Mn/DOT 2005-19

Harder, K., Bloomfield, J., Levinson, D., and Zhang, L., *Route Preferences and the Value of Travel-Time Information for Motorists Driving Real-World Routes*, Mn/DOT 2005-20

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Cherkassky, V., and Rostovtsev, H., *Implementation of Quality of Service (QoS) with Dynamic Resource Allocation*, Mn/DOT 2004-34

Donath, M., Murray, D., and Short, J., *Homeland Security and the Trucking Industry*, CTS 05-08

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Kwon, T., *Atmospheric Visibility Measurements Using Video Cameras: Relative Visibility*, CTS 04-03

Kwon, T., *TMC Traffic Data Automation for MnDOT's Traffic Monitoring Program*, Mn/DOT 2004-29

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Rajamani, R., Levinson, D., Michalopoulos, P., Wang, J., Santhanakrishnan, K., and Zhu, X., *Adaptive Cruise Control System Design And Its Impact on Traffic Flow*, CTS 05-01

Sergi, M., and Donath, M., *Bus Rapid Transit Technologies: A Virtual Mirror for Eliminating Vehicle Blind Zones*, Volume 2, CTS 04-12

Shekhar, S., Lu, C., and Liu, A., *High Performance Spatial Visualization of Traffic Data*, CTS 04-04

Smith, T., *Reducing Risk Taking at Passive Railroad Crossings With Active Warnings*, Mn/DOT 2004-33

## New transportation professor

Henry Liu accepted a position as assistant professor in transportation engineering with the University's Department of Civil Engineering. Liu had been an assistant professor in the Department of Civil and Environmental Engineering at Utah State University. He earned his doctorate in transportation engineering (with a minor in computer sciences) from the University of Wisconsin—Madison and



Henry Liu

was a post-doctoral researcher at the California Partners for Advanced Transit and Highways (PATH) Program at the University of California, Berkeley. Liu's research interests include dynamic transportation network modeling, traffic simulation, traffic operations and control, and artificial intelligence applications in transportation systems.

Veeraraghavan, H., Atev, S., Bird, N., Schrater, P., and Papanikolopoulos, N., *Finding What the Driver Does*, CTS 05-03

Wahlstrom, E., Masoud, O., and Papanikolopoulos, N., *Monitoring Driver Activities*, CTS 04-05

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**Transportation Infrastructure research**  
Bentler, J., Labuz, J., and Schultz, A., *Earth Pressure Behind A Retaining Wall*, Mn/DOT 2005-14

Clyne, T., and Marasteanu, M., *Inventory of Properties of Minnesota Certified Asphalt Binders*, Mn/DOT 2004-35

Davich, P., Labuz, J., Guzina, B., and Drescher, A., *Small Strain and Resilient Modulus Testing of Granular Soils*, Mn/DOT 2004-39

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Schultz, A., *Rapid Assessment of Distortional Stresses in Multi-Girder Steel Bridges*, Mn/DOT 2004-48

Skok, E., and Clyne, T., *Best Practices for the Design and Construction of Low Volume Roads- REVISED*, Mn/DOT 2002-17REV

Smith, K., Kampf, C., Engstrom, L., and Pierce, B., *Developing Project Management Expertise*, Mn/DOT 2004-38

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Zofka, A., Marasteanu, M., Clyne, T., Li, X., and Hoffmann, O., *Development of Simple Asphalt Test for Determination of RAP Blending Charts*, Mn/DOT 2004-44

**Transportation Planning and the Environment research**

Diamond, M., Monabbati, M., and Archbold, J., *Environmental Hazard Assessment For Transportation Related Chemicals: Development of a Decision Support Tool*, Mn/DOT 2004-14

Gale, S., and Biesboer, D., *The Effect of Novel Soil Amendments on Roadside Establishment of Cover Crop and Native Prairie Plant Species*, Mn/DOT 2004-41

Gulliver, J., and Weiss, P., *Cost Effectiveness Analysis of Storm Water Runoff Best Management Practices*, Mn/DOT 2005-23

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Monabbati, M., *Environmental Hazard Assessment For Transportation Related Chemicals: Development of a Decision Support Tool - USERS GUIDE*, Mn/DOT 2004-14G

Reinhardt, C., and Galatowitsch, S., *Best Management Practices for the Invasive Phalaris arundinacea L. (Reed Canary Grass) in Wetland Restorations*, Mn/DOT 2004-36

**Accomplishments**

Civil engineering professor **Jerome Hajjar** received the 2004 Special Achievement Award from the American Institute of Steel Construction (AISC) in recognition of his work on the behavior and design of composite steel/concrete columns in composite frame structures.

Associate Professor **David Levinson** is the recipient of the 2004 New Faculty Award from the Council of University Transportation Centers (CUTC) and the American Road & Transportation Builders Association.

Computer science and engineering professor **Shashi Shekhar** was one of five individuals named a University of Minnesota Distinguished McKnight University Professor for 2005.

Applied economics professor **Thomas Stinson** was one of six individuals to receive a 2005 Outstanding Community Service Award.

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## Passings

**Robert Dexter**, a University of Minnesota associate professor of civil engineering and a leading expert on fatigue and cracking of steel structural elements, died in November 2004. He was 48. Dexter was a member of the CTS Infrastructure Council and conducted a number of research projects through the CTS research program.

**Darryl E. Durgin**, retired deputy commissioner/chief engineer with Mn/DOT and a member of the CTS Board of Advisors, died in November 2004. He was an active participant in numerous local and national transportation and professional groups and served as a mentor for many in the transportation field. A long-time contributor to CTS, Durgin received the Ray L. Lappegaard Distinguished Service Award in 2000.

**Miles S. Kersten**, a professor of civil engineering at the University of Minnesota for 33 years, died in August 2005 at age 92. He was instrumental in developing programs in soil mechanics and highway engineering related to soils and pavement design. In 1990, the CE department created the Miles Kersten Land Grant Chair with gifts from the highway industry and friends in Minnesota. In 1995, he received the first Richard P. Braun Distinguished Service Award from CTS.

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