



The Institute's activities in education encompass a multidisciplinary program of coursework and experiential learning that reinforces the Institute's theme. The educational program includes the disciplines of computer science and engineering, electrical and computer engineering, civil engineering, mechanical engineering, human factors, public policy, and others.

By sponsoring and supporting varied educational initiatives for students, the Institute is generating interest in its core ITS science and technologies. These initiatives include developing new curriculum and courses, involving undergraduate and graduate students in research projects, sponsoring students to attend national conferences, presenting awards that recognize outstanding students, and offering research assistantships to help attract more students to the study of transportation. This section of the annual report highlights some of our efforts in the area of education.

Transportation seminars highlight diverse ITS research

During the 2002–2003 academic year, the Institute 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.

From the seminars, students learned about ITS technologies in areas outside their current field of study, researchers learned about other research projects in progress, and practitioners learned about the technologies of the future.

New this year, the seminar series was offered during the fall semester and was available as a one-credit graduate-level course. It was also a required course in the new Graduate Certificate Program in Transportation Studies at the University of Minnesota.

The past year's presentations were:

- "Ramp Meters on Trial." David Levinson, Department of Civil Engineering
- "Is the Sequential Travel Forecasting Paradigm Counterproductive?" David Boyce, Department of Civil and Materials Engineering, University of Illinois at Chicago
- "Wireless EMS Services: Opportunities and Challenges to Bringing Safety and Travel Services to Rural Minnesota." Tom Horan and Frank Douma, Humphrey Institute of Public Affairs

- “Ecological Validity in Applied Perception Research in Simulation Environments: Past, Present, and Future.” Michael Manser, HumanFIRST Program
- “Simulating Snowplow Scheduling in District 1.” Martha Wilson, Department of Industrial Engineering, University of Minnesota Duluth (videocast from Duluth)
- “Dynamics and Control of Tilting Vehicles.” Lee Alexander, Department of Mechanical Engineering
- “Mn/DOT ITS Projects.” Farideh Amiri, Mn/DOT Office of Traffic, Security and Operations

Seminar addresses homeland security issues

On June 2, the Institute sponsored a special ITS seminar, “Advanced Technology for Homeland Security Applications.” Vassilios Morellas, senior principal research scientist at the Situation Assessment Technologies Laboratory in Honeywell Laboratories’ Automation and Control Systems business unit, discussed new video and imaging systems the company developed for three security applications. About 30 people attended, including many University faculty and researchers, Mn/DOT staff, and a representative from Rep. Jim Ramstad’s office.

At the Minneapolis-St. Paul International Airport, Honeywell is testing DIVAS (Digital Integration of Video for Airport Security), a networked video camera system that not only tracks selected people by using



Vassilios Morellas discussed technology for homeland security operations at an Institute-sponsored seminar.

body and clothing colors and facial particle filtering, but also detects entry- and exit-point bolting. Morellas said the company is also designing a face recognition technology system called S-Gate for naval bases that uses a new tri-band light imaging system to detect faces, discriminating between human and dummy skin as well as identifying disguises. S-Gate secures authorized access to a base by matching the mug shot on an RF-ID tag to the driver, automatically diverting questionable vehicles to a checkpoint.

To continue security technology improvements, Morellas encouraged U of M faculty to pursue work in this area. “We need to work collaboratively and exchange information,” he said. Additional video data-mining work is needed and local agencies should develop the technology for the benefit of all, he added.

Students hear advice at Career Expo

In March, the Institute partnered with the CTS Education/Outreach Council, the Women’s Transportation Seminar, the Minnesota Local Road Research Board, and Minnesota LTAP to hold the eighth annual Transportation Career Expo in Minneapolis.

Mn/DOT Seeds program intern Alia Abdel-al, a graduating University of Minnesota senior, came to the expo with an intention similar to that of many other students: to get a job.

With tightening budgets, openings for entry-level civil engineers have become scarce, even for a student with internship experience. “The



The eighth annual Transportation Career Expo brought together students and potential employers.

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job market is tight," said Abdel-al. "It's the toughest part of a person's life—graduating and looking for an entry-level position."

About 75 students, from Minnesota and Wisconsin, and 18 exhibitors attended the expo, which provided job seekers advice for pursuing a variety of careers in transportation. Employers promoted their organizations through booths, and several company representatives led informational sessions.

The event offered a general session on career preparation and four concurrent sessions on specific areas of transportation: engineering/technical careers, transportation planning and policy careers, transportation logistics careers, and careers in intelligent transportation systems.

Student of the Year awarded to Robert F. K. Martin

Graduate research assistant Robert F. K. Martin received the ITS Institute's 2002 Outstanding Student of the Year Award. He was recommended for the award by Nikolaos Papanikolopoulos, professor of computer science and engineering.

Martin, who earned his bachelor's degree in electrical engineering from the University of Minnesota, is seeking his master's in computer and information science. His current work is focused on the detection, tracking, and classification of vehicles using computer vision techniques. He was chosen for the award based on his contributions to addressing the problem of shadow removal for vehicle detection and classification.



Student of the Year Robert Martin (center), receives the award from J. Richard Capka (left) and Ellen Engleman (right).

Martin has held previous positions as a principal software engineer for Lockheed Martin—Technical Defense Systems and as a software engineer for MicroDynamics Corporation. This experience provided him with the programming background that has been invaluable to his current research for the ITS Institute.

Martin says he appreciates being recognized for the work he's accomplished thus far, since as a graduate student, "there is your ultimate goal of getting a degree, but in between the beginning and the end, it feels like a lot of work goes unnoticed. Receiving this award was a large pat on the back."

Martin plans to pursue a Ph.D. and then teach and conduct research in the area of computer science, specializing in computer vision and the cognitive workings of human vision. He received the award in January at the Transportation Research Board 82nd Annual Meeting in Washington, D.C. It was presented by Ellen Engleman, administrator, USDOT Research and Special Projects Administration, and J. Richard Capka, deputy administrator, Federal Highway Administration.

Institute student receives awards from CTS, FHWA

An ITS Institute student was one of two recipients of the 2003 Matthew J. Huber Award for Excellence in Transportation Research and Education. Lei Zhang is a doctoral candidate in the Department of Civil Engineering, concentrating in transportation engineering. He is advised



Award recipient Lei Zhang (center), with Cheri Marti (left) and advisor David Levinson (right)

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by Assistant Professor David Levinson.

The award was presented by Cheri Marti, CTS assistant director, at the center's annual meeting and awards ceremony held in April in Minneapolis. Zhang thanked CTS and Levinson, adding that the award makes him feel he is doing something worthwhile for this area of transportation and encourages him to contribute more to this area of study.

The award is named in honor of the late Professor Matthew J. Huber, in recognition of his contributions to the teaching and study of transportation at the University of Minnesota.

Zhang also received the Milton Pikarsky Award—Science and Technology during the annual Transportation Research Board meeting in Washington, D.C., in January. Christine Johnson of the Federal Highway Administration presented the award to Zhang at the Council of University Transportation Centers Sixth Annual Awards Banquet.

In Zhang's thesis, *Developing Efficient and Equitable Freeway Ramp Control Strategies*, measures of efficiency and equity for ramp meters are defined and applied to data collected in the Twin Cities ramp metering shut-off experiment of fall 2000. Zhang also developed an analytical framework for ramp metering under which future ramp metering studies can be conducted.

Institute sponsorships help students attend national conferences

The Institute grants travel awards to students so they can attend various conferences to report on their research to a larger audience. This past year, the Institute sponsored 11 students to attend the national meeting of the Transportation Research Board (TRB) in January. The students were Wei Chen, Wenling Chen, Joseph Keith Fortowsky, Andy Johnson, Robert Martin, Jonathan Osmond, Tait Swenson, Haifeng Xiao, Wuping Xin, Lei Zhang, and Xi Zou.

High school students experience ITS America annual meeting

The University of Minnesota's ITS Institute, 3M, and ITS America partnered to sponsor a high school student competition held in conjunction with the 2003 ITS America Annual Meeting.

The winning student teams, from Twin Cities-area Eastview and Harding High Schools, joined the usual ITSA exhibitors to share what they learned from the competition about the effectiveness of ramp meters, having completed a Web-based curriculum on the topic. The curriculum, which was created by the Institute, is aimed at introducing students to ITS while having them practice their research, data synthesis, and presentation skills.

The 3M Foundation provided stipends to the participating high schools to offset their cost of attendance, plus an additional \$1,000

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Student teams from Harding High School (above, left) and Eastview High School (above, right) were among the exhibitors at ITS America's annual meeting.

By reaching students with engaging, hands-on activities, the Institute hopes to spark an early interest in transportation.

grant for each school. ITS America donated the exhibit hall space for the students.

While at the annual meeting, the students took time to visit the exhibits and meet with some of the ITS professionals in attendance, later commenting that the experience taught them more about intelligent transportation systems and its far-reaching effects.

The student competition is just one way the Institute is working to interest more of the best and brightest students in a career in intelligent transportation systems.

Web modules provide learning opportunity for high school students

A ramp meter module designed by the ITS Institute's K-12 coordinator, Mark Tollefson, has been distributed to all Twin Cities metropolitan-area high schools and is being used by many teachers.

Students in physics, algebra, and statistics classes are using the computer-based curriculum that covers ramp metering theories and intelligent transportation systems concepts.

"It brings students the opportunity to learn about a subject most people know very little about," said Tollefson. "I think informed students today will make informed taxpayers in the future."

The youth, who also learn about ITS careers through the module, "could become the ITS workers of tomorrow," he said.

By reaching students with engaging, hands-on activities, the Institute



Eastview High School students use the Web module designed by teacher Mark Tollefson (center back).

hopes to spark an early interest in transportation.

"I like this unit because I get to use the computer, get to learn about cars, and I can work at my pace," said a student who explored the module in a test group.

Additionally, Tollefson has designed a Web-quest curriculum on global positioning systems that is currently at the review stage. Along with listing various Web sites about GPS, the curriculum includes quizzes that check students' learning progress. The unit can be used in the same courses as the ramp meter module as well as in earth science and physical science courses. The GPS module will be distributed and available on the Institute's Web site during the first quarter of FY04 (check www.its.umn.edu/education for updates).

The ramp meter module can be accessed at www.its.umn.edu/education/rampmodule/index.html.

Lab opens door to ITS career

When recent graduate Kyle Wood began his internship with the Center for Transportation Studies his sophomore year, he had no interest in transportation. Although the electrical engineering student was hired for administrative-related duties, his background and a budding interest led him more and more into helping out in the ITS Lab across the hall. Soon he was "adopted" by the lab.

Two and a half years later, Wood is pursuing a full-time engineering job in ITS technology with a resume stacked full of skills and original



Student Kyle Wood works in the ITS Lab's Digital Immersive Environment.

project work he's developed at the Institute. His experience in assisting research fellow John Hourdakakis on the Beholder project has been so extensive that Wood is only halfway through writing an over 50-page how-to manual on what he does.

"I'm really the only one that knows the 'ins and outs' of how the entire system is working," he said. Wood helped design Beholder's wireless infrastructure, using an 802.16 protocol, for traffic data transmission from Autoscope® vehicle detection systems—a challenge because he had to deal with conversions using different protocols. His other major accomplishment for the project was building four dedicated, fully automated video encoders to capture and broadcast the video over a 20Mbit wireless network back to the lab.

The Beholder experience became instrumental to Wood's senior project, titled Video Compression over Limited Bandwidth Channels, which couldn't have covered a more related subject. For the project, Wood and his four group members spent a lot of time using the ITS Lab—a valuable resource available to any undergraduate student working on a transportation-related assignment.

Other work experiences also spilled over into Wood's classroom learning, including the PCB (printed circuit board) he built for Beholder's initial communications equipment, and the use of stereo imaging and ultrasonic motion tracking when helping Ted Morris design and construct the lab's Digital Immersive Environment (DEN) for investigating novel human interfaces.

"We are always learning and doing new things here," Wood said, adding that he couldn't have chosen a better place to work. "The experience I've gotten has been phenomenal." Together with the contacts he's made, Wood said he's on excellent footing for his career. "I owe it all to the ITS Institute."



Kyle Wood

ry and optimize them prior to implementation. However, their use is often restricted to advanced researchers with access to special facilities.

By introducing students in diverse engineering disciplines to traffic simulation, Liao's simulation modules will help the ITS Institute expand the understanding and application of intelligent transportation systems.

After joining the ITS Laboratory in 2002, Liao began supporting simulator use and developing simulation-based modules for several transportation-related courses in the Civil Engineering department. His first task was to support the simulation module used in a transportation engineering course focusing on freeway ramp metering and capacity expansion. In this case, students were able to analyze and compare different traffic management strategies on an important metro commuter route.

Liao is also working on an ambitious project to develop a virtual reality traffic simulation environment for use over the Web. This module will allow users to control parameters such as traffic volume and signal timing, then watch the results play out in a realistic artificial world. Users of the advanced simulation module will be able to observe traffic behavior from any vantage point—from overhead to street level, or even from the driver's seat of a vehicle on the road. The new module will be targeted at undergraduate and high school students, traffic engineers, and distance-learning students at the University.

Using Virtual Reality Modeling Language (VRML), Liao is currently constructing a detailed electronic model of the streets and buildings along a section of Washington Avenue near the East Bank campus. These streets will be populated with virtual vehicles, generated by a traffic simulation application in the ITS Lab. An added benefit of the virtual reality environment is that it can be used in other simulation projects, such as the HumanFIRST Program's advanced driving simulator and the ITS Laboratory's Digital Immersive Environment (DEN).



Chen-Fu Liao

Interactive simulations enhance ITS education, outreach

At the ITS Laboratory, work is underway to make traffic simulation tools more widely available. Senior Systems Engineer Chen-Fu Liao is working to give researchers, students, and eventually the public access to advanced computer-generated traffic simulation systems that would allow users to experiment with traffic flow on the streets of Minneapolis, for example.

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Traffic simulators are important because they enable researchers to study the effects of ITS technologies in the laboratory and optimize them prior to implementation.