EDUCATION

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

By supporting and sponsoring a variety of 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, giving 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.

Seminar series showcases varied work in ITS
This was the fifth year that the Institute sponsored its multidisciplinary seminar series at the University. These Advanced Transportation Technologies seminars featured presentations by local and national researchers addressing diverse areas of ITS research, such as traffic management and modeling, human factors, intelligent vehicles, sensing, controls, communications, and policy issues as they relate specifically to road- and transit-based transportation. The seminars give researchers a chance to report on recent research findings and bring new information to the ITS community.

The series is available as a one-credit graduate-level course, or attendees can earn one professional development hour for each seminar. The series is also a required course in the Graduate Certificate Program in Transportation Studies at the University of Minnesota. Seminars are recorded onto DVD and available for loan by request.
The past year’s presentations were:
- “Minnesota Guidestar Program and Project Updates,” given by Ray Starr, Assistant State Traffic Engineer (ITS), Minnesota Department of Transportation
- “Model Reference Adaptive Control Framework for Real-Time Traffic Management Under Emergency Evacuation,” given by Henry Liu, Department of Civil Engineering
- “Multiple Model Techniques in Automotive Estimation and Control,” given by Derek Caveney, Toyota Technical Center
- “Technologies and Human Factors Related to the Intersection Decision Support Project,” given by Janet Creaser, HumanFIRST Program
- “In-vehicle Technology to Correct Teen Driving Behavior: Addressing Patterns of Risk,” given by Shawn Brovold, Department of Mechanical Engineering
- “Understanding the Potential Market of Metro Transit’s Ridership and Services,” given by Kevin Krizek, Hubert H. Humphrey Institute of Public Affairs
- “Development of Flexural Vibration Inspection Techniques to Rapidly Assess the Structural Health of Timber Bridge Systems,” given by Brian K. Brashaw, Northland Advanced Transportation Systems Research Laboratories, University of Minnesota Duluth

UMD team, vehicle rev up for competition
With the help of the ITS Institute, three students from the University of Minnesota Duluth spent months designing and building an independently guided robot to compete June 10–12 in Michigan at the 14th annual Intelligent Ground Vehicle Competition.

The UMD team started almost from scratch in the school’s second year of competition. Electrical and computer engineering students Paul Bushey, Ryan Weidemann, and Jason Brownlee pit their vehicle, MARVIN III, against nearly 40 other teams at Selfridge Air National Guard Base in Harrison Township.

To win the competition, teams must design and build a vehicle that, without human aid, negotiates an obstacle course in the least time and navigates with precision to designated locations on a field, both while ferrying a 20-pound payload.

MARVIN III, which stands for Mobile Autonomous Robotic Vision-Aided Intelligent Navigator, features everything a robot needs to independently navigate a course wrought with pits and barriers: Global Positioning System, digital video camera, SICK laser sensor, onboard computer, and plenty of batteries.

Professor Rocio Alba-Flores, with UMD’s Department of Electrical and Computer Engineering, said that even with classes and senior job searches going on, the team members always wanted to spend more energy and time on the vehicle. Maybe that’s because, as team member Weidemann put it, “I learned more about troubleshooting, team work, and deadlines then I have in any of my classes.”

Teamwork of students helps power solar car
Twenty-five hundred miles is a long way to drive, especially without air conditioning in July. But driver comfort isn’t much of a priority in Borealis III, the University of Minnesota’s competitive
solar car. Forty-six Minnesota students, with ITS Institute support, designed Borealis to capture energy from the blazing summer sun and maximize efficiency—keeping running weight, aerodynamics, and the weather in mind at every stage.

Borealis III finished second in the 2,500-mile North American Solar Challenge (NASC) July 17–27, 2005. After driving for 54 hours from Austin, Texas, to Calgary, Alberta, the team finished just 11 minutes out of first.

Instead of buying a solar array for the vehicle or the electronics system, team members won the NASC Design Innovation Award by fabricating their own. The team also designed peak power trackers to optimize the energy collection of the array and battery protection circuitry for safety, while saving $60,000 by doing it themselves.

The teamwork from the vehicle development stage carried over to the road, where the team developed strategies on how to balance power consumption with speed (and ended up winning the Team Spirit Award). Other teams usually don’t let students make race strategy decisions, but the Borealis team’s sole advisor, Professor Patrick Starr, saw the educational opportunity as more valuable than winning any race.

Minnesota has fielded another team and will compete again in 2007.

**Brovold awarded Student of the Year**

Each year, the ITS Institute selects one graduate student for the Outstanding Student of the Year Award sponsored by the U.S. Department of Transportation's Research and Innovative Technology Administration (RITA).

This year’s award winner is Shawn Brovold, a master’s candidate in mechanical engineering at the University of Minnesota. Brovold received his bachelor of science degree in civil engineering with high honors from the University of Illinois at Urbana-Champaign.

Brovold’s research, In-Vehicle Technology to Correct Teen Driving Behavior, focuses on recognizing behaviors such as speeding, aggressive driving, seat belt use, and driving while intoxicated and provides mechanisms to report these behaviors to parents.

Among the accomplishments that led to Brovold’s selection as Student of the Year are his 3.87 GPA in his graduate studies, several awards he has received throughout his undergraduate and graduate career, his role as the 2005 team leader for the University of Minnesota’s Intelligent Ground Vehicle robotics team, and the various publications to his credit.

Brovold received the award at the annual TRB meeting in Washington, D.C., in January; he was also recognized at the annual CTS awards ceremony in April, during which Professor Stephen Simon of the Law School, Brovold’s advisor, lauded Brovold as a “can-do” person and “an indication of what smart young American adults can do in our society.”

**Huber Award goes to ITS student**

An ITS Institute student was one of two recipients of the 2006 Matthew J. Huber Award for Excellence in Transportation Research and Education.

Harini Veeraraghaven, a doctoral candidate in computer science and engineering, was presented with the award by Cheri Marti, CTS associate director, at the center’s annual meeting and awards ceremony held in April in Minneapolis.

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.

Professor Nikolaos Papanikolopoulos, who serves as Veeraraghaven’s advisor, says her work is “seminal, in the sense that it’s the basis for the detection system” that his research is developing. The scene-monitoring software has
been deployed at the Minneapolis-St. Paul International Airport and is part of a project with the Department of Homeland Security. “Without this great student,” he said, “these things wouldn’t be possible.”

**Institute gives students chance to attend national conferences**

This past year, the Institute sponsored 11 University of Minnesota students to attend and participate in the national meeting of the Transportation Research Board (TRB) in Washington, D.C. They were Nathan Aul, Shawn Brovold, Xiaozheng He, Wenteng Ma, Norah Montes de Oca, Tyler Patterson, Xinkai Wu, Feng Xie, Wu-Ping Xin, Hongbing Zhang, and Xi Zou.

**Networking emphasized at Career Expo**

The ITS Institute once again partnered with CTS, the Minnesota Local Road Research Board, the Minnesota Local Technical Assistance Program, the Women’s Transportation Seminar, and the Council of Supply Chain Management Professionals to put on the 11th Annual Transportation Career Expo. Four main topics were covered by this year’s panelists: networking, job searching, creating a resume, and interviewing. But nothing was emphasized more than the importance of establishing connections, be it with people, an organization, or the career itself.

Approximately 65 college students from Minnesota and Wisconsin attended the event, which gives students the opportunity to ask questions, receive seasoned advice, hear feedback on their resumes, and network with industry professionals. Employers promoted their organizations with booth displays, and several company representatives led informational sessions on transportation-related careers in areas such as intelligent transportation systems, engineering, policy and planning, and logistics management.

**Institute fosters undergraduate work**

The Institute is continuing an undergraduate research program that will fund additional undergraduate students as research assistants. The program gives the students a hands-on research experience and the chance to learn more about ITS technologies.

Three students were awarded funding during the 2005–2006 academic year. HunWen Tao is assisting on a project on bus signal priority based on GPS and wireless communication under the direction of Gary Davis, a professor in the civil engineering department, and Chen-Fu Liao, senior systems engineer with the ITS Laboratory. The other two students, John Grittner and Maria Le, are working under the direction of Albert Yonas, a professor in the Institute of Child Development, on improving the ability of drivers to avoid collision with snowplows in fog and snow.

**Student’s research, design tested by state DOT**

When Michael Etheridge was an undergraduate student in the University of Minnesota’s mechanical engineering program, he presented his senior project to Mn/DOT maintenance staff and the University in April 2005. A year later, his design for a safer, quicker system to change snowplow blades is just beginning to show its potential.

The Quick Edge Rapid Underbody Plow Cutting Edge Changing System was designed, Etheridge said, with several objectives in mind. The design aims to reduce the risk of injury to workers changing snowplow cutting edges, reduce the amount of time it takes to do so, and achieve these objectives with minimal effects on the rest of the machine.

In January 2006, a prototype of the Quick Edge system was
mounted on an in-service snowplow truck in Golden Valley, at which time the system performed adequately in trials, according to Etheridge.

However, snowplow drivers were able to use the prototype only four or five times throughout the rest of the winter, said John Tarnowski, a Mn/DOT maintenance research project manager.

“We really haven’t had a fair chance to test this out,” Tarnowski said. “But it does show a lot of promise.”

Etheridge said the University is also looking into patenting his design. According to Intelligent Vehicles program director Craig Shankwitz, who served as Etheridge’s advisor throughout the project, the University’s Patents and Technology Marketing office will first do a marketing analysis of the design. The next step would be gauging companies’ interest in licensing the design.

But if nothing else, the Quick Edge system is an example of what can happen when students are able to use their abilities outside of the classroom.

“It provided a unique opportunity for an undergraduate engineering student to design a solution to a real-world problem identified by Mn/DOT maintenance staff,” said Linda Preisen, CTS research program manager. “This project was an undergraduate research success.”

Etheridge, who has graduated and is now a project engineer at 3M, said he is interested in seeing how far the design will go, but that its fate is mostly up to Mn/DOT researchers and the University.

“It would definitely be fun to see it move forward,” Etheridge said. “It was pretty much the biggest undertaking of my undergrad career.”

**Topographic mapping and human factors modules released to Minnesota high schools**

The ITS Institute launched two new Web modules to help high school students learn about transportation technologies.

The new Topographic Mapping module introduces students to techniques of accurate mapping and the role of digital maps in new transportation technologies.

The Human Factors module explores the important issue of how human capabilities and limitations affect the design of vehicles and transportation systems.

The new modules join previously developed modules on the Global Positioning System and freeway ramp metering. All were designed by Mark Tollefson, ITS Institute K-12 education coordinator and a high school science teacher. The Web modules are intended for classroom use and feature guided exploration of Web-based resources along with lab exercises that let students immediately practice using what they have learned.

To encourage teachers to try out the modules in their own classroom, a mailing of the two CDs, along with a poster explaining each topic as well as ITS, were distributed to 160 high schools around Minnesota. The modules are also available on the Institute’s Web site at www.its.umn.edu/education /modules, making them available to educators and students around the world.

---

*Michael Etheridge (far right) demonstrates the Quick Edge system for Mn/DOT staff and IV program director Craig Shankwitz (center, standing).*
Summer transportation camp attracts area students
In June, the ITS Institute and CTS hosted 45 students from the National Summer Transportation Institute, a 20-day camp held by the Fond du Lac Tribal and Community College and funded by the U.S. Department of Transportation. Most students came from middle schools and high schools on the Fond du Lac Reservation near Cloquet, Minn., and the surrounding area, said director Holly Pellerin.

The group toured ITS facilities to learn about traffic safety technology and Web-based programs that help students design roads. They then got a taste of cutting-edge transportation research by visiting the HumanFIRST Program’s driving simulator in the mechanical engineering department, and later made a stop at a Freeway Incident Response Safety Team (FIRST) vehicle outside of the Civil Engineering Building. Driver Julie Todora explained how Mn/DOT’s FIRST program minimizes freeway congestion and safety risks through quick response to incidents like crashes and stalled vehicles.

The camp is designed “in the hopes of trying to get kids interested in careers in transportation and impact them at an early age,” Pellerin said. “If they wait until after high school to think about careers, it’s too late.” Students said they enjoyed the camp because it gave them a chance to see things they wouldn’t have otherwise. “I come every year and each year we get to go new places and see new stuff,” said student Wesley Nikko.