

UNIVERSITY OF MINNESOTA



CENTER FOR TRANSPORTATION STUDIES

2002
ANNUAL REPORT

Center for Transportation Studies

University of Minnesota

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This publication is a report of transportation research, education, and outreach activities for the period July 2001 through June 2002 (fiscal year 2002). It covers the Center for Transportation Studies and the three special programs housed within it:

- Intelligent Transportation Systems (ITS) Institute
- Minnesota Local Technical Assistance Program (LTAP)
- Transportation and Regional Growth Study

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director's message





T rue innovation involves debate and challenging the status quo. In fact, the *Harvard Business Review* describes it as often being radical, disruptive, and controlled chaos. The research projects featured in these pages all have challenged current assumptions and, at times, have encountered resistance. Fortunately, we have been able to sustain and grow our transportation research and education programs at CTS not only because of our skilled researchers but also because of our sponsors, who understand the value of debate, and our capable staff, who often serve as intermediaries.



We also continued our successful relationships with our ongoing sponsors: Mn/DOT, FHWA, RSPA, the Local Road Research Board, the Department of Public Safety, and the Metropolitan Council. As Van de Ven has taught us, it is the professionals in these organizations that carry out the other three components of innovation. Our faculty produce transportation ideas and educate students using funding that we help attract, and then we help make connections so that these resources are considered and used, in the same way 3M uses chemical engineering research and students.

Indeed, universities play a critical role in the innovation enterprise. As Andrew Van de Ven of our University's Carlson School of Management has written, successful innovation by an industry requires a community infrastructure, a social system that consists of four components: public resources, development functions, institutional arrangements, and market functions. The two key public resources that a research university provides are scientific knowledge and a human competence pool. 3M, for example, with its close ties to our University's chemical engineering department, uses knowledge from faculty research and hires graduates to help fuel its own product development and marketing functions.

More than ever, economic leadership today depends on knowledge and ideas to create and develop innovations. In 2002—despite the uncertainties caused by a recession, the September 11 attacks, and a new administration—national R&D growth continued, projected by the Battelle Memorial Institute to reach \$286 billion. This growth is especially reflected in R&D investments by our leading Minnesota companies. 3M spends approximately 6.5 percent of annual sales—about \$1.1 billion per year—on R&D. Medtronic invests about \$600 million a year in R&D, which is 10 percent of its sales.

I give this private sector perspective on R&D to provide a context for describing our past year's activities. Our efforts at CTS were devoted to advancing the same public resources—scientific knowledge and human competence—for the field of transportation. Our growth is not as great as the national R&D increases cited above, but we continue to thrive and to attract resources despite public-sector budget uncertainties. We and the University researchers we work with so closely have created relationships with a new and diverse set of sponsors and partners this year: United Way, Federal Transit Administration (and its bus rapid-transit partners), Nissan, Minnesota Public Radio, the National Transportation Library (and its evolving Midwest library coalition), the Minnesota AgriGrowth Council, and the Minnesota congressional staff. You can read about these new relationships in these pages.

We are especially proud of two initiatives this past year that go beyond our usual program activities and that honor two Minnesota transportation leaders. Our establishment of the Richard P. Braun CTS Endowed Chair in Transportation Engineering will increase our capacity at the University to create knowledge and produce students in transportation. Our creation of the James L. Oberstar Forum on Transportation Policy and Technology has given us the opportunity to transfer our knowledge in transportation to the highest level of transportation leaders in the United States.

While we have had strong support, we know that more could be done. At neither the federal nor state level do we have close to the percent investment in transportation research that innovative corporations such as 3M and Medtronic have. The USDOT research and technology investment for fiscal year 2001 was 1.5 percent of its total budget. This also falls short of research investments by the Departments of Agriculture (2.8 percent), Health and Human Services (4.8 percent), Environmental Protection (8.1 percent), and Defense (14.9 percent). TRB Special Report 261, which cites these statistics, recommends a future focus on fundamental, long-term research, a recommendation that we should all support in the upcoming federal reauthorization.

As Van de Ven says, innovation requires a social system infrastructure. Our researchers and our students need to have social connections for their work to make a difference. I want to thank all of you who are part of that social system—our sponsors, our committee members, our participants, our staff, and especially the engineers, planners, and other professionals who grapple with our ideas and hire and train our students. Your engagement is what leads to innovations in transportation.

Robert Johns, Director
Center for Transportation Studies

More than ever, economic leadership today depends on knowledge and ideas to create and develop innovations. Our efforts at CTS have been devoted to advancing the same public resources—scientific knowledge and human competence—for the field of transportation.



year at a glance



AUGUST: CTS cosponsors a national listening session on transportation and the environment, the first such session in the reauthorization process for TEA-21, which expires in 2003.



OCTOBER: CTS hosts the "Conference on Community-Based Transportation" for the Greater Twin Cities United Way.



AUGUST: CTS hosts four congressional staff members to provide an overview of transportation-related activities at the University.



JANUARY: The ITS Institute launches the Human Factors Interdisciplinary Research in Simulation and Transportation—or HumanFIRST—Program to conduct research on driver performance and system design related to surface transportation.



SEPTEMBER: Current and prospective University graduate students visit CTS to learn about the Center's Graduate Certificate Program in Transportation Studies.



FEBRUARY: University officials and faculty break ground on the Minneapolis campus for the new Multi-Axial Subassemblage Testing (MAST) facility, which will test structures for their ability to withstand stresses.



MARCH: CTS collaborates with the Department of Civil Engineering to establish the Richard P. Braun CTS Chair.



APRIL: CTS sponsors the inaugural James L. Oberstar Forum on Transportation Policy and Technology, featuring an address by Oberstar titled "How Should Transportation Change After September 11?"



APRIL: Congressman Martin Olav Sabo reflects on more than 40 years of public service at an inaugural lecture series named in his honor at the Humphrey Institute.



APRIL: CTS cosponsors "Getting There," a day-long forum on transportation in Minnesota at the Humphrey Institute.



MAY: Bruce Katz discusses "The New Metropolitan Reality" at the CTS Thirteenth Annual Transportation Research Conference.

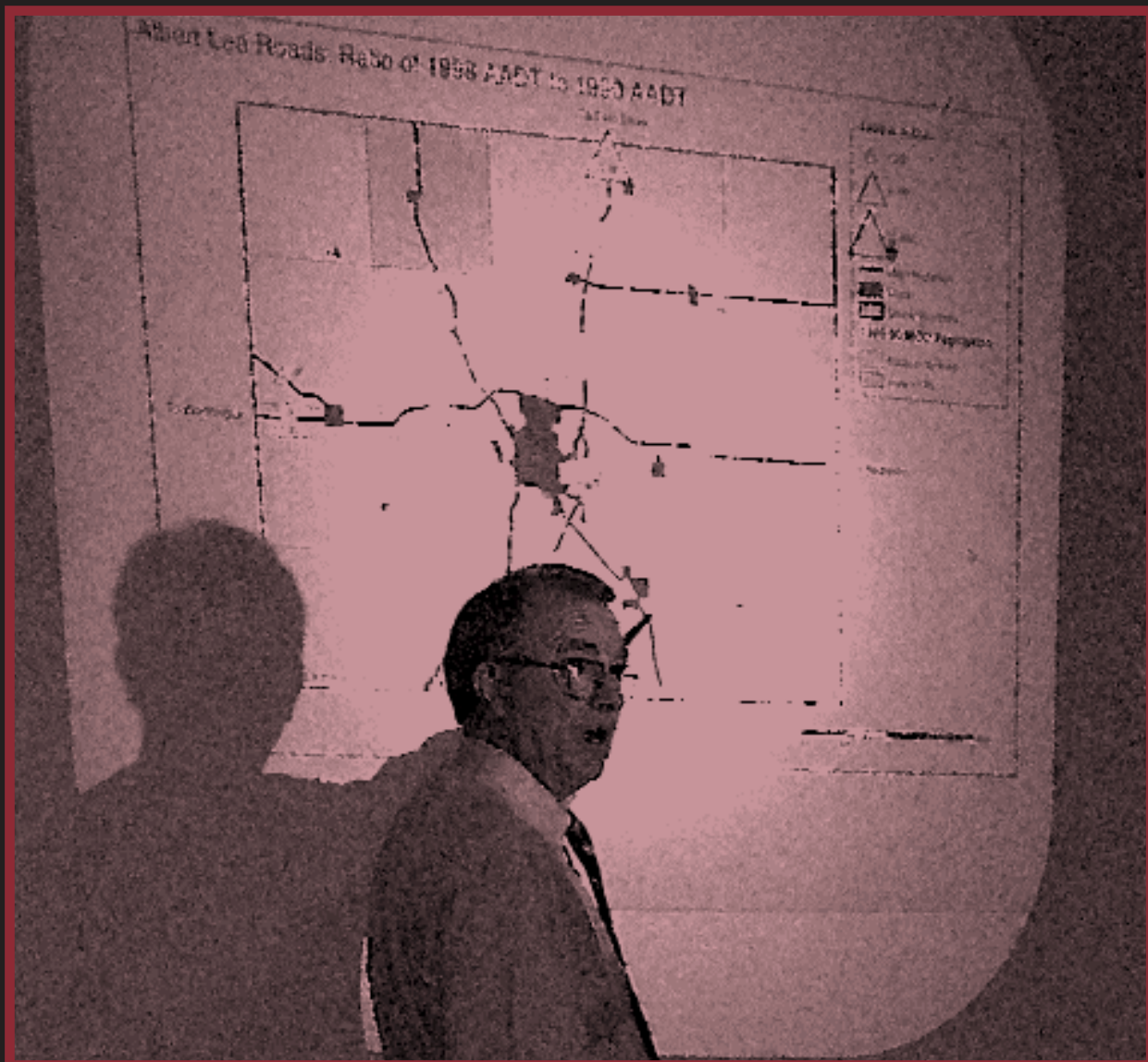


APRIL: CTS honors a project team for research about recycling shingles into pavement at its annual meeting and awards luncheon.



MAY: University researchers introduce the "TechnoBus" at a bus rapid-transit workshop hosted by the ITS Institute.

research





research highlights

- **CTS allocated** FUNDING FOR 79 NEW AND CONTINUING RESEARCH PROJECTS totaling approximately \$6.7 million. Funding sources included the USDOT, Mn/DOT and its Minnesota Guidestar Program, the Minnesota Local Road Research Board, and the University of Minnesota. As part of the CTS research program, the ITS Institute selected nine research projects for funding involving 22 researchers. Total Institute research project funding amounted to \$1.6 million.
- **Civil engineering** PROFESSOR CATHERINE FRENCH, who has conducted bridge research through the CTS research program, led a team that was awarded a \$6.5 million National Science Foundation grant to fund the new MULTI-AXIAL SUBASSEMBLAGE TESTING (MAST) FACILITY at the University. Construction of the MAST facility began on the Minneapolis campus in February 2002.
- The University of Minnesota's HumanFIRST Program was awarded a three-year project with Japanese automaker Nissan to explore the potential of intelligent driver-support systems. HUMANFIRST IS A NEW EFFORT FUNDED BY THE CENTER'S ITS INSTITUTE applying human factors research to the design and evaluation of intelligent transportation systems for improving traffic safety and mobility.
- In November 2001, engineers at the ITS INSTITUTE'S INTELLIGENT VEHICLES LABORATORY, a program for developing innovative, human-centered driving technologies, launched a field operational test along Minnesota Trunk Highway 7 with four snowplows, an ambulance, and a state patrol car. The IV Initiative Field Operational Testing Program is funded by USDOT and Mn/DOT.
- In May 2002, University researchers introduced a lime-green METRO TRANSIT DEMONSTRATION BUS OUTFITTED WITH THE LATEST NAVIGATIONAL TECHNOLOGY, dubbed the "TechnoBus," at a BRT (bus rapid-transit) lane-assist workshop, hosted by the ITS Institute.

transportation and the economy

Travel behavior in large U.S. cities

Large U.S. cities exhibit a surprising degree of variation in population density and in the amount of daily auto travel per person. While there is a widespread belief that higher density facilitates lower driving rates (because destinations are closer together and alternate modes are more feasible), the extent and nature of this relationship are not yet well-understood. In a cross-section of cities, high population density is weakly related to low daily vehicle miles traveled. However, it is not clear to what extent this is the result of density as opposed to other factors, such as congestion or poverty, which may also be correlated with density.

The Minnesota Department of Transportation funded research aimed at better understanding this phenomenon. Humphrey Institute researcher Gary Barnes set out to discover how population density influences travel behavior, in terms of mode choice, trip lengths and quantities, and other factors. He also explored the large differences in daily auto travel across cities, considering that demographic and economic factors could play significant roles.

Barnes used innovative research techniques that included a comprehensive analysis of an unusually large number of variables, both in terms of factors that may influence travel behavior and in ways of describing behavior. He also developed (especially for this study) a number of quantitative methods for describing urbanized area land-use density.

The research revealed that land use, at the aggregate level studied, is not a major leverage point in determining overall population travel choices. While much policy seems to be based on the belief that relatively minor changes to land use will have a big impact on travel choices, the findings of this project imply just the opposite. That is, even large, widespread differences in land use have little impact on travel behavior, in good ways or in bad.

In addition, the connections that are often assumed between different travel choices were not generally observed in this research. For example, while many other studies have noted the impact of density on transit share—which is also found in this study—what is not seen here is evidence for the implication that higher transit



Gary Barnes

share must also lead to less driving, shorter commutes, and less congestion. None of these effects were observed. If anything, Barnes reports, the higher densities that increase transit share tend to increase commute times and congestion levels.

Moving forward, in order to integrate land use and transportation planning and use them to make cities better places to live and work, it will be important to determine the real reasons why some cities are less reliant on driving, Barnes says. Further research may include studying specific cities with fewer vehicle miles traveled, continuing to explore the link between density and transit use, and extracting lessons specifically applicable to the Twin Cities.

The entire research report is available online at: www.lrrb.gen.mn.us/PDF/200124.pdf.

Road financing alternatives

A significant part of the way roads are currently funded is hidden from users and unrelated to travel. A better way to fund roads would be through new tax policies based on travel and road use, say two University researchers in *Road Finance Alternatives: An Analysis of Metro-Area Road Taxes*. This recently published report by Barry Ryan and Thomas Stinson of the Department of Applied Economics is the ninth in a series of the Transportation and Regional Growth Study.

Even large, widespread differences in land use have little impact on travel behavior, in good ways or in bad.

The report describes how the current tax system uses both fixed fee mechanisms, like the vehicle registration tax, and taxes that vary with system use, like the motor-vehicle-fuels tax, to fund state and local roads. Other important sources of road revenues—property taxes, income, and sales taxes—are hidden from the traveler’s perspective. Of all the revenue sources, 71 percent are from fixed or hidden taxes and are unrelated to travel behavior.

The way roads are paid for affects household budgets and creates location incentives, say the authors. To illustrate, they model the budget impacts for a set of representative households, identifying the tax cost from an increasingly longer work commute by moving the households further from the central cities. They also explore two alternative road tax policies.

Current tax policy tends to penalize households that travel less and households with lower incomes. Alternatives that are more reliant on variable pricing mechanisms could actually save some households money while encouraging better fuel economy, less pollution, and alternative modes of travel, Ryan and Stinson say.

In addition, while many factors influence housing location decisions, road tax policy can affect development at the urban/rural fringe. Under the proper conditions, more reliance on variable pricing tax policy may slow conversion of the region’s farmland to non-farm use.

Giving road users more feedback about incremental travel costs would improve the use of state and local roads. Because variable tax mechanisms send road users a clearer price signal about the true cost of their travel, alternative road taxes, like a vehicle-mileage tax or congestion fee, could lead to better travel decisions by factoring weight, distance, or time into the tax price. The authors caution that concerns for improving system efficiency, however, must be balanced with tax fairness and administrative ease.

Ryan and Stinson maintain that policy reforms are needed if road tax revenues are to keep pace over the next 25 years with the rising cost of building and maintaining roads. Between now and 2025, without changing current law, vehicle-registration taxes and motor-fuel taxes will grow more slowly than the costs of road construction. Motor-vehicle-sales taxes, on the other hand, will grow much more quickly. A revenue shortfall in these three taxes would lead to additional pressure to pay for roads with property taxes and the state general fund, they say.

As a result of their research, Ryan and Stinson recommend broad public discussion of tax policy choices and their potential economic and social consequences, which could improve understanding of and support for tax reform.

The entire research report is available online at: www.cts.umn.edu/trg/publications/pdfreport/TRGrpt9.pdf.

Alternative road taxes, like a vehicle-mileage tax or congestion fee, could lead to better travel decisions by factoring weight, distance, or time into the tax price.



transportation safety and traffic flow

Improving transmission of digitized images and data

As technological progress has chugged full-speed ahead in recent years, our transportation system has grown increasingly more reliant on electronic data networks, especially in areas such as traffic management, emergency response, traveler information, transit, and trucking/shipping. But storing and transmitting needed digital images, and sending video data in real time, can place a heavy burden on any network. The problem is particularly acute in wireless networks because they typically offer less capacity than hard-wired systems, including those using fiber-optic cable.

A few years ago, University electrical engineering professor Vladimir Cherkassky and a team of researchers approached the problem by responding to a growing need at Mn/DOT for compressing large image files, such as aerial photographs and maps. Such compression is needed for efficient storage and retrieval of image data, and for image transmission over—at minimum—low-capacity Internet connections.

Researchers compared the performance of several commercial and research methods for image compression based on the “typical” image provided by the Mn/DOT Office of Land Management. They also surveyed some new image compression methods based on wavelet thresholding. Researchers chose MrSID, a commercial software package for image compression, as suitable for the needs of the Office of Land Management and implemented a demo Web site (rocky.dot.state.mn.us/research). The software allows both the efficient storage and retrieval of large digital images and offers improved use of storage and transmission resources and a multi-resolution browsing capability. The software can selectively decompress a portion of an image by zooming to different levels of detail.

Upon completion of the image compression and storage project in mid-2001, Cherkassky’s team continued studying the problem with a new Mn/DOT research contract that focused on the issues involved in wireless transmission of video data and addressed two main issues: video compression and quality of service (QoS). A report published in April 2002 detailed Phase I of a two-part project dealing with practical transmission of multiple video streams over limited-bandwidth networks.

During Phase I, the researchers compared several compression techniques that are commercially available and recommended a wavelet-based compression technique for video compression and network prioritization for issues related to quality of service. This work helped clarify and quantify the trade-offs among the amount of compression, quality of video, available network bandwidth, and varying network traffic loads.

In Phase II, set to begin in early 2003, the team will implement and analyze data prioritization software in a prototype network system and then provide recommendations for future use of such software in Mn/DOT networks for transmitting video data. These recommendations will be particularly important since Mn/DOT’s existing video and image data transmission systems have no provisions for QoS.

Cherkassky’s team is also working to identify several typical network configurations for video and image transmission and will define their characterization in terms of available bandwidth, potential performance bottlenecks, and the number of video streams that can be transmitted over such networks. This characterization will be useful to Mn/DOT in developing scalable and expandable networks to meet current and future needs. Ultimately, this research will also help to improve the wireless infrastructure for accessing traffic video and image data and will benefit other researchers involved with remote traffic monitoring projects by providing the ability to set bandwidth allocations dynamically for different cameras and other sensors.

Completed research reports for these projects are available online at: www.lrrb.gen.mn.us/PDF/200114.pdf and www.lrrb.gen.mn.us/PDF/200224.pdf.

Ultimately, this research will help to improve the wireless infrastructure for accessing traffic video and image data.



Monitoring complex traffic flows

The Center's Intelligent Transportation Systems (ITS) Institute published *Monitoring Weaving Sections*, detailing the development and use of a new portable traffic monitoring system based on automatic computer analysis of data gathered by video cameras. This system represents a major improvement in researchers' ability to accurately monitor areas such as freeway entrance and exit ramps, where vehicles frequently change lanes, accelerate, and decelerate as they enter and exit the traffic flow.

The research team, led by computer science and engineering professor Nikolaos Papanikolopoulos, developed this system in response to the needs of other ITS Institute researchers, who have successfully deployed it on Twin Cities-area freeways to gather data for ongoing traffic pattern research. Existing sensor systems, such as pavement-embedded loop detectors that record the presence of a vehicle in a lane, proved inadequate for gathering data on vehicle movements between lanes.

In the new system, a video camera mounted on a telescoping pole sends images of traffic in the monitoring area to a computer, which interprets "blobs" of similar pixels in the image as individual vehicles. The vehicle-objects are then tracked individually, and data such as speed, acceleration, and lateral movements are recorded for each one. Users can adjust the computer software to compensate for optical perspective and distance from the roadway, making it possible to deploy the monitoring system almost anywhere.

Although the monitoring system is already in use by researchers and Mn/DOT, the developers are working on enhancements that will make it more accurate and reliable. In particular, they want to improve the system's ability to track large, multi-part vehicles (such as semi tractor-trailers) and to compensate for extreme glare and shadows on the roadway.

The entire research report is available online at: www.cts.umn.edu/pdf/CTS-01-06.pdf.





The program's mission is to apply human factors research to the design and evaluation of usable intelligent transportation systems to improve traffic safety and mobility.



HumanFIRST researchers working on the Nissan project include (from left) Peter Easterlund, Michael Manser, program director Nic Ward, and research assistant Amit Chohan.

HumanFIRST

The Human Factors Interdisciplinary Research in Simulation and Transportation—or HumanFIRST—Program is a new ITS-Institute funded program conducting research on driver performance and system design related to surface transportation. The program's mission is to apply human factors research to the design and evaluation of usable intelligent transportation systems to improve traffic safety and mobility. As implied by its name, the program's research strategy is based on a driver-centered approach, considering the "human first" within the transportation system.

The HumanFIRST Program, directed by Dr. Nicholas Ward, is a reconfiguration of the ITS Institute's original Human Factors Research Laboratory. This new program has a core staff of transportation research specialists made up of cognitive psychologists and software engineers linked to a broader interdisciplinary network of other psychologists, engineers, computer scientists, and public health and safety practitioners. This network is supported by affiliations with additional University research units, including:

- Center for Cognitive Science
- Intelligent Vehicles Laboratory
- Human/Machine Design Laboratory
- Artificial Intelligence, Robotics and Vision Laboratory

- Regional Injury Prevention Research Center
- Minnesota Laboratory for Low-Vision Research

This versatility allows the program to create responsive, interdisciplinary teams that investigate a broad range of complex human factors research issues. Moreover, HumanFIRST has close relationships with Mn/DOT and the Department of Public Safety, as well as with traffic engineering consultants. These connections provide additional support for implementing research that will influence transportation policy in response to real-world problems both regionally and nationally.

Much of the research of the HumanFIRST Program uses a state-of-the-art driving simulator engineered specifically for human factors research in surface transportation. This Virtual Environment for Surface Transportation Research (VESTR), provided by AutoSim, is an extremely versatile and realistic simulation environment that can be used for a variety of theory- and application-based research. To support the use of VESTR, the program also has access to a variety of closed test tracks and road network field sites for on-road studies with instrumented vehicles.

More information about HumanFIRST is available online at: www.its.umn.edu/labs/humanfirst.html.

HumanFIRST Program awarded Nissan project

The University of Minnesota's HumanFIRST Program was awarded a three-year project with Japanese automaker Nissan to explore the potential of intelligent driver-support systems.

The systems under study communicate the demands of the environment to the driver in a multi-sensory fashion, using a number of sensors that look at the environment and the driver. The HumanFIRST Program will be evaluating various system prototypes, drawing on the program's expertise in these areas and employing its state-of-the-art driving simulator and its test tracks.

The research team will explore multi-sensory ways to give drivers information that helps them better control their vehicles and manage distractions that might lead to crashes. The current prototype system uses haptic (tactile) feedback to communicate the presence of hazards to the driver by the "feeling" imparted (such as a vibration) through the steering wheel and pedals.

How and when this multi-modal information is presented to the driver depends not only on the driving conditions but also on driver state (e.g., drowsy, distracted), as well as sensor and system uncertainties. Over the next three years Nissan and the University of Minnesota will work together closely to determine how it may be possible to better support drivers in driving safely and comfortably.

The multidisciplinary research project with Nissan, which began in April 2002, involves a consortium of universities in the United States, Canada, Japan, and Europe.

At the project's conclusion, researchers plan to have developed prototype driver support systems for driving simulators and test vehicles and will have evaluated the potential benefits of these systems.

transportation infrastructure

Assessing distortional fatigue in steel bridge girders

Steel bridges with multiple girders are a commonly used structural system for highways in the United States and throughout the world. These bridges have functioned well in the past and are an efficient structure for spans common within our nation's infrastructure. However, displacement-induced fatigue cracking has developed in many types of steel bridges, particularly those designed prior to 1985, when the practice of welding tension flanges in girders to web stiffeners was discouraged. The pre-1985 designs resulted in prevalent incidents of fatigue-prone areas on bridges. Fatigue cracking often occurring in composite bridges with unstiffened girder web gaps is considered the most significant source of fatigue damage in U.S. steel bridges.

While past research has focused on understanding the extent of distortional stress problems on bridges with unstiffened web girders and assessing how effective retrofit solutions are in alleviating the problems, none has offered any guidelines for identifying and assessing which structures are in jeopardy of developing web cracks and which are not. The need for a reliable method to assess distortional fatigue-susceptible bridges prompted Mn/DOT to fund a project, led by civil engineering associate professor Arturo Schultz, in which researchers sought to better understand bridge-girder deflection behavior and to advance the ability to estimate web-gap distortional stress.

Researchers developed full-scale, three-dimensional, finite-element models for analysis to accurately predict bridge-girder deflection behavior. A parametric study was conducted to determine the bridge characteristics that significantly impact girder deflection and therefore also have strong influence on stress and distortion-induced fatigue. The models included all possible combinations of parameters thought to have significant effect on differen-

tial deflection. Other parameters believed to have less influence on bridge deflection behavior were investigated in secondary modeling studies.

The results of this research provide engineers with a clearer picture of bridge diaphragm deflection behavior and enable them to better estimate web gap distortional stress and assess distortional fatigue. By analyzing the results of the parametric studies, Schultz and his team generated simple formulas for estimating differential vertical deflection and characterizing web-gap geometry. These formulas, along with the web-gap stress formula developed in a previous study, provide a simpler method by which bridge girder differential deflection and distortional stress may be assessed in steel bridges, eliminating the need for complex modeling and analysis. Results from the parametric studies have led to general observations that assist engineers in identifying fatigue-prone bridges. In addition, proposed procedures, resulting from this study, for evaluating out-of-plane stress should also aid in screening, identifying, and assessing bridges vulnerable to distortion-induced fatigue cracking.

The entire research report is available online at: www.lrrb.gen.mn.us/PDF/200206.pdf.

Researchers developed full-scale, three-dimensional, finite-element models for analysis to accurately predict bridge-girder deflection behavior.



Recycled asphalt pavement mixtures

During the oil embargo of the mid-1970s, increased demand for hot-mix asphalt (HMA) recycling was driven by rising asphalt costs and scarcity of quality aggregates near the points of use. Since then, tens of millions of tons of recycled asphalt pavement (RAP) have been used with similar performance characteristics to and substantial cost savings over virgin HMA mixes. Today, an estimated 33 percent of all asphalt concrete pavement is recycled into HMA.

In 1992, the Strategic Highway Research Program introduced the Superpave (Superior Performing Asphalt Pavements) mixture design

procedure, which enables pavement designers to tailor asphalt mixes to specific traffic loads and climates, creating better-performing, longer-lasting pavement. The problem, however, is that Superpave was developed for virgin asphalt-aggregate mixtures with no consideration for recycled mixtures. Thus, civil engineering professor Andrew Drescher and research assistants Michael S. Sontag and Bruce A. Chadbourn set out to develop a modified methodology that incorporates RAP materials into the Superpave system.

The researchers performed moisture sensitivity, resilient modulus, and complex modulus testing on asphalt samples subject to indirect tension. The resilient modulus test provides a measure of the elastic properties of the mixture, and allows for comparison with testing performed by other researchers. From the complex modulus test, on the other hand, not only the elastic but also the viscous properties can be determined using software developed at the University of Minnesota.

Moisture-sensitivity tests were conducted to determine how durable or susceptible to moisture-related problems the mixtures were. In tests, researchers compared mixtures made with only virgin materials to those made with varying amounts of RAP. Based on resilient modulus and complex modulus test results, the team determined the correct amount of RAP contents and respective asphalt binders (the “glue” that holds the mix together) to create a stiffness similar to a virgin asphalt concrete mixture. A recycled mixture was considered acceptable when its properties were similar to those of a mixture composed entirely of virgin material.

In the future, additional testing is recommended to verify these mixtures will have adequate performance in the field. Additionally, the low temperature cracking potential of these mixtures should be evaluated prior to use.

The entire research report is available online at: www.lrrb.gen.mn.us/PDF/200215.pdf.



Researchers compared mixtures made with only virgin materials to those made with varying amounts of RAP, or recycled asphalt pavement.

Mn/ROAD update

Located 40 miles northwest of Minneapolis/St. Paul, the Minnesota Road Research Project, or Mn/ROAD, is the world's largest and most comprehensive outdoor pavement laboratory, distinctive for its electronic sensor network embedded within six miles of test pavements.

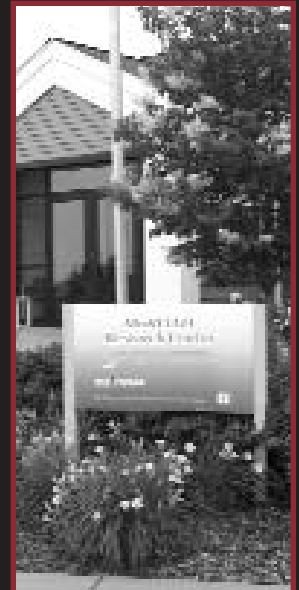
In February 2002, Mn/ROAD staff and other researchers presented their research discoveries at the Second Annual Mn/ROAD Workshop. Mn/ROAD staff also added a number of new research tools—developed in part by University researchers—to the program's Web site. Visitors can download the following:

- PaveCool—an asphalt pavement cooling tool—and the PaveCool final report (PDF)

- MultiCool, a multi-layer asphalt pavement cooling tool
- MnPAVE, a mechanistic-empirical thickness design procedure
- A seal-coat design program and seal-coat design manual

The Mn/ROAD project, which began in 1994, was designed and constructed by Mn/DOT with support from the University, the FHWA, the Minnesota Local Road Research Board, and the U.S. Army Corps of Engineers/Cold Regions Research Engineering Lab.

More information about Mn/ROAD may be found online at: mnroad.dot.state.mn.us.



MAST facility groundbreaking

University of Minnesota president Mark Yudof and several regents, deans, and faculty broke ground February 28, 2002, for the new facility to house the Multi-Axial Sub-assembly Testing (MAST) system, which will test structures for their ability to withstand earthquakes, explosions, high winds, and other stresses.

The MAST system was funded by the National Science Foundation in February

2002 through a \$6.5 million grant awarded to the Department of Civil Engineering. Civil engineering professor Catherine French, who has conducted bridge research through the CTS research program, was the leader of the team that submitted the proposal to the NSF.

The facility's research is expected to benefit transportation bridge research. The facility is scheduled to be operational in 2004.



transportation and the environment

Personal safety and transit

Personal safety is an important issue in an effective transit system because the real safety of transit users and their perception of their safety are often crucial factors in whether or not people use transit. While much attention is paid to the safe design and operation of the transit vehicle, personal safety considerations do not stop there. Typically, decisions to ride transit are based on how safe a person feels when walking to the stop, waiting at the stop, and walking to his/her destination after leaving the transit vehicle.

Thus, as the Twin Cities metropolitan area looks to improve transit choices and to improve existing transit service, the safety of transit users must be considered carefully. To aid this effort, University of Minnesota landscape architecture researcher Mary Vogel, along with James L. Pettinari of the University of Oregon, studied the design of a variety of transit environments from a personal safety standpoint and used their findings to create guidelines that will help shape transit decisions in the Twin Cities metropolitan area and throughout Greater Minnesota.

The team examined physical transit stop and station design issues, focusing on transit stop environments, the pathways that lead to and from the stop, and the pathway environments. They also took into account personal safety issues for riders who come to the stop via foot, bicycle, car, or in another transit vehicle. Traditional bus, light-rail, park and ride facilities, and other transit modes applicable to the Twin Cities metropolitan area were all part of the study which included transit stops in the central city, post-World War II suburbs, and “New Urbanism” suburbs—the types of communities found in the metro area.

Prior to this project, Vogel’s research into design strategies that could promote personal safety, in collaboration with the Saint Paul Planning and Economic Development Department, led to the publication of the handbook, *Design for Saint Paul Public Safety: A Guide for Making a Safer Public Realm*. The principles outlined in it are now regularly incorporated in Saint Paul’s major developments, and the handbook is used by many other cities as well.



Vogel and Pettinari also used these design principles to create their transit-based personal safety guidelines. “People make decisions on what to do and where to go based on personal safety issues,” Vogel explains. For example, if someone does not feel safe waiting for a bus, they might drive instead. “Good urban design promotes personal safety and bad design doesn’t,” she adds.

In their report, the pair evaluated existing transit environments and offered suggestions for developing new ones. The first chapter of their guidebook presents personal safety principles, which are then demonstrated throughout the rest of the report. Photographs of actual environments and design drawings of hypothetical or proposed environments illustrate how these principles can be applied or they can point out things that do not work to support personal safety.

The entire research report is available online at: www.cts.umn.edu/pdf/CTS-02-05-1.pdf.

Fine-particle emissions on Minnesota highways

Engine and exhaust aftertreatment manufacturers have made great progress reducing harmful vehicle emissions, but it seems much smaller and potentially harmful “nanoparticles” remain beyond the reach of current technology. In fact, the highly volatile, sub-micron-sized particles could well be an unintended byproduct of the very systems developed to improve fuel economy and reduce emissions.

To provide real-world data for developing engine laboratory test methods to study this problem, University of Minnesota researcher David Kittel-

Typically, decisions to ride transit are based on how safe a person feels when walking to the stop, waiting at the stop, and walking to his/her destination after leaving the transit vehicle.

son, director of the University's Center for Diesel Research, examined the physical characteristics of combustion aerosols found on Minnesota highways. Using a mobile aerosol lab, Professor Kittelson and his research team focused on quantifying and characterizing ultrafine and nanoparticles on Minnesota roadways under a variety of traffic conditions. The particles, much smaller in mass and much greater in number than those addressed by current emissions standards, raise potential health concerns because they remain unregulated and, when inhaled, may be deposited in deep-lung tissue.

Because the tiny particles may be relatively insoluble, health experts suggest they may play a part in causing asthma, heart attacks, and cardiovascular disease or increased hospital admissions for other reasons. What's more, ultrafine and nanoparticles can be tough to measure in the laboratory because they're formed predominantly as the exhaust dilutes and cools as it mixes with ambient air. This process is very sensitive to environmental conditions and is therefore difficult to simulate in the laboratory. As the aerosol moves away from the highway, the concentration of nanoparticles decreases because of dilution and the transient nature of nanoparticles.

To date, University researchers have gathered data about nanoparticles during the course of several research projects, funded by a variety of sponsors including the U.S. Department of Energy. An interdisciplinary research team assembled for these projects has included members with diverse backgrounds in mechanical engineering, aerosol physics, air pollution, and environmental health.

Building on previous research, Kittelson was awarded a Mn/DOT research contract through CTS in 1999 to examine the physical characteristics of combustion aerosols on Minnesota highways. The research team collected aerosol data along Minnesota roadways and regulated on/off ramps to characterize particulate-matter emissions.

The most surprising result of the research is the discovery that concentrations of nanoparticles are inversely related to road congestion—high-speed, free-flowing traffic produces higher concentrations, and diesel traffic further increased the concentrations. The material that leads to nanoparticle formation, heavy hydrocarbons and sulfuric acid, appears to be stored in the tailpipe as vehicles move slowly under congested conditions. When the vehicles are operating at highway speed in uncongested conditions, the exhaust system heats up and these materials cook out, leading to the formation of large numbers of nanoparticles.

Kittelson notes that the highest concentrations of nanoparticle emissions are likely to be along higher-speed roadways and freeway ramps. Consequently, areas close to an interstate highway, or other high-speed roadways where nanoparticles are constantly generated, create "hotspots." Commuters and professional drivers who spend a lot of time on those busy highways are most at-risk. Larger airports where jet engines are in use may be another hotspot.

A report, published in 2001, summarizing nanoparticle research conducted for Mn/DOT through CTS, is available online at: www.lrrb.gen.mn.us/PDF/200112.pdf.

Using a mobile aerosol lab, Professor Kittelson and his research team focused on quantifying and characterizing ultrafine and nanoparticles on Minnesota roadways under a variety of traffic conditions.



University researchers study engine emissions using a mobile aerosol lab.

Research reports published in FY02

Economy research reports

Adams, J.S, et al. *House Price Changes and Capital Shifts in Real Estate Values in Twin Cities-Area Housing Submarkets*. CTS 02-01. Transportation and Regional Growth Report #7.

Barnes, G. and Davis, G. *Land Use and Travel Choices in the Twin Cities, 1958-1990*. CTS 01-01. Transportation and Regional Growth Report #6.

Barnes, G. *Population and Employment Density and Travel Behavior in Large U.S. Cities*. Mn/DOT 2001-24.

Fruin, J. and Tiffany, D. *Filling the Livestock Feed Troughs of Minnesota and Beyond*. Mn/DOT 2002-13.

Fruin, J. and Tiffany, D. *Where Does Minnesota's Grain Crop Go?* Mn/DOT 2002-12.

Ryan, B. and Stinson, T.F. *Road Finance Alternatives: An Analysis of Metro-area Road Taxes*. CTS 02-04. Transportation and Regional Growth Report #9.

Smith, L.J. et al. *Highway Improvements and Land Development Patterns in the Greater Twin Cities Area, 1970-1997: Measuring the Connections*. CTS 02-03. Transportation and Regional Growth Report #8.

Infrastructure research reports

Drescher, A. and Chadbourn, B. *Investigation of Recycled Asphalt Pavement (RAP) Mixtures*. Mn/DOT 2002-15.

Hajjar, J. *Live Load Stresses In Steel Curved Girder Bridges*. Mn/DOT 2002-08.

Larson, T. *INV 709: Evaluation of Retrofit Procedures for Nail-Laminated & Stringer Bridges*. Mn/DOT 2002-28.

Newcomb, D., Chadbourn, B., and Hanson, M. *Superpave Level One Mix Design At The Local Government Level*. Mn/DOT 2002-19.

Schultz, A. *Analysis Tools and Rapid Screening Data for Distortional Fatigue in Steel Bridge Girders*. Mn/DOT 2002-06.

Skok, E. *Best Practices for the Design and Construction of Low Volume Road*. Mn/DOT 2002-17.

Snyder, M., Schultz, A., Embacher, R. *Condition and Durability of Segmental Concrete Block Retaining Walls Along Roadways in Minnesota*. Mn/DOT 2001-16.

Environment research reports

Mulholland, S. and Rapp, G. *Site/Environmental Correlations in Northeastern Minnesota*. Mn/DOT 2002-10.

Vogel, M. and Neckar, L. *The Snelling Corridor and its Districts: Developing and Enhancing A Transit-Oriented Lattice Connective Structure*. CTS 01-04.

Vogel, M. and Pettinari, J.L. *Personal Safety and Transit: Paths, Environments, Stops, and Stations*. CTS 02-05.

Safety and traffic flow research reports

Cherkassky, V. *Wireless Transmission of Image and Video Data*. Mn/DOT 2002-24.

Corkle, J. *Investigating the Effectiveness of Traffic Calming Strategies On Driver Behavior, Traffic Flow and Speed*. Mn/DOT 2002-02.

Davis, G. *Development and Testing of a Vehicle/ Pedestrian Collision Model for Neighborhood Traffic Control*. Mn/DOT 2002-23.

Harder, K. *Investigating the Effects of Traffic Calming Strategies on Driver Behavior*. Mn/DOT 2002-20.

Kwon, E. *Capacity Analysis for Dynamic Bottlenecks and Alternative Concepts for Coordinated Ramp Metering Operations*. Mn/DOT 2002-09.

Naveh, E. and Marcus, A. *A Re-assessment of Road Accident Data Analysis Policy*. CTS 02-02.

Papanikolopoulos, N. *Pedestrian Control Issues at Busy Intersections and Monitoring Large Crowds*. Mn/DOT 2002-29.

Papanikolopoulos, N., Masoud, O. and Rogers, S. *Monitoring Weaving Sections*. CTS 01-06.

Papanikolopoulos, N., and Veeraraghavan, H. *Detecting Driver Fatigue Through the Use of Advanced Face Monitoring Techniques*. CTS 01-05.

Wade, M. *Forward Looking Blindspots: A report of A-Pillar induced field-of-view obstruction and driver performance in a simulated rural environment*. Mn/DOT 2002-16.

Wade, M. and Smith, T. *Investigating The Effect On Driver Performance Of Advanced Warning Flashers At Signalized Intersections*. Mn/DOT 2002-05.

To foster additional faculty participation with CTS, Center staff held a session in early 2002 with 17 faculty representing nine departments. Topics included CTS performance measures and structure, overhead recovery, funding opportunities, proposal and reporting requirements, and working with Mn/DOT.



education





education highlights

- *CTS is collaborating with the Department of Civil Engineering to establish a new endowed faculty chair in transportation engineering. THE RICHARD P. BRAUN CTS CHAIR is named in honor of Dick Braun, the Center's founding director.*
- *In cooperation with Mn/DOT, CTS developed a new two-and-a-half day certification workshop, "Mn/DOT CONSULTANT SERVICES CONTRACT ADMINISTRATOR CERTIFICATION TRAINING."*
- *Cheri Marti, director of Minnesota LTAP, joined leaders from transportation agencies, academia, industry, labor unions, professional associations, and consulting firms at the NATIONAL TRANSPORTATION WORKFORCE SUMMIT, a first-ever national meeting held in May 2002 in Washington, D.C., to address workforce development issues.*
- *CTS welcomed the first group of students to its NEW GRADUATE-LEVEL CERTIFICATE PROGRAM IN TRANSPORTATION STUDIES during fall semester 2001.*
- *CTS hosted FACULTY SEMINARS presenting the latest findings of University researchers about a variety of topics, from road drainage systems and erosion control to land use and planning. The ITS Institute sponsored a for-credit series of SEMINARS ON ADVANCED TRANSPORTATION TECHNOLOGIES, which took place on the Twin Cities campus and were simultaneously broadcast to the University of Minnesota Duluth campus.*
- *Minnesota LTAP developed and delivered a new one-day workshop on CONTEXT-SENSITIVE DESIGN FOR LOCAL GOVERNMENT, based on a three-day context-sensitive design workshop previously developed for Mn/DOT project managers.*

degree and course development

Richard P. Braun CTS Chair

CTS is collaborating with the Institute of Technology's Department of Civil Engineering to establish a new endowed faculty chair in transportation engineering. The Richard P. Braun CTS Chair is named in honor of Dick Braun, the Center's founding director and a visionary industry leader in transportation engineering throughout his career.



Richard P. Braun

Royalties from Autoscope™—an invention in traffic detection technology developed by CE professor Panos Michalopoulos, sponsored by CTS and the Minnesota Department of Transportation, and patented by the University—will support the endowment. A fundraising committee is seeking to raise \$500,000 that will create the equivalent of a \$1.5 million permanent endowment fund to support the chair in perpetuity.

The Braun CTS Chair is a leadership position that will build on the legacy started by the late Professor Matthew Huber and foster innovation in the transportation engineering academic program. Under the new chair's leadership, the Richard P. Braun Transportation Engineering Program will be expanded to include a combination of new courses in transportation and traffic planning, design, and engineering and a series of seminars or workshops for government and private sector transportation engineers.

Graduate Certificate Program in Transportation Studies

CTS began offering the new Graduate Certificate Program in Transportation Studies beginning fall semester 2001. CTS and the University of Minnesota Graduate School created the program for professionals in transportation-related fields as well as for students seeking a master's degree in a related discipline. By completing the flexible program requirements, participants will acquire advanced

knowledge of the complex issues in transportation and gain a significant professional credential.

The certificate program is built around a set of core graduate-level courses in civil engineering and public affairs. Participants are required to complete two of these courses (six-credit minimum), as well as a seminar in transportation technology. Participants must select nine additional credits (minimum) from a broad range of courses offered in numerous academic departments.

Several students were accepted into the program and began classes in fall semester 2001. Praveena Pidaparathi, who earned her master's at the University in urban and regional planning, became the first to complete the program and earn her certificate.



Praveena Pidaparathi

Pidaparathi, who transferred from Kansas State University specifically for the chance to specialize in transportation issues, began the CTS certificate program in fall 2001 while working as a research assistant with the Humphrey Institute to study the effects of telecommuting on travel behavior.



Current and prospective University graduate students interested in the program can join faculty and CTS staff at information sessions hosted by CTS each fall and spring. The latest news or application materials and additional information about the Graduate Certificate Program may be found online at: www.cts.umn.edu/certificate.

The Braun CTS Chair is a leadership position that will build on the legacy started by the late Professor Matthew Huber and foster innovation in the transportation engineering academic program.



Vaughn R. Voller

CTS Faculty Seminars

CTS holds hour-long faculty seminars to allow researchers from a variety of disciplines to share their findings.

Fall-semester presentations

"Characteristics of Erosion Control Measures and their Impact on Erosion," Bruce Wilson, Biosystems and Agricultural Engineering

"The Feasibility of a Shipper Panel to Measure Transportation Services," Fred Beier, Marketing and Logistics Management, Carlson School of Management

Spring-semester presentations

"Modeling Drainage in Layered Systems," Vaughn R. Voller, Civil Engineering

"Nanoparticles and Engines: Current Issues," David Kittelson, Mechanical Engineering

"Minnesota's Road Network: Characteristics of Ownership, Use, and Spending Services," Barry Ryan, Applied Economics

Advanced transportation technologies seminars

During the 2001–2002 academic year, the ITS Institute continued its multidisciplinary seminar series. 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.

New this year, the seminar series was offered for credit and required as a course in the Graduate Certificate Program in Transportation Studies at the University of Minnesota.

Fall-semester presentations
"Orientation and Navigation in Elderly Drivers," Herb Pick and Selma de Ridder, College of Education and Human Development

"The Effect of Intelligent Cruise Control Vehicles in Mixed Traffic on the Environment and Traffic Flow Characteristics," Petros Ioannou, Department of Electrical Engineering Systems, University of Southern California

"Simpson's Paradox, Measurement Error, and Ecological Fallacies in the Speed Versus Safety Debate," Gary Davis, Civil Engineering

"Effects of Advance Warning Flashers at Signalized Intersections on Simulated Driving Performance," Tom Smith, Kinesiology

"Networks and Places: New Hierarchies in Access and Activities," Lee Munnich, Tom Horan, and Ken Keller, Humphrey Institute, and David Levinson, Civil Engineering

"The Use of Range Sensors in ITS Applications," Alec Gorjestani, Mechanical Engineering

"Can Advances in Vehicle Technologies Provide Solutions to Highway Congestion?" Rajesh Rajamani, Mechanical Engineering

Spring-semester presentations

"A Unified Approach to Spatial Outliers with Application to Traffic Data Analysis," Shashi Shekhar, Computer Science and Engineering

"Advanced Traffic Signal Control and Prioritization," Thomas Urbanik II, University of Tennessee–Knoxville, Civil and Environmental Engineering

"Vehicle-Based Student Competitions at the U of M: History and Educational Impact," Patrick Starr, Mechanical Engineering

"Comparing Dualmode Transportation Systems with Other Proposed and Existing Systems," Francis D. Reynolds, Dualmode Transportation Inventor and private consultant

"ITS Laboratory: Building for the Future," Ted Morris, Center for Transportation Studies

"Traffic Flow Study of the Miller Hill Corridor," Jiann-Shiou Yang, Electrical and Computer Engineering, University of Minnesota Duluth

"Behavior Variability is More Than Just Noise: The Meaning of Behavioral Entropy," Erwin R. Boer, Erwin R. Boer Consulting

Advanced transportation technologies seminars included a diverse set of presentations by local and national researchers addressing different areas of ITS research.



Thomas Urbanik II



Barry Ryan

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

continuing education

LTAP

Housed within CTS, the Minnesota LTAP Program is part of a network of 57 centers nationwide funded by the Federal Highway Administration's Local Technical Assistance Program, better known as LTAP. Funds for Minnesota LTAP are also provided by the Minnesota Local Road Research Board and Mn/DOT.

Minnesota LTAP offers a statewide workshop program, and partners with other organizations to cosponsor events. LTAP offered the following workshops in FY2002:

- Bridge Maintenance
- Gravel Road Maintenance
- Context-Sensitive Design Workshop for Local Governments
- Roadside Vegetation Management
- Asphalt Pavement Maintenance and Preservation
- Motor Grader Operator Training
- Planning and Designing Roads for Older Driver Safety
- Hydraulic Design for Culverts and Storm Sewers

LTAP cosponsored the following events:

- Seventh Annual Transportation Career Expo
- Sixth Annual Minnesota Pavement Conference
- Spring and Fall State Maintenance Expos
- Work Zone Traffic Control and Road Marking workshop
- Traffic Engineering Fundamentals workshop

Minnesota LTAP coordinated a three-day workshop on the topic of context-sensitive design. The primary audience for this training was Mn/DOT project managers and representatives from key stakeholder audiences, such as the Minnesota DNR and the state's Historic Preservation Office. In conjunction with this effort, LTAP produced and distributed 800 copies of a CD-ROM containing the participant manual.

Minnesota LTAP also developed and delivered a new workshop on bridge maintenance, offered at three sites across the state, and a new one-day

workshop on context-sensitive design for local government, offered at four sites. Both will become part of the Minnesota LTAP education program.

More information about Minnesota LTAP is available online at: www.cts.umn.edu/T2.

State maintenance expos

Minnesota LTAP partners with Mn/DOT, 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. These events allow transportation professionals, especially those in the maintenance area, to exchange ideas and information; learn about new technologies, practices, and materials; and improve communications within the workplace. Also included are half-day outdoor equipment demonstrations and indoor equipment displays of exhibitors' technology.

Expo attendance has been increasing each year. The fall 2001 expo, held September 26-27 in St. Cloud, attracted more than 1,600 registrants from state, county, city, and township governments. It included a session that showcased automated anti-icing bridge systems, which have been deployed in six locations in the state. The spring 2002 expo drew 1,200 attendees April 24-25, also in St. Cloud.



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.



Kathleen Schaefer

Kathleen Schaefer, formerly a supervisor with Mn/DOT, became the new CTAP instructor in March 2002. In her new role, Schaefer made statewide tours focused on two main topics: snow and ice control, and asphalt pavement maintenance.

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

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

Over the last year, AirTAP sponsored both fall and spring training workshops, and published highlights for statewide distribution. In December 2001, the program offered training sessions on airport snow and ice control. About 70 participants representing airports from throughout the state attended these sessions in Minneapolis, Brainerd, and Duluth.

Airport lighting was the topic of AirTAP training held in May 2002 in Grand Rapids, Fergus Falls, and Mankato. These sessions provided information on airport lighting and navigational aid equipment selection, funding, maintenance, and operation.

In addition, AirTAP personnel staffed an information booth at the MCOA annual symposium in April 2002, while Cheri Marti, AirTAP program director, presented an update of AirTAP activities and demonstrated the program's newly created Web site (www.airtap.umn.edu).



Minnesota AirTAP staff and steering committee members tour the Park Rapids Airport.

The program also began publication of *Briefings*, a quarterly one-page insert for the MCOA newsletter, and continued to publish highlights of its workshops and training sessions. Electronic versions of all AirTAP publications may be downloaded from the new Web site, along with other useful information, materials, and resources.

Workforce summit produces partnership

Minnesota LTAP director Cheri Marti joined leaders from transportation agencies, academia, industry, labor unions, professional associations, and consulting firms at the first-ever National Transportation Workforce Summit, facilitated by FHWA in May 2002 in Washington, D.C.

The summit emphasized the need to make a sustained and proactive commitment to ensure that young people as well as mid-career individuals are attracted to and choose transportation careers. In Minnesota and across the nation, the transportation industry is finding it increasingly difficult to attract and retain a qualified and well-trained workforce.

Summit participants signed a partnership charter committing their support to an effort that will improve workforce development through new initiatives in the academic and transportation communities. In addition, a steering committee of partner organizations is being formed to further address the national workforce needs identified at the summit.

More information on the National Workforce Summit and other workforce activities can be found online at: www.cts.umn.edu/libraries.

The National Transportation Workforce Summit emphasized the need to ensure that young people as well as mid-career individuals are attracted to and choose transportation careers.



Cheri Marti, Minnesota LTAP director and CTS assistant director

Over the past year, Minnesota has had the opportunity to share its state and local transportation practices with delegates from Siberia.

Minnesota-Sibera transportation partnership update

Minnesota has a sister-state relationship with selected Russian oblasts (states) to assist them in advancing free-market reforms in the highway sector and to improve their highway networks. Over the past year, Minnesota has had the opportunity to share its state and local transportation practices with delegates from Siberia.

In August 2001, Siberian officials spent time with Mn/DOT and Wright County learning about maintenance management systems, maintenance and equipment operations, and state and local highway financing. Minnesota LTAP provided information on the development and operation of a technology transfer center, the Mn/DOT-LTAP partnership, and the training and development of key technical experts.

tion from the Kemerovo and Tomsk Highway Administrations toured Minnesota following a visit with the FHWA in Washington, D.C. They signed a memorandum of understanding with Mn/DOT to strengthen international transportation knowledge and technology transfer to promote efficient, safe, and environmentally sound transportation systems in Kemerovo, in Tomsk, and in Minnesota.

In addition, CTS provided information on its overall structure, the Center's research and technology transfer/LTAP programs, and the relationship among the Center, University faculty, and Mn/DOT. University pavement and structures faculty from the Department of Civil Engineering provided an overview of their research programs and also gave a tour of their respective research labs.

In December 2001, a second Siberian delega-



CTS conducts certification training for Mn/DOT consultant services

Mn/DOT is streamlining the acquisition and use of consultant expertise for delivering Mn/DOT's transportation program. The Mn/DOT Consultant Services Reform Steering Committee—including Pat Hughes, Dave Ekern, Del Gerdes, Janet Blacik, and Joe Pignato of Mn/DOT; Doug Differt, Dale Grove, and Glen Schreiner representing the Consulting Engineers Council of Minnesota; and Bob Johns and Cheri Marti of CTS—provided the overall direction to the initiatives.

In cooperation with Mn/DOT, CTS developed a new two-and-a-half day certification workshop, "Mn/DOT Consultant Services Contract Administrator Certification Training." The certification training offered a two-hour management overview, two days of participative exercises to provide participants first-hand experience with key elements of the contract administration process, and a comprehensive reference manual.

The certification workshop resulted from an innovative public-private workshop, hosted by CTS in October 2000, aimed at discovering new roles for Mn/DOT and the transportation consulting community to expedite the consultant contracting process.



A pilot kick-off session was held December 2001, followed by eight additional training sessions that concluded in May 2002 and reached a total of 320 participants. Mn/DOT Consultant Services, with assistance from Mn/DOT Contract Management, will continue to provide training on an ongoing basis.

Context-sensitive design workshop for local governments

Minnesota LTAP introduced "Context Sensitive Design (CSD) for Local Units of Government," a one-day workshop to help local transportation managers. During the workshops, funded in part by Mn/DOT's State Aid for Local Transportation Group, participants had an opportunity to apply CSD principles by doing a "working case study" using a real-life project.

CSD integrates projects into their physical context, environmental setting, or cultural community through careful planning, consideration of different perspectives, and tailoring of designs to particular project circumstances. CSD uses a collaborative, interdisciplinary approach, including early involvement of key stakeholders and an early identification of critical issues, to contribute to more efficient program delivery.

Training in context sensitive design began in 1998 when the Federal Highway Administration and the American Association of State Highway and Transportation Officials cosponsored a national workshop called "Thinking Beyond the Pavement." Following that workshop, FHWA selected Minnesota as one of five states to pilot education and outreach related to CSD. CTS,

with assistance from ZAN Associates and SRF Consulting Group, Inc., prepared and hosted four three-day CSD workshops for Mn/DOT project managers. The one-day workshop on CSD for local units of government was based on materials prepared for the three-day Mn/DOT workshop.

"Context Sensitive Design for Local Units of Government" workshops, held in Detroit Lakes, Rochester, Duluth, and St. Paul, were targeted toward city and county engineers and other professionals involved in transportation project development at the local level. The workshops, taught by Charleen Zimmer, Zan Associates, with assistance from Mn/DOT's Scott Bradley, drew 91 attendees, including four from Winnipeg.

Additional information about CSD may be found online at: www.cts.umn.edu/education/csd.



CSD uses a collaborative, interdisciplinary approach, including early involvement of key stakeholders and an early identification of critical issues, to contribute to more efficient program delivery.

student programs

The expo was “simply the best networking forum I have ever attended.”

—John Luis, a visiting MIT student



Transportation career expo

In March 2002, CTS sponsored the Seventh Annual Transportation Career Expo in Minneapolis. College students from as far away as Holland and Massachusetts received an opportunity to gather career advice, hone job-hunting skills, and network with a wide variety of transportation professionals. The 75 student attendees represented not just the University of Minnesota Twin Cities and Duluth campuses, but also Metropolitan State, North Dakota State, St. Cloud State, St. Paul Technical College, the Technical University of Holland, and the Massachusetts Institute of Technology.

A general session on career preparation featured panelists Howard Preston of Howard R. Green, Don Theisen of Washington County, and Theresa Johnson of Mn/DOT. Four concurrent sessions followed on transportation careers in engineering, transportation planning and policy, intelligent transportation systems, and transportation logistics.

Twenty exhibitors involved in transportation were also on hand to answer questions. The CTS Education/Outreach Council hosted the event in cooperation with the Women’s Transportation Seminar, the Minnesota Local Road Research Board, and the ITS Institute.

CE orientation highlights transportation careers

CTS assisted civil engineering professor Roger Arndt in preparing a two-hour session in April 2002 for students about possible careers in transportation as part of his “CE 1101: Civil Engineering Orientation” course. The course is designed to introduce first-year students to the various aspects of civil engineering.

The transportation session featured guests with engineering careers in private industry and in government, including Sandy Cullen, transportation manager, Washington County; Loren Hill, state traffic engineer, Mn/DOT; and Jack Broz, project manager, HNTB. The three pre-

sented an overview of the type of transportation-related work they perform, discussed their organization’s particular “niche” in the field of transportation engineering, and told stories about work and other career-related experiences.

More information on transportation-related job openings for students and graduates can be found online at: www.cts.umn.edu/jobs.

National Summer Transportation Institute

For the second year, the ITS Institute partnered with the Fond du Lac Tribal and Community College to host the National Summer Transportation Institute. The program, sponsored by the U.S. Federal Highway Administration, ran from mid-July to mid-August 2001. The summer institute provides career orientation and educational experiences to high school students interested in the various fields of transportation. More than 2,000 secondary school students have completed the national program hosted by 30 colleges and universities in 23 states.

In August 2001, 12 students participated in a field trip to the Twin Cities to learn about ITS-related research and technologies. The students toured the Human Factors Research Lab, where they tested the driving simulator. The trip included a tour of the Mn/DOT Traffic Management Center control room. The group ended their trip at the Holman Field airport beacon in St. Paul’s Mounds Park.



The ITS Institute cohosts the National Summer Transportation Institute for high-school students interested in careers in transportation technology.



SESEM students, immersed in science and engineering for five weeks at the University of Minnesota's Institute of Technology, tour the ITS Lab.

Summer explorations for high school students

In July 2001, 10 high school students toured the Human Factors Research Laboratory, the ITS Laboratory at CTS, and the Mn/DOT Traffic Management Center in Minneapolis as part of the Summer Explorations in Science, Engineering and Mathematics (SESEM).

During a five-week immersion in science and engineering at the University of Minnesota's Institute of Technology, students, ranging from freshmen to seniors, are enrolled in a University

calculus class and also actively learn by participating in workshops and seminars. CTS helped coordinate a transportation week that included a tour of the Anoka County Airport, surveying instruction, and a tour of a consulting firm, where the students learned about project development.

The tour of the CTS and Mn/DOT labs gave the students a chance to learn about traffic management and modeling, ramp-metering algorithms, and other CTS research projects. They also participated in demonstrations of the Human Factors Research Lab driving simulator.

A tour of the CTS and Mn/DOT labs gave students a chance to learn about traffic management and modeling, ramp-metering algorithms, and other CTS research projects.

K-12 initiatives/ramp-meter module

In an effort to reach high school students and their teachers, the Institute's K-12 coordinator, Mark Tollefson, developed a strategic plan that outlines more than a dozen potential activities for the Institute to initiate over the next several years, time and funding permitting. As phase one of this plan, Tollefson has developed and tested a research Web module on the topic of ramp metering aimed at high school math and science students. The research module was used by several classrooms in late spring, and students reported that it was a "fun way to learn about ramp metering." Tollefson is currently working on a "Web quest" geared toward middle school students on the topic of

Global Positioning Systems (GPS) and mapping.

By reaching students early with engaging, hands-on activities, the Institute hopes to spark an interest that may potentially lead students to a career in transportation. Many of the products developed under this effort will also be used by parents and others in the general public, thereby increasing the knowledge base concerning transportation issues and ITS solutions.

Tollefson plans and coordinates ITS Institute outreach efforts to K-12 students. Tollefson is the science department coordinator, advanced placement physics teacher, and accelerated chemistry teacher with Eastview High

School in Apple Valley, Minn. He works part-time for the Institute to help develop outreach ideas and activities for teachers, students, and parents.

The ITS Institute promoted careers in intelligent transportation systems to K-12 students by creating a poster for classrooms and an interactive CD-ROM featuring ramp-metering research problems.



Top: CTS director Robert Johns (left) with Mazen O. Hasna and Mohamed-Slim Alouini



Upper middle: Johns with Praveena Pidaparathi and Frank Douma



Lower middle: Julie Cidell (left), Erin Mitchell, and Eve Skoog.



Bottom: Ben Chihak (second from left) and USDOT administrators Mary Peters, Jennifer Dorn, and Ellen Engleman



CTS awards, scholarships, and employment

CTS presented the Matthew J. Huber Award for Excellence in Transportation Research and Education to two students: Mazen O. Hasna, a doctoral student in electrical engineering, advised by Assistant Professor Mohamed-Slim Alouini; and Praveena Pidaparathi, a graduate student in urban and regional planning at the Humphrey Institute, advised by Assistant Professor Kevin Krizek. CTS presents the award to graduate students each year in April 2002 at the CTS annual meeting and awards ceremony. The award is named in honor of the late Professor Matthew J. Huber, in recognition of his contribution to the teaching and study of transportation at the University of Minnesota.

University of Minnesota students Julie Cidell, a doctoral student in geography advised by Professor John Adams, and Eve Skoog, an undergraduate student in aerospace engineering and mechanics, were the 2002 scholarship recipients from the Minnesota Chapter of the Women's Transportation Seminar. Erin Mitchell, chapter scholarship director, presented the awards at the chapter's awards luncheon in April.

Benjamin Chihak, a graduate research assistant in the ITS Institute's HumanFIRST Program, received the Institute's Outstanding Student of the Year Award for 2001 at the Transportation Research Board's 81st Annual Meeting in Washington, D.C. in January 2002. Chihak's contributions to the HumanFIRST Program include the analysis of data to explore various passing lane configurations and the design and implementation of a custom audio system for a new driving simulator.

CTS continued to offer graduate assistantships and undergraduate scholarships to help increase the number of transportation students, and provided expense reimbursement scholarships for student attendance at the annual TRB and ITS America conferences. CTS also continued to help match University of Minnesota students with possible job opportunities in transportation-related organizations through its newsletter and Web site. And the Center's student interns assisted in the research, education, and outreach areas, as well as provided office support.





outreach





outreach highlights

- *Congressman James L. Oberstar was honored in April 2002 at a transportation forum named after him and hosted by CTS. At the inaugural OBERSTAR FORUM ON TRANSPORTATION POLICY AND TECHNOLOGY, regional and national transportation officials, policymakers, and professionals discussed the impact of the September 11 tragedy on transportation.*
- *CTS EXPANDED ITS USE OF ELECTRONIC COMMUNICATIONS—with more frequent use of e-mail announcements, CD-ROMs, and its first electronic newsletter Transit Research E-News—and continued to add new features and resources to its extensive Web site (www.cts.umn.edu).*
- *In November 2001, CTS HOSTED AND FACILITATED A STREAMLINING WORKSHOP for Mn/DOT and other state and federal agency staff to solicit broad stakeholder input on proposals to streamline projects during the design process, right-of-way process, and environmental impact process.*
- *CTS cosponsored "GETTING THERE," A DAY-LONG TRANSPORTATION FORUM held in April 2002 at the Hubert H. Humphrey Institute of Public Affairs, with MPR, the Minnesota History Center, and the Humphrey Institute's State and Local Policy Program. The goal of the summit was to build ideas for a better, smarter transportation system in Minnesota.*
- *In October 2001, CTS hosted the "CONFERENCE ON COMMUNITY-BASED TRANSPORTATION" for the Greater Twin Cities United Way and other cosponsors. The event brought together participants from local human service agencies, government, private industry, and other groups to discuss improving access for the transportation disadvantaged.*
- *Transportation librarians from the Midwest gathered at CTS in December 2001 to discuss plans for developing a MIDWEST NETWORK OF TRANSPORTATION LIBRARIES. The meeting was held in Minnesota, in part, in recognition of "the Minnesota model" for providing transportation information services.*

CTS events

James L. Oberstar Forum on Transportation Policy and Technology

Congressman James L. Oberstar was honored in April 2002 at a transportation forum named after him and hosted by CTS. At the inaugural forum, titled "How Should Transportation Change After September 11?" regional and national transportation officials, policymakers, and professionals discussed possible responses to the September 11 tragedy.

Rep. Oberstar headlined the event, which featured Secretary of Transportation Norman Mineta. Also participating in invitation-only discussions preceding the public portion of the forum were Minnesota Gov. Jesse Ventura and USDOT administrators Ellen Engleman (Research and Special Programs Administration), Jane Garvey (Federal Aviation Administration), Adm. James Loy (Coast Guard), and Jeffrey Runge (National Highway Traffic Safety Administration). In addition, many other state and national leaders attended. CTS director Robert Johns served as master of ceremonies.

Throughout the forum, Oberstar, a nationally recognized transportation expert and policy leader, reiterated his key priorities for crafting transportation policy in this new century, especially in light of new and pressing concerns raised on and after September 11. Specifically, those priorities focus on harnessing transporta-



University president Mark Yudof and Congressman James Oberstar

tion to improve our quality of life, developing intermodal connections for moving people and goods, expanding the role of technology in transportation, and increasing transportation safety, especially on roadways.

University researchers led off the program of the two-day forum by introducing participants to their research and discussing the long-term impacts of September 11 on transportation. The forum also featured an innovative conversation circle with satellite-style seating to facilitate dialogue and an exchange of ideas about the long-term issues, policy implications, and possible near-term actions in response to the tragedy.

Next, Secretary Mineta, introduced by Oberstar, outlined government measures to secure the nation's transportation system following the terrorist attacks.

Finally, during the portion of the forum open to the public, Oberstar joined a panel of top transportation executives to further discuss the implications of September 11 in their respective modes for Minnesota and the nation.

A report summarizing the main events of the two-day forum on transportation policy and technology is available online at: www.cts.umn.edu/oberstarforum.

(Clockwise, from left) University of Minnesota professors Max Donath, Fred Beier, and John Adams; USDOT secretary Norman Mineta; U of M provost Christine Maziar and UMD chancellor Kathryn Martin; and Minnesota governor Jesse Ventura, Mn/DOT commissioner Elwyn Tinklenberg, and Mark Dysart.



**Bud Wright****Bruce Katz**

2002 Annual Transportation Research Conference

In May 2002, CTS held the Thirteenth Annual Transportation Research Conference in St. Paul. Throughout the event, security concerns since September 11 consistently emerged as a top priority along with congestion and funding reauthorization.

Highlights include:

- A "National Transportation Policy Update" by Frederick "Bud" Wright of the Federal Highway Administration
- A luncheon presentation titled "The New Metropolitan Reality" by Bruce Katz of the Brookings Institution
- A recap of the 2002 Minnesota Legislative session, featuring Rep. Carol Molnau, Sen. Satveer Chaudhary, and finance commissioner Pamela Wheelock
- A half-day workshop with researchers from the Transportation and Regional Growth Study
- Nearly two dozen concurrent sessions, including several touching upon security since 9-11, traffic calming, the U-Pass program, SMART transit initiatives, transportation corridors, and preventive road maintenance.
- A half-day ITS Institute research showcase featuring faculty, researchers, and students from all technology areas discussing research findings, implementation, and impacts.

Complete coverage of the 2002 Transportation Research Conference may be found online at: www.cts.umn.edu/news/2002/06.

CTS annual meeting and awards luncheon

CTS presented the following awards at its annual meeting in April 2002. The ceremony is an opportunity for CTS to recognize significant contributions to the field of transportation.

- William K. Smith Distinguished Service Award: New this year, the award is presented to a professional in the freight transportation and logistics field for leadership and contributions to the education of future leaders in private-sector freight transportation. The award is named in honor of William K. Smith, who served on the committee to establish CTS and on many CTS research and education councils until his death in 2001. Richard "Pinky" McNamara, a University of Minnesota regent, presented the inaugural award to **Gary Eikaas**, executive vice president of Dedicated Logistics. Like Smith, Eikaas served on the committee establishing CTS.

**Gary Eikaas and Richard "Pinky" McNamara****Mary Hill Smith and Doug Weiszhaar****Dick Braun and Panos Michalopoulos****Dick Hansen and Fred Corrigan**

- Distinguished Public Leadership Award: CTS Executive Committee member Doug Weiszhaar, Minnesota Department of Transportation deputy commissioner, presented the award to **Mary Hill Smith**, member of the Metropolitan Council since 1993.
- Richard P. Braun Distinguished Service Award: Richard P. Braun, founding director of CTS, presented the award named in his honor to **Professor Panos G. Michalopoulos** of the Department of Civil Engineering. Michalopoulos is the inventor of Autoscope™—a traffic detection technology sponsored by CTS and Mn/DOT and patented by the University.
- Ray L. Lappegaard Distinguished Service Award: CTS Executive Committee member Fred Corrigan, executive vice president of the Transportation Alliance, presented the award to **Dick Hansen**, public works director/highway engineer with St. Louis County's Public Works Department.
- CTS Research Partnership Award: This year's project recipient is *Influence of Roofing Shingles on Asphalt Concrete Mixture Properties*. The project began when University researchers conducted a laboratory study to establish the feasibility of using shingles in pavements. Mn/DOT constructed test sections and later incorporated the use of scrap shingles into its specifications.



(Front row, from left) John Gulliver, CTS director Robert Johns, Wayne Gjerde, Darlene Gorrill, Karen Billiar; (middle row) Roger Olson, Micky Ruiz; (back row) Kent Peterson, Dan Krivit, Mike Jorgenson.

Project partners included:

- Roger Olson, Mn/DOT Office of Materials and Road Research
- Micky Ruiz, Jim Klessig, and Karen Billiar, Mn/DOT Office of Research Services
- David Newcomb, National Asphalt Pavement Association (formerly of the University of Minnesota Department of Civil Engineering)
- Dan Krivit, Dan Krivit and Associates
- Don Kyser and Wayne Gjerde, Minnesota Office of Environmental Assistance
- Kent Peterson and Mike Jorgenson, Bituminous Roadways, Inc.
- Darlene Gorrill, communications and publications consultant

the foreign-born population, and suburbs also becoming more diverse.

TRG Study workshops

CTS held three workshops as part of the education and public involvement efforts of the Transportation and Regional Growth Study. Research workshops are designed to familiarize faculty, students, and practitioners with the Transportation and Regional Growth Study's research topics and methodologies, and to provide feedback to the presenters. The following were offered:

"Transit-Supportive Urban Design Impacts on Suburban Land Use and Transportation," Carol Swenson, Design Center for the American Urban Landscape

"Urbanization of the Countryside—Low-Density Residential Development Near Minnesota's Regional Centers," John Adams, Geography

"Commuter Rail-Oriented Design: New Suburban Patterns," Lance Neckar, Landscape Architecture

In addition, the impact that the research already has had on public policy and planning in the metropolitan area was displayed at a TRG workshop held in May 2002 as part of the CTS annual research conference. Moderated by Ed Ward of Ward and Company, the workshop featured TRG researchers John Adams, Gary Barnes of the Humphrey Institute, Barry Ryan of Applied Economics, Lance Neckar, Barbara Lukermann of the Center for Urban and Regional Affairs, and Carol Swenson.

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.

Current carsharing systems and prospects for the future were the topic of the CTS fall luncheon speech, "Carsharing: an International Perspective," by Dr. Susan Shaheen, Honda Distinguished Scholar at the University of California-Davis, in November 2001.

Shaheen, who holds a joint appointment with Partners for Advanced Transit and Highways at UC-Berkeley, explained that in typical carsharing groups, users pay a fee per use or per month, gaining access to a fleet of vehicles without the costs and responsibilities of ownership. In 1999, Shaheen developed Carlink, a commuter carsharing model in the San Francisco Bay Area.

At the CTS spring luncheon in May 2002, Bruce Katz of the Brookings Institution Center on Urban and Metropolitan Policy described "The New Metropolitan Reality." The major trend affecting cities and metropolitan areas nationwide, he observed, is the rampant decentralization of economic and residential life, or "sprawl." Another important trend is racial and ethnic change, with city growth fueled by immigration and increases in



"Carsharing: an International Perspective," by Dr. Susan Shaheen, Honda Distinguished Scholar at the University of California-Davis



Conference on community-based transportation

In October 2001, CTS hosted the "Conference on Community-Based Transportation" for the Greater Twin Cities United Way. cosponsors included: Children, Youth, and Family

Consortium; University of Minnesota; Minneapolis Planning Department; Hennepin County; and Minnesota Department of Human Services.

The event brought together participants from regional human service agencies, government, private industry, and other groups to discuss transportation barriers and their impact on self-sufficiency and to share possible solutions for these problems.

In opening remarks, James Colville, Greater Twin Cities United Way, said that in studying transportation and funding options, his agency realized that its separate efforts could not handle the Twin Cities' growing transportation needs. The goal of the conference, he said, was to share what United Way has learned, and to learn from attendees.



Sandra Rosenbloom

Keynote speaker Sandra Rosenbloom, director of the Roy P. Drachman Institute for Land and Regional Development Studies at the University of Arizona, said there is an increasingly larger share of people who have difficulty getting to jobs, appointments, or other services.

According to Rosenbloom, transportation planning must include all modes of transportation, and communities must now play the new role of mobility providers and managers.

A plenary session on innovations and barriers in Minnesota, moderated by Sandra Vargas of Hennepin County, featured Richard Graham of DARTS, Sandy Froiland of the Anoka County Job Training Center, Jack Tamble of Minneapolis Community Education, and John Barrett of Rise, Inc.

A session titled "Solutions for Minnesota: Policy Issues," moderated by Terri Barreiro of United Way, featured panelists Lee Pao Xiong of the Urban Coalition, Jay Lindgren of the Metropolitan Council, and Mary Cummins of the Minnesota House of Representatives.

Other conference sessions discussed language and cultural barriers, the role of medical providers and volunteer drivers, resource sharing among agencies, community development, logistics and operations support, taxis as community-based transportation providers, vanpooling, and car loan, leasing, and repair programs.

A conference summary is available online at: www.cts.umn.edu/publications.

Freight and Logistics Symposium

Some of the many engaging topics examined by transportation professionals and policymakers at the Fifth Annual Freight and Logistics Symposium included September 11, subsequent security and economic concerns, infrastructure deterioration, growing congestion, and the possible development of an intermodal air cargo facility in or near the Twin Cities.

The event, hosted by CTS in December 2001, included a keynote address by C.H. Robinson Worldwide's Barry Butzow, panel discussions on state freight initiatives and carrier-shipper perspectives, and updates on national freight initiatives and the latest transportation-related congressional activity.

Butzow, a senior vice president with CHRW, outlined the state of freight transportation in a keynote presentation titled "Four Weeks, Four Months, Four Years: The Future of Freight Transportation." Though references to September 11 permeated his talk, Butzow said that the tragedy just pushed ahead things—like corporate cost-cutting and consolidations, rising insurance rates, decreased freight volume, and an equipment glut—that were happening anyway. Butzow also focused attention on the development of total supply-chain systems, and he emphasized the importance of infrastructure improvements and exploiting technology to make that happen.

Other highlights include Minnesota Transportation Commissioner Elwyn Tinklenberg's presentation of the Mn/DOT freight investment plan and consultant John Hartnet's recap of the Minneapolis-St. Paul international air cargo study.

A copy of the eight-page report is available online at: www.cts.umn.edu/publications.

CHRW's Barry Butzow focused attention on the development of total supply-chain systems, and he emphasized the importance of infrastructure improvements and exploiting technology to make that happen.



CTS state-fair exhibits

Working with the University's Institute of Technology, CTS again exhibited at the Minnesota State Fair. This year's exhibit featured an intelligent ground vehicle built by University of Minnesota mechanical engineering students. The students had built the vehicle for and competed in the Ninth Annual Intelligent Ground Vehicle Competition in Rochester, Michigan, in June 2001, with funding from the Center's ITS Institute.

Also at the fair, Associate Professor Gerard McCullough of Applied Economics, former director of CTS, presented the "Effect of Higher Energy Prices on Household Transportation Budgets in Minnesota."

BRT lane-assist workshop debuts 'TechnoBus'

Researchers introduced a lime-green Metro Transit demonstration bus outfitted with the latest navigational technology, dubbed the "TechnoBus," at a workshop in May 2002 hosted by the Intelligent Transportation Systems Institute at the University of Minnesota.

The workshop helped identify the requirements for using lane-assist technology with bus rapid

transit and offered a live demonstration of a prototype lane-assist system installed on the TechnoBus during an extended ride to the workshop at the University's Minneapolis campus. Representatives from transit agencies and universities across the country, state transportation departments, and the federal government, as well as manufacturers and consultants, attended the event.

Jennifer L. Dorn, administrator of the Federal Transit Administration, toured the bus. Project managers and technicians from Metro Transit and the University took the opportunity to demonstrate the lane-assist technology to Dorn as she sat for a few moments in the driver's seat of the TechnoBus.

Metro Transit project manager Aaron Issacs, presenting an overview of the lane-assist project during the ride, pointed out that buses rigged with lane-assist technology can take maximum advantage of narrow freeway shoulders and other dedicated lanes.

At the workshop, Edward L. Thomas, former FTA Associate Administrator for Research, Demonstration, and Innovation, addressed participants. FTA engineer Brian Cronin added that the lane-assist project is a good example of the kind of ideas needed as FTA solicits systems requirements for larger bus rapid-transit projects. This project and the workshop are funded by the Intelligent Transportation Systems Joint Program Office at FHWA. Metro Transit, managing the project, furnished the bus, while the ITS Institute has provided the technical expertise and analysis to implement it.

The project will also involve human-factors testing, led by Nic Ward and the University's HumanFIRST Program, to measure driver adaptability to the technological innovations and compare the stress levels of drivers using the system to those without it.

More information about this project is available online at: www.its.umn.edu/research/brt.

Congressional staff visit

CTS hosted four congressional staff members in August 2001 to provide them with an overview of transportation-related activities at the University. The following attended:

- Bill Black, Representative Collin Peterson's office
- Darin Broton, Representative William

Buses rigged with lane-assist technology can take maximum advantage of narrow freeway shoulders and other dedicated lanes.



Jennifer L. Dorn, administrator of the Federal Transit Administration, tours the TechnoBus.

- Luther's office
- Heather Krause, Representative James Oberstar's office
- Louis Moore, Representative Martin Sabo's office

closed with a congressional staff dialogue led by John Engelen, director of federal relations for the University.

In addition, the day's agenda also featured a presentation about the U Pass Transit Program by University parking services director Bob Baker, as well as presentations by CTS staff on technological advancements and research, the ITS Intelligent Vehicles Lab and the ITS SAFEFLOW, transportation policy research, the CTS Transportation and Regional Growth Study, and education and technology transfer programs. Also featured were tours of the Human Factors Research Lab and the ITS Lab. The day's meetings



Congressional staff members examine the latest SAFEFLOW technology.

cosponsored events

Minnesota pavement conference

Participants at the Sixth Annual Minnesota Pavement Conference were treated to news of pavement methods from places as varied as France, South Africa, and Australia—and, of course, Minnesota. Mn/DOT and Minnesota LTAP were cosponsors of the February 2002 event in St. Paul.

Pat Hughes of Mn/DOT moderated the opening plenary session and presented the Annual Pavement Conference Award to Gerry Rohrbach of Mn/DOT. Rohrbach, with a long history of contributions to the pavement field, credited his staff for his success. (Sadly, a few months later, Rohrbach passed away, on October 29, 2002.)

Next, Buzz Powell, test track manager for the National Center for Asphalt Technology near Auburn, Alabama, reviewed research efforts at the NCAT pavement test track. Chuck Jahren, professor at Iowa State University, presented "Low-Volume Roads in Australia," pointing out some of the differences in approach and expectations from the United States. Duane Blanck, county engineer in Crow Wing County, gave highlights from the "Pavement Preservation Scanning Tour" during which he and 12 other U.S. officials traveled to France, South Africa, and Australia.

Conference session topics included spring load restrictions, whitetopping, stone matrix asphalt, warranties, and geotextiles. Planning committee members from the University were civil engineering researchers Mihai Marasteanu and Gene Skok, Jim Grothaus of CTS, and Lori Graven and Teresa Washington of the College of Continuing Education.

The pavement conference was preceded by the Second Annual Mn/ROAD Workshop, where Minnesota Road Research Project staff and other researchers presented their research discoveries made at the test facility. There, Professor Marasteanu presented "Dynamic Modulus Testing of Asphalt Mixtures." Following the pavement conference, the University's Department of Civil Engineering sponsored the 50th Annual Geotechnical Engineering Conference.

MPR transportation summit

Minnesota Public Radio broadcast two hours of live discussion from "Getting There," a day-long transportation forum held in April 2002 at the Hubert H. Humphrey Institute of Public Affairs at the University of Minnesota. CTS cosponsored the event in conjunction with MPR, the Minnesota History Center, and the Humphrey Institute's State and Local Policy Program.

Annual Pavement Conference session topics included spring load restrictions, whitetopping, stone matrix asphalt, warranties, and geotextiles.

The goal of the summit was to build ideas for a better, smarter transportation system in Minnesota.



Lee Munnich, of the State and Local Policy Program at the Humphrey Institute, facilitates a breakout session at the MPR summit.

The goal of the summit was to build ideas for a better, smarter transportation system in Minnesota. CTS director Robert Johns joined MPR's Leonard Witt and Minnesota Historical Society curator Brian Horrigan in welcoming a broad range of invited guests, including transportation policymakers and professionals, academics, concerned citizens, and a handful of high school students.

Gary Eichten, host of MPR's *Midmorning* show, kicked off the on-air portion of the event moderating a panel considering the question, "How did we get here and where are we headed?" University geography professor John Adams led the discussion with a history of road congestion in Minnesota.

Joining Adams were former Metropolitan Council chair Curt Johnson, state Sen. Dean Johnson, who brought the latest news from the Capitol about a hotly debated transportation funding package, and Eagan mayor Pat Awada.

Following breakout sessions debating major transportation issues, which included congestion, safety, environmental impact, accessibility, and efficient spending, Eichten led another live, hour-long discussion about what can be done about area transportation problems. State transportation commissioner Elwyn Tinklenberg, Federal Highway Administration program manager Cynthia Burbank, and Metropolitan Council chair Ted Mondale served as panelists.

Following the panel, participants joined peers in forming breakout groups of stakeholders. They identified the most workable ideas from the morning's issue groups and developed action plans to make them a reality. Government, business and industry, academia, special interests, citizens, and youth/student groups each presented detailed suggestions to the

entire forum. Finally, Humphrey Institute senior fellow Lee Munnich wrapped up the day with a ten-point list summarizing the day's key transportation issues. Topping the list was leadership.

A detailed summary report of the MPR transportation summit is available online at: www.cts.umn.edu/pdf/getthere.pdf.

Global food transportation conference

More than a dozen regional and national transportation professionals and academics joined Barry Prentice, director of the Transport Institute at the University of Manitoba, to pack a variety of presentations into a day-long series of panels at a policy forum about agricultural transportation issues. The Minnesota Agri-Growth Council, the University of Minnesota's College of Agricultural, Food and Environmental Sciences, and CTS were the main sponsors of the event, titled "Transportation Needs in Today's Global Food Economy: What Do We Need?"

Some of the hot topics to emerge during the forum included the challenge of determining environmental and social costs of transportation systems development, the growing Mexican grain market, and shifting from commodity- to product-oriented agriculture. Panelists included Jerry Fruin and Gerard McCullough, associate professors of applied economics at the University of Minnesota; Davis Helberg, executive director of the Duluth Seaway Port Authority; Fred Corrigan, executive vice president of the Minnesota Transportation Alliance; and Tim Worke, director of government relations with Mn/DOT. In addition, Robert Johns, director of CTS, moderated a panel discussing carrier-shipper business relations, and Tim Penny, chair of the Minnesota Freight Advisory Committee, moderated a panel about balancing environmental and social concerns with development needs.

National listening session for transportation and the environment

In August 2001, the University hosted a national listening session on the environmental aspects of the Transportation Equity Act for the 21st Century (TEA-21), the federal legislation passed in 1998. This was the first such session in the reauthorization process for TEA-21, which expires in 2003.



The session's sponsors were the State and Local Policy Program at the Humphrey Institute of Public Affairs, CTS, the Federal Highway Administration, the Federal Transit Administration, and Mn/DOT. Participants included U.S. Representatives Jim Oberstar and Martin Sabo; Sean O'Hollaren, USDOT assistant secretary for governmental affairs; Cindy Burbank, FHWA program manager for planning and environment; and a number of state and local elected officials, organizations, and businesses. Several other state and regional leaders also participate in two panel discussions.

Oberstar, in his keynote address, noted that concern for congestion, urban sprawl, and air quality led to the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA), and that ISTEA and TEA-21 have subsequently addressed environmental issues. He stated that the formula for TEA-21 should be used for reauthorization, and that citizens need to be involved.

In closing, O'Hollaren summarized the main ideas from the conference that federal, state, and local agencies need to partner together to solve issues and that they should build upon current transportation-related environmental programs. He also suggested that transportation and land use should be considered together, assisted by a strong research program.

Project-delivery streamlining

In February 2002, Mn/DOT and CTS released a new report as part of the ongoing effort to streamline the delivery of transportation projects in the state. The report contains final task force recommendations for streamlining the pre-construction phases of projects in three focus areas: design process, right-of-way process, and environmental impact process.

In November 2001, CTS hosted and facilitated a streamlining workshop for Mn/DOT and other state and federal agency staff to solicit broad stakeholder input on the development of the streamlining recommendations.

Many of the initiatives outlined in the report have already been implemented, while some are currently underway and others are under evaluation by Mn/DOT staff for possible implementation in the near future.

The report, along with additional information about the streamlining initiative, is available online from the Mn/DOT Project Delivery Streamlining Web page at: www.dot.state.mn.us/tecsup/pds.

Midwest network of transportation libraries

In response to an increasing demand for transportation-related information, transportation librarians from throughout the Midwest gathered at CTS in December 2001 to discuss plans for developing a Midwest network of transportation libraries.

The meeting was held in Minnesota, in part, to recognize "the Minnesota model"—based upon the Minnesota Transportation Libraries program—for providing transportation information services. MTL, which serves the state's entire transportation community, is cosponsored by Mn/DOT, CTS, and the Minnesota Local Road Research Board.

At the meeting, attendees from eight state DOTs (Iowa, Illinois, Michigan, Minnesota, Missouri, Nebraska, South Dakota, Wisconsin) Northwestern University, the University of Michigan, the National Transportation Library, and CTS discussed the role a regional network could play in improving access to transportation-related information resources. The group also formed working groups to create a drafts of an agreement for the exchange and sharing of information resources and a draft of criteria for participation in the network.

The CTS Library works in partnership with the Mn/DOT Library and the University of Minnesota Libraries to provide assistance in obtaining transportation-related information. More information about the CTS Library and related resources is available online at: www.cts.umn.edu/libraries.

Urban transportation corridor development conference

In June 2002, the Humphrey Institute's State and Local Policy Program hosted a "Case Study Conference on Urban Transportation Corridor Development." The event helped identify lessons from other urban areas that may be useful during corridor development in the Twin Cities.

The conference convened more than 100 participants representing academia, policymakers, and a wide range of public, neighborhood, and business interests. Conference participants had opportunities to learn national and international practices of transportation corridor development. Research findings on 10 case studies were distributed in conference packets, focusing on the role of governance, citizen participation, financ-

Midwest Librarians met at CTS, in part, to recognize "the Minnesota model"—based upon the Minnesota Transportation Libraries program—for providing transportation information services.

The task force recommended streamlining the pre-construction phases of projects in three focus areas: design process, right-of-way process, and environmental impact process.

European bridge researchers observed significant differences from U.S. research arising from the traditions and priorities of European transportation management.

ing, economic impacts, and design of each case study area.

At the conference, representatives from three of the case studies—Denver’s T-REX, San Diego’s managed lanes on Interstate 15, and Ottawa’s busway system—shared their experiences on corridor development practices. Other speakers included: Hank Dittmar, president of Great American Station Foundation; Minnesota Senator Satveer Chaudhary; Hennepin County administrator Sandra Vargas; and Hennepin County commissioner Mark Stenglein.

The event was part of an 18-month study led by the State and Local Policy Program at the Humphrey Institute, which hosted the event with additional support from CTS and the Minnesota Transportation Alliance. The research project itself is a collaborative effort between the State and Local Policy Program, the Design Center for American Urban Landscape at the University’s College of Architecture and Landscape Architecture, and the Claremont Graduate University, and is funded by Hennepin County with support from the Federal Transit Administration. The research will culminate in a proposed strategy for implementing the lessons learned.

NSF-sponsored bridge research workshop

The Fifth National Workshop on Bridge Research in Progress, sponsored by the National Science Foundation, was held

in October 2001 in Minneapolis. Hosted by the Department of Civil Engineering and CTS, the workshop provided a forum for researchers to present their current work on bridges as well as an opportunity for bridge engineers and consultants to present their current concerns with bridge design and performance.

In the keynote presentation, Don Flemming of URS Corporation gave numerous examples of real-world bridge problems in Minnesota. During a luncheon presentation on “Aspects of European Bridge Research,” Michael Forde of the University of Edinburgh observed significant differences from U.S. research arising from the traditions and priorities of European transportation management.

Among more than 50 presentations during the workshop, the following were given by University civil engineering department researchers:

- Carol Shield, Catherine French, and Andrew Lawver, “Seasonal and Daily Environmental Effects on an Integral Abutment Bridge” (poster session)
- Robert Dexter and Mark Mutziger, “Performance Testing of Modular Bridge Expansion Joint System”
- Katsyoshi Nozaka, Carol Shield, and Jerry Hajjar, “Rehabilitation of Fatigued Steel Girders with Carbon Fiber Strips”
- Art Schultz and Evan Berglund, “Assessing Distortional Fatigue in Multi-Girder Steel Bridges”





CTS Executive Committee



CHAIR:
Frederick J. Beier, Director, Logistics Management Research Center, University of Minnesota



Ann Beers, Chief of Minnesota State Patrol, Minnesota Department of Public Safety



Tom Chaffin, Vice President, Traffic Control Division, 3M



Fred Corrigan, Executive Vice President, Minnesota Transportation Alliance



Duane Crandall, President and CEO, AAA Minnesota/Iowa



Douglas Differt, Vice President, URS Corporation



Carol Flynn, Former Minnesota State Senator



Jeff Hamiel, Executive Director, Metropolitan Airports Commission



John Hausladen, President and CEO, Minnesota Trucking Association



Margot Imdieke-Cross, Community Program Specialist, Minnesota State Council on Disability



Keith Langseth, Minnesota State Senator



Ronald Lifson, Vice President, LDI Fibres Inc.



Christine Maziar, Executive Vice President and Provost, University of Minnesota



Wayne Murphy, Executive Director, AGC of Minnesota



Richard T. Murphy Jr., President, Murphy Warehouse Company



Lee Sheehy, Regional Administrator, Metropolitan Council



Al Steger, Minnesota Division Administrator, Federal Highway Administration



Elwyn Tinklenberg, Commissioner, Minnesota Department of Transportation



Doug Weishaar, Deputy Commissioner, Minnesota Department of Transportation



Roger Williams, District #11 Member, Metropolitan Council



Charleen Zimmer, President, ZAN Associates



CTS Executive Committee member Jim Newland retires

At its November 27, 2001, meeting, the CTS Executive

Committee, chaired by Fred Beier, expressed its appreciation to retiring member Jim Newland.

After serving on the Executive Committee since 1993, Newland retired from his current role as chair of the CTS Council Coordinating Committee, an ex-officio position on the Executive Committee. Newland also chaired the Interim Advisory Committee, the first committee established to guide the Center, and was the founding chair of the Education Council.

Bill Smith, founding member of CTS advisory committee, dies

Bill Smith, a long-time General Mills executive and leader in the transportation industry, died October 11, 2001. He was a founding member of the CTS Interim Advisory Committee, the initial committee established to define the mission of CTS.

Note: Listings in these appendixes are current as of December 2002.



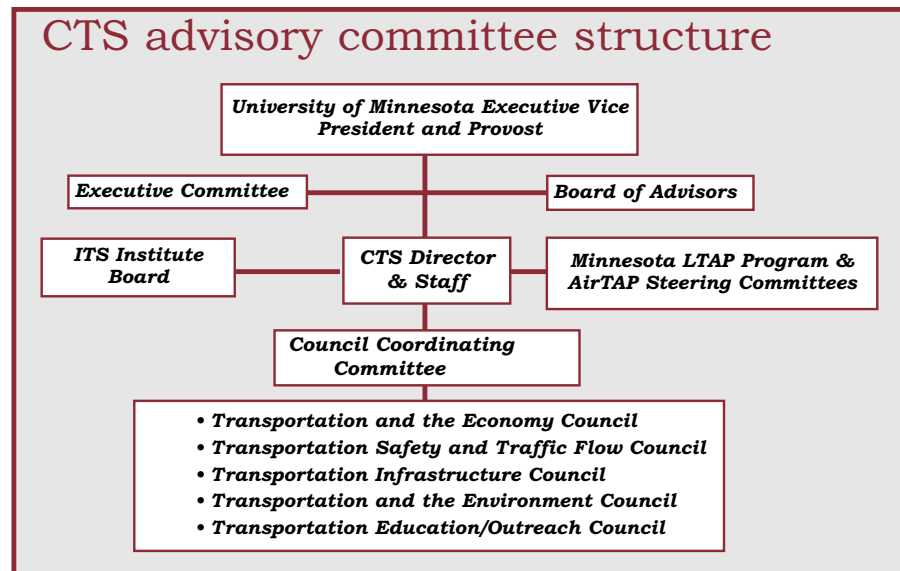
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Richard Braun
Gerry Brown, Cargo Carriers Inc.
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David Fricke, Minnesota Association of Townships

John Gulliver, Department of Civil Engineering, University of Minnesota
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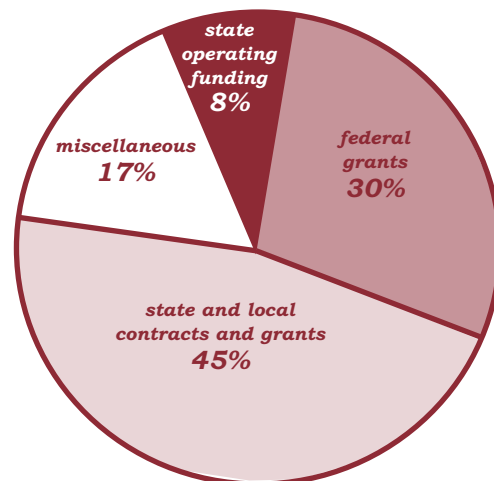
CTS advisory committee structure



CTS associate director Laurie McGinnis oversees operations of the Center, including its budget and staff.

CTS total annual revenues

FY2002: approximately \$9.63 million





Councils and Advisory Committees

Council Coordinating Committee

Chair: Charleen Zimmer, ZAN Associates
 George Cochran, Mn/DOT (ret.)
 Jody Hauer, Office of Legislative Auditor
 Ann Johnson, Professional Engineering Services
 Connie Kozlak, Metropolitan Council
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Selected CTS Publications

Newsletters

CTS Report

A monthly publication on transportation research, education, and information/outreach activities at the University of Minnesota

The *Sensor*

A quarterly publication of the ITS Institute covering ITS research and education at the University of Minnesota

Technology Exchange newsletter

A quarterly publication of the Minnesota Local Technical Assistance Program (LTAP)

TRG *Study Notes*

The newsletter of the Transportation and Regional Growth Study, with coverage of related news and events

AirTAP *Briefings*

A quarterly publication of Minnesota Airport Technical Assistance Program (AirTAP), inserted in the Minnesota Council of Airports newsletter

Proceedings

Inaugural James L. Oberstar Forum on Transportation Policy and Technology, April 28–29, 2002

Getting There: Building Ideas for a Better, Smarter Transportation System, April 11, 2002

Congestion in the Twin Cities: Who's Paying the Price? November 28–29, 2000, Minneapolis, MN

Fifth Annual Freight and Logistics Symposium, December 7, 2001, Minneapolis, Minnesota
Impacts of Logistics on the Upper Midwest Economy, Fourth Annual Symposium, September 11, 2000, Bloomington, MN

North Star Workshop – Connecting the Minnesota Safety Agenda: Towards Zero Deaths, June 11–13, 2001, St. Paul, MN

Conference on Community-Based Transportation: Improving Access for the Transportation Disadvantaged, October 2, 2001, St. Paul, MN

Intelligent Transportation Systems Institute 2001/2002 Annual Report

AirTAP workshop highlights: *Airport Project Funding and Development*

AirTAP workshop highlights: *Airport Snow and Ice Control*

Videos

Spring 2002 ITS Institute Seminar Series:

February 12
Advanced Traffic Signal Control and Prioritization
Thomas Urbanik II, University of Tennessee–Knoxville, Dept. of Civil and Environmental Engineering

February 26
Vehicle-based Student Competitions at the U of M: History and Educational Impact
Patrick Starr, Dept. of Mechanical Engineering

March 12
Comparing Dualmode Transportation Systems with Other Proposed and Existing Systems
Francis D. Reynolds, dualmode transportation inventor and private consultant

March 26
The ITS Laboratory – Building the Future
Ted Morris, CTS

April 9
Traffic Flow Study of the Miller Hill Corridor
Jiann-Shiou Yang, Dept. of Electrical and Computer Engineering (UMD)

April 23
Behavior Variability is More than Just Noise: The Meaning of Behavioral Entropy
Erwin R. Boer, Erwin R. Boer Consulting

Handbooks

Asphalt Pavement Maintenance Field Guide

Best Practices Handbook on Asphalt Pavement Maintenance

Best Practices Handbook on Roadside Vegetation

Minnesota LTAP workshop catalog

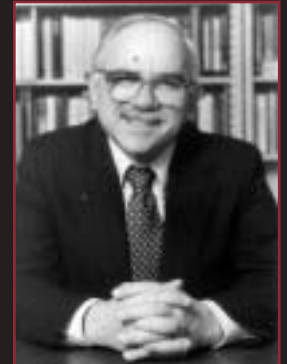
Reclaimed Glass Information Kit

Brochures

Circuit Training and Assistance Program (CTAP)

HumanFIRST Program

Intelligent Vehicles Laboratory



Professor Emeritus Theodore Galambos, Department of Civil Engineering, received the 2002 OPAL Award from the American Society of Civil Engineers for Outstanding Lifetime Achievement in Education. Galambos was chosen for his “demonstrated excellence in furthering civil engineering education.” This is ASCE’s highest award. Also, Galambos received the Structural Stability Research Council 2002 Lynn S. Beedle Award, SSRC’s highest award, given to an individual in recognition of stability research and international leadership.

Information about obtaining these resources is available online at www.cts.umn.edu or by contacting the CTS Library at 612-626-1077.



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