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

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

The Institute’s research program joins technologists—for example, engineers and computer scientists—with those who study human behavior to ensure that new technologies adapt to human capabilities, rather than requiring drivers to adapt to technology.

The Institute’s geographic location gives it a unique advantage for developing research applicable to transportation in a northern climate and transportation in rural environments in addition to the metropolitan Twin Cities area. The ITS Institute research program includes research projects funded by various partners, including federal funds from the USDOT Research and Innovative Technology Administration’s University Transportation Center program, the Federal Highway Administration, the Federal Transit Administration, the National Highway Traffic Safety Administration, the National Park Service, and the Department of Homeland Security. Other funding partners include the Minnesota Department of Transportation (Mn/DOT), Minnesota Local Road Research Board, Metropolitan Council, Hennepin County, Metro Transit, and the Minnesota Valley Transit Authority in addition to local governments, agencies, and private companies that contribute funding and in-kind match.

Activities undertaken by the Institute support all ITS-related research projects, regardless of funding source; all current ITS-related projects are listed in this annual report. The research section comprises two parts. The first highlights in detail a selection of projects under way, while the second lists all Institute projects either recently completed, in progress, or selected to begin this coming year.
Fuel Economy Driver Interfaces: Develop Interface Recommendations

There's more to vehicle fuel economy than an efficient engine and an aerodynamic body. How drivers choose to operate their vehicles can have a significant effect on fuel consumption.

HumanFIRST researchers are developing interface technologies to show drivers how their driving style is affecting fuel economy in real time. HumanFIRST director Mike Manser, who led the project, and researchers Mick Rakauskas (formerly with the University), Justin Graving, and James Jenness (a collaborator from collaborating organization Westat) recently evaluated a variety of fuel efficiency driver interface concepts, or FEDICs, to identify the most effective ways to display fuel economy information to drivers while they are behind the wheel. The HumanFIRST research is a portion of a larger study of FEDIC designs sponsored by the U.S. Department of Transportation’s National Highway Traffic Safety Administration.

The smoother the better
Research suggests that smooth driving practices—staying below the posted speed limit, avoiding aggressive acceleration, remaining alert to changes in traffic conditions in order to avoid large changes in speed—can reduce overall fuel consumption by as much as 15 percent. But while such a reduction represents a significant savings in fuel costs over time, drivers may not appreciate the benefits of changing their driving style if they cannot connect them to specific behaviors while they are driving.

With drivers more concerned than ever about saving fuel, a number of fuel efficiency display designs have appeared on the market in recent years. Some are standard equipment on certain automobile models; others are available as aftermarket add-ons. The absence of generally accepted or scientifically validated design standards for these devices has led to a wide variety of designs, many of which are quite visually complex.

A key objective of the HumanFIRST research was to identify design elements that are informative to the driver but not so complicated that they contribute to driver distraction—a significant safety hazard.

The interface study consisted of three components: a comparative rating activity designed to determine how well each FEDIC design met the needs of users and conformed to principles of good user interface design; usability testing to identify the most useful components and design approaches; and testing in the HumanFIRST Program’s immersive virtual driving simulator to examine the effectiveness of FEDIC concepts in realistic driving scenarios.

Testing and results
During comparative rating of the display concepts, the researchers found that user needs were satisfied by simple interfaces that combined multiple types of information—for example, showing fuel economy in different ways, or displaying the effects of behaviors (such as acceleration) that affect fuel economy.

Although the performance of the various FEDICs was largely similar, the designs differed markedly at the component level.

This finding led the researchers to focus the second phase of the study on examining individual components of FEDIC designs. In these tests, results show that representative or symbolic displays such as bars or icons were more usable than text-based displays; however, the researchers concluded that textual displays could still be
valuable if they help users understand fuel economy.

Moving into the driving simulator, the HumanFIRST researchers tested a pair of alternative FEDIC designs under typical driving conditions. One interface concept displayed information about fuel economy, while the other displayed information about driver behaviors associated with fuel economy. In this test, the display of fuel economy information was more effective than the behavioral display in improving fuel economy. Data from participants driving with both displays indicated performance was similar to a control group who were instructed to drive efficiently without a fuel economy display.

Overall, the study results suggest that fuel efficiency displays based on graphical representations augmented by textual information are likely to be effective and easy to use. Combining real-time and long-term information also appears to be an effective strategy. Keeping the display visually simple is an important consideration, both to improve the readability and effectiveness of the display and to avoid distracting the driver.

**Comparison of Dual-Phase and Static Signage**

As many as 25,000 drivers a year end up at the wrong terminal at Minneapolis-St. Paul International Airport, sometimes missing their flights.

To reduce the confusion, the Metropolitan Airport Commission renamed the airport’s Lindbergh and Humphrey terminals as Terminal 1 and 2 and put up signs with the new names this spring. Simultaneously, a research team from the University conducted a study to find out whether conventional or electronic signs were more effective in helping drivers arrive at the correct terminal.

The study, led by Kathleen Harder, director of the University’s Center for Design in Health, found that drivers responded well to both conventional and changeable message signs (CMSs) if the signs included airline information. Harder’s study also added to research that found older drivers drive more slowly and make more mistakes when responding to highway signs.
**Unique airport**

The Twin Cities airport has 14 airlines split between two terminals, with 9 airlines at the larger Terminal 1 and 5 airlines at the smaller Terminal 2. The airport is unique in the United States in that its two terminals are separated by different freeway exits. That forces drivers to make split-second decisions about where to exit for their airline.

“The challenge is to devise a format to present information so drivers can deal with it in a timely way,” Harder said.

In the University study, 120 licensed drivers from the Twin Cities used a simulator to take two trips on a trunk highway approaching the airport. Participants were randomly assigned to either changeable signs that cycled the names of airlines or three static message signs and had to pick the correct airline.

Participants chose the correct exits for 215 of the 240 trips. Of the drivers who picked the wrong exit, 20 of the misses occurred on the first drive and five on the second drive, showing that the drivers had a quick learning curve. “That’s fine for repeat visitors to the Twin Cities,” Harder said. “The question is, what do you do with first-timers in terms of signage?”

The high success rate of drivers masked some differences in driver reactions. Older drivers had more than three times the mistakes of the youngest group of drivers. And they drove almost five miles per hour slower than the younger drivers.

Harder found similar age-related differences in two previous studies she helped conduct on changeable message signs—one on how drivers respond to traffic directions, the other on driver response to an Amber Alert sign. That’s a problem that will get worse as the population ages, she said.

**Better-designed signs**

The study found no statistically significant difference in the number of driver mistakes based on the type of sign—11 mistakes were made with the CMSs and 14 with the static signs. But Harder helped the Minnesota Department of Transportation make a number of design changes on its new static signs, which include airline names for Terminals 1 and 2. Her suggestions include alphabetizing and centering the airline names to help drivers scan the information more quickly.

Cassandra Isakson, assistant state traffic engineer for Mn/DOT, which sponsored the project, said she was encouraged by the study’s finding that most drivers needed only one sign to pick the right terminal.

The airport is likely to expand in the future, with Humphrey, or Terminal 2, slated to take as much as half of the airport’s driver traffic, she said.

“There’s room on the corridor for three signs. But as the airport starts to grow, [it] might end up with 20 or 30 airlines,” she said. “We needed to investigate this issue for the possibility of future growth. We needed to know motorists had the ability to get the terminal information from one CMS as needs changed.”

Research results helped inform design changes made to highway signs, such as alphabetizing and centering airline names to help drivers scan information quickly.
Engineers have been intrigued by the properties of carbon nanotubes since they were discovered nearly 20 years ago. Now University of Minnesota researchers, with funding from the ITS Institute, are putting the cylindrical carbon molecules to work in a new role: creating advanced paving materials for tomorrow’s smarter roads.

Xun Yu, assistant professor of mechanical and industrial engineering at the University’s Duluth campus, is working with UMD director of transportation research programs Eil Kwon and research associate Baoguo Han to develop a new type of traffic sensor that relies on the electromechanical properties of carbon nanotubes incorporated into concrete pavements.

Carbon nanotubes (CNTs) are cylindrical molecules in which carbon atoms are organized into hollow cylinders only a few atoms in diameter but up to millions of atoms long. In addition to being extremely strong, carbon nanotubes are electrical semiconductors that exhibit linear changes in electrical resistance in response to mechanical stress, a quality known as piezoresistance.

Yu’s research aims to put piezoresistance to work by mixing CNTs with cement. In a well-formulated CNT/cement composite, evenly distributed nanotubes would form a web of carbon filaments spanning the entire paved area. Installing a simple set of electrodes to measure electrical resistance would turn the pavement into a single large pressure sensor.

Such pavements could even monitor their own health. Because the piezoresistive properties of a CNT network depend on the mechanical stress within the CNT/cement composite, the response of a composite pavement will change when cracking occurs. This self-monitoring would enable transportation agencies to quickly detect and respond to pavement damage, as well as track the condition of their pavement infrastructure assets.

With no moving parts or complex electrical circuits, the composite pavement design is mechanically simple, and therefore immune to many types of damage that cause failures in more complicated sensor systems such as pavement-embedded inductive loop detectors. A properly formulated CNT/cement composite could be installed much like traditional concrete pavement and would be resistant to mechanical damage. Indeed, the high strength of carbon nanotubes could reinforce the pavement, making it more wear-resistant than standard concrete.

However, fabricating CNT/cement composites that can perform effectively as sensors is far more challenging than pouring a cupful of nanotubes into a cement mixer. CNTs tend to clump together when placed in solution, forming discrete blobs rather than the even, continuous network that piezoresistive sensing requires. To overcome this tendency, Yu is studying different chemical methods of encouraging CNTs to disperse, with an eye toward identifying methods that can be incorporated into commercial concrete mixing processes.

In addition to developing a manufacturing process for CNT/cement composites, Yu’s sensor concept also depends on developing a thorough understanding of the electrical and mechanical properties of CNTs. In the laboratory, Yu is currently investigating composites’ piezoresistive response to dynamic and static stresses as well as the effects of temperature, humidity, and other environmental factors. Yu’s research has also recently been extended as a result of funding from the National Science Foundation and the Federal Highway Administration.
Automated Vehicle Location, Friction Measurement, and Applicator Control for Winter Road Maintenance

Each winter, Minnesota uses an estimated 200 pounds of sand and salt per person to deice roads and keep them safe for travel. Deciding just where to apply the salt and sand mixture is the job of the state’s snowplow drivers—that’s in addition to directing the blade, clearing the snow, and driving in adverse weather conditions.

But the drivers’ job could become a lot easier thanks to an automated deicing system developed by mechanical engineering professor Rajesh Rajamani and colleagues Lee Alexander and Gurkan Erdogan for a research project funded by the Minnesota Department of Transportation (Mn/DOT). (Previous phases of this research were funded by the ITS Institute.)

The system relies on a sensor attached to a small wheel mounted near the front axle of the snowplow. The sensor wheel is mounted at a slight angle to the snowplow’s direction of travel, causing it to receive a constant lateral force as the plow moves forward. When the snowplow passes over icy pavement, the sensor wheel slips more easily and experiences less lateral force, indicating a proportional drop in the tire-road friction coefficient. Data on the amount of lateral force against the sensor wheel are continually sent to an onboard data processor, which calculates the friction coefficient and signals the deicer applicator to release sand and salt as the rear of the plow passes over the slippery area a quarter of a second later.

One of the most difficult challenges the team faced in designing the system is that data from the sensor wheel contains a lot of “noise” caused by oscillations in the body of the snowplow and irregularities in the road surface. Normal steering and acceleration cause additional variations in the signal from the sensor wheel. The researchers developed a set of sophisticated filtering algorithms to deal with these factors, enabling the system to accurately determine the friction coefficient under real-world operating conditions.

According to Rajamani, the new system is reliable, has few moving parts, and is inexpensive to build; the total cost of the components is less than $1,500. “This system reduces the burden on drivers because it relieves them of controlling the applicator, deciding when to sand, and determining what the rate of sanding should be,” Rajamani said.

The system also reduces unnecessary use of salt and sand because it targets only icy spots on the road. This saves money and limits environmental damage caused by the overuse of chemicals. In addition, the system employs GPS technology that collects quantitative data that could be used both to identify areas likely to become slippery and to inform the general public about winter road conditions.

In April, the deicing system received the Research Partnership Award from the Center for Transportation Studies [see page 45]. The system has also been featured on KSTP-TV, in the Minnesota Daily (the University of Minnesota’s campus newspaper), and as a lead news item on the University of Minnesota Web site.

The researchers are confident the deicing system will soon be ready to roll on Minnesota’s streets and highways. “We are hoping that this technology will be evaluated by Mn/DOT supervisors and snowplow drivers on two or three snowplows during the next year,” Rajamani said.
A car traveling along a rural road stops at an intersection with a divided highway. The driver waits for a gap in traffic on the highway, then moves forward into the intersection to merge with highway traffic. But the driver has made a dangerous miscalculation, and the car is struck by an oncoming vehicle that closed the gap too quickly.

This scenario plays out every day on rural roads throughout the United States, often with fatal results. Recent research has shown that driver miscalculation, or unsafe gap acceptance, rather than issues such as stop sign violations, is the key factor contributing to crashes at unsignalized rural through-stop intersections.

But a groundbreaking system now being field-tested could reduce the number of such crashes by giving drivers reliable, accurate information about approaching traffic. The system, developed by researchers from the ITS Institute’s Intelligent Vehicles Laboratory (IV Lab) and HumanFIRST Program in cooperation with the Minnesota Department of Transportation, uses multiple sensors and advanced computer algorithms to track vehicles moving along a rural divided highway.

The Cooperative Intersection Collision Avoidance Systems–Stop Sign Assist (CICAS-SSA) system warns drivers stopped on a secondary rural road when gaps in the highway traffic are too small to allow entry or cross safely. On the active LED icon-based sign, a yellow rectangle indicates an approaching vehicle, and a red circle and red rectangle warn that the vehicle poses a threat to drivers preparing to cross or merge.

Key players in this interdisciplinary project are Craig Shankwitz, director of the IV Lab, and researchers Arvind Menon and Alec Gorjestani. Also collaborating is Mike Manser, director of the HumanFIRST Program, along with researchers Janet Creaser, Justin Graving, and Ensar Becic. ITS Institute director Max Donath is the principal investigator.

If the CICAS-SSA system works well, costly reconstruction of dangerous intersections could be avoided. The system is economical: the cost of the SSA system is about the same as that of a four-way stop light, but unlike the stop light, the system doesn’t decrease the capacity of the expressway. The cost of a sign (there are four per intersection) might be reduced by designing a custom version once the system has proven successful at reducing crashes at these intersections.

A three-year field test of the CICAS-SSA system began in January 2010 when the first system was activated at the intersection of U.S. Highway 52 and County State Aid Highway (CSAH) 9 in Goodhue County near Cannon Falls, Minnesota. This intersection was chosen because a statewide analysis of through-stop expressway intersections showed it had a history of serious crashes and fatalities—for which unsafe gap acceptance was a key contributing factor.

A second SSA system was activated in April 2010 in
Washburn County, Wisconsin, at the intersection of U.S. 53 and Wis. Hwy. 77, about 40 miles south of Spooner. This intersection also has a history of serious crashes.

This fall, two more systems will be activated: the first on Minn. Hwy. 23 at CSAH 7 in Lyon County near Marshall, Minnesota, and the second on U.S. 169 at CSAH 11 in Milaca County. During the three-year period from 2006 to 2008, an average of four right-angle crashes per year have occurred at each of these two intersections.

The CICAS-SSA field test will follow three tracks. The first track—implemented at the Goodhue County, Minnesota, and Washburn County, Wisconsin, sites—consists of continuous data collection for all traffic passing through the intersection on both the major and minor roads. These data will be subjected to a “macroscopic” analysis to determine whether the SSA system helps drivers reject smaller gaps and accept larger ones. If so, this will mean that drivers are making better decisions at the intersections, which should reduce the number of crashes.

In the second track, which will be implemented at the Lyon County intersection, instrumentation will be installed in the vehicles of 30 drivers who normally pass through the intersection. Data collected by the instrumentation will be subjected to a “microscopic” analysis of driver behavior. This analysis will quantify both how drivers respond to the CICAS-SSA system, and whether the system leads drivers to accept safer gaps over time.

The third track, implemented at the Milaca County intersection, will simply monitor the intersection to verify whether there is a reduction in crashes due to the CICAS-SSA deployment.

Although field-testing is still in the preliminary stages, the early results are promising. At the Goodhue County intersection, one crash occurred during the seven months from February through July 2010; normally there would be an average of six per year. At the Washburn County intersection, no crashes occurred in the four months from April through July 2010. This is especially significant as that intersection is located in an area of Wisconsin that is heavily traveled during the spring and summer.

Over the course of the field test, the research team will determine whether driver decision making and behavior change over time as a result of learning, familiarity, or satisfaction with the CICAS-SSA system. If drivers learn to make better decisions (that is, if they learn to cross or merge only when the gap is safe), crash rates may drop for nearby intersections as well, not merely those at which the CICAS-SSA system is deployed.

[More information about rural unsignalized intersection research can be found at www.its.umn.edu/Research/FeaturedStudies/intersections/index.html.]
The I-94/I-90 freeway corridor between the Minneapolis-St. Paul metropolitan area and Chicago is one of the most important links for freight traffic in the Upper Midwest, and freight traffic on the route is steadily increasing. To help the Minnesota Department of Transportation (Mn/DOT) better understand freight movements along this key corridor, Chen-Fu Liao, senior systems engineer with the Minnesota Traffic Observatory, evaluated data from the national Freight Performance Measure (FPM) system. Liao worked with John Tompkins, project manager with Mn/DOT’s Office of Freight and Commercial Vehicle Operations, who helped coordinate the data from Wisconsin and Illinois. The research was sponsored by Mn/DOT.

The Freight Performance Measure system is a collaborative effort of the Federal Highway Administration and the American Transportation Research Institute (ATRI). Since 2002, the system has collected data from automatic vehicle location (AVL) units and cellular/wireless communication systems installed on commercial vehicles in order to measure freight movements along the interstate highway system. Currently, the system has the ability to derive average truck travel speed and travel time on all national highways.

Liao’s research is an effort to extend the utility of the FPM system by deriving new performance measures from the data collected. Understanding how traffic volumes affect the reliability of shipping times between major commercial centers, for example, will be useful to logistics planners who need to estimate how long it will take to move goods from place to place.

The ATRI receives more than two billion data points every year, and the amount of data is expected to double in just a few years. Liao’s research addressed the need to develop efficient techniques for turning this huge volume of data into usable information.

Liao’s research analyzed data on heavy trucks (mainly commercial Class 8 vehicles weighing over 20,000 pounds). Using statistical software, he processed data on truck trips along the corridor from May 2008 to April 2009, including truck speed, speed variation, truck volume variation, distribution of destinations, stop location, and rest duration. Based on this data, Liao developed methods to measure the level of congestion and travel-time reliability along the corridor.

Results from the FPM analysis could be applied to a number of freight planning issues, Liao says, including measuring truck travel-time reliability and the impact of congestion on the cost of freight, determining where truck stops or parking facilities are needed, and evaluating how traffic volume affects cars and trucks differently.
Anyone who has waited a long time at a red light on a busy road knows how challenging it is for traffic planners to get the signal timing right.

The timing patterns of current traffic signals use data from historical loop-detector traffic counts. These data don’t take into account daily traffic fluctuations based on crashes, seasonal patterns, bottlenecks at other upstream or downstream intersections, or other factors that can influence driver decisions.

But researchers at the University of Minnesota are working on a new method that would feed real-time traffic data into signals on arterial roads. Their aim is to capture data from the increasing number of vehicles that have GPS equipment and the ability to communicate their location.

“We envision that in the future, cars will have a communication mechanism,” said Henry Liu, assistant professor in the Department of Civil Engineering, who is leading the research sponsored by the ITS Institute. “Cars will be able to talk to the intersection controller and talk to each other to communicate their speed and location on a link.”

To use the new data, Liu and his team developed a model that could incorporate both the real-time GPS data, which include the speed and trajectory of individual vehicles, with loop-detector data on traffic volumes.

“The important thing is the technology is now available to track vehicles over a short segment to allow us to determine their location and speed at a certain point,” Liu said. “We’re looking at how these new data can help us develop better signal timing.” Their work is one of the first attempts to estimate traffic flows on an arterial road with traffic signals using the in-pavement detector and GPS data.

To create their new traffic models, Liu’s team faced several challenges. The first was the unpredictable nature of traffic at signalized intersections. Many current traffic density models are based on the continuous flow of traffic on a freeway. But multiple lights interrupt traffic on arterial roads, and drivers have multiple turn options at each intersection.

“What we found is that it’s not easy to estimate density on a signalized link,” Liu said. “The traffic dynamics are actually very complex. First, your measurements are not ideal. Second, the current traffic flow model is really a coarse approximation of the real world.” In addition, his team assumed they would only know the trajectories of a portion of the GPS-equipped vehicles, or probe cars.

To adjust for the incomplete data, Liu used a Kalman filtering model, which allowed him to combine the two data sources and filter out potential errors, both in measuring and in estimating the traffic. Liu and his team then merged hardware-in-the-loop data from a signalized arterial road with GPS speeds and detector counts in a computer model and tested examples for a signal link with eight different GPS penetration rates.

By using this Kalman filtering model, combined with the data, the researchers were better able to estimate the traffic density on a signalized link, Liu said. “This density estimate is the critical piece for traffic signal timing.”

The researchers found that a 10 percent penetration rate of GPS-equipped vehicles was critical to ensure accurate density estimates, but additional GPS-equipped vehicles did not improve the estimation error rates significantly.

With several states currently pursuing funding for the Federal Highway Administration’s IntelliDriveSM research, Liu sees his model as an important step forward. (IntelliDrive is a multimodal initiative seeking to enable networked wireless communications among vehicles, the infrastructure, and passengers’ personal communications devices.) Although IntelliDrive tests are still in the early stages, the networking capability of vehicles on the road is “increasingly becoming universal,” he said. “If it’s going to happen, we’re well prepared to take this to the next step.”
Imagine a driver in the not-so-distant future rushing to meet a new client. As she drives, the car’s GPS helps navigate unfamiliar roads; traffic-monitoring technologies warn of potential traffic delays ahead and suggest alternative routes.

The driver arrives at her destination safely with time to spare. But as she turns off the ignition, an on-screen display informs her that she owes $315 in traffic fines—for speeding, improper lane changes, and failure to come to a complete stop at a crosswalk. All offenses were recorded and reported to local law enforcement agencies by the very technologies that assisted her in her travels.

This hypothetical situation may never come to pass, but current developments in intelligent transportation systems (ITS) make such monitoring and enforcement a real possibility. “Most ITS applications gather and compile data, and the potential use of [these] data is beginning to raise privacy concerns,” said Frank Douma, assistant program director of the State and Local Policy Program at the University of Minnesota’s Humphrey Institute of Public Affairs.

Douma recently completed an investigation of the legal and policy implications of new ITS technologies. Assisting Douma were graduate students Jordan Deckenbach, who coauthored the project’s final report, and Steve Frooman, who helped in the early stages of the project, which was sponsored by the ITS Institute. Stephen Simon, a professor at the University of Minnesota Law School, served as expert advisor.

The research team members examined applicable federal and state laws, studied law review articles, and reviewed court decisions. They discovered that the United States currently lacks a comprehensive legal framework for privacy, relying instead on a nebulous web of state and federal constitutional provisions and statutes.

To help ITS developers anticipate the legal implications of new technologies, Douma and his team created a privacy law “toolbox.” Included are three essential considerations about the range of information that ITS technologies may collect and use.

First, developers should determine where the collected information falls on the spectrum of anonymous versus personally identifiable data. Truly anonymous data present no problem, but the collection of personally identifiable data may lead to legal challenges. To avoid these legal challenges, developers must find creative solutions that minimize the need to collect identifiable data.

Second, when a new technology does require the collection of personally identifiable information, consent becomes an important issue. Allowing drivers or other users to choose to share their information (that is, to “opt in”) is preferable to requiring those who do not want to participate to “opt-out.” When consent is voluntary, liability over ITS information practices can be limited or even waived.

Finally, it is important to determine who will collect the data and with whom the information will be shared, Douma said. Regulatory approaches differ depending on whether data are collected by a government entity or a third-party organization. In each case, the legal challenges and liabilities for ITS managers are different.

Douma and his team also created a taxonomy of privacy expectations and legal protections. Each level of the taxonomy includes the type of observation and its purpose, the vehicle and driver information collected, and the expectation of privacy and legal protection.

On the simplest level, using a counter to monitor traffic flow requires no collection of vehicle or driver information and has virtually no privacy or legal consequences. At the other end of the spectrum, using a
You love your job, but the commute is painful. Gas is expensive and traffic is bumper-to-bumper. What if you could work from home and avoid the commute, at least a day or two each week? Not only might you be happier and more productive, but the benefits of your telecommuting would also extend to the environment and area roads.

Telework—the ability to work from home and connect to office, coworkers, and clients via the Internet, phone, and mobile devices—has the potential to limit the need for expanded transportation infrastructure. Less driving also means reductions in vehicle-miles traveled (VMT), auto emissions, and greenhouse gases. An estimated 40 percent—or about 700,000—of the Twin Cities’ 1.8 million residents have the type of job that would allow them to work from home at least part of the time.

In 2007, the United States Department of Transportation selected the Minnesota Department of Transportation and the Twin Cities Metropolitan Council to participate in its Urban Partnership Agreement program (UPA). The purpose of the program is to reduce congestion in urban areas through the use of the “4Ts”: tolling, transit, technology, and telework. The Minnesota UPA projects focus specifically on traffic congestion in the I-35W corridor and downtown Minneapolis.

The original goal of the Minnesota UPA telework component sponsored by Mn/DOT was to recruit and retain 500 new telecommuters in the Twin Cities metro area. After the project was rebranded as eWorkPlace, the goal was expanded to 2,700 participants to be recruited between June 2009 and June 2010. The project also aimed to reduce congestion in the metro area by shifting a minimum of 5,400 trips each week from peak to non-peak hours.

According to Adeel Lari, a research fellow and director of innovative financing at the University’s Humphrey

Research assistant Cynthia Yuen, research fellow Adeel Lari, and research assistant Denise Huynh examined the benefits of telecommuting.

Minnesota UPA Telework Component

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Institute of Public Affairs, these goals have been met. Lari, who directed the project, was assisted by graduate students Denise Huynh and Cynthia Yuen.

EWorkPlace also attracted more than 30 employers, ranging in size from Design 1, with 20 employees, to Hennepin County, with more than 8,000 employees—about 18 percent of whom were able to participate.

The research team used electronic survey techniques to collect information from participating employees and companies. Employees kept a survey diary and were asked questions that assessed qualitative and behavioral changes.

The collected data indicate that the average eWorkPlace participant saves about $10 per telework day in fuel and vehicle maintenance costs. Since the typical teleworker works remotely 2.4 times per week, or the equivalent of approximately five commute trips, the annual savings add up to about $1,170.

Employees also reported a reduction of more than 30 percent in peak period trips, as well as a reduction of more than 46 percent in VMT. In addition, eWorkPlace participants saved an estimated 22.5 minutes in commute time on telework days. Over the course of a year, this frees up more than 43 hours to spend with family, volunteer, invest in professional growth opportunities, exercise, or work on a hobby.

Companies were surveyed before they began participating in eWorkPlace, three months after they started, and again after nine months. In general, employers reported increased productivity, better retention, and reduced absenteeism. Fairview Health Services, for example, documented less stress, better well-being, higher expectations, and improved relationships for both managers and employees. The company also noted a 50 percent decrease in overtime hours and a 3.6 percent decrease in the average number of trips made by employees during rush hour.

“Minnesota is the only UPA partner that has mounted such a far-reaching telework program,” Lari says. “It includes public education and outreach, as well as comprehensive measurement and evaluation.” The eWorkPlace Web site (www.eworkplace-mn.com) offers information about telecommuting, employer resources, a “press room” with the latest news about the project, and a blog written by Lari. EWorkPlace also has its own Facebook page, and fans of telework can follow eWorkPlace on Twitter.

Minneapolis mayor R.T. Rybak, St. Paul mayor Chris Coleman, Bloomington mayor Gene Winstead, and Minnesota governor Tim Pawlenty all proclaimed April 2010 “Explore and Experience Telework Month.” In addition, a bill introduced into the Minnesota House of Representatives during the 2009–2010 session called for allowing state workers in appropriate jobs to “perform telework during at least 20 percent of the [their] normal expected hours of work in each pay period.”

Lari expects eWorkPlace to continue beyond the UPA completion date in December 2010. In a follow-up project, he will focus on measuring the economic benefit of telework to employers and their bottom lines.