Student pass program provides educational, economic, societal benefits

In August 2013, all transportation-eligible Minneapolis high school students began using public transportation instead of yellow school buses under the Go-To Student Pass Program. The program, a partnership between Metro Transit and Minneapolis Public Schools (MPS), enables students to take unlimited rides on regular-route buses and light rail from 5 a.m. to 10 p.m. daily during the school year.

A just-released analysis of the program by U of M researchers documents a range of benefits—

‘New logistics’ will change the way goods are delivered—and how the road network is used

Today, moving freight accounts for more than a third of the world’s transport energy—and that share is growing. The rise in global trade, online retailing, and business-to-business delivery is not only changing how goods are moved but also the type of goods moved and how far or frequently they are transported.

Currently, this massive movement of goods throughout the economy relies on an intricate—and largely decentralized—multimodal network of truck, rail, ship, and airplane delivery. However, change is on the horizon. In a study sponsored by the Minnesota Department of Transportation
With early warning about traffic delays ahead of them, highway drivers can adjust their speeds to keep traffic flowing smoothly and avoid dangerous sudden stops that often result in rear-end crashes. Nationally, the U.S. Department of Transportation has made the development of smart speed harmonization and queue warning systems that can provide these warnings a high priority.

As part of this national effort, researchers at the U of M’s Minnesota Traffic Observatory (MTO) are working to establish a testbed for developing and testing connected vehicle technologies and applications, including speed harmonization and queue warning, as part of a project funded by the Roadway Safety Institute.

“A lot of people in the federal government [and] academia are creating new connected vehicle technologies,” says MTO director John Hourdos. “They will need a place where they can test them in a real environment—in a very interesting environment.”

The testbed is building on the MTO’s permanent I-94 field lab, which consists of three rooftop locations equipped with surveillance cameras and machine-vision sensors focusing on a high-crash area of I-94 in Minneapolis.

“We are very fortunate to be near a very unfortunate site,” Hourdos says, referring to the area that experiences more than 100 crashes annually—the majority of which are rear-end crashes resulting from a failure to stop or too little headway. Since 2003, this lab has been capturing detailed data on hundreds of crashes, including sensor data, video records, and Minnesota Department of Transportation control actions.

This project is adding two basic elements to the current I-94 lab: high-resolution radar sensors, which will allow the researchers to collect vehicle trajectories, and a communication element in the form of roadside units that transmit radio signals compatible with the dedicated short-range communications (DSRC) standard.

So far, researchers have been deploying and testing the sensors in different locations, allowing them to better gauge radar accuracy and improve speed detection. They are also able to compare the new sensor data with that from existing camera locations for real-time observation. In addition, they’ve upgraded their wireless communication and used the improved sensor data to create and test a new version of the queue warning application.

Next steps include deploying additional sensors, conducting live field tests of the infrastructure-based queue warning application, and developing a vehicle-to-infrastructure (V2I) version of the application.

Ultimately, Hourdos says, the result of this project will be a fully functional connected vehicle testbed uniquely situated to attract freeway safety-oriented V2I and vehicle-to-vehicle safety application development, implementation, and evaluation projects.
In coming years, bus rapid transit (BRT) will play a growing role in the Twin Cities transit system. Later this year the A Line will open along Snelling Avenue in Roseville and St. Paul; plans for the Metro Orange Line (along I-35W in the south metro), Metro Gold Line (along I-94 in the east metro) and additional arterial BRT lines are advancing; and the Metro Red Line (along Cedar Avenue in the south metro) is continuing to grow.

“One of the drivers behind the transitway build-out is to increase employment access by transit,” says Andrew Guthrie, research fellow with the Humphrey School of Public Affairs. “Achieving that to the fullest extent possible requires job growth in station areas. Even if the same number of jobs would have been added elsewhere in the region without the transitway, jobs that are easily accessible by transit have additional social benefits.”

In a project funded by the Transitway Impacts Research Program (TIRP), Guthrie and co-investigator Yingling Fan compared job-change rates around dedicated guideway BRT, arterial BRT (in which buses operate primarily in mixed traffic), and light-rail transit (LRT) corridors before and after implementation in 15 regions around the nation. BRT corridors include high-amenity stops, signal priority, and off-board fare collection.

“Planned BRT corridors already serve 500,000 jobs as well as businesses that collect half of the region’s sales tax revenue,” says Charles Carlson, senior manager for BRT at Metro Transit. “But these corridors often suffer from slow transit speeds and a lack of fixed stations. Upcoming BRT improvements will improve regional job access and position these corridors for planned development.”

The researchers separated jobs into different sector categories defined by skill level and type of work: blue collar (low skilled, production), pink collar (low skilled, service), and white collar (high-skilled, professional). In addition, they separately considered differences between low-wage and higher-wage jobs.

“Our project is unique because it uses a consistent, comparable national sample of transitway stations and directly studies job growth and loss, as opposed to less direct measures of economic activity such as commercial property values,” says Guthrie, the study’s principal investigator.

One key finding is that job growth varies among the different transitway modes. “The greatest difference in station-area job change was between some type of fixed infrastructure and no continuous fixed infrastructure at all,” Guthrie explains.

Arterial BRT attracted fewer station-area jobs than LRT or dedicated guideway BRT. “Promoting growth and a corridor identity along any transit corridor is an important strategy to attract job growth,” Guthrie says. “This is particularly important along arterial BRT projects to create public awareness of these lines.”

The team also found differences by job sector and wage. “Businesses hoping transit brings customers to their area prefer rail, while businesses that see transit more as improving access for employees see little difference between LRT and dedicated guideway BRT,” Guthrie explains. Arterial BRT stations were associated with significantly less job growth than otherwise similar LRT stations; overall, job growth was strongest in stations closest to downtown areas (where many arterial BRT corridors are located). Distance from the central business district was a strong negative predictor of both white-collar and high-wage job growth.

Another key finding is that total street mileage (excluding limited access highways)—a measure of transportation network density—was a significant, positive predictor of jobs. “This underscores the importance of fine-grained connectivity between transitway stations and their surroundings,” Guthrie says. “Providing street connections to stations in suburban areas will be a critical step for attracting jobs.”

Finally, the study found that regional factors, such as rate of job change after implementation, are highly important in determining changes in station-area jobs. According to Guthrie, this finding speaks to the importance of broad, regional policies that support economic growth. It also shows strong potential for future BRT station areas in the Twin Cities region to share in regional job growth, he says.

TIRP was launched by the Hennepin County–University of Minnesota partnership and has grown to include a mix of funding partners and program supporters.
Thinking globally, acting locally: confronting Minnesota’s freight and logistics challenges

Traffic congestion in one metro market can hurt regions thousands of miles away.

Today’s global economy is fast-moving and more competitive than ever—and more metropolitan-centered than ever. Metropolitan leaders, along with their state and federal peers, must begin to “design policies to address the new reality of the modern metropolis,” said Adie Tomer, the keynote speaker at the 18th Annual Freight and Logistics Symposium.

Leaders and experts from all walks of transportation discussed this new logistics reality and other challenges and opportunities at the December event in Minneapolis.

National trade statistics generally look only at how the U.S. trades with other countries, said Tomer, a fellow at the Brookings Institution Metropolitan Policy Program. “When an airplane built in Seattle by Boeing is sold to Delta Airlines in Atlanta…we can’t see that anywhere in our trade statistics.”

Trade concentrates in large metropolitan areas: 80 percent of traded value starts or ends in them. Without a full understanding of how these trade networks work together, leaders in both the public and private sectors cannot develop targeted freight strategies and transportation investments to support the extensive supply chains that underpin the U.S. economy, Tomer said.

In its Metro Freight research series, Brookings Institution researchers addressed these data deficiencies. Their findings help better explain how communities relate to each other and what their freight needs might be moving forward, Tomer said, and help drive home the importance of trade in economic terms.

Large cities—home to the bulk of economic activity—are also where most traffic congestion occurs. Congestion in one market can hurt regions hundreds or even thousands of miles away. And the problem will only get worse, Tomer predicted. The Brookings research indicates that urban trucking is continuing to grow, directly coinciding with the rise of e-commerce and the use of digital communications to manage shipping.

Other speakers discussed new federal law and state policies. The Fixing America’s Surface Transportation Act (FAST Act), signed in December 2015, establishes both formula and discretionary grant programs to fund critical transportation projects designed to benefit freight movements.

“The FAST Act has a lot of ingredients many of us have been advocating for, for many years,” said Bill Gardner, director of the Office of Freight and Commercial Vehicle Operations at the Minnesota Department of Transportation (MnDOT). “There is dedicated freight funding that I think is a game changer.”

Gardner also reported on Minnesota’s recently updated statewide freight system plan, which provides a new policy framework and strategies to guide planning and investment in various transportation modes. The action agenda will drive freight system improvements for the next 5 to 10 years.

Panelists then discussed implementation of the plan. Tim Henkel, assistant commissioner of modal planning and program management at MnDOT, said all infrastructure is rapidly aging, so serious discussion is needed about revenues. Without that conversation, MnDOT will be able only to preserve the system and unable to tackle the many strategies in the action agenda.

Senator Scott Dibble agreed, adding that such a dialog will be necessary for government leaders to respond with tangible policy changes and projects.

The symposium was sponsored by CTS in cooperation with MnDOT, the Minnesota Freight Advisory Committee, the Council of Supply Chain Management Professionals, the Metropolitan Council, and the Transportation Club of Minneapolis and St. Paul. A proceedings summarizing all the sessions will available online.

Within U.S. borders, $17 TRILLION WORTH OF DOMESTIC GOODS is traded between regions.
MnDOT) and the Minnesota Local Road Research Board, U of M experts outline the important impacts these changes will have on the road network and transportation infrastructure.

“There is hope that new methods of organization and proposed standardization will increase efficiency of freight movement and give rise to a new era of goods transport,” says Adam Boies, an assistant professor in the Department of Civil, Environmental, and Geo-Engineering (CEGE). “In the years to come, we expect that advances in logistics systems will be enabled by new technologies, approaches, and the desire for increased efficiency.”

Changes in the way logistics operations are organized will help drive advances. New information technology permits the sharing of data between and across businesses, which in turn drives efficiency and leads to fuller vehicles. “This may reduce the distance traveled by heavy goods vehicles per unit of GDP, which may in turn reduce costs and entice more demand for delivered goods,” says CEGE professor David Levinson, the study’s principal investigator. “Ultimately, this could mean fewer trips by individual consumers and more deliveries. We anticipate the result will be a net reduction in distance traveled.”

The study also examined some of the potential drivers for changes in the freight industry as a result of logistics reorganization. These include supply chain pooling, in which individual logistics operations are shared between collaborators, and the Physical Internet Initiative, which seeks to create standards for packaging to enable the homogenization of freight technology. “While both of these advancements have the potential to increase logistics efficiency by reducing the transportation of empty loads, they will also increase truck weights—which may increase pavement damage,” Boies says.

Other transportation and logistics changes will result from shifts in the ways businesses and consumers receive goods and services, including business-to-business systems and technologies that enable a sharing economy, same-day delivery services, 3-D printing, and “last mile” delivery services. In addition, a growing portion of purchases can be delivered directly over the Internet. “Delivery is easily automated for data-based goods like books, music, video, and software,” Levinson says. “Purchases that could once only be completed by moving things can now be done by moving data.”

The research is part of a multi-pronged study that analyzed the technological shifts altering surface transportation and the implications for Minnesota. Other contributors included associate professors Jason Cao and Yingling Fan of the Humphrey School of Public Affairs. Their high-level white papers are compiled in a final report: The Transportation Futures Project: Planning for Technology Change. Future issues of Catalyst will share findings from other chapters.

New webinar series focuses on moving research into practice

The Roadway Safety Institute has launched a new joint webinar series in partnership with the Midwest Transportation Center at Iowa State University. The Transportation Safety Webinar Series: Moving Research Into Practice will be held monthly from February through May 2016.

The series will highlight innovative transportation research and feature both researchers leading the work and practitioners implementing results in the field. Speakers will include researchers from the U of M’s Minnesota Traffic Observatory and HumanFIRST Laboratory.

More information is available at roadwaysafety.umn.edu/events/webinarseries.
from better student attendance to financial savings to reduced vehicle mileage and emissions.

“Several other cities across the country have implemented similar cross-sector programs,” says Yingling Fan, associate professor in the Humphrey School of Public Affairs and the principal investigator. “Their experience points to significant benefits, but solid research about the impacts of the approach has been limited.”

“We believed from the beginning that the Student Pass program would benefit students, schools, and Metro Transit,” says Metro Transit general manager Brian Lamb. “We’re pleased to have the data that explain and confirm the benefits.”

For the analysis, Fan and research fellow Kirti Das used existing data from MPS and Metro Transit and collected additional data through surveys completed by more than 2,400 students and about 500 parents during May–July 2015.

Highlights of their findings:

- **Educational.** The pass not only helps students attend school more regularly—pass users had 23 percent lower absenteeism—it also provides access to after-school learning opportunities at and away from school.
- **Economic.** Metro Transit ridership increased significantly: by March 2014, 103 additional bus trips were added to accommodate growing ridership, typically increasing service frequency on regular routes. The costs of that extra service were almost entirely made up for by revenue from pass sales. For MPS, financial benefits totaled $1,550,412 in 2013–2014 from reduced contracting and fleet expenditures.
- **Transit perception.** Of the student pass users, 81 percent reported being “Satisfied” or “Very Satisfied” and 93 percent reported benefiting from the pass. Similarly, 80 percent of the parents reported being “Satisfied” or “Very Satisfied” and 85 percent reported that the pass had benefits for their family.
- **Younger rider base.** Students using the pass were more likely to report that they would use transit after graduation. This suggests that the program enables Metro Transit to tap into a young rider base and acclimatize them to transit use, increasing their chances of being transit users as adults.
- **Safety.** A higher percentage of female students reported negative perceptions related to safety while waiting for buses/trains at stops, walking to or from bus/train stops, and traveling on buses/trains compared to male students. Metro Transit and MPS are meeting to discuss these perceptions and consider potential solutions.
- **Mileage.** Annual reductions were estimated at 18,304 trips and 158,400 vehicle-miles traveled (VMT) from replacing yellow buses and 2,038,784 VMT from personal vehicles.
- **Emissions.** Estimated annual emissions were 93 percent lower for nitrogen oxide, 89 percent for particulate matter, and 59 percent for CO₂.
- **Equity.** Reported benefits and level of ridership were most pronounced for students eligible for free/reduced lunch and those who were black, foreign-born, or belonged to single-parent families.

After expanding the program in 2015—including a Summer Student Pass pilot—Student Pass ridership increased 12.5 percent from 2014 to nearly 4 million rides. Metro Transit continues to consider opportunities to expand the program in the future. Learn more about the Student Pass program at metrotransit.org/student-pass.

The analysis was funded by Metro Transit. The report—Assessing the Impacts of Student Transportation on Public Transit—is available on the CTS website.

Students using the pass were more likely to report that they would use transit after graduation.
Transportation summer camp scheduled for July 11–22

CTS will once again give students a hands-on introduction to transportation as part of the National Summer Transportation Institute (NSTI) July 11–22.

The free, two-week program is designed to help students entering grades 7–9 explore transportation topics and to spark their interest in science, engineering, and transportation careers.

Planned activities include classroom and laboratory sessions with transportation experts, field trips to facilities around the Twin Cities, and a group project.

Know any students that would like to attend? Applications are due April 8.

More information and instructions are available at cts.umn.edu/summercamp.

U of M faculty and students share research at TRB national conference

U of M researchers presented in more than 50 sessions at this year’s Transportation Research Board (TRB) annual conference in Washington, DC, on January 10–14.

Presenters shared their papers and posters on wide-ranging topics, including work-zone safety, pavement preservation, accessibility, and public transit.

In addition, 24 graduate students received travel awards to attend the conference, where they also presented research and networked with other attendees. Nine of the awards were funded by CTS and fifteen were funded by the Roadway Safety Institute.

NEW RESEARCH REPORTS

Recently published reports on transportation-related research at the University of Minnesota explore the following topics:

EFFECT OF TEMPERATURE ON PRESTRESSED CONCRETE GIRDERs (MnDOT 2015-50)

CONCRETE STRENGTH REQUIRED TO OPEN TO TRAFFIC (MnDOT 2016-01)

WATER USE AT MINNESOTA REST AREAS (CTS 15-11A)

Research reports are available at cts.umn.edu/Publications/ResearchReports.

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Student pass program provides educational, economic, societal benefits.

‘NEW LOGISTICS’ WILL CHANGE HOW GOODS ARE DELIVERED and roads are used.

Researchers are establishing a TESTBED for exploring CONNECTED VEHICLE TECHNOLOGIES.

BUS RAPID TRANSIT study offers insights for BOOSTING JOB GROWTH near station areas.