

CTS Catalyst

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Accelerating the pace of transportation innovation

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New tools engage the public in local road funding challenges and decision making

Ask any of Minnesota's county transportation officials whether there is a local road funding problem and you'll most likely hear a resounding "Yes!" Challenges these counties face include declining resources, rising expenses, deferred maintenance, and changes in who users are and what they want and need from their road system. The public, however, is typically unaware of these challenges—and therefore not engaged in the necessary decision-making process surrounding local road funding and service levels.

Engagement continued on page 5

New Accessibility Observatory to provide annual rankings for cities

Major American cities get a report card each year on their mobility, focusing chiefly on how fast motorists can drive on their highways. In coming years, however, cities will have another way of understanding their transportation systems thanks to the work of the Accessibility Observatory at the University of Minnesota.

The new Observatory will go beyond congestion rankings to focus on accessibility: a measure that examines both land use and the transportation system.

"Focusing solely on mobility and traffic delay doesn't provide a complete picture of how the

Accessibility continued on page 7



New tool helps MnDOT expand living snow fence program

On a drive through south-central Minnesota you'll encounter vast, unbroken expanses of corn and soybean fields. During a winter storm, this rural landscape and strong winds often combine to create big snow drifts and blowing snow that can strand motorists and reduce driver visibility. On average, 11 people die in Minnesota each year in blowing snow conditions.

This winter, the region's local MnDOT office is taking action to prevent blowing and drifting snow with the help of a new snow fence payment calculator tool developed by U of M researchers as part of a living snow fence study. Living snow fences are plantings of trees, shrubs, grasses, or crops used as windbreaks to control high winds and control drifting snow before it reaches the roadway. The tool is designed to analyze the benefits and savings of creating living snow fences—such as standing corn rows—in specific locations and compare that with the cost of managing blowing and drifting snow on the roadway.

"Leaving standing corn rows in certain areas can create tremendous benefits including increased motorist safety, improved visibility, fewer snow plow trips, lower salt usage, and fewer traffic slowdowns," says lead researcher Gary Wyatt, an agroforestry professor with the University of Minnesota Extension in Mankato. "At the same time, leaving standing corn rows means farmers can't harvest that corn with their combines in the fall, corn may grow up among soybeans the following season, and they must complete additional tillage during the busy spring season—so farmers need to be reimbursed for those costs."

Using the new web-based version of the snow fence payment calculator, highway officials can easily plug in values such as labor and material



The new payment calculator can be used to help set reimbursement rates to landowners.

costs for treating a specific stretch of roadway, site-specific crash statistics, and the current price of corn. The payment calculator takes those inputs and creates a cost-benefit analysis report that can be used to help set reimbursement rates to landowners for the creation of living snow fences.

This winter, MnDOT will use the payment calculator tool to determine where to add standing corn row snow fences in the area surrounding Gaylord, Minnesota—especially along the State Highway 19, 22, and 111 corridors, where blowing and drifting snow is a frequent problem. To further incentivize landowners to participate in the program, Wyatt is helping farmers connect with local 4-H groups for a unique fundraiser: 4-H members volunteer to hand-pick corn from the standing corn rows in exchange for a donation to the club.

"One of the big reasons I'm doing it again this year after taking last year off was the benefit of having the 4-H kids out to pick the cobs from the standing corn; we like to give it to the horses," says participating farmer Bryan

Sommers. "MnDOT is also giving a fairer price this year than in years back and the roads stay cleaner—no doubt about it."

Mike Barnes, MnDOT's operations director, says the decision tool "helps transportation managers see where they are getting the best value when deciding to invest in blowing and drifting snow control measures such as purchasing standing corn rows, planting living snow fences, installing structural snow fences, or possibly even regrading the road ditch."

In the future, researchers plan to make this payment calculator available to local Minnesota transportation agencies, as well as transportation agencies in other states and even other countries. "We will be putting this tool online next fall and conducting outreach workshops at both the state and national level to explain the tool and demonstrate how to use it," Wyatt says. "It's amazing to think that this research could have a positive impact on highway safety in snow regions across the country and potentially around the world."

I-35W ‘smart’ bridge stands the tests of time

Though still basking in the gleam of youth upon turning 5 in September, the new I-35W St. Anthony Falls Bridge is, like most of us, coping with a little shrinkage and creep.

But not to worry. Modern engineering technology finally may be able to provide the critical long-term maintenance strategies needed to keep the bridge satisfying generations of drivers.

For the past year, researchers at the University of Minnesota have been studying how the innovative engineering marvel spanning the Mississippi near downtown Minneapolis is aging. In more formal terms, the researchers have been focused on characterizing the time-dependent behavior of the post-tensioned, precast concrete box-girder bridge.

The researchers are monitoring nearly 500 sensors installed during construction of the bridge for strain, load distribution, vibrations, temperature, and the overall movement of the bridge. Other sensors help keep an eye on the bridge’s security and control automatic anti-icing and lighting systems.

As the bridge ages, the concrete will naturally shorten due to the process of “shrinkage.” The concrete will also “creep,” meaning that it will continue to deform with time due to the permanent gravity and post-tensioning loads. “Post-tensioning” is a way to strengthen the concrete structure using strands of steel that are tightened after the concrete hardens.

Brock Hedegaard, a civil engineering graduate student, is part of a research team led by civil engineering professors Cathy French and Carol Shield that is collecting and analyzing the “smart bridge” data to investigate the bridge’s structural behavior in a project funded by the Minnesota Department of Transportation (MnDOT).

“These time-dependent deformations take years to fully develop,” Hedegaard says. “Being able to predict how the bridge is expected to change is critical to evaluating the long-term performance of the structure.”

The research team is in the process of refining models to better predict the behavior of the bridge over time—data they plan to use as a baseline for detecting damage or potential problems in the structure. The award-winning bridge, constructed in 10½ months for \$234 million, is designed to last 100 years.

“The bridge is performing very well. In terms of long-term behavior, most models predict more deformation than we are actually seeing in the bridge,” Hedegaard says. “Traffic load is basically a non-factor for this particular bridge—it is such a small portion of the total load the bridge carries day after day, which is mostly self-weight and post-tensioning. Thermal behavior seems good, but we did find that thermal stresses were a bit higher than were expected in design.”

In conjunction with predicting the long-term structural behavior of the bridge, the research team has continued to monitor the sensors for behaviors related to temperature and time. Nearly every measure the team has evaluated has included dependence on temperature, time, or both. That

includes expansion joint movement, strains, and the dynamic modes of vibration.

The researchers found that warmer temperatures (above room temperature) speed up concrete creep and shrinkage, while colder temperatures slow down such time-dependent behavior. “When it is below freezing, the concrete deforms so slowly that for all practical purposes it stops,” Hedegaard adds.

The research team also is developing a unique prototype monitoring system that provides warnings to MnDOT Metro Maintenance personnel should problems arise in the expansion joints. They focused on the expansion joints first because those joints are easiest to incorporate into maintenance and inspection routines.

“We find the most value in the systems that will provide MnDOT with information on creep, shrinkage, and the movement of the expansion joints,” says MnDOT state bridge engineer Nancy Daubenberger. “The research under way at the U of M will help us better understand the behavior of these types of structures and inform future concrete bridge designers. In the near-term, the information on movement at the joints will also help us develop a maintenance tool.”

Once the monitoring framework for the expansion joint movement is finalized, the prototype also may be extended to evaluate other sensor data.

The award-winning bridge is designed to last
100 YEARS.



Forum: freight transportation aids state's economic competitiveness

Freight transportation is vitally important to jobs and economic competitiveness in Minnesota. This was the common message of the speakers at the Transportation Policy and Economic Competitiveness Forum held September 20 in Minneapolis.

The forum was part of a two-year project by researchers in the U of M's Humphrey School of Public Affairs. The project is exploring ways to understand and enhance the value of freight transportation, particularly freight rail, to Minnesota's economy, local communities, and the surrounding region.

Lee Munnich and Tom Horan, two of the researchers, shared interim findings from the study. Through data analysis and interviews with national and regional experts, the research team found that freight rail plays a vital role for key Minnesota industries. Growth in Minnesota's Gross State Product, for example, has been stronger than the national average each year during the economic recovery in several key industries dependent on rail: agriculture, mining, and manufacturing.

Freight rail's value, however, "is under-recognized in comparison to other modes of transportation," Munnich said. "Public perception often leans against freight rail due to its behind-the-scenes benefits but visible nuisances."

Next steps in the study include creating policy recommendations and sharing them with partners, communities, and the public, Horan said. The project, funded by BNSF Foundation, wraps up in 2014.

The forum then turned to perspectives from public- and private-sector leaders. Matt Rose, chairman and CEO of BNSF Railroad, stressed the importance of efficient freight networks in enabling U.S. workers to compete in the world market. Good supply chains also have the potential to help repatriate high-value jobs from offshore locations, he said.

Moving forward, what does the freight industry need? "It needs to be



Agriculture, mining, and manufacturing are key industries in Minnesota that depend on rail.

able to grow—on the highways, the railroads, the rivers, and at the ports," Rose said. Massive capital investments will be needed to handle a projected 60 percent increase in total freight tonnage by 2040. He added that the Humphrey School's study has important implications not just for Minnesota but also for many other states and Washington.

U.S. Sen. Amy Klobuchar also emphasized the importance of exports for economic growth. The diversity of Minnesota's economy, she said, helped us "keep our head above water" during the economic downturn—and the common thread among those diverse industries is exports. "We have to invent things and export to the world, and we're not going to be able to do that if we don't have a transportation system that matches our 21st century economy," she declared. "There is such a possibility for growth if the private and public sectors make a major commitment to investment."

The forum also included two panel discussions featuring businesses and local policymakers. Several noted the need to maintain our current



competitive edge with other countries. For example, Mahendra Mishra, assistant vice president of Esser Steel, explained that mining plays a huge role in the state's economy, and "rail freight and mining go together... We don't want a Gulf Coast steel mill to procure its inputs from as far away as Europe."

Former U.S. Congressman James Oberstar put his closing stamp on the forum: "Unless we resolve nationally to make a greater focus on freight and understand its role in our national economy, we're not going to be competitive in the international marketplace."

Engagement from page 1

To help overcome this communication barrier, the Minnesota Local Road Research Board enlisted the help of U of M Humphrey School of Public Affairs assistant professor Kathryn Quick. “Our aim was to develop a better understanding of the knowledge gaps surrounding local transportation funding that need to be addressed, then create a public engagement tool and conduct direct interventions to begin to engage the public in this issue,” Quick says.

The first challenge was explaining the complex nature of the road funding problem to a layman audience. To accomplish this goal, Quick and her research team—Zhirong Zhao, Guillermo Narvaez, and Emily Saunoi-Sandgren—developed an engaging presentation meant for a general audience that presents Minnesota’s road funding challenges in an accessible yet comprehensive way. The presentation outlines the nature of the problem, the reasons why the public should care about the issue, the history behind Minnesota’s road funding challenges, and the options for addressing the budget shortfall. “We found that even though most people weren’t aware of the road funding problem, once they became aware they did care about it,” Quick says.

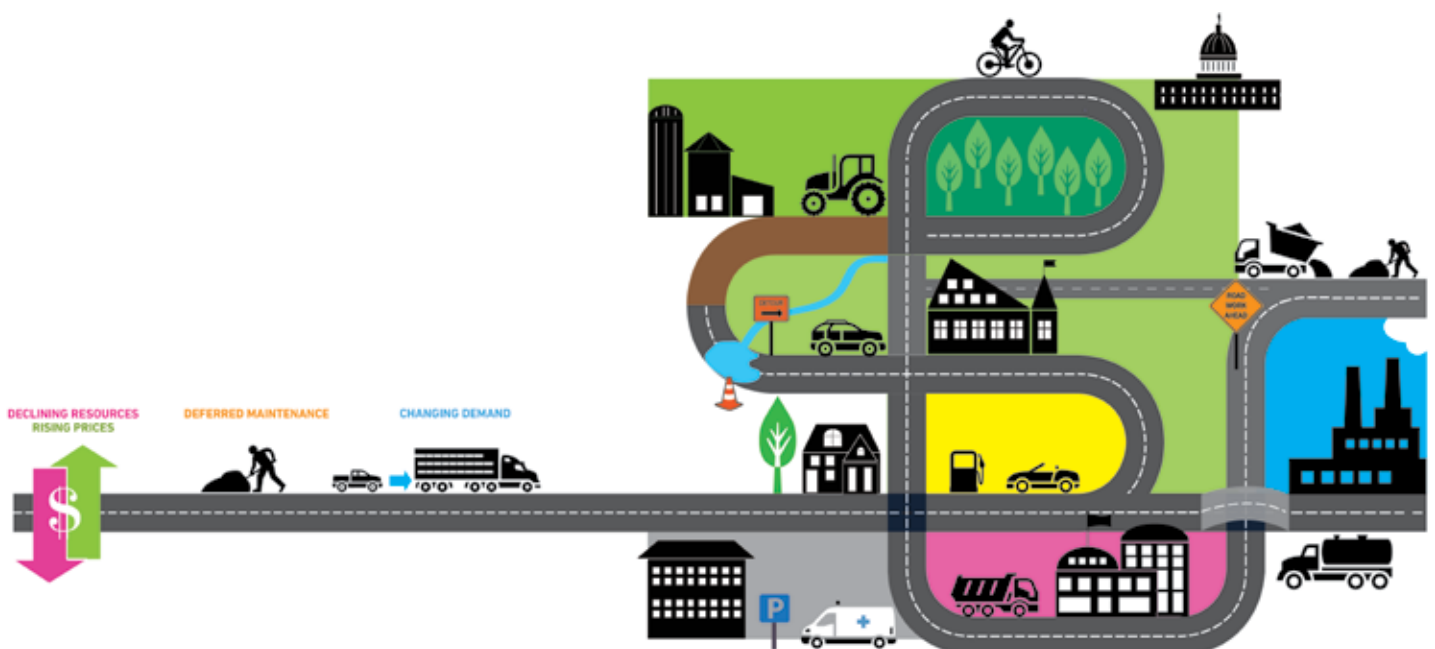
Throughout the summer, the research team conducted a series of community meetings to engage the public with the road funding issue in three Minnesota counties. The most comprehensive of those interventions occurred in Beltrami County, where the research team worked directly with a diverse group of stakeholders including county commissioners, county engineers, volunteer fire departments, school district transportation supervisors, local businesses, and interested members of the general public. “We gauged the interests and concerns of these various groups,” Quick says. “Then, we presented them with a range of options including changing roads from blacktop to gravel, adding

restrictions and fees for heavy vehicles, having the county commission create a local sales tax, and even doing nothing.”

According to Quick, the process generated interesting and promising results. The group’s attitude toward a local option sales tax changed throughout the intervention period—at the outset many people were strongly opposed to a new tax, and by the end of the process most individuals and the group as a whole expressed strong support for a new tax. County transportation officials also gained a better understanding of what options stakeholders would and would not be willing to support. In addition, there was overwhelming agreement that doing nothing was highly undesirable. “Everyone agreed that this was a real issue, and that’s an important message for policymakers,” Quick says.

Beltrami County officials plan to use the insight gained during this process to help guide their transportation decision making. “Moving forward, we now have a core group of stakeholders who are knowledgeable of the transportation planning and funding issues that the county faces. Hopefully they will be advocates for any future changes in policies or funding,” says county engineer Bruce Hasbargen. “Overall, these meetings have helped lay the foundation for future planning and funding discussions.”

Researchers will document this public engagement process in their final report (May 2014); they anticipate that the process will serve as a model for the many other counties throughout the state and country facing similar challenges. In the future, the research team hopes to complete similar public meetings in additional Minnesota communities. In the meantime, local road officials looking for an immediate way to engage the public in their decision-making process can use the presentation developed by the research team, available at tinyurl.com/local-roads.



The research team created an engaging presentation meant for a general audience that presents Minnesota’s road funding challenges.

Synthesis of transitway research published

The Twin Cities metro region is in the midst of a transit build-out. The Metro Blue Line (formerly known as Hiawatha), Red Line (Cedar Avenue Bus Rapid Transit), and Northstar Commuter Rail are in operation, and the Green Line (Central Corridor) opens next year. All are part of an expanding regional transit network.

These regional investments have the potential to significantly change long-term land-use patterns and travel behavior. They also raise important questions for policymakers and elected officials regarding the potential return on investment.

The Transitway Impacts Research Program (TIRP) was launched in 2006 to help answer these questions. Under the TIRP

umbrella, U of M researchers are providing an objective analysis of data, public perceptions, and complex impacts resulting from transitway investments. A 24-page synthesis of their work is now available on the CTS website.

The synthesis pulls together findings from TIRP studies completed over the past seven years as well as findings from two related projects. It summarizes the actual and projected impacts of transitways on the Twin Cities region, offering lessons learned to help guide the build-out of the rest of the network most effectively. It concludes with a set of implications for policymakers.

“This body of research and objective analysis confirm the many positive ways that expanding our transit network supports economic competitiveness, greater accessibility to jobs, opportunity for low-income populations, and enhanced livability for our region as a whole,” says Kate Wolford, president of the McKnight Foundation, the synthesis sponsor. “We learn through research and practice, and we should implement policy reform based on this analysis and the experience of our work.”

TIRP was launched by the Hennepin–University Partnership and has grown to include a mix of state, regional, and local jurisdictional partners. Read more and download the synthesis at cts.umn.edu/Research/featured/transitways.



Key findings

- Transitway investment is significantly improving access to jobs and workers, particularly benefiting low-wage earners.
- Transit improves mobility.
- Development is occurring along new and emerging transit corridors.
- The marketplace values transit access.
- People of all incomes benefit from transitway expansion, and those with lower incomes gain the most.
- A majority of residents and businesses see the value in transit.
- There is pent-up demand for transit-oriented development in the Twin Cities metropolitan region.
- Policymakers can maximize the benefits of transitway investment.



**READ
CATALYST
ONLINE**

for links to research reports and other resources.

Research Partnership Award: nominees sought

CTS is accepting nominations for the 2014 Research Partnership Award. The award honors research projects within the CTS program that have resulted in significant impacts on transportation. The award will be presented at the CTS annual awards ceremony on April 23, 2014.

Please submit your nomination to Shawn Haag of CTS by January 24. Criteria and submission instructions are at cts.umn.edu/about/awards/rpa.

Accessibility from page 1

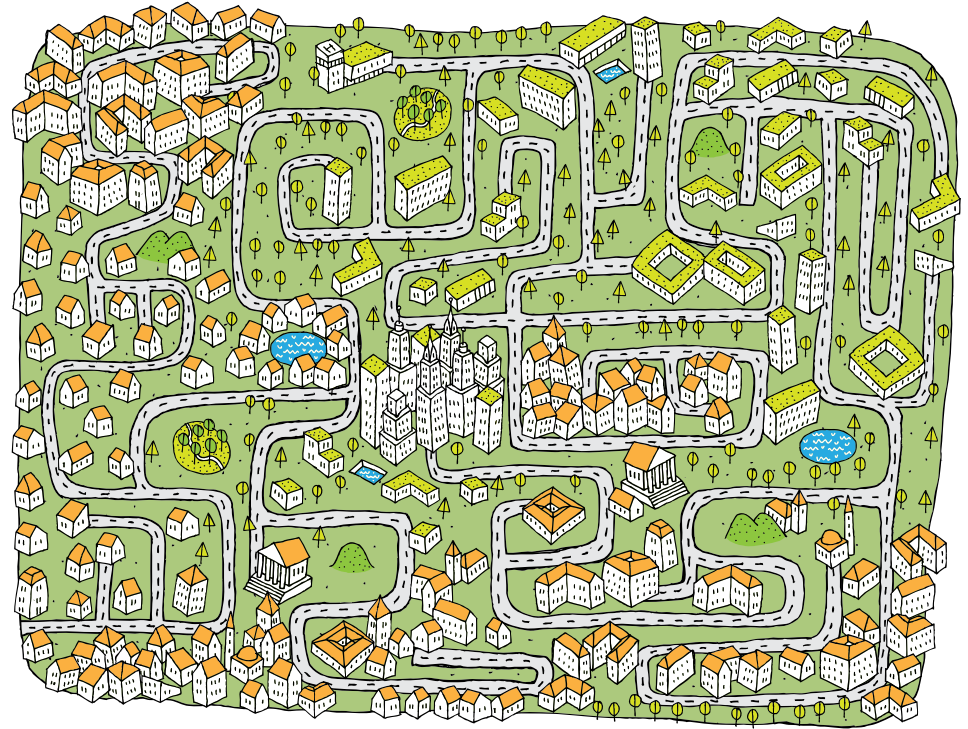
traffic system is functioning,” says Professor David Levinson, the RP Braun/CTS Chair in Transportation and principal investigator for the Observatory. “Travelers may be able to reach their desired destinations in a reasonable amount of time despite congestion because their cities have greater density of activities. In short, these travelers enjoy better access to destinations.”

The Accessibility Observatory, a program of CTS and the Department of Civil Engineering (CE), will focus on the research and application of accessibility-based transportation system evaluation. It will be guided by a threefold mission:

- To advance the field of transportation system evaluation through research of new data sources and methods for accessibility evaluation.
- To develop standards and tools to facilitate the use and communication of accessibility-based metrics in transportation planning, engineering, and evaluation.
- To apply its tools and expertise in support of continual improvements in the planning, design, engineering, and analysis of transportation systems.

The Observatory’s initial goal will be the development, application, and continuous improvement of a system for multimodal accessibility evaluation, says Andrew Owen, the Observatory’s director and a CE research fellow. Outputs from this system will be publicized through annual reports summarizing trends in accessibility across major U.S. metropolitan areas.

The first such report came out this past spring. *Access Across America*, published by CTS, evaluated the



accessibility provided by the road and highway systems in 51 U.S. metropolitan areas. “The study was the first systematic comparison of accessibility to jobs by car,” Levinson says. “It demonstrated the feasibility and the value of applying consistent accessibility evaluation methods across many cities.”

The *Access Across America* report was widely cited by transportation policy practitioners and commentators. For example, Reihan Salam of the *National Review Online* wrote that focusing on “accessibility rather than infrastructure spending levels as such will get us much closer to tackling the frustrations that plague commuters.”

Access Across America provided aggregate metro-level accessibility metrics. The Accessibility Observatory will expand on this work by providing accessibility evaluations that can be analyzed at much smaller areas, Owen

explains.

The Accessibility Observatory will also build on earlier work conducted at the University of Minnesota, including the Access to Destinations research study. The study, a multi-phase, multidisciplinary effort incorporating theoretical as well as practical research, built local expertise and prepared the University for next steps into the future of accessibility research and evaluation. CTS led the study; funding sponsors included the Minnesota Department of Transportation, Hennepin County, and the McKnight Foundation, in cooperation with the Metropolitan Council.

CTS is creating and hosting a new mobile-friendly and dynamic website for the Observatory. The site—ao.umn.edu—includes an interactive map/calculator, research reports, and other materials.

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Center for Transportation Studies
 University of Minnesota
 200 Transportation & Safety Building
 511 Washington Ave S.E.
 Minneapolis, MN 55455

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The new
**ACCESSIBILITY
 OBSERVATORY**

will go beyond congestion rankings.

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**LIVING SNOW
 FENCE**

PAYMENT CALCULATOR

is helping MnDOT keep snow off roadways.

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monitor how well the
**I-35W BRIDGE IN MINNEAPOLIS
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**New tools engage the public
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