CENTER FOR TRANSPORTATION STUDIES

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Researchers rate job accessibility for five Twin Cities transitway scenarios

Transitway service is expanding across the Minneapolis–Saint Paul metro area. In an analysis for the Metropolitan Council, U of M researchers evaluated job accessibility for five transitway scenarios. "Our results show that all five scenarios improve accessibility across the region and especially increase accessibility for workers living near transit stops," says Kristin Carlson, a researcher with the

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Regional effort tests turfgrass performance in cold climate states

Vibrant green grass along roadways is a common sight across urban and rural landscapes in Minnesota and many other states, but its survival is a significant challenge—especially in cold climates. Roadway salt and other stressors can cause turfgrass installations to fail, requiring expensive reseeding or sodding efforts.

For more than a decade, University of Minnesota researchers have been conducting projects

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Study looks at the role of transportation in addressing social isolation in older adults

COVID-19 is bringing greater attention to the personal and societal hardships of social isolation. A U of M team recently received a grant to study the role of transportation in addressing social isolation, with particular focus on older adults.

"Older adults face unique risks related to social isolation and loneliness, largely because of the many major life transitions that they are more likely to experience," says Carrie Henning-Smith, an assistant professor at the School of Public Health, the project's principal investigator.

In many cases, aging includes losing the ability to drive. Engaging in social and civic opportunities, however, often requires traveling outside the home. Such travel can be complicated by health problems that make it difficult to drive and that may require accessible transportation options. "Solutions to address social isolation and loneliness need to include public transportation as a key factor," Henning-Smith says.

Even before COVID-19, recent research has shown a widespread prevalence of social isolation. "Connecting people to resources, community amenities and events, and to one another using public transportation is one promising avenue," she says. "Our research will help us understand how best to do so in different geographic contexts across the US."

Strategies need to take both geographic and societal contexts into account. Factors such as public transportation, community infrastructure, population density, broadband Internet, and cellular connectivity are all essential to promoting social connectedness, "yet they are uniquely challenging in both urban and rural areas," says Henning-Smith, who is also the deputy director of the U's Rural Health Research Center.

The study, funded by the National Center for Mobility Management, will explore a number of questions:

- What data are available to monitor and evaluate the relationship between transportation and social isolation?
- What other associated factors contribute to social isolation, beyond public transportation challenges?
- What examples exist of successful models or practices, and what outcomes and learnings can be gleaned from those activities?
- What are the impacts of transportation availability on various stakeholder groups?
- Where are areas of opportunity for collaboration and change between public transportation and public health?

The researchers will conduct interviews with content experts from around the nation and identify promising practices and exemplar programs. They will also prepare case studies of success stories, along with lessons learned from unsuccessful approaches, for rural, suburban, and urban areas. The final report will include specific, actionable policy and programmatic recommendations.

Other members of the research team include Professor Yingling Fan of the Humphrey School of Public Affairs and Christina Worrall, a senior research fellow at the State Health Access Data Assistance Center in the School of Public Health's Division of Health Policy and Management. The project is slated to be completed early this summer.

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Redesigned iron-enhanced ditch checks could help filter pollutants from stormwater runoff

The Minnesota Department of Transportation (MnDOT) is exploring innovative ways to filter pollutants from stormwater runoff and meet permit requirements for construction projects. In a recent study, U of M researchers documented the performance of an iron-enhanced ditch check filter to remove phosphates from stormwater. They found that the filter was effective, though its performance decreased over time.

Traditionally, MnDOT has used wide, shallow ditches known as linear swales along roadways to filter contaminated highway runoff, in addition to constructed filtration and infiltration basins. Ditch checks are low permeable mounds placed in a swale to reduce water velocity. MnDOT wanted to know if an additional filtering device could be cost-effective in the swales.

"Iron-enhanced ditch checks capture phosphates using a filter of sand and iron filings installed horizontally across a swale," says Professor John Gulliver of the Department of Civil, Environmental and Geo- Engineering. MnDOT wanted to determine if a 2014 test installation improved a swale's ability to cost-effectively capture phosphates from runoff over the long term.

For this study, researchers monitored the performance of the iron-enhanced ditch check in Stillwater, Minnesota, during 40 rain events from 2015 through 2018. The data they collected included rainfall amounts, water sampling at the inflow and outflow points, water levels, flow rate, flow volume, rainfall depth, and upstream and downstream water levels at the filter insert section. The research team retrieved water samples within 24 hours of the end of a rain event and tested the samples for total phosphorus, ortho-phosphate, and dissolved copper and zinc concentrations.

Results of the study show that the iron-enhanced ditch check filter successfully removed phosphorus during the majority of the 40 rain events, reducing the phosphate mass loads between 22 and 54 percent. However, researchers found that the cumulative phosphate retention in the filter decreased from 42 percent in 2015 to 30 percent in 2016, 25 percent in 2017, and 23 percent in 2018. Core tests taken at the end of the research period confirmed that the bottom 3.9 inches of the filter media filtered most of the inflow volumes of the runoff, and that this heavy runoff load reduced the filter's effectiveness over three years while the upper part of the filter was active only infrequently.

"Our success in removing phosphorus from stormwater runoff using iron particles in filtering ditch checks showed strong proof of concept," Gulliver says. "Modification of the filters' orientation in the ditches could result in a device that is both more effective and low-maintenance for MnDOT."

One recommendation resulting from the study findings is the need to mix up the contents of the filter every other year to redistribute the filter media at the bottom. "Enhancing ditch checks with iron filings will aid in the removal of phosphorus in stormwater," says Beth Neuendorf, MnDOT Metro District water resources engineer. "However, since the bottom of the filter receives the most consistent flow, more frequent mixing of the iron filings is required than originally anticipated based on the results of this research."

Researchers also made additional design recommendations that could further improve the iron-enhanced ditch check filter's performance. These include using peat instead of soil and sod to cover the ditch check, installing ditch checks in series, and re-engineering the filter to more evenly distribute the runoff load throughout the filter to reduce maintenance frequency.

The research was funded by MnDOT and the Local Road Research Board.

Near the end of the study, workers used a boring machine to take core samples of the ditch check and the filter insert.

Study finds big differences in effects of congestion on access to jobs

The impact of traffic congestion on access to jobs differs significantly among major US cities. According to the Access Across America: Auto 2018 study from the U's Accessibility Observatory, the Minneapolis–Saint Paul metro area ranked 6th in terms of job accessibility but 28th in the reduction in job access due to congestion. In fact, the Twin Cities this year edged above the much-larger Houston, which ranks 7th in job accessibility even though it has a million more jobs.

"Every year I look at these results, it's stunning how well the Twin Cities does in making it easier to get to work compared to other major US metros," says Andrew Owen, director of the Observatory. "We have a well-designed and well-managed transportation network that connects people to lots and lots of jobs."

By contrast, Philadelphia ranks 6th nationally in total jobs but 13th in access to those jobs and 13th in congestion delays. The Boston metro, which ranks 10th in total jobs, also faces significant challenges, ranking 5th in congestion delays and 17th in accessibility.

Key factors affecting the rankings for any metro area include the number of jobs available and where they are located, the road network structure, traffic management practices, the provision of alternate transportation modes, and population size, density, and location. Better coordination of transportation systems with the location of jobs and housing improves job accessibility by auto.

The annual study, part of the Access Across America study that began in 2013, ranks the 50 largest (by population) metropolitan areas in the United States for connecting workers with jobs by auto and measures the delay getting to those jobs due to traffic congestion.

Rankings of the top 10 metro areas for job accessibility by auto in 2018 changed only slightly from the previous year, with Los Angeles, New York, and Dallas topping the list.

Rankings for the top 10 metro areas for loss in job accessibility due to congestion are topped by Los Angeles; Riverside, California; and New York. The Washington, DC, metro area fell to 8th, likely due to the unavailability of census data on federal workers.

This year's report also includes detailed block-level maps that illustrate the spatial patterns of accessibility within each area.

The research is sponsored by the National Accessibility Evaluation Pooled-Fund Study, a multi-year effort led by the Minnesota Department of Transportation and supported by partners including the Federal Highway Administration and 12 additional state DOTs.

The Observatory is the nation's leading resource for the research and application of accessibility-based transportation system evaluation.

Top 10 metro areas with the greatest accessibility to jobs by auto in 2018:

1. Los Angeles
2. New York
3. Dallas
4. San Jose
5. Chicago
6. Minneapolis–Saint Paul metro
7. Houston
8. Denver
9. Detroit
10. San Francisco

Top 10 metro areas where congestion causes the greatest percentage reduction in job accessibility:

1. Los Angeles
2. Riverside, CA
3. New York
4. San Francisco
5. Boston
6. Atlanta
7. Miami
8. Washington
9. San Jose
10. Chicago

U of M findings support testing of bridge-beam fabrication method

Supported by U of M findings, the Minnesota Department of Transportation (MnDOT) has begun piloting a fabrication method for prestressed concrete bridge beams that could reduce end cracking and lower construction costs.

Bridge designers often prestress concrete beams with steel strands to improve the performance of the beams. The strands precompress the beams so that when external loads like vehicle traffic are applied, the concrete is less likely to crack.

Prestressing, however, also causes high stress and cracking at beam ends. One method to reduce this end stress is debonding the strands. "Debonding reduces the prestress force in the beam ends by putting a sleeve around some of the steel strands," explains Catherine French, CSE Distinguished Professor with the Department of Civil, Environmental and Geo- Engineering.

Debonding hasn't been permitted in Minnesota because of concerns that chloride from road salt would enter along the debonded strands and reduce durability. MnDOT currently uses an alternative design approach—draping the strands—to relieve end stresses, but fabricators would like to rely less on draping, which they say requires more time, cost, and care to make safely. Local agencies are also interested in debonding because draping requires thicker and more expensive concrete beams.

The research team began by studying current MnDOT prestressing specifications, national prestressing and debonding guidelines, and relevant research. For a number of years, the American Association of State Highway and Transportation Officials has permitted debonding but limited the percentage of debonded strands to 25 percent. "Part of this limitation was based on early research, but the limit may be raised to 45 percent or more given new findings," French says.

The researchers also surveyed road agencies in 10 states with climates similar to Minnesota's about their use of debonding, how well debonding reduced beam-end stresses, and their observations regarding potential corrosion issues. They also met with two MnDOT concrete beam fabricators to review prestressing procedures and visited plants to observe their processes and talk with plant personnel.

"We found that many agencies in states with weather conditions similar to Minnesota's successfully use the debonded strand option," French says. Typically, the beam ends are sealed with silicone to protect sleeved cables from water and salt intrusion. The states surveyed did not observe any excessive corrosion.

"Our recommendations provide guidance for using debonded strands as an alternative to draping where appropriate," she says. "The findings also position agencies to adopt current and imminent national debonding standards." The Minnesota Local Road Research Board sponsored the project.

Based on the findings, MnDOT has begun piloting the debonding option. "The team is recommending we start at debonding 40 percent of prestressed strands," says Brian Homan, State Aid bridge plans engineer with MnDOT's Bridge Office. "To begin implementing this recommendation, MnDOT has recently let for construction two pilot projects that are utilizing debonding percentages of 25 and 31 percent."

READ
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for links to research reports and other resources.

CTS Research Conference Call for Presentations

CTS has issued a call for presentations for its Annual Transportation Research Conference, scheduled for Thursday, November 5, 2020, at the Graduate Minneapolis hotel.

We invite you or your organization to share the results of your research or innovations in transportation. If you're interested in presenting your work at the conference, please submit a brief abstract by Monday, April 27, 2020.

For more information or to submit your abstract, please visit **cts.umn.edu/events/conference**.

Turfgrass *from page 1*

aimed at solving this problem by identifying best management practices for turfgrass establishment and recommending new species and cultivars that perform best in harsh roadside conditions. As part of these studies, researchers have tested various turfgrass species at multiple sites in Minnesota. However, year-to-year weather variability doesn't allow for test sites in a single state to provide adequate information about turfgrass tolerances to many roadside stressors.

To address this challenge, U of M researchers directed a coordinated testing effort across five states—Michigan, Minnesota, Nebraska, New Jersey, and Wisconsin—that allowed for the simultaneous evaluation of stressors common to roadsides in cold climates. The pooled-fund project was led by the Minnesota Department of Transportation (MnDOT), with additional funding from the Michigan, Nebraska, New Jersey, and Wisconsin departments of transportation.

"The development of resilient turfgrass species and mixes is most effectively accomplished as a collaboration among cold climate states," says Dwayne Stenlund, erosion control specialist at MnDOT. "Working across state lines, we can simultaneously test many species and mixes across a wide range of soil and weather conditions."

In all five states, researchers tested 50 individual cultivars and 10 standard turfgrass mixes across several growing seasons. The cultivars were chosen through breeder recommendations and public data that indicated potential use as a roadside turfgrass.

Researchers in each state seeded plots in two locations in 2016: an urban or suburban street with a curb and a rural highway without a curb. Plots were assessed in October 2016, April and October 2017, and April 2018, and data about cultivar successes and failures at each location were stored on a project website to assist agencies in choosing the best turfgrass species for their roadway sites.

"This multistate research project is the first to provide participating DOTs with unbiased, up-to-date information about the performance of turfgrass cultivars and mixtures used on roadsides in the northern US," says Eric Watkins, professor of horticultural science at the U of M and the project's principal investigator.

Although turfgrass establishment varied by state, general findings show that fine fescues perform well at urban sites and are more tolerant of salt than other species. Results also suggest that sites with high amounts of salt usage would benefit from mixtures incorporating alkaligrass. In addition, the study highlighted the importance of multi-site testing and difficulties establishing turfgrass: only 6 of the 10 sites resulted in first-year data because of weather and human interference.

Watkins says future studies evaluating optimal cultivars, species, or mixtures for roadsides should continue including multi-site testing for research projects. Such studies could be coordinated with the same group of researchers and even expanded to include other interested states. Researchers could also consider partnering with the National Turfgrass Evaluation Program to leverage its existing national turfgrass cultivar testing infrastructure.

Changes at CTS in response to COVID-19

To help slow the spread of COVID-19, the University of Minnesota has suspended all in-person events through May 13.

In accordance with recommendations from the State of Minnesota, all major venues at the University are closed to the public until further notice, including the CTS office, and all meetings and events will be canceled, rescheduled, or moved online where possible. The University is working closely with public health officials and will regularly assess the ongoing need for these restrictions.

Effective immediately, CTS will not hold any in-person meetings or events until restrictions from the University and the State of Minnesota are lifted. If a meeting you were scheduled to attend is being moved online, CTS staff will be in communication with you to provide access instructions.

Additionally, CTS staff are working remotely until further notice. We will continue to be available during our usual business hours by email and phone.

As circumstances change and updates become available, they will be posted on **cts.umn.edu/covid19**.

Your health, safety, and well-being—and that of the community—are of the utmost importance to the University of Minnesota and to CTS. Thank you for your partnership and patience as we work together during this challenging time.

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U's Accessibility Observatory (AO).

The project involved two main components. The first analysis compares the network as of May 2019 to the funded baseline. The funded baseline adds the C Line along Penn Avenue (which began service in June 2019), the Orange Line along I-35W to Lakeville (planned to open in late 2021), and the Green Line extension to Eden Prairie (expected in 2023).

The funded baseline increases service frequency along new and existing corridors. "On the funded network, the average worker may experience a job accessibility increase from the May 2019 baseline of 2.29 percent, averaging various travel times," Carlson says. Transit accessibility improves on most blocks but declines where Route 19 service along Penn Avenue is reduced.

The second analysis compares the funded baseline accessibility results to those of three proposed lines: The B Line along Lake Street, the D Line along Emerson/Fremont and Chicago Avenues, and the E Line along Hennepin and France Avenues. The transitways are evaluated in isolation and in a scenario combining all three.

These lines would provide high-frequency transit service to existing transit corridors and augment local routes 5, 21, and 6. "The prospective network improves transit accessibility for the average worker by 5.51 percent, again averaging various travel times," Carlson says. The accessibility improvements are due to the increased service frequency, speed, and directness of BRT.

However, the modifications made to local routes 5, 21, and 6 result in accessibility decreases for several groups of blocks. These areas experience a combination of reduced service frequency on local routes and longer walking distances to high-frequency routes. "The research did not account for local bus schedule coordination with the prospective transitways," Carlson notes. "In practice, accessibility loss can be mitigated when new and existing transit services are coordinated."

Three other scenarios isolate the relative impact of each proposed BRT line. "We found that the D Line has the greatest impact on connecting more workers with jobs in shorter travel times," Carlson says. "The majority of accessibility benefits associated with the prospective network are from D Line service and the numerous local transit connections made in the corridor."

The B Line appears to provide a "backbone" of transit service across the east-west axis of the urban Metropolitan Council region. Saint Paul workers gain the most accessibility benefits as a result of B Line connections and frequency.

Finally, the E Line and the changes to local Route 6 introduce accessibility gains over 100 percent in some neighborhoods while decreasing accessibility by up to 35 percent in areas that lose Route 6 service.

"The E Line corridor is an example of the ways transit network changes can manifest in accessibility impacts that change from block to block," says Andrew Owen, AO director. "The insights from the data can inform the implementation of the E Line and the supporting transit network to best serve metro residents."

"We know that when we add fast, frequent BRT service to these important local routes, we can shorten wait times and travel times for our riders," says Eric Lind, manager of Research & Analytics – Strategic Initiatives for Metro Transit. "What the Accessibility Observatory analysis shows is that these improvements cascade through the bus system to improve connections in areas not immediately adjoining the transitways in question. This means there can be widespread benefit to these improvements to employees and employers across the Twin Cities."

The research was sponsored by the Metropolitan Council as part of the National Accessibility Evaluation, a multi-year effort led by the Minnesota Department of Transportation.

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